

SYMPOSIUM

BIOLOGY AND CONSERVATION OF XANTUS'S MURRELET

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Xantus's Murrelet chicks shortly before nest departure at Lava Bench, Cave #1, Anacapa Island, California, 28 May 2004 (Photo by D.L. Whitworth).

BIOLOGY AND CONSERVATION OF XANTUS'S MURRELET: DISCOVERY, TAXONOMY AND DISTRIBUTION

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SUMMARY

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The biology of Xantus's Murrelets *Synthliboramphus hypoleucus* is similar in many respects to better-studied Ancient Murrelets *S. antiquus*, especially regarding morphology and the species' precocial mode of post-hatching development. It nests mainly in rock crevices but also under shrubs on islands in southern California, United States, and northwestern Baja California, Mexico (27°N to 34°N). The species was discovered in 1859 by János Xántus. Two subspecies (*S. h. hypoleucus* and *S. h. scrippsii*) are recognized that show limited evidence of interbreeding. At sea, closely related Craveri's Murrelets *S. craveri* co-occur with Xantus's Murrelets off California and western Baja California during half the year, but the former species has a discrete breeding range in the Gulf of California, Mexico. Breeding was documented at 13 island groups between 1863 and 1976. Post-breeding dispersal as far north as central British Columbia, Canada (c. 52°N) was observed in the 1940s to 1960s. A few Xantus's Murrelets disperse south of breeding colonies to Magdalena Bay, Baja California (c. 24°N). The southernmost record is the type specimen collected by Xántus near Cabo San Lucas, Baja California (c. 23°N). Chief threats to this species include introduced mammalian predators on breeding islands, heightened predation by natural predators in human-modified island habitats, and oil pollution. In January 2005, a Pacific Seabird Group special symposium, "Biology and conservation of the Xantus's Murrelet," highlighted conservation concerns and promoted publication of recent studies of this little-known alcid, with nine symposium papers published in this issue of *Marine Ornithology*. Much of what we know about Xantus's Murrelets has been learned in recent years, and many aspects of biology remain to be described.

Key words: Xantus's Murrelet, *Synthliboramphus hypoleucus*, Craveri's Murrelet, *Synthliboramphus craveri*, distribution, taxonomy, genus *Endomychura*

INTRODUCTION

Xantus's Murrelet *Synthliboramphus hypoleucus* is one of four *Synthliboramphus* murrelets, which are unusual among marine birds for their precocial mode of post-hatching development (Sealy 1973, 1976; Murray *et al.* 1983; Gaston 1992; Drost & Lewis 1995; Gaston & Jones 1998). About two days after hatching, one or two well-developed chicks (Fig. 1) leave their nest site at night. They complete their development at sea where they are cared for by one or both parents for an unknown period of time. Most modern knowledge of the breeding biology of Xantus's Murrelet stems from one study at Santa Barbara Island, California, United States, in 1975–1977 (Murray *et al.* 1983) and nest monitoring there each year since 1985 (Drost & Lewis 1995). Early observations on breeding were made primarily at the Coronado Islands, Baja California, Mexico (e.g. Lamb 1909, Howell 1910).

Synthliboramphus murrelets have the most southern distribution of all alcids. Ancient Murrelets *S. antiquus* breed widely across the North Pacific, but Japanese Murrelets *S. wumizusume* are limited to Japan and Korea (Udvardy 1963, Springer *et al.* 1993, Gaston & Jones 1998). Xantus's and closely related Craveri's *S. craveri* murrelets breed only in southern California, northwestern Baja California and the Gulf of California. Within breeding ranges

of Xantus's, Craveri's, and Japanese murrelets, few or no other alcids coexist on colonies or at sea. Cool ocean conditions occur in southern California and northwestern Baja California during the relatively early breeding season of Xantus's Murrelets. These conditions provide marine habitat similar to more northerly habitats



Fig. 1. Precocial Xantus's Murrelet chicks shortly before nest departure at Lava Bench Cave #1, Anacapa Island, California, 28 May 2004. (Photo by D.L. Whitworth)

favored by other alcids (Gaston & Jones 1998). During the non-breeding season, individuals disperse offshore and northward, with most of the world population occurring north of the breeding range from central California to central British Columbia in late summer and early fall (Whitworth *et al.* 2000, Karnovsky *et al.* 2005).

In many ways, the biology of Xantus's Murrelet is similar to the better-known Ancient Murrelet (Storer 1945a, 1945b; Gaston & Jones 1998). In addition to nocturnal colony visitation, breeding on southern islands is facilitated by use of natural crevices, small caves, and hollows under shrubs for nesting cover, often on steep slopes or cliffs which are relatively inaccessible to researchers. Adaptations for feeding on planktonic fish and invertebrates at relatively shallow depths in offshore habitats (Hamilton *et al.* 2004, 2005) include multi-day incubation shifts and egg neglect (Murray *et al.* 1983, Drost & Lewis 1995, Whitworth *et al.* 2000, Roth *et al.* 2005). Access to offshore areas is facilitated by the use of offshore nesting islands and a generally narrow continental shelf. The striking black-and-white plumage is present year-round and does not appear to differ with age; prebasic molt occurs in late summer and a partial prealternate molt likely occurs in late winter (Drost & Lewis 1995).

Xantus's Murrelet was described less than 150 years ago, and the earliest images were photographs of a chick (Howell 1910) and adults

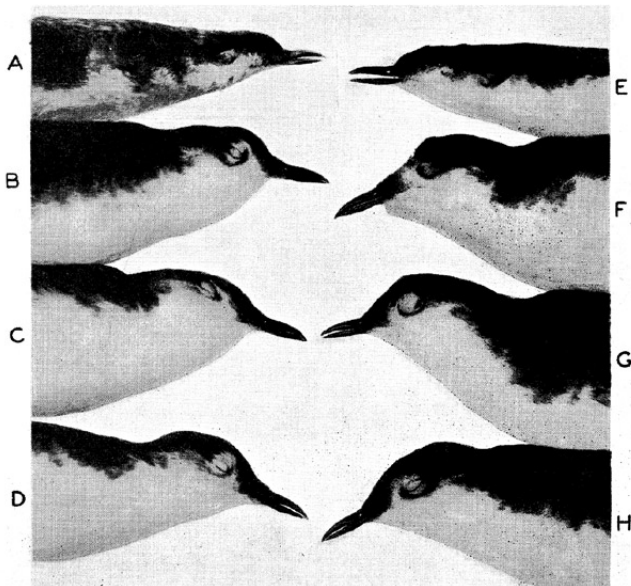


Fig. 2. "Murrelets showing characteristic white 'eye-area' of Xantus' type: A. 13046, U.S.N.M. [National Museum of Natural History, Smithsonian Institution, formerly the United States National Museum], female, type of *Endomychura hypoleuca* (Xantus), 14 miles off coast of Cape San Lucas, Lower California, Mexico, July 14, 1859 (from a photograph); B. 28057, C.A.S. [California Academy of Sciences], male, Guadalupe I., Lower Calif., April 19, 1925; C. 28056, C.A.S., male, Guadalupe I., Lower Calif., April 19, 1925; D. Collection Ed. N. Harrison, Encinitas, Calif., female, Guadalupe I., Lower Calif., April 6, 1938; E. 66618, U.S.N.M., female, San Jose, Lower Calif., March 1860, J. Xantus coll.; F. 38, S.D.S.N.H. [San Diego Society of Natural History], male, Guadalupe I., Lower Calif., May 18, 1892; G. 8867, S.D.S.N.H., male, Guadalupe I., Lower Calif., July 13, 1923; H. 17668, S.D.S.N.H., female, Guadalupe Is., Lower Calif., July 13, 1937". (Figure and caption reproduced with permission from Green & Arnold 1939: Fig. 14, copyright Cooper Ornithological Society)

(Van Rossem 1915). To help link recent studies with past knowledge, we provide historical and geographic information on the discovery of the species, taxonomy, and distribution that is not available in recent species accounts (Drost & Lewis 1995, Gaston & Jones 1998).

SPECIES DISCOVERY

Xantus's Murrelet was scientifically recognized in 1859, based on a specimen collected 14 miles (23 km) off the coast of Cabo San Lucas, Baja California, Mexico, on 14 July 1859 by János Xántus de Csisk Tapolsza, also known as John Xántus, Louis de Vésey, or Xántus de Vésey (Xántus 1859, Baird 1859, Zwinger 1986a; USNM #A13046, Fig. 2). Xántus also obtained a second specimen in March 1860 off nearby San José del Cabo (USNM #066618, Fig. 2), but both localities are far south of where Xantus's Murrelets have since been found to occur at sea (Brewster 1902). Xántus clearly documented collection dates and localities on specimen tags, and he mentioned the first specimen in a letter to S.F. Baird dated 23 July 1859, calling it a "*Phaleris*" species, using an old alcid genus name for auklets and puffins (Ridgway 1919, Zwinger 1986a). Both individuals apparently had dispersed far south of breeding colonies in the non-breeding season.

Along with A.L. Heermann, W. Gambel, and J.G. Cooper, Xántus (1825–1894) is recognized as one of the great early bird collectors in California and Baja California (Zwinger 1986a, 1986b; Fischer 2001). His name (Xántus or de Vésey) is also associated with two other birds (Xantus's Screech Owl *Otus asio xantusi* and Xantus's Hummingbird *Hylocharis xantusii*; AOU 1957) and many reptiles, mollusks, insects and plants. His discovery of *Synthliboramphus hypoleucus* carries some ornithological significance. Craveri's Murrelet was described subsequently in 1865, but its type specimen had been collected a few years earlier (1856 or 1857—Ridgway 1919, Violani & Boano 1990). The Long-billed Murrelet *Brachyramphus perdix* was reassigned species status in 1997 (Friesen *et al.* 1996), but had been originally described as a species in 1826 (Ridgway 1919). Thus, Xántus's collection of the murrelet bearing his name marked the last discovery of an extant alcid "new to science."

NOMENCLATURE AND TAXONOMY

Xantus's Murrelet has been called variously the White-bellied Murrelet (or Auk), Southern Auk, Xantus' Guillemot, Guadalupe Murrelet, or Scripps Murrelet (Grinnell & Miller 1944). In Spanish, it has been known as *Paloma del Mar* (as noted by Xántus in 1860; see Zwinger 1986a: 304), *Pato de noche* (Wilbur 1987), *Pato nocturno de Xantus* or *Pato nocturno de Scripps* (Drost & Lewis 1995), and *Mérgulo de Xantus* (Howell & Webb 1995). Ridgway (1919) summarized early taxonomy, and Coues (1903) and Ridgway (1896, 1919) described morphology and plumage in detail. After original description, the genus *Brachyramphus* was used from 1859 to 1909. From 1898 to 1900, the genus *Micruria* was applied, then *Endomychura* in 1899, which remained in use until 1983. This new genus contained only Xantus's and Craveri's murrelets, acknowledging these species' morphologic and geographic differences from *Brachyramphus* murrelets and other alcids. In 1944, the American Ornithologists' Union (AOU) chose to relump *Endomychura* with *Brachyramphus*, whereupon Storer (1945a, 1945b) demonstrated that *Endomychura* murrelets most closely resembled *Synthliboramphus* murrelets on most points of morphologic comparison (i.e. skull, pelvis, tarsometatarsus, wing length, plumage and eggs) and available ecological data. Bill

shape resembled *Brachyramphus* murrelets more closely, but was considered a less modified character. While examining the validity of using *Endomychura*, Storer (1945a) remarked:

Endomychura appears to be the most primitive genus of the Alcidae.... *Synthliboramphus* is an offshoot of this genus.... The relationship between *Endomychura* and *Synthliboramphus* parallels that between *Ptychoramphus* and *Aethia* or *Cyclorrhynchus*. In each case the more primitive genus (*Endomychura* or *Ptychoramphus*) agrees with the more advanced (*Synthliboramphus* or *Aethia* or *Cyclorrhynchus*) in skeletal structure and eggs, and differs in having a less deepened bill, in lacking elongated plumes on the head, and in having a more southern distribution.... Combination of the genera *Endomychura* and *Synthliboramphus* is a borderline case which "splitters" could never attempt to propose and which "lumpers" would jump to make. The gap between these two genera is so distinct that each name suggests a definite series of characters applicable to the two species of each genus.

Storer's careful work kept *Endomychura* in use long after 1945, but the genus *Synthliboramphus* was assigned in 1983 by the AOU (1983) for undocumented reasons.

The species name has been more consistent: *hypoleucus* from 1859, *hypoleuca* in 1898, then back to *hypoleucus* in 1983 (Ridgway 1919, AOU 1983). The English name, Xantus' Murrelet, was widely used after 1859, but was changed to Xantus's Murrelet in 1998 (AOU 1998).

Green & Arnold (1939) documented the existence of two subspecies with distinct plumages: *E. h. hypoleucus* (Guadalupe Island, which included the two specimens collected by Xantus), with extensive white in front and above the eye, and *E. h. scrippsi* (throughout the breeding range from Anacapa Island, California, to San Benito Islands, Baja California), with little or no white in front of or above the eye (Figs. 2 & 3). The recognition of two subspecies (sometimes called the "Guadalupe" Murrelet and "Scripps" Murrelet) immediately raised concern for the viability of the nominate subspecies, which appeared to be limited to Guadalupe Island. Feral cats apparently had extirpated murrelets on the main island of Guadalupe, and *S. h. hypoleucus* murrelets seemed restricted to cat-free offshore islets, a tiny fraction of former nesting habitats (Green & Arnold 1939).

Since 1939, the nominate subspecies has been found to occur and breed regularly in small numbers at San Benito Islands (Jehl & Bond 1975, Whitworth *et al.* 2003b, Keitt 2005, Wolf *et al.* 2005). Jehl & Bond (1975) suspected that *S. h. hypoleucus* birds may have moved fairly recently from Guadalupe Island to the San Benito Islands, in response to overcrowding on Guadalupe nesting islets. Two nests of the nominate race were found at the same site in 1977 and 1978 on Santa Barbara Island, California, but one member of the pair was of intermediate plumage (Winnett *et al.* 1979). All other breeders examined in the same colony have been referred to *S. h. scrippsi*. Small numbers of the nominate subspecies were captured near colonies in southern California in 1976 and 1994–1997 (Winnett *et al.* 1979; HRC & D.L. Whitworth, unpubl. data), and at least one *S. h. scrippsi* murrelet has been recorded at Guadalupe Island (Jehl & Bond 1975). The occurrence of small numbers of individuals in intermediate plumage at the San Benito Islands indicates limited interbreeding between subspecies (Jehl & Bond 1975, Whitworth *et al.* 2003b, Keitt 2005, Wolf *et al.* 2005).

CONFUSION WITH CRAVERI'S MURRELETS

From April to October, Craveri's Murrelets co-occur with Xantus's Murrelets off the west coast of Baja California and in southern and central California (Brewster 1902, Grinnell & Miller 1944, Jehl & Bond 1975, Howell & Webb 1995). These species are similar in appearance, and caution must be exercised in analyzing at-sea count data (Karnovsky *et al.* 2005).

Whether Xantus's and Craveri's murrelets were distinct species, subspecies, or age variants was debated for some time (Anthony 1900, Grinnell 1915, Bent 1946; see summaries in Brewster 1902, Jehl & Bond 1975). Brewster (1902) carefully described each species, and Van Rossem (1915, 1926) further distinguished their plumages: wing linings (i.e. white in Xantus's versus mottled in Craveri's), base of the inner vanes of the distal primaries (i.e. white in Xantus's versus dusky in Craveri's), dark collar (present in Craveri's only), and dorsal coloration (i.e. browner in Craveri's, Figs. 3 & 4). Discussion of possible interbreeding continued (Van Rossem 1939, Jehl & Bond 1975). Blake (1972) listed Craveri's Murrelet as a subspecies of the Xantus's Murrelet. Recent phylogenetic analyses have laid the question to rest as genetic differences clearly warrant species designation (Friesen *et al.* 1996).

The breeding ranges of Xantus's and Craveri's murrelets do not appear to overlap, despite suggestions to the contrary for the San Benito Islands and Natividad Island. Although the type specimen of Craveri's Murrelet was obtained by Italian Frederico Craveri reportedly at Natividad Island in 1857, some later sources concluded that it was actually collected at Raza Island in the Gulf of California in 1856 (Cooke 1916, AOU 1957; but see Jehl & Bond 1975, Violani & Boano 1990). Craveri's Murrelet eggs were first collected at Raza Island in 1875 (Streets 1877). Several Craveri's Murrelets have been recorded at sea near the San Benito Islands in spring, when some post-breeding birds from Gulf of California colonies disperse up the west coast of Baja California to California (Jehl & Bond 1975, DeWeese & Anderson 1976). A relatively

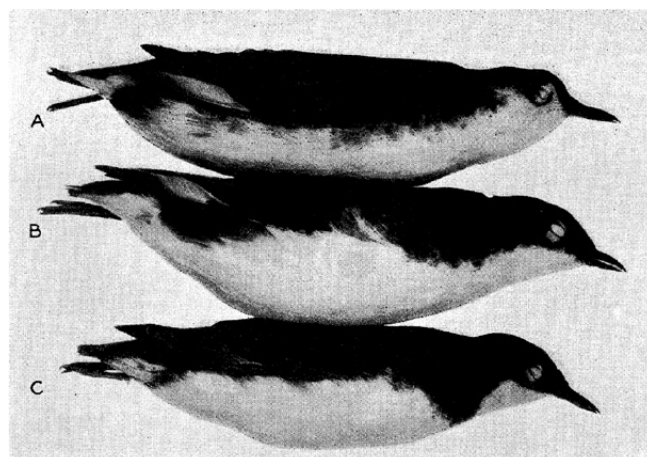


Fig. 3. "Specimens of the three murrelets, selected to show characteristic plumage differences: A. *Endomychura hypoleuca hypoleuca*, no. 17668, S.D.S.N.H. [San Diego Society of Natural History]; B. *Endomychura hypoleuca scrippsi* (type), no. 17934, S.D.S.N.H.; C. *Endomychura craveri* (showing maximum extension of dark collar), no. 15154, S.D.S.N.H." (Figure and caption reproduced with permission from Green & Arnold 1939: Fig. 16, copyright Cooper Ornithological Society)

large distance barrier (*c.* 1000 km) exists between breeding areas of the two species. Few islands with suitable nesting habitat occur between Asunción Island and Espíritu Santo Island (Brewster 1902, DeWeese & Anderson 1976). At Magdalena Island and Santa Margarita Island, murrelet breeding has not been documented, and several endemic mammals may prevent its occurrence (Nelson 1922). Craveri's Murrelets on the west coast of Baja California in spring most likely are subadults that have not returned to colonies in the Gulf of California. Surveys in February 2002 did not detect the presence of Craveri's Murrelets during the early breeding season at the San Benito Islands (Whitworth *et al.* 2003b, Keitt 2005), and no Craveri's Murrelet nests have been found outside of the Gulf of California (DeWeese & Anderson 1976).

DISCOVERY OF BREEDING COLONIES

To review discovery of the breeding distribution, we identified as "colonies" 13 geographically separated islands or groups of islands with breeding murrelets. We use the primary island for the colony name (except for San Roque/Asunción Islands which we considered within the same island group), and we take as first evidence of breeding the first reported nest site, backed up by museum egg records, published accounts, or unpublished reports. Breeding was first discovered by J.G. Cooper on Santa Barbara Island, California, in 1863 (Cooper 1868). Three more colonies were discovered 29–33 years later in Baja California by A.W. Anthony: Guadalupe Island (Walrus Bay, 1892, USNM #B25236), Coronado Islands (1893, USNM #B26319; Anthony 1899, 1900; Whitworth *et al.* 2003c), and San Benito Islands (1896; Whitworth *et al.* 2003b; WFWZ #11804). Colonies continued to be discovered in the twentieth century: Anacapa Island in 1911 (H.C. Burt; WFWZ #80,896 and #80,897; Willett 1912; Peyton 1913; McChesney *et al.* 2000), Santa Cruz Island in 1928 (M.C. Badger; WFWZ #92,441), San Jerónimo (also spelled "San Geronimo") Island in 1932 (N.K. Carpenter; USNM #B46624), Todos Santos Islands in 1940 (E.E. Sechrist; WFWZ #145,114), Santa Catalina Island in 1967 (Hunt *et al.* 1979), San Miguel Island in 1968 (Crossin & Brownell 1968, Huber 1968), San Clemente Island in 1976 (Hunt *et al.* 1979), and San Roque/Asunción Islands in 1977 (Drost & Lewis 1995; see Bancroft 1927). Nesting on San Martín Island has been long suspected, but a nest has yet to be found (Kaeding 1905, Keitt 2005).

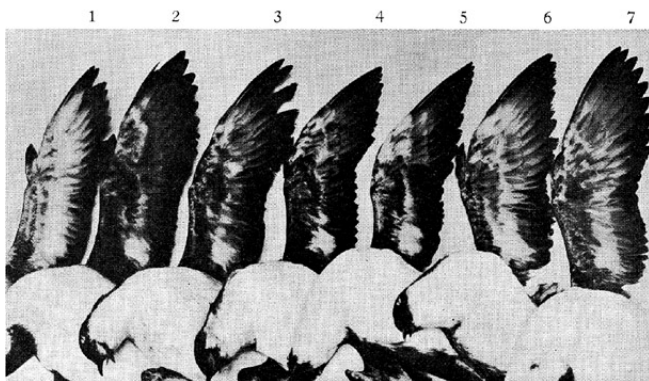


Fig. 4. "Specimens of *Brachyramphus hypoleucus* (No. 1) and *B. craveri* (Nos. 2–7), showing color of wing linings". (Figure and caption reproduced with permission from van Rossem 1915: Fig. 26, copyright Cooper Ornithological Society)

San Miguel Island (*c.* 34°N) and Asunción Island (*c.* 27°N) are the northernmost and southernmost breeding islands, respectively. Nesting areas are relatively accessible to researchers on foot only on certain portions of Santa Barbara, Coronado and San Benito Islands (Murray *et al.* 1983; Drost & Lewis 1995; Whitworth *et al.* 2003b, 2003c; Wolf *et al.* 2005). Nesting under shrubs has been described on Santa Barbara Island, Afuera Islet (off Guadalupe Island) and occasionally on the Coronado Islands (Murray *et al.* 1983, Carter *et al.* 1992, Whitworth *et al.* 2003c, Keitt 2005), while nesting in sea caves occurs on Anacapa, Santa Cruz and Coronado Islands (Whitworth *et al.* 2005; HRC, unpubl. data). Xantus's Murrelets also use sheer cliffs and very steep slopes for nesting at several Channel Islands breeding colonies (Hamer *et al.* 2003, 2005; HRC, unpubl. data), which suggests a much wider distribution on larger islands than is known from discovered nests alone.

DISCOVERY OF NORTHERN AT-SEA RANGE

Xantus's Murrelets were not reported in central California at Monterey Bay (*c.* 36°N) until 1894 (Brewster 1902). By 1925, many specimens had been collected between Monterey Bay and the Mexican border (Beck 1910; Van Rossem 1915, 1926). In 1910, murrelets were recorded farther north off Tomales Bay, Marin County, California (*c.* 38°N; Dawson 1923) and in April 1926 off Point Arena, Mendocino County, California (*c.* 39°N; Grinnell & Miller 1944). The first record north of California was that of two birds collected and others seen about 200 km SSW of Cape Flattery, Washington (*c.* 47°N), on 7 August 1947 (Cowan & Martin 1954; UBCZM #1518 and #1519). Jehl & Bond (1975) referred those specimens to the nominate subspecies. Subsequently, Feinstein (1958) reported an earlier beached specimen of *S. h. scrippsi* at Copalis Beach, Washington on 6 December 1941. The first Oregon record occurred far offshore in November 1969 (Scott *et al.* 1971).

The northern limit of the at-sea range of Xantus's Murrelets apparently occurs in British Columbia at about 52°N (Drost & Lewis 1995; Karnovsky *et al.* 2005; K.H. Morgan, unpubl. data). The first sight record (*S. h. scrippsi*, based on a drawing) in British Columbia was obtained on 14 July 1948 about 29–32 km west of the Goose Islands (*c.* 52°N) by C.J. Guignet (unpubl. field notes). The first specimens obtained in British Columbia were collected in October and November 1971 between Vancouver Island and the Queen Charlotte Islands (Sanger 1973). One specimen (UWBM #26813; 25 October) is referable to *S. h. scrippsi* (see photograph with incorrect specimen number in Campbell *et al.* 1990) whereas the other (UWBM #16809, 16 November) could not be assigned to subspecies because only a partial skeleton was preserved. At-sea surveys in the 1970s and 1990s demonstrated that substantial numbers of both subspecies regularly move into waters as far north as central British Columbia in late summer and fall (Wahl 1975; Karnovsky *et al.* 2005; K.H. Morgan, unpubl. data). In fall 2001, at least 90% of 106 Xantus's Murrelets seen more than 90 km from shore off Oregon and Washington were referred to the nominate subspecies (Mlodinow *et al.* 2002).

SOUTHERN LIMIT OF AT-SEA RANGE

During the non-breeding season, Xantus's Murrelets are rarely found south of the southernmost breeding colony at Asunción Island (*c.* 27°N), but have been noted to just south of Magdalena Bay (*c.* 24°N; Brewster 1902, Anthony 1925, Jehl & Bond 1975, Howell & Webb 1995, Karnovsky *et al.* 2005). The two *S. h. hypoleucus*

specimens collected by Xantus near Cabo San Lucas in 1859 and 1860 remain the southernmost records (*c.* 23°N). Similarly, the southernmost record of Ancient Murrelets is from Punta Arena near Cabo San Lucas in December 1995, and the three individuals involved are considered vagrants, because the next closest record is from 1700 km north, near the US–Mexico border (Sealy & Carter 2004). Craveri's Murrelet holds the distinction of being the most southerly breeding (*c.* 24.5°N) and wintering (*c.* 21°N) alcid (DeWeese & Anderson 1976, Howell & Webb 1995, Gaston & Jones 1998).

CONSERVATION

Concern about the status of Xantus's Murrelet developed in the 1990s based on

- its relatively small world population size and restricted breeding range (Drost & Lewis 1995, Gaston & Jones 1998);
- poor breeding success, high predation and declining population size at the largest US colony (Santa Barbara Island, California);
- introduction of mammalian predators at most breeding islands (McChesney & Tershy 1998); and
- threats at sea, especially oil (Murray *et al.* 1983; Carter *et al.* 2000).

Since the mid-1990s, introduced predators have been removed from several nesting islands (see Hamer *et al.* 2005, Keitt 2005, Whitworth *et al.* 2005), and new studies of breeding biology (Roth *et al.* 2005, Whitworth *et al.* 2005, Wolf *et al.* 2005), physiologic health (Newman *et al.* 2005) and population status (Whitworth *et al.* 2003a, 2003b, 2003c, 2005; Keitt 2005; HRC, unpubl. data) have been conducted. In 2004, Xantus's Murrelet was listed as Threatened under the *California Endangered Species Act* (Burkett *et al.* 2003), and a decision is pending whether to list the species under the *US Endangered Species Act*. It is listed as Threatened in Mexico (Keitt 2005) and is not currently listed in Canada.

SYMPOSIUM

Despite the relatively high level of research and conservation action since 1990, little peer-reviewed literature has been produced. A special symposium, "Biology and Conservation of the Xantus's Murrelet," was held at the joint meeting of the Pacific Seabird Group and Waterbird Society in Portland, Oregon, on 20 January 2005. The aims of the symposium were to increase awareness in scientific, agency and conservation communities concerning the plight of Xantus's Murrelet and to promote publication of recent findings, both in this issue of *Marine Ornithology* and in another symposium issue (in preparation) of the *Proceedings of the Western Foundation of Vertebrate Zoology*. Symposium papers have greatly augmented available information on this little-known species.

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