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SEASONAL ABUNDANCE OF WATERBIRDS AT POINT REYES: A COASTAL CALIFORNIA PERSPECTIVE

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Numerous studies undertaken since 1940 document seasonal abundance patterns of aquatic birds in California wetlands. Many of these studies focus only on shorebirds at a single site (e.g., R. W. Storer 1951, Recher 1966, Jehl and Craig 1970, and Gerstenberg 1972) but together they span the length of the state from San Diego Bay (Jehl and Craig 1970) to Humboldt Bay (Gerstenberg 1972). The most ambitious shorebird census study is that of Jurek (1972, 1973, 1974), who used volunteer observers to count shorebirds in wetlands throughout the state. State and federal agencies have also conducted waterfowl censuses throughout California. Some researchers have attempted to quantify the seasonal abundance patterns of all aquatic birds in wetland habitat: Gerdes (1970) at Morro Bay, Winkler et al. (1977) at Mono Lake, Bollman et al. (1970) and Gill (1972a) in San Francisco Bay, Swarth et al. (1982) in salt ponds in south San Francisco Bay, King et al. (1987) at San Elijo Lagoon, and Funderburk and Springer (1989) at lakes Earl and Talawa. Collectively, these studies and the more general accounts of Grinnell and Miller (1944), Cogswell (1977), McCaskie et al. (1979), and Garrett and Dunn (1981) provide a very useful description of the seasonal use patterns of aquatic birds in California.

Since 1965 volunteers and the staff of Point Reyes Bird Observatory (PRBO) have conducted censuses of birds in the wetlands of the Point Reyes Peninsula, Marin Co., California. These censuses, which extend up to 10 consecutive years at a single site, provide more detailed information on variation in bird numbers than has been reported previously for California waterbirds. In this paper we describe the seasonal use patterns of aquatic birds of two estuaries, one lagoon, and the inshore zone

of the ocean off southern Point Reyes, and, when appropriate, compare these patterns to those found elsewhere in coastal California. We also examine the influence that variations in rainfall have on variations in bird abundance, on the timing of species' arrival and departure, and on intersite variation in occurrence patterns on Point Reyes.

Beyond describing the dynamics of this local system, the data provide a baseline on the population sizes and seasonal abundance patterns of birds in most wetlands of the Point Reyes Peninsula. In contrast with many of California's wetlands, the Point Reyes wetlands remain relatively pristine. Much of the study area is currently protected wildlife habitat and should remain so into the future, thereby permitting continued monitoring of changes in bird abundance in a natural system.

STUDY AREA AND METHODS

The study area included wetlands of the Point Reyes Peninsula (bounded on the east by Bolinas Lagoon, the Olema Valley, and Tomales Bay), Marin Co., and Bodega Harbor, Sonoma Co. (Fig. 1). Seasonal abundance patterns were derived from counts of aquatic birds on Bolinas Lagoon, Limantour Estero, Abbott's Lagoon, and the nearshore coastal waters between Stinson Beach and the Point Reyes Lighthouse. Supplemental information was also obtained from censuses at Drake's Estero and Bodega Harbor and incidental sightings as described below. We called Bolinas Lagoon, Limantour Estero, Bodega Harbor, Drake's Estero, and Tomales Bay seasonal estuaries (see Pritchard 1967) because they are semienclosed bodies of water subject to daily tidal action, and their salt water is measurably diluted by fresh water only from October through April. In contrast, Abbott's Lagoon's lower basin is separated from the ocean by a barrier bar that is only occasionally breached during storms, extremely high tides, or periods of heavy runoff. Breaching causes a rapid drop in water level and subjects the lagoon to tidal action for a few days. Abbott's Lagoon is essentially brackish, minimally influenced by tidal action, and best fits the definition of a true lagoon (Caspers 1967). For simplicity, we refer to the estuaries and Abbott's Lagoon as wetlands, even though they also contain deepwater habitat.

Rain is highly seasonal with about 95% of the yearly total falling from October through April (Fig. 2). From 1967 to 1982, June through May rainfall on the coast 6 km northwest of Bolinas Lagoon averaged 88.3 cm (SE = 8.1); extremes were 44.9 and 40.7 cm in the drought years of 1975–76 and 1976–77, respectively, and 147.0 and 132.6 cm in the wettest years, 1972–73 and 1981–82, respectively.

Census Locations

Bolinas Lagoon. Bolinas Lagoon, 24 km northwest of San Francisco, is a Marin Co. Nature Preserve. At mean low tide 26.0% of the 587-ha estuary is open water, 57.2% unvegetated tidal flat, and 16.8% salt marsh or upland. More information on the area is available in Ritter (1969), Ritter and Brown (1973), Bergquist (1978), and Page et al. (1979).

We conducted 247 censuses at Bolinas Lagoon (hereafter Bolinas) between June 1971 and May 1982 at a frequency declining from one every 10 days in 1971 and 1972 to one per month for only part of the year in 1981 and 1982. Censuses were during specific 5-day periods if tides were suitable (Fig. 3) or the nearest appropriate period if they were not suitable (see Page et al. 1979 for further details of census methods).

Limantour Estero. Limantour Estero, a Point Reyes National Seashore (PRNS) natural area 20 km northwest of Bolinas, is bordered by hills, freshwater impoundments, a spit with scattered high dunes, and a channel to the ocean shared with Drake's Estero. Several intermittent streams run into the estero. At the time of our study, at mean low tide 47.6% of the 331-ha estuary was open water, 41.2% non-vegetated tidal flat, and 11.2% salt marsh or upland. Six freshwater impoundments abutting the estero added an additional 63.9 ha of aquatic bird habitat. Since 1982 breaks in dikes have drained 28.1 ha of pond habitat, part of which was restored to tidal action.

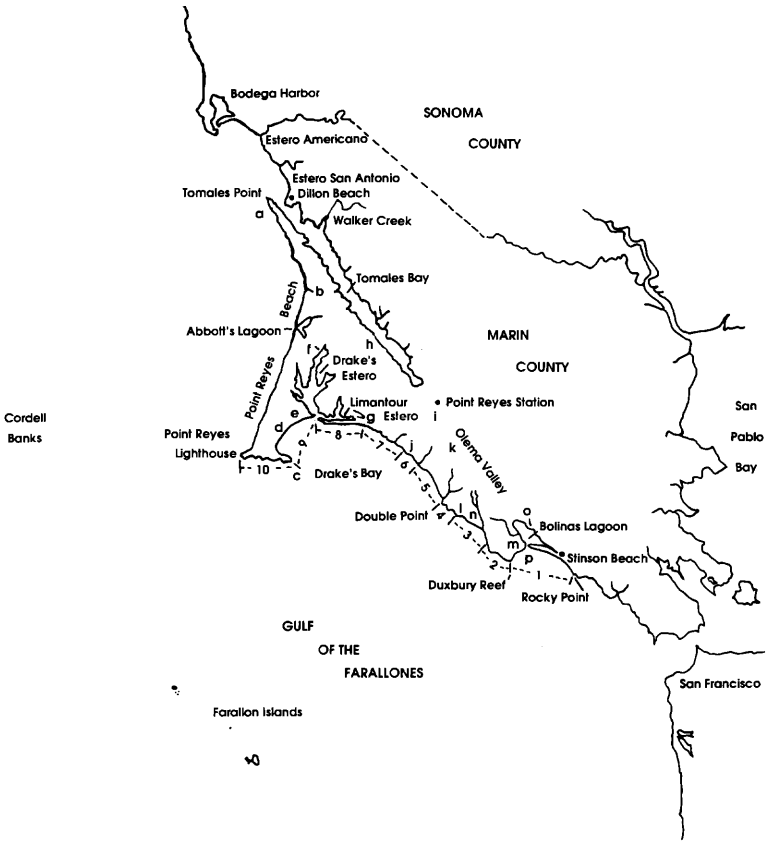

Figure 1. Point Reyes study area. a, Bird Rock; b, Kehoe Marsh; c, Chimney Rock; d, Drake's Beach Pond; e, Horseshoe Pond; f, Schooner Bay; g, Glenbrook and Muddy Hollow ponds; h, Inverness; i, Olema Marsh; j, Point Resistance; k, Five Brooks Pond; l, Abalone Flat; m, Bolinas and Bolinas sewer ponds; n, Palomarin; o, Audubon Canyon Ranch; p, Bolinas Bay. The 10 numbered sub-areas denote sections of the inshore zone censused between September 1980 and September 1981.

The 146-ha northern extension of the estuary (upper Limantour) was not censused initially (see below) because of its distance from the census route along the spit. One hundred sixty-six counts, encompassing the southern 169 ha of the estero and 16.4 ha of impoundments (Muddy Hollow Pond and a small nearby pond), between June 1967 and June 1981 contributed to the data base for all species. An additional 63 counts of ponds from July 1965 to May 1967 augmented the data for the Cinnamon Teal, Redhead, and Ring-necked Duck, which were restricted primarily to the impoundments. Although censuses were distributed fairly evenly throughout the year (Fig. 3), they were not taken in specified 5-day periods or with respect to tides until 1973–74.

Abbott's Lagoon. This undeveloped area lies 2 km northwest of the northern end of Drake's Estero in PRNS. Two interconnected freshwater ponds, derived mainly from winter runoff, total 32 ha and are linked to the northeast shore of the lower, brackish 83-ha lagoon, which temporarily becomes tidal on rare occasions

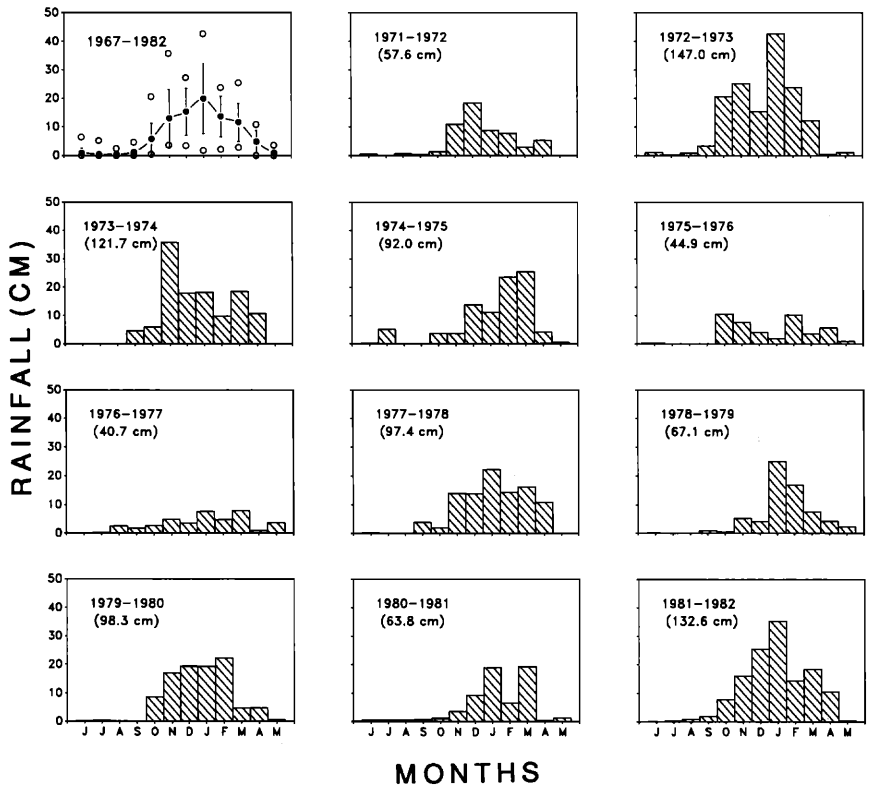

Figure 2. Rainfall patterns at Palomarin, 6 km northwest of Bolinas. Upper left, monthly rainfall for the period 1967–1982. Solid circles, mean; vertical bars, one standard deviation; open circles, minimum and maximum values. Other graphs, rainfall by month for individual years; yearly totals in parentheses.

when the barrier bar is breached. Even when the bar is intact the surface area of the lagoon varies by a factor of about 2, depending on rain and evaporation. Dunes and an extensive sand flat border the lagoon's southwest margin.

We conducted 135 censuses of the 115 ha of combined lagoon and pond habitat between July 1973 and June 1982. The censuses did not correspond with specified 5-day time periods or tides until June 1980.

Supplemental census areas: Drake's Estero, upper Limantour Estero, and Bodega Harbor. At monthly intervals from October 1979 to May 1980 and from

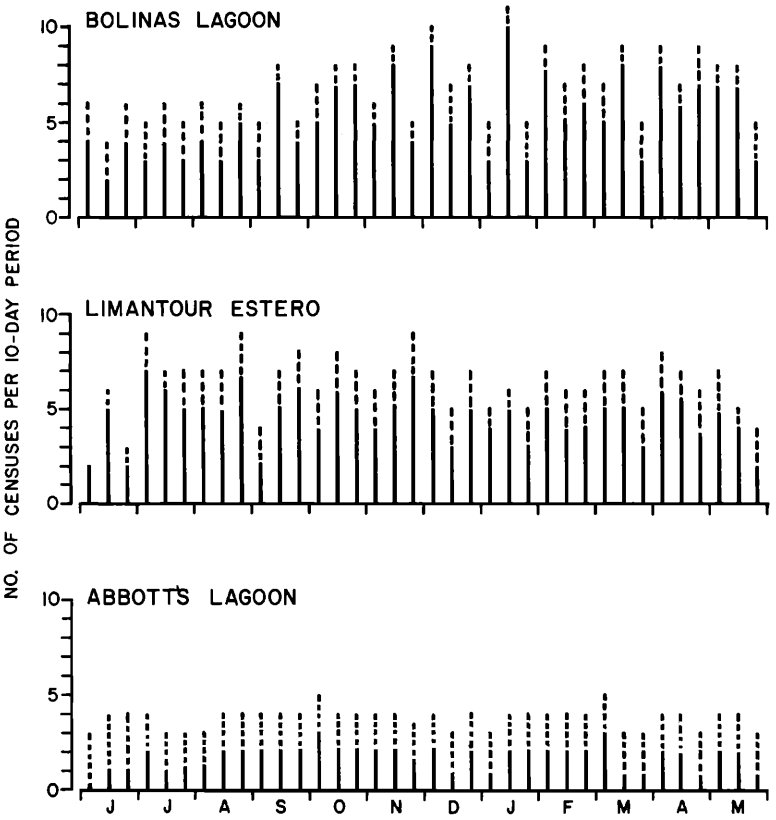

Figure 3. Numbers of censuses of aquatic birds taken at three wetlands during 10-day periods (alternate 5-day periods) from 5–9 June through 21–25 May between 1967 and 1982. Censuses taken outside these 5-day periods are tallied in the closest 5-day period. Dotted lines for Bolinas indicate censuses on which only shorebirds were counted. Dotted lines for Limantour indicate censuses valid for only the Cinnamon Teal, Ring-necked Duck, and Redhead (see Methods). Solid lines for Abbott's indicate censuses used for graphs of the Black-bellied Plover, Semipalmated Plover, Marbled Godwit, Western Sandpiper, Least Sandpiper, and Dunlin; all censuses used for other species (see Methods).

September 1980 to June 1981 we conducted 18 censuses of the 964-ha Drake's Estero and 39.1 ha of adjacent ponds. From October 1979 to May 1980 we conducted 8 monthly censuses of the 146-ha north–south arm of Limantour Estero and 37.7 ha of adjacent ponds. From November 1978 to February 1979 and from November 1979 to May 1980 we conducted 11 monthly censuses of Bodega Harbor, a 368-ha estuary 55 km northwest of Bolinas.

Outer coast. We made 12 counts of aquatic birds inshore in the ocean from Rocky Point, just south of Stinson Beach, to the Point Reyes Lighthouse within 4 days of monthly censuses in adjacent estuaries between September 1980 and September 1981. One to three people counted non-flying birds as far from shore as they could see with binoculars and 20× spotting scopes in each of 10 sub-areas (Fig. 1). We refer to sub-areas 6–10 as Drake's Bay. Flying birds were not tallied to ensure that counts represented birds definitely using study area waters. Assuming an effective census distance of 1500 m from shore, we estimated the area covered as 9400 ha of coastal water.

Unidentified Birds

Those taxa regularly posing identification problems in wetlands were Western and Clark's grebes, scaups, dowitchers, small sandpipers (Least Sandpipers, Western Sandpipers, and Dunlins), and gulls. Both species of large grebes, scaups, and dowitchers were pooled for all analyses. Unidentified small sandpipers were apportioned among those identified as described by Page et al. (1979). The seasonal abundance patterns of gulls are based on identified birds only, underestimating the abundance of most species except for Bonaparte's and Heermann's gulls. Despite this limitation the graphs of gulls are useful for defining patterns of seasonal occurrence.

On censuses of nearshore waters identification of the species of small grebes (Horned and Eared), scoters, and particularly loons often proved difficult because of the long distances between birds and observers. We allocated unidentified birds to species by using proportions of those identified from the same sub-area of the coast unless numbers of those identified in a sub-area were very small. In such cases the proportions of identified birds in either the eastern or western five sub-areas were used to apportion the unidentified birds by species and sub-area. Unidentified loons constituted 9–86% (median 20%) of the ones identified on the 10 coastal censuses, unidentified scoters 6–60% (median 26%), and unidentified small grebes 0–24% (median 10%), except on the September 1980 census, when only 3 of 25 small grebes were identified.

Other Data Sources

We used sightings from published and unpublished sources to supplement our census data, especially for rare to very rare species. Foremost among these sources were the quarterly seasonal reports of the Middle Pacific Coast Region of *American Birds*, formerly *Audubon Field Notes* (cited as AB or AFN), and the compilation of records from which the published accounts were derived, the "American Birds Notebooks" (cited as ABN: observer's initials) on file with the regional editors. Unpublished PRBO records, the authors' field notes, and personal communications from other observers (cited as PRBO or the observer's initials) were an additional source of data. Observers whose initials are cited are David G. Ainley (DGA), Peter Allen (PA), Stephen F. Bailey (SFB), Laurence C. Binford (LCB), Bob Boekelheide (BB), Gerald Brady (GB), Courtney Buechert (CoB), Scott Carey (ScC), Ted (TAC) and Zoe Chandik (ZCh), Bill Clow (BC), Howard L. Cogswell (HLC), Chris Cutler (CC), Dave DeSante (DDeS), Richard Ditch (RD), Richard A. Erickson (RAE), Jules G. Evens (JGE), Marc Fenner (MFe),

Rudi Ferris (RF), William B. Gladfelter (WBG), Philip E. Gordon (PEG), Keith Hansen (KH), Rob Hayden (RHa), R. Phil Henderson (RPH), Burr Heneman (BHe), David A. Holway (DAH), Alan S. Hopkins (ASH), Steve N. G. Howell (SNGH), Stuart Johnston (SJ), Durrell D. Kapan (DDK), John Kelly (JPK), Susan Kelly (SK), Joe Kennedy (JKe), Bill Lenarz (BiL), Phil Lenna (PL), Gary S. Lester (GSL), Baron McClean (BMc), Peter J. Metropulos (PJM), Grace Miller (GM), Joseph Morlan (JM), Dan P. Murphy (DPM), Gary W. Page (GWP), Benjamin D. Parmeter (BDP), Steve Perry (SP), Ed Piccolo (EP), Lina Jane Prairie (LJP), William M. Pursell (WMP), Peter Pyle (PP), C. J. Ralph (CJR), J. Van Remsen (JVR), Barry Sauppe (BSa), Kenneth Schulz (KSc), David Shuford (DS), John Smail (JS), Bruce Sorrie (BSo), Rich Stallcup (RS), Lynne E. Stenzel (LES), Robert M. Stewart (RMS), Nick Story (NS), Chris Swarth (CSw), Ted Van Velzen (TVV), Nils Warnock (NW), Alice Williams (AW), David Wimpfheimer (DWm), Jon Winter (JW), and Keiko Yamane (KY).

We also used information from the Point Reyes Peninsula Christmas Bird Count (CBC) and, secondarily, the Marin Co. (southern), Tomales Bay, and Drake's Bay CBCs, published in *American Birds*. Unless otherwise noted, the only records of extreme rarities that we report have been reviewed and accepted by the California Bird Records Committee (CBRC). These records are cited as CBRC and either have been published in CBRC reports (Winter 1973, Winter and McCaskie 1975, Luther et al. 1979, Luther 1980, Luther et al. 1983, Binford 1983, Binford 1985, Morlan 1985, Roberson 1986, Dunn 1988) or have been accepted by that committee and will be published in the near future (D. Roberson, CBRC Secretary, in litt.).

We followed Ainley and Sanger's (1979) definitions for the zones in the ocean used to describe the distribution of sea-going birds. "Oceanic" describes waters of the deep ocean from the continental slopes beyond the continental or insular shelves. "Neritic" describes waters over the continental shelf. The neritic zone can be subdivided into inshore and offshore zones. The demarcation between the inshore and offshore zones is the line beyond which the bottom is too deep for a diving seabird to reach—a depth of approximately 70 m (Ainley and Sanger 1979). We place quotes around "offshore" and "inshore" when we refer to literature that defines these terms differently or not at all.

Data Analysis

We determined seasonal abundance patterns for all but very rare species from the censuses of Bolinas Lagoon, Limantour Estero, and Abbott's Lagoon. Because most species are scarce to absent in the wetlands in summer, we defined a year as extending from 1 June to 31 May. For all but very rare species, the minimum, mean, and maximum number of birds in alternate 5-day periods (Fig. 3) are graphed by wetland and species. Bolinas shorebird graphs derived from censuses from June 1971 to May 1976 (e.g., Fig. 25) were published by Page et al. (1979). Bolinas graphs for non-shorebirds (e.g., Fig. 4) are based on 176 censuses from August 1972 to May 1980, except for that for the American Coot, which is based on only 125 censuses from August 1972 to May 1976 because of the sharp drop in numbers after that period. Most graphs for Abbott's Lagoon are based on all 135 censuses from July 1973 to June 1982. We used only the 75 censuses taken at low tides from June 1980 to June 1982 to graph results for certain shorebirds known to fly from Drake's Estero to Abbott's to roost at high tide (Fig. 3). Occurrence patterns in the inshore zone are described primarily by histograms based on censuses of the outer coast (see Figs. 5, 6, and 7). We present preliminary data on winter population trends at Bolinas and Limantour (see Fig. 14) that are part of ongoing studies.

Occurrence patterns of very rare species recorded on wetland censuses on Point Reyes are described by either histograms summarizing area-wide records (see Fig. 12) or by a summary or listing of individual records. Histograms are based on all records available through fall 1982, except that CBC records were excluded to avoid the bias of intense observer effort each year during late December. Histograms are based on Point Reyes records only, except those for the Cattle Egret, Lesser Yellowlegs, Wilson's Phalarope, Parasitic Jaeger, and Common Tern, which also include additional Marin Co. records to give better definition to migratory periods. The graph of Lesser Golden-Plover includes only wetland census records and excludes records from upland habitat where migrant and wintering birds mingle, blurring the boundaries of migratory periods. Listings of records in the species accounts include all data available through fall 1988 and selected data through spring 1989. Although we occasionally use census data from Bodega Harbor in the species accounts, we do not use them in describing occurrence patterns of very rare species.

Peaks and troughs in the graphs of seasonal abundance (e.g., Fig. 4) enabled us to select dates that independently define each species' occurrence by fall, winter, spring, or summer periods. We eliminated the tails of peaks and troughs from the intervals defining periods to minimize the effect of unusually early or late influxes or departures of birds on seasonal means. The dates used to define periods for each species are reported in table 4 of Page et al. (1983), which may be obtained from the authors on request. From the seasonal means calculated for each year and site we derived an average abundance index expressed as birds per 100 ha for the three main census areas—Limantour, Bolinas, and Abbott's—combined. Following the approach of DeSante and Ainley (1980), we used a logarithmic scale (base 4) to categorize each species' overall abundance in the three wetlands as follows:

Very rare: less than 0.1 birds per 100 ha
Rare: 0.1–0.4 birds per 100 ha
Uncommon: 0.5–1.6 birds per 100 ha
Fairly common: 1.7–6.4 birds per 100 ha
Common: 6.5–25.6 birds per 100 ha
Very common: 25.7–102.4 birds per 100 ha
Abundant: 102.5–409.6 birds per 100 ha

The following terms were used to categorize the regularity of occurrence of relatively rare species in a geographic region broader than the study area:

Irregular: not recorded every year but on average recorded more than once every 5 years.
Casual: recorded on average less than once every 5 years.
Vagrant: a species far from its normal range of occurrence. This term alone does not indicate regularity of occurrence but must be modified by one of the two previous terms, e.g., a casual vagrant to coastal California.

The following terms were used to categorize the seasonal occurrence status of each species:

Breeder: species confirmed as nesting in the study area by the presence of active nests, flightless young, or recently fledged young with some down remaining.
Resident: species present continuously throughout a non-migratory period. Although some individuals may stage in the area during migration, migrants are not sufficiently abundant that their occurrence can be detected by a substantial spring or fall peak in numbers. Resident does not imply breeding even

when the classification is as a year-round (winter and summer) resident or summer resident.

Transient: species passing through the area during migration. In a given season, if numbers swell noticeably during migration periods, species that might otherwise be classified as residents may be defined primarily as transients.

Dispersant: species that arrive in an area after a long-distance dispersal from their breeding sites. The timing and magnitude of occurrence varies markedly from year to year, probably in response to fluctuating food supplies or marked variations in reproductive success.

Visitant: species occurring intermittently in marginal habitat or on the edge of its normal range.

SPECIES ACCOUNTS

We describe the seasonal occurrence patterns and abundance of all species of aquatic birds recorded on censuses of the Point Reyes wetlands in species accounts, except for Osprey, Bald Eagle, and Belted Kingfisher, which we arbitrarily exclude. The accounts provide information on inter-wetland and year-to-year variation in occurrence patterns, peculiarities of distribution on Point Reyes, historical population trends, sex- or age-related differences in migrational timing or distribution, and habitat preferences. Seasonal abundance patterns in the Point Reyes area are compared to those on the rest of the California coast when these comparisons are instructive. The northern California coast, from Monterey Co. north to the Oregon border, is the most frequent frame of reference for these comparisons; the central California coast refers to the sub-area from Monterey Co. north to include the counties surrounding San Francisco Bay. Southern California is the area from San Luis Obispo Co. south to the Mexican border.

Red-throated Loon (*Gavia stellata*)

A rare summer resident and uncommon winter resident (Fig. 4). High inshore summer counts off Drake's Beach were 25 birds on 10 Jul 1977 (ABN: JVR) and 24 on 1 Jul 1981 (DS). The only suggestion of a peak of migrants on our censuses was in Nov and Dec on inshore waters (Fig. 5). Although limited movement occurs in Sep (ABN), fall migration over inshore and offshore waters occurs primarily from mid-Oct to mid-Dec with peak movement in Nov (Cogswell 1977, DeSante and Ainley 1980, ABN).

Away from the censused wetlands, flocks of 200 to 800 birds are reported along the Marin Co. shoreline in most years between late Dec and late Feb (ABN). Concentrations are reported most regularly at Tomales Bay, where the high count was 2000 to 3000 birds on 27 Feb 1965 (ABN: JKe, TAC). We know of no other mid-winter gatherings of comparable size elsewhere in California. We suspect these birds are attracted to feed on spawning Pacific Herring (*Clupea harengus pallasii*) at the state's largest runs just inside San Francisco and Tomales bays (Spratt 1981).

Spring migration over neritic waters extends primarily from late Mar to early Jun (ABN); peak migration dates in central California range from 17 to 21 Apr (ABN: BSa et al.).

At Point Reyes, Red-throated Loons were found in greatest numbers in inshore waters (Table 1), deep bays, estuaries, and lagoons. They were rare in freshwater

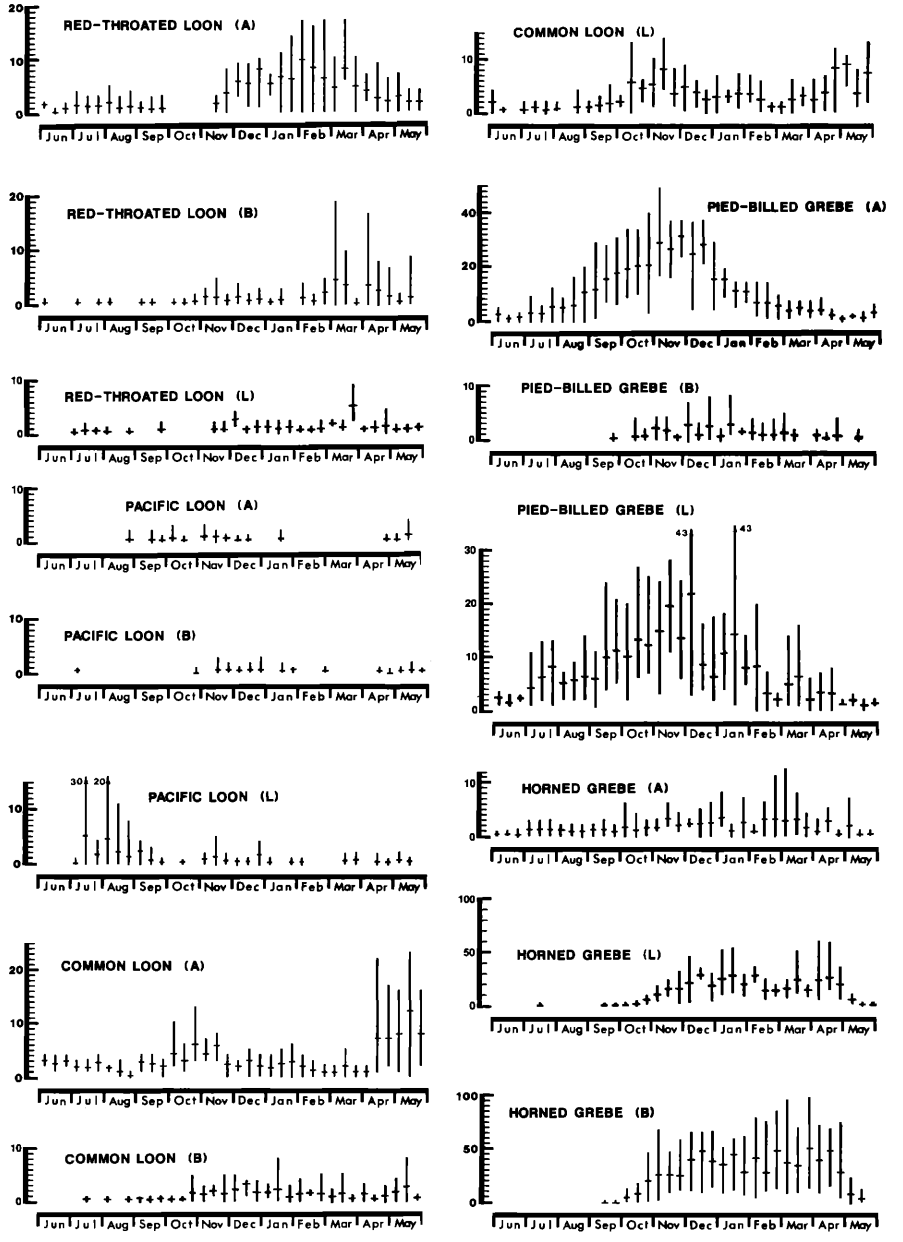

Figure 4. Seasonal abundance of some loons and grebes in wetlands of Point Reyes. The top of each vertical line represents the maximum number counted on any census during the corresponding third of a month, the bottom of each vertical line represents the minimum number counted on any census during the corresponding period, and the horizontal line is the mean for the corresponding period. Maxima exceeding the scale on the graph are indicated by arrows and the appropriate number. A, Abbott's Lagoon; B, Bolinas Lagoon; L, Limantour Estero.

ponds, lakes, and reservoirs, but more frequent there during migration than at other times. During migration, Red-throated Loons occupy ocean waters closer to shore than do Pacific and Common loons, and during winter they are closer to shore than are Pacifics (Briggs et al. 1987).

Pacific Loon (*Gavia pacifica*)

A rare summer resident, rare fall transient, very rare winter resident, and rare spring transient (Fig. 4). Although thousands of Pacific Loons fly by Point Reyes during spring and fall migrations, few pause here. Peak inshore numbers were recorded in Jul and Aug (Fig. 5). At that time the species was rare or absent on the wetlands (Fig. 4), except at Limantour, where birds move into the estero mouth from Drake's Bay. From Jul to Sep high single-observer counts for inshore waters have ranged from about 30 to 85 birds (ABN) with a maximum of 170 on

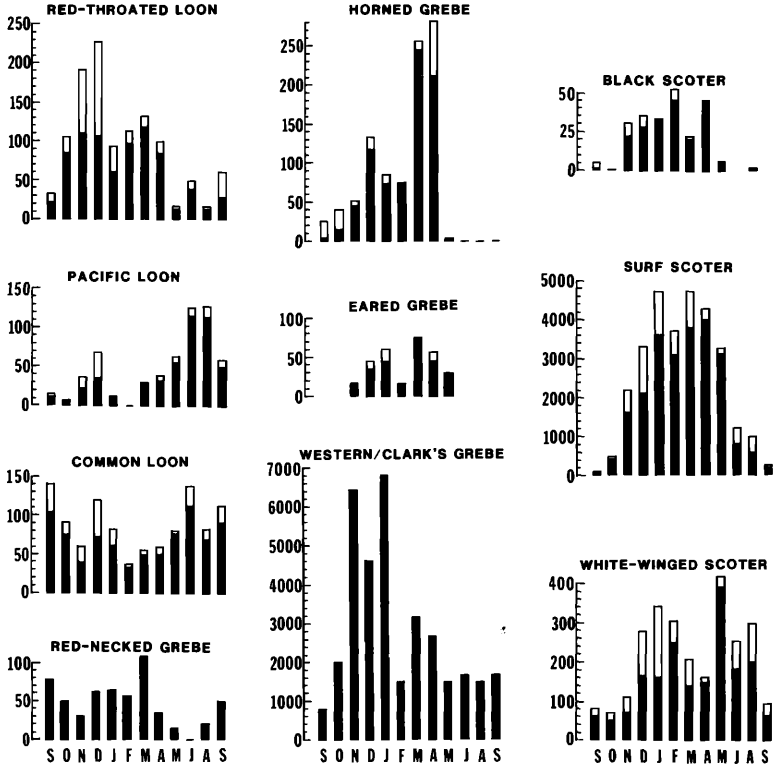

Figure 5. Seasonal abundance of loons, grebes, and scoters in the inshore zone along the southern coast of Point Reyes (see Fig. 1) from September 1980 through September 1981 (there was no June 1981 census). Solid bars, identified birds; open bars, unidentified birds, proportioned among the identified as described under Methods.

Table 1 Comparison between Inshore and Estuarine Areas of Monthly Counts of Waterbirds, November 1980 to March 1981[a]

Species	Inshore			Estuarine		
	M	SE	Range	*M*	SE	Range
Red-throated Loon	98	10	60-118	5	1	1-7
Pacific Loon	20	6	1-36	2	2	0-8
Common Loon	51	7	33-72	18	4	8-28
Loon spp.	81	31	15-84	—	—	—
Red-necked Grebe	64	12	31-107	1	[b]	0-1
Horned Grebe	120	36	51-256	245	30	201-327
Eared Grebe	42	12	16-74	328	107	181-746
Western/Clark's Grebe[c]	4498	994	506-6799	76	6	61-91
Black Scoter	29	4	20-45	—	—	—
Surf Scoter	2836	419	1608-3778	737	101	547-1004
White-winged Scoter	158	29	71-251	269	46	148-418
Scoter spp.	850	96	594-1088	—	—	—

[a] Estuarine counts combined for three estuaries; inshore counts combined for 10 sub-areas (Fig. 1). See Methods for corrections for small numbers of unidentified birds. *M*, mean number of birds for 5 counts; SE, 1 standard error.
[b] Value of 0.2.
[c] Predominantly Western Grebe (see species account).

Drake's Bay on 1 Sep 1980 (DS). Along the central California coast fall migration extends from mid-Oct through Dec with peak movement from Nov to early Dec (ABN, Cogswell 1977, DeSante and Ainley 1980). However, sometimes thousands of birds can still be seen flying south past Point Reyes from mid- to late Dec (AB 33: 309, 35: 331).

Although generally much less numerous in California after Dec (Briggs et al. 1987), Pacific Loons occupy sheltered coastal waters then and concentrate locally, apparently to feed on spawning Pacific Herring. High mid-winter counts are of 2000 birds flying north at Bolinas on 6 Jan 1977 (AB 31: 367), 2500 to 2800 off Muir Beach on 4 Feb 1978 (JGE), and about 6300 just north of the Golden Gate on 3 Jan 1983 (BB). Spring migration over neritic waters extends primarily from late Mar to early Jun (ABN); peak migration dates in central California range from 21 Apr to 6 May (ABN: BSa et al.). The end of spring migration was difficult to define. Records such as that of 300 to 1000 Pacific Loons at Drake's Bay between 18 and 24 Jun 1982 (AB 36: 1011, ABN) may have represented summer stragglers, since numbers typically dwindled later in the summer (Fig. 5).

Pacific Loons occurred in greater numbers in the inshore zone than in the estuaries (Table 1). In the inshore study area they usually concentrated in Drake's Bay (Fig. 6). Although overlapping with the other loons in habitat choice, Pacifics tend to occupy deeper coastal waters and migrate farther from shore (Briggs et al. 1987). In northern California they migrate primarily over the continental slope within 50 km of shore, but also over the continental slope up to 110 km from shore (Briggs et al. 1987). During migration in Apr 1986 they were seen feeding with Common Murres 65–80 km off Point Reyes (D. G. Ainley pers. comm.).

Pacific Loons occur rarely along the coast on freshwater lakes, reservoirs, and ponds, especially during migration (ABN, pers. obs.).

Common Loon (*Gavia immer*)

A rare summer resident, uncommon fall transient and winter resident, and fairly common spring transient (Fig. 4). Numbers in neritic waters in Jul were among the highest of the year, whereas from Jun to Aug estuarine numbers were the lowest (Figs. 4 and 5). The highest single-observer summer count was of 76 birds in Drake's Bay on 28 Jul 1980 (AB 34: 925). A high fall count was of a flock of 150 off Bolinas on 16 Oct 1976 (JGE). Although limited data from the Pacific Coast suggest some southward movement from mid-Sep to Oct (Palmer 1962, ABN), fall peaks at Abbott's and Limantour indicated a mid-Oct through early Dec passage as at the Farallones (DeSante and Ainley 1980). Although not evident from our censuses of birds *on* inshore waters (Fig. 5), Common Loons migrate in fall over neritic waters off California from late Oct to mid-Dec (Briggs et al. 1987).

Common Loons migrate in spring over neritic waters primarily from late Mar through May (ABN); peak migration dates in central California range from 12 Apr to 6 May (ABN: BSa et al.). Peak spring numbers in Point Reyes wetlands were found in Apr and May (Fig. 4).

Common Loons use estuaries, lagoons, larger bays, and inshore waters. They were more evenly spread between estuarine and inshore habitats than the other loons (Table 1, Fig. 6); inshore they were concentrated in Drake's Bay (Fig. 6). The species is also found on the coast in small numbers on freshwater lakes, ponds, and reservoirs (ABN, pers. obs.).

Pied-billed Grebe (*Podilymbus podiceps*)

A rare summer resident and fairly common winter resident exhibiting no migratory peaks (Fig. 4); small numbers nest at scattered sites in the study area and elsewhere in Marin Co. (PRBO unpubl. data). Declining early winter numbers at the wetlands (Fig. 4) may have partly reflected shifts of birds to freshwater habitat newly available or enhanced as a result of winter rains. The broad overlap of the breeding and wintering range and the species' nocturnal migratory habits (Palmer 1962) make it difficult to define migration periods. A Sep to Nov fall migration was indicated by increases on the wetlands (Fig. 4).

Although most closely associated with freshwater ponds, Pied-billed Grebes at Point Reyes also use bays, estuaries, lagoons, and, rarely, inshore neritic waters in the non-breeding season. They breed here on freshwater ponds with much shore and emergent vegetation or in marshes with some open water.

Horned Grebe (*Podiceps auritus*)

A very rare summer visitant and a common winter resident (Fig. 4). Two birds at Limantour on 16 Jul 1975, one to two at Abbott's on six dates from 5 Jun to 25 Jul 1980, three at Drake's on 23 Jun 1980, and one at Bolinas on 24 Jun 1981 were the only summer census records. Repeated sightings of one to two birds at Drake's Bay from 5 to 20 Jun 1980 and 6 Jun to 18 Aug 1981 (DS) demonstrated occasional oversummering on inshore waters. Migration spanned late Sep to Dec in fall and Mar to early May in spring (Figs. 4 and 5).

Horned Grebes use estuaries, lagoons, and inshore waters in preference to freshwater habitats. In our study area Horned Grebes occurred in greater numbers in estuaries than in inshore waters (Fig. 7, Table 1), where most birds were found in Drake's Bay (Fig. 7). Horned Grebes outnumbered Eared Grebes by almost 3

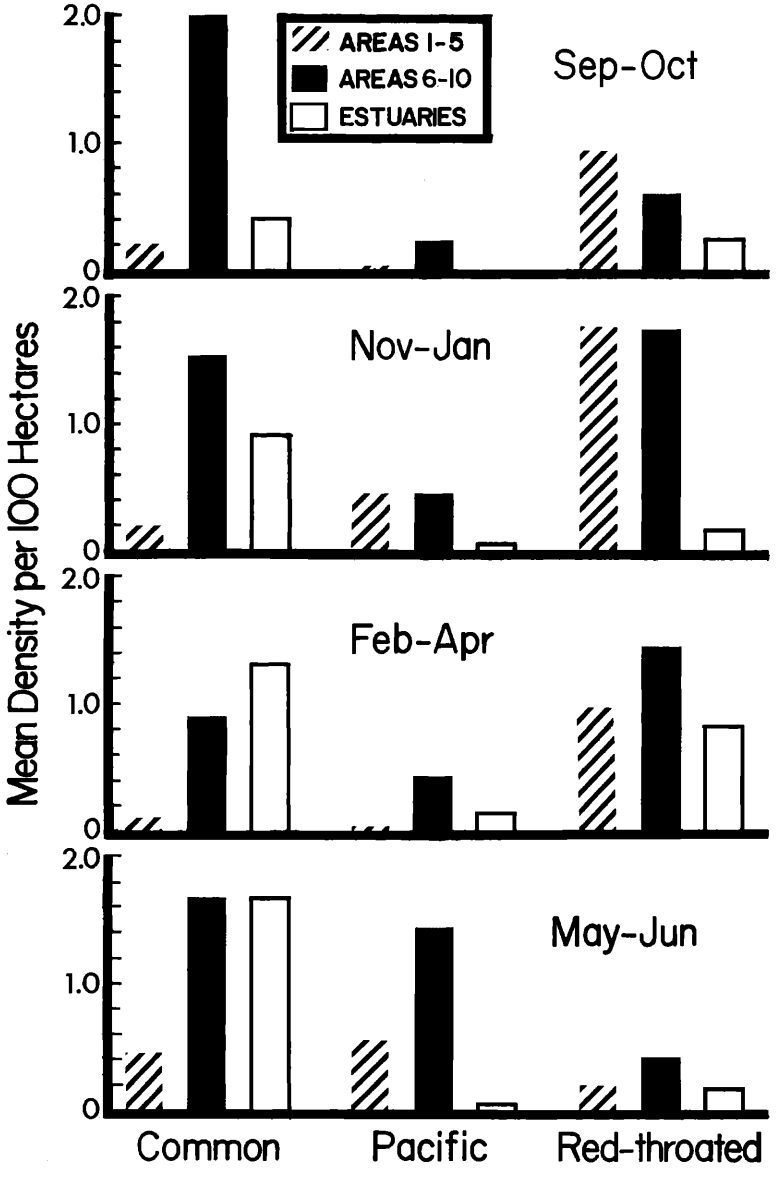

Figure 6. Densities of positively identified loons in estuaries and along two stretches of the southern coast of Point Reyes. See Fig. 1 for sub-areas. Estuarine values are for Bolinas Lagoon, Limantour Estero, and Drake's Estero combined.

to 1 in the inshore study area in winter, whereas at the Farallon and Channel islands, Horned Grebes are vastly outnumbered by Eared Grebes (DeSante and Ainley 1980, Briggs et al. 1987). Cogswell (1977) reported that Horned Grebes have become increasingly common in coastal California since 1930.

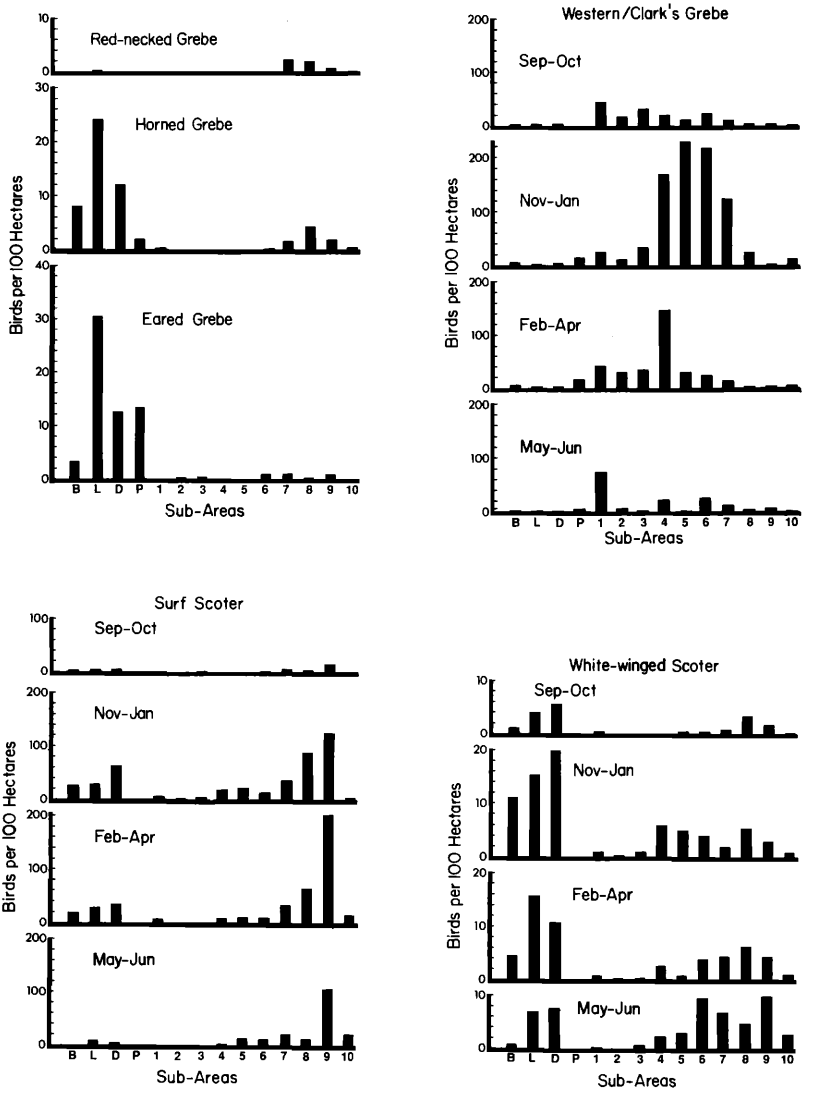

Figure 7. Densities of grebes and scoters along the southern coast of Point Reyes. The numbered sub-areas are shown in Figure 1. B, Bolinas Lagoon; L, Limantour Estero; D, Drake's Estero; P, Horseshoe Pond.

Red-necked Grebe (*Podiceps grisegena*)

A very rare estuarine winter resident with 18 birds on 32 census dates from 23 Sep to 8 May; 12 of the 18 were at Limantour on 25 dates. Repeated sightings of one to two birds in the inshore zone off Drake's Beach from 6 Jun to 20 Jul 1980 (ABN), from 6 Jun to 31 Jul 1981 (ABN), and from 18 Jun to 9 Jul 1983 (AB 37: 1022) represented oversummering birds. A bird at Limantour Estero on 10 and 16 Jul 1975 (AB 29: 1025, ABN) was the only one found in an estuary in summer. In 1981 in Drake's Bay, 3 birds on 4 Aug (ABN: DWm), 7 on 15 Aug (AB 36: 212), and 21 on 17 and 18 Aug (Fig. 5) suggested that fall arrival begins in early Aug and that numbers increase through the month. High inshore counts of 78 birds in Sep and 107 in Mar (Fig. 5, Table 1) were during fall and spring migratory periods. Although our data suggested fall movement from Aug to Sep, Palmer's (1962) statement that "nearly all birds are on salt water by mid-November" suggests a more protracted migration.

Our Mar peak, the occurrence of 15 birds on Drake's Bay on 7 May 1981 (Fig. 5), and the paucity of late May and early Jun records for northern California (ABN) suggest that spring migration extends from Mar to early May. Red-necked Grebes are scarce diurnal migrants over inshore waters of the central California coast in spring, from at least 11 Mar to 5 May (ABN: BSa et al.), because the species is very rare in southern California (Garrett and Dunn 1981) and most birds probably migrate at night (Palmer 1962).

Red-necked Grebes are generally considered rare in California (Grinnell and Miller 1944, Cogswell 1977, McCaskie et al. 1979), but at least locally in inshore waters at Point Reyes their numbers were similar to those of the other grebes and loons, except for the abundant Western Grebe (Table 1). We found no reference to numbers of Red-necked Grebes consistently this high elsewhere on the California coast. Virtually all Red-necked Grebes recorded on inshore censuses were in Drake's Bay (Fig. 7, Table 1), but they also congregated at the mouth of Tomales Bay, where there were sightings of 45 birds on 22 Dec 1973 (ABN: SFB) and 37 on 9 Jan 1978 (DS). Although Red-necked Grebes at Point Reyes inhabit mostly inshore waters and the mouths of deeper bays, they sometimes also occupy estuaries, lagoons, and, occasionally, brackish streams (DS) or freshwater ponds adjoining marine waters (fide J. Morlan).

Eared Grebe (*Podiceps nigricollis*)

A very rare summer visitant and common winter resident (Fig. 8). The only summer census record was of one bird at Abbott's on 29 Jun 1976. At Abbott's, where Eared Grebes were most numerous, the fall build-up was protracted and the spring decline was rapid (Fig. 8). None of the wetlands exhibited migratory peaks (Fig. 8). Except for the low Feb numbers (see Methods), seasonal use of inshore waters was similar to that in the estuaries (Figs. 5 and 8). Our evidence of protracted fall migration (Fig. 8) is supported by the pattern inland at Mono Lake, where numbers in fall begin to build up in late Jul and peak in mid-Oct; large numbers may remain until at least late Dec in some years (Jehl 1988). In San Francisco Bay salt ponds, where greater numbers "winter" than on Point Reyes, the population increases throughout the fall and winter and peaks in Apr (Swarth et al. 1982). This may reflect the overlapping of birds from the protracted fall migration with those from spring migration, which extends from Mar to mid-May (Palmer 1962, Jehl 1988).

In our study area Eared Grebes used estuaries and lagoons more than inshore waters (Table 1, Fig. 7), where they concentrated in Drake's Bay (Fig. 7; see also Horned Grebe). Eared Grebes were also numerous on freshwater ponds.

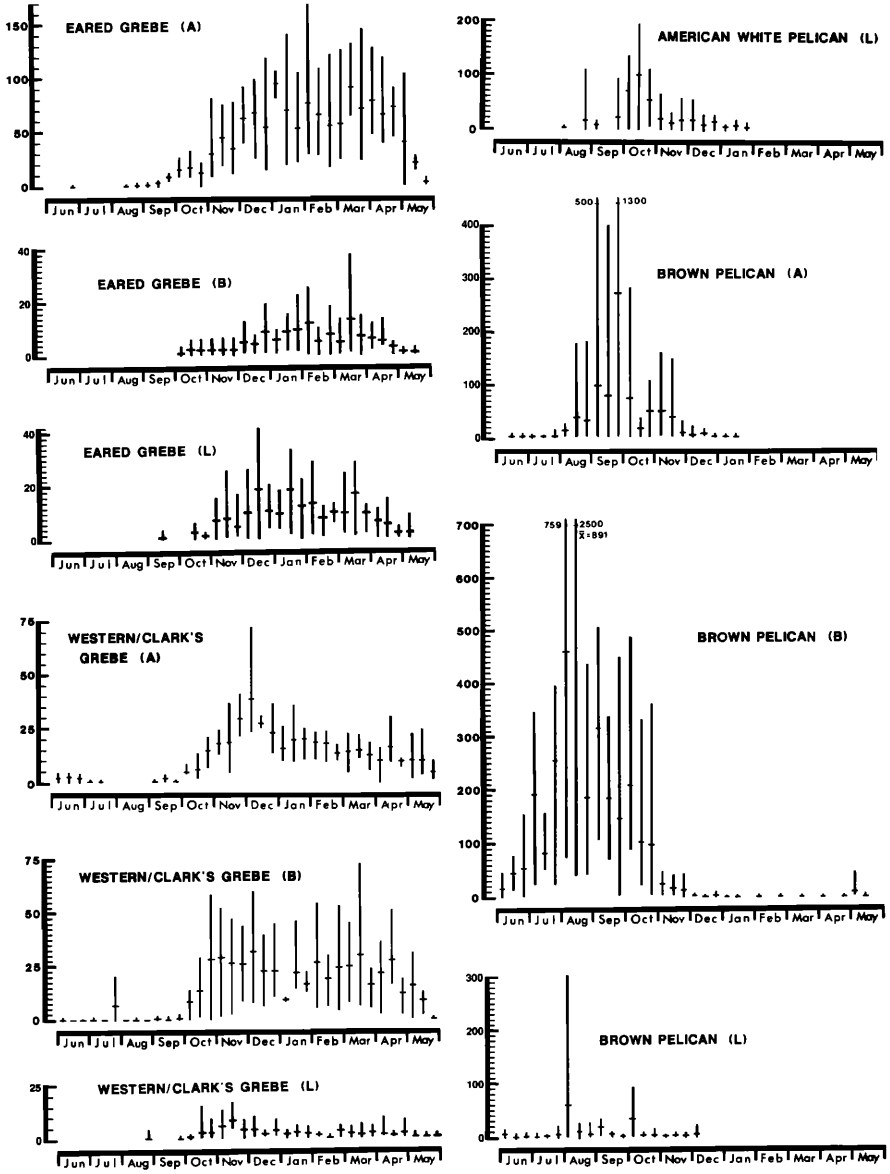

Figure 8. Seasonal abundance of some grebes and pelicans in wetlands of Point Reyes. See Figure 4 for details.

Western Grebe (*Aechmophorus occidentalis*) and Clark's Grebe (*A. clarkii*)

We did not distinguish Western and Clark's grebes, formerly thought to be morphs of a single species, on our censuses. *Aechmophorus* spp. were rare summer residents, common fall transients, and fairly common winter residents (Fig. 8). Fall migration extended primarily from Sep to Dec (Fig. 8) and perhaps to Jan (Fig. 5). Briggs et al. (1987) also recorded peak numbers on inshore waters along the California coast from Nov through Jan. A fall peak at Abbott's and Limantour was followed by a gradual decline in numbers through the winter, while at Bolinas no fall peak was evident and numbers remained relatively stable through the winter (Fig. 8). Seasonal use of inshore waters was similar to that of the estuaries, except that inshore waters supported a large oversummering population (Figs. 5 and 8). Spring movement extends from late Mar through May (Palmer 1962, Figs. 5 and 8).

Aechmophorus spp. were found in much larger concentrations in inshore waters than in estuaries, lagoons, or ponds (Fig. 7, Table 1); inshore concentrations shifted seasonally (Fig. 7). Overall, *Aechmophorus* densities were the highest of any waterbird in our inshore study area. These birds prefer waters within 0.5 km of shore over sandy bottom less than 10 m deep, especially downwind from major headlands (Briggs et al. 1987).

Western Grebes are much more common in this area than Clark's Grebes. Counts in Jan 1977 showed 88.4% of the birds in California and Nevada to be Westerns; at the two Marin Co. sites close to our study area 87.1% of the birds were Westerns (Ratti 1981). Also, at least 90% of 280 birds in Drake's Bay on 18 Apr 1980 were Westerns (JGE). Both Western and Clark's grebes oversummer on coastal waters, with the former predominating (ABN).

Ashy Storm-Petrel (*Oceanodroma homochroa*)

A very rare visitant with one census record of a single, apparently healthy, individual found inside Bolinas Lagoon on 21 Feb 1977 (AB 31: 368). For much of the year this species inhabits pelagic waters off California from the continental shelf edge to 25 km seaward, particularly on the warm sides of thermal fronts bordering upwellings (Briggs et al. 1987). A few Ashy Storm-Petrels breed in our study area on Bird Rock, Tomales Point; over 75% of the world's population breeds nearby on the Farallones (Sowls et al. 1980). Off central California peak numbers occur from Sep to Jan; an increase in sightings seaward of the continental slope after Dec suggests that many birds winter in deeper waters (Briggs et al. 1987). Stragglers inside San Francisco Bay and casualties on city streets have invariably been immature birds (D. G. Ainley pers. comm.).

American White Pelican (*Pelecanus erythrorhynchos*)

A fairly common winter resident (Fig. 8). A summering bird on Drake's Estero from 8 Mar to 8 Jul 1965 was apparently injured (PRBO). There appears to be no regular movement along the coast; instead, birds move directly overland to and from inland breeding sites. Birds from Drake's Estero use Limantour erratically, explaining the gaps in the Limantour graph. Censuses at Limantour reveal the normal timing of sightings, early Aug to late Jan (Fig. 8), but not the Oct to Jan period of peak numbers on Point Reyes (pers. obs.). Earliest and latest non-census records, respectively, were 17 Jul 1983 (RMS) and 3 Feb 1981 (DS), except for 21 birds on Tomales Bay on 24 May 1988 (ABN: RHa), 61 there on 2 June 1988 (TNo), a number there on 12 June 1989 (TNo), and 7 at Bolinas on 27 Jun 1989 (KH). These May and June sightings paralleled widespread reports at that time in

the San Francisco Bay Area (AB 42: 477, ABN), and particularly high numbers in that season in 1988 may have reflected breeding failures inland following the 1986–89 drought. From 1970 to 1988 the median number of White Pelicans recorded on the Point Reyes CBC was 77 (range 6–827); the high count is likely an overestimate due to duplicate counts of conspicuous soaring flocks. The highest non-census count at a single location was 360 at Limantour on 19 Dec 1971 (CBC data fide BiL). White Pelicans' occurrence on Point Reyes is generally briefer than on San Francisco Bay, where small numbers occur irregularly through the spring, non-breeders may arrive as early as mid-May, and substantial numbers may build up by late Jun to early Jul (ABN).

On Point Reyes White Pelicans use shallow estuarine waters and, to a limited extent, freshwater ponds. Most birds aggregate in Drake's Estero and near the mouth of Tomales Bay, perhaps because suitable fish prey concentrate in the extensive eelgrass beds at these sites. White Pelicans irregularly used Bodega, Abbott's, and Bolinas, in descending order of frequency. The sandspit at the mouth of Drake's Estero, the mouth of Walker Creek on Tomales Bay, and Bird Rock off Tomales Point are traditional roosting sites.

Habitat loss and disturbance reduced overall numbers and breeding sites in California from the 1880s until the late 1950s (Grinnell and Miller 1944, Remsen 1978). This decline paralleled a reduction in the number of breeding colonies throughout the western U.S., with numbers stabilizing in recent years (Sloan 1982, Smith et al. 1984, Sidle et al. 1985). These declines suggest that numbers of White Pelicans wintering on the California coast have also decreased historically.

Brown Pelican (*Pelecanus occidentalis*)

A very common summer to early winter dispersant and a very rare late winter to spring visitant (Fig. 8). Seasonal movements of Brown Pelicans, and a number of other seabirds, are strongly affected by seasonal cycles of upwelling and temperature changes in the California Current (see below and Results and Discussion). At Point Reyes Brown Pelicans were most numerous at Bolinas, where numbers increased from Jun to Aug, peaked from late Jul to early Oct, and declined sharply thereafter (Fig. 8). Although a few birds were present at Abbott's by Jun, numbers there did not increase markedly until Aug. Brown Pelicans visited Limantour erratically. In neritic waters, however, Brown Pelicans frequently may be found earlier and later in the year than in Point Reyes estuaries. Birds dispersing north typically begin to trickle into San Francisco Bay and neritic waters north of Monterey in May, rarely in Apr, or exceptionally in Mar (ABN); they arrive later farther north (Anderson and Anderson 1976, Henny and Collins 1980, Briggs et al. 1983). Overall on the central California coast, pelican numbers peak in Sep and Oct (Briggs et al. 1983). In neritic waters of this region a secondary peak occurs in Nov and Dec, but the birds do not fly consistently south, as would be expected of a rapid, directed migration. Stragglers are usually seen in neritic waters through Jan, and occasionally small numbers remain through winter and spring, as in 1977–78, 1983–84, and 1987–88 (AB 32: 394 and 1050, AB 38: 352, Briggs et al. 1983, AB 42: 314). A few stragglers sometimes use Bolinas Lagoon in winter as well.

The timing of arrival in northern California varies annually as a function of variation in the seasonal warming of the ocean surface (Anderson and Anderson 1976; Briggs et al. 1981, 1983). While the timing of peak numbers is correlated with timing of peak mean sea surface temperatures south of Point Reyes (Briggs et al. 1983), the magnitude of the peak appears to be related more to preceding events at breeding colonies in the Gulf of California (Anderson and Anderson

1976, Briggs et al. 1981, 1983). The pelicans' northward dispersal lags well behind the warming trend (Briggs et al. 1981), as would be expected for a species responding to fish productivity. Exceptionally early dispersal is often preceded by breeding failures in the Gulf of California related to unusually warm water along the Pacific Coast, which, in turn, often corresponds to intense El Niños off South America (Anderson and Anderson 1976). Early arrivals at Bolinas of 44 birds on 7 May 1973 and 8 birds on 28 Apr 1983 (JGE) heralded very early build-ups of numbers along the northern California coast in El Niño years (AB 27: 814 and 912; AB 37: 907). Counts off Bolinas of 6 birds on 24 Apr and 35 on 26 Apr 1987 (RMS) and 450 on 30 Apr 1989 (ABN: PEG) also coincided with early build-ups along the northern California coast (AB 41: 483, ABN) in non-El Niño, though warm-water, years. The departure of Brown Pelicans to the south in early winter coincides with a period of dwindling food resources, but departure at that time is perhaps more strongly influenced by stormy weather (D. W. Anderson pers. comm.).

At Bolinas Lagoon marked year-to-year variation in the timing of peak numbers (Fig. 9) was caused to some extent by pelicans concentrating to prey on Northern Anchovies (*Engraulis mordax*), which also migrate seasonally north to central California (Mais 1974, Parrish et al. 1981) and move in and out of bays and estuaries (Richardson 1980). The highest pelican counts in our study area—6000 birds inside Bolinas Lagoon on 7 Sep 1984 (RMS), 9000 in Bolinas Lagoon and Bolinas Bay on 8 Sep 1984 (DGA, RF), and 3800 in Bolinas Lagoon on 24–25 Aug 1985 (RMS)—were recorded during large anchovy runs.

Overall in central California, pelicans concentrate from Point Lobos to Bodega at traditional, safe roosts near optimal foraging areas (Briggs et al. 1981). Traditional pelican roosts in the Point Reyes area are on tidal flats, sand spits, and large offshore rocks. Foraging birds frequent estuaries, lagoons, and inshore and offshore waters (mostly within 20 km of shore), particularly where plumes of cool, upwelled water intrude into warmer, more stratified water of the California Current (Briggs et al. 1983, 1987).

Anderson and Gress (1983) summarized population trends, showing a drastic decline from 1969 to 1973, coinciding with high DDT levels that affected reproductive success in pelican populations in southern and Baja California, and an increase from 1974 to 1980, as pollution levels declined. By the mid-1980s the southern California breeding population appeared to have reached historical levels, but the species is still listed as endangered by state and federal governments (D. B. Lewis pers. comm). We did not detect any consistent trends in pelican numbers over the course of our study, perhaps because of the marked year-to-year variability in numbers and the local extent of our census efforts (see Briggs et al. 1983).

Double-crested Cormorant (*Phalacrocorax auritus*)

A fairly common summer resident, common fall transient, and fairly common winter resident (Fig. 10). High Aug to Dec numbers at wetlands corresponded with post-breeding dispersal of adults and young from the nearby Farallon Islands (Boekelheide, Ainley, Huber, and Lewis in press), as evidenced by sightings of Farallon-banded birds at Bolinas Lagoon, Drake's Estero, Tomales Bay, and Abbott's Lagoon (*ibid*, DS pers. obs.). Migration of inland breeders to the coast (Sowls et al. 1980) or the dispersal of other coastal breeding populations may also contribute to the fall peak. Although Farallon-banded birds have been recovered from British Columbia to San Diego, with the majority found along the central California coast, overall there is a southward trend to dispersal, especially among first-year birds (Boekelheide, Ainley, Huber, and Lewis in press). Since Double-crested Cormorants are essentially absent from the Farallones from Sep until mid-

Mar (*ibid*), the Jan decline in wetland numbers may have been due to birds moving to increased freshwater habitat following heavy winter rains. Notable spring migratory movement was indicted by flocks of about 1000 flying up the west shore of Tomales Bay on 8 and 9 Apr 1986 (AB 40: 519).

Although some Double-crested Cormorants on Point Reyes estuaries in summer are Farallon breeders on foraging trips (Boekelheide, Ainley, Huber, and Lewis in press), many others are immature non-breeders. Recently the species has been discovered nesting on the Richmond–San Rafael and Oakland–San Francisco (Bay) bridges (AB 38: 1057). Birds from these colonies may venture outside of San Franciso Bay on occasion, but probably most breeding birds in summer in the Point Reyes area originate from the Farallon Islands.

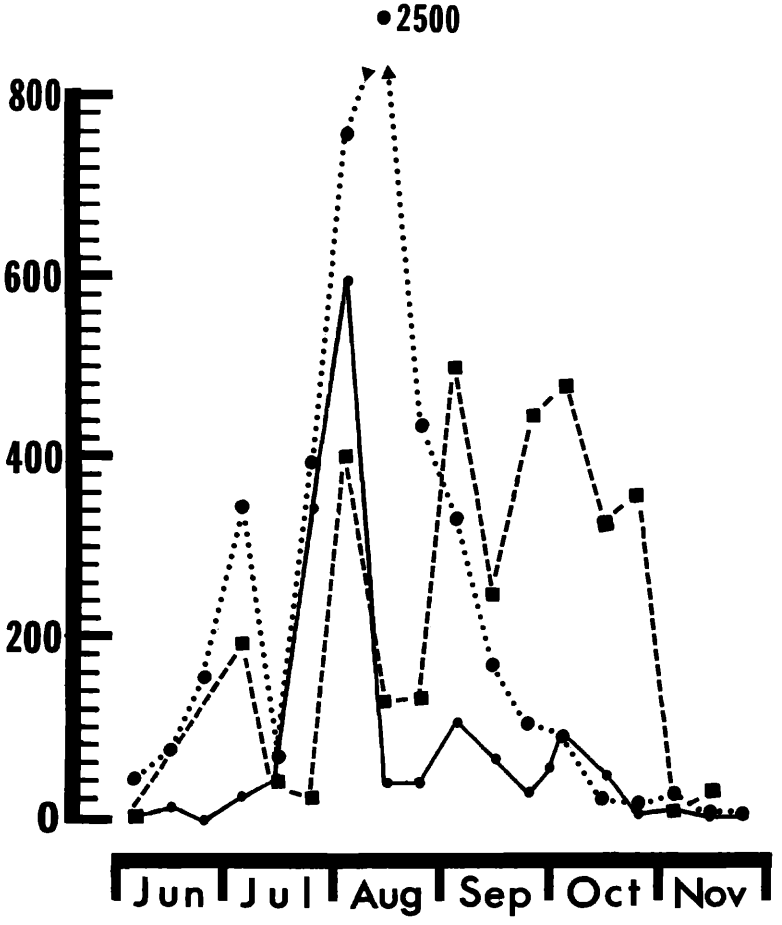

Figure 9. Numbers of Brown Pelicans at Bolinas Lagoon during 1973 (dotted line), 1974 (broken line), and 1975 (solid line).

In the Point Reyes area Double-crested Cormorants forage in estuaries, lagoons, bays, and large ponds; they occur only rarely here in inshore waters.

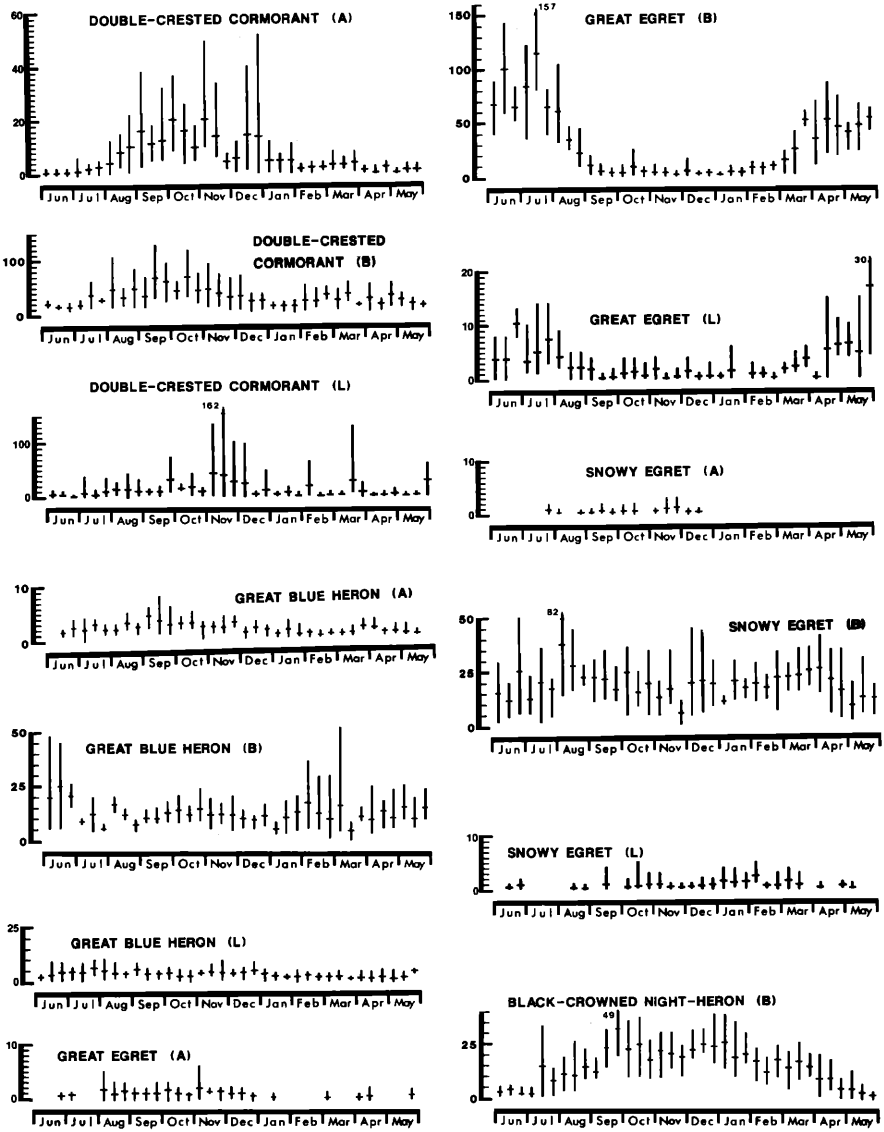

Figure 10. Seasonal abundance of the Double-crested Cormorant and some herons and egrets in wetlands of Point Reyes. See Figure 4 for details.

They often roost on sandbars, small islands, and pilings. A few also roost during the day on some coastal rocks and reefs, and many roost at night on Bird Rock off Tomales Point (DS). They forage for schools of fish "from the surface to near, but not on, bottoms having no relief" (Ainley et al. 1981).

Double-crested Cormorants formerly bred on coastal bluffs at Point Resistance just north of Bear Valley (L. P. Bolander and Bryant 1930). Although they have not bred recently anywhere along the Point Reyes shoreline (Sowls et al. 1980, authors' pers. obs.), they do breed on offshore rocks, cliffs, and man-made structures at scattered sites elsewhere along the California coast (Sowls et al. 1980, ABN). Because of various disturbances, breeding populations at the Farallones (Ainley and Lewis 1974), on islands off southern California and Baja California (Gress et al. 1973), and in interior California (Grinnell and Miller 1944, Remsen 1978, Sowls et al. 1980) have declined steeply. Ainley and Lewis (1974) argued that the failure of marine breeding populations to recover from their decline was due to the crash in the late 1940s of the Pacific Sardine (*Sardinops caerulea*) population, apparently caused by overfishing at a time of unfavorable environmental conditions. Human disturbance on the Farallones undoubtedly continued to keep numbers down, but with protection the population has increased modestly since the early 1970s (Boekelheide, Ainley, Huber, and Lewis in press). Other increases on Anacapa Island off southern California (Anderson and Gress 1983), in San Francisco Bay, and for California as a whole (USFWS Breeding Bird Surveys fide Sam Droege) indicate a trend of widespread recovery of breeding populations of Double-crested Cormorants.

Brandt's Cormorant (*Phalacrocorax penicillatus*)

Brandt's Cormorants nest regularly on offshore rocks and coastal bluffs in our study area and all along the California coast, including the Farallon Islands, where 45% of the total California population breeds (Sowls et al. 1980). They were very rare fall and winter visitants to the estuaries (Fig. 11). The scarcity of spring and summer estuarine sightings coincided with the occupation of nearby nesting colonies; more numerous fall sightings coincided with the dispersal of juveniles (Boekelheide, Ainley, Morrell, and Lewis in press). Our data for inshore waters were not adequate to explain seasonal movements, especially since Brandt's Cormorants are highly mobile when feeding (PRBO unpubl. data). After dispersal from nearby breeding areas, Brandt's Cormorants were least abundant in our inshore study area from Dec to Apr, a pattern similar to that for the central California coast overall (Briggs et al. 1987). Farallon band recoveries show an Aug to Nov northward movement by juveniles and, to a lesser degree, by adults (Boekelheide, Ainley, Morrell, and Lewis in press). Movement to the south, as early as Sep (Briggs et al. 1987), leaves the winter population spread out along the entire California coast with the bulk of the birds in the central region (Briggs et al. 1987, Boekelheide, Ainley, Morrell, and Lewis in press). Garrett and Dunn (1981) reported a northward movement in Feb and Mar in Santa Barbara Co.

Brandt's Cormorants prefer neritic waters mostly within 10 km of shore and 25 km of roosts and colonies (Briggs et al. 1987); they are rarely found in the small estuaries and lagoons (Fig. 11). Large numbers occur regularly in San Francisco Bay, and seasonally in Tomales Bay during winter herring runs. They feed primarily on both schooling and non-schooling fish on or just above rocky, sandy, or muddy bottoms, though they also catch appreciable prey from middle depths to the surface (Ainley et al. 1981). The Farallon nesting population was decimated by commercial egg collectors in the 1800s but has recovered rapidly since the 1920s (Ainley and Lewis 1974).

Pelagic Cormorant (*Phalacrocorax pelagicus*)

Pelagic Cormorants breed regularly on rocky coastal cliffs in our study area and all along the California coast (Sowls et al. 1980). They forage in inshore waters, mostly within 10 km of land (Briggs et al. 1987), and in the mouths of deep bays. They were very rare visitants to the wetlands from Sep to early Jun (Fig. 11). The greater incidence of fall sightings coincided with dispersal from breeding sites. Information on seasonal movements is scanty (Boekelheide, Ainley, Huber, and Lewis in press). Garrett and Dunn (1981) reported increased numbers south of San Luis Obispo Co. from mid-Sep to late Apr, indicating that some Pelagic Cormorants move south in winter (Garrett and Dunn 1981), but Briggs et al. (1987) did not note any seasonal movements. Although Pelagic Cormorants often feed on solitary prey that hide in rocky reefs (Ainley et al. 1981), Farallon breeders are strongly dependent on mid-water schooling rockfish (*Sebastes* spp.)

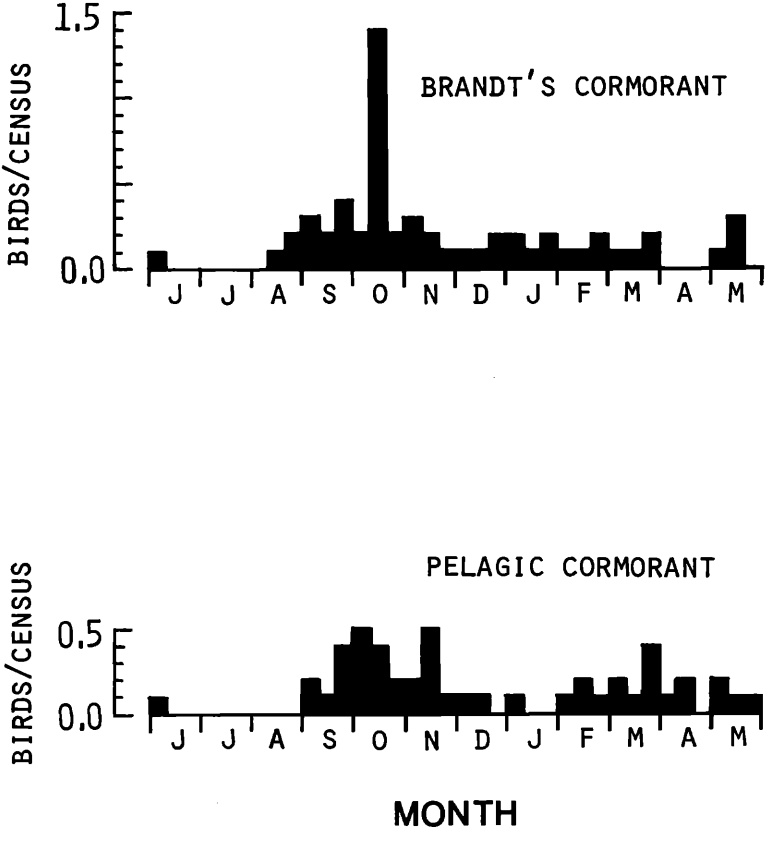

Figure 11. Mean number of Brandt's and Pelagic cormorants per census for Bolinas and Abbott's lagoons combined.

(Boekelheide, Ainley, Huber, and Lewis in press). Breeding populations declined drastically at the Farallones during the 1800s because of disturbance from commercial egg collectors but have recovered slowly since the early 1900s (Ainley and Lewis 1974).

Great Blue Heron (*Ardea herodias*)

A fairly common year-round resident (Fig. 10). Since there is little evidence for migration away from coastal California (Palmer 1962, Gill and Mewaldt 1979), seasonal changes in abundance are best explained by local movements. Variation in numbers at Bolinas (Fig. 10) corresponded with breeding at the Audubon Canyon Ranch rookery on the east side of the lagoon. The median number of adult Great Blue Herons nesting at Audubon Canyon from 1967 to 1981 was 90 birds (range 54–124; Pratt 1983). Birds begin occupying the rookery in late Jan or early Feb and commence nesting shortly thereafter (Pratt 1970, 1972a,b). Initiations of first clutches peak in mid-Mar (Pratt 1974); heron numbers on the lagoon then dropped while one of each pair was incubating. At this stage of nesting Pratt (1980) found that 45% of the departing herons went to Bolinas Lagoon to forage, while the others went elsewhere. The Jun peak on Bolinas Lagoon occurred when most chicks, at that time at least 3 weeks old, are first left unattended for part of the day (Pratt 1970) and the number of adults foraging at any one time increases. Fledglings and adults leave the heronry between late Jun and mid-Jul (Pratt 1970); at the same time numbers on the lagoon dropped. Only small numbers of herons breed close to Abbott's and Limantour (Pratt 1983), where numbers were slightly lower during the breeding season (Fig. 10). Abbott's, the only site without a heronry on its shores, had greatest numbers from mid-Aug to mid-Oct. This pattern is similar to that in fall on the Farallones (DeSante and Ainley 1980), which presumably involves wandering juveniles. Great Blue Herons may also concentrate more in estuaries and lagoons during summer and fall as ephemeral freshwater habitats dry up. They feed in the shallow waters of estuaries, freshwater ponds, marshes, flooded fields, open stream edges, and tidal reefs. They also frequent fields to prey on rodents.

American Bittern (*Botaurus lentiginosus*)

On Point Reyes, American Bitterns frequent freshwater marshes, ponds, or swales, and occasionally brackish marshes. Their status as a very rare year-round resident with a winter peak (Fig. 12) reflects the limited suitable habitat in the study area. Between 1970 and 1988 the median number of bitterns recorded on the Point Reyes CBC was 3 (range 1–10). A decline in winter sightings after early Jan (Fig. 12) may have been caused by birds dispersing over a wider area as winter rains created additional habitat. Late May to Aug records presumably pertained to local breeders or fledglings and possibly non-breeding, oversummering individuals. The only confirmed evidence for local breeding was two birds with a few tufts of down on their heads at a freshwater pond at Abbott's Lagoon on 28 Jul 1981 (DS). Bitterns begin nesting early enough in California (Bent 1926, Palmer 1962) that fledglings from outside the study area presumably could arrive here by early Jul, but data are lacking on the timing of arrival. Palmer (1962) noted that fall migration is in Sep and Oct and most spring migration is from Mar to mid-Apr but that there is "considerable wandering from late summer to early fall." Numbers are greatest on the northern California coast from early Sep to mid-May (McCaskie et al. 1979) and on the southern coast from late Sep to mid-Apr (Garrett and Dunn 1981).

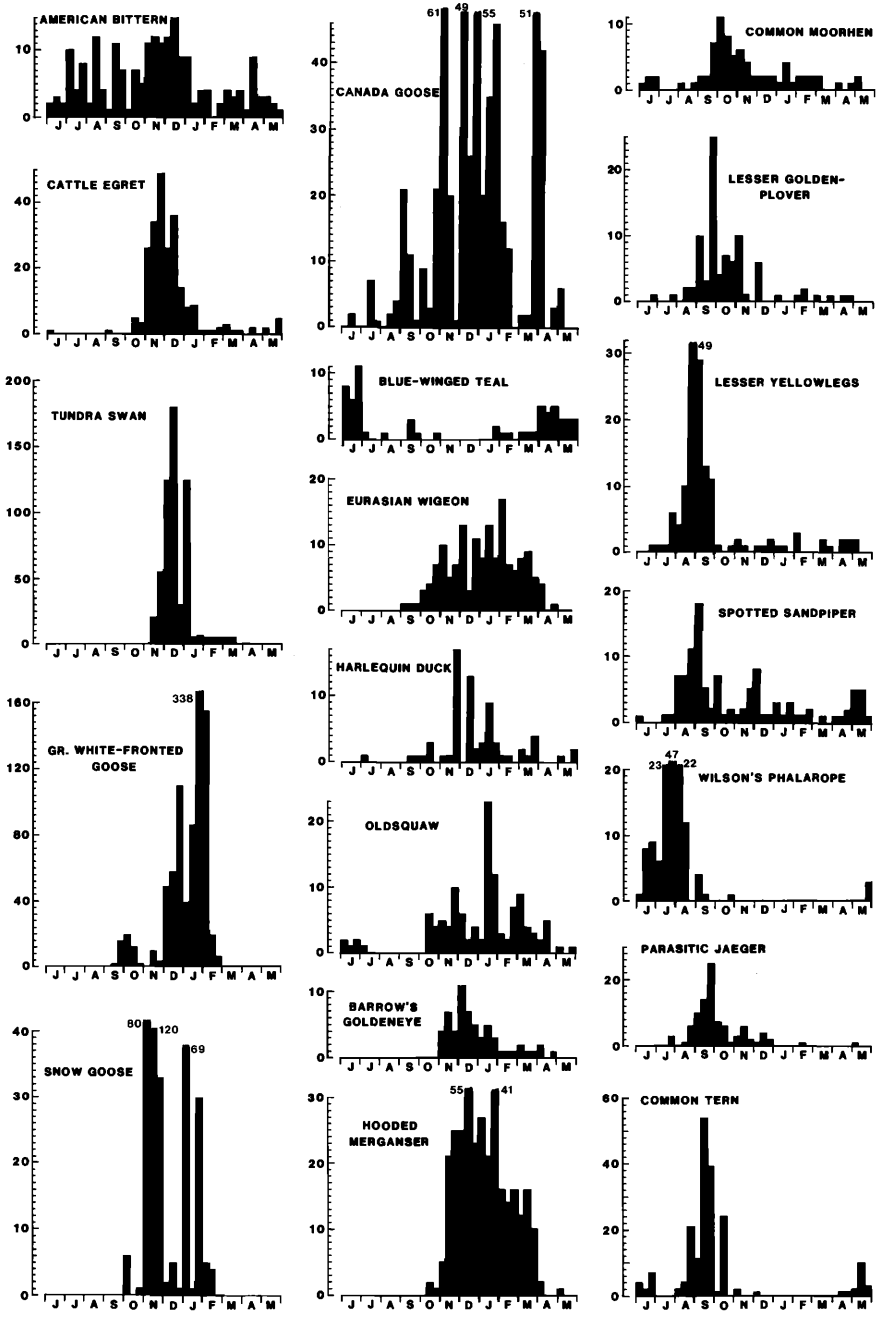

Figure 12. Occurrences of some very rare aquatic birds by 10-day periods (see Methods) from all records, 1954–1982.

Great Egret (*Casmerodius albus*)

A common summer resident and uncommon winter resident (Fig. 10). The seasonal abundance pattern at Bolinas (Fig. 10) reflected the tendency for Great Egrets from a rookery at Audubon Canyon Ranch on Bolinas Lagoon's east shore to forage on the lagoon. The median number of adult Great Egrets nesting at Audubon Canyon Ranch from 1967 to 1981 was 172 birds (range 130–296; Pratt 1983). Great Egret numbers at Bolinas built up slightly in Feb but increased sharply in Mar, when birds begin occupying the rookery (Pratt 1970). Egg laying usually peaks in early Apr, and the last egrets begin building nests by mid-Apr (Pratt 1972a,b, 1974). Numbers stabilize on the lagoon from late Mar to late May, then reach a peak from early Jun to early Aug as adults first leave their young unattended and later as the first young fledge (H. Pratt pers. comm.). The steady decline in numbers on the lagoon in Aug (Fig. 10) coincided with a reduced number of occupied nests (Pratt 1970) and was due to post-breeding dispersal of fledglings and adults from the area. Seasonal use at Limantour was generally similar to that at Bolinas but not to that at Abbott's (Fig. 10). Limantour and Abbott's are equally close to two small egret rookeries (Pratt 1983); however, Limantour is closer to the large Bolinas rookery, and birds consistently seen flying along the coast west of Bolinas during the breeding season (DS) appeared to be moving back and forth between the Bolinas rookery and Limantour. At Abbott's, the small numbers present from Aug to Dec (Fig. 10) followed post-breeding departure from Bolinas, as do the six Farallon records (21 Sep to 8 Nov, DeSante and Ainley 1980). The paucity of sightings at Abbott's between Jan and Mar may indicate poor foraging conditions caused by rising water levels after winter rains, and the paucity of sightings there from Apr through Jul corresponds to the occupation of rookeries elsewhere. The lower winter numbers at all sites are due probably to the migration of most of the population to wintering locations as distant as Baja California or the west coast of mainland Mexico (Palmer 1962).

Great Egrets appear to forage more in estuaries than do Great Blue Herons, but they also frequent freshwater ponds, marshes, streams, and, especially in the rainy season, fields and pastures. In Jun 1984, up to 56 Great Egrets fed in tidal pools of the rocky reef from Duxbury Point to Bolinas Point (RMS).

Hunters for the feather trade drastically reduced egret numbers in California in the 1880s and 1890s, but because of legislative protection the population recovered substantially from 1911 to 1943 (Grinnell and Miller 1944). Great Egrets reappeared in the San Francisco Bay area in 1924 (Stoner 1934) and the first Marin Co. sightings were of seven birds at Bolinas on 7 May 1929 (Stoner 1934) and one at Drake's Estero on 7 Jun 1931 (Stephens 1931). These birds may have been nesting at nearby rookeries at the time (Pratt 1983). Great Egrets reproduced poorly in the late 1960s and early 1970s because of DDT-induced eggshell thinning, but a decrease in egg loss during incubation since then suggests that the egrets are recovering (Pratt 1974).

Snowy Egret (*Egretta thula*)

A fairly common year-round resident (Fig. 10). A large rookery on West Marin Island near San Rafael, about 22.5 km from Bolinas, has been active since at least 1952 (Ralph and Ralph 1958, Pratt 1983). Seasonal and/or daily movements of birds from this or other San Francisco Bay rookeries may greatly influence counts at wetlands in our study area. Numbers at Bolinas (Fig. 10) were generally low during the late Apr to Jul breeding season (Stone and Rigney 1978) but increased in Aug when young and adults depart from breeding colonies in San Francisco Bay. Small numbers of Snowy Egrets wintered at Limantour from early Oct to mid-Mar and occurred irregularly at other times (Fig. 10). The few at Abbott's

from late Jul to mid-Dec (Fig. 10) may have been birds dispersing after breeding, or potential wintering birds that left the lagoon after foraging conditions changed because of winter rains. Recoveries of birds banded in San Francisco Bay suggest that juvenile Snowy Egrets migrate south for long distances to winter (as far as southern California and Mexico), while adults move short distances or winter near breeding areas (Gill and Mewaldt 1979).

Snowy Egrets forage in shallow estuaries, freshwater ponds, and marshes. They were nearly extirpated from California between 1880 and the early 1900s by the ravages of plume hunters, but because of legislative protection they recovered from 1908 to 1943 (Grinnell and Miller 1944).

Little Blue Heron (*Egretta caerulea*)

A very rare spring visitant with census records of single adults at Bolinas Lagoon from 26 May to 3 Jun 1975 (AB 29: 903, ABN) and from 11 to 24 May 1976 (AB 30: 883, ABN). The only other records for Point Reyes were of one to two birds at Bolinas Lagoon from 18 to 27 May 1984 (AB 38: 953, ABN) and an immature at Abbott's Lagoon on 2 Oct 1977 (KY, RMS). Although quite rare in coastal northern California, Little Blue Herons have been recorded in all but two years since first discovered in 1964 (Unitt 1977, ABN). There are three documented winter records for northern California, all of immatures (Jeter and Paxton 1964; AB 36: 326 and 889, AB 41: 322). Otherwise all northern California records fall between 18 Apr and 12 Oct (ABN), except for one on 26 Nov (AB 41: 137). Most are of adults near heron or egret rookeries in the San Francisco Bay area (Unitt 1977, McCaskie et al. 1979, ABN), where they presumably have been breeding since at least 1981 and apparently also hybridizing with Snowy Egrets (Morlan and Erickson 1988, AB 42: 1336). The few immatures sighted in summer may be locally produced or perhaps post-breeding dispersants from the south. In coastal southern California most records are of northward-dispersing immatures in fall, with some remaining to winter; fewer adults occur in spring and early summer (Unitt 1977, Garrett and Dunn 1981). Some have nested annually in the Tijuana River Valley since 1980 (P. Unitt pers. comm.).

Cattle Egret (*Bubulcus ibis*)

A very rare late fall to early winter dispersant. Our only census records—two birds on 1 Dec 1977, one on 4 Dec 1978, three on 7 Nov 1979, and two on 7 Dec 1979—were all from pastures bordering Pine Gulch Creek at Bolinas Lagoon. Highest non-census counts were of 18 birds on 23 Nov 1977 flying from Bolinas Lagoon north up the Olema Valley (LES, GWP, SJ), 19 birds near Olema Marsh on 17 Dec 1977 (ABN: BDP), and 19 birds on 1 Nov and 20 birds on 24 Nov 1984 at Bolinas Lagoon (DS, RMS). Between 1970 and 1988, Cattle Egrets were recorded on 15 of 19 Point Reyes CBCs; the median for the 15 years was 3 (range 1–30). Most Marin Co. records extend from mid-Oct to mid-Jan and peak strongly from early Nov to mid-Dec (Fig. 12). This peak coincides with the peak in Washington and British Columbia (Roberson 1980) but is later than that in coastal southern California, where birds are present year round with the largest numbers occurring from late Sep through early Nov (Garrett and Dunn 1981). Since Cattle Egrets breed in California from at least Apr to Aug (Cogswell 1977, AB 32: 1204) and young fledge after mid-May (AB 24: 716), one might expect initial post-breeding dispersal as early as Jun or Jul. However, noticeable northward movement on the West Coast averages much later and corresponds well with the beginning of winter rains, which may influence food availability. The importance of rainfall to the seasonal cycle of Cattle Egrets is evidenced by rainfall triggering breeding in South America (Lowe-McConnell 1967) and the post-breeding dis-

persal of birds in South Africa to areas of greater rainfall (Siegfried 1970). By Feb, most Cattle Egrets have moved south of northern California. The mid-Apr to early Jun records (Fig. 12) likely represent northward spring dispersants. At that season birds have also been found in the eastern United States far north of known breeding areas (Palmer 1962).

Cattle Egrets appear to have spread naturally from the Old World to the Western Hemisphere, occurring in South America in 1877 and in Florida by at least 1942 (Crosby 1972). They now have expanded over much of North America. The first record for Point Reyes—of one bird at Olema Marsh on 27 Dec 1970—coincided with the first widespread influx into northern California (AFN 24: 534) and followed the first sighting in California in 1964 (McCaskie 1965). Nesting was first observed in southern California in 1970 (AFN 24: 716) and in northern California in 1978 (AB 32: 1204). Despite a continuing population increase in northern California as a whole, annual numbers at Point Reyes have remained relatively stable in the 1980s (Point Reyes CBC, ABN).

Siegfried (1978) described Cattle Egret habitat as the moist ecotone between aquatic and dry upland areas. Locally, Cattle Egrets forage in moist short-grass pastures, usually around dairy cattle, and much less frequently in brackish marshes.

Green-backed Heron (*Butorides striatus*)

A very rare fall and spring visitant with the only census records being of single birds at Abbott's on 25 and 31 Aug 1966, at Bolinas on 11 Oct 1976, and at Limantour on 28 Apr 1970. This rarity reflects the limited freshwater habitat in the study area and the species' overall rarity in Marin Co. (Shuford 1982). Between 1970 and 1988, Green-backed Herons were recorded on only 4 of 19 Point Reyes CBCs, with a high count of three. Green-backed Herons occur uncommonly in northern California from early Apr to mid-Oct and rarely and locally during the remainder of the year (McCaskie et al. 1979); the average spring arrival date in Sonoma Co. is 14 Apr (G. L. Bolander and Parmeter 1978). A noticeable increase in numbers in the southern California deserts from late Mar through early May and from early Aug through mid-Oct indicates the timing of migration (Garrett and Dunn 1981). Green-backed Herons frequent the borders of streams, ponds, freshwater marshes, and, much less commonly, brackish marshes.

Black-crowned Night-Heron (*Nycticorax nycticorax*)

A rare summer resident and fairly common winter resident (Fig. 10). Bolinas was the only study site on Point Reyes with substantial numbers of night-herons. Other scattered census records, mostly from Abbott's, generally fit the Bolinas pattern. Seasonal use patterns at Bolinas probably reflected movements to and from the breeding colony at West Marin Island, Marin Co. (Ralph and Ralph 1958, Pratt 1983), or other more distant San Francisco Bay colonies. Migration is limited in California, and build-ups and declines at Bolinas were the inverse of those at coastal northern California rookeries (Ives 1972, Stone and Rigney 1978). It is also possible that the increase in winter numbers at Bolinas involves migrant birds from the interior. Although band recoveries suggest that San Francisco Bay breeders are essentially non-migratory (Gill and Mewaldt 1979), at least a few central California breeders travel to southern California and Mexico (Gill and Mewaldt 1979, Grinnell and Miller 1944). Black-crowned Night-Herons roost communally in the daytime at traditional sites near estuaries, ponds, and marshes where they feed mostly at night.

White Ibis (*Eudocimus albus*)

A very rare spring and summer visitant. An adult on Bolinas Lagoon from 14 to 19 May 1971 (AB 25: 794) and on a 23 Jun 1971 census represents the only Point Reyes record. Apparently the same bird was present in San Rafael, Marin Co., from 27 Jun to 9 Sep 1971 (AB 25: 901, AB 26: 113). This is the only northern California record, but the AOU (1983) and the CBRC (Morlan 1985) have concluded it was of an escaped captive. Others, however, favor a wild origin (AB 25: 794, McCaskie et al. 1979, Roberson 1980). Jon Winter, in a report on file with the California Bird Records Committee, summarized White Ibis sightings from *American Birds* for the rest of the country for the spring and summer of 1971. He found that an unprecedented northward surge of several species of ciconiiforms, including the White Ibis, was attributed to drought conditions in the southeast and southwest. This pattern, the lack of any escapees reported from northern California, the bird's wariness, and the known tendency of ciconiiforms to wander to the north, all argue for a natural origin of this individual.

Tundra Swan (*Cygnus columbianus*)

A very rare winter visitant with a total of 63 birds on six censuses from 16 Nov to 9 Jan. Non-census records extend the continuous date span to 7 Apr (ABN, Fig. 12); an outlying record of a bird at Bolinas Lagoon for one week in "late May" 1983 (fide RMS) was exceptional. On the northern California coast most Tundra Swans occur from mid-Nov to mid-Mar. Extreme dates are 1 Sep and 22 May, but records before late Oct or after early Apr are exceptional (ABN).

Our high census count was 27 birds at Limantour on 8 Dec 1980, and the high count from the study area was 125 birds at Bolinas Lagoon on 13 and 14 Dec 1967 (AFN 22: 473, ABN). Most sightings in the study area have been of transient flocks; however, up to 20 birds have wintered irregularly since 1979 in a pasture at the south end of Tomales Bay (ABN). From 1970 to 1988 Tundra Swans were recorded on 14 of 19 Point Reyes CBCs; the median number for the 14 years was 6 (range 1–90). Despite some recovery, numbers in California have been greatly reduced over former times (Grinnell and Miller 1944), even on the coast where they have always been scarce (Willett 1933, Garrett and Dunn 1981).

A bird thought to be a Bewick's Swan (*C. c. bewickii*) was observed at Bolinas Lagoon on 12 and 13 Dec 1982 (AB 37: 333). This is the only coastal record of this Asiatic subspecies which has been casual in California in the winter since first recorded in Jan 1975 (AB 29: 736).

Locally, wintering Tundra Swans have been found on freshwater ponds and wet pastures, but most have been seen in flight or for short periods on margins of estuaries or lagoons.

Greater White-fronted Goose (*Anser albifrons*)

A very rare fall and winter visitant with 87 birds on eight censuses from 15 Sep to 21 Jan; additional Point Reyes records follow a similar pattern (Fig. 12) and extend from 3 Sep to 18 Apr (ABN, PRBO). Extreme dates for coastal northern California are 3 Sep and 31 May (ABN, Yocum and Harris 1975), except for a 10 Jul 1988 record on San Francisco Bay (AB 42: 1336). Most records extend from late Sep to early Mar, and ones in early Sep or May are exceptional. Our high census count was of 36 birds at Bolinas on 14 Dec 1973, and the high count for the study area was of 250 at Bolinas Lagoon on 25 Jan 1971 (AB 25: 621). White-fronted Geese have been recorded on only 7 of 19 Point Reyes CBCs from 1970 to 1988; the median number for the 7 years was 13 (range 1–30). Most Point Reyes records are of transient flocks, but occasionally a few birds winter on

pastures or grass-bordered freshwater ponds. Historically, numbers in California have declined greatly both overall (Grinnell and Miller 1944) and on the coast, especially in southern California (Willett 1933).

Snow Goose (*Chen caerulescens*)

A very rare winter visitant with 15 birds on nine censuses from 25 Nov to 10 Feb; additional Point Reyes records extend from 3 Oct to 14 Mar (Fig. 12, ABN). Coastal northern California records extend from 25 Sep to 23 May, except for three Jul–Aug records. Most birds occur from mid-Oct to early Mar, and records before Oct and after early Apr are exceptional (ABN). Snow Geese were recorded on 8 of 19 Point Reyes CBCs from 1970 to 1988; the median number for the 8 years was 3 (range 1–32). The high non-census count was of 120 birds flying over Bolinas Lagoon on 16 Nov 1980 (DS). Snow Geese on Point Reyes have been observed in pastures, at grass-bordered ponds, and around lagoon and estuary margins. Historically, numbers of Snow Geese have declined greatly in California both overall (Grinnell and Miller 1944) and on the coast, especially in southern California (Willett 1933).

Ross' Goose (*Chen rossii*)

A very rare visitant with a single census record of one bird at Abbott's on 13 May 1976. There are seven additional Point Reyes records of one to four birds lingering for a few days between 30 Nov to 10 Feb (ABN) near freshwater inflows to estuaries or lagoons, at sewage ponds, and in agricultural fields. Additionally, there are records of migrants over the ocean of two birds at the Cordell Banks on 11 Oct 1986 (ABN: SFB) and of 11 birds 8 km northwest of Tomales Point on 1 Nov 1986 (AB 41: 137). Coastal northern California records extend from 24 Sep to 16 Jun, with perhaps one bird oversummering; most records are from mid-Nov to late Mar (ABN). Although much reduced from former times (Grinnell and Miller 1944), the population has increased substantially since the 1950s (Bellrose 1980). Numbers remain reduced on the southern California coast (Willett 1933, Garrett and Dunn 1981), but Ross' Geese were apparently never regular on the northern coast (Grinnell and Wythe 1927). A slight increase in sightings along the northern California coast in recent years (ABN) is just as likely a result of increased observer coverage and awareness as it is an indication of population trends.

Emperor Goose (*Chen canagica*)

A very rare winter visitant with Limantour census records of one on 27 Dec 1967 (also seen from 28 to 31 Dec, AFN 22: 473; CBRC) and two on 26 Dec 1968 and 7 Jan 1969 (one to two from 12 Dec 1968 to 9 Jan 1969, AFN 23: 515, PRBO). Details of these records, as well as those for non-census records of one bird at Tomales Bay on 18 Dec 1948 (AFN 3: 183) and of three birds flying south off Limantour on 7 Dec 1966 (AFN 21: 453), have not been submitted to the CBRC. The three Point Reyes (all Limantour) records accepted by the CBRC are of one bird on 13 Dec 1928 (Orr 1944), three that wintered from 28 Dec 1977 to 4 Feb 1978 and seen again from 9 to 22 Apr 1978, and another bird that joined the latter three on 22 Apr (AB 32: 395, AB 32: 1050, ABN).

The Emperor Goose is casual in California. The accepted Point Reyes records are among 48 (24 coastal) for the state spanning 8 Oct to 26 Apr, 1884 to 1988; most birds do not arrive before Nov or linger past Feb (CBRC). The unsubmitted records above are among a backlog of 39 such records; as this goose is so distinctive, most of these are probably valid. Most of the Point Reyes records since the 1960s have been in flight years when birds were also seen at other coastal California localities (AB 32: 395, AB 32: 1050, Roberson 1980, Garrett and

Dunn 1981), though the strong philopatric tendencies of geese in general (Johnsgard 1978) suggest that the same individuals may have returned to Limantour from 1966 to 1969.

Black Brant (*Branta bernicla nigricans*)

A rare summer visitant, an uncommon fall transient and winter resident, and a very common spring transient (Fig. 13). On the surveyed wetlands, Black Brant occurred regularly only at Limantour, which is contiguous with Drake's Estero, a major staging area for the species. More than 50 Brant were recorded at Bolinas (Fig. 13) only in spring 1973; one to three Brant were recorded on only seven censuses at Abbott's, with the exception of 39 on a 14 Nov 1981 census. Although rarely 100 to 200 birds have been seen at Limantour in mid-Jun, later in the summer it is unusual to see as many as 10 to 20 birds; a non-census count of 131 birds at "Point Reyes" on 29 Aug 1968 (AFN 23: 100) was exceptional. In fall Black Brant migrate along the California coast primarily well "offshore," so southbound migrants are only occasionally sighted from coastal promontories (Garrett and Dunn 1981, ABN, authors' pers. obs.; however, compare Roberson 1985). The occasional early fall arrivals in the Point Reyes area from 29 Sep to mid-Oct (Moffitt 1941, ABN) may represent migrants headed farther south (Moffitt 1941, ABN). Fall migration begins in earnest in early Nov and continues through early to mid-Dec (Moffitt 1932). Local wintering birds usually return to the Point Reyes area about 10–20 Nov (Moffitt 1941, ABN). Only small numbers paused on the estuaries during fall (Fig. 13), and currently numbers remain low through the winter (see below).

Large numbers of spring migrants can be seen regularly from shore during the strong northwesterly winds characteristic of spring. During offshore or slack winds they occur widely over inshore, offshore, and oceanic waters. Black Brant were seen at least 190 km off central California in Apr 1987 (D. G. Ainley pers. comm.). On Point Reyes spring migrants are most visible from the beach at Limantour. At this location many birds veer into Drake's Estero to rest or feed or continue northwest over Drake's, by-passing the Point Reyes headlands (DS). Drake's Estero and Tomales Bay are the main spring staging areas at Point Reyes (Table 2). Our censuses and those of the California Deptartment of Fish and Game do not support the report by Briggs et al. (1987) that Bolinas Lagoon is an important staging area, though hundreds of birds sometimes concentrate nearby at Duxbury Reef (RMS). Although Moffitt (1932) formerly counted thousands of wintering Black Brant in Tomales Bay on 10 Feb censuses (Table 2), he detected spring migrants as early as 11 Feb in some years. A flock of 2000 birds on Tomales Bay on 3 Feb 1988 (ABN: RS, DWm) probably represented early migrants as wintering numbers there now average about 200 birds (Table 2). During our study, numbers on the estuaries increased in late Feb, peaked from mid-Mar to early May (Fig. 13), and declined to summer lows by mid-Jun (Fig. 13). The low numbers at Limantour in late Mar (Fig. 13) reflected the high between-year and within-season variation, as pulses of migrants on estuaries may go undetected at 10-day census intervals (cf. Bayer 1983). Dates of peak spring migration over the inshore zone in central California range from 30 Mar to 20 Apr (ABN: BSa et al.).

Decreases in numbers of Black Brant wintering in California were evident by the early 1900s, especially in southern California (Grinnell et al. 1918). Historically Tomales Bay, Drake's Estero, and Bodega Harbor supported large wintering populations, but since the 1950s numbers there have declined substantially (Table 2). The local winter decline was part of a larger trend in which the bulk of the California wintering population shifted to Mexico (Bellrose 1980). The

average number of migrants in Apr in Drake's Estero, Tomales Bay, Bolinas Lagoon, and Bodega Harbor decreased from 8000 birds between 1961 and 1965 to 3000 between 1966 and 1970 (Calif. Dept. Fish and Game unpubl. data). Depletion of estuarine eelgrass (*Zostera marina*), the Brant's main food source, and human disturbance are thought to be the key factors responsible for the Brant's decline here (Moffitt and Cottam 1941, Cottam et al. 1944, Einarson 1965).

Canada Goose (*Branta canadensis*)

A very rare winter visitant with a minimum of 116 birds on 39 censuses from 19 Sep to 1 May; most birds are transients but a few winter. The highest census count was of 33 flying birds at Limantour on 26 Jan 1974, and the highest non-census count was of 170 over Palomarin on 24 Dec 1984 (PRBO). Most Canada Geese were found on Point Reyes from Sep to Apr (Fig. 12). The infrequent and abbreviated occurrence of the birds at estuaries reflects the species' preference for freshwater habitats and adjoining grassy fields, which are scarce on Point Reyes. From 1970 to 1988 the median number of Canada Geese on the Point Reyes CBC was 41 (range 0–384); most of these birds were at freshwater habitat inland. In coastal California, Canada Geese are primarily winter residents or transients. A small breeding population, perhaps of *B. c. moffitti*, has been established in the San Francisco Bay area at least since 1959 (Lidicker and McCollum 1979, ABN) and perhaps as early as 1932 (Moffitt 1939, Sibley 1952), and it is still increasing (ABN). These breeders may have originated from a recent semi-captive flock of *moffitti* at Lake Merritt, Oakland (AFN 10: 276, AB 27: 913), or from birds bred

Table 2 Numbers of Black Brant at Coastal Estuaries in Winter[a]

Years	Tomales Bay	Drake's and Limantour esteros	Bodega Harbor
1931-1942[b]	5620 ± 854 (n = 12)	2657 ± 611[c] (n = 9)	1425 ± 325 (n = 11)
1952[d]	7900	2170[e]	235[f]
1956-1968[g]	1330 ± 264 (n = 13)	—	—
1966-1969[h]	—	242 ± 226	—
1961-1971[i]	118 ± 110 (n = 9)	338 ± 148 (n = 7)	0 (n = 9)
1970-1988[j]	207 ± 44 (n = 19)	(Tomales, Drake's, and Limantour combined)	—

[a] Counts for mid-December to mid-February reported as the mean ± 1 standard error; n = sample size.
[b] Moffitt (1943); counts made 10 February each year.
[c] Counts made in Drake's every year, in Limantour only in some years.
[d] Leopold and Smith (1953); counts made 6-13 January 1952.
[e] Unclear if Limantour counted this year.
[f] Bodega Harbor has had only occasional wintering Brant since 1953 (B.D. Parmeter unpubl. data).
[g] Tomales Bay Christmas Bird Count (CBC), late December to early January each year.
[h] Drake's Bay CBC, late December each year.
[i] California Department of Fish and Game unpublished data from January censuses each year.
[j] Point Reyes Peninsula CBC, mid to late December each year.

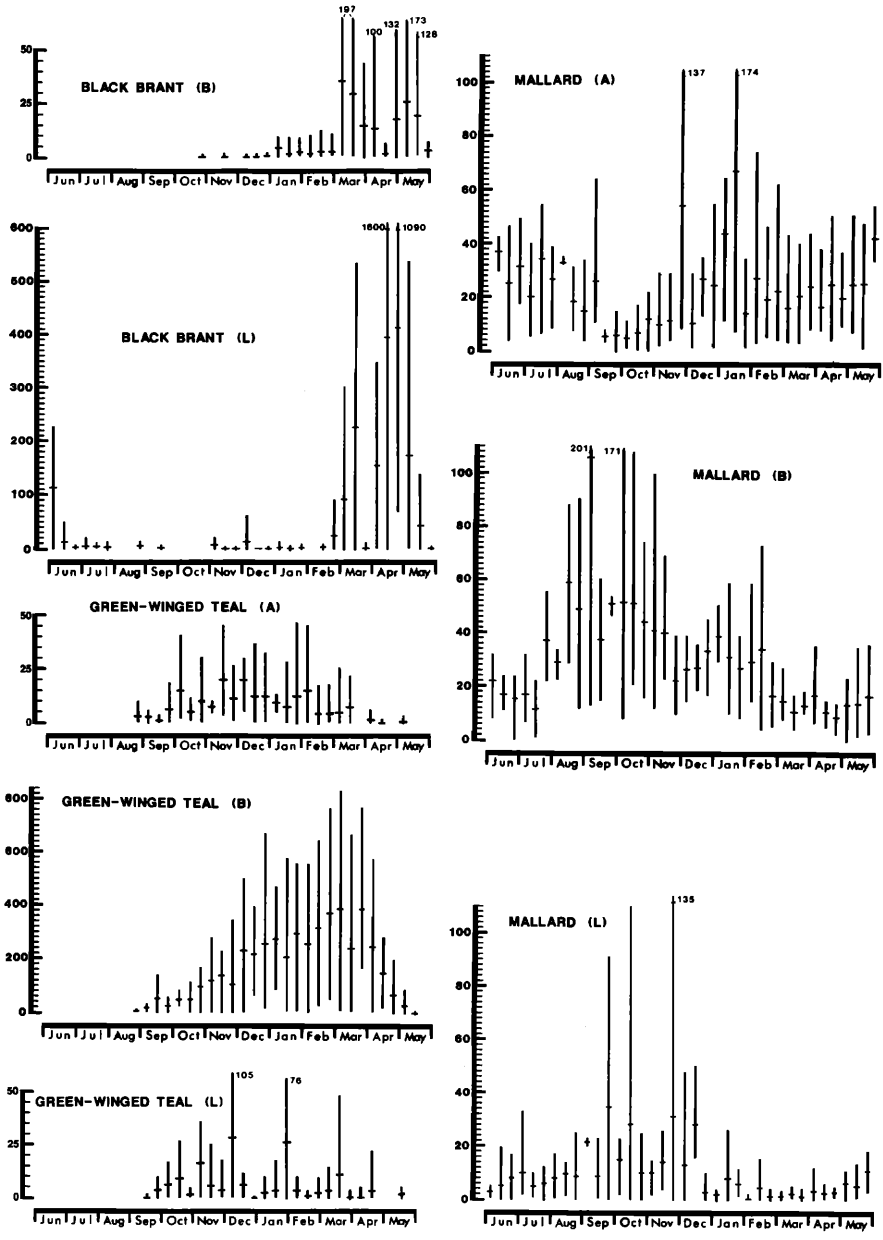

Figure 13. Seasonal abundance of the Black Brant, Green-winged Teal, and Mallard in wetlands of Point Reyes. See Figure 4 for details.

in captivity in the Bay Area in the early 1900s from eggs collected at Lake Tahoe (Grinnell et al. 1918). Canada Geese found on the Point Reyes estuaries in mid-summer, e.g., up to 35 birds at Bolinas Lagoon in Jun and Jul each year since 1984 (RMS, ABN), may represent dispersants from the San Francisco Bay breeding population.

Wood Duck (*Aix sponsa*)

A very rare visitant to surveyed wetlands with only one census record on 8 Nov 1979 from the upper Glenbrook pond behind Limantour Estero. Small numbers of Wood Ducks reside year round on Point Reyes, primarily in the Olema Valley, where ducklings were seen at Mill Pond on 5 May 1980 (DS) and at Five Brooks Pond from late May through Jul from 1987 to 1989 (ABN). On Point Reyes numbers increase only slightly in winter, in contrast to the state-wide pattern of numbers increasing 37-fold in winter because of an influx of about 90% of the Pacific Flyway population (Naylor 1960). From 1970 to 1988 Wood Ducks were recorded on only 12 of 19 Point Reyes CBCs; the median number for the 12 years was 7 (range 2–78). A high winter count was of 55 birds at Point Reyes Station on 23 Mar 1988 (ABN: RS). Because of the small numbers involved and the species' retiring habits, the timing of the local winter increase is unclear. However, a bird at a ranch pond in open grassland on outer Point Reyes on 5 Sep 1974 (ABN: WMP) was either a post-breeding wanderer or a fall migrant. Southern California records, away from areas with summer populations, reveal a winter build-up primarily from mid-Sep to mid-Apr (Garrett and Dunn 1981). Wood Ducks declined markedly in California prior to 1915 and were considered extirpated in the San Francisco Bay area (Grinnell and Wythe 1927, Grinnell and Miller 1944). Despite subsequent increases, historical levels have not yet been reached (Naylor 1960, ABN). Wood Ducks prefer bodies of slow-moving fresh water with overhanging vegetation along the margins and extensive nearby forests on the floor of which birds forage for acorns. This habitat is sparse in our study area.

Green-winged Teal (*Anas crecca*)

A very common winter resident (Fig. 13). Numbers at Bolinas increased slowly in fall but declined more rapidly in spring, a pattern not evident at Abbott's and Limantour, where the species is scarcer (Fig. 13). Extreme dates for Point Reyes were 8 Aug and 30 May (DS, ABN), except for a male at the Bolinas sewer ponds on 25 Jun and 30 Jul 1989 (DS). Winter numbers at Bolinas increased from 1972–73 to 1976–77 but declined in 1977–78 and subsequently remained low (Fig. 14). The upward trend corresponds to a continental increase of breeding and wintering numbers (Bellrose 1980). However, numbers at Bolinas were highest during the two winters of the state-wide drought, 1975–76 and 1976–77, when birds displaced from dried-up freshwater habitats may have increased the usual numbers at estuaries. On Point Reyes Green-winged Teal prefer the shallowest portions of estuaries and freshwater ponds (especially early in the fall). Four or five individuals of the Eurasian race of the Green-winged Teal (*A. c. crecca*) have been recorded on Point Reyes from 19 Nov to 4 Mar (AFN 21: 453, AB 29: 114, AB 31: 368, ABN, PRBO). First recorded in the state in 1962 (AFN 16: 364), this race is a very rare but annual winter visitant in coastal California from 2 Oct to 5 May (ABN).

Mallard (*Anas platyrhynchos*)

Year-round resident, varying from fairly common in spring and summer, to common in fall, to fairly common in winter (Fig. 13). Small numbers breed on

estuarine borders; larger numbers breed at freshwater ponds and marshes. Of any of the study sites, the upper portions of Abbott's Lagoon, which are primarily fresh water, supported the largest number of breeding Mallards. In the two estuaries Mallards were most numerous in fall and early winter, but at Abbott's numbers were lowest in fall (Fig. 13). The fall to early winter peaks at Limantour and Bolinas may have reflected the concentration of birds on estuaries after the dry season. The subsequent decline may have represented dispersal to take advantage of freshwater habitat enhanced by winter rains and/or simultaneous or progressive dispersal to potential breeding sites. At Abbott's, low fall numbers reflected post-breeding dispersal and the subsequent increase reflected the arrival of wintering birds, some of which perhaps remained to breed. Although Mallards prefer freshwater ponds, they also use tidal flats (especially near freshwater inflows), saltmarsh channels, flooded pastures, and ephemeral pools.

Northern Pintail (*Anas acuta*)

A very rare summer visitant and an abundant winter resident (Fig. 15). A record of a pair at Home Bay on 17 June 1981 (DS) suggests the possibility of occasional breeding on Point Reyes. Irregular non-census records of up to 30 birds in mid-Jul (PRBO) perhaps represent post-breeding dispersants from San Francisco Bay (ABN), since migrants traditionally arrive in early Aug (Fig. 15). At Bolinas "spring" departure usually was abrupt (a drop of 75 to 95% or 700 to 2500 birds) and variable from year to year, with the bulk of the population leaving as early as Jan in 1978 (Fig. 16). Only in the drought years of 1975–76 and 1976–77 did large numbers of Pintails remain into Mar. In all other years from 1972–73 to 1981–82, abrupt departure from early Jan to mid-Feb coincided with periods of 16 cm or more of rain in a 10-day period, or 20 cm or more in a 20-day period. Heavy rainfall in late fall did not trigger departure of large numbers of birds. At Abbott's and Limantour most Pintails departed by late Jan or Feb in all years (Fig. 15). Protracted fall migration and abrupt spring departure characterize the species throughout its winter range (Bellrose 1980). Although abrupt departure at Bolinas followed periods of heavy winter rains, it is unclear whether Pintails were fleeing adverse conditions, such as the inundation of estuarine feeding areas, or whether they were moving to newly flooded freshwater areas inland. High winter numbers during the 1975–76 and 1976–77 drought years (Fig. 14) may have been due to the lack of alternate freshwater habitats. On Point Reyes, Pintails forage in shallow estuarine waters, on tidal flats, and in freshwater ponds, and sometimes raft on deeper bays or even inshore waters during migration.

Blue-winged Teal (*Anas discors*)

A very rare spring transient with eight records on seven censuses from 13 Feb to 8 May. Although most additional records were of spring migrants, some fell in every month of the year (Fig. 12, ABN, Point Reyes CBC). Three Blue-winged Teal have been recorded on only two of 19 Point Reyes CBCs from 1970 to 1988. Fall records were probably under-represented because of the difficulty of separating the Blue-winged from the more numerous Cinnamon Teal at that time of year; non-breeding-plumaged teal of these species were generally assumed to be Cinnamon Teal (however, see Phillips 1975). Although Blue-wingeds are not known to breed on Point Reyes, at least seven reports of from one to six birds at scattered sites between 18 May to 23 Jun, 1975 to 1988, suggest they may breed here rarely. Coastal breeding has been reported from western Oregon (Wheeler 1965) and northern California (Yocum and Wooten 1956, ABN), but most records are based on male Blue-wingeds associating with unidentified females with broods, thus not eliminating the possibility of mixed Blue-winged/Cinnamon pairs.

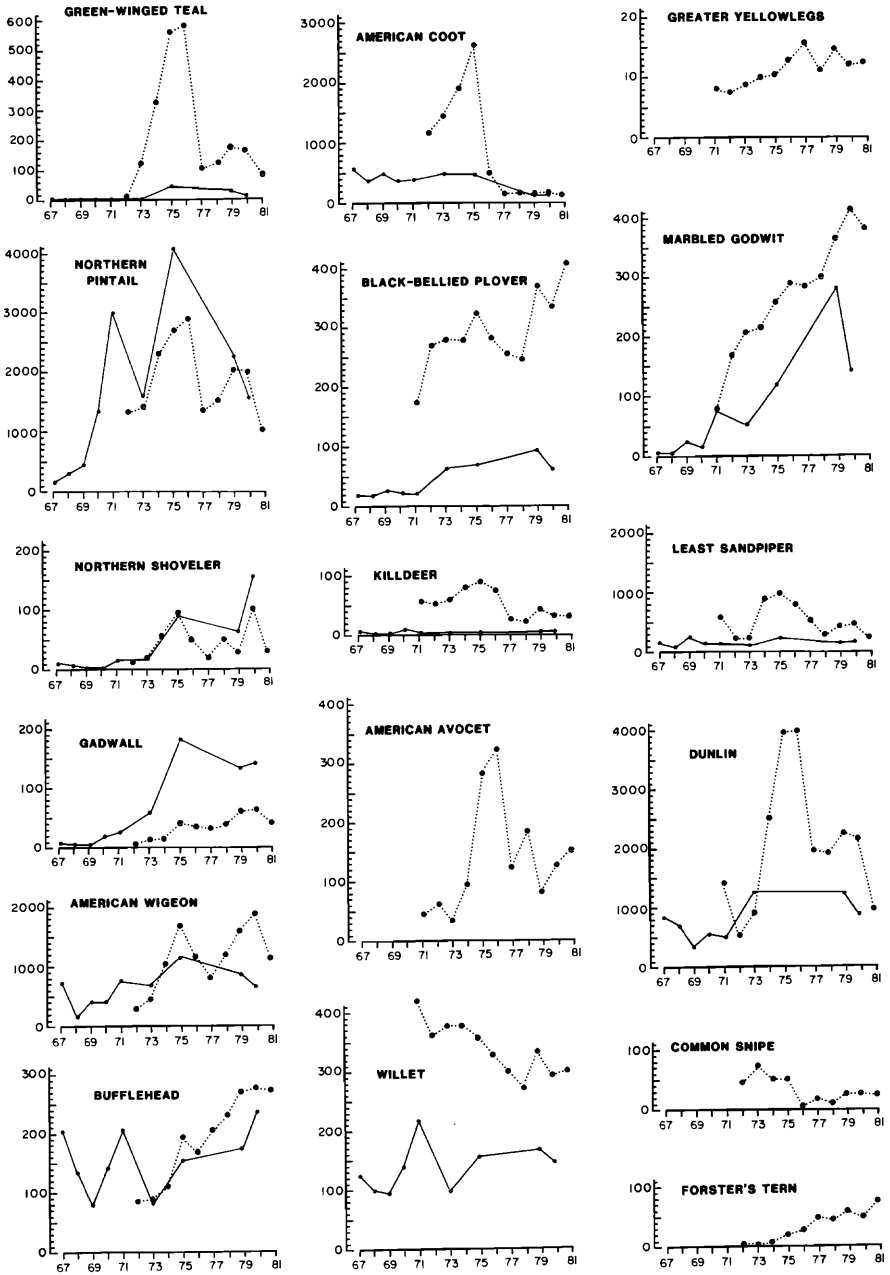

Figure 14. Mean numbers of some wintering aquatic birds at Limantour Estero (solid line) and Bolinas Lagoon (dotted line) between 1967–68 and 1981–82. Note gaps in the census record for Limantour.

Wheeler (1965) and Connelly (1978) reported that from the 1930s to the 1960s the Blue-winged Teal pioneered new breeding areas and increased in number on the Pacific Coast, especially north of California. The species tends to abandon drought-stricken areas to pioneer habitat far from the center of its

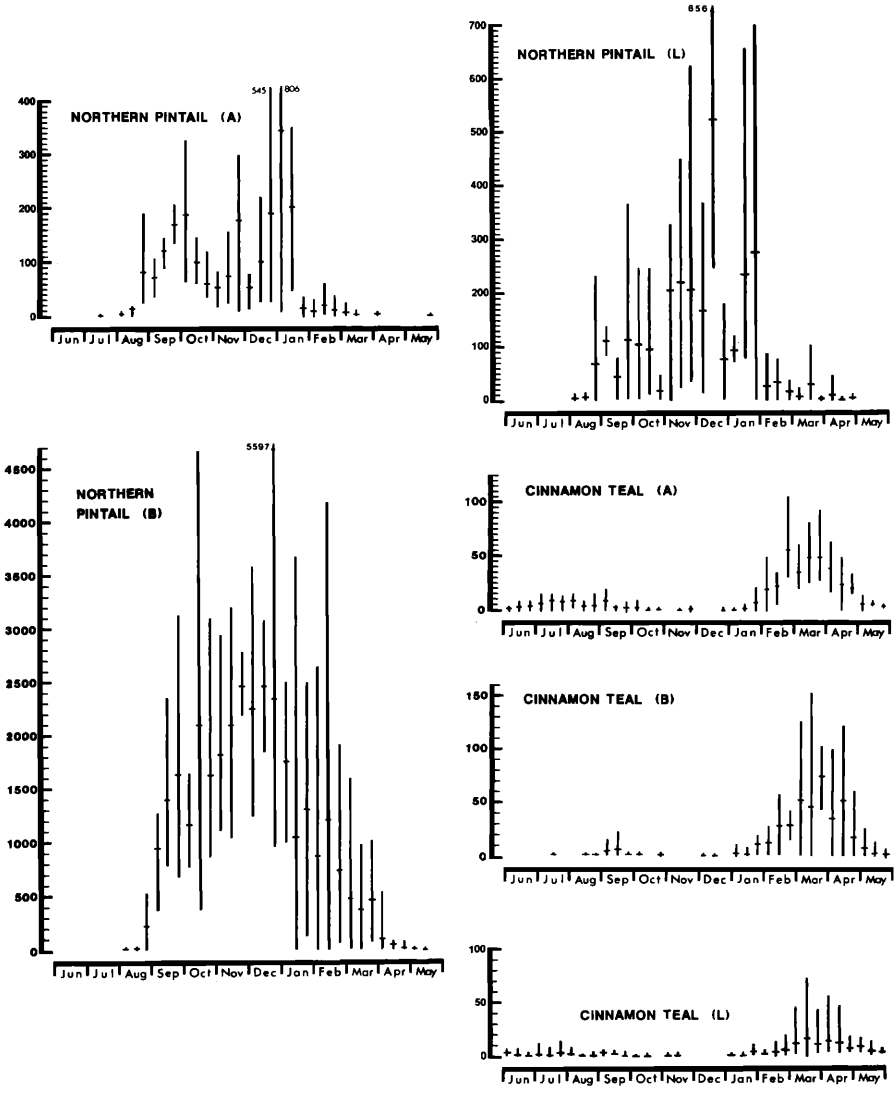

Figure 15. Seasonal abundance of the Northern Pintail and Cinnamon Teal in wetlands of Point Reyes. See Figure 4 for details.

breeding range (Bellrose 1980), perhaps explaining periodic influxes, both locally (23 birds in Marin Co., May–Jun 1980, DS) and throughout coastal northern California (e.g., AB 34: 926). Blue-winged Teal inhabit shallow freshwater ponds and marshes and, less frequently, estuaries near freshwater inflow or fresh to brackish impoundments. Although overlapping broadly in habitat use with Cinnamon Teal, Blue-wingeds are less likely to feed in water with emergent vegetation (Connelly and Ball 1984).

Cinnamon Teal (*Anas cyanoptera*)

Although found year round, the Cinnamon Teal was principally a spring transient in the study area. Census data indicate that it is uncommon in summer and fall, rare in winter, and common in spring (Fig. 15). Spring arrival began in Jan, with numbers peaking in Mar and declining through Apr and May. A few remained to breed on freshwater ponds, as reflected by the Jun and Jul numbers at Abbott's and Limantour (Fig. 15). Additional breeding sites in the study area include the Bolinas sewer ponds and other ponds at Limantour and Drake's

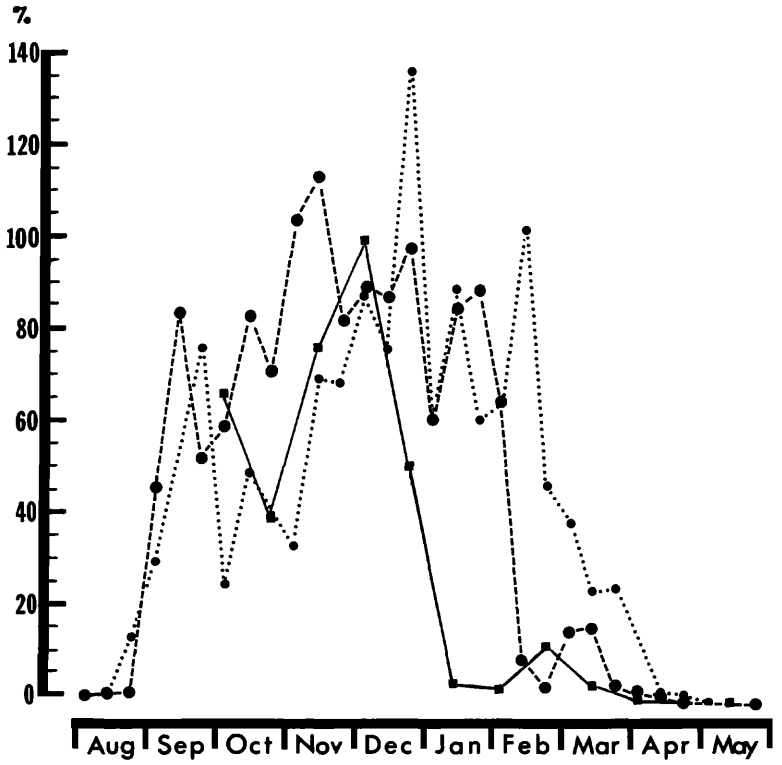

Figure 16. Numbers, expressed as a percentage of the winter mean, of the Northern Pintail at Bolinas Lagoon during 1974–75 (broken line), 1975–76 (dotted line), and 1977–78 (solid line).

esteros but not tidal marshes, which are used in San Francisco Bay. Cinnamon Teal forage primarily in shallow fresh water (cf. Blue-winged Teal) but also use estuaries and brackish impoundments.

Northern Shoveler (*Anas clypeata*)

A common winter resident (Fig. 17). The earliest fall arrival date for Point Reyes was 5 Aug 1962 (ABN: HLC). Numbers increased from late Sep through early Dec (Fig. 17) at the two estuaries. Migration continues perhaps until mid-Dec (Palmer 1976a). At Bolinas numbers decreased steadily from Jan through Apr, in contrast to Limantour where birds departed abruptly between late Jan and the end of Feb (Fig. 17). Shovelers used Abbott's to only a limited degree, mostly from early Sep to mid-Jan. Irregular high counts at Limantour and Abbott's may have represented Shovelers that had been flushed from nearby ponds and settled in our census areas for brief periods. It is unclear why Shovelers left Limantour by Feb because birds concentrated there on estuarine rather than on pond habitat, which was most subject to change during winter rains. Shoveler numbers increased at Limantour during the study (Fig. 14). A few May sightings and a pair seen near Drake's Beach on 16 Jun 1981 (DS) suggest that Shovelers may nest occasionally in the study area, as they do rarely around San Francisco Bay (Grinnell and Miller 1944, ABN). At Point Reyes, Shovelers feed in shallow freshwater ponds, brackish ponds or impoundments, sewage ponds, and estuaries near freshwater inflow, especially in muddy areas such as the Pine Gulch Creek delta on Bolinas Lagoon.

Gadwall (*Anas strepera*)

An extremely rare summer and common winter resident (Fig. 17). Although Gadwalls breed in moderate numbers around San Francisco Bay (Gill 1977), they are irregular in Jun and Jul on Point Reyes where there is only one breeding record (AB 35: 974). Fall arrival begins in late Aug and probably continues until Dec. At Limantour freshwater ponds hosted greater numbers than the estuary before Nov, but later, after the commencement of winter rains, virtually all birds shifted to the estuary (near freshwater inflow), perhaps because of rising pond levels or depletion of food in the ponds (Fig. 18). Rising water levels or food depletion perhaps also explain the departure of Gadwalls from Abbott's in early winter (Fig. 17). A preference for ponds may explain why arrival began two months earlier at Limantour and Abbott's than at Bolinas, where freshwater habitat is mostly lacking. At Bolinas Gadwalls concentrated at the mouth of Pine Gulch Creek, the area of greatest freshwater inflow. An upward trend in winter numbers at Bolinas and Limantour (Fig. 14) paralleled a "dramatic" post-1950s rise in the breeding and wintering population (Johnsgard 1978, Bellrose 1980) and an expansion of the species' breeding range (Palmer 1976a). Gadwalls occur in freshwater ponds and the innermost reaches of estuaries where the substrate is soft and muddy.

Eurasian Wigeon (*Anas penelope*)

A very rare winter resident (Fig. 12). Eurasian Wigeons occurred most frequently at Bolinas, the wetland study site which also supported the largest numbers of American Wigeons. At Bolinas, Eurasian Wigeons wintered every year from 1975–76 to 1981–82. The total of 15 birds on 38 Bolinas censuses from 4 Nov to 1 Apr probably overestimates the total, because high counts there were of four birds on a 2 Feb 1976 census and five on 5 Feb 1977 (ABN: RS) and many birds probably returned annually. However, single females were recorded on only

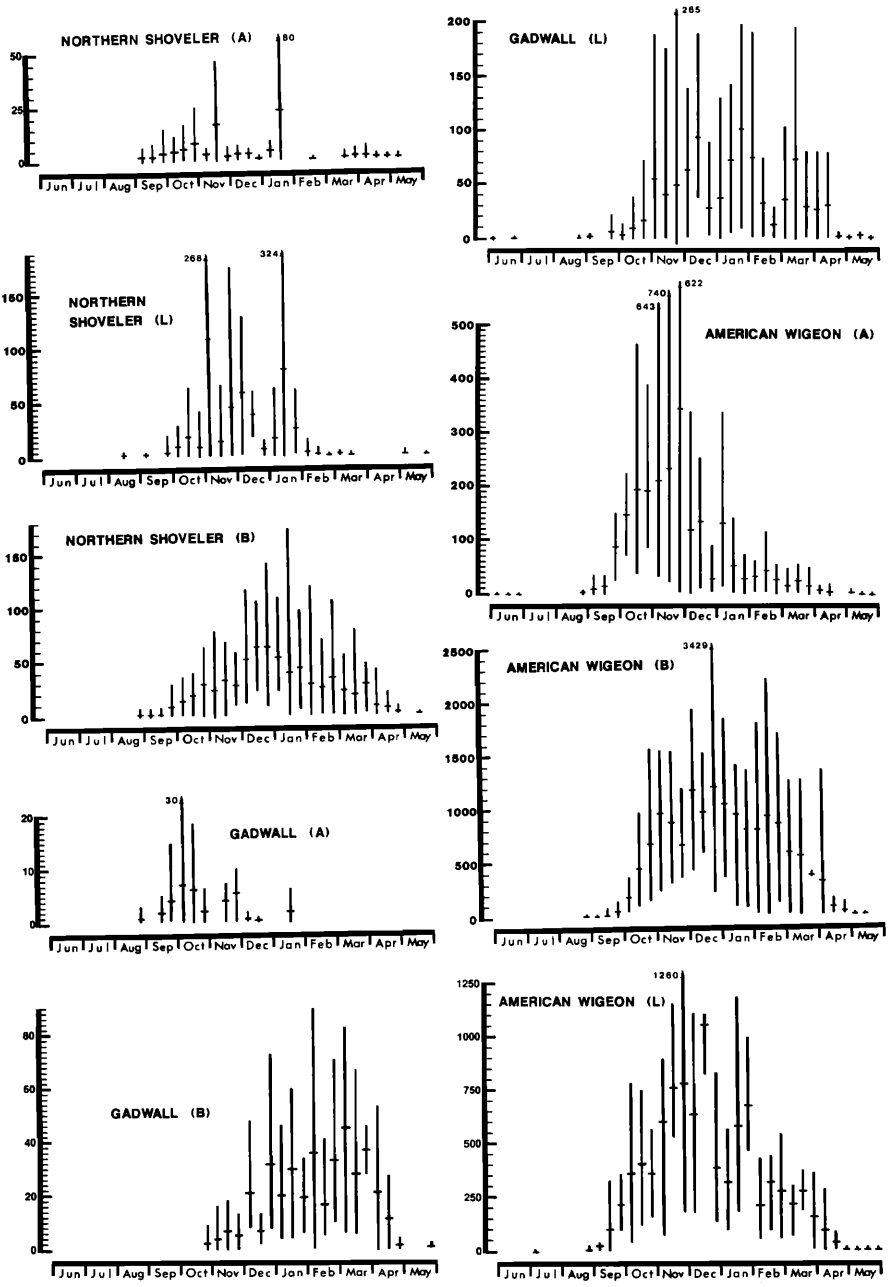

Figure 17. Seasonal abundance of the Northern Shoveler, Gadwall, and American Wigeon in wetlands of Point Reyes. See Figure 4 for details.

two censuses and a number of others were probably overlooked. Seven records on seven censuses from 27 Oct to 15 Mar at Limantour and Abbott's were all of transients. Eurasian Wigeons were reported on 14 of 19 Point Reyes CBCs from 1970 to 1988 with a high count of 4. At Point Reyes, extreme dates of occurrence were 10 Sep and 30 Apr. Except for one 8 Jul to 7 Aug 1979 record at Palo Alto (Morlan and Erickson 1988), extreme dates for coastal northern California are 9 Sep and 15 May (ABN). An apparent increase in Eurasian records at Bolinas over the course of the study may have been a result of high American Wigeon populations in later years (Fig. 14).

Eurasian Wigeons appear to have habitat preferences identical to those of American Wigeons (see that species), with which they associate. Locations of most frequent sightings of Eurasians in the study area include the Pine Gulch Creek mouth at Bolinas Lagoon, Bolinas sewer ponds, Walker Creek mouth on Tomales Bay, Muddy Hollow pond at Limantour, and the ponds at Abbott's Lagoon.

American Wigeon (*Anas americana*)

A very rare summer visitant and an abundant winter resident (Fig. 17). Summer census records were of one at Limantour on 10 Jul 1975 (GWP) and one at Abbott's until 24 Jun 1980 (DS). Non-census summer records were of one at a pond near Drake's Bay 6 Jul 1964 (ABN: GM) and one at Horseshoe Pond on 10 Jul 1982 (DS). Fall arrival on Point Reyes sometimes begins as early as 8 Aug (1987, DS), but typically it commences in late Aug (Fig. 17). At Bolinas, numbers peaked from Nov to Feb and birds departed from Mar to May (Fig. 17). Numbers declined sharply (by 35 to 75% or 350 to 550 birds) at Bolinas between late Dec and mid-Feb in 1972–73, 1974–75, 1977–78, and 1981–82 when 20 cm or more of rain fell in a 10-to-20-day period; numbers there remained high until Mar in the dry years of 1975–76, 1976–77, 1978–79, and 1980–81 (Fig. 2). Anomalous years were 1973–74 and 1979–80 when numbers remained high despite more than 20 cm of rain in late Dec and early Jan. These data suggest that cumulative and short-term rainfall may affect departure but that other factors may also be involved. At both Limantour and Abbott's, numbers typically declined markedly by Jan or Feb and remained low until final departure in May (Figs. 17 and 18). The early decline at the latter sites occurred at the same time some birds shifted from freshwater ponds to the estuaries and water levels in the ponds rose following winter rains (Fig. 18). Other birds left the area probably because the wetlands could not support as large a population of wigeons without suitable pond habitat. Wigeons at Bolinas did not rely as heavily on freshwater ponds but were the only dabbling ducks there that grazed intensively in moist pastureland and salt marsh. American Wigeons prefer shallow water where aquatic vegetation is available and are most numerous on freshwater ponds and on estuaries in areas of freshwater inflow. Wigeons often associate with American Coots, which they rob of vegetation obtained by diving.

Canvasback (*Aythya valisineria*)

A very rare summer visitant and a common winter resident (Fig. 19). The only two mid-summer census records were from Abbott's on 27 Aug 1973 (RMS, RPH) and 28 Jul 1981 (DS). In fall birds arrived a few weeks earlier at Abbott's and Limantour than at Bolinas (Fig. 19). The winter of 1975–76 produced an all-time high count of Canvasbacks at Abbott's (winter mean 610), probably because of the drought-related shortage of habitat elsewhere. Within the study area, freshwater ponds support the highest Canvasback concentrations, followed by bays, estuaries, and lagoons.

Redhead (*Aythya americana*)

A rare winter resident with census records from 23 Sep to 5 Apr at Limantour and Abbott's (Fig. 19). Except for an unseasonal high count of 14 birds at Abbott's on 17 Jul 1988 (ABN: LJP), non-census records extend from 11 Aug to 26 Apr (ABN, PRBO). Redheads at Abbott's (Fig. 19) were either transients or wintering birds that shifted habitats, perhaps because of changing water levels from winter rains or depletion of food. The median number of Redheads, primarily from a flock wintering near Walker Creek's mouth on Tomales Bay, was 295 (range 0–1006) on the Tomales Bay CBC from 1956 to 1968 and 298 (range 1–784) on the Point Reyes CBC from 1970 to 1981. The Tomales Bay flock was not seen on the Point Reyes CBC from 1982 to 1988, when Redhead numbers ranged from 0 to 15. Otherwise, high counts in the study area of fall transients on freshwater ponds have exceeded 20 birds only four times, with a maximum of 43 birds at Limantour on 10 Nov 1965 (TVV et al.). Away from Tomales Bay, Redheads are found on Point Reyes on freshwater ponds.

Redheads were formerly quite common in California but by the early 1900s had been greatly reduced in number at all seasons (Grinnell et al. 1918, Grinnell and Miller 1944). On the North American continent as a whole, the Redhead population has decreased drastically because of drainage of breeding habitat (Cogswell 1977) and overshooting (Palmer 1976b).

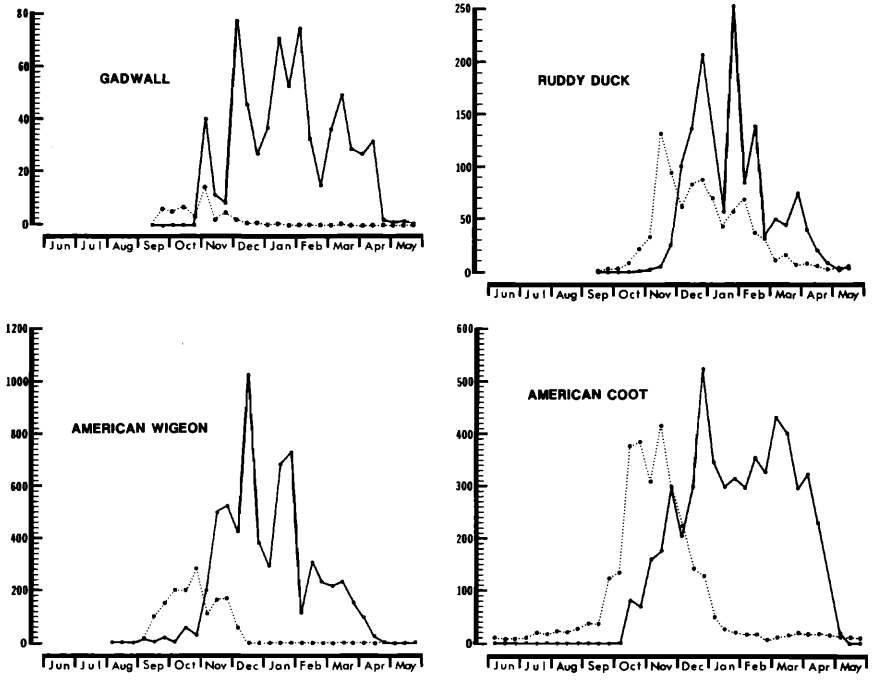

Figure 18. Mean numbers of the Gadwall, American Wigeon, Ruddy Duck, and American Coot in Limantour Estero (solid line) and ponds associated with Limantour (dotted line) between 1967 and 1974.

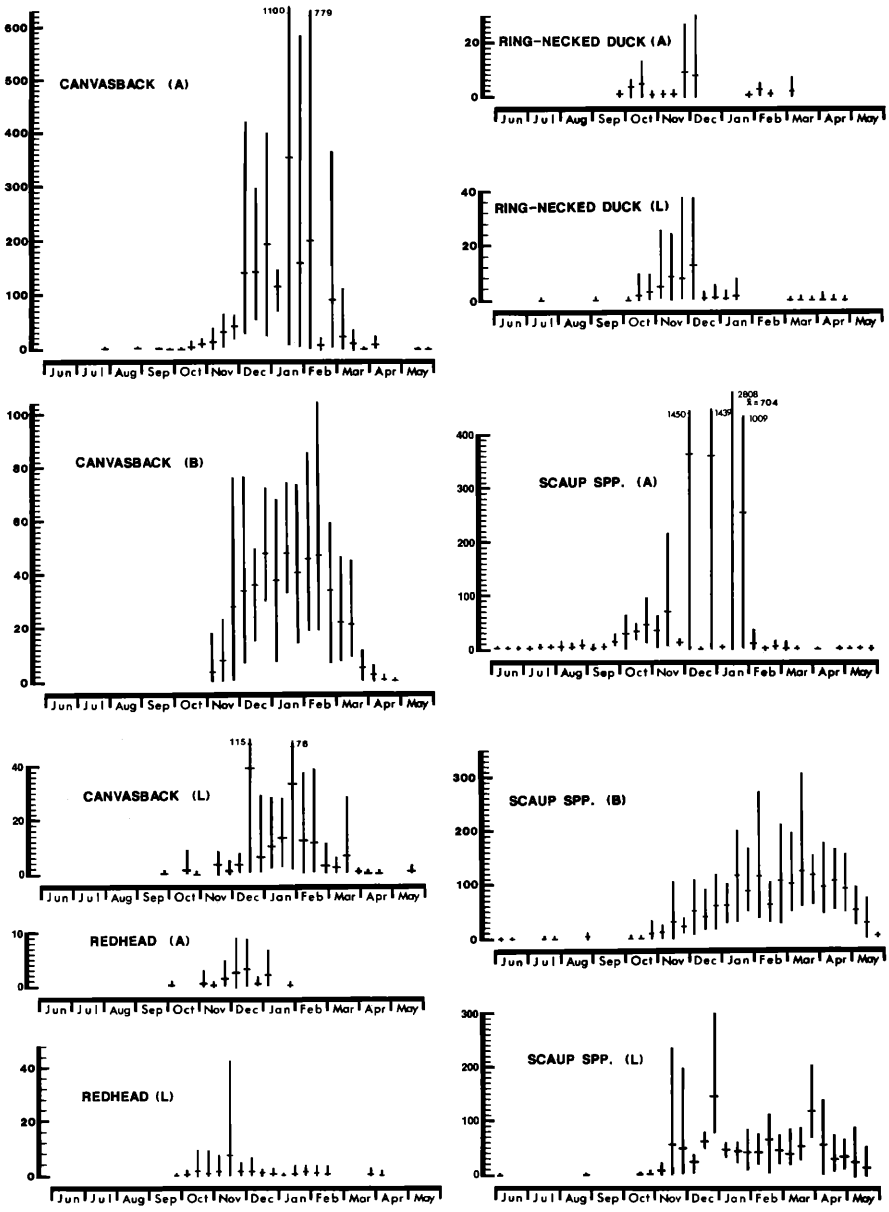

Figure 19. Seasonal abundance of some diving ducks in wetlands of Point Reyes. See Figure 4 for details.

Ring-necked Duck (*Aythya collaris*)

A very rare summer visitant, an uncommon fall transient, and a rare winter resident at freshwater ponds at Limantour and Abbott's (Fig. 19). The only summer records are of a female on 16 Jul 1980 at Muddy Hollow Pond (AB 34: 926), two males and a female there on 20 Jul 1981, and a female on 28 Jul 1981 at Horseshoe Pond (DS). Otherwise, extreme dates of occurrence in the study area are 5 Sep and 3 May (ABN). On Point Reyes most birds occur from Oct to early Dec (Fig. 19). This pattern may have reflected passage of migrants or a local shifting of birds to non-censused ponds as habitat suitability changed during winter rains. A flock of 87 Ring-necked Ducks at Five Brooks Pond on 21 Dec 1979 (JGE) was an unusual concentration for the study area. The Mar and Apr records at Limantour suggest a limited spring passage (Fig. 19). Ring-necked Ducks show a strong preference for shallow freshwater lakes, ponds, and reservoirs. The only local records for estuaries were of one bird on 7 Dec 1985 (DS), 26 on 27 Dec 1986 (RMS, DS), and one on 15 Nov 1988 (RMS, PA), all on Bolinas Lagoon near the mouth of Pine Gulch Creek.

Tufted Duck (*Aythya fuligula*)

A very rare winter visitant with sightings of two to three birds on seven censuses from 7 Oct to 3 Mar, 1979 to 1982, at Limantour and Abbott's. Because birds return in successive years and may move between sites both in the same and in successive years, it is difficult to assess the exact number of individuals involved (Dunn 1988). The CBRC currently accepts two records of the Tufted Duck for Point Reyes: (1) one male at Limantour from 7 Jan to 17 Apr 1978 that returned 23 Nov 1978–10 Mar 1979, 29 Sep 1979–12 Jan 1980, and 3 Oct–27 Dec 1980; in 1981 it was first seen at the Horseshoe Pond, Drake's Beach, from 26 Oct to 14 Nov, then returned again to Limantour from 5 to 19 Dec; (2) a second male at Limantour from 9 Nov to 2 Dec 1980 that returned to the Horseshoe Pond on 8 Nov 1981 then again to Limantour from 5 Dec 1981 to 3 Jan 1982. A pair at Limantour on 7 Nov 1981 was rejected by the CBRC. The Limantour birds were seen mostly at Muddy Hollow Pond and occasionally at the larger Glenbrook pond. A record at Abbott's of a male from 5 Feb to 3 Mar 1980 (felt to represent the second male that was seen the following fall at Limantour) was accepted by the CBRC (Dunn 1988). It is currently being reviewed again along with more recently submitted Abbott's records for 14 Jan 1981 and 7 Oct 1981–22 Feb 1982. A 7 Nov 1982 record for Abbott's and a 15 Feb 1987 record for Tomales Bay have not been submitted to the CBRC. *All* the records for Abbott's may be rejected as representing possible hybrids (D. Roberson in litt.).

Tufted Ducks have been expanding their palearctic breeding range (Palmer 1976b), and sightings of vagrants to North America have increased since the early 1970s (Bellrose 1980, Roberson 1980, ABN). The first California record was in the winter of 1948–49 (Orr 1950, 1962, Dunn 1988), and the species has been recorded annually in the state since 1968 (CBRC). Except for one of oversummering, the 40 currently accepted records for California (mostly coastal slope) span 29 Sep to 11 May; most are for Nov–Mar (CBRC).

Scaup spp. (*Aythya* spp.)

Because many Greater Scaups (*A. marila*) and Lesser Scaups (*A. affinis*) were indistinguishable on censuses, we present data for both species combined. Scaups were rare summer visitants and very common winter residents (Fig. 19). Careful non-census identifications revealed that the seasonal abundance pattern at Bolinas (Fig. 19) was based primarily on the Greater Scaup, which apparently arrives later

and departs earlier from the wintering grounds than does the Lesser Scaup (McCaskie et al. 1979, Bellrose 1980). The scaups on fresh water at Abbott's Lagoon in 1975–76 were mostly Lessers (Fig. 20). Typically, the increase in numbers of both species in fall was more gradual than the decrease in spring (Figs. 19 and 20).

Greater Scaups use deep bays, estuaries, lagoons, and, to a limited extent, freshwater ponds. Although Lessers overlap with Greaters on saltwater, they occur much more frequently on freshwater ponds and generally prefer fresher and shallower waters than do Greaters (Palmer 1976b).

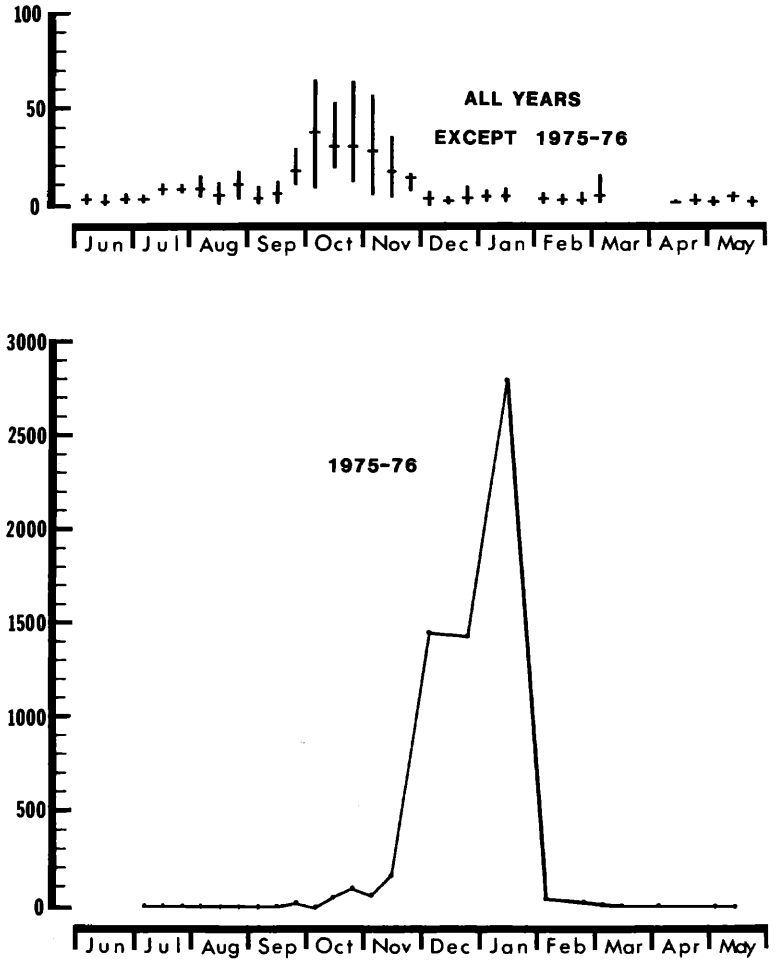

Figure 20. Numbers of scaups at Abbott's Lagoon in 1975–76 and all years except 1975–76. See Figure 4 for details.

From careful identifications we can report the following:

Greater Scaup. Although of irregular occurrence, a few oversummering Greater Scaup can be found almost every year somewhere on Point Reyes. High summer census counts were 9 and 12 birds at Abbott's on 15 Jul and 4 Aug 1981 (DS), respectively. The winter build-up of Greaters began in late Sep or early Oct, and most birds had departed by mid-May. A high winter number for the study area was 8000 on Tomales Bay on 18 Jan 1987 during a run of Pacific Herring (ABN 41: 323).

Lesser Scaup. Although the only summer census records were of two to three birds at Abbott's throughout the summer of 1981, numbers on additional counts there increased steadily from 10 to 50 birds from 6 Jul to 12 Aug 1965 (PRBO). A flock of 40 at Abbott's on 21 Aug 1979, if not oversummering, was a month earlier than the usual arrival date for central California (AB 34: 195). Regardless, Lesser Scaups were not seen most summers in the Point Reyes area, despite their breeding irregularly in the San Francisco Bay area (Grinnell and Miller 1944, AB 40: 1250, AB 42: 1336). At Abbott's, in most years Lessers occurred primarily as fall transients (Fig. 20). An unusually large concentration of 2800 birds on the large upper freshwater arm on the 14 Jan 1976 census (Fig. 20) was composed perhaps of refugees from freshwater habitat that had dried up because of drought. Within the study area Lesser Scaups were usually present from late Sep to mid-May.

King Eider (*Somateria spectabilis*)

A very rare fall visitant with only one census record of an immature male at Abbott's Lagoon from 13 to 28 Nov 1980 (AB 35: 220, Binford 1985). The only other accepted record for Point Reyes is a specimen of a juvenile female collected from among a group of three eiders at the mouth of Tomales Bay on 16 Dec 1933 (Moffitt 1940, Dunn 1988). Records of a dying female at Bolinas on 26 Oct 1973 and another dead female at Bolinas on 2 Nov 1973 (AB 28: 100) have not been submitted to the CBRC. Individuals of this circumpolar, high-latitude species occur only irregularly as far south as California (Roberson 1980, AOU 1983). The 23 accepted records for California, 1933 to 1986, are of single birds spanning all months of the year (CBRC). Most birds occur from Nov to Mar on coastal bays, estuaries, lagoons, or inshore waters.

Harlequin Duck (*Histrionicus histrionicus*)

A very rare winter visitant with one census record of a male at Drake's Estero on 2 May 1980. Midsummer study area records are of "flocks" in Jun 1880 at Point Reyes (Maillard 1904), a female at Stinson Beach on 10 Jul 1980 (ABN: CoB), and a male at Bolinas on 25 Jun and 12 Aug 1988 (ABN: RD, DAH). Most local records fall between Sep and Mar with a peak from late Nov to mid-Jan (Fig. 12). Winter numbers have decreased at Point Reyes. In the Tomales Bay area there were "hundreds" in the fall of 1913 (Grinnell et al. 1918), "flocks" on 22 Dec 1929 and 28 Nov 1936 (Grinnell and Miller 1944), at least 10 birds on 13 Dec 1955 (AFN 10: 277), and 16 on 25 Nov 1956 (AFN 11: 54). On Tomales Bay CBCs from 1956 to 1961 the median number of Harlequin Ducks was 8 (range 1–15), and from 1962 to 1968 it was 1.7 (range 0–6). From 1970 to 1988 Harlequins were recorded on only 8 of 19 Point Reyes CBCs (high count 2), although this count excludes the area around the mouth of Tomales Bay where numbers were seen in the past (ABN). The species has declined markedly as a breeder in California (Remsen 1978, McCaskie et al. 1979), but sightings in the breeding season in the Yosemite region have increased in the last 10 years (Gaines 1988). The decline in winter numbers in the Point Reyes area may be a reflection

of the decreased size of the California breeding population, although the source of wintering birds is unknown. Wintering Harlequin Ducks are found in the inshore zone in turbulent waters along rocky coastlines and in bays and estuaries, particularly larger ones.

Oldsquaw (*Clangula hyemalis*)

A very rare winter resident with only 9 birds on 14 censuses from 15 Oct to 9 May. Most birds in the Point Reyes area were present from mid-Oct to mid-Apr (Fig. 12). The highest census count was two at Limantour on 14 Mar 1969, and the highest non-census count was 15 off Tomales Point on 14 Jan 1976 (GWP, DS, NS). From 1970 to 1988 Oldsquaws were recorded on 12 of 19 Point Reyes CBCs with counts ranging from one to five birds except for a high count of 13 in 1975. The only Point Reyes records for mid-summer are of single birds at Bolinas Bay on 3 Jun 1968 (AFN 22: 644), Tomales Bay on 28 Jun 1981 (AB 35: 974) and from 21 Jun to 8 Jul 1986 (AB 40: 1250), and Drake's Bay from 23 May to 10 Jul 1982 (ABN: JGE et al.) and from 5 May until at least 5 Jul 1988 (AB 42: 1336, ABN); a bird at Abbott's on 9 Sep 1984 may have summered locally also (AB 39: 97). Oldsquaws inhabit inshore waters, bays, estuaries, and lagoons.

Black Scoter (*Melanitta nigra*)

A very rare summer visitant and winter resident with about 61 birds on 53 censuses, mostly at Limantour from Nov to May (Fig. 21). All census records of Black Scoters fell between 14 Nov and 15 May except for one at Abbott's on 27 May and 5 Jun 1980, one at Limantour on 7 Jul 1970, one there on 2 Aug 1971, and two there on 14 Sep 1969. The high census count was 18 birds at Limantour on 28 Apr 1968. Although Black Scoters were not recorded regularly on censuses until Nov, fall migration appears to start by early to mid-Oct (ABN), or rarely by late Sep (e.g., AB 39: 97). Black Scoters are more numerous in deeper and larger bays such as Tomales Bay, where the highest count was 93 birds on 21 Dec 1985 (BB). The bulk of the Point Reyes population inhabits inshore waters and has a seasonal occurrence pattern (Fig. 5) similar to that of estuarine birds (Fig. 21). A high winter count in the inshore area from Drake's Bay to Point Reyes Lighthouse was 150 birds on 13 Jan 1981 (AB 35: 332), and a high spring count was 200 birds on 6 Apr 1971 (ABN: BMc); typically fewer than 100 birds occur there (ABN, DS). Up to eight birds were observed in Drake's Bay in early Jun 1976, but only one or two have been found there later in the summer (ABN). Another concentration area is the rocky shoreline from Dillon Beach to Estero San Antonio, where 75 were counted on 18 Feb 1978 (DS). From 1970 to 1988, the median number of Black Scoters on the Point Reyes CBC, which does not include outer Point Reyes or the mouth of Tomales Bay, was 59 (range 16–115).

Limited numbers of Black Scoters migrate over inshore waters of central California in spring, primarily in Apr and May (ABN: BSa et al.). Black Scoters prefer inshore waters near the mouths of estuaries, along stretches of rocky shoreline, and inside larger bays; smaller numbers frequent estuaries and lagoons. They appear to forage over coarse gravel, boulders, and rock substrate in the intertidal zone (Vermeer and Bourne 1984).

Surf Scoter (*Melanitta perspicillata*)

A fairly common summer resident and a very common winter resident (Fig. 21). The fall influx began in late Sep or early Oct and continued into Nov at Bolinas and Limantour and into Dec at Abbott's (Fig. 21). Winter numbers were erratic at Bolinas (Fig. 21) perhaps because of the frequent interchange of birds

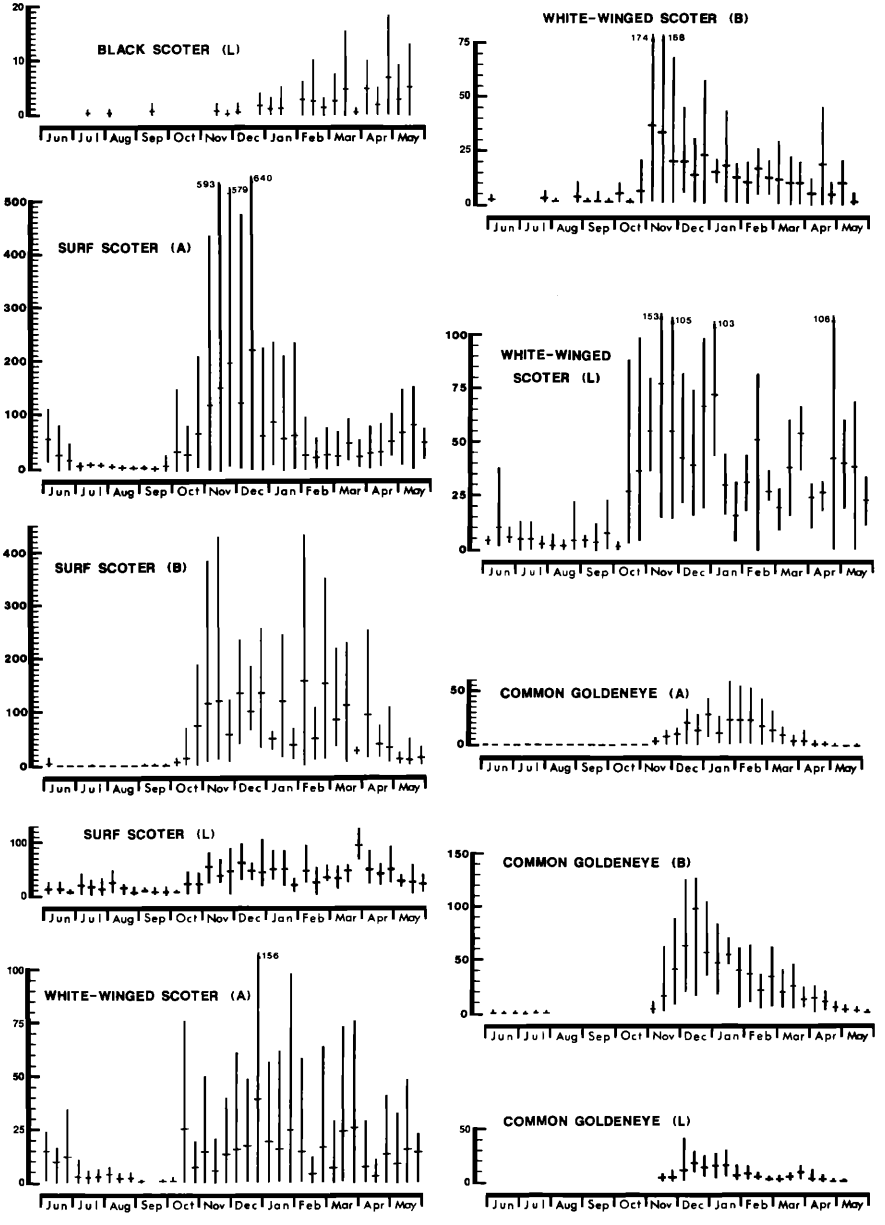

Figure 21. Seasonal abundance of scoters and goldeneyes in wetlands of Point Reyes. See Figure 4 for details.

between estuarine and inshore waters. Surf Scoters maintained highest average numbers at Bolinas from early Nov to mid-Mar. At Limantour numbers were relatively stable from Nov through Apr (Fig. 21). At Abbott's numbers peaked in Nov and Dec and to a lesser extent in Apr and May; birds lingered through Jun (Fig. 21).

Peak movement in fall over inshore waters is during the first two weeks of Nov (Ralph 1969). An estimated 110,000 Surf Scoters off Point Reyes Beach from 31 Oct to 25 Nov 1987 was an exceptionally large flock of staging migrants (AB 42: 129). Along the south shore of Point Reyes, Surf Scoters were concentrated mostly in Drake's Bay (Fig. 7). In inshore waters numbers rose from Oct through Dec, stayed at a plateau through May, then declined to reach yearly lows in Sep (Fig. 5). To the north in cooler waters off Cape Mendocino, numbers rise in Aug and Sep, peak in Oct or Nov, and usually decline gradually through the winter (Briggs et al. 1987). Spring migration in the wetlands extended mainly from late Mar through May (Fig. 21), bracketing peak migration dates over inshore waters off central California, which range from 16 to 23 Apr (ABN: BSa et al.). Our summer inshore counts (Fig. 5) of 796 birds (1204 adjusted for unidentifieds) from 1 to 4 Jul 1981, and 580 birds (904 adjusted) on 17 and 18 Aug 1981, dwarfed those on the estuaries (Figs. 7 and 21). Declining numbers through Jun at Abbott's (Fig. 21) and from Jun to Sep in inshore waters off southern Point Reyes (Fig. 5) suggested even more protracted movement after the main spring passage.

At Point Reyes, Surf Scoters inhabit inshore waters, bays, estuaries, and, rarely, freshwater ponds. Large numbers concentrate on Tomales Bay, presumably eating eggs of Pacific Herring (Briggs et al. 1987). Estimates from Tomales Bay of 11,000 Surf Scoters on 28 Feb 1987 (AB 41: 323) and 10,000 on 28 Oct 1988 (ABN: JW) fell, respectively, during and before the annual period of herring spawning, suggesting that Tomales Bay serves as both a major migratory staging area and a concentration area during times of seasonally abundant food. Of the three scoters, the Surf forages over the widest variety of substrates, from fine sand to boulder and rock (Vermeer and Bourne 1984). In the inshore zone off California they generally prefer waters over sandy substrate lying in the lee of a promontory (Briggs et al. 1987).

White-winged Scoter (*Melanitta fusca*)

An uncommon summer resident and a common winter resident (Fig. 21). Fall migration, concentrated between mid-Oct and mid-Nov, may continue into Dec (Fig. 21, Bellrose 1980, AB 34: 196). Influxes to the wetlands began in Oct (Fig. 21). At Limantour numbers reached highs in Nov and Dec and declined abruptly to moderate numbers in Jan. At Bolinas numbers peaked in Nov and declined gradually thereafter. After the fall influx in Oct, numbers at Abbott's remained relatively stable through the winter. Irregular increases in numbers at all sites in midwinter may have reflected movement between inshore and estuarine waters, and from late Mar to mid-May may have represented pulses of migrants. Wetland numbers declined through May to summer lows by early Jun at Limantour and Bolinas or by early Jul at Abbott's; Bolinas was the only site where Surf Scoters were irregular in summer.

Numbers of White-winged Scoters on inshore waters off Point Reyes increased from Oct to Dec, maintained a mid-winter plateau from Dec to Feb, and declined somewhat in Mar and Apr (Fig. 5). In spring White-winged Scoters migrate over inshore waters between late Mar and May (ABN), though on our monthly inshore counts we detected staging migrants *on* inshore waters only in May (Fig. 5). Peak migration dates over inshore waters in central California range from 1 to 23 Apr (ABN: BSa et al.). Summer numbers remained relatively high on inshore waters

(Fig. 5), in contrast to the pattern on the estuaries (Fig. 21). At Point Reyes, White-winged Scoters frequent bays, estuaries, inshore waters, lagoons, and, rarely, freshwater ponds. In the inshore zone off southern Point Reyes, White-wingeds concentrated in Drake's Bay (Fig. 7). The ratio of the number on estuaries to the number on inshore waters was higher for the White-winged than for the Surf Scoter (Fig. 7, Table 1). Elsewhere, White-winged Scoters feed in deeper water than do the other scoter species and forage over silt, mud, sand, and fine gravel (Vermeer and Bourne 1984). On inshore waters along the California coast, White-winged and Surf scoters occupy similar habitat (see account, Briggs et al. 1987).

Common Goldeneye (*Bucephala clangula*)

A very rare summer visitant and a common winter resident (Fig. 21). Our only summer census records at Point Reyes were of two birds lingering until 25 Jun and one lingering until 28 Jul 1975 at Bolinas. The only non-census records for summer were of one bird on 2 Aug 1964 at Bolinas (ABN: TAC, ZCh), one bird on 18 Jul 1965 (RS) at Abbott's, and two birds there on 17 Jul 1988 (ABN: LJP). The earliest fall arrival was 3 Nov at Bolinas. Although numbers at Bolinas built up abruptly through Nov, peaked in Dec, and subsequently declined steadily, at Abbott's and Limantour both the fall increase and spring decline were gradual (Fig. 21). Most goldeneyes in the Point Reyes area were found on estuaries, bays, and lagoons, with smaller numbers in the inshore zone and on freshwater ponds, impoundments, and sewage ponds.

Barrow's Goldeneye (*Bucephala islandica*)

A very rare winter resident with about eight individuals on 18 censuses (17 at Bolinas, 1 at Limantour) from 9 Nov to 8 Mar. Non-census records from Point Reyes extended from 31 Oct to 28 Apr (ABN) with most records between Nov and Jan at Bolinas Lagoon or Tomales Bay (Fig. 12). The earliest record for coastal northern California is 28 Oct (Grinnell and Miller 1944), except for the unprecedented arrival of six birds at Foster City, San Mateo Co., on 26 Sep 1982 (ABN: DPM). Barrow's Goldeneyes were reported on 10 of 19 Point Reyes CBCs from 1970 to 1988; 12 birds in 1978 was the only count over 3. Although the species has always been rare and local in the state in winter (Grinnell and Miller 1944), its extirpation as a breeder from Colorado (Palmer 1976b) and California (Cogswell 1977, Remsen 1978) may have caused coastal wintering populations to decline. However, as recently as 1987 winter numbers appeared to be rebounding in the San Francisco Bay area (J. Morlan pers. comm.), where most coastal birds reside (Cogswell 1977, ABN). Barrow's Goldeneyes use bays, estuaries, lagoons, freshwater ponds, and sewage ponds.

Bufflehead (*Bucephala albeola*)

A rare summer resident and a very common winter resident (Fig. 22). Up to seven birds oversummered at Abbott's in four of five years with summer censuses, whereas none oversummered at Limantour or Bolinas, despite longer census records. Numbers increased abruptly from late Oct to late Nov, but thereafter occurrence patterns at the various wetlands differed substantially. At Bolinas numbers remained relatively stable from Nov to Apr; at Limantour numbers declined slowly from Dec through May; at Abbott's numbers remained relatively stable from Nov to Feb, but increased in Mar and Apr (Fig. 22). These patterns suggest complex local movements at least one facet of which is the use by Buffleheads of ephemeral ponds created by winter rains. An estimated 4000 + Buffleheads

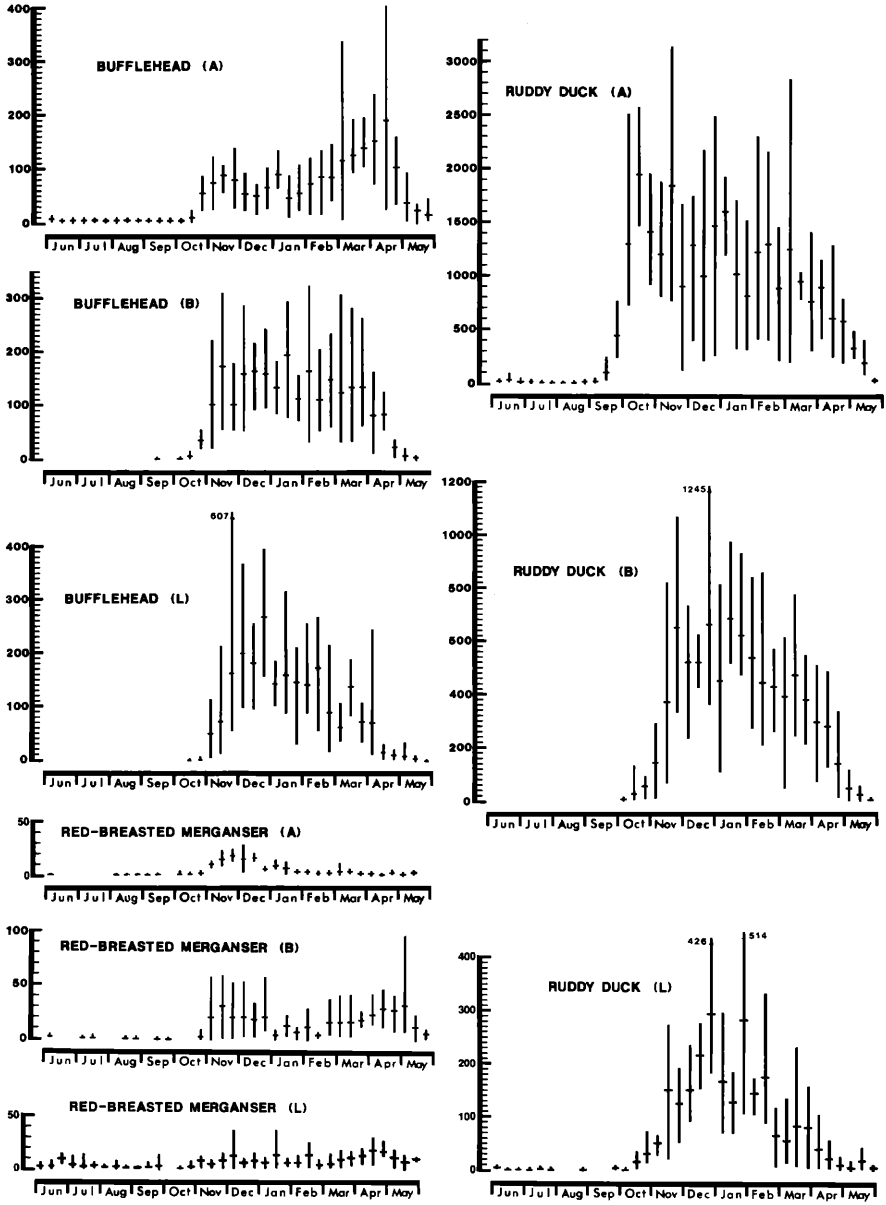

Figure 22. Seasonal abundance of the Bufflehead, Red-breasted Merganser, and Ruddy Duck in wetlands of Point Reyes. See Figure 4 for details.

were on Tomales Bay on 18 Jan 1987 during the annual period of spawning for Pacific Herring (AB 41: 323). Over the course of the study there was an increase in the population wintering at Bolinas (Fig. 14). Regional declines in the West at least through the mid-1960s (Grinnell and Miller 1944, Erskine 1972) suggest Buffleheads may be less abundant in Point Reyes estuaries than formerly. However, our census data and local CBCs since 1956 indicate that recently numbers have been relatively stable. Buffleheads frequent estuaries, bays, lagoons, freshwater ponds, and sewage ponds.

Hooded Merganser (*Lophodytes cucullatus*)

A very rare winter resident with about seven individuals on 17 censuses from 8 Nov to 4 Mar. Non-census records extend from 4 Oct to 3 May (ABN, PRBO) with most records from mid-Nov to late Mar (Fig. 12). Outside the area of breeding near Lake Earl, Del Norte Co. (Yocum and Harris 1975), the earliest arrival to coastal northern California is 3 Oct (ABN), the latest departure is 30 May (AB 42: 478), and the only record of oversummering is of a bird at Rodeo Lagoon, Marin Co., from 25 Jun to 25 Sep 1966 (AFN 20: 596, 21: 73). The highest count at a single site on Point Reyes was 30 birds at Five Brooks Pond on 14 Dec 1979 (AB 34: 303, ABN). The median number of Hooded Mergansers on the Point Reyes CBC from 1970 to 1988 was 5.6 (range 0–32). Hooded Mergansers occur primarily on freshwater ponds and slow-moving streams, especially those bordered with vegetation, and occasionally on estuaries at stream mouths.

Common Merganser (*Mergus merganser*)

A very rare visitant with only one census record of three individuals at Abbott's Lagoon on 28 Aug 1981 (DS). Except for CBC reports there are only four non-census records for Point Reyes: one bird at Five Brooks Pond from 3 Dec 1976 to 8 Jan 1977 (DS et al.), one bird at Schooner Bay, Drake's Estero, on 12 Nov 1978 (DS, JW), five birds at Abbott's on 13 Aug 1987 (ABN: ASH), and four birds at Abbott's on 30 Aug 1988 (DS, SCc). Common Mergansers have been recorded on 16 of 19 Point Reyes CBCs from 1970 to 1988 with a median number of 5 (range 1–54) for those 16 years. Many of the CBC records pertain to birds sighted just east of the Point Reyes Peninsula on streams and reservoirs in watersheds where the species breeds (AB 35: 974). We suspect some CBC reports from Point Reyes proper are misidentifications. In coastal California the species occurs primarily as a winter resident from Nov to Mar (McCaskie et al. 1979, ABN, Garrett and Dunn 1981), but it is rare from Marin Co. south (breeding south to Monterey Co.). In California the species inhabits primarily freshwater lakes, reservoirs, and rivers, but salt water only occasionally during migration or winter.

Red-breasted Merganser (*Mergus serrator*)

A rare summer resident and a fairly common winter resident (Fig. 22). In summer, Red-breasted Mergansers were recorded most frequently at Limantour (Fig. 22), where high census counts were 14 birds on 25 Jun and 16 Jul 1980. Seasonal changes in abundance at the wetlands indicated that fall migration extends from Oct through Dec and spring migration extends from Apr through May (Fig. 22). The small numbers of Red-breasted Mergansers migrating over inshore waters of the central California coast peak in mid-Apr (ABN: BSa et al.). At Point Reyes Red-breasted Mergansers use bays, estuaries, lagoons, inshore waters, and, much less frequently, freshwater ponds.

Ruddy Duck (*Oxyura jamaicensis*)

A fairly common summer resident and an abundant winter resident (Fig. 22). Most oversummering birds, on either salt or fresh water, are non-breeders. The only breeding records for Point Reyes are of a female with young at a pond at Drake's Beach visitors' center on 10 Jul 1982 (JGE) and at Cypress Grove near Marshall, Tomales Bay, on 19 May 1989 (SK). In fall Ruddy Ducks arrived and reached peak numbers earlier at Abbott's Lagoon (Fig. 22) and on freshwater ponds (Fig. 18) than at Bolinas or the tidal areas of Limantour (Fig. 22). At Limantour numbers increased more rapidly on the freshwater ponds than on the estero proper, but, with the advent of the rainy season, numbers on the ponds decreased steadily through winter, while numbers on the estero initially increased and then remained high until Feb (Fig. 18). An estimated 3380 Ruddy Ducks were on Tomales Bay on 28 Feb 1987 during the period of spawning for Pacific Herring (AB 421: 323). The spring exodus from Mar to May (Fig. 22) encompassed the mid-Apr period of peak spring migration in North America (Bellrose 1980). Grinnell and Miller (1944) felt that numbers in California were much reduced from former times, a condition Palmer (1976b) attributed to market hunting in the late 1880s. Ruddies in the Point Reyes area are found primarily on Tomales Bay, Abbott's Lagoon, and freshwater ponds, secondarily on the other estuaries, and only occasionally on protected inshore waters.

Black Rail (*Laterallus jamaicensis*)

A very rare winter visitant on censuses with only one record of three birds at Bolinas Lagoon on 14 Dec 1981. Non-census records indicate the species is a year-round resident and that birds disperse more widely after breeding (ABN). Non-census records at Bolinas Lagoon were of one bird calling along the west shore on 10 and 11 Mar 1979 (RS et al.), up to five individuals roosting together in the Pine Gulch Creek delta during fall and winter extreme high tides from 1980 through 1987 (ABN: RS et al.), one to two calling birds at Pine Gulch from 2 Mar to 20 May 1987 (ABN: DDeS,DAH), and one to two calling on the east shore on various dates from 29 Mar to 11 Jul, 1983 to 1986 (ABN: CC et al.). A probable transient was flushed from *Salicornia* marsh at Limantour on 27 Nov 1979 (AB 34: 196). Although Kehoe Marsh, 3 km north of Abbott's Lagoon, supported up to four wintering birds as late as 1975 (Point Reyes CBC), none has been reported there since 16 Dec 1978 (AB 33: 310). In Oct and Nov 1897, C. A. Allen collected 22 Black Rails at the south end of Tomales Bay (Brewster 1907); others were collected on Tomales Bay through at least 1940 (Manolis 1978). Just how numerous the Black Rail was there is suggested by the 53 winter specimens from "Point Reyes" and Tomales Bay at the American Museum of Natural History, New York (fide SNGH). Even though subsequent conversion of much of the marsh to pastures, starting in 1945 (D. Livingston pers. comm.), has greatly reduced the amount of tidal marsh habitat, 17 Black Rails were captured there at high tides by Great Egrets and Great Blue Herons over 11 days of observation from 21 Nov 1984 to 19 Jan 1985 (Evens and Page 1986), and recent summer surveys yielded a high summer count of seven calling birds there on 16 May 1986 (JGE).

Recent work has documented a substantial breeding population of Black Rails in the tidal marshes of San Pablo and Suisun bays (Manolis 1978, Evens et al. 1989), though historically this population appears to have declined greatly. The species is listed as threatened in California and is a candidate for federal listing. On Point Reyes, nesting was confirmed on Tomales Bay near Inverness in the summer of 1966 (AFN 21: 73). Olema Marsh records of a single calling bird from 7 Apr to 18 May 1975 (AB 29: 903), one calling on 5 Apr 1977 (Manolis 1978), and up to four calling from 17 Jun to 30 Jul 1980 (JGE, DS), and the Bolinas and

Tomales Bay spring and summer records listed above all suggest local breeding birds. An observation of two at Olema Marsh on 21 Sep 1930 (Stephens and Pringle 1933) suggests birds also winter there. At all seasons Black Rails inhabit salt, brackish, and freshwater marshes. In salt marshes they are usually found above the mean high tide line, and while breeding appear to favor areas that have a dense overstory of *Salicornia* or low-growing forms of *Scirpus* (Manolis 1978, PRBO unpubl.).

Clapper Rail (*Rallus longirostris*)

A very rare fall and early winter visitant with only one census record, of a single bird on Kent Island, Bolinas Lagoon, on 4 Dec 1981. Additional non-census records are of singles at Bolinas on 22 Dec 1967 (PL), 31 Dec 1978 (GWP), 15 Nov 1980 (AB 35: 221), and in spring 1972 (GWP); at Limantour on 31 Oct 1971 [Gull 54(1): 3]; at Tomales Bay in Oct 1965 (ABN: GB), from late Jul to 24 Sep 1969 (GB fide PL), and on 12 Sep 1982 (AB 37: 220); and at Schooner Bay, Drake's Estero, on 31 Dec 1966 (RS). Records of birds in northern California found out of habitat in fall extend from 3 Sep to 18 Nov (Evens and Page 1984). Most records in northern California away from known breeding areas have been during fall and early winter and presumably involve post-breeding dispersal. There is a pronounced southward shift in winter of Clapper Rails in the San Francisco Bay area (P. R. Kelly pers. comm.). It is possible that some winter records involve birds dispersing from marshes inundated by exceptionally high storm tides.

Although the California Clapper Rail (*R. l. obsoletus*) is still a locally fairly numerous year-round resident and breeder around San Francisco Bay (Grinnell and Miller 1944, Gill 1979, Evens and Page 1984), it has declined dramatically since the late 19th century and is currently protected as an endangered species by state and federal governments. Initial reductions were due to market hunting (Grinnell et al. 1918), but the loss of 60–95% of the bay's tidal marshes (Nichols and Wright 1971, Josselyn 1983) has been the primary cause of decline and failure to return to historical levels. The species still faces pressures from habitat fragmentation and introduced predators. The decline of the San Francisco Bay population has probably reduced the number of fall and winter dispersants to our study area. The historical status of this species at Tomales Bay, where marsh habitat has also been reduced (see Black Rail), is not clear. It was first recorded there on 22 Nov 1914 (T. I. Storer 1915, MVZ 24915), and single birds were collected there on 1 Nov 1936 and 11 Nov 1939 (CAS 66755, 66751). Since an adult female with an enlarged ovary was also collected there on 21 Feb 1936 (MVZ 100396), and Clapper Rails can begin laying in early Mar (Evens and Page 1983), it is possible they once bred and were resident at Tomales Bay. Intensive rail surveys from 1984 to 1986 at the south end of Tomales Bay failed to reveal any birds (JGE, GWP). California Clapper Rails inhabit salt marshes, particularly those with extensive tidal channels and sloughs.

Virginia Rail (*Rallus limicola*)

A very rare year-round resident with at least 23 birds on 48 censuses. Its true status is masked by difficulty of detection—the Virginia Rail is probably an uncommon winter resident and a rare summer resident. Away from the censused wetlands Virginia Rails occur more commonly on Point Reyes at scattered marshes. Overall the local breeding population is inflated from Sep through Mar by wintering birds that swell numbers in freshwater and brackish marshes and expand into salt marshes. The median number on Point Reyes CBCs from 1970 to 1988 was 55 (range 14–101). Censuses at Olema Marsh, the largest fresh-

water marsh on Point Reyes, yielded an average of 20 birds in winter 1985–86 and 11 pairs in summer 1986 (Evens and Stallcup 1986a,b). Breeding has been confirmed on Point Reyes by the presence of chicks at Olema Marsh on 1 May 1980 (DS) and on the west shore of Tomales Bay on 30 Apr 1967 (PL). Breeding habitat is probably restricted to swales and freshwater and brackish marshes.

Sora (*Porzana carolina*)

A very rare year-round resident with about 11 birds on 14 censuses. Its true status is masked by difficulty of detection—the Sora is probably an uncommon winter resident and a very rare summer resident. All census records fell between 27 Aug and 25 Apr except for those of single birds at Bolinas on 26 Jul 1973 and at Limantour on 10 Jul 1975. Away from the censused wetlands Soras occur more commonly at freshwater marshes scattered around Point Reyes. Numbers swell in fall and winter and some birds extend then into tidal marshes (JGE, GWP). The median number on Point Reyes CBCs from 1970 to 1988 was 8 (range 2–32). Although infrequently reported on Point Reyes in the breeding season, at Olema Marsh one to two pairs occur regularly at that time versus one to six birds there in winter (Evens and Stallcup 1986a,b). Two juveniles at the Bolinas sewer ponds on 2 Aug 1983 were probably locally produced (JGE). Like Virginia Rails, Soras are probably restricted while breeding to swales and freshwater and brackish marshes.

Common Moorhen (*Gallinula chloropus*)

A very rare summer visitant and winter resident with about seven birds on 11 censuses. All census records were from freshwater ponds at Limantour between 6 Oct and 27 Dec, except for singles on 2 May 1980 and 2 Aug 1971. Point Reyes records, which peak from late Sep to mid-Nov (Fig. 12) are mostly from Olema Marsh, Muddy Hollow Pond, and Five Brooks Pond. Moorhens have been found on 11 of 19 Point Reyes CBCs from 1970 to 1988 with the highest count being of three birds. Breeding on Point Reyes is irregular but has been confirmed by sightings of small young accompanied by adults at Olema Marsh on 31 Aug 1967 (AFN 22: 85) and at the Bolinas sewer ponds on 12 Jul 1983 (AB 37: 1023). Breeding is also suggested by six or seven immature birds at a Limantour pond on 7 Oct 1964 (ABN: GM, KSc), one immature there on 16 Jun 1966 (PRBO), and a "pair" 3 miles south of McClure's Beach on 25 Jun 1972 (ABN: WBG). At Point Reyes, moorhens are restricted to freshwater marshes and ponds edged with emergent vegetation.

American Coot (*Fulica americana*)

A fairly common summer resident and an abundant winter resident (Fig. 23). Coots breed on freshwater ponds at Limantour and Abbott's where a small increase in numbers during summer (Fig. 23) was due to the fledging of young. Occasional birds at Bolinas in summer were non-breeders or early dispersing failed breeders from nearby freshwater habitat.

Coot numbers peaked earlier and declined much sooner in Limantour ponds than on the estero proper (Fig. 18), perhaps because some coots shifted to the estero when water levels in the ponds increased during the rainy season. However, there was a net exodus of coots from Limantour (ponds and estuary combined) from Dec to Jan (Fig. 23). At Abbott's, where water levels also typically rise beginning in late fall, coots also peaked in fall and subsequently declined. Funderburk and Springer (1989) noted a similar fall peak and early winter decline of coot numbers at lakes Earl and Talawa. At Bolinas, where freshwater habitat is

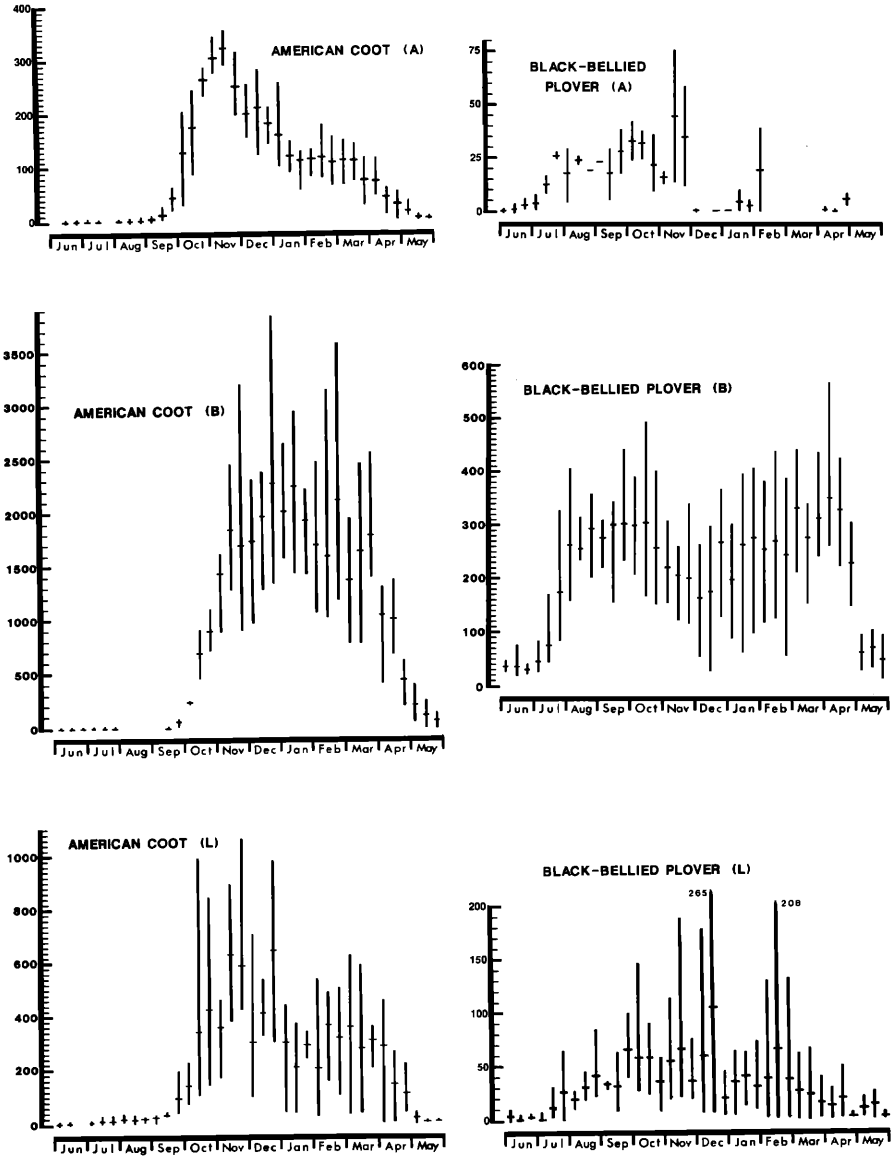

Figure 23. Seasonal abundance of the American Coot and Black-bellied Plover in wetlands of Point Reyes. See Figure 4 for details.

lacking but extensive fresh green grass is avilable in winter for grazing, coots did not decline in Dec and Jan (Fig. 23).

Winter numbers at Limantour declined after 1975–76 (Fig. 14). At Bolinas, winter numbers increased from 1972–73 to 1975–76, then declined sharply in 1976–77 and 1977–78 (Figs. 14 and 24). Coots also declined from 1975 to 1976 on the Marin Co. (southern) CBC while increasing in 1975 and decreasing in 1976 on the Point Reyes CBC. The sharp decline in peak numbers from the first to second year of a major drought may have reflected a concentration of birds on the estuaries during the first winter, as freshwater habitat dried up, followed by drought-induced reproductive failure that caused a significant regional decline in numbers. Subsequently, coot numbers in our coastal study did not recover to pre-drought levels but instead declined further during the recent drought years of 1986–87 and 1987–88 (PRBO unpubl. data).

In winter on Point Reyes, coots inhabit bays, lagoons, estuaries, freshwater marshes, and ponds, and graze on adjacent grassy fields. They breed at freshwater ponds and marshes edged with dense emergent vegetation.

Sandhill Crane (*Grus canadensis*)

A very rare visitant with a census record of one bird at Bolinas Lagoon on 12 May 1975, apparently the same bird seen later that day on outer Point Reyes (BC). Other recent Point Reyes records were of 13 flying birds at Bear Valley on 16 Nov 1963 (ABN: CJR), two birds at Palomarin on 24 May 1979 (KH, DDeS), one on Point Reyes on 27 Feb 1984 (AB 38: 353), one near Five Brooks from 29 Dec 1984 to 1 Jan 1985 (AB 39: 206), and single birds at Bolinas in "early fall" 1987 (NW, KH), on 11 Dec 1987 (PA et al.), and on 12 May 1989 (BHe). A bird on pastures at the south end of Tomales Bay from 16 Sep 1983 to 9 Mar 1984 (JGE et al.) is the only recent record of a crane wintering on the coastal slope of northern California (ABN). Sandhill Cranes formerly wintered as close as San Rafael and San Francisco, but numbers declined in California in the early 1900s (Grinnell and Miller 1944), and they are now extremely rare on the California coast (McCaskie et al. 1979, Garrett and Dunn 1981, ABN). Since the 1950s Sandhill Cranes have visited the coastal slope of northern California irregularly, mostly between 6 Sep and 18 Jan (ABN). The only other coastal spring records besides those for Point Reyes are of singles at Año Nuevo, San Mateo Co., on 9 May 1976 (AB 30: 884) and Oakland, Alameda Co., on 3 Apr 1988 (AB 42: 478). A Sandhill Crane also summered in Humboldt Co. in 1974 (Yocum and Harris 1975).

Black-bellied Plover (*Pluvialis squatarola*)

A fairly common summer resident and a very common winter resident (Fig. 23). Fall migration extended from mid-Jul through Oct (Fig. 23), possibly through Nov or later (Jurek 1973, DeSante and Ainley 1980), and numbers peaked from early Aug to late Oct (Fig. 23, Jurek 1973). Juveniles arrived at least by Sep (DS); an early date for Oregon is 26 Aug (Paulson 1983). Low numbers at Bolinas in Nov and Dec (Fig. 23) probably were due to daily local movements rather than a departure of migrants; once winter rains commenced, some Black-bellied Plovers left the lagoon as the tide was rising (often before our censuses were completed) to forage later at high tide in nearby pastures. At Abbott's numbers declined markedly after late Nov and remained generally low but irregular thereafter (Fig. 23). This decline may have been caused by regional movements of birds away from Abbott's as runoff from winter rains inundated the lagoon's flats, rather than by the departure of long-distance migrants. Winter inter-site movement in our study area, perhaps explaining the irregular high winter counts at Abbott's and

Limantour (Fig. 23), can be expected since Black-bellied Plovers arrive on and depart from the Farallones then (DeSante and Ainley 1980). Spring migration extends from mid- or late Mar through May (Jurek 1973, ABN), although this was not readily apparent from numbers on the Point Reyes wetlands (Fig. 23). Numbers at Bolinas dropped suddenly in late Apr and reached yearly lows in Jun (Fig. 23). During the study, winter numbers increased at Bolinas and Limantour (Fig. 14). Exposed tidal flats are the most important habitat for this species, and at Bolinas flats of intermediate substrate texture are used more than sandier or muddier ones (Page et al. 1979). Sand beaches, flat rocky shores such as Duxbury Reef, and rain-soaked pastures at high tide are also used.

Lesser Golden-Plover (*Pluvialis dominica*)

A very rare fall transient, winter resident, and spring transient (Fig. 12). Two subspecies of Golden-Plovers, perhaps separate species (Connors 1983), are found in California: *P. d. fulva*, which breeds in Alaska and Siberia, and *P. d. dominica*, which breeds in Alaska and arctic Canada (AOU 1983). Fall migrants were detected from late Jul to mid-Nov (Fig. 12). Six birds (race unknown) at Abbott's on 8 Dec 1965 may have been late migrants or wintering birds from nearby. Juveniles, *dominica* as early as 22 Aug (SNGH) and *fulva* by 13 Sep (JM), predominated over adults during the peak of fall migrants from early Sep to early Nov (Fig. 12, unpubl. data). Apparently the latest California specimen of *dominica* was collected on 11 Nov (Chaniot 1966). However, sight records suggest this race may remain with wintering *fulva* until mid-Dec (DS). Migrants (race unknown) have lingered to 31 Dec 1975, 14 Dec 1982, and 3–8 Jan 1981 at the Farallon Islands, where the species does not winter (DeSante and Ainley 1980, ABN). Maximum census counts of fall migrants were 11 birds on 29 Sep 1969 and 8 birds on 8 Nov 1979 at Limantour. Our only estuarine wintering records were of single birds at Bolinas on censuses through the winter of 1974–75, and at

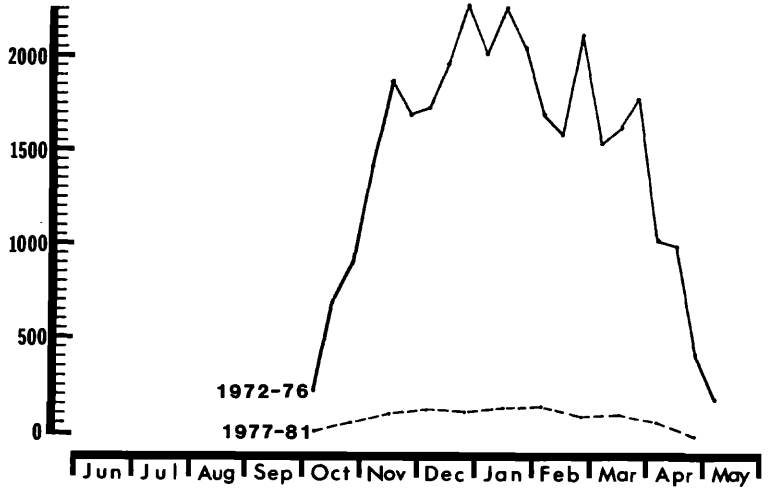

Figure 24. Mean number of American Coots at Bolinas Lagoon from 1972 to 1976 and from 1977 to 1981.

Limantour through the winter of 1968–69 (JS et al.) and on 20 Dec 1986 (JGE). Although small numbers of *fulva* winter annually at scattered sites on the coastal slope of California (ABN, Garrett and Dunn 1981), two sites in the Point Reyes area are among the few long-standing wintering sites. As many as 27 *fulva* (usually 5–10) winter annually in the plowed fields and pastures on the Hall and Spaletta ranches west of Drake's Estero (ABN). Up to 15 birds (usually 4–6) have wintered since at least the late 1960s at a moist, marshy-edged pasture at Lawson's Landing, Dillon Beach, Tomales Bay (ABN); these birds also sometimes use adjacent tidal flats. Wintering birds have lingered at Lawson's Landing until 6 May (AB 42: 478) and on outer Point Reyes until 5 May (AW). During spring migraton in Apr and May (Jurek 1973, ABN), Golden-Plovers occur much less regularly than in fall. *P. d. fulva* is the only race confirmed in California in spring, although specimens exhibiting intermediate characters have also been collected and *dominica* has been collected at that season on the Pacific coast of Mexico (Chaniot 1966). The only local summer record is of one bird at Abbott's Lagoon on 22 Jun 1966 (PRBO), reflecting the species' extreme rarity at that season anywhere in California (McCaskie et al. 1979, Garrett and Dunn 1981, ABN). Golden-Plovers are found on plowed fields and grazed pastures, estuarine tidal flats, and occasionally on sand beaches during migration.

Snowy Plover (*Charadrius alexandrinus*)

An uncommon summer resident and breeder and a common winter resident (Fig. 25). The California coastal wintering population is about 2.6 times the size of the breeding population (Page et al. 1986). The local population is made up of year-round residents, migrant breeders, and winterers (Warriner et al. 1986). Migrant breeders may arrive in early Jan but most come from early Feb to late Apr. Others arrive later, for second nesting attempts, from early May to early Jul. Breeders depart between late Apr and late Nov, the earliest moving to other sites for second nesting attempts and the later ones to molting and/or wintering areas. Surveys in 1977 and 1989, respectively, found 1 and 0 adults at Bolinas, 8 and 0 at Limantour, 2 and 7 at Drake's Beach, and 29 and 17 on Point Reyes Beach, mostly around Abbott's Lagoon (Stenzel et al. 1981, PRBO unpubl.). Wintering birds arrive between early Jul and early Nov (most in Jul) and depart from mid-Feb to early May. From 1979 to 1984 an average of 38 Snowy Plovers wintered at Dillon Beach, 64 at Point Reyes Beach (mostly around Abbott's Lagoon), 92 on Drake's Bay (Limantour and Drake's esteros combined), and 29 at Bolinas (Page et al. 1986). Color-marking has shown that wintering birds are derived from the Great Basin and the coast north and south of Point Reyes and that individuals shift between areas so that the composition of wintering birds at any location varies temporally.

In historical times human development, recreational use of beaches, and plantings for dune stabilization have lowered the size of the coastal breeding population, especially in southern California (Page and Stenzel 1981), where the wintering population has also declined since at least 1962 (Page et al. 1986). The coastal breeding population is currently being considered for federal listing as threatened or endangered.

Snowy Plovers roost in flocks in open places on wide beaches with birds often huddling in human footprints or behind debris to get out of the wind. Both breeding and wintering plovers prefer spits adjoining wetlands, dune-backed beaches, and pocket beaches over bluff-backed beaches (Stenzel et al. 1981, Page et al. 1986). They forage on sand beaches and on tidal flats when available.

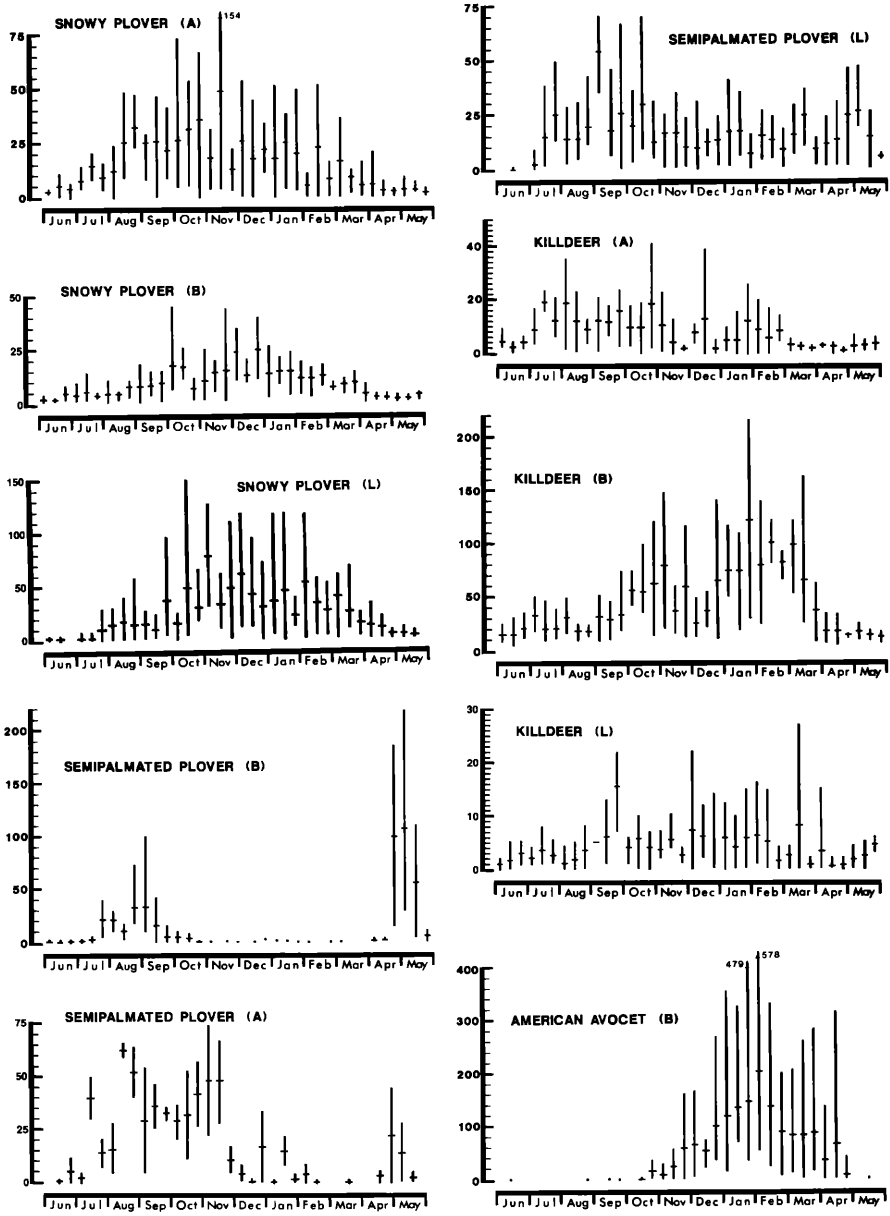

Figure 25. Seasonal abundance of some plovers and the American Avocet in wetlands of Point Reyes. See Figure 4 for details.

Semipalmated Plover (*Charadrius semipalmatus*)

A rare summer visitant, a common fall transient, a fairly common winter resident, and a common spring transient (Fig. 25). During fall migration adults arrive in early Jul and juveniles arrive as early as 2 Aug (Page et al. 1979). Numbers peaked in late Aug and early Sep, and migration was evident until mid-Oct at Bolinas and Limantour (Fig. 25). The late Nov decline in numbers at Abbott's (Fig. 25) may have represented a local shift of birds due to rising water levels after the onset of winter rains rather than a departure of migrants. In winter Semipalmated Plovers were virtually absent at Bolinas and irregular at Abbott's but regular at Limantour (Fig. 25), Drake's (Dec–Feb 1979–80 and 1980–81 mean 2.6), and Tomales Bay (DS). The highest winter census count was 41 birds at Limantour on 3 Jan 1970, and the highest non-census count was 45 at the south end of Tomales Bay on 23 Jan 1981 (DS). From 1970 to 1988, the median number on the Point Reyes CBC, which provides a reasonable estimate of the entire Point Reyes wintering population, was 51 (range 13–124). Spring migration spanned Apr and May (Fig. 25). At Bolinas spring migration was more pronounced than fall migration, in contrast to Limantour and Abbott's, where fall migration was more apparent (Fig. 25). In general, the spring peak is greater at interior California sites and the fall peak is greater at coastal sites (Jurek 1973). On the Farallones, Semipalmated Plovers occur only in fall (DeSante and Ainley 1980). On Point Reyes they inhabit mainly tidal flats but also use sand beaches (especially near estuaries and lagoons), plowed fields and pastures, and, during migration, pond margins. Numbers of wintering Semipalmated Plovers in the San Francisco Bay area increased in the 1940s (Storer 1951).

Killdeer (*Charadrius vociferus*)

A fairly common summer resident and breeder and common winter resident (Fig. 25). Killdeers breed from mid-Mar until at least Jul on wetland margins and widely in the interior of Marin Co. (pers. obs.). Local breeders and their offspring probably made up the population from early Apr to mid-Sep (Fig. 25), when numbers were lowest. A Jun to Jul increase, especially noticeable at Abbott's (Fig. 25), may have represented a movement of locally raised juveniles, and possibly adults, from breeding sites nearby. A larger fall build-up at Bolinas from Sep to early Nov (Fig. 25) coincides with a late Sep to mid-Oct migratory peak on the Farallones (DeSante and Ainley 1980) and falls within the state-wide Aug to Nov migration period (Jurek 1973). The limited evidence of a fall peak at Abbott's and Limantour (Fig. 25) indicates a low carrying capacity for Killdeers there at any season. A Nov to Dec dip in numbers at Bolinas and Abbott's (Fig. 25) may reflect a temporary shift to agricultural lands, enhanced as Killdeer habitat by the onset of winter rains (see Black-bellied Plover). The shift from Abbott's may have been augmented by rising water levels and that from Bolinas by high tides. However, this pattern might also be explained by a passage of long-distance migrants followed later by a second influx of hard-weather migrants. Movement on the Farallones continues until at least Dec (DeSante and Ainley 1980). Winterers leave Point Reyes' wetlands chiefly in Mar (Fig. 25), as noted for other coastal sites (Gerstenberg 1972), but departure may begin by late Feb and continue into Apr (Jurek 1973, Fig. 25). During the study, winter numbers at Bolinas were relatively high during the drought years of 1975–76 and 1976–77 and declined thereafter (Fig. 14).

Killdeers frequent flat or gently rolling open terrestrial habitats such as cultivated fields, heavily grazed pastures (particularly when rain-soaked), and lawns. They also use pond and stream margins, tidal flats, where they seem to prefer muddy over sandy substrates (Page et al. 1979), and sandy beaches in the vicinity

of estuaries or creek mouths. They often nest near a source of fresh water. Killdeers have probably increased historically because of agricultural practices that open up the land.

Black-necked Stilt (*Himantopus mexicanus*)

A very rare visitant with only three census records of single birds at Bolinas Lagoon on 21 Jan 1976 and 4 Apr 1977 and at Drake's Estero on 5 May 1981. Including census records, on Point Reyes there are six fall records from 29 Jun to 20 Sep, nine winter records from 20 Nov to 4 Feb, and six spring records from 4 Apr to 23 May, 1969 to 1988. All birds except possibly one were transients. Although Jurek (1973) reported that the stilt's migratory periods in California are from Aug to Oct and from mid-Mar to May, the above records indicate that fall movement (perhaps including post-breeding dispersal) begins earlier and that some birds wander in winter. Early in the 1900s only small numbers of Black-necked Stilts could be found around San Francisco Bay, from spring through fall and irregularly in winter (Grinnell and Wythe 1927, Grinnell and Miller 1944). In the 1950s and 1960s both nesting and wintering populations increased substantially in south San Francisco Bay (Gill 1977, Cogswell 1977, Rigney and Rigney 1981). Nesting probably did not begin in north San Francisco Bay until after the mid-1960s (R. Gill pers. comm.), and the number of breeders there still appears to be increasing (ABN). In the Monterey Bay area stilt numbers have increased in winter since at least 1959 (Roberson 1985). Continued expansion of the coastal population is evident from a spring 1984 influx of about 40 birds north to Humboldt and Del Norte counties and the extension of the breeding range to near Humboldt Bay in 1985 (AB 39: 958). The scarcity of stilts on Point Reyes probably reflects a lack of suitable habitat. Stilts have lingered briefly here at sewer ponds, freshwater ponds, and estuarine margins. Elsewhere on the central California coast stilts forage in the shallow waters of salt evaporation ponds, sloughs, freshwater and brackish ponds, sewer ponds, and flooded fields.

American Avocet (*Recurvirostra americana*)

A very rare summer visitant, rare fall transient, and common winter resident (Fig. 25). In California, fall migration extends from Jul through Nov and spring migration extends from Mar through May, with the peak from late Mar through Apr (Jurek 1973). In the Point Reyes area avocets wintered regularly only at Bolinas, Schooner Bay (Drake's Estero), and Bodega Harbor. On monthly winter censuses in 1979–80 and 1980–81, up to 29 avocets were found at Schooner Bay and up to 12 were found at Bodega Harbor. From 1970 to 1988 avocet numbers on the Point Reyes CBC (mostly at Schooner Bay) ranged from 0 to 20 (median 3.5) except for high counts in three years ranging from 52 to 66. Other high counts at Schooner Bay of 95 birds on 4 Oct 1966 and 102 on 14 Oct 1968 (PRBO) may have been mostly of fall transients. Counts of up to 81 birds at Abbott's between 7 Jul and 4 Oct 1966 were atypical; in subsequent years we saw a total of four avocets there on three censuses between 14 Aug and 23 Dec. At Limantour we recorded a total of 12 on 16 censuses between 28 Jul and 26 Feb.

Formerly, avocets were considered irregularly common fall and winter visitors to San Francisco Bay (Grinnell and Wythe 1927), where nesting was first recorded in 1926 (Gill 1977). Although avocets had begun to use San Francisco Bay area salt ponds by at least 1899 (Grinnell et al. 1918), not until the early 1940s did the population begin to expand there to include large numbers of wintering and breeding birds (R. W. Storer 1951, Gill 1972b, 1977). Avocets have also increased in winter in Humboldt Bay since 1958, especially from 1961 to 1968 (Gerstenberg 1972). A rough comparison of breeding (Gill 1977) and wintering

(R. W. Storer 1951) numbers in San Francisco Bay indicates that the winter population is substantially greater, as it is around Monterey Bay (Roberson 1985). At Bolinas avocets have wintered regularly at least since 1971, and numbers there increased over the study period (Fig. 14). Numbers were highest during drought years presumably because of a shift of avocets from dried-up freshwater habitats to marine habitats.

In all years we suspect the winter influx reflected a local shift of avocets from San Francisco Bay to Bolinas Lagoon feeding areas. These birds probably move daily to nighttime roosts in San Francisco Bay since early in the morning they can be seen arriving at Bolinas from the south (Blick 1980). In the study area avocets use estuaries and lagoons, and at Bolinas they concentrate on muddy rather than sandy substrates (Page et al. 1979).

Greater Yellowlegs (*Tringa melanoleuca*)

A very rare summer visitant and uncommon winter resident (Fig. 26). Fall migration extends from early Jul to Nov; spring migration extends from Mar to May (Jurek 1973, Fig. 26). The earliest juvenile recorded at Point Reyes was seen on 8 Aug (SNGH). The greater regularity of winter sightings at Abbott's and Limantour after Jan (Fig. 26) suggests local movements, perhaps influenced by changing water levels in freshwater habitats during winter rains. Spring passage was only weakly evident on Point Reyes wetlands. Coastal birds forage in shallow ponds, at marsh edges, and along stream margins, as well as in saltmarsh pools and water over tidal flats and channels, especially near freshwater inflows.

Lesser Yellowlegs (*Tringa flavipes*)

Lesser Yellowlegs are very rare at all times, occurring primarily as fall migrants. One or two wintered at Bolinas from 1973–74 to 1979–80. Other census records were of one at Bolinas from 16 Jul to 24 Sep 1973 and one there on 12 Apr 1974, one at Abbott's from 7 to 25 Aug 1975, one at Limantour on 13 Sep 1972, one there on 29 Mar 1968, and one to four there between 11 and 27 Sep 1973. Cumulative Marin Co. records (Fig. 12) indicate an early Jul to early Oct fall migration, as in the rest of the state (Jurek 1973). A sharp peak from mid-Aug to late Sep (Fig. 12) corresponds with the passage of juveniles (Garrett and Dunn 1981), which begins as early as 29 Jul on Point Reyes (ABN: RS), or 21 Jul elsewhere on the northern California coast (AB 42: 1337). Single Lesser Yellowlegs have been recorded on only three of 19 Point Reyes CBCs from 1970 to 1988. A small spring passage in California extends primarily from late Mar to early May with an occasional bird lingering through Jun (Jurek 1973, McCaskie et al. 1979, Garrett and Dunn 1981). Lesser Yellowlegs were not recorded wintering in the San Francisco Bay area by Grinnell and Miller (1944), but they may have been overlooked among the similar but more numerous Greaters. Lesser Yellowlegs inhabit the same range of habitats as Greaters though presumably Lessers exploit somewhat shallower water.

Willet (*Catoptrophorus semipalmatus*)

A common summer resident and a very common fall transient and winter resident (Fig. 26). A fall peak at Abbott's and Bolinas, from late Jun to late Oct (Fig. 26), was not apparent at Limantour, where numbers increased gradually from Jun until Sep, when they reached winter levels. Fall migration in California extends from late Jun to early Nov (Jurek 1973), and juveniles arrive on the coast as early as 13 Jul (SNGH). Kelly and Cogswell (1979) reported an Oct peak in San Francisco Bay and suggested that peaks of fall migrants occur progressively

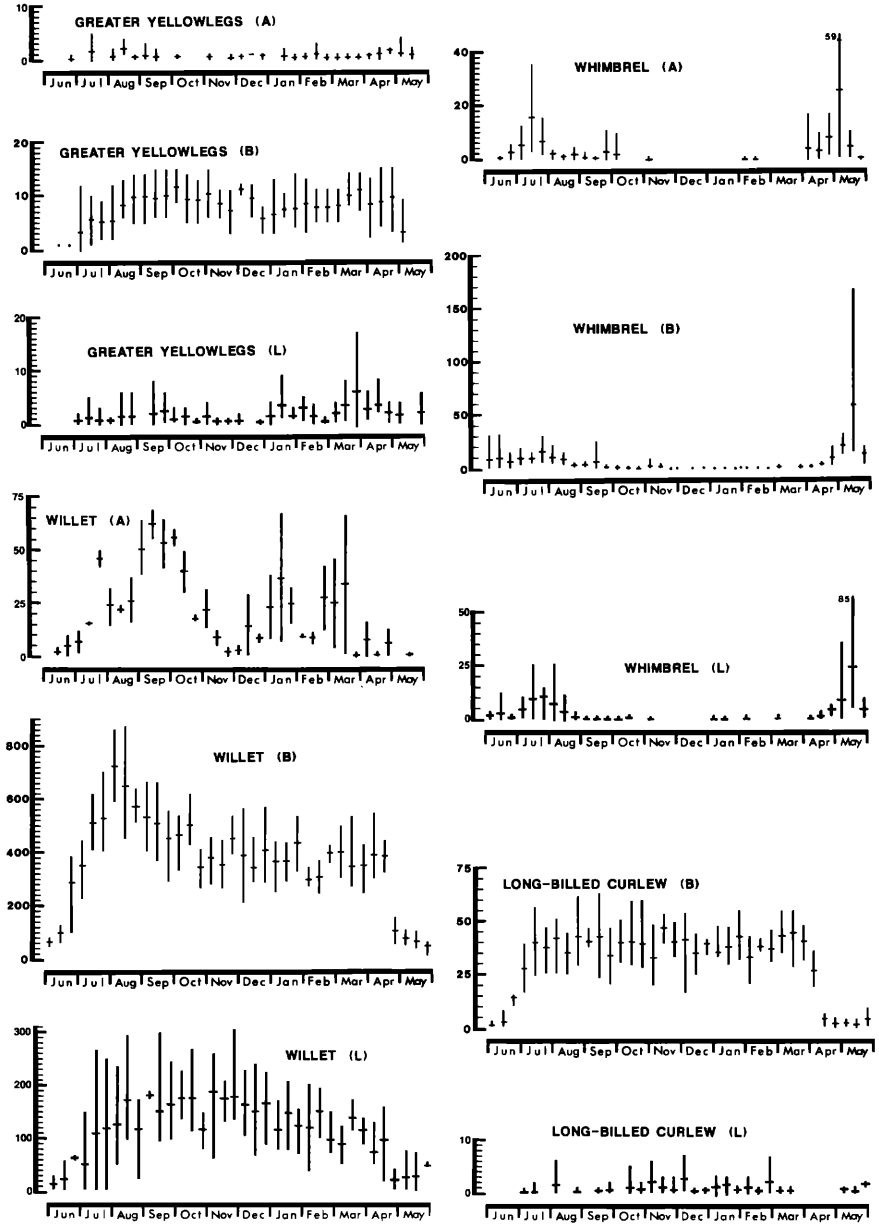

Figure 26. Seasonal abundance of the Greater Yellowlegs, Willet, and curlews in wetlands of Point Reyes. See Figure 4 for details.

later from north to south along the California coast. This hypothesis is not corroborated by our study since peaks at Bolinas and Abbott's were in Aug and Sep (Fig. 26), respectively, although both sites are at roughly the same latitude as San Francisco Bay. Any latitudinal trends could be masked, however, by the birds staging at different times at sites at the same latitude. Winter numbers at Abbott's fluctuated (Fig. 26), perhaps reflecting high seasonal and yearly variation in water levels in the lagoon. Winter numbers at Bolinas decreased during the study (Fig. 14). At Limantour and Bolinas there was a sudden spring exodus in mid- to late Apr. The lack of a spring migratory peak in any of the wetlands coupled with the scarcity of spring migrants on the Farallones (DeSante and Ainley 1980) suggests there is little spring movement of Willets along the coast at this latitude; spring migrants may move directly from the coast to interior breeding sites. For the state as a whole, spring migration extends from Mar to late Apr (Jurek 1973). Willets feed on sandy and muddy substrates of tidal flats (Page et al. 1979), sandy and rocky beaches, and lagoon margins; unlike most shorebirds, they regularly feed in salt marshes (Stenzel et al. 1976).

Wandering Tattler (*Heteroscelus incanus*)

Because tattlers prefer rocky shores along the outer coast, they were very rare fall and spring transients on the estuaries and lagoon. Fall census records included one bird at Bolinas on 1 Aug 1973, up to 11 at Limantour on four dates from 28 Jul to 26 Oct (7 on 31 Aug 1972), and at least 13 at Abbott's on seven dates from 28 Jul to 4 Sep (11 on 25 Aug 1975). Of the few juveniles identified, our earliest was 14 Aug (DS), which compares with the earliest date of 9 Aug in Oregon (Paulson 1983). Our only spring census record was of two birds at Abbott's on 1 May 1980. Fall migration on the northern California coast extends primarily from mid-Jul through Oct with an Aug to Sep peak (Jurek 1973, ABN). Spring migration extends primarily from early Apr through May. The only Point Reyes records for Jun and early Jul are of two birds at Abalone Flat near Palomarin on 4 Jun 1981 (JGE) and one at Chimney Rock on 10 Jul 1982 (JGE). Migrants and the small Point Reyes wintering population use primarily low rocky reefs and sea stacks at scattered sites along the outer coast. Wandering Tattlers were formerly considered to winter north only to Monterey Bay (Grinnell and Miller 1944). We suspect the discovery that they now winter regularly north to Marin and Sonoma counties and irregularly north to Humboldt and Del Norte counties (ABN) is a result of more thorough coverage rather than a true change in status.

Spotted Sandpiper (*Actitis macularia*)

A rare fall transient, winter resident, and spring transient (Fig. 12). Up to three Spotted Sandpipers regularly used Bolinas, where extreme dates of occurrence were 28 Jul (early fall) and 9 Jun (late spring). Small numbers also winter on Tomales Bay and on rocky beaches of Point Reyes' outer coast. The median number on the Point Reyes CBC from 1970 to 1988 was 14 (range 4–31). Fall migratory movement was apparent from counts of at least six birds on nine censuses from 28 Jul to 16 Sep at Abbott's and Limantour. Spring movement was apparent from high counts of eight birds in early and mid-May at Bolinas and three birds on three dates from 11 May to 5 Jun at Abbott's and Limantour. In California, fall migration probably extends from early Jul through Oct and spring migration extends from mid-Apr to early Jun (Fig. 12, Jurek 1973, Garrett and Dunn 1981). Although Spotted Sandpipers are not known to nest in the study area, they have bred twice in Marin Co.—both times along the shoreline of San Francisco and San Pablo bays (PRBO unpubl.). They frequent rocky or gravelly

shorelines at estuaries, lagoons, and stream mouths, rocky reefs and beaches along the outer coast, and the margins of freshwater ponds and sewage ponds. Although Spotted Sandpipers may use channel margins in estuaries, they avoid expansive tidal flats.

Whimbrel (*Numenius phaeopus*)

A fairly common summer visitant, fairly common fall transient, rare winter resident, and fairly common spring transient (Fig. 26). Non-breeders in summer overlapped with fall migrants, which arrived by at least early Jul. The abbreviated Jul to mid-Aug peak of migrants (Fig. 26) suggests that few juveniles pass through the area; passage of juveniles begins at least by 22 Aug (SNGH). Fall movement continued through Nov, and small numbers wintered irregularly at Bolinas and regularly on the rocky outer coast of Point Reyes. The median number on the Point Reyes CBC from 1970 to 1988 was 3.4 (range 1–9). Spring migration extended from late Mar through May (Fig. 26). Our early to mid-May spring peak is somewhat later than the mid- to late Apr peak reported for southern California (AFN 24: 644, Jurek 1972). At Point Reyes migrant Whimbrels feed on tidal flats, salt marshes, sandy or rocky beaches, and in pastures or ungrazed fields with low-growing vegetation. In winter they inhabit primarily marine habitats.

Long-billed Curlew (*Numenius americanus*)

An uncommon summer resident and a fairly common winter resident (Fig. 26). Throughout California fall migration extends from mid-Jun to Oct and spring migration extends from late Mar to early May (Jurek 1973). There were no peaks of migrants at Limantour or Bolinas, but census records at Abbott's of 10 birds on four dates from 16 Jun to 4 Sep indicate a small passage of fall migrants through the area. Identification problems have hindered the study of the timing of juveniles' passage, but juveniles arrive by at least 10 Aug (SNGH). The absence of a spring peak at Point Reyes (Fig. 26) supports Jurek's (1973) suggestion that coastal wintering Long-billed Curlews fly east in spring toward interior breeding areas rather than north along the coast. We cannot explain why Bolinas has the only regular winter curlew population in the Point Reyes area because the curlews' main prey items (Stenzel et al. 1976) are also available on the other large estuaries. On Point Reyes curlews feed on tidal flats (except for the sandiest substrates), occasionally in salt marshes (Stenzel et al. 1976, Page et al. 1979), and rarely in plowed fields or pastures. Historically, curlews have declined in California (Grinnell et al. 1918) and throughout much of their breeding range because of hunting and habitat loss (Palmer 1967, Johnsgard 1981). Although there has been some recovery from the effects of hunting, numbers remain below historic levels (Grinnell and Miller 1944, Palmer 1967). In recent years curlews have apparently declined in numbers to the north in Humboldt Bay (Gerstenberg 1972, Yocum and Harris 1975), but our census data show a stable population on Point Reyes.

Bar-tailed Godwit (*Limosa lapponica*)

Our only record of this vagrant to California is of a single bird at Bolinas from 26 Oct to 2 Dec 1973 (AB 28: 101, Winter and McCaskie 1975, Page et al. 1979). A non-census record for Schooner Bay, Drake's Estero, on 28 Sep 1975 (AB 30: 120) was rejected by the CBRC, and a 20 Sep 1988 record (AB 43: 163) is currently under review by the CBRC. The accepted Bolinas record is among only six for California, 1968 to 1984: four fall records of adults and juveniles, 11 Jul to 2 Dec, one winter record, 11 Feb to 2 Mar 1976, and one spring record,

3–5 Jun 1984 (CBRC). *Limosa l. baueri*, breeding in northern and western Alaska and in northeastern Asia (AOU 1957, Johnsgard 1981), normally migrates south along the west side of the Pacific in fall (Palmer 1967).

Marbled Godwit (*Limosa fedoa*)

A common summer resident and very common winter resident (Fig. 27). Peaks of migrants were not evident at Limantour or Bolinas, but at Abbott's there was a fall peak from late Jun to early Nov (Fig. 27), corresponding to the 8 Jul to 18 Oct span for fall transients at the Farallones (DeSante and Ainley 1980). Juveniles, difficult to age in the field, appear in fall by at least 28 Jul (SNGH). The fall birds at Abbott's could have been southbound migrants or potential winterers forced out by rising winter water levels. Although little migration was evident at our census sites, birds may have been staging in spring at more favored sites such as Tomales and San Francisco bays, where spring influxes have been noted (Jurek 1973, 1974). Jurek (1973, 1974) reported a noticeable northward movement in spring along the southern and central California coast as far north as the Point Reyes/Bodega area and that overland migration is directed to the northeast. Overall, godwit migration in California extends from Jul to about Oct in fall and from Mar to early May in spring (Jurek 1973).

Declining godwit numbers from Jan to Feb at Limantour (Fig. 27), from Nov 1978 (2781) to Feb 1979 (899) and from Jan 1980 (1902) to Feb 1980 (820) at Bodega, and from Nov 1979 (1225) to Feb 1980 (761) at Drake's Estero confirmed winter godwit movements in this area. At Humboldt Bay, Gerstenberg (1972) also found a post-Dec decline in godwit numbers. Kelly and Cogswell (1979) reported progressively later fall and winter peaks toward the south along the California coast, suggesting regional winter godwit movements. Winter numbers at Bolinas and Limantour increased over the course of our study (Fig. 14). Godwits forage on tidal flats (at Bolinas they prefer areas of intermediate substrate texture, Page et al. 1979) and sandy beaches of the outer coast, infrequently in salt marshes, and periodically in rain-soaked pastures. Many godwits feed at Bolinas Lagoon during the day and probably roost in San Francisco Bay at night. We have observed flocks heading south over the ocean in the evening, and Blick (1980) reported godwits arriving at Bolinas from the south at sunrise.

Ruddy Turnstone (*Arenaria interpres*)

A rare summer visitant, uncommon fall transient, rare winter resident, and uncommon spring transient (Fig. 27). Non-breeders occurred in Jun, and fall migrants occurred from early Jul until mid-Oct (Fig. 27). At both Bolinas (Fig. 27) and Humboldt Bay (Gerstenberg 1972) there are two peaks of fall migration, in late Jul and from late Aug to Sep. The first presumably reflects the passage of adults, the second, that of juveniles, which arrive as early as 15 Aug (Page et al. 1979). Bodega Harbor, Tomales Bay, and Drake's Estero were the only sites in the Point Reyes area with regular wintering populations. Bodega's wintering population averaged 29 birds in 1978–79 and 45 in 1979–80; Drake's averaged 2 from 1979 to 1981. From 1970 to 1988 the median number of Ruddy Turnstones on the Point Reyes CBC was 17 (range 1–34); most birds were on Tomales Bay or Drake's Estero. Spring migration extends from mid-Apr through May. A flock of 97 Ruddy Turnstones at Limantour on 8 May 1980 was the largest we recorded at any season. On Point Reyes Ruddy Turnstones frequent gravel or rocky beaches, gravelly areas in estuaries, mussel beds, algae-covered tidal flats, oyster-farm middens, and occasionally sand beaches littered with kelp. They sometimes forage in pastures at Bodega at high tide (DS).

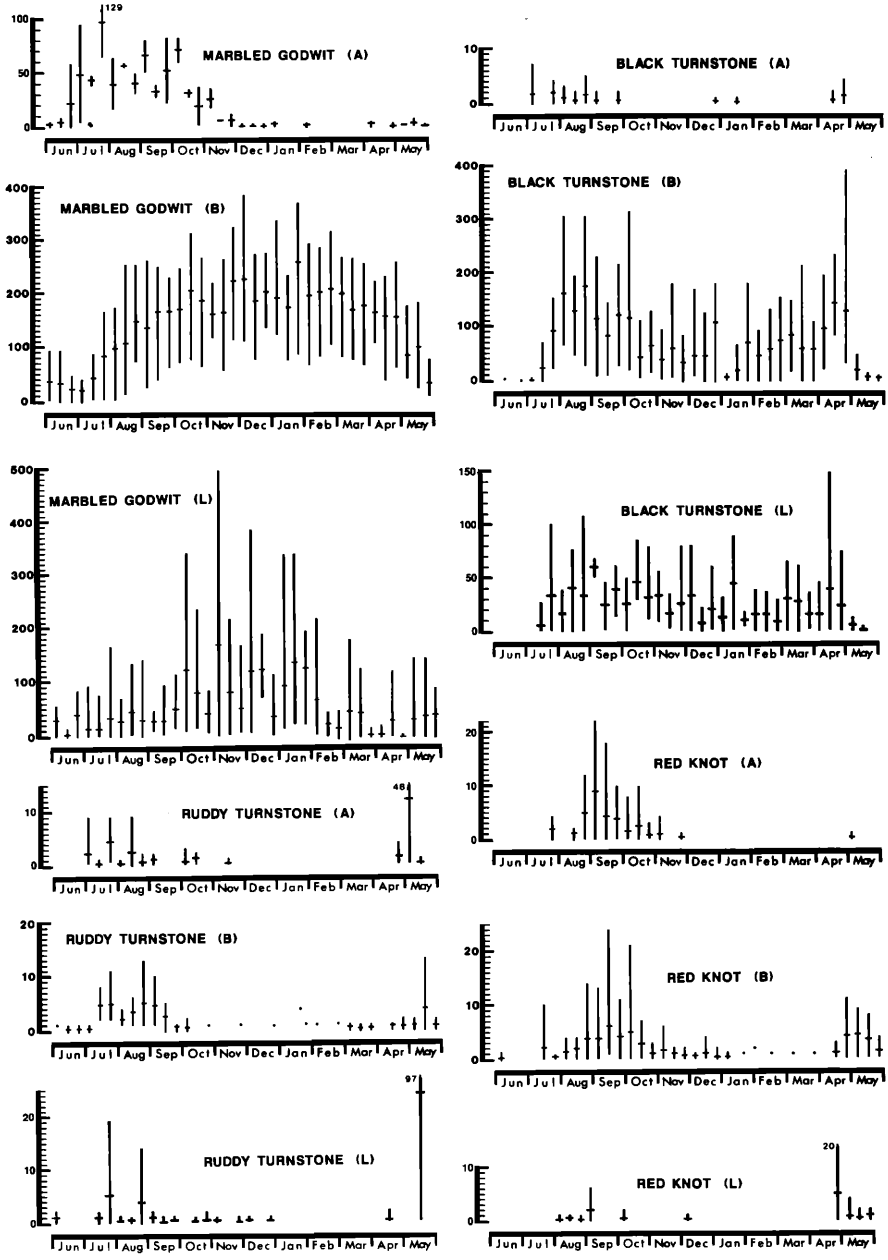

Figure 27. Seasonal abundance of the Marbled Godwit, turnstones, and Red Knot in wetlands of Point Reyes. See Figure 4 for details.

Black Turnstone (*Arenaria melanocephala*)

A very rare summer visitant and a common fall transient, winter resident, and spring transient (Fig. 27). Non-breeders occurred sporadically through Jun, and fall migrants occurred from early Jul through early Oct (Fig. 27); juveniles arrived as early as 20 Aug (Page et al. 1979). Abbott's was the only study-area wetland not used by wintering birds (Fig. 27). Spring migration occurred mostly in Apr (Fig. 27). Black Turnstones use rocky reefs and sea stacks along the outer coast, estuarine tidal flats (especially around algal mats), and occasionally sand beaches littered with kelp.

Surfbird (*Aphriza virgata*)

This rocky-coast species is a very rare fall and spring transient on the estuaries. Our only census records were of one bird at Bolinas on 9 Oct 1971 and eight at Limantour on 21 Apr 1974. In the Point Reyes vicinity extreme dates for Surfbirds are 12 Jul and 14 May; data on local fall arrival of juveniles are lacking but in Oregon juveniles arrive as early as 26 Jul (Paulson 1983). Roughly 30 to 50 Surfbirds winter in the Point Reyes–Bodega area (ABN, DS pers. obs.). Migration in California extends from mid-Jul through Oct in fall and from late Mar through early May in spring; Surfbirds are sighted only irregularly from mid-May to early Jul (Jurek 1973, McCaskie et al. 1979, Garrett and Dunn 1981). In spring, flocks of 20 to 60 birds have been seen regularly on Point Reyes, but a flock of 155 birds at Drake's Beach on 29 and 30 Apr 1975 (EP, DS) was exceptional. Fall and winter flocks consist usually of under 20 birds. Surfbirds primarily frequent rocky reefs, sea stacks, jetties, and occasionally tidal flats and sandy beaches during migration.

Red Knot (*Calidris canutus*)

An uncommon fall transient, very rare winter resident, and rare spring transient (Fig. 27). The only local (non-census) mid-summer record was of two birds at Schooner Bay, Drake's Estero on 16 Jun 1981 (DS). In fall adult females migrate before males, which migrate before juveniles (Harrington 1982). On Point Reyes fall migration began in mid-Jul, juveniles arrived as early as 14 Aug (DS), peak numbers extended from late Aug to early Oct, and small numbers lingered to late Nov or Dec (Fig. 27); a high fall count was 200 at Bolinas on 29 Oct 1973 (ABN: PJM). At Bodega, at least four knots wintered in 1978–79 and two wintered in 1979–80; at Drake's Estero, two wintered in 1979–80. Small numbers of knots also winter irregularly on Tomales Bay, as indicated by the Point Reyes CBC. Knots were recorded on 9 of 19 counts between 1970 and 1988; the median number for the 9 years was 8 (range 1–28). Thirty at the south end of Tomales Bay on 21 Jan 1979 (ABN: LCB) is the high mid-winter count for the Point Reyes area. Spring migration extended from mid-Apr to early Jun (Fig. 27); the highest spring count (non-census) was of 57 birds at Bolinas on 18 Apr 1976 (GWP, LES). During migration knots typically stage in large numbers at restricted locations (Morrison et al. 1980, Morrison 1984), but the Pacific Coast population is small and knots largely by-pass the Point Reyes area. On Point Reyes, Red Knots usually frequent tidal flats but they sometimes feed in pastures when tidal flats are inundated.

Sanderling (*Calidris alba*)

A rare summer visitant and very common fall transient, winter resident, and spring transient (Fig. 28). Small numbers of non-breeders occurred irregularly in

Jun (Fig. 28). A pronounced fall peak extended from mid-Jul to mid-Nov at all wetlands with juveniles arriving as early as 21 Aug (Page et al. 1979). Winter numbers were relatively stable at Bolinas and Limantour (Fig. 28). At Abbott's, mid-winter and spring peaks (Fig. 28) reflected local rather than migratory movements. These peaks were caused mostly by storm-created breaches in the barrier bar which temporarily expose sizable sand flats where large foraging flocks concentrate. In six instances on censuses from 1973 to 1982, we recorded Sanderling numbers at Abbott's suddenly jumping from 200 to 500 birds above the previous census total when water levels dropped after storms opened the lagoon mouth. As many as 1300 Sanderlings, a number of them banded at Bodega Harbor, converged on Abbott's in Mar 1980 within four days of the lagoon breaking open to the sea (Myers 1980). There was a small peak of spring migrants at Bolinas from mid-Apr to late May (Fig. 28) but none at Limantour. Sanderlings on the Pacific Coast largely by-pass the Point Reyes area in spring and stage in large numbers in Oregon and southern Washington (Myers et al. 1984).

Numbers of Sanderlings at Bodega reach a peak in Dec, decline slowly through the winter, then drop rapidly in spring (Myers et al. 1985). The fall increase there involves the direct arrival of long-distance migrants, the return of birds that have staged for a month or more on Point Reyes, or the return of birds that were wandering widely on the central California coast after their initial arrival at Bodega. A Mar decline in numbers at Bodega results from local movement of a large portion of the population to Point Reyes rather than from migration, which extends from Apr or early May through the end of May. At Bodega intense storms may sometimes cause numbers to plummet in mid-winter apparently because eroding beaches offer Sanderlings little food (Myers 1980).

Census studies by J. P. Myers and associates from 1976 to 1983 provide information on numbers of Sanderlings wintering in the Bodega to Bolinas area. The population varies between 500 and 700 birds in the Bodega Bay area, 225 and 450 at Dillon Beach, 400 and 675 at Point Reyes Beach (including Abbott's Lagoon), and 400 and 650 in Drake's Bay (including Limantour and Drake's Estero); it is under 200 along Bolinas Bay (including Bolinas Lagoon). Sanderlings primarily inhabit sand beaches, sandy tidal flats and, to a limited degree, rocky beaches. Densities are highest on sand beaches linked with estuaries, and away from estuaries they are higher on extensive beaches than on short beaches (Myers et al. 1984). Around estuaries, birds typically concentrate on sandy beaches at high tide, but on tidal flats at moderate and low tides (Connors et al. 1981).

Semipalmated Sandpiper (*Calidris pusilla*)

A very rare fall and spring transient. The three fall census records were all from Abbott's: one adult on 4 Aug 1980 (DS), two juveniles from 16 to 18 Aug 1980 (DS), and one juvenile on 14 Aug 1981 (DS). The only spring records were of single birds at Bolinas on 25 Apr 1979 (AB 33: 803) and at Abbott's on 16 and 17 Jun 1976 (AB 30: 884, Luther et al. 1979). Additional non-census records extend the date span of Point Reyes fall records from 19 Jul to 24 Sep (ABN). First recorded in coastal northern California in 1968 (AFN 22: 644), Semipalmated Sandpipers have been sighted regularly in small numbers since 1977 because of observers' increased awareness (ABN). Fall records for the northern California coast, mostly of juveniles, extend from 4 Jul to 2 Oct, with most sightings from mid-Aug to mid-Sep (ABN). Overall, in fall adults (females before males) precede juveniles (Morrison 1984). On the northern California coast juveniles have arrived as early as 18 Jul (AB 37: 1023), but they typically first arrive from 22 to 25 Jul (ABN). There are six spring records for the northern California coast from 19 Apr to 24 May (ABN), the mid-Jun Bolinas record

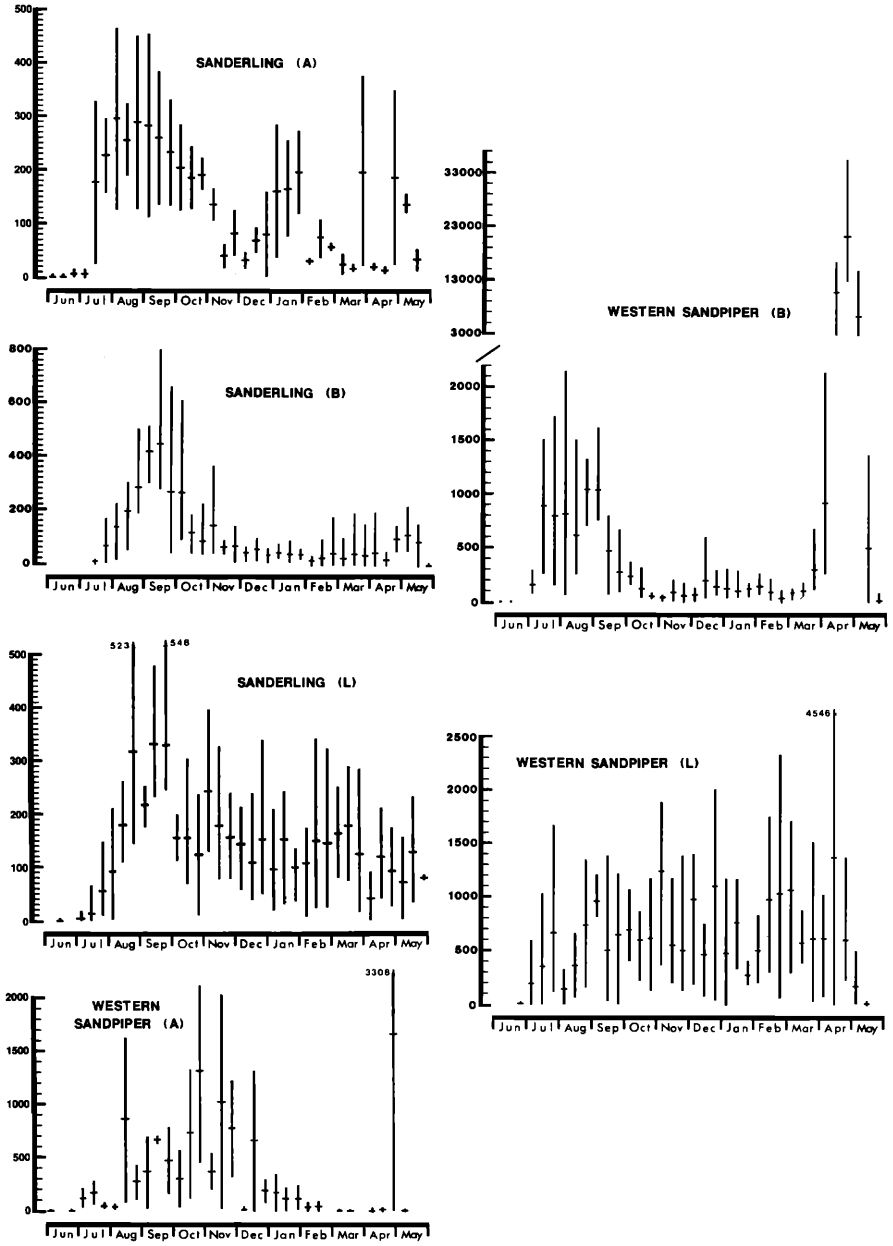

Figure 28. Seasonal abundance of the Sanderling and Western Sandpiper in wetlands of Point Reyes. See Figure 4 for details.

(above), and another of a bird at the Pajaro River mouth, Monterey Co., which remained through the summer of 1979 (AB 33: 803 and 894). Coastal Semipalmated Sandpipers are found on lagoon margins, in estuaries, and at sewage ponds.

Western Sandpiper (*Calidris mauri*)

An uncommon summer visitant and an abundant fall transient, winter resident, and spring transient (Fig. 28). Non-breeders occurred irregularly in Jun at all sites; otherwise seasonal patterns differed markedly from area to area. Bolinas had a well-defined peak of fall migrants from early Jul to mid-Oct and a very pronounced peak of spring migrants from late Mar to mid-May (Fig. 28). In fall, juveniles have been sighted at Point Reyes by 28 Jul (DS). Elsewhere on the northern California coast juveniles have arrived as early as 19 Jul (ABN: KFC), but they normally first arrive from 23 to 26 Jul (ABN). A very high count on one mid-Apr census was the only evidence of the passage of migrants at Limantour (Fig. 28). At Abbott's a small Jul peak (Fig. 28) coincided with the passage of adults, and was followed by a higher peak in mid-Aug that coincided with the passage of juveniles. A decline in use of Abbott's from Dec to Feb (Fig. 28) coincided with the flooding of sand flats as runoff filled the lagoon. Spring migrants used Abbott's irregularly in Apr. Males precede females in spring migration (Page et al. 1972).

Female Western Sandpipers winter farther south than males, and in California the latter greatly outnumber the former (Page et al. 1972). Most wintering Westerns at Bolinas are immature males, while most at Limantour are adult males (Page et al. 1972, unpubl. data). In the study area Western Sandpipers primarily forage on estuarine tidal flats and lagoon margins and secondarily on low rocky reefs, on beaches (especially at the margins of ephemeral pools left by high tides), and in rain-soaked pastures. At Bolinas, Westerns forage in sandier areas than do Least Sandpipers (Page et al. 1979).

Least Sandpiper (*Calidris minutilla*)

An abundant fall transient and very common winter resident (Fig. 29). We did not record Least Sandpipers on any censuses in the first two-thirds of Jun, although the species occurs irregularly then in northern California (McCaskie et al. 1979, ABN). On the basis of distinct peaks at three census sites, fall migration extended from late Jun/early Jul to mid-Nov (Fig. 29). At Point Reyes, juveniles arrive as early as 27 Jul (SNGH) and elsewhere in northern California as early as 23 Jul (ABN: RAE). This migration period is broader than the late Jun to early Oct span Jurek (1973) reported for the state as a whole. Spring migration, which begins in Mar (Jurek 1973) and continues through mid-May, was not clearly reflected by spring peaks in the study area (Fig. 29). At Bolinas, the lowest winter averages (Fig. 14) were from the wettest years, 1972–73, 1973–74, and 1981–82 (Fig. 2), suggesting that during wet years birds either fled adverse conditions on the estuary or moved to enhanced freshwater habitats, or that during dry years birds concentrated on the estuary as freshwater habitats inland dried up. Least Sandpipers forage primarily on tidal flats, where they prefer muddier substrates than do Westerns (Page et al. 1979). They also feed in salt marshes, on the margins of freshwater ponds, in wet pastures, and to a limited degree on sand beaches and flat rocky areas such as Duxbury Reef.

Baird's Sandpiper (*Calidris bairdii*)

An uncommon fall transient and very rare spring transient (Fig. 29). Fall migrants, mostly juveniles, were detected on censuses from 28 Jul to 5 Oct.

There was also a single adult on a 15 Jul 1972 Bolinas census. Peak numbers were from mid-Aug to mid-Sep (Fig. 29). Other notable local fall records were of single adults on outer Point Reyes on 20 Jul 1986 and at Abbott's on 21 Jul 1986 (AB 40: 1250) and 20 Jul 1988 (AB 42: 1337) and a late bird on outer Point Reyes on 15 Oct 1972 (ABN: DDeS). The highest counts were at Abbott's: 19 on a 14 Aug 1975 census (LES,DS) and 20 on 5 Sep 1987 (non-census; ABN:

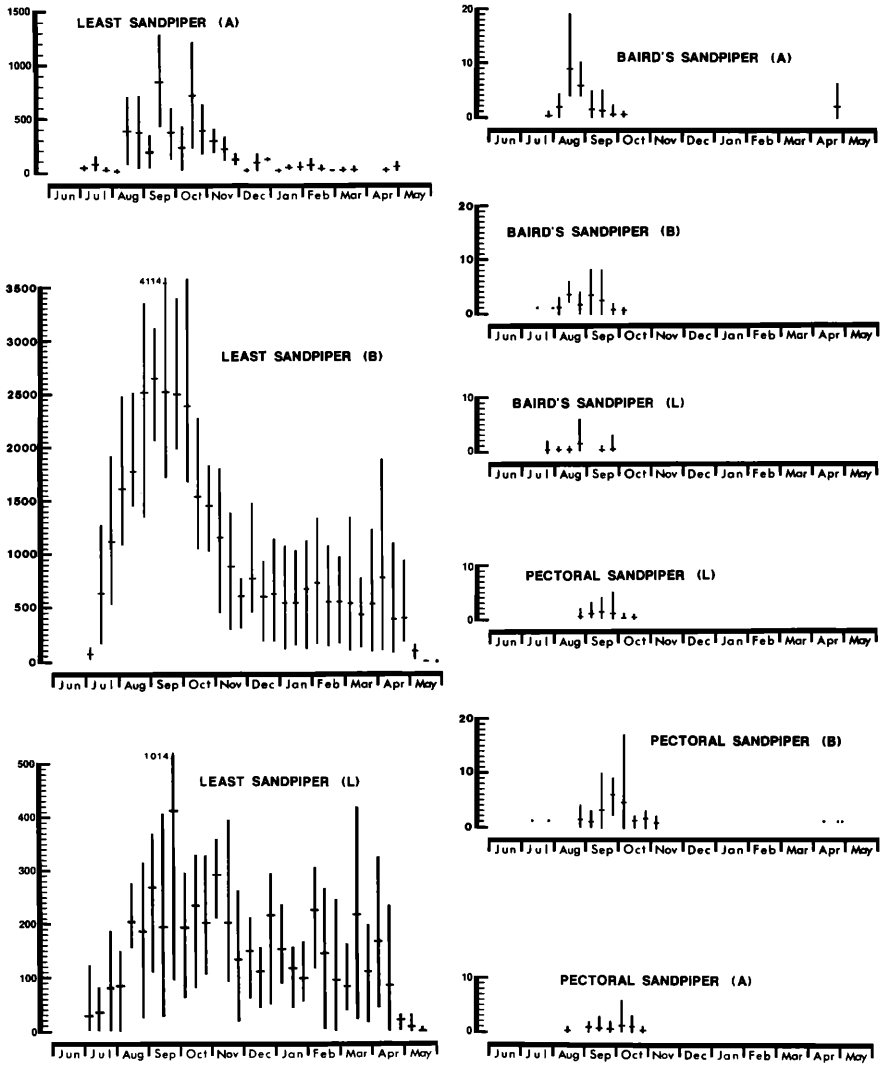

Figure 29. Seasonal abundance of the Least, Baird's, and Pectoral sandpipers in wetlands of Point Reyes. See Figure 4 for details.

MFe). In fall, adults migrate mostly from mid-Jul to early Aug (females precede males) and are followed by juveniles (Jehl 1979). Fall records for coastal northern California span the period 28 Jun–27 Nov (earliest record of a juvenile, 18 Jul), but Baird's Sandpipers occur irregularly before late Jul and after early Oct (ABN); there are only two Nov records (AB 32: 252).

Our only spring census records were of one bird at Bolinas on 8 Apr 1981 (AB 35: 859) and six birds at Abbott's on 21 Apr 1982 (AB 36: 890). The only other substantiated Point Reyes spring records are of one to three birds at Abbott's from 14 to 27 Apr 1977 (AB 31: 1043) and one at the Bolinas sewer ponds on 10 May 1985 (RS). Baird's Sandpipers are now reported almost annually in spring on the northern California coast from 27 Mar to 12 May (ABN); also, there are three records of single birds from 2 to 18 Jun (AB 37: 1023, 41: 1483, 42: 1337). Coastal Baird's Sandpipers use tidal flats, lagoon and pond margins, and sewage ponds primarily and sandy beaches of the outer coast occasionally.

Pectoral Sandpiper (*Calidris melanotos*)

An uncommon fall transient and very rare spring transient (Fig. 29). Fall migrants, mainly juveniles, were recorded on censuses from 17 Aug to 6 Nov with a peak from mid-Sep to early Oct (Fig. 29); non-census records extended the occurrence period to 16 Nov (ABN). The high census count was 17 birds at Bolinas on 5 Oct 1973, and the high non-census count was 32 at the Bolinas sewer ponds on 25 Sep 1982 (GWP, LES). On censuses the only verified fall records of adults were of single birds at Bolinas on 13 Jul 1971 and 25 Jul 1972 and at Abbott's on 17 Aug 1980. Non-census records of adults were of two birds at the Bolinas sewer ponds on 20 Jul 1983 (JGE) and at Abbott's on 24 Jul 1988 (ABN: LJP). Fall records for coastal northern California extend from 8 Jul to 4 Dec, but birds occur irregularly before mid-Aug (primarily adults) and after early Nov (ABN). The earliest record of a juvenile is for 13 Aug (ABN: RAE). Our only spring census records were of single birds at Bolinas from 23 to 28 Apr 1973 (AB 27: 815) and on 21 Apr 1976 (BSo). The only other Point Reyes spring records are of one bird at Bolinas Lagoon on 9 Apr 1976 (GWP), another there from 17 to 24 May 1980 (AB 34: 812), one to two birds from 17 to 21 Apr 1976 (DS et al.) at the Bolinas sewer ponds, and one at Lawson's Landing, Dillon Beach, from 15 to 17 Apr 1986 (ABN: RHa). Pectoral Sandpipers occur irregularly in spring on the northern California coast from 4 Apr to 3 Jun (ABN). They are found in salt marshes, on tidal flats, at sewage ponds, and around freshwater pond and lagoon margins, especially where muddy or grassy.

Dunlin (*Calidris alpina*)

A very rare summer visitant and an abundant fall transient and winter resident (Fig. 30). A few birds occurred irregularly from early Jun to early Sep (Fig. 30). Dunlins reach California at least two months later than most other species of shorebirds and, atypically for this group, adult and first-year Dunlins arrive simultaneously. At Bolinas and Limantour, numbers rose rapidly to peak in Nov, then declined gradually to mid-Apr, before dropping off sharply in late Apr (Fig. 30); Holmes (1966) recorded a similar pattern on San Francisco Bay. Spring migration, evident from our data only by a decline in numbers (Fig. 30), extends chiefly from Apr to early May (Jurek 1973). At Abbott's, Dunlins occurred primarily as fall migrants (Fig. 30), presumably because in winter sand flats there were flooded by runoff.

Seasonal occurrence patterns varied annually depending on rainfall (Fig. 31). Winter numbers at Bolinas were highest during the drought years of 1975–76 and 1976–77, lowest in the wet years of 1972–73, 1973–74, and 1981–82 (Figs. 2

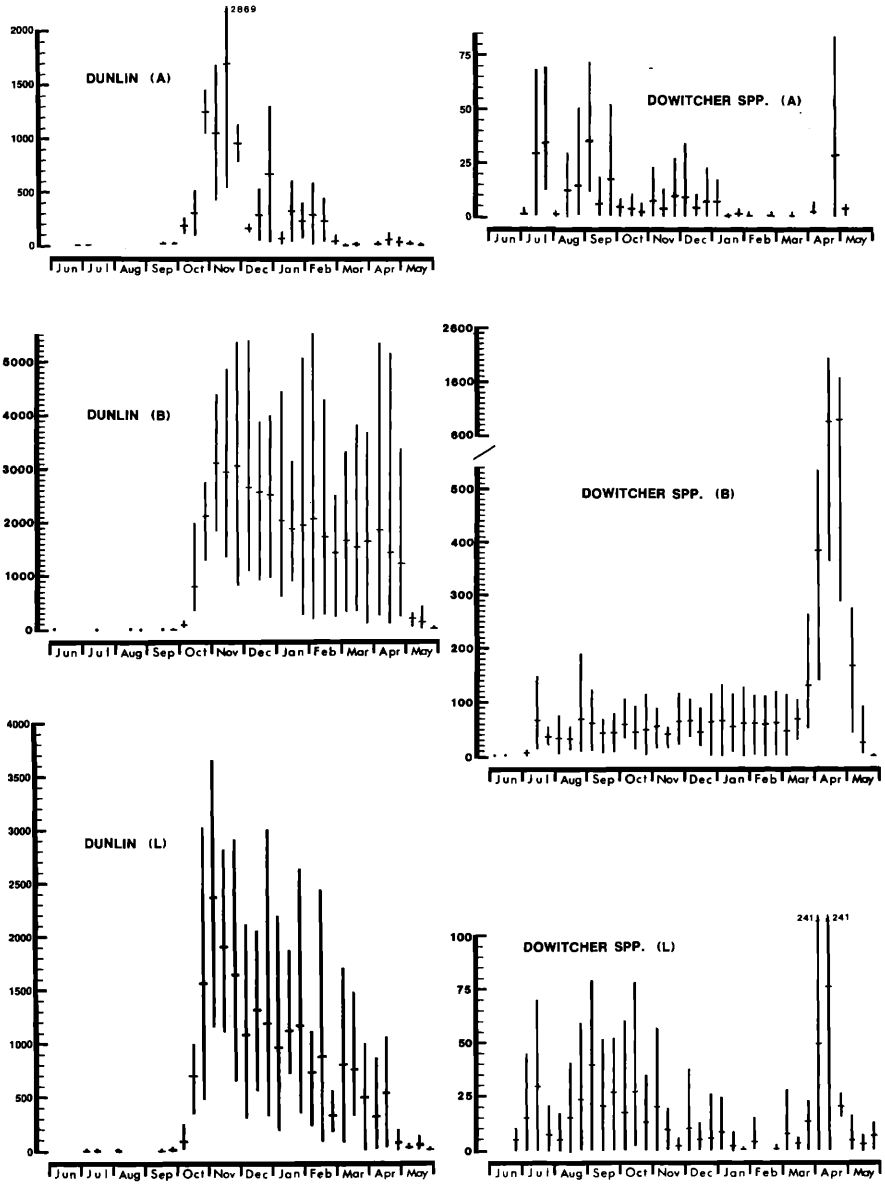

Figure 30. Seasonal abundance of the Dunlin and dowitchers in wetlands of Point Reyes. See Figure 4 for details.

and 14). In the drought years birds may have moved from freshwater habitats that dried up to tidal areas, and in wet years many may have remained in freshwater habitats. Part of the reason why numbers were high in the drought may have been that heavy rain in wet years, flooding mud flats, induced the birds to depart early, lowering the winter averages for wet winters. For example, in Jan 1973, when several days of heavy rains and very high tides inundated the tidal flats for most daylight hours, numbers at Bolinas fell sharply from about 1000 to 300 birds, and remained unusually low for the rest of the season (Fig. 31). The departure in Jan 1973 coincided with 29 cm of rain in 10 days, the highest total during our study for a 10-day period. Since this was also the only large drop in numbers during our study attributable to rainfall, it appears that Dunlins remain on the estuary except under extreme conditions. Dunlins feed on tidal flats, lagoon margins, freshwater and sewage pond margins, and, to a limited extent, on rocky reefs. At high tides they feed in rain-soaked pastures. At Bolinas, Dunlins, like Western Sandpipers, feed on somewhat sandier substrates than do Least Sandpipers (Page et al. 1979). Salt marshes are important nighttime roosts.

Curlew Sandpiper (*Calidris ferruginea*)

A very rare fall visitant from Asia with one census record of a juvenile at Bolinas Lagoon from 7 to 14 Sep 1974 (AB 29: 114, Luther et al. 1979). This is the only Point Reyes record and one of only 13 for California, 1971 to 1987: 12 in fall (adults and juveniles) from 4 Jul to 1 Nov and one in spring for 27 and 28 Apr 1974 (CBRC).

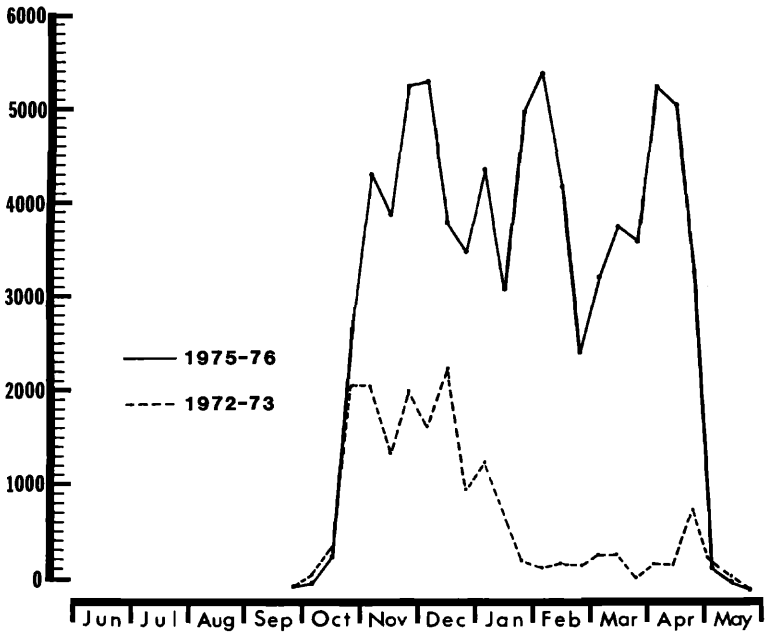

Figure 31. Mean number of Dunlins at Bolinas Lagoon in 1972–73 and 1975–76.

Stilt Sandpiper (*Calidris himantopus*)

A very rare fall visitant with one census record of an adult at Bolinas between 7 and 13 Jul 1971 (AB 25: 902, Page et al. 1979). Another adult was at Limantour from 19 to 20 Jul 1985 (ABN: SNGH). There are additional records for Point Reyes of about 10 individuals from 7 Aug to 22 Oct; birds identified to age were all juveniles (ABN). On the northern California coast, extreme dates for fall transients are 6 Jul and 8 Nov; most records are from mid-Aug to early Oct, the time of passage of juveniles, which begins at least by 17 Aug (ABN). In California, small numbers of Stilt Sandpipers winter and remain through the spring only at the south end of the Salton Sea (Garrett and Dunn 1981). Away from that locale there are only a handful of California records of spring migrants from mid-Apr to early Jun (Garrett and Dunn 1981, McCaskie et al. 1979). On Point Reyes Stilt Sandpipers use tidal flats, lagoon margins, freshwater ponds, and sewage ponds.

Ruff (*Philomachus pugnax*)

A very rare visitant with only one census record, of juvenile at Limantour from 14 to 22 Sep 1980 (AB 35: 221, Binford 1985). The three other substantiated Point Reyes records, all of single juveniles, are of one at Limantour from 30 Aug to Sep 1978 (AB: 33: 210, Luther et al. 1979); one at Abbott's from 25 to 30 Sep 1986 (ABN: DDK et al.), and another from 10 to 11 Oct 1986 (DAH, SP). Nothern California Ruff records, which have increased in frequency since 1974 (ABN), extend from 15 Jul to 6 May (four records for Jul one for May). Most occurrences are in Sep and Oct and represent migrating juveniles, which arrive as early as 23 Aug (ABN).

Dowitchers (*Limnodromus spp.*)

Since all Long-billed Dowitchers (*L. scolopaceus*) and Short-billed Dowitchers (*L. griseus*) were not identified to species on censuses, we have grouped them for analysis. As a whole, dowitchers were rare summer visitants, common fall transients and winter residents, and very common spring transients (Fig. 30). Non-census identifications provided a reasonably clear picture of seasonal occurrence for the two species. Dowitchers forage in estuaries, lagoons, and ponds. Long-billeds are found primarily in freshwater habitats, Short-billeds in more saline areas, although they occur also in fresh water during migration (Pitelka 1950). On Point Reyes, Long-billeds are most numerous at ponds and at freshwater inflows into estuaries. At Limantour and Bolinas, Long-billeds occur on muddier substrates than do Short-billeds (Lenna 1969, Page et al. 1979). Lenna (1969) reported that Long-billeds move to estuaries when muddy freshwater feeding areas are inundated by winter rains.

Short-billed Dowitchers were very rare visitants in the first two-thirds of Jun. Migration was apparent by late Jun with the movement of adults into the study area; Short-billeds outnumbered Long-billeds in fall. The earliest record of a juvenile Short-billed on Point Reyes is for 31 Jul (ABN: DAH), although juveniles may occur on the coast as early as 23 Jul (Pitelka 1950). On the central California coast, adults are greatly outnumbered by juveniles, whose peak passage is from mid-Aug to mid-Sep (Pitelka 1950, Lenna 1969, authors' unpubl. data). In contrast, on Humboldt Bay, Gerstenberg (1972) reported greatest movement and two peaks during the passage of adults and a smaller and later passage of juveniles. This corresponds with the sequence of fall passage in the East of adult females, then adult males, and finally juveniles (Jehl 1963). The peak of over 20,000 dowitchers, most adults, on Humboldt Bay suggests that adults largely by-pass the

Point Reyes area; in the East, Short-billeds appear to stage in certain areas and avoid others (Jehl 1963). Transients were seen regularly on Point Reyes through mid-Oct and sometimes lingered until late Nov, when winter population levels were reached.

Although Long-billeds generally outnumbered Short-billeds in winter in this area, the latter appear to be present annually, as indicated by the following records: Bolinas—five on 27 Dec 1975 and singles on 11 and 23 Jan 1976 (GWP,LES); Limantour—one or two on 2 Jan 1978 (DS); Bodega Harbor—up to eight throughout Jan and Feb 1978 (DS), and 6 and 13 on 19 and 21 Jan 1979 (DS), respectively; Drake's Estero—up to 10 during Jan and Feb 1981 (DS), and two on 25 Jan 1982 (DS); Tomales Bay—singles on 17 Dec 1977, 16 Dec 1978, and 21 Jan 1978 (DS). The low numbers and irregular occurrence in winter of Short-billeds at particular sites on Point Reyes may be a consequence of California's being at the north end of the species' winter range (Pitelka 1950). Spring migration began in mid-Mar (41 on 16 Mar 1976 at Bolinas), numbers peaked sharply from early to late Apr, and movement continued through May (Fig. 30). In contrast, others have reported two spring peaks, one in late Mar and another in late Apr (Lenna 1969, Gerstenberg 1972). Short-billeds vastly outnumber Long-billeds on the coast during spring migration.

Long-billed Dowitcher. The only Jun records were of single birds on Bolinas Lagoon on 9 Jun 1976 (PRBO), at the Bolinas sewer ponds on 12 Jun 1980 (DS), and on outer Point Reyes from 10 to 12 Jun 1988 (AB 42: 1337). Although adults normally appeared in mid-Jul (earliest 4 Jul), the main influx began with the arrival of numbers of juveniles in mid- to late Sep (Pitelka 1950, Lenna 1969, authors' unpubl. data). Our earliest date for a juvenile was 4 Sep (DS), which compares with 26 Aug in Oregon (Paulson 1983). The end of fall migration was ill defined, because of the substantial wintering population, but migration appeared to continue through mid-Oct, with stragglers trailing into Nov. Our highest winter census total was 158 birds at Bolinas on 6 Feb 1980. We suspect wintering birds in the Point Reyes area include both age classes but that immatures predominate, as Pitelka (1950) described for the coast in general; inland the opposite is true. In Jan 1973, numbers at Bolinas dropped dramatically from 100 to 0, when 29 cm of rain falling in a 10-day period and storm tides flooded foraging areas for extended periods, a pattern like that found by Gerstenberg (1972) at Humboldt Bay (see Dunlin account). No peak of spring migrants was detected in the Point Reyes area, but occasional sightings of small flocks of Long-billed Dowitchers in local non-wintering areas suggested that the spring migration period coincided with that of the Short-billed.

Common Snipe (*Gallinago gallinago*)

A fairly common winter resident with no obvious peaks of migration (Fig. 32). The span of dates of continuous occurrence in the Point Reyes area was 31 Aug to 11 May. Sightings of single birds at the Bolinas sewer ponds produced extreme dates of 28 Jul 1985 (AB 39: 958) and 24 May 1980 (AB 34: 812). For the northern California coast the early fall record on 16 Jul 1983 at Lake Earl, Del Norte Co. (ABN: RAE) is exceptional, as are Jul records in general. The delay until Oct in the arrival of snipes at Bolinas (Fig. 32) was due to the lack of freshwater habitat there before the winter rains. From 1972 to 1975, the four years with sufficiently frequent census data, snipes arrived in late Sep and their numbers built up by mid-Oct only in 1972 and 1973, when the rainy season began in Sep (Fig. 2). Arnold (1981) noted the importance of several heavy rains in fall before habitat becomes suitable for snipes. At Bolinas there was a sharp decline in winter numbers between the drought years of 1975–76 and 1976–77. Subsequently, snipes remained well below their pre-1975 abundance (Fig. 14).

At Bolinas snipes are restricted to a complex of vegetated brackish ponds in salt marsh, *Juncus*-covered swales, and water-soaked pastures on the Pine Gulch Creek delta. The paucity of similar habitat at the other censused wetlands explained why numbers were lower there than at Bolinas (Fig. 32). Snipes may concentrate locally elsewhere on Point Reyes, as 120 birds did near Olema Marsh

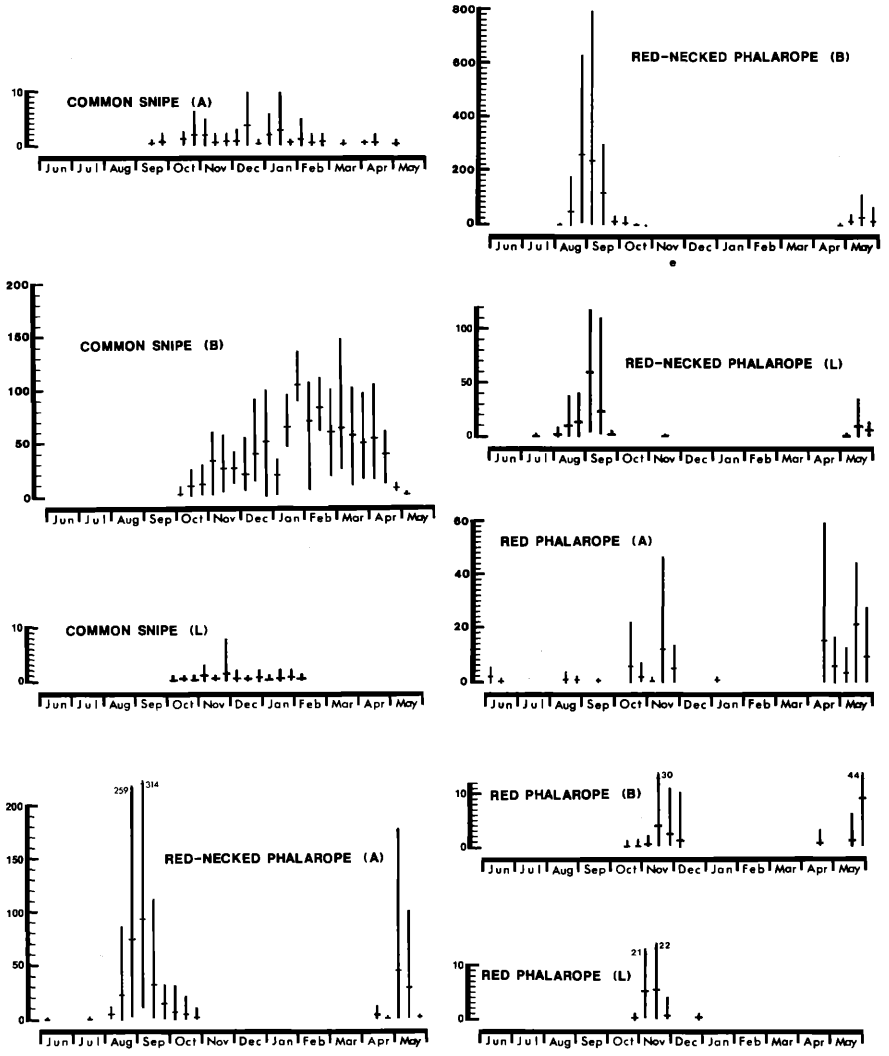

Figure 32. Seasonal abundance of the Common Snipe and phalaropes in wetlands of Point Reyes. See Figure 4 for details.

on 2 Dec 1983 (JGE). They were found roosting on dredge spoils when pastures nearby were flooded. Typically, snipes frequent the muddy edges of freshwater marshes and swales, wet fields with relatively tall vegetation, and, to a lesser extent, wet close-cropped pastures. Salt marshes are little used except in unusual circumstances, as described for Bolinas.

Wilson's Phalarope (*Phalaropus tricolor*)

A very rare fall transient with 26 birds on 15 censuses from 16 Jun to 15 Sep and a very rare spring transient with two birds on 22 May 1981 at Abbott's. There are four other Point Reyes records in spring from 3 May to 6 Jun (ABN); two records for 12 June, 1977 and 1988 (ABN), are hard to classify seasonally. The earliest record of a juvenile on Point Reyes is for 17 Jul 1988 at Abbott's (ABN: LJP). The greater adundance of fall migrants is consistent with the statewide pattern (Jurek 1973, McCaskie et al. 1979, Garrett and Dunn 1981, Swarth et al. 1982). Fall passage in coastal California extends primarily from mid-Jun to mid-Sep (Fig. 12; Swarth et al. 1982, Jurek 1973, Garrett and Dunn 1981) with stragglers seen rarely through Oct; females precede adult males which are followed by juveniles (Jehl 1988). Since 1980 there have been two Jan to Feb coastal northern California records at salt ponds (AB 34: 303, Roberson 1985). Birds on spring migration pass primarily through the the Salton Sea and east of the Sierra Nevada and mostly avoid the coast. Spring passage extends primarily from mid-Apr to early Jun (Jurek 1973); the earliest northern California spring record is 3 Apr (AB 41: 484). In spring migration females apparently predominate early, males later (Oring and Davis 1966).

On Point Reyes, Wilson's Phalaropes frequent freshwater, sewage, and brackish ponds and occasionally tidal flats. They were formerly quite rare in the San Francisco Bay area (Grinnell and Wythe 1927) but, since the creation and expansion of salt-pond evaporators in south San Francisco Bay starting in the 1860s (Ver Planck 1951), their numbers in fall have increased dramatically. Now tens of thousands can be seen during the peak of migration in early Jul (Swarth et al. 1982, Jehl 1988). The species' status in the Point Reyes area appears to be similar to that in the Bay Area before the creation of salt ponds.

Red-necked Phalarope (*Phalaropus lobatus*)

A common fall and spring transient (Fig. 32). Although not recorded on our summer censuses, the species was an irregular visitant at that season; at the Horseshoe Pond 22 birds on 6 Jun 1981 dwindled to four or five birds that remained from mid-Jun through early Jul (DS). At Point Reyes wetlands, fall migration spanned early Aug to late Oct and peaked in late Aug and early Sep (Fig. 32); a similar pattern was recorded on Humboldt Bay (Gerstenberg 1972). Locally, stragglers have remained as late as 15 Dec 1979 at Tomales Bay (AB 34: 659). In contrast, the fall build-up in the interior at Mono Lake or at coastal salt ponds begins in late Jun or early Jul and peaks in late Aug (Winkler et al. 1977, Swarth et al. 1982, Roberson 1985, ABN). On neritic waters numbers build up at least by mid- to late Jul and peak in late Aug to mid-Sep (DeSante and Ainley 1980, Stallcup 1976, Briggs et al. 1987, ABN). From mid-Aug to mid-Sep 1971, 93% of all birds banded at Bolinas were juveniles (Page et al. 1979). In the same period in 1980 the percentage of juveniles in counts of 50–300 birds at Abbott's increased steadily from 69 to 98% (DS). At Mono Lake from Jul through Aug, adults outnumber juveniles, which have been banded as early as 3 Aug (Winkler et al. 1977); large numbers of Red-necked Phalaropes arriving in Jul on salt ponds in San Francisco Bay (Swarth et al. 1982) are presumably also adults. The pattern at favored sites reflects shorebirds' typical pattern in fall of adults preceding juveniles,

whereas the pattern on Point Reyes estuaries primarily reflects the passage of juveniles. Adult females precede males in fall migration (Orr et al. 1982). Fall numbers on coastal and neritic waters fluctuate markedly from year to year (Stallcup 1976, DeSante and Ainley 1980, Briggs et al. 1987, this study). Since 1974 healthy Red-neckeds have been found irregularly in Jan and Feb on salt ponds on the central California coast (ABN, Roberson 1985).

In spring, Red-necked Phalaropes migrate mainly over the inshore and offshore zones; only small numbers use estuaries, salt ponds, freshwater ponds, and sewage ponds (Fig. 32, Jurek 1973, Garrett and Dunn 1981, Swarth et al. 1982). Spring migrants occur primarily from mid-Apr to the end of May in all habitats; non-breeders may remain into Jun or Jul, when they blend with returning fall migrants. The spring peak in numbers is from late Apr to mid-May; Point Reyes' early date for a spring migrant is 3 Apr (GM); Monterey's is 24 Mar (Roberson 1985). Numbers of spring migrants over inshore waters of central California have peaked from 22 Apr to 19 May (ABN: BSa et al.). Red-neckeds on ocean waters generally occur closer to shore (within 50 km) than do Red Phalaropes (Wahl 1975, Briggs et al. 1984, 1987), and foraging birds of both species concentrate at surface convergences that concentrate zooplankton (Briggs et al. 1984). Migrants concentrate over the outermost shelf and upper continental slope (Briggs et al. 1987).

Red Phalarope (*Phalaropus fulicaria*)

A fairly common fall and spring transient (Fig. 32). In fall Red Phalaropes were found on the estuaries irregularly from mid-Aug to early Jan but mostly from mid-Oct to early Dec (Fig. 32); extreme (non-census) dates were 6 Aug and 31 Jan (ABN). This species' fall migration appears to be the most prolonged of any of our shorebirds. Offshore the Red Phalarope usually occurs from at least mid-Jul to early Jan and the timing of peak numbers in the Farallones–Point Reyes area varies annually between late Aug and late Nov (DeSante and Ainley 1980). Overall, peak numbers in northern California are from Jul through Oct and for central California are in Oct or Nov (Briggs et al. 1987). In some years the species remains numerous into Feb, with stragglers "wintering" from late Feb through Mar (Briggs et al. 1987). In fall, females precede males, which are followed by juveniles (Connors et al. 1979, Orr et al. 1982).

The species' occurrence on estuaries was irregular both within and between years because Red Phalaropes generally do not stray from their principal migration route over offshore or oceanic waters. During our censuses, influxes to the estuaries—up to 20–60 birds per day—occurred only in Nov in 1973, 1976, and 1979. On 21 Nov 1976 an estimated 10,000 individuals were on Tomales Bay following a severe storm (AB 31: 218). Not all fall influxes coincided with storms but all involved some emaciated adults and juveniles that were readily killed by raptors and scavengers (unpubl. data).

We had census records of spring migrants from mid-Apr to early Jun (Fig. 32) and non-census records from 16 Apr to 17 Jun (ABN). In northern California, Red Phalaropes sometimes arrive by early Apr, and stragglers may linger into Jul (ABN). We recorded true spring influxes of about 10–60 birds on censuses only in 1975, 1979, and 1982. A non-census estimate of 4000 to 8000 birds on Bodega Harbor on 25 May 1980 was by far the largest spring influx recorded (Connors and Smith 1982). In spring, influxes usually followed several days of strong onshore winds, and survival of birds appeared to be much better than during fall influxes. Strong onshore winds appear to be a necessary but not sufficient cause of onshore influxes of Red Phalaropes, as onshore winds typically blow for extended periods in spring. Perhaps when ocean food supplies are poor, birds

are weakened and more susceptible to wind drift, or they are forced to seek food away from the open ocean. Although small numbers of Red Phalaropes migrate over inshore waters of central California in spring (peak dates of migration range from 6 to 18 May, ABN: BSa et al.), most birds pass farther offshore than Red-necked Phalaropes (Wahl 1975, Briggs et al. 1984, 1987). Most Red Phalaropes concentrate over the central continental slope (10–75 km offshore, average 35 km), but some birds range to at least 195 km off Point Reyes (Briggs et al. 1984). In winter birds occupy waters mostly seaward of the continental shelf (Briggs et al. 1987). Ocean-foraging birds frequent zooplankton concentrations at surface water convergences where strong thermal gradients border upwelling waters (Briggs et al. 1984). Onshore they forage on the water's surface or along the shorelines of estuaries, lagoons, freshwater ponds, and sewage ponds, and occasionally on sandy beaches.

Parasitic Jaeger (*Stercorarius parasiticus*)

A very rare fall transient with about 20 birds on 17 censuses from 31 Aug to 14 Dec, mainly in Sep. Most sightings were at Bolinas, where the jaegers were frequently observed pirating food from Elegant Terns, which are numerous there. The occurrence of Parasitic Jaegers in the study area (Fig. 12) coincided with the fall passage in California, which extends from late Jul to late Dec and peaks in late Sep (Stallcup 1976, McCaskie et al. 1979, Garrett and Dunn 1981, Roberson 1985). Parasitic Jaegers are found in small numbers in ocean waters off California in winter, in greater numbers in spring, and irregularly in summer (McCaskie et al. 1979, Garrett and Dunn 1981). They are not recorded on the estuaries at these seasons. The species is found in neritic waters out to 75 km, but mostly within 15 km of land (Briggs et al. 1987), and in estuaries with concentrations of terns and gulls from which they pirate food.

Franklin's Gull (*Larus pipixcan*)

A very rare visitant with one census record of an adult at Abbott's on 23 Jun 1976 (AB 30: 399). Non-census records are of single birds at Abbott's from 18 to 25 Aug 1966 (AFN 21: 74, PRBO) and at Hog Island, Tomales Bay, on 13 Aug 1989 (DS, JPK). Franklin's Gulls occur irregularly on the northern California coast primarily in fall from mid-Aug to mid-Nov and secondarily in spring from mid-Apr to late Jun (ABN). They occur casually at other times of year.

Bonaparte's Gull (*Larus philadelphia*)

A rare summer visitant, an abundant fall migrant, an uncommon winter resident, and a very common spring migrant (Fig. 33). Small numbers occurred irregularly in summer and usually dwindled through the season. Fall migration extended primarily from mid-Oct through late Dec, peaking from mid- to late Nov. Over neritic waters numbers rise in Sep and Oct and peak in late Oct and Nov (Briggs et al. 1987). Our highest estuarine counts of migrants were after strong southwest winds from 22 to 28 Nov 1974 with 11,600 birds at Bolinas and 45,000 at Limantour. Bolinas was the only censused wetland where Bonaparte's Gulls remained through the winter. Spring migration extends from late Mar to early Jun and peaks from mid-Apr to mid-May (Fig. 33, ABN). Over inshore waters of central California, peak dates of migration usually range from 21 to 24 Apr, but strong movement exceptionally can start by 31 Mar (ABN: BSa et al.). Immatures predominate at the end of spring movement. Off California, Bonaparte's Gulls migrate over the continental shelf but mostly within 40 km of land (Briggs et al. 1987). Estuarine numbers were quite variable during migration

as birds veer from their over-ocean migration path at irregular intervals during inclement weather to seek refuge or feed in the estuaries. At any season Bonaparte's Gulls may be found in bays, estuaries, lagoons, and a variety of freshwater habitats, especially sewage ponds.

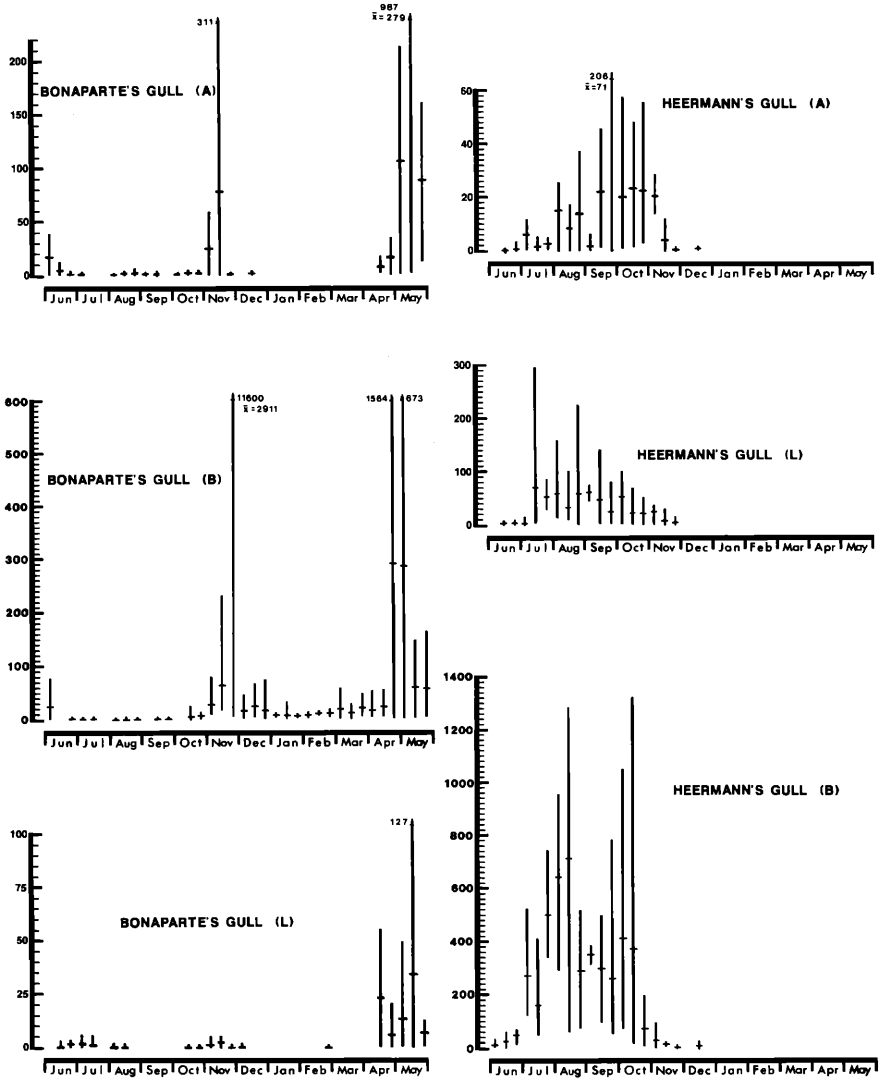

Figure 33. Seasonal abundance of Bonaparte's and Heermann's gulls in wetlands of Point Reyes. See Figure 4 for details.

Heermann's Gull (*Larus heermanni*)

A very common summer to early winter dispersant (Fig. 33). Although our earliest local non-census record was for 24 May, in central California northward spring movement may begin (very rarely) as early as late Apr (ABN); the increase in numbers occurs progressively later to the north (Briggs et al. 1987). Our earliest estuarine census record of 10 birds at Bolinas on 29 May 1973 coincided with a very early build-up of Heermann's Gulls and Brown Pelicans along the northern California coast (AB 27: 914) following a breeding failure in the Gulf of California attributed to anomalously warm water (Anderson and Anderson 1976, D. W. Anderson pers. comm.). In most years Heermann's Gulls did not begin arriving until mid-Jun, with the first major influx occurring in early Jul (Fig. 33). During anchovy runs in late Aug and Sep of 1984 and 1985 from 2000 to 6000 Heermann's Gulls concentrated in Bolinas Lagoon for short periods. Similar peaks were not apparent at Limantour and Abbott's, which are much less used by this species than Bolinas. Numbers remained high on the wetlands until late Oct, and only stragglers were left by Dec (Fig. 33). Although in some years a few birds remain throughout the winter along the Point Reyes–Bodega coast (ABN), the only ones recorded during our study were up to 10 immatures at Bodega Harbor throughout the late winter and spring of 1980 (DS et al.). Occurrence patterns vary along the California coast, with greater winter numbers and earlier spring influxes from Monterey south (Roberson 1985, Garrett and Dunn 1981).

The pattern and timing of post-"breeding" dispersal of Heermann's Gulls are linked to water temperatures as they affect food supply (D. W. Anderson pers. comm.; see also Brown Pelican). Since breeding Heermann's Gulls arrive at nesting islands in the Gulf of California in late Mar and begin laying in early Apr (Bent 1921), the Oct–Nov departure from northern California appears to be a response to a seasonal dwindling of food supplies and, perhaps more so, to stormy weather (D. W. Anderson pers. comm.), rather than migration directly to the breeding grounds.

Heermann's Gulls feed in inshore and offshore waters, estuaries, and lagoons and sometimes bathe in freshwater ponds along the coast. Because they are kleptoparasites on Brown Pelicans, the two species are very closely associated in the post-breeding season. Grinnell and Miller (1944) noted a decline in Heermann's Gulls' abundance between 1915 and 1930 with a recovery by 1943. Although Heermann's Gulls suffered the effects of DDT accumulation, disturbance, and egging in the late 1960s and early 1970s, their populations did not decline as did those of the Brown Pelican (D. W. Anderson pers. comm.).

Mew Gull (*Larus canus*)

An abundant winter resident (Fig. 34) with census records extending from 5 Oct to 5 May and non-census records extending from 3 Oct to 18 May. Although not recorded in summer on Point Reyes, the Mew Gull occurs casually along the northern California coast then (ABN). Fall migration over the inshore zone extends from early or mid-Oct until at least late Nov (DS pers. obs.). Our wetland data (Fig. 34) suggest that most Mew Gulls were transients in the area, a pattern similar to that of the California Gull (Fig. 34). The Mew Gull graphs for Bolinas and Limantour indicate a fall peak from Nov to mid-Jan, a mid-winter low between late Jan and early Feb, and a spring peak from mid-Feb to mid-Mar. In spring migration adults precede sub-adults, which predominate at the tail end of migration. Mew Gulls are found primarily on estuaries, lagoons, beaches, and inshore waters. Inshore they are often associated with windrows or tidal "rips" close to the shoreline (Briggs et al. 1987); they are casual offshore (Wahl 1975). They also forage in wet pastures after heavy rain and in freshly plowed fields within a few

kilometers of the coast. Mew Gulls are only rarely seen at refuse sites (Cogswell 1974).

Ring-billed Gull (*Larus delawarensis*)

A fairly common summer resident, a very common fall transient, and a common winter resident (Fig. 34). Summering birds were virtually all sub-adults. Our fall peak from Jul to Oct (Fig. 34) reflected the movement of inland breeders to the central California coast and their subsequent departure for wintering grounds in southern California and western Mexico (Vermeer 1970). Juveniles arrive on the northern California coast as early as 16 Jul (AB 37: 1024). The lack of a pronounced spring peak (Fig. 34) was consistent with the evidence that spring migration is primarily through the interior (Vermeer 1970). Conover (1983) reported an approximately 22-fold increase in the breeding population of the western U.S. in the last 50 years, which also implies a large increase in the West Coast's migrant and wintering populations. On the coast Ring-billed Gulls feed on protected estuaries, lagoons, bays, beaches, freshwater ponds, plowed fields, pastures, playgrounds, and dumps. They are casual offshore (Wahl 1975), rarely occurring more than 1 km from shore (Briggs et al. 1987).

California Gull (*Larus californicus*)

A fairly common summer resident, a very common fall dispersant, and a very common winter resident (Fig. 35). Virtually all birds summering on the Point Reyes wetlands were sub-adults. After breeding mostly at interior sites, California Gulls travel to the Pacific Coast and fan out to both the north and south (Woodbury and Knight 1951), though dispersal at this time is predominantly northward (V. M. Norris and D. W. Winkler unpubl. data). Adults and juveniles begin arriving on the northern California coast in mid-Jul, increasing numbers on the Point Reyes wetlands (Fig. 35). The earliest date for a juvenile, away from the recently established San Francisco Bay breeding colony (Jones 1986), is 9 Jul 1981 (ABN: RAE), though dates of 20–25 Jul are more typical (ABN). Numbers on the Point Reyes wetlands rose sharply in late Sep and peaked from Oct until mid-Jan, when they dropped to mid-winter lows (Fig. 35).

Cogswell (1974) and Johnston (1956) attributed a similar mid-Jan drop in numbers at San Francisco Bay trash dumps to competition for food between California Gulls and larger gulls, which arrive later at the dumps. However, surveys of coastal gulls by L. B. Spear (pers. comm.) show that in Oregon numbers peak in Oct then drop sharply to winter lows by Dec, that in northern California numbers peak in Oct but decline more gradually to winter lows by Jan, that in central California numbers peak in Nov then fall gradually to lows in Feb and Mar, and that in southern California numbers peak in Dec and fall to lows by May. These observations suggest that California Gulls drift south during late fall and early winter, a pattern also noted for gulls on ocean waters off California by Briggs et al. (1987). V. M. Norris and D. W. Winkler (unpubl. data) studied this phenomenon by analyzing band recoveries. Their data indicate an initial concentration of both adults and juveniles to the north off Washington and a progressive shift of the population south from Aug through Feb (peak movement in Oct and Nov), with sub-adults generally moving farthest south.

Since California Gulls initially shift north on the coast and later retreat south at roughly the same time that Brown Pelicans, Heermann's Gulls, and Elegant Terns do (see accounts), all these species appear to be responding to changes in ocean productivity stimulated by the upwelling that occurs progressively later to the north on the coast in spring and summer and declines in late summer and fall (see habitat preferences below and Results and Discussion). The southward shift to

exploit these seasonal changes in food supply may have kept California Gulls from competing with larger gulls as the former shift their range south of the latter's during a period of diminishing food supplies. Very large numbers of California Gulls "winter" in the Gulf of California and along the Baja California coast, and they may respond to southern oceanic conditions somewhat as Brown Pelicans and Heermann's Gulls do (D. W. Anderson pers. comm.).

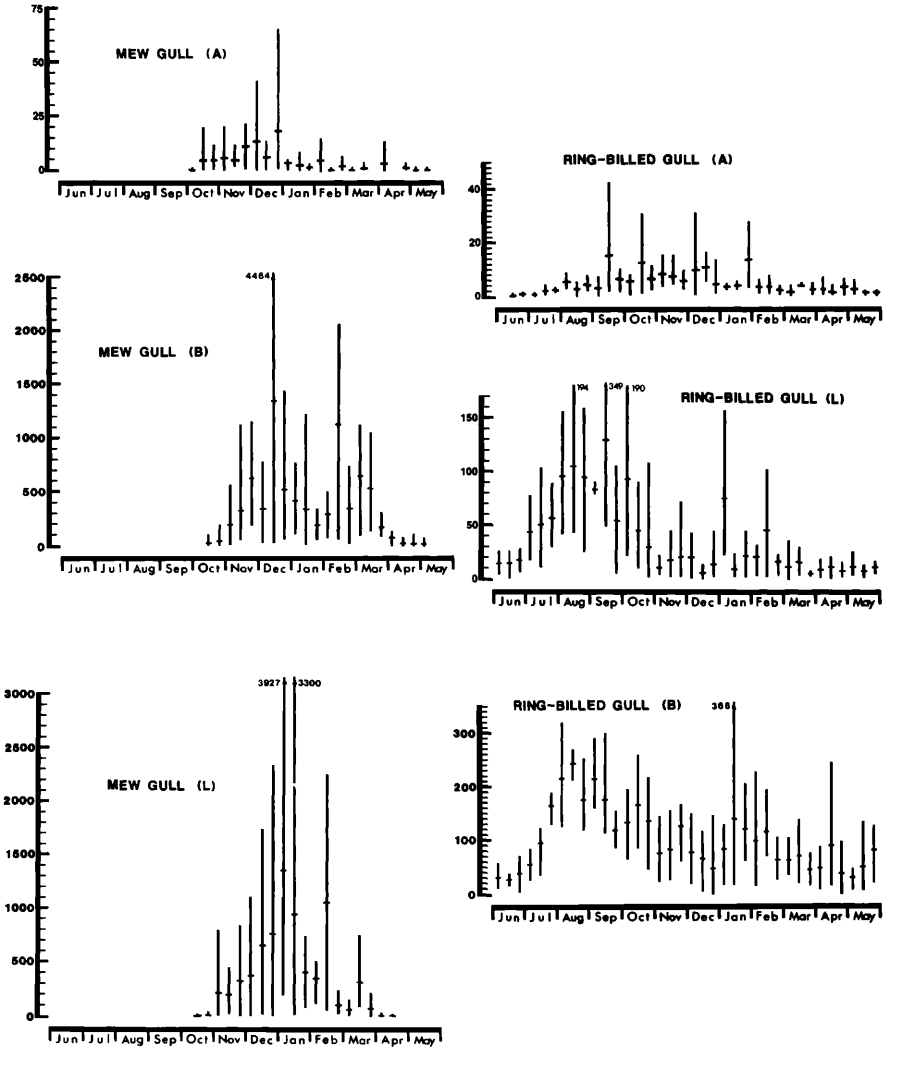

Figure 34. Seasonal abundance of the Mew and Ring-billed gulls in wetlands of Point Reyes. See Figure 4 for details.

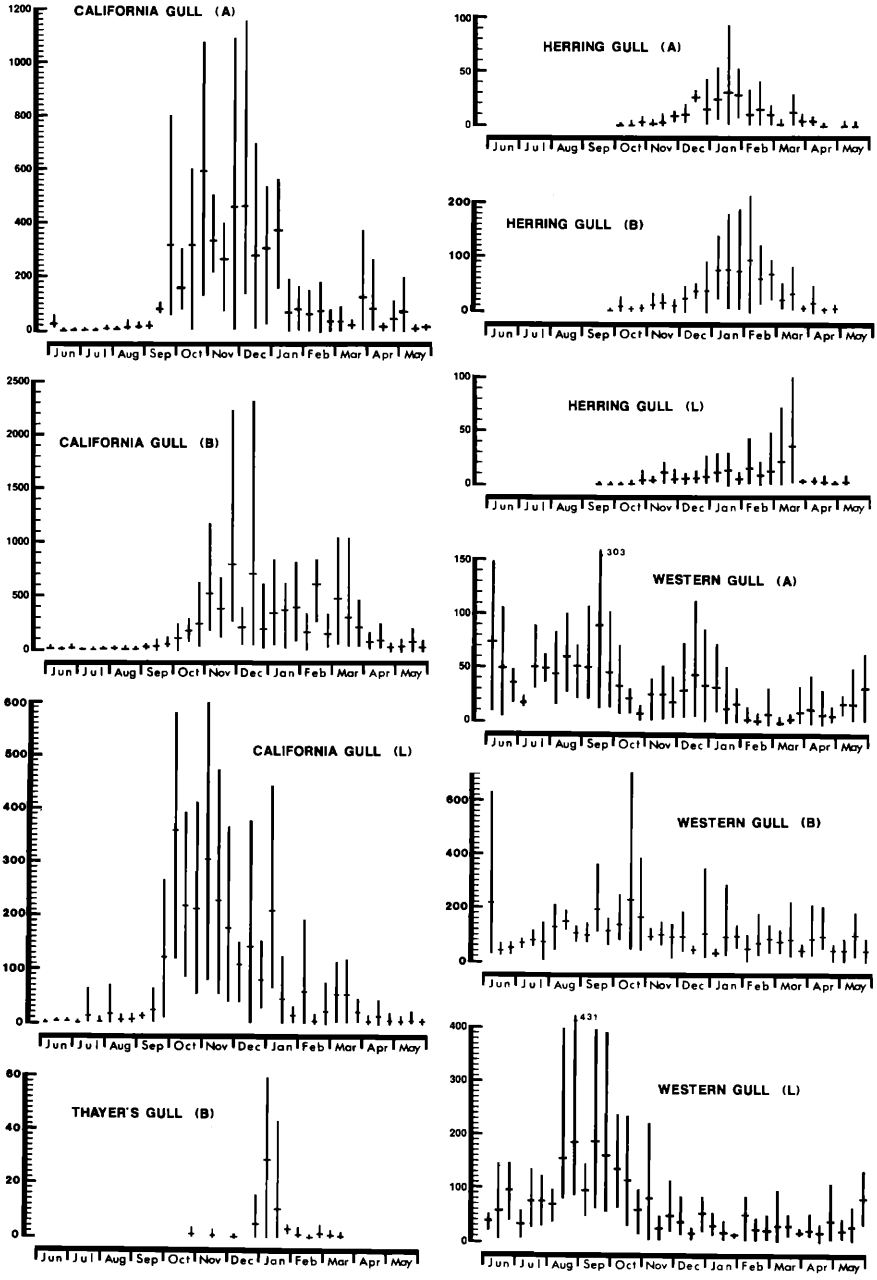

Figure 35. Seasonal abundance of some large gulls in wetlands of Point Reyes. See Figure 4 for details.

Since in spring there are only small peaks of migrants between Mar to May at coastal sites (Fig. 35, Cogswell 1974, L. B. Spear pers. comm.), most adults must migrate directly overland to interior breeding sites. Most sub-adults remain on the coast and shift progressively north (V. M. Norris and D. W. Winkler unpubl. data). On Point Reyes sub-adults make up the bulk of the California Gulls by early May and they can be seen moving north at least through late May (DS) when low summer numbers are reached. Sub-adults continue moving north throughout the summer (V. M. Norris and D. W. Winkler unpubl. data), but the low summer numbers on Point Reyes (Fig. 35) suggest that the magnitude of movement then is small. The northward shift of sub-adults in spring again puts them in a region with increasing food supplies.

Conover (1983) reported that the nesting population of the western U. S. has more than doubled in the last 50 years, implying also a large increase in the coastal population. California Gulls feed in estuaries, lagoons, and inshore and offshore waters. Off Point Reyes they range as far seaward as the central continental slope (Briggs et al. 1987). Offshore they may outnumber all other species of gulls in the fall, with immatures being particularly common in this zone (Wahl 1975). Non-marine foraging habitats include freshwater ponds and marshes, plowed fields, pastures, playing fields, parking lots, and dumps.

Herring Gull (*Larus argentatus*)

A common winter resident (Fig. 35). The only local (non-census) summer records were of one bird at Limantour on 4 Jul 1965 (RS), a third-year bird at Limantour on 5 Aug 1977 (AB 32: 353), and a first-year bird at Dillon Beach on 3 Jun 1982 (DS); the Herring Gull occurs casually on the northern California coast in summer (ABN, McCaskie et al. 1979). At Bolinas and Abbott's numbers increased from late Sep through Dec, peaked in Jan and Feb, and declined in Mar and Apr. High Mar numbers at Limantour may reflect a pulse of migrants (Fig. 35). On inshore waters off California numbers peak from Dec to Feb (Briggs et al. 1987). At the Farallones there appears to be a minor fall peak in late Oct, pronounced peaks in late Nov and late Dec, and a sharp spring peak in late Mar, and a minor peak late Apr (DeSante and Ainley 1980). Garrett and Dunn (1981) reported that Herring Gulls move north in Mar and Apr in coastal southern California. On the coast Herring Gulls frequent estuaries, lagoons, inshore and offshore waters, garbage dumps, and, less commonly, freshwater habitats. At sea Herring Gulls concentrate in neritic waters, but appreciable numbers also occupy waters over the continental slope (Briggs et al. 1987) and open ocean (Sanger 1970, 1973, Harrington 1975, Wahl 1975).

Thayer's Gull (*Larus thayeri*)

An uncommon winter resident (Fig. 35). Thayer's Gulls were seen on censuses from 24 Oct to 18 Mar with most birds occurring from late Dec to early Feb. Extreme non-census dates for the study area are 13 Oct (JGE) and 9 Apr (GWP), except for an immature at Bolinas from 5 to 11 Aug 1986 (AB 41: 139). On the northern California coast birds may occasionally arrive by late Sep (McCaskie et al. 1979), linger into May, and are casual in summer (ABN). Our highest census counts were at Bolinas, with 60 birds on 2 Jan 1975, 44 on 11 Jan 1977, and 54 on 8 Jan 1980. A large (non-census) count was of over 300 Thayer's Gulls in Tomales Bay from 10 to 13 Jan 1985 (AB 39: 206); birds there were apparently concentrated around spawning Pacific Herring. Thayer's Gulls frequent dumps, estuaries, beaches, and inshore and offshore waters. The highest concentrations in the San Francisco Bay area usually are at dumps, but, like Herring Gulls, Thayer's are abundant only in the absence of Western Gulls (Winter and Erickson

1977). Sources differ on whether Thayer's are common or only casual offshore (Sanger 1973, Wahl 1975, Winter and Erickson 1977).

Western Gull (*Larus occidentalis*)

A year-round resident, very common in fall and common in winter, spring, and summer (Fig. 35). Although Western Gulls are not long-distance migrants, their seasonal dispersals (Coulter 1975, Spear 1988) are reflected by changes in numbers in the estuaries. They breed regularly along the coast in the study area and on the nearby Farallon Islands, where about 60% of the total California breeding population is located (Sowls et al. 1980). Numbers on Point Reyes wetlands peaked from Aug to Oct (Fig. 35), when numbers are highest along all of the California coast, after post-breeding movement from the Farallones (Spear 1988). Spear (1988) found that in late summer and fall most immatures move north from the Farallones as far as Washington, then south of the Farallones for the winter. In years of poor upwelling and consequently poor ocean food supplies, many immatures go south without first going north. Each spring immatures go north again until their third year, when they move close to the Farallones. Individual adults disperse each year to the same location where they remain during the few months they do not occupy territories on the Farallones. Western Gull numbers on the wetlands were lowest from Nov to Apr (Fig. 35) when immatures had dispersed to the south and adults had reoccupied territories on the Farallones; numbers rose slightly in May and Jun (Fig. 35), perhaps because of a later northward movement of sub-adults when upwelling intensified, increasing ocean food supplies. The Western Gull is a marine species preferring estuaries, lagoons, tidal reefs, beaches, and neritic waters. Although most birds stay within 50 km of land, a few range up to 95 km from shore (Sanger 1973, Harrington 1975, Briggs et al. 1987). Western Gulls regularly travel a few kilometers inland to drink and bathe at lakes and reservoirs and feed at dumps. See Spear (1988) for age- and sex-related habitat preferences.

Western Gull numbers at the Farallones reached a plateau in 1959 after rebounding rapidly from low population levels early in the century caused by human disturbance (Ainley and Lewis 1974). Presently, the California population may be at an all-time high because garbage and fish offal produced by an expanding human population have increased the gulls' food resources and consequently their survival rate (especially of juveniles and sub-adults) in winter (Ainley and Lewis 1974, Sowls et al. 1980, Spear et al. 1987). The recent closing of many San Francisco Bay area dumps may reverse this trend.

Glaucous-winged Gull (*Larus glaucescens*)

An uncommon summer resident and a common winter resident (Fig. 36). Virtually all oversummering birds in the Point Reyes area were immatures. Although first-year birds may reach the northern California coast by 14 Sep (ABN: RAE, GSL), substantial influxes of birds to Point Reyes began in Oct (Fig. 36). At the Farallones, in fall there is a peak in late Nov and in spring in late Mar (DeSante and Ainley 1980), just before numbers at two census sites on Point Reyes declined (Fig. 36). Glaucous-winged Gulls prefer estuaries, lagoons, beaches, tidal reefs, neritic waters, and especially garbage dumps. They are also seen in moderate numbers in pelagic waters, with immatures tending to occur farther from shore than adults (Sanger 1973, Harrington 1975, Briggs et al. 1987). Interbreeding between this species and the Western Gull has been documented in the area of sympatry from southern British Columbia to Oregon (Scott 1971, Hoffman et al. 1978). Birds exhibiting characters intermediate between these two species were seen regularly in small numbers on our censuses.

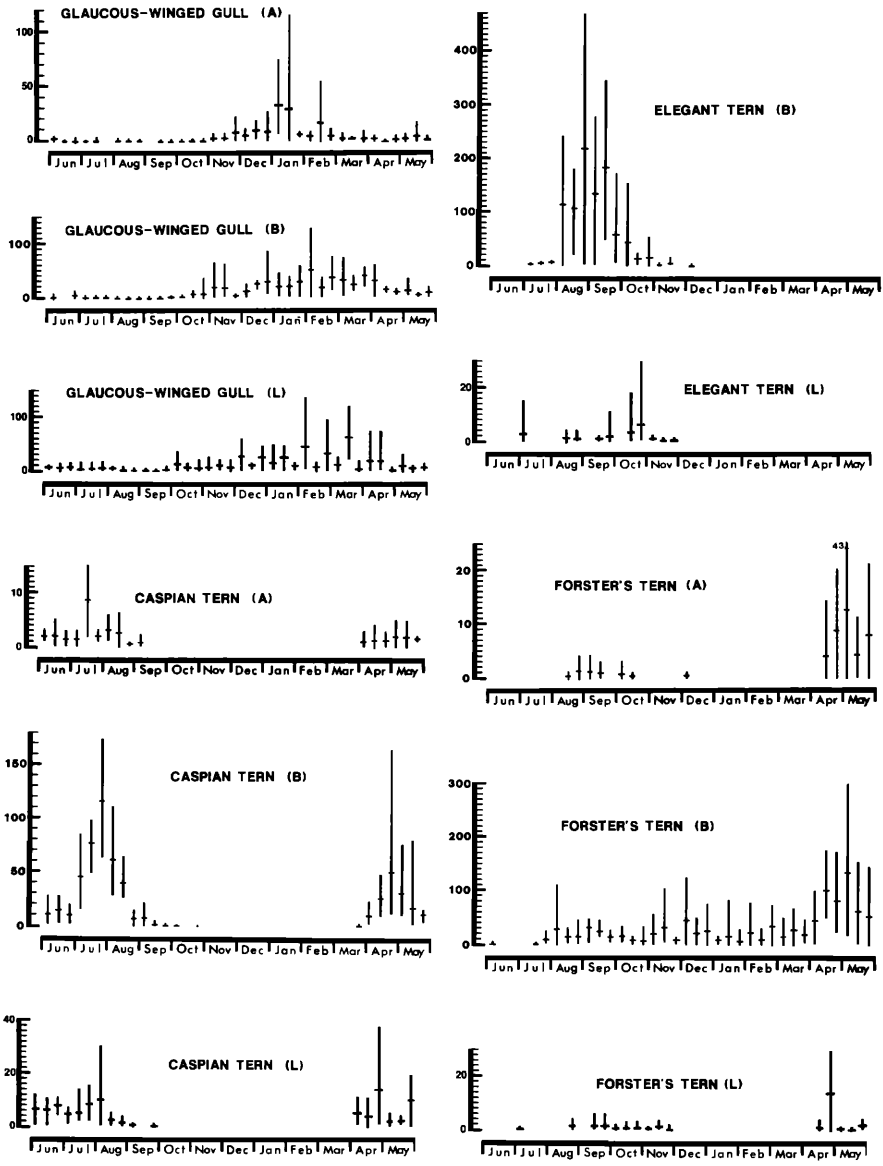

Figure 36. Seasonal abundance of the Glaucous-winged Gull and some terns in wetlands of Point Reyes. See Figure 4 for details.

Glaucous Gull (*Larus hyperboreus*)

A very rare visitant with one census record of one bird at Abbott's on 6 Dec 1975 (DS, JGE). Glaucous Gulls are now reported almost annually from Point Reyes waters on dates spanning 20 Oct to 21 May (ABN); the only adult was at Tomales Bay on 12 Dec 1976 (AB 31: 369). This species is rare the length of the California coast from late Nov to early Apr and is irregular from mid-Sep to late Nov and from early Apr to late May; stragglers have been recorded as late as 21 Jun (AB 39: 958). Almost all records are of immatures, and most of these are first-winter birds (Devillers et al. 1971, McCaskie et al. 1979, Garrett and Dunn 1981). Glaucous Gulls are found at dumps, estuaries, and occasionally well "offshore" (Harrington 1975, ABN).

Black-legged Kittiwake (*Rissa tridactyla*)

A very rare wetland winter visitant with census records of 26 birds on 14 dates from 17 Oct to 29 Jun and scattered non-census records in all months except Aug. Kittiwakes are pelagic birds that associate with the cold landward side of productive waters of the transition zone between warm subtropical and cold subarctic waters found well "offshore" of central California (Ainley 1976b); they may occur in similar densities over shelf, slope, or oceanic waters (Briggs et al. 1987). They typically show up in coastal wetlands only when unusually warm ocean surface temperatures cause them to move to shore (Ainley 1976b). Black-legged Kittiwakes inhabit the open ocean off California primarily from Sep to May and are most numerous from Dec to Mar (Ainley 1976a, Stallcup 1976, McCaskie et al. 1979, Garrett and Dunn 1981, Briggs et al. 1987). After flight years they also occur from Jun to Aug, although numbers dwindle through this period. Our only May to Jun records were for 1976 and followed an exceptional influx that left the highest numbers of kittiwakes to date in late spring and summer on the coast of northern (AB 30: 999, ABN) and southern California (Garrett and Dunn 1981).

Kittiwake numbers in California waters vary greatly from year to year and are highest in years with winter ocean surface temperatures at or below normal (Ainley 1976a); numbers are much lower in El Niño years (Briggs et al. 1987). The timing of peak winter abundance each year also varies greatly with seasonal variation in water temperature (Ainley 1976a,b). The timing of northward movement also varies markedly, as indicated by spring censuses of migrants over the inshore zone of central California, where from 1977 to 1979 numbers peaked from 5 to 24 Mar but in 1976 they peaked on 15 May (ABN: BSa et al.). In 1976 very large numbers of kittiwakes occurred far off California in mid-winter when ocean temperatures were below normal, but apparently unusually warm waters from mid-Feb to mid-Mar forced birds close to shore and precipitated a large die-off. This was followed by large numbers of kittiwakes lingering into spring and summer after water temperatures again fell below normal (Ainley 1976b). Kittiwakes undertake a leisurely long-distance dispersal from the breeding grounds rather than a true migration (Coulson 1966, Ainley 1976a). In 1976 and 1977, during spring movement over the inshore zone of central California, immatures were three times as common as adults (ABN: BSa et al.); although adults and immatures are equally represented in oceanic waters in winter, immatures predominate close to shore (Harrington 1975).

Caspian Tern (*Sterna caspia*)

A fairly common summer visitant, a common fall transient, and a fairly common spring transient (Fig. 36), with census records from 22 Mar to 26 Oct and non-census records from 16 Mar to 14 Nov (ABN). Before the 1980s

Caspian Terns were casual on the northern California coast between late Oct and mid-Mar (ABN). In 1981 arrival averaged about two weeks early at most locations, with the earliest bird noted on 19 Feb (AB 35: 332), and during the winters of 1985–86 through 1987–88 there were sightings of unprecedented numbers of birds (3–10 per year) from Dec to Feb (AB 40: 326, 41: 324, 42: 316).

The few birds oversummering in the study area may be prebreeders (Ludwig 1965, Gill and Mewaldt 1983) or perhaps breeders on long-distance feeding trips, since Bolinas is within the 60-km foraging range of adults (Gill 1976) from the nearest breeding colony on San Francisco Bay in Napa Co. (Gill 1977). Breeding there likely extends from early Apr to Sep, with the first young fledging in late Jun (Gill 1972b, 1977, Ludwig 1965). The early Jul increase in numbers on Point Reyes (Fig. 36) may have been the result of adults and young arriving from nearby breeding colonies, given the timing of breeding and our frequent observation of adults feeding fledged young; our earliest record of a juvenile was for 2 Jul 1980 (DS). After fledging, hatching-year birds disperse primarily to the north (Gill and Mewaldt 1983). Spring migrants pause on the estuaries mostly in Apr and May (Fig. 36). A high spring count was 250 at Bolinas on 26 Apr 1989 (KH). Peak dates of spring migration over inshore waters of the central California coast range from 12 to 29 Apr (ABN: BSa et al.).

Grinnell and Miller (1944) noted a slow recovery in numbers since the era of the feather trade prior to 1900. Since the beginning of this century the Pacific population has shifted from nesting in numerous small colonies in inland freshwater marshes to nesting primarily in large colonies in human-created habitats along the coast (Gill and Mewaldt 1983). Since 1960 the Pacific nesting population has increased by over 70%, and the San Francisco Bay population has increased by about 27% (Gill and Mewaldt 1983). However, our 1973 to 1982 censuses indicated no marked change in the spring population at Bolinas. Caspian Terns at San Diego Bay appear to be suffering from impaired reproductive success due to DDE accumulated from their prey (Ohlendorf et al. 1985). Caspian Terns use estuaries, lagoons, and the immediate inshore zone, as well as freshwater ponds, streams, reservoirs, and marshes. They forage in the shallow water over mudflats but more frequently in tidal channels (Baltz et al. 1979).

Elegant Tern (*Sterna elegans*)

A common summer and fall dispersant from 24 Jun to 4 Dec with highest numbers from Aug to early Oct (Fig. 36). Exceptional non-census records are of four birds at Bolinas on 26 Apr 1989 (ABN: KH) and one at Tomales Bay on 14 Dec 1983 (AB 38: 353). A count of 135 birds at Bolinas on 24 Jun 1986 (RMS) was high because only small numbers usually arrive before the main influx in early Aug (Fig. 36). Elegant Terns dispersing north typically reach southern California, north of the Gulf of California and San Diego breeding colonies, by late Jun and become common in Jul (Garrett and Dunn 1981). They generally arrive progressively later with increasing latitude (ABN). Birds have tended to arrive earlier in the season since about 1977 (Garrett and Dunn 1981, Roberson 1985), paralleling a northward expansion along the coast of the limits of regular post-breeding dispersal and an increase in late winter and early spring sightings since the late 1970s (Cogswell 1977, McCaskie et al. 1979, Morlan and Erickson 1988). Elegant Terns have now been seen on the northern California coast in every month of the year, and small numbers have been seen in Apr and May since 1985 (ABN). These spring birds may be prospecting for new nesting grounds, as they usually remain for short periods, Apr and May are too early for post-breeding dispersal, and the breeding range in southern California continues to expand (AB 41: 1488).

Elegant Terns breeding at San Diego are highly dependent on Northern Anchovies for feeding chicks (Schaffner 1986), and movements of Elegant Terns in California are probably closely related at all times to movements of Northern Anchovies (F. C. Schaffner pers. comm.). Although overall occurrence in northern California is similar to that at Point Reyes (Fig. 36), the timing of arrival in the region is variable and somewhat earlier to the south in the Monterey area (Roberson 1985, ABN). The Elegant Tern's progressively later movement to the north and variable timing of arrival are strikingly similar to those of the Brown Pelican (and Heermann's Gull), another anchovy-dependent species (see pelican account and Schaffner 1986). Timing of arrival may depend on patterns of anchovy abundance and oceanographic conditions, both at the breeding colonies and in the northern areas to which the terns disperse (F. C. Schaffner pers. comm.). The initial size of Brown Pelican breeding populations generally varies little from year to year, but that species' reproductive success is highly variable and positively correlated with anchovy abundance. In contrast to the pattern exhibited by pelicans, the breeding population size of Elegant Terns is variable and positively correlated with anchovy abundance, but the reproductive success of birds that do breed is generally high (Schaffner 1986). Hence, Brown Pelicans arriving early in central California may represent failed breeders (see account) while Elegant Terns arriving early may represent non-breeders (F. C. Schaffner pers. comm.).

In our study area large numbers of Elegant Terns were found consistently only at Bolinas (Fig. 36). Unusual numbers, such as 2500 on 7 Sep 1984, 2000–3000 from 26 to 28 Sep 1984, 3700 on 24 and 25 Aug 1985 (RMS), and over 6000 on 28 Aug 1985 (JGE), concentrated at Bolinas during the very rare anchovy runs inside the lagoon. Another high count was of over 2000 birds in Drake's Bay on 29 Sep 1985 (ABN: JW). Elegant Terns occurred irregularly at Limantour (Fig. 36). During our census period they were recorded at Abbott's only in 1981, a year of high anchovy abundance in southern and central California (Schaffner 1986), on six of seven censuses from 20 Jul to 16 Sep; the high count was 140 on 4 Sep.

Before 1950 Elegant Terns ventured rarely and irregularly north to San Francisco Bay (Grinnell and Miller 1944). Then a dramatic increase began (Cogswell 1977), including establishment of the San Diego colony in 1959 following the El Niño of 1957 and 1958 and coincident with increasing anchovy abundance (Schaffner 1986). Now large numbers of Elegant Terns are present regularly along the north-central California coast in fall (McCaskie et al. 1979, Garrett and Dunn 1981). For many years large numbers dispersed north regularly only as far as the Point Reyes area, but they now reach Humboldt Co. regularly (Morlan and Erickson 1988).

Royal Terns (*Sterna maxima*) formerly occurred as far north as Tomales Bay (Grinnell and Miller 1944). When Elegant Terns increased in California, Royals withdrew almost completely from central California and became less abundant in southern California (Cogswell 1977, McCaskie et al. 1979, Garrett and Dunn 1981). Simultaneously, Pacific Sardine numbers in central and southern California waters declined drastically, while Northern Anchovy numbers increased (Ainley and Lewis 1974, Schaffner 1986). Elegant Terns currently have seasonal movements roughly similar to the anchovy's (Schaffner 1985) and they have increased their numbers and range in California apparently by exploiting anchovy increases. In central California, Royal Terns likely depended heavily on sardines, which were abundant formerly inshore (along beaches, and in estuaries and lagoons) but also ranged to offshore and pelagic waters (Murphy 1966, Schaffner 1985). This dependence is suggested by the decline of the Royal Tern population at the time of the southward retraction of the sardine population (Schaffner 1985). See Appendix for former status of Royal Tern in the Point Reyes area.

Schaffner (1985) reported that in southern California the Elegant Tern feeds farther "offshore" than the Royal Tern, which he considered to be a warm-water species and primarily an "inshore" coastal forager, as it is throughout much of its range. In the Gulf of California, D. W. Anderson (pers. comm.) also notes that Elegant Terns are "pelagic" feeders and that Royal Terns are "inshore" or near-shore feeders. Briggs et al. (1987) reported that Elegant Terns are rare more than 4 km from shore along the California coast and Royal Terns are rare more than 1 km from shore. Our experience at Point Reyes is that Elegants forage in shallow water very close inshore and inside estuaries, harbors, and lagoons. Grinnell and Miller (1944) reported that Royal Terns forage "on the open ocean, mostly well offshore," areas that had been less intensively exploited by the sardine fishery (F. C. Schaffner pers. comm). Thus, these seemingly conflicting reports of habitat preference probably represent geographical differences in seasonal movements of anchovies, historical expansions and contractions of the anchovy populations, and possible seasonal observer biases.

Common Tern (*Sterna hirundo*)

A very rare fall transient, with 48 birds on 11 censuses from 7 Aug to 26 Sep, and a very rare spring transient, with 17 birds on 8 censuses from 21 Apr to 29 Jun. Most census records were for Abbott's, but Common Terns were also seen with regularity at Tomales Bay (DS). Marin Co. records extend from 9 Apr (JGE) to 19 Dec (AB 26: 651) with a fall peak of migrants from mid- to late Sep and a spring peak in mid-May (Fig. 12). Peak spring migration dates over inshore waters of the central California coast range from 25 Apr to 12 May (ABN: BSa et al.). Migration periods in northern California extend from early Apr through May in spring (with stragglers in Jun) and from early Jul to early Nov in fall (McCaskie et al. 1979, ABN). Common Terns are casual in northern California after mid-Nov (McCaskie et al. 1979), with the latest record being for 4 Jan (AB 38: 353).

Common Terns frequent estuaries, lagoons, and inshore and offshore waters. The general scarcity of the species along the shoreline of most of northern California, especially in spring (ABN), contrasts with the situation in the Monterey area, where the species is common, possibly because there the deep waters of the Monterey Submarine Canyon occur within a few miles of shore (Roberson 1985). This difference suggests Common Terns migrate over deep neritic waters at distances from shore influenced somehow by underwater topography. Briggs et al. (1987) reported that Common Terns are most numerous within 25 km of shore.

Forster's Tern (*Sterna forsteri*)

A very rare summer visitant, a fairly common fall transient, a fairly common winter resident, and a common spring transient (Fig. 36). Forster's Tern is primarily a transient in the Point Reyes area, although birds winter in moderate numbers at Bolinas (Fig. 36) and Tomales Bay (DS, JGE) and in small numbers at Bodega Harbor (DS). Spring migration extended from early Apr to late May and post-breeding dispersal and fall migration extended primarily from mid-Jul to mid-Oct, with stragglers to early Dec (Fig. 36). Migration over inshore waters of the central California coast begins in mid- to late Mar (ABN), and peak dates range from 24 Apr to 13 May (24 to 28 Apr in three of four years, ABN: BSa et al.). Breeding in San Francisco Bay extends from late Apr (Gill 1972b, 1977) probably until Sep, with the first young fledging in late Jun. In the Point Reyes area Forster's Terns were seen in only a few instances during the middle of the breeding season, although they occur regularly at that season as close as Tiburon in San Francisco Bay (BiL). Numbers at Bolinas began increasing by late Jul (Fig. 36), presumably as a consequence of post-breeding dispersal from nearby breeding

colonies since there are recoveries in Marin Co. of birds banded at San Francisco Bay. The limited evidence suggests most post-breeding dispersal is to the north (Gill and Mewaldt 1979). The first fall arrivals at Limantour and Abbott's in Aug (Fig. 36) may have been migrants from the north or dispersants from San Francisco Bay breeding colonies spilling over into less desirable habitat.

Since 1948 the San Francisco Bay nesting population has increased from about 100 pairs at one site (Sibley 1952) to about 2500 pairs at eight major sites (Gill 1977, Rigney and Rigney 1981). Although spring numbers at Bolinas have been relatively constant over the years, winter numbers have increased greatly (Fig. 14). This parallels the increase of winter numbers in Sonoma Co. (G. L. Bolander and Parmeter 1978) and the length of the northern California coast from the mid-1970s (AB 30: 762, AB 31: 369) to the present (AB 42: 316). A flock of 250 Forster's Terns off Bolinas on 31 Dec 1988 (ABN: PP) exemplifies this trend and approaches in size high counts during spring migration (Fig. 36). Forster's Terns inhabit estuaries, lagoons, inshore waters, freshwater ponds, and marshes. They feed primarily over mudflats in water 1 m or less deep (Baltz et al. 1979) but do not catch fish deeper than 30 cm (Salt and Willard 1971). Over the ocean they range to 15 km from shore (Briggs et al. 1987).

Black Tern (*Chlidonias niger*)

A very rare fall and spring visitant with census records of an immature at Abbott's on 27 Aug and 4 Sep 1980 (ABN) and a breeding-plumaged bird at Bolinas on 5 May 1982. Additional non-census records are of four single birds in fall, extending the date span to 15 Oct, and singles on 14 May 1965 and 30 May 1989 (ABN). In coastal northern California Black Terns are rare but regular transients from 23 Apr to 7 Nov, with most records in May, Aug, and Sep (ABN); there is also one record for 24 and 25 Jan (AFN 24: 536). The increasing abundance of migrant Black Terns from north to south along the coast of California (Garrett and Dunn 1981, McCaskie et al. 1979) indicates that virtually all birds move to and from interior breeding grounds via interior routes that intersect the coast in southern California or farther south. Since at least the 1940s, the Black Tern has decreased in California both as a migrant (Garrett and Dunn 1981) and as a breeder (McCaskie et al. 1979). Transients on the northern California coast have been found in estuaries, lagoons, marshes, freshwater ponds, and, occasionally, over the open ocean up to 16 km from shore (Willett 1933, ABN).

Common Murre (*Uria aalge*)

A very rare fall and winter visitant to the estuaries with eight single birds on eight dates from 28 Jul to 3 Oct at Limantour and Bolinas and single birds at Bolinas on 8 Feb 1973 and 21 Jan 1976. Common Murres breed regularly at three sites along our inshore study area, and 17% of California's population breeds nearby on the Farallon Islands (Sowls et al. 1980). Adults and flightless young disperse from these breeding sites between late Jun and mid-Aug (Boekelheide, Ainley, Morrell, Huber, and Lewis in press), shortly before most records of murres in the small estuaries. Most of our estuarine records were of immatures that were likely starved, sick, or injured, as juvenile mortality is very high at that season (Stenzel et al. 1988). Murres also occur regularly in the mouth of San Francisco Bay in "late summer" (Grinnell and Wythe 1927) and sometimes in outer Tomales Bay. Common Murres primarily inhabit inshore and offshore waters out to the edge of the continental shelf, with most birds concentrated on the inner shelf usually between depths of 55 and 150 m (Wahl 1975, Briggs et al. 1987). In the 1970s, the Farallon breeding population recovered dramatically from near extinction due to commercial egging, oil pollution, and disturbance

(Ainley and Lewis 1974), only to decline markedly again in the 1980s because of poor ocean productivity in El Niño years, oil pollution, and gill netting (Takekawa et al. in press). Recent declines of populations on the central California coast, including all three colonies along our inshore study area, have been even more dramatic than on the Farallones.

RESULTS AND DISCUSSION

Abundance

In all, 122 species, representing 16 families of aquatic birds, were recorded on the wetland censuses. Additional species that have been sighted at other times in the Point Reyes area (Appendix), but were not detected on censuses because of their extreme rarity or their use of non-estuarine habitats, are not included in the following analyses. Three families—the Anatidae (waterfowl), Scolopacidae (sandpipers and phalaropes), and Laridae (jaegers, gulls, and terns)—accounted for 68.0% of all species on censuses. Of the 122 species, 7.4% were abundant during at least one season, 11.5% were very common, 21.3% were common, 9.0% were fairly common, 8.2% were uncommon, and 42.6% were rare to very rare (Table 3). Of the 52 very rare or rare species, 34 are "very uncommon" or rarer in coastal northern California (McCaskie et al. 1979) or "uncommon" or rarer in coastal southern California in the comparable season (Garrett and Dunn 1981), 15 are more numerous on the coast in aquatic habitats poorly represented in the censused wetlands (Table 3), and 3, the Spotted Sandpiper, Clapper Rail, and Clark's Grebe, are difficult to compare for varying reasons. The Spotted Sandpiper's solitary behavior and patchy local distribution caused us to categorize it as rare whereas its overall widespread distribution renders it fairly common on a regional scale (McCaskie et al. 1979, Garrett and Dunn 1981). Likewise, Clapper Rails are more common at the regional level than at Point Reyes because of their restriction to a habitat lacking in our study area. Although Clark's and Western grebes were not differentiated in regional accounts (McCaskie et al. 1979, Garrett and Dunn 1981) or during our censuses, the available evidence (see accounts) suggests that these two species occur in the same relative abundance on Point Reyes as they do along the entire California coast.

Seasonal Use Patterns

The 70 most numerous species (categories abundant through uncommon), of course, dominate the seasonal use of the wetlands (Table 3). Although most of these species occur during more than one season, we have categorized each by one of six primary use patterns: *year-round resident* (4 species), *summer resident* (1 species), *winter resident* (46 species), *transient* (15 species), and *dispersant* (4 species).

A species-by-species analysis provides some insight into the importance of the estuaries to spring and fall migrants. Of the 15 transient species, six had roughly equivalent spring and fall peaks, two had almost exclusively spring peaks, three had peaks greater in spring than in fall, and four had peaks greater in fall than in spring. Of the 46 winter resi-

Table 3 Abundance Ranking for the Season of Peak Occurence of 122 Species of Aquatic Birds on Wetland Censuses at Point Reyes

Abundant
- Northern Pintail
- American Wigeon
- Ruddy Duck
- American Coot
- Western Sandpiper
- Least Sandpiper
- Dunlin
- Bonaparte's Gull
- Mew Gull

Very Common
- Brown Pelican
- Black Brant
- Green-winged Teal
- Surf Scoter
- Bufflehead
- Black-bellied Plover
- Willet
- Marbled Godwit
- Sanderling
- Short-billed Dowitcher
- Heermann's Gull
- Ring-billed Gull
- California Gull
- Western Gull

Common
- Horned Grebe
- Eared Grebe
- Western Grebe
- Double-crested Cormorant
- Great Egret
- Mallard
- Cinnamon Teal
- Northern Shovelar
- Gadwall
- Canvasback
- Greater Scaup
- Lesser Scaup
- White-winged Scoter
- Common Goldeneye
- Snowy Plover
- Semipalmated Plover
- Killdeer

Common (Continued)
- American Avocet
- Black Turnstone
- Long-billed Dowitcher
- Red-necked Phalarope
- Herring Gull
- Glaucous-winged Gull
- Caspian Tern
- Elegant Tern
- Forster's Tern

Fairly Common
- Common Loon
- Pied-billed Grebe
- American White Pelican
- Great Blue Heron
- Snowy Egret
- Black-crowned Night-Heron
- Red-breasted Merganser
- Whimbrel
- Long-billed Curlew
- Common Snipe
- Red Phalarope

Uncommon
- Red-throated Loon
- Ring-necked Duck
- Virginia Rail
- Sora
- Greater Yellowlegs
- Ruddy Turnstone
- Red Knot
- Baird's Sandpiper
- Pectoral Sandpiper
- Thayer's Gull

Rare[a]
- NW Pacific Loon
- Clark's Grebe
- •• Redhead
- Spotted Sandpiper

Table 3 (Continued)

Very Rare			
**	Red-necked Grebe	**FW	Hooded Merganser
OW	Ashy Storm-Petrel	FW	Common Merganser
NW	Brandt's Cormorant	**	Black Rail
NW	Pelagic Cormorant		Clapper Rail
* FW	American Bittern	**FW	Common Moorhen
**	Little Blue Heron	**UP/FW	Sandhill Crane
* UP/FW	Cattle Egret	**	Lesser Golden-Plover
**FW	Green-backed Heron	SP/FW	Black-necked Stilt
**	White Ibis	FW	Lesser Yellowlegs
* FW/UP	Tundra Swan	RC	Wandering Tattler
**FW/UP	Greater White-fronted Goose	**	Bar-tailed Godwit
		RC	Surfbird
**FW/UP	Snow Goose	**	Semipalmated Sandpiper
**FW/UP	Ross' Goose	**	Curlew Sandpiper
**	Emperor Goose	**	Stilt Sandpiper
* FW/UP	Canada Goose	**	Ruff
**FW	Wood Duck	SP/FW	Wilson's Phalarope
**FW	Blue-winged Teal	NW	Parasitic Jaeger
**	Eurasian Wigeon	**	Franklin's Gull
**	Tufted Duck	**	Glaucous Gull
**	King Eider	OW	Black-legged Kittiwake
**	Harlequin Duck	NW	Common Tern
**	Oldsquaw	**FW	Black Tern
**	Black Scoter	NW	Common Murre
**	Barrow's Goldeneye		

[a] A double asterisk indicates the species is "very uncommon" or rarer in coastal northern California (McCaskie et al. 1979), and "uncommon" or rarer in coastal southern California (Garrett and Dunn 1981); a single asterisk indicates the species is relatively rare in one region but not the other. Codes for habitat preferences that may explain rarity on estuaries or lagoons but not on the coast as a whole: FW, freshwater; NW, neritic waters; OW, oceanic waters; RC, rocky coasts; SP, salt ponds; UP, moist uplands.

dents, only 11 had pronounced peaks of migrants. Of these four had spring and fall peaks roughly equivalent, while seven had only pronounced fall peaks. Numbers of the four species of dispersants all peaked in late summer or fall. Because of the tendency of young birds to migrate over broader corridors or to wander out of range in fall, inclusion of rarer species in these breakdowns would bolster the total number of species with fall peaks, but these species represent relatively few individuals. Clarification of the importance of the wetlands as spring and fall staging areas awaits detailed analysis of numerical abundance rather than species totals for these seasons.

Because the dispersant category of seasonal use is not recognized in most avifaunal works, the five species so classified (including the rarer Cattle Egret) deserve further comment. Although these species generally move long distances between breeding and non-breeding areas they are

not true transients that proceed from point *A* to point *B* during annual migrations. Instead they generally disperse northward after breeding, and later retract southward, with the distance, timing, duration, and intensity of dispersal varying greatly (within certain bounds) with fluctuating food resources. Cattle Egrets disperse north into the Point Reyes area from more southerly breeding areas between late fall and early winter. The coincidence of their arrival with the initial part of the rainy season, rather than the end of their breeding season, suggests the dispersal is related to enhanced food resources rather than to post-breeding wanderings. Brown Pelicans, Heermann's Gulls, and Elegant Terns all disperse north along the California coast from their primary nesting grounds in the Gulf of California with the timing, duration, intensity, and distance of their movements apparently fluctuating with food (anchovy) availability in the California Current (see Species Accounts). In the fall, California Gulls migrate to the Pacific Coast from interior breeding sites. They then fan out along the coast, but initially concentrate to the north. A pattern of progressively later peaks of abundance of California Gulls with decreasing latitude along the coast coincides in timing with southward shifts in the abundance of Brown Pelicans, Heermann's Gulls, and Elegant Terns. This pattern suggests that, once on the coast, California Gulls also disperse as a result of a southward shift in food availability. Although exhibiting other primary seasonal use patterns, at least part of the Western Gull and Brandt's Cormorant populations also disperses north along the coast in summer and fall then returns south, presumably also in response to seasonal fluctuations in food supply. The category of dispersants separates out another group of species with common characteristics of seasonal occurrence, further highlighting the complexities of seasonal movements of waterbirds.

Most of the 122 species found on our wetland censuses do not breed locally. Only 10 species breed regularly in or within 1 km of the wetlands: Pied-billed Grebe, Great Blue Heron, Great Egret, Green-backed Heron, Mallard, Cinnamon Teal, Virginia Rail, American Coot, Snowy Plover, and Killdeer. Eight species breed irregularly in or within 1 km of the wetlands: American Bittern, Snowy Egret, Gadwall, Ruddy Duck, and Common Moorhen, definitively, and Blue-winged Teal, Black Rail, and Sora, probably. Of the 122 species an additional 19 breed regularly within 75 km, either in San Francisco Bay, on the Farallon Islands, on other coastal rocks and bluffs, or at inland lakes, streams, or marshes: Ashy Storm-Petrel, Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Black-crowned Night-Heron, Canada Goose, Wood Duck, Northern Pintail, Northern Shoveler, Common Merganser, Clapper Rail, Black-necked Stilt, American Avocet, Spotted Sandpiper, California Gull, Western Gull, Caspian Tern, Forster's Tern, and Common Murre.

When we compared the primary seasonal use patterns of the most numerous species (abundant through uncommon) within and between taxonomic groups (Table 3), certain trends were evident. All loons (Gaviidae) and grebes (Podicipedidae) were winter residents. Of the 17 species of waterfowl (Anatidae), all were primarily winter residents except

for the Mallard, which is a year-round resident, and the Black Brant (formerly a winter resident), and Cinnamon Teal, which are primarily spring transients. All rails (Rallidae) were primarily winter residents. Of the 24 shorebird species (Charadriidae, Recurvirostridae, and Scolopacidae), 14 were winter residents and 10 were transients. The importance of the Point Reyes wetlands to migrant shorebirds is further indicated by the fact that five winter residents became even more numerous in migration. Snowy Plovers, Killdeers, and American Avocets might be classified as year-round residents but we considered them primarily winter residents because numbers on the coast of all three increased substantially in winter. Species of pelicans and cormorants (Pelecanidae and Phalacrocoracidae), herons and egrets (Ardeidae), and gulls and terns (Laridae) were rather widely distributed among the various seasonal use categories.

These comparisons stress that Point Reyes wetlands are used primarily by wintering species, secondarily by migrants, less by dispersants, and relatively little by year-round residents, summer residents, and local breeders. About three-quarters of the winter residents, which include loons, grebes, ducks, coots, shorebirds, and gulls, did not have migratory peaks on the estuaries, indicating that the wetlands served primarily as a final destination rather than a staging area for migrants. However, at least a few species in most taxonomic groups showed peaks of migrants. Although shorebirds were the predominant species using Point Reyes' wetlands during migration periods, the wetlands were a major staging area for only one species of shorebird, the Western Sandpiper in spring. But the importance of Point Reyes estuaries to migrant shorebirds should not be downplayed as Point Reyes is one of only 10 areas on the Pacific Coast known to support 20,000 or more shorebirds during the peak of migration (Senner and Howe 1984). The Black Brant, which concentrates in Drake's Estero and Tomales Bay during spring migration, is another species for which the Point Reyes estuaries serve as a major staging area. Large numbers of loons and scoters appear to use the inshore zone of Drake's Bay as a staging area in spring and fall. Also, Surf Scoters stage in large numbers in Tomales Bay, and further work there may document the importance of that bay to other migrant species. Most species that occurred primarily as transients had peaks in both spring and fall, indicating that their populations typically pass along the central California coast in both seasons. Although species richness is highest during the transition from autumn migration to the winter period we did not determine if overall aquatic bird abundance parallels this trend.

The change through the year in the species composition of the wetland community resulted from the combination of a large number of different species' seasonal use patterns. From late May to late June abundance and diversity were at the yearly low. Post-breeding influxes of birds in June and July consisted predominantly of shorebirds, terns, and dispersants from the Gulf of California; in August and September of dabbling ducks and shorebirds; and in October and November of diving and dabbling ducks, gulls, loons, and grebes. Many of the species that arrived

in October and November continued to increase into December. Most transient shorebirds and terns passed through by mid-October; some wintering species continued to increase through the fall. Gulf of California dispersants declined in October and November. Although spring migration began in late January with the arrival of Cinnamon Teal, in February and March the most abundant species of wintering waterfowl, shorebirds, and gulls were still at mid-winter peaks or, particularly in wet years, declining. Numbers of dabbling ducks and diving ducks that feed in shallow water declined rapidly in March, whereas most loons, grebes, and diving ducks declined in April. April was the peak month of spring shorebird migration, when the wintering numbers of some species were augmented by migrants and other purely transient species passed through the wetlands; terns were also migrating in April. Departure and migration continued though most of May until species diversity and population sizes reached summer lows late that month or in early June.

Inter-wetland Variation in Seasonal Occurrence

Most instances of the occurrence pattern of a single species varying among sites appeared to be explainable by habitat and resource differences. Occurrence patterns at Abbott's Lagoon frequently differed from those at the two estuaries, apparently because of different hydrographic regimes. Because Abbott's is a true lagoon with a barrier bar (see Methods), it becomes tidal infrequently and irregularly in winter. Water levels generally rise with the winter rains and decline during the summer dry period. In contrast to the situation at the estuaries, at Abbott's Lagoon Black-bellied Plovers, Semipalmated Plovers, Killdeer, Marbled Godwits, Sanderlings, Western Sandpipers, Least Sandpipers, and Dunlins (Figs. 23, 25, 27, 28, 29, and 30) remained numerous for an extended period in fall, were scarce and irregular in winter, and showed at most a limited peak in spring. The winter decline of shorebirds at Abbott's may have been due partly to the inundation of foraging flats by rising water levels during winter. However, censuses at Abbott's throughout the drought winter of 1975–76 did not reveal numbers of shorebirds consistently higher than in wet years. An alternative explanation may be that because of the lack of tidal influence and fluctuating winter salinities, Abbott's supports low numbers of prey which are depleted early in the season, forcing birds to move on. Shorebirds can deplete prey populations during migration (Schneider and Harrington 1981), but it is unknown if prey depletion itself ever causes shorebirds to migrate.

Numbers of Sanderlings at Abbott's appeared to be more closely linked to water levels than did those of other shorebirds. Sanderling numbers there increased rapidly when new feeding areas were exposed by dropping water levels when storms opened the lagoon mouth (see account). Funderburk and Springer (1989) also reported increased use by shorebirds of foraging flats exposed by dropping water levels at lakes Earl and Talawa.

Rising water levels that reduced food *availability* seemed to explain both declining winter numbers of American Wigeon, Ruddy Ducks, and American Coots at Abbott's (Figs. 17, 22, and 23) and a shift of these species and the Gadwall from freshwater ponds to the estuary at Limantour (Fig. 18). *Depletion* of food resources by the birds also may have caused these shifts.

Many differences in occurrence patterns appeared to be caused by strong preferences for one site over another, presumably because of gross differences in resources between sites. This probably explained why Brown Pelicans, Black-crowned Night-Herons, American Avocets, Common Snipes, and Elegant Terns occurred regularly at Bolinas Lagoon but irregularly at Limantour and Abbott's. Apparently for similar reasons a species that used two or three sites regularly differed in its seasonal use of those sites. For example, Forster's Terns occurred only as migrants at Abbott's and Limantour but also wintered at Bolinas (Fig. 36); Semipalmated Plovers occurred primarily as migrants at Abbott's and Bolinas but also wintered at Limantour (Fig. 25); Black Turnstones occurred only as migrants at Abbott's but also wintered at Bolinas and Limantour (Fig. 27); Western Sandpipers staged during spring migration primarily at Bolinas (Fig. 28). Although not documented by our census work, peak numbers of loons, grebes, cormorants, diving ducks, and gulls at Tomales Bay surely must have differed in timing from peaks at the other sites because Pacific Herring runs in Tomales draw thousands of birds there at irregular intervals in winter. That numbers of loons, grebes, and scoters in summer in inshore waters (Fig. 5) are higher than in wetlands (Figs. 4, 8, and 21) also suggests resource differences between the areas. In this case birds may move into less desirable areas as their numbers increase in fall and winter and then concentrate in preferred areas when numbers decline in summer.

The absence of Black-crowned Night-Herons at Limantour and Drake's may have been due to an absence of suitable daytime roosts. It is also possible that tradition, or proximity to the large San Francisco Bay population, may have played a role in the occurrence of a regular population of Long-billed Curlews at Bolinas since their main prey items (Stenzel et al. 1976) also occur in abundance at Limantour, where the curlew occurred only rarely. Certain species were numerous at only one site during the nesting season because the site offered requisites for breeding lacking at other sites. Examples were Great Egrets and Great Blue Herons at Bolinas (Fig. 10) and Mallards and Cinnamon Teal at Abbott's (Figs. 13 and 15). Particularly early arrival at one site, for example, of Northern Shovelers at Bolinas or Ruddy Ducks at Abbott's (Figs. 17 and 22), may have reflected the earlier settling of birds at preferred sites, as documented for other species elsewhere (Zwarts 1976, Goss-Custard 1977, van der Have et al. 1984).

We have no ready explanations for many differences in seasonal use patterns. For example, why was the spring peak of Semipalmated Plovers at Bolinas greater than the fall peak when the reverse was true at both Limantour and Abbott's (Fig.25)? Why did the occurrence pattern of Buffleheads differ at three sites (Fig. 22)? Conversely, did similar pat-

terns observed for the same species at different sites really reflect equivalent use? We suspect that the fall peak of Least Sandpipers at Bolinas may have represented fall staging or migration, while a similar peak at Abbott's (Fig. 29) may have reflected movement in relation to rising water levels or prey depletion.

Variation in Timing and Abundance

Although many facets of waterbird movements seem to be internally regulated, there is a certain amount of fine tuning influenced by external factors. In the Point Reyes area rainfall and winter storms appeared to be the most important immediate factors influencing waterbird movements locally and regionally. Changing water levels appeared to cause local shifts of dabbling ducks and coots from ponds to the estuary at Limantour, fall declines in shorebird numbers at Abbott's Lagoon, and dramatic influxes of Sanderlings to Abbott's. Annual variation in the timing of rainfall and storms also appeared to influence the timing of movements. The arrival of Common Snipe at Bolinas was influenced by the onset of winter rains. Rainfall also broadened the spectrum of winter habitat use of shorebirds, such as Black-bellied Plovers, Killdeer, Dunlins, Least Sandpipers, Long-billed Dowitchers, and Marbled Godwits (see accounts), that fed and roosted in rain-soaked pastures, especially at high tides.

Rainfall was also linked with rapid declines of the Northern Pintail, American Wigeon, Dunlin, and Long-billed Dowitcher at Bolinas Lagoon (see accounts). Pintail departure after intense mid- to late winter rain was a regular phenomenon except in very dry years, while wigeon departure after intense rainfall was less predictable. Wigeon may be able to remain at Bolinas longer than pintail because, unlike other dabbling ducks there, wigeon graze extensively in fields and marshes. The infrequent departure of the Dunlin and Long-billed Dowitcher suggests that these species usually adapt to local flooding and flee only under extreme circumstances. Rainfall and storm tides presumably may force departure by flooding favored feeding areas for extended periods. The effect of storms on high tides was more dramatic at Bolinas than at Limantour apparently because the former receives more stream inflow for its size and because the estuary mouth faces south toward storm winds and ocean swells. Siltation during heavy runoff covers feeding areas at creek deltas, possibly affecting the dabbling ducks that concentrate there. Lack of rainfall may have triggered slightly earlier arrival of some species in 1976–77, the second winter of a two-year drought. Although our censuses were infrequent that year, the Northern Pintail, American Wigeon, and American Avocet appeared to arrive slightly earlier, perhaps because of the shortage of shallow freshwater habitat inland.

Species that depend the most on irregularly fluctuating resources varied the most in timing of arrival, departure, and peak abundance. The schedules of Brown Pelicans (Fig. 9), Heermann's Gulls, and Elegant Terns (species breeding primarily in the Gulf of California) varied more than those of other regularly occurring estuarine species. The timing of

arrival of these species along the California coast is dependent mostly on when and whether birds initiate or fail in their breeding attempts, which is influenced by productivity in the Gulf of California (see Species Accounts). However, oceanic conditions along the California coast can affect the timing of regional peaks because dispersal northward along the coast generally follows the progression of upwelling in that direction (Anderson and Anderson 1976, Briggs et al. 1983, Bakun et al. 1974, Brinton 1976). In addition, local resource fluctuations such as anchovy runs also markedly affected seasonal or yearly variation in the period of peak abundance of these same species on the estuaries (see Species Accounts). As described in the previous section, Pacific Herring had a similar influence on the timing of peak numbers of loons, cormorants, scoters, and gulls in Tomales Bay. The irregular timing and abundance of Red Phalaropes, Bonaparte's Gulls, and Black-legged Kittiwakes on the estuaries also appeared to be related to fluctuating resources in the ocean (see Species Accounts). These species typically were numerous on the estuaries only when poor food supplies or storms caused them to look for alternative foraging habitats or shelter.

A few species increased or declined in abundance during the study (Fig. 14, Species Accounts). An increase was apparent in the number of wintering Marbled Godwits and Gadwalls at Limantour and Bolinas, in the latter species paralleling a continent-wide trend (Johnsgard 1978, Bellrose 1980). For the Red-breasted Merganser spring numbers increased at Limantour and Bolinas and winter numbers increased just at Limantour. Winter numbers of Buffleheads and Snowy Egrets increased at Bolinas, as did winter numbers of Black-bellied Plovers, Pied-billed Grebes, and Northern Shovelers at Limantour. Forster's Terns increased in winter and spring at Bolinas, the winter increase paralleling an overall increase in northern California (see Species Account). Range expansions accounted for increases in two species. American Avocets are continuing to expand their range and numbers in northern California. They have occurred regularly on Bolinas Lagoon since at least 1971, and their numbers increased through the 1975–77 drought. They have since stabilized at somewhat lower levels. Although rather rare in the area, the Cattle Egret was first recorded at the time of its initial range expansion into northern California and now occurs annually on Point Reyes. Populations of fewer species declined. Numbers of wintering Willets declined slightly at Bolinas. Winter numbers of American Coots declined at Bolinas and at Limantour; at Bolinas the precipitous decline occurred during the second year of the 1975–77 drought.

The abundances of some species appeared to vary in concert. The yearly variation in abundance of three fish-eaters, Western/Clark's Grebe, Red-breasted Merganser, and Forster's Tern, closely paralleled each other over a 7-year period (Fig. 37), suggesting similar resource use. During the two drought winters we recorded high numbers of most species of dabbling ducks, American Coots, American Avocets, and Dunlin, which were followed by much lower numbers in 1977–78 (Fig. 14), when rainfall returned to normal levels. Presumably these species concentrated on estuaries when freshwater habitats inland dried up.

Overview

In recent years intensive census studies (e.g., Prater 1981) and especially ecological studies of single species (e.g., Evans 1984, Pienkowski and Evans 1984) have expanded our understandings of the complexities of seasonal movements. Seasonal occurrence patterns respond to, and compromise with, constraints placed upon species in their efforts to breed, molt, migrate, and maintain themselves over winter. To meet different seasonal demands waterbirds frequently move great distances. Although generally these movements are between summering and wintering areas, there are also many within-season movements. Shorebirds may use a number of areas within a general wintering range. For example, some birds may migrate to one area in fall to molt

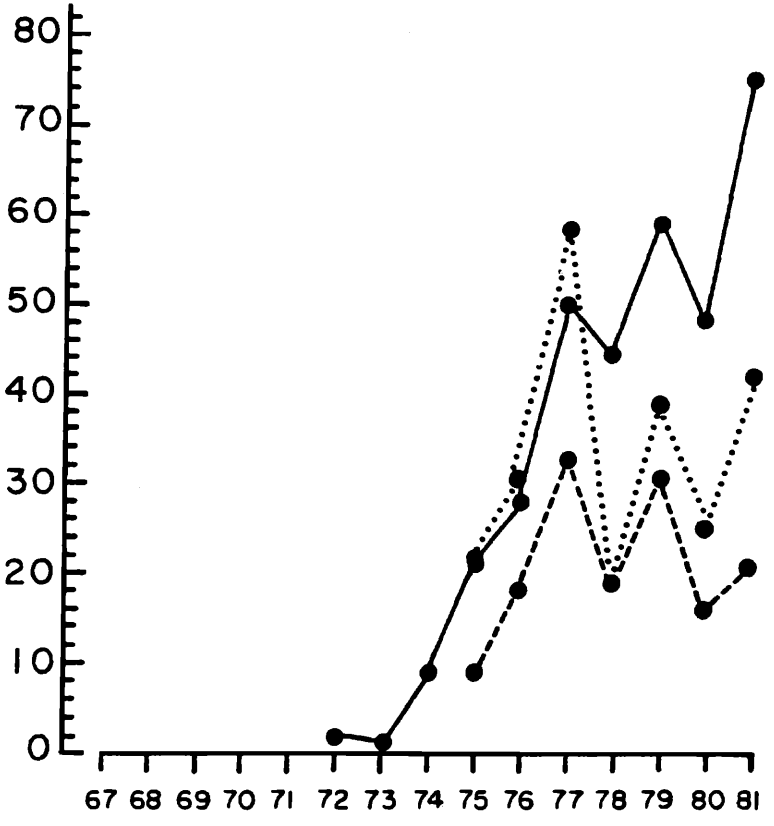

Figure 37. Winter numbers of three species of fish-eating birds at Bolinas Lagoon between 1972–73 and 1981–82. Dotted line, Western/Clark's Grebe; dashed line, Red-breasted Merganser; solid line, Forster's Tern.

("molt migration"), to another to "overwinter," and to yet another for spring molt before commencing long-distance migration to their breeding grounds (Pienkowski and Evans 1984). "Oversummering" shorebirds also move unknown directions for unknown durations (Loftin 1962). Waterfowl undertake short-distance molt migrations, post-breeding dispersal, and sometimes northward movements in fall during unseasonally mild weather (Hochbaum 1955). Strategies used in one season may have far-reaching effects in another. For example, in shorebirds the distance a species migrates or the degree of sexual segregation on the wintering grounds may be linked to the mating system (Myers 1981a,b).

Within species, layers of complexity in seasonal use patterns are (1) differences in migration routes and timing in different populations (e.g., see Harrington and Morrison 1979); (2) different schedules of migration by age and sex classes (see Page et al. 1979, Morrison 1984); (3) geographic or habitat segregation of sex or age classes on the wintering grounds (e.g., Bellrose et al. 1961, Page et al. 1972, Alexander 1983, Jorde et al. 1984); and (4) different seasonal use strategies of individuals (e.g., Evans and Pienkowski 1982, Townshend 1985). Many of these complexities follow predictable patterns within taxonomic groups. Although there are exceptions, in shorebirds the timing of migration of the sexes typically differs in spring (e.g., Myers 1981b) and fall (e.g., Morrison 1984). In fall adults migrate before juveniles (e.g., Page et al. 1979). Fall migration is slower than spring migration (e.g., Pienkowski and Evans 1984, Jehl 1979), and the fall migratory pathways of juveniles are broader than those of adults (e.g., Jehl 1979). Within a taxonomic group, there is, of course, some variation in seasonal use strategy such as the short- or long-hop migrations of shorebirds (e.g., Pienkowski and Evans 1984). Trends in seasonal use patterns may cross taxonomic boundaries. Both shorebirds and waterfowl "oversummering" on the wintering grounds are usually immature (Bellrose 1980, Johnsgard 1981).

Despite the vast improvement in knowledge of the details of seasonal movements, the reasons for concentrations of particular species on particular estuaries at particular times of year are poorly known (Evans 1984). Much of the recent work on winter ecology of waterbirds has focused on energetics and how birds stay alive. However, changes in species' use of an area have seldom been shown to relate to the density of available prey or changes in daylight or average winter temperatures, any of which might be expected to make a difference in a bird's ability to maintain itself. This lack of correlation suggests that many environmental factors may not be the proximate causes of movements within the nonbreeding range (Evans 1976, Evans and Dugan 1984). Although hard weather induces some movements in winter, apparently most estuarine shorebirds attempt to endure, not flee, periods of adverse weather (Evans 1976); hard-weather movements appear more frequent in inland species of shorebirds (Pienkowski et al. 1984). Some patterns of change in winter numbers may depend upon movements from outside the local system, some on the social behavior of birds on an estuary (see Townshend 1985). Most studies, however, have been conducted at lati-

tudes where freezing temperatures are thought to be the primary factor increasing energy demands while decreasing prey activity and availability (e.g., Evans and Dugan 1984, Pienkowski et al. 1984). In some climates rainfall acting via water levels can cause movements of waterbirds that rely on ephemeral freshwater habitats (e.g., Kushlan 1981). Our census studies on Point Reyes wetlands suggested that, in a seasonally wet environment, rainfall and storms also caused waterbirds to move.

Much remains to be learned about the patterns and causes of seasonal waterbird movements, which will be understood only through the coordination of census efforts with studies of individual species, particularly those involving marked birds. Census studies alone have many inherent limitations since our perceptions of seasonal abundance patterns obtained from graphs may not be correct. For example, a spring decline of Sanderlings at Bodega Bay easily might have been interpreted as the beginning of spring migration, but sightings of banded birds revealed that the decline reflected local movements to Point Reyes (Myers et al. 1985). Also, stable mid-winter peaks may suggest a lack of movement when in fact they conceal a dynamic stability in which departures and arrivals roughly cancel each other out (Evans and Pienkowski 1982, Myers et al. 1985). For species that occur year round, migration timing may be demonstrated only by intensive banding studies (e.g., Warriner et al. 1986). The importance of broad regional work is illustrated by both intra-estuarine (e.g., Bayer 1983) and inter-estuarine variation in seasonal abundance patterns (e.g., Jurek 1972, 1974; Prater 1979; this study).

California Perspective

The diversity of birds' seasonal use strategies in an estuary or a region is determined by climate, habitat and resource diversity, geographic setting, and perhaps tradition. The Mediterranean climate, which characterizes much of California, is found nowhere else in North America and only in a few places in the world (Major 1977). This climate is winter wet and summer dry, with the vast majority of precipitation falling as rain from October through April. We have discussed examples of the effects of seasonal rainfall on birds in the Point Reyes wetlands. We suspect that the amount of rainfall influences movement between estuarine and interior freshwater habitats, particularly in extremely wet and dry years. Such movements have been mentioned in the literature only infrequently (as for the Canvasback, Rienecker 1985), although we suspect they are an integral part of many species' strategies. Temperatures along the California coast vary little between summer and winter, with few days below freezing annually; generally temperatures decrease and rainfall increases with latitude along the coast. The mild winter climate allows a high diversity of waterbirds to overwinter on the coast. General avifaunal works (Grinnell and Miller 1944, McCaskie et al. 1979, Garrett and Dunn 1981) show that coastal California is primarily a wintering area for estuarine waterbirds, as demonstrated also by our study at Point Reyes. California is at the northern end of a broad geographical area (from 40°N to 40°S) with high numbers of shorebird species in the northern

winter (Pitelka 1979b). We know of no similar analysis for waterfowl or other waterbirds but suspect that California, and particularly Point Reyes, is at the high end of species diversity for estuarine waterbirds in winter on the Pacific Coast and perhaps for all of North America.

The productive current off the coast of California, Oregon, and Washington undergoes unique seasonal cycles not found elsewhere in North America. The influence of these cycles on seabirds breeding on the Farallon Islands and on the seasonal occurrence of offshore and pelagic species off the California coast has been well described (Ainley 1976a, Briggs et al. 1987, Ainley and Boekelheide in press). Research has also begun to focus on the effects of these cycles on estuarine and inshore species such as the Brown Pelican (Anderson and Anderson 1976, Briggs et al. 1981, 1983) and the Western Gull (Spear 1988). We surmise that several species that feed in late summer and fall in both inshore and estuarine waters have seasonal abundance patterns affected by the cycle of upwelling, which begins progressively later in the spring and summer from south to north along the California coast (Bakun et al. 1974, Brinton 1976). In addition to the Brown Pelican and Western Gull, these species are Brandt's Cormorant, Heermann's Gull, California Gull, and Elegant Tern (see Species Accounts).

The high diversity of species wintering in the Point Reyes area and California in general must reflect to some degree a high diversity of habitats. The extent, and presumably diversity, of coastal wetland habitats on the West Coast and their importance to waterfowl, however, are much less than on the Gulf and Atlantic coasts (Shaw and Fredine 1971, Sanderson 1980). On the basis of fragmentary information, the East Coast appears to be more important, overall, than the West Coast for staging of migratory shorebirds, but the latter area and the coastal southeastern United States are the only major wintering areas for shorebirds in North America (Senner and Howe 1984). Although the limited extent of West Coast estuaries probably is responsible for their secondary importance as staging grounds, geography must also play a part. California's position on the western edge of North America and the northwest-to-southeast orientation of the Americas places it out of a direct line for species migrating from the Arctic to tropical and south temperate areas, where most Western Hemisphere shorebirds winter (Senner and Howe 1984). On a regional scale, even when species are moving along a roughly straight corridor, migratory stops may by-pass seemingly suitable feeding areas because they are not strategically placed in relation to a direct route or the length of a particular migratory flight (e.g., Wilson 1981).

An underlying theme in recent research on waterbirds, because of many species' long-distance movements and elaborate life-history strategies, is the importance of advancing knowledge applicable to conservation on a broad geographic scale (e.g., Pitelka 1979a, Prater 1981, Senner and Howe 1984). Much of this work has focused on single species or specific taxonomic groups, particularly waterfowl and shorebirds, and only exceptionally have coordinated efforts been made to census all estuarine species in a large geographic area (e.g., Prater

1981). Advancement of knowledge has been uneven geographically, with Europe leading the way (e.g., Prater 1981, Evans et al. 1984), followed more recently by coordinated shorebird studies on the east and west coasts of North America and in Central and South America (Morrison and Harrington 1979, Myers 1983, Stenzel et al. 1989). Although some attention has been focused on the Pacific Coast (Pitelka 1979a), there has been no region-wide effort to census waterbirds except for federal and state waterfowl surveys and shorebird studies in California (Jurek 1974, Stenzel et al. 1989). Because of its unique climate, its role as a wintering area for aquatic birds, and the different sources of its waterbird populations, the Pacific Coast can provide a valuable perspective on waterbirds' seasonal occurrence patterns. Broad-scale census work is needed to provide information on the importance of various wetlands to waterbirds, while species-specific studies are needed for knowledge about local movements, habitat requirements, and foraging ecology. Intensive long-term local census studies such as ours are most useful in documenting long-term population trends, year-to-year variation in seasonal occurrence patterns, and, perhaps most importantly, in uncovering patterns that cry out for focused research.

SUMMARY

Long-term censuses at Point Reyes in coastal California provided information on the seasonal abundance of 122 species of aquatic birds. Two-thirds of the species were members of three families—the Anatidae (waterfowl), Scolopacidae (sandpipers and phalaropes), and Laridae (jaegers, gulls, and terns). The Point Reyes wetlands were used primarily by winter residents, secondarily by migrants, less by dispersants, and relatively little by year-round residents, summer residents, and breeders. The importance of Point Reyes as a wintering area was further emphasized by the fact that about 75% of the wintering species did not have migratory peaks on the wetlands. Shorebirds were the predominant group showing migratory peaks. Although most migrant species occurred in both spring and fall, the number of species of waterbirds was greatest in fall and early winter.

Inter-wetland variation in seasonal occurrence patterns was usually explainable by habitat and resource differences. The contrasts between a lagoon and two estuaries were due to different hydrographic regimes that may have caused changes in seasonal food availability or lowered prey densities, resulting in birds leaving after they depleted their prey. Rainfall and storms were probably the most important proximate factors influencing local and regional habitat shifts and the timing of these movements. The highest numbers of many species that use fresh water were found on the coastal wetlands during two years of a major drought. California's seasonal ocean cycles also affected some wetland species. These species varied the most in timing of arrival, departure, and peak abundance, and most dispersed north after breeding in the Gulf of California, with their movements timed to food availability and the progression of upwelling in spring and summer from south to north along

the coast. Population fluctuations and local movements of Northern Anchovies and Pacific Herring also strongly affected the timing and abundance of some fish- and egg-eaters.

On a continental scale, wetlands along the central California coast appear to be on the high end of wintering waterbird diversity, but overall they are of secondary importance as areas for wintering waterfowl and staging migrant shorebirds. Much work on the complexities of seasonal movements has been conducted in north temperate areas where freezing temperatures limit numbers of wintering species. Because of its seasonally wet climate, its importance as a wintering area, and the different sources of its waterbird populations, California can provide a valuable additional perspective on seasonal waterbird movements that may further help conservation efforts.

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APPENDIX

The following accounts are of waterbird species from Point Reyes not detected on censuses because of their extreme rarity or their preference for non-estuarine habitats. We have included many species with strong affinities for offshore and oceanic waters when they have been recorded alive onshore or when seen with some regularity from shore. Because they are generally associated with the open ocean we have excluded all Procellariiformes, although species such as the Sooty Shearwater can be abundant in inshore waters here. Additional species that have been seen at sea off Point Reyes or have been recorded from beach-cast specimens are the Short-tailed Albatross, Black-footed Albatross, Laysan Albatross, Northern Fulmar, Mottled Petrel, Murphy's Petrel, Cook's Petrel, Pink-footed Shearwater, Flesh-footed Shearwater, Buller's Shearwater, Short-tailed Shearwater, Black-vented Shearwater, Wilson's Storm-Petrel, Fork-tailed Storm-Petrel, Leach's Storm-Petrel, Black Storm-Petrel, Long-tailed Jaeger, South Polar Skua, Arctic Tern, Craveri's Murrelet, Parakeet Auklet, Crested Auklet, and Horned Puffin.

Their status in waters off Point Reyes is covered by references on pelagic species in California (Ainley 1976a, Stallcup 1976, Sowls et al. 1980, Roberson 1985, Briggs et al. 1987) or more general avifaunal works discussing northern California (Grinnell and Miller 1944, McCaskie et al. 1979, Morlan and Erickson 1988).

Yellow-billed Loon (*Gavia adamsii*)

Six Point Reyes records, all of single birds: five for Tomales Bay from 13 Nov to 1 Jan, 1967 to 1983, and one for Drake's Estero on 13 Apr 1983 (CBRC). Details of a Tomales Bay report for 25 Jan 1971 (AB 25: 620) have not been submitted to the CBRC; an additional 4 Point Reyes reports have been rejected by the CBRC. First recorded in California in 1967, now occurs annually in the state with 42 accepted records of single birds (CBRC). Yellow-billed Loons have been found in California waters every month of the year, but most birds occur from from Dec through Apr (Remsen and Binford 1975, CBRC). They usually prefer large bays, estuaries, inshore ocean waters, or, occasionally, freshwater lakes.

Red-footed Booby (*Sula sula*)

An immature was seen from the mouth of San Francisco Bay north to Bolinas (14 Oct) from 13 to 18 Oct 1987 until picked up sick and brought to a wildlife rehabilitation center on 18 Oct (CBRC, AB 42: 128, ABN). This was 1 of 4 (possibly 5) Red-footed Boobies sighted off California in fall 1987, and 1 of a total of 7 accepted records for California (since 1975), all in fall from 26 Aug to 15 Nov, except for one for 22 May 1985 (CBRC).

Magnificent Frigatebird (*Fregata magnificens*)

There are at least 5 inshore or estuarine records for Point Reyes involving at least 7 birds (mostly immatures) from 12 Jul to 26 Aug (ABN, PRBO). Magnificant Frigatebirds occur in coastal waters of northern California primarily as post-breeding dispersants from Mexico and mostly from mid-Jul to early Sep (ABN). Extreme dates are 20 Jun and 20 Oct (Grinnell and Miller 1944, ABN), except for 3 winter records (McCaskie et al. 1979, AB 34: 302, AB 40: 519).

Least Bittern (*Ixobrychus exilis*)

Three records for Point Reyes: 1 adult at Drake's Beach pond on 18 Sep 1980 (AB 35: 220), 1 at Olema Marsh on 27 Dec 1967 (ABN: RS), and 1 at Olema Marsh on 29 Jan 1969 (AB 23: 515). Occurs irregularly on the northern California coast with records for every month (ABN, Grinnell and Wythe 1927, Roberson 1985). Interior breeding populations have declined, owing to habitat loss (Remsen 1978).

White-faced Ibis (*Plegadis chihi*)

Two fall records: singles at Drake's Estero on 12 Oct 1978 (AB 33: 210) and on "Point Reyes" on 6 Oct 1985 (ABN: RMS). Local spring records, all in 1988 and perhaps involving the same birds: 15 birds flying south by Cypress Grove, near Marshall, Tomales Bay, on 20 May (ABN: JPK), up to 12 at Bolinas sewer ponds on 25 and 26 May (DDeS et al.), and 4 on outer Point Reyes on 26 May (ABN: RS). The birds were observed at freshwater ponds and marshes and in flight.

On the northern California coast White-faced Ibises occur almost annually in fall from 9 Aug to 19 Nov, except for 1 bird that lingered from 11 Oct to 28 Dec; there are 5 additional winter records, 25 Dec–20 Mar (ABN, Roberson 1985).

Fall records are usually of 1–3 birds, rarely up to 15; maximum for winter is 31. Spring records, of flocks up to 57 birds, extend from 3 May to 20 Jun with most from mid- to late May (ABN, Roberson 1985). Formerly accidental on the northern California coast in spring until seen in 5 of 7 years from 1981 to 1987 (ABN). A major coastal influx in spring 1988 involved about 15 widespread records of about 300 birds total (ABN). Until recently, White-faced Ibis had declined markedly in California (Grinnell and Miller 1944, Remsen 1978). Breeding ibises expanded their range and increased their population in the interior of California (ABN) and Oregon (Ivey et al. 1988) during a wet period from 1982 to 1985, when flooding may have displaced breeding ibises from Great Salt Lake (Ivey et al. 1988). The 1988 influx to coastal California may have been prompted by recent colonizers abandoning marshes in the interior of the state that dried up during the drought in 1987 and 1988.

Trumpeter Swan (*Cygnus buccinator*)

The only Point Reyes record, of a single bird at Abbott's Lagoon from 1 Jan to 9 Mar 1962 (Williams and Miller 1963, Dunn 1988), is one of a total of 11 accepted records for California involving 19 birds on dates spanning 8 Nov to 15 Mar, 1935 to 1987 (CBRC).

Yellow Rail (*Coturnicops noveboracensis*)

There are 7 old specimen records for Point Reyes from marshes at the south end of Tomales Bay, 27 Oct–22 Feb, 1898 to 1936, 4 in 1905 alone (CAS and MVZ, fide CBRC). Not yet reviewed by the CBRC, an additional 5 specimens for "Point Reyes," 27 Oct–27 Dec 1905, are at the American Museum of Natural History, New York (numbers 354496, 354497, 354499, 354500, 354502, fide SNGH). Likely there are further specimens from the area at other eastern museums. The few recent local records have all been of single birds from the south end of Tomales Bay during winter flood tides: 1 on 3 Dec 1986 (AB 41: 323, CBRC); 1 on 2 Dec 1987 (AB 42: 316) and 1 dropped by a Great Egret and retrieved on 21 Dec 1987 (AB 42: 316, CAS 84063) (both under review by CBRC as one record); details of a report on 13 Feb 1961 (AFN 15: 354–355) have not been submitted to the CBRC. The accepted Point Reyes records are among 52 (all but 5 prior to 1937) of birds wintering at tidal or freshwater marshes on the coast or in the interior from 2 Oct to 10 Apr (CBRC). Although this rail was formerly considered rare in California (Grinnell and Miller 1944), the number of old records and its secretive habits suggest a substantial population once wintered on the coast. The probable extirpation of breeding populations in the interior of California (Remsen 1978) and declines elsewhere may explain the apparent decline of the coastal wintering population. Recent coastal wintering records and the discovery of breeding populations in southern Oregon (AB 36: 999, 38: 1042), however, may presage a limited resurgence of California's population.

Mountain Plover (*Charadrius montanus*)

One estuarine record from Limantour Estero on 10 Feb 1967 (AFN 21: 454). Additionally, at least 26 birds have been found in pastures and plowed fields from 2 Oct to 1 Jan in 5 years from 1978 to 1988 (ABN). All local records involve 1–3 birds, except for a flock of 21 at the RCA Station, Point Reyes on 21 Oct 1983 (AB 38: 242, ABN). Transient and wintering birds occur irregularly on the coastal slope of northern California from 22 Sep to 10 Feb (ABN). Has decreased historically in California (Grinnell and Miller 1944).

Eurasian Dotterel (*Charadrius morinellus*)

Two records of single juveniles in pastureland on outer Point Reyes: 6–9 Sep 1986 (AB 41: 138–139, CBRC) and 10–13 Sep 1988 (AB 43: 27 and 163; under review by CBRC). The only other record for California is of a juvenile on SE Farallon Is. from 12 to 20 Sep 1974 (Henderson 1979, Luther et al. 1979).

Black Oystercatcher (*Haematopus bachmani*)

A year-round resident of rocky reefs, seastacks, and offshore islets on the outer coast of Point Reyes. Fairly evenly distributed along rocky shoreline during the breeding season, when a minimum of 8 pairs inhabit Point Reyes (Sowls et al. 1980). Breeding has been confirmed at Tomales Point, Chimney Rock, Double Point, and between Point Resistance and Miller's Point (Stephens and Pringle 1933, ABN, DS). Distribution more clumped in winter, especially when the rocky shoreline is extensively wave-washed during storm tides, concentrating roosting birds. Flocks of up to 20 birds have been recorded in winter at Tomales Point (ABN). Birds occasionally stray for brief periods to sandy beaches and estuarine shorelines, usually those near their rocky shoreline haunts.

Solitary Sandpiper (*Tringa solitaria*)

Occurs on Point Reyes almost annually in fall from 4 Aug to 29 Sep (ABN), with an outlying date of 19 Oct 1984 (RMS). Most fall birds are juveniles, of which the earliest reported date is 6 Aug 1988 (ABN: LJP). Two local spring records: 2 birds on Bolinas Mesa on 2 May 1974 (AB 28: 847) and 1 at the Bolinas sewer ponds from 5 to 6 May 1980 (DS et al.). One at a freshwater pond near Inverness from 22 Jan to 14 Mar 1984 (AB 38: 353, 954) is the only winter record for northern California (McCaskie et al. 1979, Morlan and Erickson 1988) and one of few for the state as a whole (Garrett and Dunn 1981). On the northern California coast dates of transient Solitary Sandpipers in fall extend from 19 Jul to 19 Oct with a peak from late Aug to mid-Sep (ABN). Spring dates range from 9 Apr to 24 May with a peak in late Apr and early May (ABN). Solitary Sandpipers are generally less numerous on the coast in spring than in fall, but since the mid-1980s they have been seen on the north coast with regularity and in increasing numbers in spring (Morlan and Erickson 1988, ABN). They frequent the margins of freshwater ponds, sewer ponds, reservoirs, stock ponds, or slow-moving streams.

Little Stint (*Calidris minuta*)

The only Point Reyes record, of a juvenile at the Bolinas sewer ponds from 14 to 22 Sep 1983 (Roberson 1986), is 1 of 2 currently accepted records of the species for California (CBRC).

White-rumped Sandpiper (*Calidris fuscicollis*)

One Point Reyes record of a single bird at Kehoe Beach on 11 Jun 1978 (Luther et al. 1983). This is among a total of 9 accepted records for California, 1969 to 1986: 7 in spring from 17 May to 16 Jun; 2 in fall from 15 Aug to 18 Sep (CBRC).

Sharp-tailed Sandpiper (*Calidris acuminata*)

One old Point Reyes record from Olema on 27 Nov 1870 (Grinnell and Miller 1944); 16 later records of 18 birds (all juveniles) on Point Reyes from 21 Sep to 22 Nov, 1966 to 1988. Now recorded annually in coastal northern California (all

juveniles) from 2 Sep to 27 Nov (most from late Sep to early Nov), except for 1 bird remaining on a salt pond in south San Francisco Bay from 17 Nov 1985 to 5 Jan 1986 (AB 40: 326).

Rock Sandpiper (*Calidris ptilocnemis*)

Four records for Point Reyes, all of single birds: 25 Oct 1966 at Abalone Point (AB 21: 74), 27 Feb 1975 at Duxbury Reef (AB 29: 737), 29 Nov 1980 at RCA Beach, Bolinas (ABN: CSw), and 20 Dec 1986 at Walker Creek mouth, Tomales Bay (AB 41: 324). All were on rocky substrate on the outer coast except the Tomales Bay bird, which, atypically, was on tidal mudflats. Dates of occurrence on the northern California coast span 15 Oct to 9 May with most records from Nov to mid-Apr (ABN).

Buff-breasted Sandpiper (*Tryngites subruficollis*)

Seven accepted records for Point Reyes of 21 birds from 24 Aug to 29 Sep, 1977 to 1987 (CBRC), with a high count of 11 birds at Tomales Point from 26 to 31 Aug 1978 (Luther et al. 1983). Additionally a record of 5–10 birds on Point Reyes from 9 to 11+ Sep 1988 is under review by the CBRC. All birds frequented pastures, or low marsh vegetation on the sandy shores of Abbott's Lagoon. Except for the first state record, 14 Sep 1923 (Grinnell and Miller 1944, CBRC), and the lone spring record, 3–4 May 1980, dates of all accepted California records range from 23 Aug to 22 Oct, 1964 to 1987 (CBRC). Buff-breasted Sandpipers have been recorded annually and in increasing numbers in California since 1975.

Pomarine Jaeger (*Stercorarius pomarinus*)

Pomarine Jaegers occur primarily at sea off central California, where they favor waters seaward of the continental shelf during migration (Briggs et al. 1987). They occur mostly as fall migrants from mid-Jul to early Nov (peak late Aug to early Oct), secondarily as spring migrants from mid-Apr to late May, and sparingly as winter residents; they are irregular in summer (Stallcup 1976, Roberson 1985, Briggs et al. 1987). Although outnumbered by Parasitic Jaegers close to land, Pomarines are seen from shore over the inshore zone and sparingly in large bays and estuaries, on Point Reyes primarily in Sep and Oct (ABN). Nearshore sightings in fall coincide with greatest offshore abundance of this jaeger, peak numbers of Elegant Terns near shore, and greatest observer coverage. Pomarines have been seen on 9 of 19 Point Reyes CBCs from 1970 to 1988, with a high count of 4 in 1985.

Little Gull (*Larus minutus*)

A Point Reyes record of 1 bird at Tomales Bay on 21 Nov 1984 is among 32 accepted records for California falling in every month, but mostly Oct to May, 1968 to 1987 (CBRC). Annual sightings in California since 1977 parallel increases elsewhere, including recent breeding in North America (AOU 1957, 1983).

Common Black-headed Gull (*Larus ridibundus*)

The only Point Reyes record is of a single bird at Tomales Bay from 5 to 8 Apr 1976 (Luther et al. 1979). This is 1 of 13 accepted California records, 1954 to 1986, all falling between Sep and Apr except for single Jun and Jul records (CBRC).

Sabine's Gull (*Xema sabini*)

The Sabine's Gull typically inhabits offshore and oceanic waters off California during migration. It occurs primarily in fall from Aug through Oct (peak Sep and early Oct) and in spring in Apr and May (peak mid-May), exceptionally in mid-winter or mid-summer (Ainley 1976a, Stallcup 1976, Roberson 1985, Briggs et al. 1987). Seen irregularly from shore at Point Reyes, mostly in fall (ABN). Two winter records from inshore at Point Reyes: 1 immature at Limantour on 15 Dec 1968 (AFN 23: 516); 2 immatures off Point Reyes Beach during a storm on 4 Jan 1978 (AB 32: 396).

Royal Tern (*Sterna maxima*)

A northward dispersant from Mexico to estuarine and inshore waters in California. Although variable in timing and abundance, Royal Terns formerly were "fairly common" off California from Sep to Mar, though recorded in every month (Grinnell and Miller 1944). A 23 Nov 1918 specimen for Humboldt Bay (Yocum and Harris 1975) is the only evidence of former occurrence north of Tomales Bay (Grinnell and Miller 1944). Specimen records for Point Reyes are of 1 bird at Bolinas on 17 Oct 1893 (CAS 43313) and 4 from Bolinas Bay: 3 on 9 Jan 1926 (MVZ 1922, 1923, 1932) and 1 on 20 Jan 1927 (MVZ 2783). There are no valid recent records for Point Reyes. See Elegant Tern for discussion of a major decline of Royal Terns at the time of a great increase of Elegant Terns beginning in the 1950s. Royal Terns now occur casually in northern California north to San Francisco Bay from Mar through Oct (Morlan and Erickson 1988, ABN).

Least Tern (*Sterna antillarum*)

Two Point Reyes records, both from Bolinas Lagoon: 1 on 27 Apr 1980 (LES) and 1 in "fall" 1987 (KH). These likely represent birds from San Francisco Bay, which currently supports the only breeding colonies of Least Terns in northern California (McCaskie et al. 1979, Morlan and Erickson 1988). Dates of occurrence in northern California span 27 Mar to 16 Oct, but Least Terns are scarce in this region before mid-Apr and after early Sep (ABN). Least Terns found irregularly in spring or fall north of the Golden Gate from 23 Apr to 13 Sep (ABN) likely represent overshooting migrants or post-breeding dispersants. Least Terns have declined dramatically as breeders on the California coast and are currently listed as endangered by both state and federal governments.

Pigeon Guillemot (*Cepphus columba*)

About 140 pairs breeds on cliffs, sea stacks, and offshore islets along the Point Reyes shoreline (Sowls et al. 1980). They forage inshore almost exclusively within 5 km, and mostly 1–2 km, of land (Briggs et al. 1987). Breeders begin to arrive in numbers by mid-Mar, remain common through Aug, and thereafter dwindle to winter lows by mid-Oct, when most that remain are young (ABN). A count of 19 juveniles in Drake's Bay on 10 Oct 1980 (DS) is high for late fall, and a count of 26 at Tomales Point at the mouth of Tomales Bay, the only locale on Point Reyes where guillemots winter regularly, on 6 Jan 1979 (DS) is high for mid-winter. Guillemots were recorded on 10 of 19 Point Reyes CBCs from 1970 to 1988 with 1–3 guillemots in 6 years, 10–13 in 3 years, and 42 in 1 year. Guillemot populations on the Farallones have recovered from declines caused probably by oil pollution (Ainley and Lewis 1974)

Marbled Murrelet (*Brachyramphus marmoratus*)

A year-round resident along the northern California coast with birds nesting in old-growth forests up to 40 km inland and foraging in nearshore waters mostly within 1–2 km of land (Carter and Erickson 1988). Occurs in nearshore waters of Point Reyes mostly from Aug to Mar (ABN). Although birds have been seen off Point Reyes in the breeding season (1 Apr–1 Sep; Carter and Erickson 1988), a lack of nearshore records from 2 May to 30 Jun and a total lack of inland records suggests that Marbled Murrelets do not breed regularly in the Point Reyes area despite the availability of seemingly suitable nesting habitat. Local Jul and Aug records probably pertain to post-breeding dispersants from elsewhere. The California population of Marbled Murrelets has probably declined because of the destruction of old-growth forests, although the species is also susceptible to mortality from gill netting and oil pollution (Carter and Erickson 1988).

Xantus' Murrelet (*Synthliboramphus hypoleucus*)

A bird hit by a car about 2 km north of Bolinas on 28 Aug 1973 (PRBO specimen 736) and another in Drake's Bay seen from shore on 9 Oct 1987 (ABN: RS) constitute the only Point Reyes nearshore records. Xantus' Murrelets typically occupy waters 20 to 100 km off the northern California coast, primarily from Jul to Oct (Roberson 1985, Briggs et al. 1987) and irregularly during the remainder of the year (McCaskie et al. 1979). With an increase in boat trips since the 1970s, Xantus' Murrelets are now seen with regularity in waters west of the Farallones and near the Cordell Banks off Point Reyes (ABN). Recent late May and Jun sightings there indicate rapid northward post-breeding dispersal (Briggs et al. 1987, D. G. Ainley pers. comm.).

Ancient Murrelet (*Synthliboramphus antiquus*)

These murrelets occupy inshore and offshore waters off Point Reyes from mid-Sep through Apr, but mostly Nov to Mar; there are only 4 May–Aug records (ABN). Numbers fluctuate greatly from year to year apparently because of varying ocean conditions and the species' preference for cold waters (Ainley 1976a). Ancient Murrelets have been recorded on 14 of 19 Point Reyes CBCs from 1970 to 1988; the outlying high count of 155 excluded, the median number for 13 years was 15 (range 2–49). Of the 155 birds on 17 Dec 1988, 150 were seen from a boat plying inshore waters from Tomales Point to the Point Reyes headlands (KH).

Cassin's Auklet (*Ptychoramphus aleuticus*)

Year round this auklet occupies California waters mostly from the mid-continental shelf to about 150 km from land (Briggs et al. 1987). In late spring and summer birds concentrate around colonies (Briggs et al. 1987), particularly the Farallones which support 80% of the California population (Sowls et al. 1980). They range more widely during post-breeding dispersal from Aug to Oct, and the state's population at least doubles in winter with immigrants from the north (Briggs et al. 1987). Cassin's Auklets are rarely seen close to shore at Point Reyes, usually during or after winter storms; they were recorded on only 6 of 19 Point Reyes CBCs from 1970 to 1988 (range 0–15).

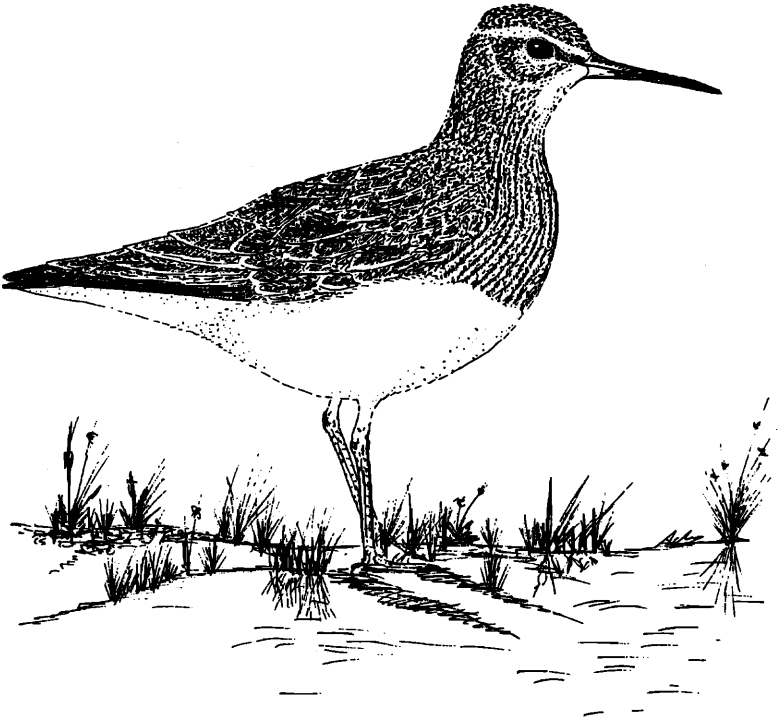
Rhinoceros Auklet (*Cerorhinca monocerata*)

Rhinoceros Auklets inhabit neritic and oceanic waters of central California year round, particularly seaward of the continental shelf break (Briggs et al. 1987). The

small nesting population of this region is swelled greatly in winter by influxes from the north. Off Point Reyes greatest numbers occur from mid-Oct to mid-Apr (ABN). Breeding populations are now increasing in California and elsewhere on the West Coast (Sowls et al. 1980, Briggs et al. 1987). Since 1977, up to 11 birds at a time have been observed on the water below the Point Reyes headlands in May and Jun (ABN). These birds have been observed "billing" and in passing flights that suggest local breeding.

Tufted Puffin (*Fratercula cirrhata*)

Tufted Puffins occur in neritic and oceanic waters off California year round, though numbers are much greater in winter than during summer (Briggs et al. 1987). At sea in any season birds are most numerous seaward of the continental slope, with a few birds as far from shore as 180 km. Breeding populations of Tufted Puffins are now expanding or becoming re-established in California after declining early in this century, perhaps because of oil pollution (Ainley and Lewis 1974, Sowls et al. 1980). Formerly they were suspected of breeding on "Point Reyes" and at Bird Rock, Tomales Point (Stephens and Pringle 1933, Grinnell and Miller 1944), but a subsequent lack of reports may have been due to limited observer coverage or actual decline. Since 1976 up to 6 birds at a time have been seen in the vicinty of the Point Reyes headlands each year from mid-Apr through Jul (ABN). These birds have been seen in passing flights, gathering algae, and carrying food up to cliffs, but no nests have been found because the sites are inaccessible. Many birds in oceanic waters off Point Reyes during the nesting season probably come from the important Farallon colony.



Pectoral Sandpiper

Sketch by Sven Achtermann