

Threatened Birds of Asia:

The BirdLife International Red Data Book

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JAPANESE MURRELET

Synthliboramphus wumizusume



Critical —

Endangered —

Vulnerable ■ A1c,d,e; A2c,d,e; C1

This small auk has a small, rapidly declining population as a result of disturbance, predation and mortality from drift-net fisheries. These factors qualify it as Vulnerable.

DISTRIBUTION The Japanese Murrelet is restricted to the warm-current regions (brought by the Kuroshio Current: Ono 1996) of the waters around central and southern Japan. It is known to breed on islands off the coast of Japan and the adjacent southern coast of South Korea (see Remarks 1), and it may also breed in the Russian Far East. There is a non-breeding record from Taiwan, and a possible record from mainland China.

■ **RUSSIA** The species is known in the Russian Far East by only by a handful of records, but there is some evidence that it could breed there. Records (by province) are as follows:

■ **Primorye Ol'ga bay**, adult, June 1973 (Labzyuk 1975); **Sudzukhe bay** (Kievka bay), adult female collected, August 1959 (Litvinenko and Shibaev 1965); **Peter the Great bay**, two adults seen, September 1971, adult female found dying near the Furugelm islands, June 1984, juvenile female with flight feathers not fully grown and remnants of down found dead in Boysman bay, July 1984, suggesting that this species may breed in the area (Nazarov and Shibaev 1987, Litvinenko and Shibaev 1991), adult seen near Verkhovsky island, September 1985 (N. Litvinenko *per* Yu. V. Shibaev *in litt.* 1997);

■ **Sakhalin Sakhalin island**, 1889 (Nikolski 1889 in Austin and Kuroda 1953, Kiyosu 1965, Nechaev 1991);

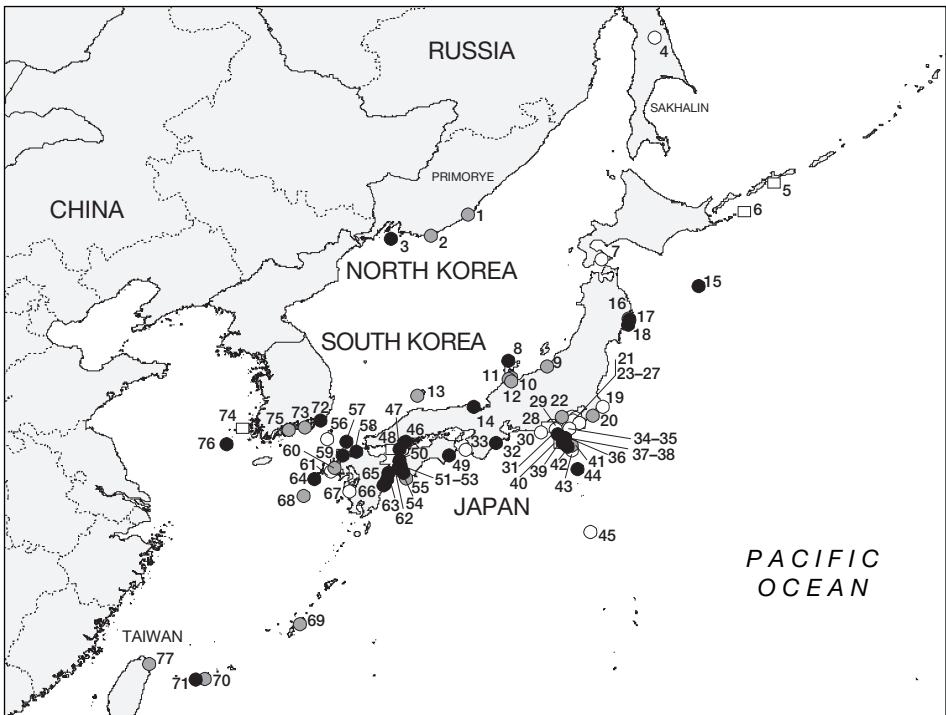
■ **Kuril islands** off the coast of south-eastern **Iturup island** (Etorofu island), southern Kuril islands, July (unspecified years) (Kuroda 1955); off the coast of **Shikotan island**, southern Kuril islands, undated (Sudilovskaya 1976).

■ **JAPAN** Almost all of the Japanese Murrelet population breeds on uninhabited islands around the coast of central and southern Japan. The most important breeding grounds are in Kyushu (notably Biro-jima, Koya-jima and Eboshi-jima) and on the Izu islands (notably Ombase-jima and Onohara-jima). Outside the breeding season, many birds (presumably from the colonies on the Izu islands and on the pacific coast of Honshu) appear to move to a well-defined area south-east of Hokkaido to overwinter (Piatt and Gould 1994), but others probably stay close to the breeding grounds. Records (by island and coastal region) are as follows:

Hokkaido Hakodate, collected once, undated (Blakiston and Pryer 1878 in Brazil 1991, Austin and Kuroda 1953, Kiyosu 1965);

Sea of Japan coast of Honshu Nanatsu-jima islands, off the Noto peninsula, Ishikawa prefecture, breeding colony discovered on Mikuriya-jima, Ooshima and Aramiko-jima islets, 1973 (Higuchi 1983), an important breeding ground (Ono 1996); Urato seashore, **Kashiwazaki-shi**, Niigata prefecture, December 1968 (Kazama 1969); **Nakata**, Himi-shi, Toyama prefecture, November 1968 (WBSJ Toyama Chapter database); Nadaura, **Himi-shi**, Toyama prefecture, May 1976 (WBSJ Toyama Chapter database); **Oyabe-gawa** river, Takaoka-shi, Toyama prefecture, July 1963 (WBSJ Toyama Chapter database); **Hoshinokami-jima** island, Oki islands, Shimane prefecture, May 1955 (A. Iyama *in litt.* 1998); **Kutsu-jima** island, Maizuru-shi, Wasaka bay, Kyoto prefecture, breeding, undated (Yoshida 1981), common resident breeder (OSJ 2000);

Pacific coast of Honshu at sea (at 40°18'–41°06'N 143°54'–145°48'E) off north-east Honshu, five caught in drift-nets, 1990–1991 (Piatt and Gould 1994); c.110 km east of **Otsuchi-cho** (Ozuchi), Kamihei-gun, Iwate prefecture, two females collected, May 1952 (Kuroda 1952, Austin and Kuroda 1953); **Sangan-jima** island, Kamaishi-shi, Iwate prefecture, March 1989 to March 1993 (WBSJ Miyako Chapter database); **Kokabe**, Sanriku-cho, Kesen-gun, Iwate prefecture, February 1996 (WBSJ Miyako Chapter database); **Inubosaki**, Kaijo-gun, Chiba prefecture, April 1933 and June 1937 (Kiyosu 1965); off **Misaki**, Chiba prefecture, “not uncommon”, February–April (unspecified years) (Austin and Kuroda 1953); **Miura-gun**, Kanagawa prefecture, one collected, April 1894, downy males collected, May 1920 and May 1921 (three specimens in YIO), downy young collected off Ippommatsu, April 1921 (Austin and Kuroda 1953, Kiyosu 1965); off **Odawara**, Kanagawa prefecture, March 1951 (specimen in YPM); **Sagami bay**, Kanagawa prefecture, “still occurs quite frequently” (Austin and Kuroda 1953), wintering (unspecified years) (Kiyosu 1965); **Uraga channel**, between Chiba



The distribution of Japanese Murrelet *Synthliboramphus wumizusume*: (1) Ol'ga bay; (2) Sudzukhe bay; (3) Peter the Great bay; (4) Sakhalin island; (5) Iturup island; (6) Shikotan island; (7) Hakodate; (8) Nanatsu-jima; (9) Kashiwazaki-shi; (10) Nakata; (11) Himi-shi; (12) Oyabe-gawa; (13) Hoshinokami-jima; (14) Kutsu-jima; (15) at sea; (16) Otsuchi-cho; (17) Sangan-jima; (18) Kokabe; (19) Inubosaki; (20) Misaki; (21) Miura-gun; (22) Odawara; (23) Sagami bay; (24) Uraga channel; (25) Joga-shima; (26) Awa-gun; (27) Tateyama-wan; (28) Suruga bay; (29) Kamo-gun; (30) Omaezaki; (31) Mikomoto-jima; (32) Mimiana-jima; (33) Hino-misaki; (34) O-shima; (35) Udone-jima; (36) Nii-jima; (37) Shikine-jima; (38) Koze-shima; (39) Tadanoe-jima; (40) Ombase-jima; (41) Miyake-jima; (42) Onohara-jima; (43) Mikura-jima; (44) Hachijo-jima; (45) Tori-shima; (46) Kure-shi; (47) Oshima-gun; (48) Ozu; (49) Mugi-cho; (50) Kuro-shima; (51) To-jima; (52) Hiburi-shima; (53) Oitsukami-jima; (54) Funakoshi; (55) Ko-shima; (56) Tsushima; (57) Okino-shima; (58) Munakata-gun; (59) Eboshi-jima; (60) Hashira-jima; (61) Nagasaki; (62) Saiki-shi; (63) Kitauro-cho; (64) Fukue-jima; (65) Biro-jima; (66) Hosojima; (67) Katsura-jima; (68) Hanaguri-jima; (69) Okinawa; (70) Ishigaki-jima; (71) Iriomote-jima; (72) Pusan city; (73) Chungmu; (74) Chibal island; (75) Yeosu; (76) Taegukhul-to; (77) Aoti.

○ Historical (pre-1950) ● Fairly recent (1950–1979) ● Recent (1980–present) □ Undated

and Kanagawa prefectures, May 1902 (male in SMF); **Joga-shima** island, Kanagawa prefecture, three females collected, April 1894, three males and three females collected, April 1925 (nine specimens in YIO); **Awa-gun**, Chiba prefecture, collected, April 1921 (Kiyosu 1965); **Tateyama-wan**, Chiba prefecture, wintering (unspecified years) (Kiyosu 1965); **Suruga bay**, Shizuoka prefecture, “relatively uncommon”, undated (Austin and Kuroda 1953); Irozaki, **Kamo-gun**, Shizuoka prefecture, April 1928 (female in YIO); **Omaezaki**, Haibara-gun, Shizuoka prefecture, April 1928, March and November 1929, March 1930, March–April 1933 (Kiyosu 1965); **Mikomoto-jima** island, Shimoda, Shizuoka prefecture, probably breeding, two collected and “fairly plentiful” at Shimoga, 1853 (Austin and Kuroda 1953, Kiyosu 1965), breeding but presumed to be fewer than 10 pairs, 1983 (Higuchi 1983), probably no birds breeding, 1994–1995 (Ono 1996); **Mimiana-jima** island, off Kii peninsula, Kiinagajima-cho, Mie prefecture, 150–200 birds breeding, 1978 (Higuchi 1979, WBSJ 1980), an important breeding ground (Ono 1996, OSJ 2000); **Hino-mizaki**, Hidaka-gun, Wakayama prefecture, April 1934 (Kiyosu 1965); northern Honshu coast (not mapped), July (unspecified year) (Kuroda 1955); Tokyo–Hokkaido ferries (not mapped), now regularly seen (Brazil 1991);

O-shima island, 1923 (Momiya in Yamashina 1942), three collected, May 1947 (Austin and Kuroda 1953, male in MCZ);

Udone-jima island, between *O-shima* and *Nii-jima*, undated (Yamashina 1942), a nesting ground of this species, undated (J. T. Moyer *in litt.* 1996), but no longer breeding on this island (Ono 1996);

Nii-jima island, May 1947 (male in MCZ), reported to breed at Cape Nebusaki, undated (Isobe 1982 in Ono 1996), but the present situation is unclear (Ono 1996), c.100 seen on the open sea at Nishigawa-oki, near Cape Nebusaki, April 1998 (*Birder* 98/7), breeding on Haya-shima island, near *Nii-jima*, undated (Hasegawa 1986 in Ono 1996, J. T. Moyer *in litt.* 1996), but the present situation there is also unclear (Ono 1996);

Shikine-jima island, April 1936 (female in YIO), breeding, undated (Yamashina 1942, Kiyosu 1965), seen during an unsuccessful search for its nests, April 1949 (Austin and Kuroda 1953), but no longer breeding on this island (Ono 1996);

Kozu-shima island, 1887 (Stejneger in Yamashina 1942), May 1901 (adult in AMNH), seen during an unsuccessful search for its nests, April 1949 (Austin and Kuroda 1953);

Tadanae-jima island, near *Kozu-shima*, c.600 birds at sea near the island, undated (Hasegawa 1986), an important breeding ground, mid-1990s (Ono 1996);

Ombase-jima island, near *Kozu-shima*, 75–100 nests estimated, undated (Ono 1996);

Miyake-jima island, breeding, collected, May 1934 (Yamashina 1942, Kiyosu 1965), more than 50 off Ma Point, scattered in groups of 2–3, April 1953, but with no evidence of nesting during a thorough search near Ma Point in late May 1953 (Moyer 1957);

Onohara-jima (Sanbondake reef), near *Miyake-jima*, seen during an unsuccessful search for its nests, April 1949 (Austin and Kuroda 1953), twelve collected and “common”, April 1953, but not a single bird present in late May 1953 although nests (including seven under one boulder) and broken eggshells were numerous (Moyer 1957, six specimens in FMNH, YPM and BMNS), May 1959 (specimen in YPM), an important breeding ground with c.75–100 nests, undated (Ono 1996), 205 birds and three nests each with a single egg, May 1995 (Kobayashi *et al.* 1997), also an important feeding ground for this species, 1995–1996 (Yamamoto *et al.* 1996);

Mikura-jima island, 1937 (Shimomura in Yamashina 1942);

Hachijo-jima island, April 1924 (Yamashina 1942), April 1932 and May 1947 (two males in MCZ), *Ko-jine* island, near *Hachijo-jima*, is an important breeding ground with an estimated breeding population of 70 birds prior to 1994 (Ono 1996);

Tori-shima island, on the north coast, 1891 (Okada in Yamashina 1942), collected (mainly on the north coast), breeding, February 1929, February 1930, April 1932, April

1933, January 1935 (Momiya 1932, Kiyosu 1965, 11 specimens, including two downy young, in YIO);

Seto Inland Sea and Shikoku off **Kure-shi**, Hiroshima prefecture, two, January 1996 (T. Nagano *in litt.* 1998); **Ooshima-gun**, Yamaguchi prefecture, one seen, August 1994, two seen, May 1995 (WBSJ 1997a); **Ozu** (Otsu-gun), Yamaguchi prefecture, undated (Brazil 1991); **Mugi-cho**, Kaifu-gun, Tokushima prefecture, April 1989 and spring 1991 (WBSJ Tokushima Chapter database); **Kuro-shima** island, Uwajima-shi, Ehime prefecture, two, January 1996 (WBSJ Ehime Chapter database); Hiburi-shima and **To-jima** islands, Uwajima-shi, Ehime prefecture, nine, May 1997 (WBSJ Ehime Chapter database); and at sea between Hiburi-shima island, Uwajima-shi and Tsushima-cho, Kitauwa-gun, Ehime prefecture, May 1998 (WBSJ Ehime Chapter database), and from the Uwajima–Hiburi-shima ferry, Ehime prefecture, three, April 1995 (WBSJ Ehime Chapter database); **Hiburi-shima** and **Oitsukami-jima** islands, Uwajima-shi, Ehime prefecture, 17, May 1997 (WBSJ Ehime Chapter database), and eight on latter, May 1997 (WBSJ Ehime Chapter database); **Funakoshi**, Nagamiyama, Uchiumi-mura, Minamiuwa-gun, Ehime prefecture, nine, April 1996 (WBSJ Ehime Chapter database); **Ko-shima** island, Kochi prefecture, breeding colony discovered, 1973 (Higuchi 1983); unspecified locality (not mapped), south-west Kochi prefecture, breeding in 1978 (WBSJ 1980);

Kyushu **Funakoshi**, **Tsushima** island, March 1891 (Iijima 1892 in Austin and Kuroda 1953, female in YIO); **Okino-shima** island, Fukuoka prefecture, c.400 birds breeding in 1978 (WBSJ 1980), common resident breeder (OSJ 2000), on *Koya-jima* island, near *Okino-jima*, 20 eggs found, March 1962 (Kiyosu 1965), c.200 pairs, 1974 (WBSJ 1975 in Brazil 1991), 408 birds in 1974, 282 in 1976 and 30 in 1991 (Takeishi 1987 and Ono 1993 in Piatt and Gould 1994), c.30 birds estimated prior to 1994 but fewer than 10 in 1994–1995 (Ono 1996); *Ooshima-mura*, **Munakata-gun**, Fukuoka prefecture, 40 birds seen, April 1998 (*Birder* 98/7); **Eboshi-jima** island, near *Okino-jima*, Fukuoka prefecture, 11 nests found and population estimated to be c.30 birds, 1990 (Nagata and Onagamitsu 1991), a maximum of 30 birds prior to 1994, c.19 birds in 1994–1995 (Ono 1996); **Hashira-jima**, 25 pairs, 1979 (Higuchi 1979 in Brazil 1991); **Nagasaki**, immature male collected (listed as *Alca umisuzume*, possibly this species), February 1867 (Swinhoe 1870a), two half-grown nestlings collected in Nagasaki Harbour, May 1881 (Austin and Kuroda 1953, Kiyosu 1965); off **Saiki-shi** island, Oita prefecture, three, January 1994 (*Birder* 94/4); *Shimaura-jima* island, **Kitaura-cho**, Higashiusuki-gun, Miyazaki prefecture, two, February 1995 (*Birder* 95/5); **Fukue-jima** to Nagasaki ferry, 12 seen, May 1999 (*Birder* 99/7); **Biro-jima** island, Kadogawa-cho, Higashiusuki-gun, Miyazaki prefecture, 2,000 in 1992 (Piatt and Gould 1994), the most important breeding ground, where c.3,000 birds can be seen during the breeding season (unspecified years) (Ono 1996); at sea off **Hosojima** island, Hyuga-shi, Miyazaki prefecture, two seen, January 1999 (*Birder* 99/3); **Katsura-jima**, adults collected and considered likely to be breeding, undated (Kuroda 1914 in Austin and Kuroda 1953); Fukuoka (Kokura) to Tsushima island (Hitakatsu) ferry (not mapped), four adults and two juveniles, May 1994 (*Birder* 94/7); Kenkai Sea (not mapped), Saga prefecture, November to May (unspecified years) (Wild Bird Society of Saga 1997); *Tsukue-jima* island (untraced), adults collected and considered likely to be breeding, undated (Kuroda 1914 in Austin and Kuroda 1953);

Hanaguri-jima island, Danjo islands, Kagoshima prefecture, more than 50 pairs breeding, 1975 (Brazil 1991);

Okinawa island, at Kumigami, January 1953 (Kiyosu 1965, specimen in YPM);

Ishigaki-jima island, January 1924 (McWhirter *et al.* 1996), January 1979 (Brazil 1991);

Iriomote-jima island, November 1978 and December 1980 (Brazil 1991), seen “fairly regularly” off the western coast from October to December (unspecified years) (Kohno and Shoyama 1982).

■ **KOREA** ■ **SOUTH KOREA** This species could be of more or less regular occurrence in winter off the south coast of Korea (Austin 1948), given that there are large colonies across the Korea Strait off northern Kyushu. Breeding was proven at one locality in 1986, and it is possible that it nests on other small islets off the south coast. Records are as follows: ■ **South Kyongsang** unspecified locality, two males collected, April 1884 (Clark 1910 in Austin 1948, Gore and Won 1971); c.4 km off Haeundae, **Pusan city**, c.200 seen with thousands of Ancient Murrelet *Synthliboramphus antiquus*, September 1986 (Lee Ki-sup *in litt.* 1999); **Chungmu**, seven seen, March 1974 (Lee Woo-shin *in litt.* 1998); ■ **South Cholla Chibal island**, breeding suspected, undated (Lee Ki-sup *in litt.* 1999); between **Yeosu** and Seongpo, seen during a survey in 1974–1975 (Min and Won 1976); **Taegukhul-to** (Gugul island), pair and two chicks collected, 1986, but this island has not been visited again during the breeding season (Lee Ki-sup *in litt.* 1999).

■ **CHINA** ■ **TAIWAN** Between **Aoti** and Patoutzu, Taipei county, one dead bird was found on the beach, and several birds were seen in flight, January 1973 (Lin Wen-horn 1997).

There is also an unconfirmed record from mainland China: Fuzhou (Foochow), Fujian province, two collected (listed as *Alca umisuzume*, possibly this species) at the mouth of the Min Jiang (Foochow river) by a local fisherman, April 1894 (Rickett 1894).

POPULATION Several estimates have been made of the population of Japanese Murrelet, but a precise figure will not be possible until all breeding colonies have been located. Hasegawa (1979 in Piatt and Gould 1994) estimated a population of 1,650 birds from colony counts and observations at sea, but a more recent compilation of data suggested a total of up to 4,000 birds (Ono 1993 in Piatt and Gould 1994). Following the discovery of the great size of the breeding colony on Biro-jima (c.3,000 birds), an estimate of 5,000–6,000 was made, and it was suggested that the total population, including undiscovered colonies, is probably not more than 10,000 birds (Ono 1996). Austin and Kuroda (1953) considered that this species was “nowhere plentiful and steadily becoming scarcer”, and most subsequent authorities have considered that it is in decline. Mochizuki and Ueta (1996) conducted a survey from the regularly scheduled ferry in the Izu islands, and found that between O-shima and To-shima this species could be observed on 46.7% of crossings in 1983–1989 but only 6.9% in 1990–1995, and between To-shima and Nii-jima it could be observed on 50.0% of the crossings in 1983–1989 but only 18.5% in 1990–1995. Ono (1996) also considered that the population in the Izu islands (which he estimated to total c.1,000 prior to 1994) seemed to be declining. On Onohara-jima the numbers of young birds declined from 205 in 1995 to 75 in 1998 and 21 in 1999 (K. Tagi *in litt.* 2000). The species was considered to be “common” in coastal Honshu in the past, but its numbers there seemed to have declined considerably in the “last few decades” (Kiyosu 1965). It is thought to have declined on Mikomoto-jima, Biro-jima (Higuchi 1984 in Brazil 1991; see Threats) and Koya-jima (Okamoto 1983 in Brazil 1991; see Threats).

ECOLOGY Habitat The Japanese Murrelet is endemic to warm-current waters around central and southern Japan, where it frequents rocky islets and headlands during the breeding season (Kiyosu 1965, Brazil 1991). It forages mainly offshore, to the edge of the continental shelf, and also inshore where upwellings or converging currents concentrate food near to the surface; in the non-breeding season it is rather pelagic, occurring well offshore, but also entering bays on occasion (Kiyosu 1965, Brazil 1991, del Hoyo *et al.* 1996).

Food It is likely that this species has a similar diet to Ancient Murrelet, a mixture of euphausiids (zooplankton) and small pelagic fish (Piatt and Gould 1994). The stomachs of specimens collected near Miyake-jima contained small fish, tiny univalve molluscs (evidence of bottom-feeding), and in one a crab larva (Moyer 1957).

Breeding The species nests in scattered small groups or single pairs on rocky islets or headlands (Austin and Kuroda 1953), but also in some large colonies (Kiyosu 1965; see Distribution). It has also been found nesting in grassy areas (Uchida 1949, WBSJ 1980) and in the gaps in an artificial stone wall (Nagata and Onagamitsu 1991). The nests are in shallow depressions well under the rocks or in crevices 15–60 m above the water (Austin and Kuroda 1953). The breeding season appears to vary slightly between colonies, as, for example, on Tori-shima it bred from mid-February to early April, but on Miyake-jima and Shikine-jima it bred between March and early May (Kiyosu 1965). Birds usually lay two eggs, and the second egg is laid about a week after the first; if the eggs or chicks are lost, no replacement clutch will be laid and the nest will be deserted (Ono 1996). Incubation takes 33–34 days (Brazil 1991).

Migration Records of birds caught in drift-nets reveal that, after breeding, birds of this species (presumably from the colonies on the Izu islands and on the Pacific coast of Honshu) move northwards to overwinter in a well-defined area south-east of Hokkaido (Piatt and Gould 1994). This region is part of the “Perturbed Area”, where the ocean is affected by the interaction of three major currents (Kawai 1972 in Piatt and Gould 1994). They also winter along the coasts of Honshu and Kyushu (Kiyosu 1965), arriving in the wintering areas in November and departing in May (K. Ono *in litt.* 1999). Some birds also appear to move south to the Nansei Shoto (Brazil 1991; see Distribution). Kiyosu (1965) reported that this species could be found near the breeding grounds throughout the year, but during recent studies (at all times of the year) in the Izu islands and around Biro-jima island it was found to be present only during the breeding season (K. Ono *in litt.* 1999).

THREATS **Human disturbance** Fishing off isolated offshore reefs and islets has become a very popular sport in Japan, and the direct disturbance and damage to habitats that this activity can cause at the nesting colonies of Japanese Murrelet is considered to be a threat to the species (Higuchi 1979). The decline in its numbers on Mikimoto-jima was suspected to be the result of increased landings being made there, and on Biro-jima egg-collecting was suspected (Higuchi 1984 in Brazil 1991). Breeding numbers have declined on Koya-jima as sports fishing has increased (Okamoto 1983 in Brazil 1991).

The Izu island population suffered a set-back when Onohara-jima (Sanbondake Reef, near Miyake-jima), its principal known nesting site, was used as a bombing target by the US Air Forces almost daily during the nesting seasons in 1951 and 1952; the target area was shifted elsewhere when they were informed of the harm being done, but it was feared that long-term damage to the breeding colony might have been caused (Austin and Kuroda 1953). During a visit in 1953, the carcasses of this species were found to “litter” the area where they formerly bred, but there was some evidence indicating that a few birds probably reared young that year (Moyer 1957). However, this site has recovered and it is still an important breeding ground (Ono 1996).

Increased predation The recent increase in sports fishing in Japan has also led to greatly increased mortality of Japanese Murrelets at their breeding colonies. The fishermen leave “ground fish” to lure large fish close to their fishing areas, and also discard small and other unwanted fish; during periods of bad weather, when the reefs are inaccessible to sports-fishermen, these dead fish attract Large-billed Crows *Corvus macrorhynchos* and Black-tailed Gulls *Larus crassirostris* from the nearby main islands, and predation by the crows (which tend to take the eggs) and gulls (which usually take the chicks) is putting immense pressure on the murrelets (Ono 1996, J. T. Moyer *in litt.* 1996). Crow predation is a main threat to the population on Biro-jima island, where it was estimated that up to 600 murrelet eggs were predated by crows in 1994, and that this might account for 40% of breeding failure (Ono 1996). At Onohara-jima there was a very high level of predation in 1995, when two out of three eggs found had been punctured and 27 dead adult birds were found at the breeding

site; they were killed by an unknown predator, probably either by the numerous Large-billed Crows or by the Peregrine Falcons *Falco peregrinus* that were observed there (Kobayashi *et al.* 1997). Perhaps as a result of this predation, only two nests were found at Onohara-jima in 1995 and none in 1996, in an area where 40–50 nests could be found in a few hours in the 1950s (J. T. Moyer *in litt.* 1996). In 1987, the remains of 145 Japanese Murrelets were found on Koya-jima island, apparently killed by introduced rats (probably brought there accidentally during visits for sports fishing), and the estimated total mortality was 414 birds; few breeding murrelets are currently found there, at what was once a very large colony (Takeishi 1987 and Ono 1993 in Piatt and Gould 1994, Ono 1996). The frequency of carcasses at other island colonies suggests that the predation of adult birds is a widespread problem (Higuchi 1979 in Piatt and Gould 1994).

Mortality in drift-nets In 1990, 98 to 417 Japanese Murrelets were estimated to have been incidentally caught and killed in drift-nets (mostly being used by the Korean squid fishery) off north-east Honshu, and 40–160 were estimated to have been caught in 1991; the annual mortality of adults in drift-nets was calculated to equal 1.0–10.4% of the total breeding population of this species, but these figures are believed to be underestimates (Piatt and Gould 1994). Mortality of this species has also been recorded in the fishing nets used to catch flying fish off the Izu islands, but in recent year this fishery has declined and it is not known whether murrelets are still caught (Ono 1996).

Decrease in food supply There is some evidence that fish stocks have declined around the Izu islands in recent years because of changes in water temperature (presumably linked to shifting ocean currents), and this may be one of the reasons for the decline of Japanese Murrelets in this area (Mochizuki and Ueta 1996, K. Tagi *in litt.* 2000).

Oil pollution Oil spills from tankers are a potential threat to all seabirds (Ono 1996). For example, in January 1997 the Russian tanker Nakhotoka was wrecked off Shimane prefecture in the Sea of Japan, and three Japanese Murrelets were among the 1,315 seabirds recorded killed in this incident (Environment Agency of Japan *in litt.* 1997).

MEASURES TAKEN Legislation The Japanese Murrelet is listed in the Russian Red Data Book (Kolosov 1983). It is on the Red List of Japan, which means that its conservation importance is recognised and it can be used as a reference species in environmental impact assessment for development projects (Environment Agency of Japan *in litt.* 1999). It was designated as a Natural Monument on 26 June 1975 (Kato *et al.* 1995). It is listed on Appendix I of the CMS (for which see Boere 1991).

Protected areas Several sites in Japan have been established as National Wildlife Protection Areas for the conservation of breeding colonies of this species, including Nanatsu-jima (0.17 km²), Kiinagashima (74.52 km² including 0.71 km² of Special Protection Area), Okino-shima (0.97 km² including 0.94 km² of Special Protection Area) and Danjo-gunto (4.16 km² of Special Protection Area) (Environment Agency of Japan *in litt.* 1999). In South Korea, Taegukhul-to (Gugul islet) was designated as Natural Monument no. 341 in August 1984 (Lee Ki-sup *in litt.* 1999).

Management of fisheries Japan, Taiwan and South Korea agreed to the cessation of large-scale drift-net fisheries in international waters of the North Pacific by the end of 1992 (as outlined in United Nations Resolution 46/215), which should have reduced the by-catch of Japanese Murrelets, although drift-nets and coastal gill-nets within the 320-km Exclusive Economic Zone of Japan have probably continued to kill this species in much of the breeding and wintering ranges (Piatt and Gould 1994).

Conservation education In Kadogawa-cho, education boards have been constructed and leaflets produced to inform fishermen about the status of this species and the importance of the largest known breeding colony on nearby Biro-jima island (K. Ono *in litt.* 1998).

MEASURES PROPOSED *Protection of breeding colonies* There should be restrictions on human access to islands with breeding colonies of this species (K. Ono *in litt.* 1998). The establishment of new protected areas should be considered at any important colonies that are not officially protected.

Control of predators Control of predators at breeding colonies is important for the survival of this species, including the Large-billed Crow (K. Ono *in litt.* 1998) and rats. New controls on the dumping of garbage should be introduced in the Izu islands to reduce the population of Large-billed Crows, although more direct methods of control may also be necessary. Measures to eliminate introduced rats may also be necessary at some of the more important Japanese Murrelet colonies.

Reduction of by-catch by fisheries Melvin *et al.* (1999) suggested several methods for reducing by-catch of seabirds (especially alcids) in gill-net fisheries that could be applied in Japanese waters for the benefit of Japanese Murrelet. This study found that by-catch could be reduced by about 60–70% with little or no reduction in fish catch by (1) using opaque nylon in the top 20 meshes; (2) using “pingers” that emit sound; (3) fishing during the day rather than at night (or at dawn and dusk); and (4) trying to avoid areas of obvious high bird concentrations. Studies of Marbled Murrelet *Brachyramphus marmoratus* mortality in nets have resulted in additional recommendations that may be relevant to the conservation of the Japanese Murrelet (K. Kuletz *in litt.* 2000; see Remarks 2).

Research In Russia, surveys are required at potential nesting places in Peter the Great bay and adjoining coastal areas, as a forerunner to the development and implementation of appropriate conservation measures for the species (Yu. V. Shibaev *in litt.* 1997). There is an urgent need to research the life history of this species, including a complete survey of all known and potential breeding locations, and to study whether coastal gill-net fisheries are causing significant levels of mortality (Piatt and Gould 1994). Continued monitoring of the populations of this (and other seabird) species is required (K. Ono *in litt.* 1998), to improve understanding of its distribution, movements and numbers, and of the impacts of the numerous threats that it faces.

Conservation education Given that this species is being negatively affected by several human activities, the provision of information to the various interest groups involved (using the most appropriate medium for each group, and focused on the key breeding colonies and wintering grounds of the species) is essential for its long-term survival. The fact that this species is virtually endemic to Japan (and that its conservation is therefore a national responsibility) should be stressed in this publicity. Sports fishermen should be informed of the effects of disturbance on this species, and that the practice of using “ground fish” should be reduced or stopped near to colonies. Statutory regulations need to be developed, in consultation with commercial fishery organisations, designed to reduce by-catch of this species (and other seabirds) through the measures described above, particularly in areas known to have important concentrations of Japanese Murrelets. Negotiations also need to be conducted with appropriate authorities to place islands with nesting colonies and areas of sea which support large wintering concentrations of the species outside oil tanker shipping lanes.

REMARKS (1) A record from North Korea is in error. A specimen collected at Kulphori in North Hamgyong province in November 1959, and originally identified as this species, is an Ancient Murrelet *Synthliboramphus antiquus* (Tomek 1999). (2) Studies of Marbled Murrelet *Brachyramphus marmoratus* by Carter and Sealy (1984) and Carter *et al.* (1995) found that more than 80% of that species were caught at night, from the surface to about 10 m, in nets with mesh sizes of 10–14 cm; mortality occurred in both drift gill-nets (225–365 m long) and set nets (stationary and generally 18 m-long units), but was very rare in offshore drift-nets (most mortality occurred within 5 km of the shore in Alaska and often within 1 km of the

shore in Prince William Sound). Carter *et al.* (1995) therefore recommended that “night” fishing be restricted and that additional restrictions on the timing of fishing activities (or a ban on fishing) should be enforced in areas with high Marbled Murrelet density (K. Kuletz *in litt.* 2000).