SEABIRD OBSERVATIONS OFF WESTERN MEXICO

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Southern Mexico's offshore Pacific avifauna has been rather little studied. Murphy (1958) and Jehl (1974) reported observations from cruises that passed through Mexican waters in November and December 1956 and in April 1973, respectively. Pitman (1986) mapped the relative abundance of 57 species of seabirds in the eastern tropical Pacific on the basis on 4333 hours of observation between 1974 and 1984; only a small number of these 4333 hours (81 noon positions, 55 of which were off Baja California), however, pertain to Mexican waters (i.e., within 200 nautical miles of Mexican territory), and 74% of the 81 noon positions were between October and March (R. L. Pitman pers. comm.). Pitman's atlas provides an excellent large-scale picture but lacks data on seasonal status of species, and the scale employed does not enable one to interpret local distributions. Other records of seabirds off western Mexico are widely scattered and mostly derive from nearshore land-based trips of a day or less (e.g., Binford 1970, 1989).

The Middle American Trench runs from the vicinity of the Islas Tres Marias, Mexico, to the Cocos Ridge, south of Costa Rica. The trench lies some 55–110 km (mean distance 75 km) offshore between Jalisco and Guerrero and is 15–50 km (mostly 20–30 km) wide. The trench is at least 3600 m deep, mostly 4300–4650 m deep from central Jalisco south, and increases to 5000–5200 m deep off central Guerrero; submarine mountains in the trench off Colima (Manzanillo) and Guerrero (Zihuatanejo) reduce depths to 3600 m. On either side of the trench waters quickly shallow to 2700–3200 m, and inshore the 1000-fathom (1800-m) contour line lies 20–55 km (mostly 35–55 km) off the coast.

From 28 April to 6 May 1992 we observed seabirds off western Mexico out to 100 km from shore, that is, from just offshore of to well inshore of the Middle American Trench, between the vicinity of Cabo Corrientes, Jalisco, and Acapulco, Guerrero. Here we describe the birds observed during our visit.

ITINERARY AND METHODS

We began observations at dawn on 28 April at 19°51' N, 106°28' W, about 110 km west-southwest of Cabo Corrientes and just offshore of the northern end of the trench. Figure 1 shows the routes of our daylight transits off western Mexico relative to the Middle American Trench. Other than 29 April and 4 May, when we made stops for supplies, daily transits were 85–145 km, with variation due to time spent observing feeding flocks and the effect of currents on our cruising speed. On 3 May we circled Las Rocas Potosí (17°32' N, 101°31' W), 13 km southeast of Zihuatanejo, and on 4 May we checked various islets 10–18 km west of Zihuatanejo (including Las Islas Blancas and Isla Grande).

SEABIRD OBSERVATIONS

We made observations with 8 × 30 binoculars throughout the day from the deck of the 14.5-m ketch *Enchantress*. Our eye level was about 3 m above sea level, giving a visible horizon of 5.5–7 km. For 30 continuous minutes of every hour of transit we counted all birds within 200 m of the vessel within a 90° sector (ahead to either port or starboard, depending on light, wind, and/or sail conditions). The radius of 200 m was chosen since beyond that distance, in winds of more than 10–15 km/h, we often were unable to identify to species smaller birds such as storm-petrels or phalaropes. Our speed over the ground averaged 11 km/h and was rarely below 9 or above 13 km/h.

We frequently changed course to observe feeding flocks within 5 km of our course more closely, and we noted the composition and behavior of species in each flock (from 5 to 45 minutes were spent at each feeding flock). We discontinued any 30-minute observation period interrupted by such course changes since it no longer represented a random transit.

One or both of us were on deck during all daylight hours and maintained a nonstandardized watch for seabirds (i.e., anything we could see from the vessel regardless of distance and direction) when not making 30-minute censuses or observing feeding flocks.

We took the surface water temperature at the start of each 30-minute observation period and at the location of each feeding flock. Positions were determined by means of a Magellan Global Positioning System; depths were interpolated to the nearest 50 m from Defense Mapping Agency chart numbers 21017 and 21020. The warmest waters were consistently those inshore of the trench (in depths of 900–3000 m), which averaged 0.5–1.0°C warmer than waters from the inshore edge of the trench to offshore of the trench. Monthly mean sea-surface temperatures for these waters are 1.0–2.5°C cooler in April and 0.5–2.0°C cooler in May than the temperatures we recorded (Robinson 1976). The relatively warm waters of our cruise probably reflect a well-developed El Niño–Southern Oscillation.

Winds were generally light (1–10 km/h), although for brief periods on 29 and 30 April they increased to 20–25 km/h. Wind direction was mostly from south to west off Jalisco, Colima, and Michoacan, and mostly northwest to west off Guerrero.

RESULTS AND DISCUSSION

Table 1 presents the results of our standardized daily censuses as birds per hour (total individuals recorded per day during census periods divided by total daily hours of census). The following species accounts describe the abundance and distribution of the 30 species of seabirds recorded more than 3 km from shore and other species of note. Common coastal species such as the Brown Pelican (*Pelecanus occidentalis*) and Laughing Gull (*Larus atricilla*) are thus omitted from the accounts.

While terms such as "rare," "common," etc., will always be subjective, we consider them useful; data for each species indicate the basis for our assessments of abundance. The numbers given in parentheses after each species' name indicate the total number observed (including standardized and nonstandardized observations and feeding flocks, but not individuals at

inshore rocks and islets), maximum number recorded per day, and number of days recorded. An asterisk after the daily maximum indicates that the high total was recorded on two days. Water temperature ranges are given at the end of each species account.

Species Accounts

Laysan Albatross, *Diomedea immutabilis* (1; 1/1). Rare. We saw one on 28 Apr associating with a feeding flock over the northern end of the trench; 29.4°C. This species has colonized islands off western Mexico in recent years (Howell and Webb 1992); Isla San Benedicto is the breeding site nearest our observation.

Pink-footed Shearwater, *Puffinus creatopus* (481; 160/8). Common to fairly common; less common in the southern half of our study area (Table 1). We recorded Pink-footed Shearwaters to within 20 km of shore but most were more than 25 km offshore over waters more than 1000 m deep. This species often was a common member of feeding flocks over midshore and offshore waters. 25.6–29.4°C.

Wedge-tailed Shearwater, *P. pacificus* (124; 75/5). Fairly common to uncommon in southern waters warmer than 27.5°C, with only one seen north of Michoacan. Wedge-tailed Shearwaters occurred to within 3.5 km of shore but most were 20–75

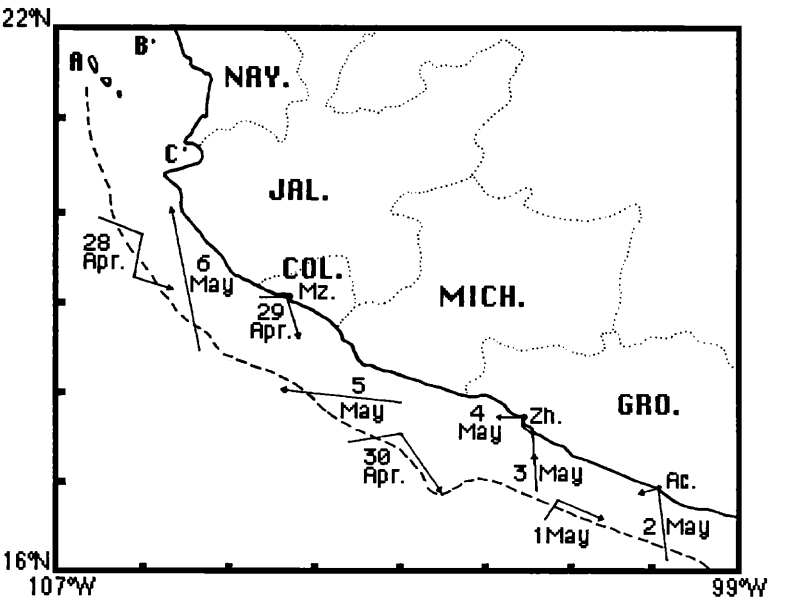

Figure 1. Routes of seabird observations off western Mexico (solid lines with arrows), 28 April–6 May 1992. Dashed line indicates bottom of the Middle American Trench. A, Islas Tres Marias; B, Isla Isabel; C, Islas Tres Marietas; Ac, Acapulco; Mz, Manzanillo; Zh, Zihuatanejo.

Table 1 Seabirds Observed (to Nearest 0.1) per Hour During 30-Minute Counts of 90° Sectors off Western Mexico, 28 April–6 May 1992

	28 Apr	29 Apr	30 Apr	1 May	2 May	3 May	4 May	5 May	6 May
Pink-footed Shearwater	3.0	2.0	0.2	0.8	0.6	1.1	—	1.7	2.2
Wedge-tailed Shearwater	*[a]	—	—	0.3	0.9	1.4	—	0.2	—
Sooty Shearwater	+	—	0.2	+	+	0.6	—	0.5	0.2
Christmas Shearwater	—	—	—	0.5	+	0.6	—	+	—
Townsend's Shearwater	0.3	0.5	+	—	0.6	2.9	—	0.5	8.7
Audubon's Shearwater	—	—	—	—	+	2.0	1.0	—	0.2
Leach's Storm-Petrel	2.9	0.5	+	—	—	0.3	—	0.8	9.1
Galapagos Storm-Petrel	4.8	0.5	0.4	1.3	3.4	1.4	2.0	0.2	5.5
Black Storm-Petrel	6.1	5.0	1.6	1.3	2.8	4.0	6.0	2.0	3.5
Least Storm-Petrel	—	1.0	—	—	1.5	0.3	11.0	*	0.5
Red-billed Tropicbird	—	+	—	+	+	—	—	+	0.2
Masked Booby	—	—	0.2	0.5	0.3	—	—	*	—
Brown Booby	5.6	2.0	6.2	8.0	3.1	19.7	5.0	0.7	12.5
Red-footed Booby	—	—	0.7	2.0	+	+	—	0.2	+
Magnificent Frigatebird	+	+	0.2	*	+	—	—	*	*
Red-necked Phalarope	3.8	1.0	0.4	1.0	5.2	6.6	—	1.2	0.7
Red Phalarope	1.3	2.5	0.2	0.7	6.2	2.0	2.0	1.5	5.6
Phalarope sp.	1.3	1.0	0.2	4.0	1.9	0.9	3.0	3.7	6.2
Pomarine Jaeger	0.2	1.5	0.4	+	0.3	0.3	+	0.3	0.5
Parasitic Jaeger	0.6	—	+	+	+	—	—	*	*
Long-tailed Jaeger	—	*	+	*	*	0.9	+	+	*
Jaeger sp.	0.2	—	—	—	—	+	+	—	—
Sabine's Gull	0.2	1.0	—	0.5	0.9	1.1	+	+	+
Common Tern	+	+	—	—	*	*	+	—	0.4
Arctic Tern	*	1.0	+	1.0	+	—	—	0.2	—
Common/ Arctic Tern	0.3	+	—	—	—	——	—		
Least Tern	—	*	—	—	+	+	+	+	0.4
Bridled Tern	—	+	—	+	—	13.1	24.0	—	+
Black Tern	0.8	6.0	0.4	1.5	10.8	4.0	1.0	0.3	6.5
Brown Noddy	—	—	—	—	—	3.1	+	—	*
Hours of observation	6.25	2.0	5.5	4.0	3.25	3.5	1.0	6.0	5.5
Sea surface temperature (range in °C)	25.6–28.5	27.5–27.6	27.0–28.4	27.7–29.4	28.5–29.4	28.0–29.3	28.4	27.7–30.2	27.2–28.8

[a] +, seen outside census periods; *, seen outside census periods and only with feeding flocks.

km offshore over waters 900–5000 m deep. We found most birds with feeding flocks, and except for two or three dark-morph birds on 2 May we saw only the light morph, agreeing with the results of Pitman (1986). 27.7–29.5°C.

Sooty Shearwater, *P. griseus* (29; 5*/7). Uncommon, seen mostly as single birds flying northwest, but a few birds associated loosely with feeding flocks. Sooty Shearwaters occurred 18–95 km (mostly beyond 35 km) offshore over waters greater than 1000 m deep. 27–29.5°C.

Christmas Shearwater, *P. nativitatis* (47; 27/4). Fairly common over waters warmer than 28.0°C and 2700–5000 m deep in a belt 35–55 km offshore of Guerrero; uncommon off Michoacan, where we saw the northernmost bird at 17°53' N, 103°41' W. We found most Christmas Shearwaters with feeding flocks. 27.7–29.4°C.

The A.O.U. (1983) considered this species "accidental at sea between Clipperton Island and the mainland of Mexico," presumably on the basis of an undated specimen collected at 12°05' N, 107° W (Loomis 1918), about 315 km northeast of Clipperton. Pitman (1986), however, reported seeing this species at rates of 0.75–2.0 per hour off western Mexico (from Michoacan to Oaxaca) between June and September; he collected a specimen (Los Angeles County Museum) on 2 June 1982 at 15°20' N, 99°22' W, about 180 km south-southeast of Acapulco. In addition, D. G. Ainley and L. B. Spear (pers. comm.) observed four Christmas Shearwaters 102–192 km offshore from Guatemala to Oaxaca, Mexico, on 9 and 10 April 1992. This species appears to be a fairly common visitor, at least during some years from April to September, to waters off southern Mexico.

Townsend's Shearwater, *P. auricularis* (404; 133/7). Fairly common, occurring 25–95 km offshore over waters 1000–4500 m deep. We detected most birds in feeding flocks or as rafting groups of up to 45 birds. The morning of 28 April we noted ones and twos steadily flying east, i.e., on a direct route from the species' nesting grounds on Isla Socorro to coastal waters off Jalisco. The plumage of most of the birds we saw in the feeding flocks was worn and faded, and several birds were molting flight feathers; we noted only 15–20 birds (including those on 28 April mentioned above) that appeared to be in fairly fresh plumage. 25.6–29.4°C.

Jehl (1982) concluded that young Townsend's Shearwaters fledge between late May and late July. Thus, while some of the birds we saw may have been failed breeders, and others breeding adults ranging to feeding grounds off western Mexico, the majority probably were immatures and nonbreeders. Jehl (1982), in plotting this species' seasonal distribution, cited only one record from waters off western Mexico from April to June, and saw none off western Mexico in early April 1973 or April 1976. Immature and nonbreeding Townsend's Shearwaters may arrive regularly off southwestern Mexico in late April.

Townsend' Shearwaters associated with Audubon's Shearwaters at feeding flocks, enabling direct comparison of these two species. While most guides emphasize the white patches on the flanks of Townsend's, most birds we saw were sitting on the water and made only short feeding flights, so the flank patches often were not visible. In addition, many Townsend's were very worn, faded, and brownish above, and the white flank patches often were inconspicuous. The features we found useful in separating these two species apply only to nominate Townsend's and the sympatric subspecies of Audubon's Shearwater (*P. l. subalaris*, nesting in the Galapagos).

Townsend's is larger and longer winged than Audubon's, and this was obvious in direct comparison. Although the National Geographic Society (1987) and Naveen (1983) mentioned the long tail of Audubon's, we did not notice this, and Murphy (1936) pointed out that "the tail in the Galapagos race is both relatively and absolutely shorter" than in Atlantic populations. The quicker wingbeats of Audubon's usually identified it in prolonged flight, but in feeding flocks flight manner was not

very useful since both species mostly made short rapid flights. We also were unable to discern on birds in feeding flocks reported differences in underwing pattern (e.g., Harrison 1983, 1987), although this pattern may be seen briefly when birds flush from the water (Figure 2).

When the birds were sitting on the water the most striking difference was the white sides of Townsend's, suggesting a Tufted Duck (*Aythya fuligula*), versus the mostly dark sides of Audubon's (Figure 3). This difference may be due in part to a tendency of Audubon's to hold its wings more drooped, since 41 of 100 specimens of *P. l. subalaris* at the California Academy of Sciences have clean white flanks; the other 59 have distinct dark streaking on their flanks.

Face and neck pattern was useful in flight and at rest: Audubon's has a clean-cut dark cap that extends to just below the eyes and may show indistinct white eye-crescents; Townsend's has a more extensive and not clean-cut blackish cap that extends well below the eyes and over the auriculars (Figure 3). Townsend's has a dark half collar on the sides of the lower neck; Audubon's has a cleaner-cut and smaller patch (Figure 3). Atlantic populations of Audubon's, however, have a dark half collar similar to Townsend's (Murphy 1936, Howell pers. obs.).

The feet of Audubon's appeared dusky flesh, those of Townsend's flesh pink, not black (*contra* Harrison 1983, Ridgely and Gwynne 1989). This is evident in photographs of Townsend's taken by Howell (unpubl.) and Jehl (1982). Six specimens of Townsend's at the California Academy of Sciences have obviously pale legs and feet with blackish only on the outer side of the outer two toes, as did two live Newell's Shearwaters [*P. (a.) newelli*] examined near Hawaii (Howell and L. B. Spear field notes).. Thus the feet of Townsend's (and Newell's) appear mostly flesh at sea, perhaps brighter and pinker than the feet of Audubon's.

Figure 2. Townsend's Shearwater off Jalisco, 28 April 1992. Note extensive dusky smudging on sides of face and neck, relatively faded and brownish upperwings, white flank patch, and extensively clean white underwing.

Photo by Steve N. G. Howell

Because of plumage wear and variable lighting conditions we found the color of the upperparts (usually considered blackish on Townsend's and dark brown on Audubon's) to be of little use in field identification.

Audubon's Shearwater, *P. lherminieri* (126; 95/4). Fairly common 20–35 km off Guerrero over waters 500–1800 m deep; we also saw five birds 20–45 km off Jalisco over waters 500–1000 m deep, north to 19°51' N, 105°37' W. Our lack of records between Guerrero and Jalisco probably reflects our lack of observations in these waters. 27.6–29.5°C.

The A.O.U. (1983) reported Audubon's Shearwater as ranging north in the eastern Pacific to Oaxaca, and Pitman (1986) reported up to 2–10 birds per hour north to waters off Colima. Our reports off Jalisco represent the northernmost records of Audubon's Shearwater in the region.

Leach's Storm-Petrel, *Oceanodroma leucorhoa* (125; 75/6). Common off Jalisco in waters cooler than 27.5°C; uncommon to rare south from there in waters warmer than 27.5°C, where we saw only 14 birds. Of the 13 dark-morph birds we saw, 60%

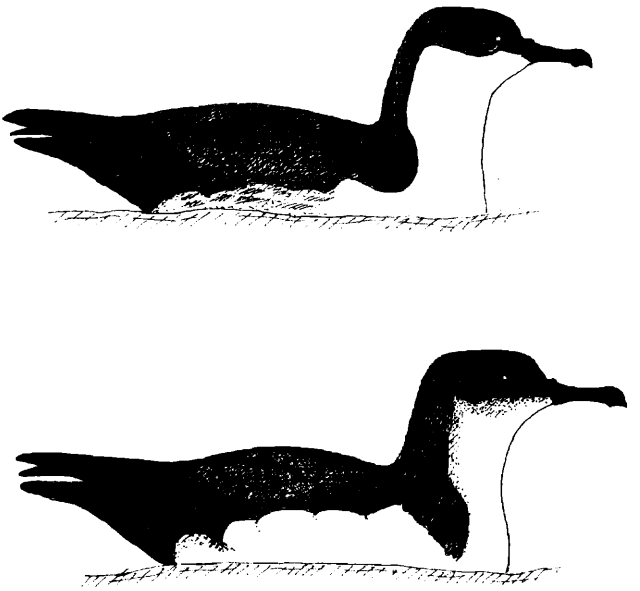

Figure 3. Comparison of Audubon's Shearwater, *Puffinus lherminieri subalaris* (upper) and Townsend's Shearwater, *P. a. auricularis* (lower).

Sketch by Steve N. G. Howell

were over waters warmer than 27.5°C, while 96% of light-morph birds were over waters cooler than 27.5°C. All Leach's Storm-Petrels were at least 45 km offshore over waters 2500–5000 m deep. 25.6–30.2°C.

Although Leach's was the commonest storm-petrel on 6 May both immediately before and after a feeding flock that included 50+ Galapagos and 90+ Black storm-petrels, only three Leach's associated with this flock.

Galapagos (Wedge-rumped) Storm-Petrel, *O. tethys* (321; 130/9). Common to fairly common throughout the cruise. We recorded it to within 9 km of shore, but most were at least 25 km offshore over waters 1000–5000 m deep. Notable concentrations were 130 birds rafting with 20 Black Storm-Petrels at 17°03' N, 101°26' W on 3 May, and 50+ rafting and feeding over Bottlenose Dolphins (*Tursiops truncatus*) on 6 May. In 45 minutes, ten birds came to a slick of cod liver oil laid at 19°42' N, 105°35' W, 6 May. 25.6–29.5°C.

Black Storm-Petrel, *O. melania* (487; 166/9). Common to fairly common throughout, occurring 2–95 km from shore over waters 75–5000 m deep. Up to 12 birds often followed the boat and scavenged galley scraps after meals. A notable concentration was 90+ birds rafting and feeding over Bottlenose Dolphins on 6 May. In 45 minutes, 26 birds came to the same slick of cod liver oil that attracted the Galapagos Storm-Petrels on 6 May. 25.6–30.2°C.

Least Storm-Petrel, *O. microsoma* (134; 46/6). Common within 35 km (and mostly within 25 km) of shore over waters less than 1000 m deep. The species' abundance in this zone is masked in Table 1 by the inclusion of hours farther offshore when none was seen. The slick of cod liver oil laid on 6 May attracted five. 27.7–28.8°C.

Red-billed Tropicbird, *Phaethon aethereus* (6; 2/5). Uncommon to rare. Even on 29 April when we passed within a few kilometers of Peña Blanca, a large colony of Red-billed Tropicbirds 18 km west of Manzanillo, we saw only two single tropicbirds. None associated with feeding flocks, and we noted only one in our census periods. Apparently this species disperses widely and is mostly solitary at sea; Au and Pitman (1986) recorded only one tropicbird in 134 feeding flocks in the northeastern tropical Pacific. 27.4–28.9°C.

Peña Blanca appears to be a previously unreported colony, although it has been known to local fishermen for many years. Howell and S. Webb visited the rock on 1 January 1987 and observed 900–1000 tropicbirds with many pairs engaged in noisy courtship flights and some birds entering crevices. Subsequent observations by Howell are of 50+ birds on 16 March 1989, 100+ on 15 March 1990, and 80–100 on 13 March 1992; on each of these dates Howell saw some courtship flights and several birds entering and leaving crevices.

At Las Rocas Potosí, Guerrero, we saw four or five pairs of Red-billed Tropicbirds engaged in screaming courtship flights and saw one bird enter a crevice in the rocks. The A.O.U. (1983) recorded breeding by Red-billed Tropicbirds along Mexico's Pacific coast south only to Las Islas Tres Marias, Nayarit, but clearly the species' breeding range is more extensive.

Masked Booby, *Sula dactylatra* (83; 40/4). Fairly common 45–100 km offshore from Michoacan south, over waters deeper than 2500 m. Most were associated with feeding flocks or attracted to the boat. All 70 adults and subadults we saw clearly had the bright yellow-orange to pinkish-orange bills characteristic of *S. d. granti* of the Galapagos, suggesting they originated there, although this subspecies also nests in small numbers on Las Islas Revillagigedo (Howell and Webb 1990). 27–28.2°C.

Blue-footed Booby, *S. nebouxii*. We saw one at Zihuatanejo on 3 May and two or three at Las Islas Blancas and 11 or 12 at Isla Grande (18 km west of Zihuatanejo) on

4 May. This species is notably sedentary about its nesting areas (south in Mexico to Las Islas Tres Marietas) and rarely wanders south to waters off Colima (Howell pers. obs.). We are aware of no previous records from Guerrero, although there is one hypothetical record from Oaxaca (Binford 1989).

Brown Booby, *S. leucogaster* (5555; 1480*/9). Common to fairly common out to 100 km from mainland. The two high counts reflect 1310 birds (99% adult) heading offshore from the large colony at Peña Blanca, Colima, between 0700 and 0730 on 29 April, and probably a large component (1000+ birds) of the colony at Las Rocas Potosí, Guerrero (100–120 km distant), on 1 May. The Brown Booby was a common member of feeding flocks and a conspicuous indicator of them at distances up to 5 km. Adults constituted 60–95% of birds seen on all days but 2 May; most were commuting to and from the mainland because usually we saw few or none at dawn when we often saw the more pelagic Masked and Red-footed boobies. On 1 and 2 May, however, we saw numerous Brown Boobies at dawn, 75–85 km offshore, and on 2 May 90% of the 175 Brown Boobies seen were juveniles and immatures. 25.6–30.2°C.

At Las Rocas Potosí we counted 6000–6500 birds, including many recently fledged juveniles, on or around the rocks, 1430–1510 on 3 May. The A.O.U. (1983) recorded breeding by the Brown Booby along Mexico's Pacific coast south only to Las Islas Tres Marias, Nayarit, thus overlooking the two colonies mentioned here, although Goldman (1951) photographed the Guerrero colony. At Las Islas Blancas (17°40' N, 101°38' W), apparently not a breeding site, we counted 200 roosting Brown Boobies.

Red-footed Booby, *S. sula* (203; 120/6). Fairly common 35–100 km offshore from Michoacan south over waters deeper than 1500 m; uncommon north to Jalisco. We also saw one brown-plumaged bird roosting at Las Islas Blancas. This species was more commonly attracted to the boat than to feeding flocks, and up to ten birds often accompanied us, outmaneuvering the less agile juvenile Brown Boobies in pursuit of flying fish flushed by the boat. Of the birds we saw, 99% were brown-plumaged and at least 80% of these were immatures; we noted only one white-morph adult and three or four brown adults. 27.6–29.5°C.

Magnificent Frigatebird, *Fregata magnificens* (40; 16/7). Uncommon. Of the total, we saw 15 on the approach to Manzanillo on 29 April and 16 at sea with feeding flocks on 5 May. Although we noted Magnificent Frigatebirds as far as 95 km offshore, most were less than 45 km from land. 26.9–28.6°C.

Wilson's Phalarope, *Phalaropus tricolor*. One flew northwest at 17°53' N, 103°35' W, on 5 May.

Red-necked Phalarope, *P. lobatus* (2990; 1500/8). Common to fairly common. We recorded Red-necked Phalaropes up to 95 km offshore but most were less than 45 km from land, and large concentrations occurred within 15 km of shore. 25.6–29.5°C.

Red Phalarope, *P. fulicaria* (487; 190/9). Common to fairly common, occurring 9–95 km offshore but mostly 20–55 km from land. 25.6–29.5°C.

Pomarine Jaeger, *Stercorarius pomarinus* (86; 24/9). Common. We saw 43 birds with feeding flocks but the only kleptoparasitic chases noted were single chases of Masked and Brown boobies and of a Christmas Shearwater. Immatures were commoner than adults at feeding flocks, and most of the 27 adults (all light-morph) were heading northwest. Pomarine Jaegers occurred 4–95 km offshore. 25.6–29.4°C.

Parasitic Jaeger, *S. parasiticus* (14; 8/6). Uncommon. After eight (including four light-morph adults) on 28 April, this species was notably uncommon, with ones and

twos (mainly immatures) seen mostly at feeding flocks, where we noted two chases of Black Terns. All Parasitic Jaegers were 25–95 km offshore. 25.6–29.2°C.

Long-tailed Jaeger, *S. longicaudus* (25; 7/8). Fairly common 25–95 km offshore, with one noted 9 km from land. The 25 birds (18 at feeding flocks) included 17 adults and 6 immatures, all of the light morph. We noted 23 chases, all of terns: 21 of the Black Tern, and one each of Arctic and Common terns. 27.5–29.4°C.

None of the adults had the long tail streamers of alternate plumage, although one showed slender streamers apparently half-grown; the rest had the shorter and thicker streamers of basic plumage. In contrast to this species' highly variable juvenile plumage, the immatures were consistent in appearance, and the available literature (e.g., Cramp and Simmons 1983, Harrison 1983) suggests the immature Long-tailed Jaegers we saw were second-summer birds. Since the immature plumages of the Long-tailed Jaeger are poorly known, we describe this plumage briefly. The head and underbody were whitish with a smudgy dark cap suggesting an adult, a buffy-yellow wash on the sides of the neck, and an obvious dark chest band. The underwings were dark with a distinct but narrow white flash along the bases of the primaries and strong pale barring on the coverts. The upperparts resembled those of the adults, but the brownish-gray upper wing coverts did not contrast as strongly with the dark remiges, and the upper tail coverts were barred whitish. We were unable to discern any projecting tail streamers.

Franklin's Gull, *Larus pipixcan* (3; 1/2). Rare. We saw only three, all in alternate plumage, 9–65 km offshore, although this species was fairly common in coastal bays and harbors. 27.5–29.2°C.

Sabine's Gull, *L. sabini* (112; 38/8). Fairly common to common 4–75 km (mostly 10–55 km) offshore. Most were seen in transit, but ones and twos occasionally associated with feeding flocks and 11 were with one flock. In this flock we observed up to two Sabine's Gulls at a time (and at least five individuals in all) making seven kleptoparasitic chases of Black Terns; at least two chases were successful. 25.8–29.4°C.

Fewer than 10% of the Sabine's Gulls we saw were fully alternate-plumaged adults, the rest apparently being first-year birds with partial hoods or mostly dark hoods flecked whitish. Some of these may have been adults that had not completed their prealternate molt, although this reportedly occurs before northward migration (Grant 1986). Alternatively, some may have been adults that wintered locally and had not yet completed their molt. Although the A.O.U. (1983) described the winter range of Sabine's Gull as "Panama south to central Chile," the species winters, at least in some years, north to waters off western Mexico, as indicated by the following: Howell and P. Pyle saw four adults between Cabo San Lucas, Baja California Sur, and Puerto Vallarta, Jalisco, on 17 December 1983; J. C. Arvin (pers. comm., Figure 4) saw 200–250 Sabine's Gulls, mainly basic-plumaged adults, over the Gorda Banks approximately 10–20 km south of San Jose del Cabo, Baja California Sur, on 2 March 1984 and 28 February 1985. Grant (1986) published photographs, taken off El Salvador in March 1980, of adult and first-year Sabine's Gulls showing extensive flight feather molt.

Common Tern, *Sterna hirundo* (30; 9/6). Uncommon to fairly common 2–80 km (mostly less than 45 km) offshore. The majority were with feeding flocks, and the 30 birds included 15 adults and 12 first-year birds. 27.1–29.5°C.

Arctic Tern, *S. paradisaea* (74; 26/6). Fairly common 30–95 km offshore, with most at least 55 km from shore over waters more than 1800 m deep. The majority were with feeding flocks, and the 74 birds included 62 adults and two first-year birds. 26.9–29.4°C.

Jehl (1974) stated, "The northward migration route of the Arctic Tern . . . is unknown," and certainly for the Pacific the literature on this subject appears to be rather vague. Our observations indicate that some Arctic Terns move north off western Mexico in spring but that they occur far offshore.

Least Tern, *S. antillarum* (41; 23/6). Uncommon to fairly common 2–30 km (mostly less than 18 km) offshore over waters less than 1500 m deep. Like other terns, this species usually associated with feeding flocks. We noted only one first-year bird. 27.5–29.5°C.

Bridled Tern *S. anaethetus* (325; 260/5). Locally common. Within 35 km (mostly within 18 km) of land over waters less than 1200 m deep off Zihuatanejo we saw 60 adult Bridled Terns on 3 May and 260 adults on 4 May. Uncommon away from this area, with single adults off Jalisco and Colima, and three adults about 55 km off Guerrero on 1 May. 27.6–29.2°C.

Howell et al. (1990) considered it "likely that Zihuatanejo was, and may still be, the site of a breeding colony" (of Bridled Terns). K. L. Garrett (pers. comm.) recently found at the Los Angeles County Museum a specimen of a Bridled Tern mislabeled as a Sooty Tern. This bird was collected at "White Friars, Mexico" (17°28' N, 101°31' W) on 7 May 1939, and the label reads "nesting from surf to summit." From the coordinates, White Friars appears to be synonymous with Las Rocas Potosí (there are no rocks 4 nautical miles south of Las Rocas Potosí). On 3 May 1992 we circled Las Rocas Potosí, 1330–1410, and saw a few Bridled Terns around the rocks but no sign of nesting; year-to-year variation in nesting chronology, El Niño, or simply time of day could account for the apparent absence of birds at the rocks.

A previously unreported nesting site for this species (and its northernmost in the eastern Pacific) is Isla Isabel, Nayarit, where we estimated 20–30 pairs on 9 May

Figure 4. Sabine's Gulls 10 km south of San Jose del Cabo, Baja California, Sur, 28 February 1985. This species occurs off Mexico during some winters, perhaps regularly.

Photo by John C. Arvin

1992, including birds displaying, copulating, and entering and leaving crevices in the rocky stacks off the eastern side of the island.

Sooty Tern, *S. fuscata* (8; 5/3). Uncommon. We saw only four adult and four first-year Sooty Terns, all with feeding flocks 40–55 km offshore over waters 1300–3600 m deep. 27.9–29.2°C.

Black Tern, *Chlidonias niger* (2061; 522/9). Common to fairly common. We saw Black Terns up to 80 km offshore, but most were within 35 km of land over waters less than 2000 m deep. Black Terns were characteristic of inshore waters, where they were a dominant component of feeding flocks. In feeding flocks off Guerrero, 80–90% of the Black Terns were immatures, and only 10% were alternate-plumaged adults; off Jalisco and Colima, 60–90% were alternate-plumaged adults. 26.0–29.5°C.

Brown Noddy, *Anous stolidus* (41; 25/3). Fairly common off Zihuatanejo within 35 km of shore over waters less than 1000 m deep. We saw only one noddy away from this area. 27.5–29.4°C.

Brown Noddies have not been reported breeding along the Mexican coast south of Las Islas Tres Marietas, Nayarit (A.O.U. 1983), but they may nest at Las Rocas Potosí, where we counted 200–250 adults on 3 May.

Brewer's Blackbird, *Euphagus cyanocephalus*. A male circled the boat at 19°36' N, 106°05' W on 28 April.

Brown-headed Cowbird, *Molothrus ater*. A male circled the boat at 17°27' N, 103°20'W on 30 April, and a female circled the boat at 19°15'N, 105°28' W on 6 May.

Species Not Seen

Pterodroma petrels were notable by their absence. At least at this season few or none apparently occur within 75–95 km of shore in the region, despite the deep waters of the Middle American Trench. Pitman (1986) mapped several species of *Pterodroma* as occurring off western Mexico (mostly between May and October; R. L. Pitman pers. comm.), but, given the scale and format employed, none may have been within 95 km of the mainland.

Feeding Flocks

Feeding flocks, predominately of shearwaters, boobies, and terns, were conspicuous during our cruise. Up to 16 jaegers (three species) occurred, but only Long-tailed Jaegers made regular kleptoparasitic chases. Small numbers of storm-petrels (particularly the Black Storm-Petrel) associated with 16 of the flocks but rarely were noted feeding. Seventy percent of one feeding flock, however, consisted of Black and Galapagos storm-petrels; this was the only feeding flock associated with Bottlenose Dolphins.

Seventeen of the 34 flocks observed, including the most diverse (average 10.8 species per flock), occurred between the inner edge of the trench and 25 km of shore over depths of 1000–4500 m; 16 of these flocks were associated with dolphins. The commoner species at these flocks were the Pink-footed, Wedge-tailed, and Townsend's shearwaters, Brown Booby, Pomarine Jaeger, and Black Tern, sometimes with with smaller numbers of Christmas and Audubon's shearwaters and Masked and Red-footed boobies.

Five feeding flocks (average 7.2 species per flock) occurred over the trench over water 4200–5200 m deep; four of these flocks were associated with dolphins. The Pink-footed and Townsend's shearwaters and Brown Booby were the commoner species in these flocks.

The remaining 12 flocks (average 3.8 species per flock) were over inshore waters less than 1000 m deep. Only one of these flocks was associated with dolphins, but nine others were over schooling fish apparently feeding at the surface. Terns, particularly the Black, dominated these flocks, with smaller and/or more local numbers of the Brown Booby, Sabine's Gull, Least and Bridled terns, and Brown Noddy.

Several species, notably terns and shearwaters, were detected commonly at feeding flocks but rarely (or not at all in the case of Sooty Tern) during censuses in transit.

Au and Pitman (1986) discussed seabird interactions with dolphins and tuna in the eastern tropical Pacific. Both seabirds and dolphins commonly

Table 2 Composition of Seabird Feeding Flocks Associated with Schools of Spotted and Mixed Spotted and Spinner Dolphins in the Eastern Tropical Pacific

	Au and Pitman (1986)[a]		This cruise[b]	
	n	%	*n*	%
Laysan Albatross	0		1	0.02
Pterodroma petrels	99	0.6	0	
Pink-footed Shearwater	?[c]		277	6.3
Wedge-tailed Shearwater	5184	31.0	84	1.9
Townsend's Shearwater	?		222	5.0
Other shearwaters	237	1.4	99	2.3
Storm-Petrel spp.	29	0.2	60	1.4
Masked Booby[d]	371	2.2	44	1.0
Brown Booby	1130	6.8	2632	61.1
Red-footed Booby + Booby sp.	5583	33.4	85	1.9
Tropicbird spp.	1	0.01	0	
Frigatebird spp.	617	3.7	19	0.4
Red Phalarope	0		55	1.3
Jaeger spp.	2168	13.0	62	1.4
Franklin's Gull	0		1	0.02
Sabine's Gull	0		25	0.6
Sooty Tern	955	5.7	9	0.2
Black Tern	?		613	14.0
Noddy terns	175	1.0	8	0.2
Other terns	161	1.0	90	2.0
Total	16710		4386	

[a]134 flocks, January–March.
[b]20 flocks, April–May.
[c]Species possibly included in "other" categories by Au and Pitman (1986).
[d]Includes Blue-footed Booby in Au and Pitman (1986).

associate with yellowfin tuna (*Thunnus albacares*) and feed on smaller fish and other prey forced near the surface by the tuna, a relationship most pronounced in the northeastern tropical Pacific.

Our observations agree with Au and Pitman's (1986) in that the Spotted (*Stenella attenuata*) and Spinner (*S. longirostris*) were the common dolphin species associated with the flocks. Bird species composition of feeding flocks associated with dolphins, however, differed strikingly (Table 2). Some of these differences can be readily explained by our cruise being closer inshore: compare proportions of the more coastal Brown Booby and Black Tern with those of the more pelagic Red-footed Booby and Sooty Tern. The season also explains some of the differences: Au and Pitman's flocks were observed from January though March when several northbound transients we noted in April and May (e.g., Sabine's Gull, Arctic Tern) would have been rare or absent and when many wintering Pomarine Jaegers were still present. Both seasonal and inshore effects probably apply in some cases, as with the Pink-footed Shearwater and Black Tern, and year-to-year variation and El Niño may be other factors.

SUMMARY

From 28 April to 6 May 1992 we cruised along the coast of southwestern Mexico from Jalisco to Guerrero, observing seabirds. This area is important for non-breeding Townsend's Shearwaters. We found Christmas Shearwaters to be fairly common. We noted Long-tailed Jaegers and Arctic Terns as fairly common spring migrants. Feeding flocks of up to 15 species were conspicuous, the most diverse flocks being in a belt 25–55 km offshore over waters 1100–3250 m deep, inshore of the Middle American Trench; most were associated with Spotted Dolphins. We report previously unpublished coastal breeding colonies of the Brown Booby, Red-billed Tropicbird, and Bridled Tern.

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