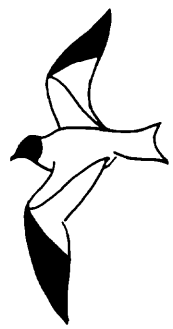


WESTERN BIRDS



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SURVEY OF MARINE BIRDS IN PUGET SOUND, HOOD CANAL AND WATERS EAST OF WHIDBEY ISLAND, WASHINGTON, IN SUMMER 1982

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This report presents results of the first complete survey of marine birds of Puget Sound and adjacent waters. Observations of marine birds in the area date back to 1792 when breeding Pigeon Guillemots were found by Menzies (Newcombe 1923). Since that time there have been observations and studies at localized sites, with results of these appearing in theses and dissertations, ornithological journals, Jewett et al. (1953), and Dawson and Bowles (1909). However, no complete surveys have been conducted.

The remainder of the inland marine areas of Washington were surveyed year-round in 1978 and 1979. Wahl et al. (1981) describe studies of populations, including nesting birds and sites, in the area of the Strait of Juan de Fuca, Strait of Georgia and adjacent waters.

METHODS

We surveyed all waters of "Puget Sound" (Figure 1) from 27 May through 20 June 1982 in an attempt to locate all non-breeding and breeding birds. Four census types were employed. Small boat was the most frequently used platform, followed in decreasing order by censuses from small aircraft, on foot, and from ferries. Boat censuses covered a strip transect 300 m wide along open shorelines, in bays and harbors, around islands and rocks, and across offshore open waters. In most cases we could obtain "total" counts of bays, harbors and some larger passages by observing beyond the 300 m zone. Aircraft censuses were used in areas of low human populations or boat traffic, using 120 m strip transects, along straight, open shorelines and across open waters. Observations from shore were limited to a few areas difficult to reach or unsuitable for boat or aircraft censuses; these usually resulted in total area counts. While traveling between study areas by ferry, 500 m strip transect censuses were used. These same methods were used in other surveys in 1978 and 1979 (Wahl et al. 1981). We recorded all observations as they occurred either directly on census forms or, in the case of aircraft censuses, on tape cassettes for later transcription.

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Actual time censusing amounted to about 52 hours from small boat and 8½ hours from the aircraft. The time spent censusing from shore amounted to about 10 hours and from ferries less than 2 hours. All areas were thoroughly surveyed once, and a few were surveyed several times during transits to new areas. Due to time and budget considerations we censused during available hours and at whatever tide stages we encountered at each site or subregion.

We attempted to count and identify all individuals and species in the study area. When possible, age determination was made also. Because of generally low numbers of birds present in the study area, nearly all sightings resulted in specific identification. Except during flights, where they were not needed, binoculars were frequently used to aid identification.

The study area included all the marine waters of Hood Canal, Puget Sound, and those east of Whidbey Island. During the survey, all of the near-shore waters and almost all waters of bays and harbors were checked for birds. Open waters of the larger passages were also sampled. Surveys along river deltas (e.g. Skagit, Nisqually deltas) consisted of transects along exposed shorelines but did not include river channels, marshes and other inland habitats of these areas.

We divided the study area into 56 geographic subregions (Figure 1), each essentially a roughly definable body of water, corresponding, in most cases, to designations used on navigation charts. The data acquired, sometimes from a variety of census types, within each subregion were then summed. The results are presented in Table 1 (breeding species) and in species accounts below. We recorded nest site locations where possible, especially for Glaucous-winged Gull, Pigeon Guillemot and Pelagic Cormorant. Photographs were obtained of most important nest sites. To minimize disturbance to nesting birds, only one colony was entered.

RESULTS

Fourteen species associated with the marine waters were found to be or were presumed to be breeding in the study area (Table 1). One additional species breeds outside the study area, with a significant portion of its population feeding within the study area (see Wahl et al. 1981). We found 26 other species as non-breeding summer residents or early fall migrants.

BREEDING SPECIES

PELAGIC CORMORANT *Phalacrocorax pelagicus*. Although this is a common bird on Washington's outer coast and in the Strait of Juan de Fuca and San Juan Islands areas with nearly 4900 birds nesting at over 60 sites (Wahl et al. 1981, Speich and Wahl in press), only one nest site was found: a colony of about 60 pairs nesting on a high wooden tower off the north end of Indian Island, Port Townsend (Figure 2). South of here, in Puget Sound there may be very small numbers (a pair or two) nesting. During our survey we observed only one adult in breeding plumage south of the above colony site. We saw 160 birds away from that site, with 95 of these in the Port Townsend subregion and small numbers of non-breeders scattered elsewhere in the study area.

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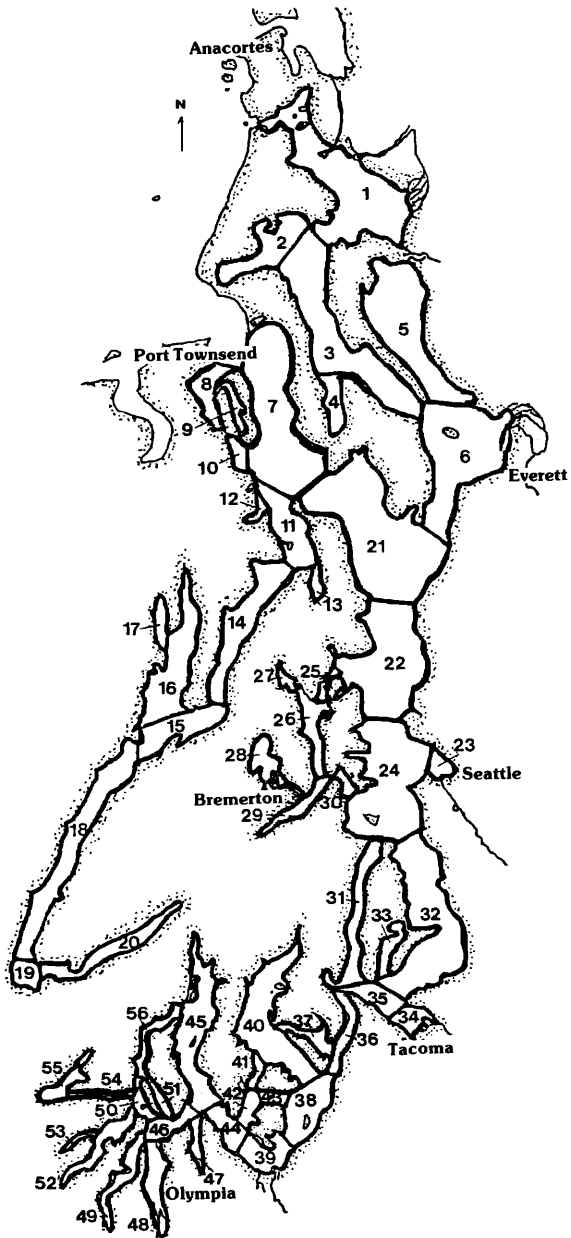


Figure 1. Study area showing subregion boundaries, in Puget Sound and adjacent waters, Washington, summer 1982.

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Table 1. Numbers of breeding marine birds by subregion in Puget Sound and adjacent waters, Washington, 1982.

SUBREGION		NUMBERS OF INDIVIDUALS ¹						
Number	Name	Great Blue Heron	Mallard	Glaucous-winged Gull ²	Pigeon Guillemot	Marbled Murrelet	Belted Kingfisher	Northwestern Crow
1	Skagit Bay	77	98		4		1	35
2	Penn Cove/Crescent Harbor	10	12		88		2	126
3	Saratoga Passage	5			9	21		15
4	Holmes Harbor	7			1	4		4
5	Port Susan	61	40		6	2	1	4
6	Possession Sound	16		300	8	24	1	4
7	Southern Admiralty Inlet	3			44	20		4
8	Port Townsend	2		100	71	159		16
9	Killisut Harbor	6			118			5
10	Oak Bay	1			21	49		13
11	Hood Canal Entrance	6		44 ³	28	26	1	8
12	Port Ludlow	1			3	1		9
13	Port Gamble	4						
14	Northern Hood Canal	1			3	10		7
15	Central Hood Canal	2				2		3
16	Dabob Bay				6	17		
17	Quilcene Bay				2			
18	Southcentral Hood Canal	11			2	8	1	2
19	Anna's Bay		3		18		3	
20	Great Bend	1	92		3	3	3	38
21	Northern Puget Sound	28			12	1		4
22	Northcentral Puget Sound	9	10	2	32	4	1	37
23	Elliott Bay	11	30	628 ⁴	1			7
24	Central Puget Sound	5	4		15	12	1	18
25	Agate Passage				27		1	42
26	Port Orchard	14	4		46	4		77
27	Liberty Bay				20			62
28	Dyes Inlet	8	36		18		1	98
29	Sinclair Inlet	14	16		8			28
30	Rich Passage		16		1	1		18
31	Colvos Passage		4		1			44
32	East Passage	9				1		8
33	Quartermaster Harbor	1	2		3	1	2	86
34	Commencement Bay			530	2			4
35	Dalco Passage	29	45		6		8	1
36	The Narrows	1			3	2	1	18
37	Hale Passage		32		11			
38	Steilacoom				6	3		7
39	Nisqually Reach	32			28	12		
40	Carr Inlet	34	41		105	4	4	363

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Table 1 (Cont.)

SUBREGION		NUMBERS OF INDIVIDUALS ¹						
Number	Name	Great Blue Heron	Mallard	Glaucous-winged Gull ²	Pigeon Guillemot	Marbled Murrelet	Belted Kingfisher	Northwestern Crow
41	Pitt Passage	1	1		18			
42	Drayton Passage	8			9	4		16
43	Balch Passage				8			5
44	Treble Point/Johnson Point	1			35	2		23
45	Case Inlet	51		2 ²	93	5	1	288
46	Dana Passage	1			9	2		
47	Henderson Inlet	6			12		3	6
48	Budd Inlet	4	9	30+	36		4	5
49	Eld Inlet		2		21			3
50	Squaxin	10	2		19			
51	Peale Passage	2			11		1	13
52	Totten Inlet	35	7		44		7	26
53	Skookum Inlet	2			8		1	3
54	Hammersley Inlet	10	13		49		5	6
55	Oakland Bay	7	5	40	1			25
56	Pickering Passage	14	8		8			45
Totals		561	532	1676	1159	406	54	1679

¹For Pelagic Cormorant, Canada Goose, domestic goose, Bald Eagle, Osprey, American Black Oystercatcher and Killdeer, see breeding species accounts for subregion and numbers observed.

²Numbers are of individuals on or associated with active nests.

³Derived from count of active nests.

⁴We observed 28 nests along Elliott Bay; this total includes estimates from Eddy (1982 and pers. comm.).

GREAT BLUE HERON *Ardea herodias*. This widespread species was found in 44 of the 56 subregions surveyed. Apparently a number of small to medium-sized heronries are located throughout the study area. Undoubtedly nearly all birds observed, all of which were adults, were breeding birds foraging near their nest sites. The observed birds represent perhaps only 50% of the actual number of nesting birds: it is very likely some adults were at nests and others were missed during censusing.

The methods of survey we employed to detect birds on the water or nearby shoreline are not suitable for locating heronries, which are often a considerable distance from the water in upland habitats. Even when close to the water, nests are

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often partially concealed in tree-top foliage. To date there has not been a statewide effort to locate and identify all nesting sites, though a one-year survey of heronries in the King County portion of the study area (greater Seattle area) was conducted by Shippe and Scott (1981).

CANADA GOOSE *Branta canadensis*. We saw only 34 birds, including family groups, in six subregions (Numbers 8, 22, 27, 56 on Figure 1), particularly in the Kellogg Island area of the Duwamish Waterway, Seattle (20 birds), and in the Puyallup River delta at Tacoma (6 birds). It is likely many additional birds were missed. A number of domestic-type geese (*Anser sp.*) were also observed.

MALLARD *Anas platyrhynchos*. We observed 532 individuals, including many family groups in 25 subregions. In most cases the birds appeared to be tame or at least partially so, nesting and feeding in close proximity to human habitations and activity.

Many urban "Mallards" are fed by humans in the study area, though some, especially those residing in industrial areas, may be self-sufficient. Many birds were of mixed plumage, revealing interbreeding with domestic stock. We believe we missed a high proportion of the Mallards that are present in the study area during the summer. Mallards are rarely found nesting in the Strait of Juan de Fuca/San Juan Islands/Strait of Georgia area (pers. obs.).

BALD EAGLE *Haliaeetus leucocephalus*. During this survey we observed 15 adult Bald Eagles in 10 subregions (Subregion-No. obs.: 2-1; 5-4; 7-1; 8-1; 39-1; 40-2; 42-1; 44-1; 47-2; 55-1). This is clearly a low count for this area, a product of our census techniques.

During summer, 1982, personnel from the state's Nongame Wildlife Program conducted eagle nesting surveys in Washington. In our present study area they found several active nests. Along Hood Canal 6 nests were located; 2 were unoccupied and the other 4 were unsuccessful. In the area of Admiralty Inlet from Port Townsend south to Port Madison, 10 nests were located, and 4 of these produced 7 young. Seventeen nests were located in the area east of Whidbey Island. Twelve of these were occupied, 11 of which produced 17 young. In the Puget Sound area south of Port Madison, only 4 of 12 nests were successful and these produced 5 young.

OSPREY *Pandion haliaetus*. We observed two adults at two possible nest sites (Subregion-No. obs.: 2-1; 54-1). Our census techniques were not well-suited to locating Osprey nests and we probably missed seeing a number of breeding birds present in the study area.

AMERICAN BLACK OYSTERCATCHER *Haematopus bachmani*. We observed only three individuals of this species during the survey, all on a gravel/sand spit island at the north end of Indian Island in Port Townsend (Figure 2). We did not find proof that these birds were breeding there, though the situation was suitable. These individuals may have been non-breeders or perhaps foraging breeders from Protection Island, about 17 km away, though our experience indicates this latter possibility is unlikely. There is no reason to believe that additional birds occur within the study area, and there are no historical breeding records for this area (Speich and Wahl in press). During surveys of breeding birds in the Strait of Juan de Fuca, San Juan Islands, Strait of Georgia and adjacent waters in 1978 and 1979, 46 pairs were found nesting on 25 islands and other sites north of the present study area. About 330 birds are known to occur at about 100 nesting locations in western Washington marine areas (Speich and Wahl in press).

KILLDEER *Charadrius vociferus*. We saw only 22 individuals during the survey. Undoubtedly, many others were overlooked in uplands adjacent to marine waters. However, total numbers are probably not large for the entire study area.

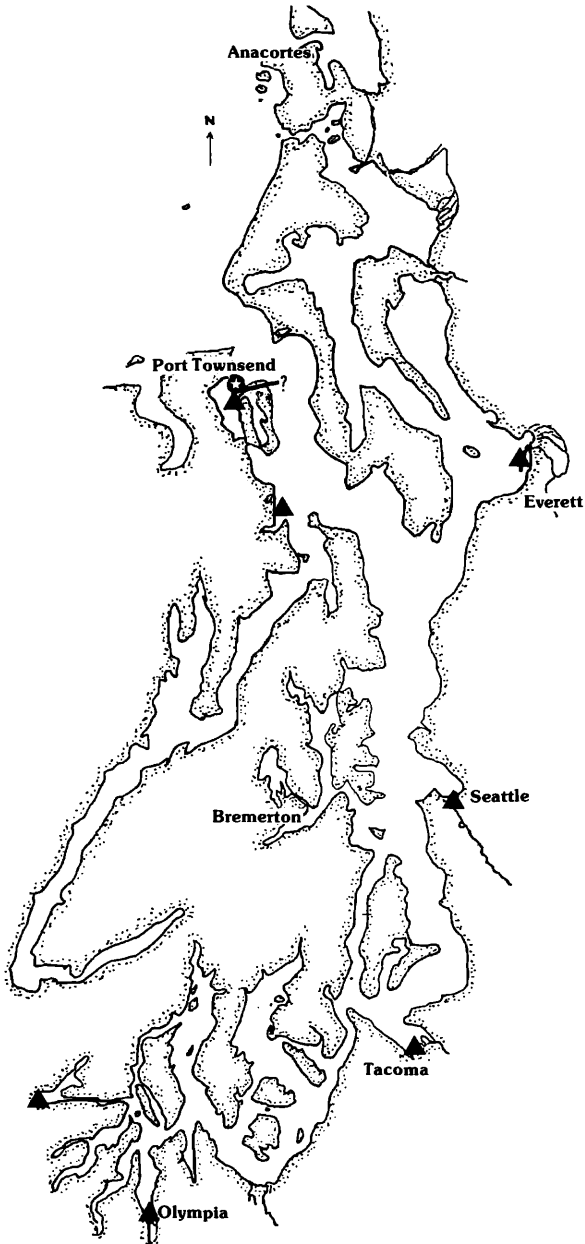


Figure 2. Nesting sites and colonies of Pelagic Cormorant (starred circle), American Black Oystercatcher (question mark) and Glaucous-winged Gull (triangles) in study area, Puget Sound, Hood Canal and waters east of Whidbey Island, Washington, summer 1982.

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GLAUCOUS-WINGED GULL *Larus glaucescens*. Although observed in numbers in nearly every subregion, relatively few were breeding. Nearly all birds were in a subadult plumage, in many cases the last recognizable one. The occurrence of subadults was particularly pronounced in areas away from the few nesting colonies. We recorded about 14,000 non-breeding birds, with concentrations near nesting sites and at feeding areas along river deltas and tidal fronts. In addition, a large proportion of the 5400 unidentified gulls observed were probably this species. Many non-breeding birds found in the study area in the summer are progeny from colonies to the north, at Protection Island and in the San Juan Islands (Wahl, unpub. banding data).

Despite the large numbers of Glaucous-winged Gulls in the study area, we found nesting sites in only 9 of the 56 subregions (Tables 1 and 2). Table 2 contains approximate locations, with comments on the colonies within each subregion. The locations of colonies are shown in Figure 2. In total, we observed about 1100 breeding birds at 16 sites (Table 2). Additionally, about 300 nests were scattered on buildings and waterfront areas of Seattle (Eddy 1982) that we could not see from the water. This brings the study area total to about 1700 breeding Glaucous-winged Gulls, or 850 pairs. It is very likely that additional isolated pairs, easily overlooked, are breeding in the study area.

As in other nesting species, the Glaucous-winged Gull nests in larger numbers in more northern regions of Washington's inland waters, outside the study area. Nesting sites inside Puget Sound are essentially confined to the colonies at Shelton, Olympia, Tacoma and Seattle. Apparently, Glaucous-wings do not nest in any numbers along Hood Canal. The colony at Jetty Island, Everett, is the only colony east of Whidbey Island. For comparison with Table 2, about 9000 pairs nest in areas north of the present study area and in total about 40,000 birds nest in western Washington, including the outer coast (Speich and Wahl in press).

PIGEON GUILLEMOT *Cephus columba*. This is the most widespread seabird which nests in the study area. It also feeds exclusively within marine habitats. It occurs in pairs and small groupings of pairs almost wherever suitable cliffs are found, nesting there and under old piers and in similar situations. We counted in total 1159 individuals; guillemots occurred in all but 4 of the 56 subregions. Many cliffs that appeared to contain suitable nesting habitat lacked birds. This species was more evenly distributed throughout the study area, including Puget Sound, than any other breeding species, except perhaps the Great Blue Heron. From four to six thousand guillemots nest in western Washington (Speich and Wahl in press).

MARbled MURRELET (*Brachyramphus marmoratus*). We found this species to be widespread in small numbers throughout the study area. It was infrequently observed in the southern reaches of Puget Sound, but was observed much more often in northern areas. Location of birds observed foraging are assumed to be close to mainland nesting locations, though in fact at least some birds may commute considerable distances inland to nest. To help complicate the picture, utilized foraging areas may shift due to prey mobility, and the species, a strong flier, is easily capable of moving rapidly between subregions. However, the overall distribution pattern in this study area is unlikely to be very different.

Nesting locations of Marbled Murrelets are still largely a mystery. Only one egg has thus far been found in Washington, near Saxton, Whatcom County, on the Nooksack River, 19 June 1925 (Anonymous 1927). A nest is yet to be found in Washington (see Kiff 1981, for a review of the few known nests elsewhere), but there is little doubt Marbled Murrelets breed in the state, and probably along many marine shorelines (Wahl et al. 1981; Speich and Wahl in press).

The total population of adult birds using the study area during the breeding season may be considerably higher than the numbers observed. Marbled Murrelets are often difficult to detect during transect counts. We observed 406 individuals, a figure that

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could at one extreme represent half their numbers. Thus, maximally about 400 pairs may be present, and minimally about 200 pairs. Similarly, about 2400 birds are known to occur in the inland marine areas east of Cape Flattery, but the actual total is likely twice that number (Speich and Wahl in press). We observed several birds-of-the-year, alone and in the company of adults.

BELTED KINGFISHER *Ceryle alcyon*. This is a widespread species, with at least one breeding pair found in most bays and harbors, and at many stream estuaries. We saw 53 individuals, and as these birds are often difficult to see in shoreline vegetation or may be unobservable in burrows, this count surely represents at best only half of all breeding birds and probably much less than that.

NORTHWESTERN CROW *Corvus caurinus*. This common species was observed throughout the study area and was one of the most widespread species. We observed 1649 individuals, certainly representing only part of their numbers in the study area. The presence of crows along marine shorelines is of course greatly influenced by tidal

Table 2. The location and numbers of Glaucous-winged Gulls nesting in Puget Sound and east of Whidbey Island, summer 1982.

Subregion Number and Name	Nesting Site Name and Description	Numbers of Nesting Birds	
		Pairs	Individuals
6 Possession Sound	Jetty Island		300 ¹
8 Port Townsend	Indian Island, bar		100 ²
11 Hood Canal Entrance	Colvos Rock, north	22	44 ³
22 Northcentral Puget Sound	Ferry terminal dolphins	1?	2?
23 Elliott Bay (Seattle)	Pier Three, dolphin	1	2
	Railroad bridge foundation	1	2
	Pier Thirty, decaying	12	24 ³
Seattle, downtown	(See Eddy 1982)	300	600
34 Commencement Bay (Tacoma)	Hylebos Waterway (two sites)	3	6
	Blair Waterway	1	2
	Puyallup River, mouth, pier		116 ¹
	Milwaukee Waterway, pier	200	400 ²
	Navigation marker	2	4
45 Case Inlet	Dolphin	1	2
48 Budd Inlet	Dolphin	1?	2?
55 Oakland Bay (Shelton)	Dolphins; old dock; channel markers; small rock (?)		30 + ¹
	sawmill: levee; floating logs	20	40 ²
	Total		1676

¹Number based on count of adults.

²Number based on count of adults and nests.

³Number based on count of adults on nests.

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level; thus our counts in many cases are minimal. Although this species nests in upland habitats, its impact on marine shorelines should not be underestimated. All the marine shoreline of Puget Sound is probably patrolled daily by crows. NOTE: For purposes of this paper we are attributing crow sightings to *caurinus*: most observers in northwest Washington believe resident birds are simply "crows" and do not attempt to identify them further (see Johnson 1961).

NON-BREEDING SPECIES

COMMON LOON *Gavia immer*. We observed 46, most in southern Admiralty Inlet and Penn Cove. Scattered birds were in deeper passages and inlets. None were in breeding plumage.

ARCTIC LOON *G. arctica*. We saw three in Carr Inlet and two other individuals elsewhere.

EARED GREBE *Podiceps nigricollis*. Two birds in breeding plumage were in Killisut Harbor.

WESTERN GREBE *Aechmophorus occidentalis*. Flocks of non-breeding birds are reported from the study area in summer (W. Harrington-Tweit pers. comm.) as they are in other Washington areas (Wahl et al. 1981). However, we observed only 154 birds, with 79 in Port Susan, 49 in the Great Bend subregion, and 14 in Case Inlet. Non-breeding numbers appeared low elsewhere in Washington inland waters in 1982 (Wahl pers. obs.)

DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus*. We observed 256 birds foraging and resting in Skagit Bay, but elsewhere noted only scattered birds, totalling 30. Nearly 3300 birds breed at about 30 sites in more northern and in the coastal marine areas of Washington (Speich and Wahl in press).

BRANDT'S CORMORANT *P. penicillatus*. Twelve birds were seen in Case and Budd inlets and Peale Passage. In Washington this species breeds only along the outer coast, and in low numbers: four sites with about 560 birds (Speich and Wahl in press).

DABBLING DUCKS *Anas* sp. One Northern Pintail (*A. acuta*) was identified, and about 200 unidentified dabblers were seen during aerial censuses in Skagit Bay.

SCAUP *Aythya* sp. Almost all of 100 scaup observed were in Skagit and Port Susan bays.

COMMON GOLDENEYE *Bucephala clangula*. Five birds were observed.

BUFFLEHEAD *B. albeola*. One bird was observed.

OLDQUAW *Clangula hyemalis*. We observed one bird.

HARLEQUIN DUCK *Histrionicus histrionicus*. We observed 72. Six in Central Puget Sound subregion and one in Rich Passage were the only birds recorded south of the entrance to Hood Canal. We saw 35 near Port Townsend on the Indian Island spit, 11 in Killisut Harbor and 14 in Penn Cove-Crescent Harbor. Harlequin Ducks nest in the mountains of western Washington.

WHITE-WINGED SCOTER *Melanitta fusca*. We identified 913, with over 600 concentrated in Penn Cove-Crescent Harbor and Skagit Bay. In addition, about 3000 unidentified scoters were recorded in these same areas, and some at least were this species.

SURF SCOTER *M. perspicillata*. Skagit Bay and Penn Cove-Crescent Harbor held over 900 of 1250 birds identified. Many unidentified scoters were likely this species. Small numbers were observed in northern Puget Sound and Hood Canal.

COMMON MERGANSER *Mergus merganser*. We saw 162 birds in Skagit Bay and 20 in Oakland Bay. This is a relatively common nesting species along coastal rivers in western Washington.

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RED-BREASTED MERGANSER *M. serrator*. Four were in Killisut Harbor and one was observed in Case Inlet.

AMERICAN COOT *Fulica americana*. Three scattered birds were noted. Coots nest commonly in inland freshwater areas in western Washington.

RUDDY TURNSTONE *Arenaria interpres*. Two were observed on the Tacoma waterfront at the Puyallup River delta.

WESTERN SANDPIPER *Calidris mauri*. About 370 birds of this species and unidentified "peeps" were observed, indicating minimum migration in the area. Adequate census coverage of the Nisqually delta area would likely have revealed many more of this and other shorebird species.

CALIFORNIA GULL *Larus californicus*. We identified a total of 393 in small flocks dispersed in appropriate habitats. The species occurs as a non-breeder and post-breeding migrant regularly in summer in inland Washington marine waters.

RING-BILLED GULL *L. delawarensis*. About 170 in Skagit Bay and 50 in Henderson Inlet comprised almost all the birds observed. This gull nests in one and perhaps two sites in outer coastal bays in western Washington, numbering perhaps 100 nesting birds (Speich and Wahl in press).

MEW GULL *L. canus*. We noted 25 birds, mostly in Skagit Bay and Penn Cove-Crescent Harbor. Some of 5451 unidentified gulls observed were likely of this and the preceding two species.

BONAPARTE'S GULL *L. philadelphia*. Numbers were relatively low, with only 140 noted. Most were in the northern part of the study area, though some may have been present in the Nisqually delta, the outer shoreline of which was observed only from a distance.

HEERMANN'S GULL *L. heermanni*. Small numbers totalling 34 birds were noted north of the entrance to Hood Canal to Port Townsend.

CASPIAN TERN *Sterna caspia*. We noted 41 birds throughout the study area, concentrated near river deltas and estuaries. Twenty-three were in Skagit Bay. In western Washington, about 8000 Caspian Terns nest at three sites in outer coastal bays (Speich and Wahl in press).

COMMON MURRE *Uria aalge*. About 340 birds were seen, with 284 in the passage between Treble Point and Johnson Point and small flocks in Carr Inlet and Pitt Passage.

RHINOCEROS AUKLET *Cerorhinca monocerata*. Of 322 birds observed, 295 were noted from Oak Bay north to Port Townsend. We observed 15 near Seattle and 11 south of Steilacoom. The latter birds were in immature plumage whereas more northerly birds were in breeding plumage. The species breeds at Protection Island, a few miles northwest of Port Townsend and in large numbers at two other sites outside the study area. About 60,000 birds nest at several sites in western Washington (Speich and Wahl in press).

DISCUSSION

Marine bird populations observed in the study area likely reflect a number of factors, though in some instances the effects of these factors and interrelationships are not clear.

Much of the study area is highly developed, some portions are heavily industrialized, and human activities are widespread and intensive.

Populations of seabirds in summer appear generally to be low. Nesting habitat for cormorants is limited. Glaucous-winged Gulls nest predominantly

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on man-made habitats. Pigeon Guillemots are widespread, utilizing nest sites throughout the study area, though not all cliffs which appear suitable are used. Guillemots nest in very small numbers in Tacoma and Seattle where piers offer many potential nest sites. Contrasting with this very limited number of breeding "seabirds" in the study area, the adjacent inland waters to the north have sizable numbers of nesting Double-crested and Pelagic cormorants, American Black Oystercatchers, Glaucous-winged Gulls and Rhinoceros Auklets, in addition to large numbers of Pigeon Guillemots and, presumably, Marbled Murrelets. In addition, breeding populations of Great Blue Herons and Bald Eagles are substantially higher to the north (Wahl et al. 1981, Speich and Wahl in press).

Populations of non-breeders include gulls associating with human activities and structures, small numbers of loons, grebes, cormorants and alcids using offshore areas, and many species using suitable nearshore estuarine habitats when disturbance is low. Population sizes of many non-breeding species appear low in comparison to areas in the San Juans, Strait of Georgia and Strait of Juan de Fuca to the north, with the exception of the area east of Whidbey Island including the Skagit and Port Susan estuaries, where large populations are indeed comparable to any in Washington in summer. The Nisqually delta, included in the present study area, is also comparable in many respects, though our survey did not adequately sample that area.

Total numbers of summer resident birds in the study area are, as in more northern areas, lower than corresponding figures for winter resident birds (Wahl et al. 1981, Wahl and Speich unpubl. obs.).

The impacts of increasing human use and development of habitats and comparisons of biological productivity of the study area with regions of the Strait of Juan de Fuca and adjacent waters warrant study and will likely contribute greatly to understanding birds and their place in the ecosystem.

ACKNOWLEDGMENTS

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Pelagic Cormorant—breeding adult

Sketch by Narcia Moore-Craig



Pigeon Guillemots on Southeast Farallon Island, California, August 1979. Photo by Bruce E. Webb