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NEST SITES AND EGGS OF KITTLITZ'S AND MARBLED MURRELETS

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ABSTRACT.—Fourteen known and three probable nests of Kittlitz's Murrelet (*Brachyramphus brevirostris*) and eight known and one probable nest of Marbled Murrelet (*B. marmoratus*) have been reported. Nests of Kittlitz's Murrelet tend to be at higher elevations and farther inland than those of Marbled Murrelet. Kittlitz's nests have much less vegetative cover than Marbled nests. Nests of both species are generally a short distance below a peak or ridge, Kittlitz's on the ground and Marbled either in a tree or on the ground. The eggs of the two species are similar in color and their mean dimensions are not separable statistically. Our findings support the idea that Kittlitz's fledglings commonly get to the sea by way of streams.

The breeding habits of both Kittlitz's and Marbled murrelets (*Brachyramphus brevirostris* and *B. marmoratus*) have long been obscure, due primarily to the dispersed and cryptic nature of their nests. To date, only nine definite Kittlitz's Murrelet nests have been reported, and we know of only six published records of definite Marbled Murrelet nests. We have found another nest of Kittlitz's Murrelet, a chick on its way to the sea, and unpublished records of seven other known or probable Kittlitz's Murrelet nests; we have also located three unpublished records of Marbled Murrelet nests. In this paper, we summarize and evaluate all definite and probable nest records of *Brachyramphus* murrelets known to us, and describe and compare characteristics of the nesting habitat and eggs of the two species. We have attempted to compile present information, correct errors in the literature, and compare the nesting biology of these two similar species.

NEST RECORDS

KITTLITZ'S MURRELET

Nearly all the records are from Alaska, and the remaining one is from the USSR (Table 1). Details on the nest records at Pavlof Volcano (approximately 55°25'N, 161°51'W), Katmai National Monument, Wales Mountain (ap-

proximately 65°35'N, 168°01'W), Tin City (65°33'N, 167°51'W), Angmakrog Mountain (68°17'N, 165°33'W), Shelikhova Bay (approximately 61°00'N, 156°30'E), Frosty Peak (55°12'N, 166°42'W), Humphrey Creek (58°22'N, 135°19'W), and East Amatuli Island (58°55'N, 152°00'W) are straightforward. Details on the Goodnews Bay, "Hill Point," and Iron River records need clarification, as do the unpublished records from Tin Creek, Windy River, the Chukchi Sea, Atka Island, and Harris Bay.

Goodnews Bay. D. B. Bull (La Mesa, CA; pers. comm. to G. E. Watson) collected a female incubating an egg in this area north of Cape Newenham, northern Bristol Bay; however, Friedmann (1934) never reported it as a nest record, only that a bird was collected. The egg was broken when the bird was collected and was not preserved.

"Hill Point," Wales. D. Tevuk collected a female with its egg at "Hill Point," near Cape Prince of Wales, Seward Peninsula (Ford 1936). A. M. Bailey (1943, 1948) later called this bird a male, rather than a female. We have been unable to locate the specimen, which was originally deposited in the Chicago Academy of Sciences (CAS #7128; Bailey 1943); hence, the sex of this bird should be considered to be unknown. The exact location of "Hill Point" is uncertain, but Bailey's (1943) discussion indicates that it was on the side of Wales Mountain, near the tip of the Cape.

Tin Creek (65°27'N, 167°11'W). R. J. Gordon (Juneau, AK; pers. comm.) found the nest of a murrelet on a mountain above this creek in the Lost River drainage, Seward Peninsula. The nest contained a "large green egg with brown blotches." Gordon saw no birds at the nest on this or

TABLE 1. Summary of all known definite or probable Kittlitz's Murrelet nest records.

Date	Location	Identification	Source
Definite nests			
10 June 1913	Pavlof Volcano, AK	bird/egg	Thayer 1914
mid-July ??	Katmai National Monument, AK	bird/egg	Murie 1959
21 June 1933	Goodnews Bay, AK	female/egg	Friedmann 1934; D. B. Bull, pers. comm.
19 July 1934	"Hill Point," Wales, AK	bird/egg	Ford 1936
29 June 1935	Wales Mountain, AK	bird/egg	Ford 1936
16 June 1943	Tin City, AK	male/egg	Bailey 1948
26 July 1960	Angmakrog Mountain, AK	bird/egg	Thompson et al. 1966
16 July 1963	Shelikhova Bay, USSR	bird/egg	Kischinskii 1965
22 July 1972	Frosty Peak, AK	bird/egg	Bailey 1973
21 June 1973	Tin Creek, AK	egg/location	R. J. Gordon; pers. comm.
26 June 1977	Windy River, AK	bird/egg	J. K. Wilson; pers. comm.
28 June 1978	Chukchi Sea, AK	bird/egg	E. C. Murphy; D. G. Rose-neau; and P. J. Bente, pers. comm.
16 June 1979	Humphrey Creek, AK	bird/egg	Fox and Hall 1982
13 July 1980	Atka Island, AK	bird/egg	R. H. Day and D. R. Barnard
Probable nests			
10 June 1904	Iron River, AK	birds/egg/ location	Bent 1919; this study
11 July 1975	East Amatuli Island, AK	flushed bird	Bailey 1976; pers. comm.
15-20 June 1976	Harris Bay, AK	bird/egg	R. and E. Elsner, pers. comm.

subsequent trips. Kittlitz's is the only murrelet known to nest in this region.

Windy River (59°24'N, 151°29'W). J. K. Wilson (Bishop, CA; pers. comm.) photographed a Kittlitz's Murrelet on its nest in the Windy River valley, southwestern Kenai Peninsula. The colors of the egg were determined from photographic slides (see Table 5 for ground-color information). The large spots are *dark grayish brown* and *fuscous*; the smaller spots are primarily *cinnamon brown* (unless indicated, italicized colors are from Smithe 1975). Large spots tend to be concentrated near the large end of the egg, although few large spots are present.

Chukchi Sea. E. C. Murphy, D. G. Roseneau, and P. J. Bente (LGL Alaska, Inc., Fairbanks, AK; unpubl. data) found a nest in mountains on the Alaska side of the Chukchi Sea. The exact location of the nest cannot at present be published, because of contractual obligations. All spots appear to be *dark brown* or *dark grayish brown* (from slides). Large spots are concentrated near the large end of the egg, much more so than in the other eggs examined.

Atka Island (55°20'N, 174°12'W). Day and Barnard flushed a Kittlitz's Murrelet from a nest near the north end of this island in the central Aleutians. The few large spots (from slides) are *dark grayish brown* and *fuscous*; there are also scattered smaller *chestnut* spots of various intensity. The egg is more heavily spotted near the large end.

Iron River (approximately 66°00'N, 163°10'W). Bent (1919:143) discussed a record of a pair of Marbled Murrelets collected, with their egg, by C. E. Doe on the "Iron Creek," 75 miles north of Nome, Seward Peninsula. The exact location of this nest is unknown, as there are at least six "Iron Rivers" on the Seward Peninsula (Orth 1967); one joining Sullivan Creek to flow into Kotzebue Sound is the only one near the location described by Bent. This record was discounted as being that of a Marbled Murrelet by Gabrielson and Lincoln (1959) on distributional grounds, but it falls well within the breeding range of Kittlitz's Murrelet. However, as Doe's work was sometimes less than accurate (L. F. Kiff, Western Foundation of Vertebrate Zoology, Los Angeles, CA; pers. comm.) and we cannot find the specimens, we have classed this record as probably that of a Kittlitz's Murrelet.

Harris Bay (59°47'N, 149°55'W). R. and E. Elsner (University of Alaska, Fairbanks, AK; pers. comm.) flushed a bird, that we believe was a Kittlitz's Murrelet, from an egg in a rock outcrop in the middle of a glacier above Harris Bay, southern Kenai Peninsula, between 15 and 20 June 1976. The spots on the egg (from slides) are *fuscous* and *burnt umber*. The few large spots present are near the large end of the egg.

MARBLED MURRELET

All of the definite or probable records are from California, Washington, Alaska, and the eastern USSR (Table 2). Details on the nest records at the Nooksack River, Okhotsk city, Big Basin State Park, and East Amatuli Island (two records) are straightforward. Details on the Kodiak Island and Pye Islands records need to be clarified, as do the unpublished records from Augustine Island and Port Chatham.

Kodiak Island (57°48'N, 152°34'W). Hoeman (1965) discovered a nest near the summit of Pyramid Peak, near the town of Kodiak, northern Gulf of Alaska. Unfortunately, the record was published in an obscure, now-defunct journal. We do not know the location of the egg specimen.

Pye Islands (59°21'N, 150°25'W). Bailey (1977) published this record from Outer Island in the Pye Islands group, Kenai Peninsula, as that of a Kittlitz's Murrelet nest. As discussed later, however, characteristics of the nesting habitat and color of the egg led us to believe that the record is instead that of a Marbled Murrelet.

Augustine Island (59°24'N, 153°24'W). R. E. Baxter (Alaska Department of Fish and Game, Bethel, AK; pers. comm.) flushed a Marbled Murrelet from its nest on this island at the entrance to Cook Inlet, Alaska. The egg was collected (U.S. National Museum of Natural History #41778); the chick inside was near hatching (Baxter, pers. comm.).

Port Chatham (approximately 59°15'N, 151°45'W). S. Johnston (Wildlife Reserve of Western Canada, Cochrane,

TABLE 2. Summary of all known definite or probable Marbled Murrelet nest records.

Date	Location	Identification	Source
Definite nests			
19 June 1925	Nooksack River, WA	egg/location	Booth 1927, Kiff 1980
27 June 1959	Augustine Island, AK	bird/egg	R. E. Baxter, pers. comm.
17 June 1961	Okhotsk, USSR	male/egg	Kuzyakin 1963
3 June 1962	Kodiak Island, AK	bird/egg	Hoeman 1965
7 August 1974	Big Basin State Park, CA	chick	Binford et al. 1975
8 July 1978	East Amatuli Island, AK (#1)	birds/egg	Simons 1980
6 July 1979	East Amatuli Island, AK (#2)	birds/egg	Simons 1980, Kiff 1980, Hirsh et al. 1981
2 July 1981	Port Chatham, AK	bird/egg	S. Johnston, pers. comm.
Probable nests			
6 July 1976	Pye Islands, AK	egg/habitat	Bailey 1977; this paper

Alberta, Canada; pers. comm. to D. D. Gibson) flushed a bird from its egg on the southwestern Kenai Peninsula, Alaska, and photographed the bird there the following day.

We refer to two other published records of Marbled Murrelet nests that could be either or neither species of *Brachyramphus*. The first is a record from the Commander Islands, USSR (Taczanowski, in Kuzyakin 1963); both species probably breed there, as they do in the Aleutians (Murie 1959). Although the egg color was a pale yellow (i.e., more toward that of Marbled Murrelet eggs), the lack of adequate details on the nest and the species identification lead us to conclude that the egg could be that of either species. The second record was from southeastern Alaska (Gabrielson and Lincoln 1959), and has already been rejected by Kiff (1980).

CHARACTERISTICS AND COMPARISONS OF NESTING BIOLOGY

NESTING HABITAT

Sufficient data now exist to permit discussion of some parameters of the nesting habitat of Kittlitz's Murrelets. Nesting habitat and nest-site characteristics of all definite and probable Kittlitz's Murrelet nests are listed in Table 3.

Elevations of definite nests have ranged from 230 m to 1,070 m, and the elevations of all probable nests except one (East Amatuli Island) have fallen well within this range. In areas where coastal forest is present (Shelikhova Bay, Windy River, Harris Bay, Humphrey Creek), the birds apparently fly inland to nest above the tree limit; the mean elevation of these nests was approximately 800 m. Nests in the Alaska Peninsula/Aleutian Island region (East Amatuli Island, Frosty Peak, Atka Island), where no trees occur, averaged approximately 520 m elevation, about two-thirds as high as those in areas of similar latitude with trees. In the arctic environments of the upper Bering Sea and Chukchi Sea, the mean elevation of nests ("Hill Point," Tin Creek, Angmakrog Mountain, Chukchi Sea) was approximately 340 m. The mean elevation of all nests in regions beyond the tree limit was approximately 420 m, and the mean elevation of all nests was 570 m.

Seven of nine nests faced the two northerly quadrants (i.e., compass directions of 270–360° and 000–090°). The mean slope of the hillsides at seven nests was 40°; in addition, the "Hill Point" nest was on a steep hillside (Ford 1936).

The mean straight-line distance to the nearest coastline was 16.4 km for 11 nests. The mean distance from the sea for the five arctic nests was about 23 km, more than twice the mean of 11 km for the six farther south. The mean distance from a stream large enough to carry fledged young was approximately 600 m for six nests; a seventh ("Hill Point") was on a slope facing the sea (Ford 1936).

The mean percentage of vegetative cover around ten nests was approximately 8%. Only two nests (Angmakrog Mountain, Tin Creek) had a vegetative cover greater than 5%; these nests were surrounded primarily by lichens, mosses, and short herbs, with the remainder of the area bare rock (Thompson et al. 1966; Gordon, pers. comm.). Vegetation at other nest sites was primarily lichens, in low densities.

Eight of nine nests were situated on the downhill side of a rock at least as big as the incubating bird. Although the Angmakrog Mountain nest was not located at the base of a rock, it was in a natural depression on the lower side of a frost heave (Thompson et al. 1966), and was thus in a protected area similar to that of the other eight nests. One nest (Chukchi Sea) was completely surrounded by rocks (E. C. Murphy, pers. comm.).

The mean vertical distance below the peak or ridge where six nests were located was approximately 145 m. One other nest (Wales Mountain) was described as being at the top of the mountain (Ford 1936).

Data on the nesting habitat of Marbled Murrelets are few and appear quite variable, so only a cursory analysis is possible at this time. Nesting habitat and nest-site characteristics of all known and probable Marbled Murrelet nests are listed in Table 4.

TABLE 3. Nesting habitat and nest-site characteristics of definitely known and probable Kittlitz's Murrelet nests.

Location	Elevation (m)	Aspect	Slope (°)	Distance to nearest		Nest at base of rock?	Vegetative cover (%)	Vertical distance below top of mountain (m)	Other	Source
				Coastline (km)	Stream (m)					
Definite nests										
Pavlof Volcano	—	—	—	—	—	—	0	—	Nest on bare lava in-side snow line	Thayer 1914
Katmai National Monument	—	—	—	—	—	yes	0	—	"Nests on rocky crests of mountain ridges"	Murie 1959
"Hill Point"	230-270	—	—	0.25-0.30	—	—	—	—	Nest facing sea	Ford 1936
Wales Mountain	≤700	—	—	—	—	—	—	—	Nest on top of mountain	Ford 1936
Tin City	—	—	—	8	—	—	—	—	—	Bailey 1948
Angmakrog Mountain	430	west	15-20	25	—	no	50	300	—	Thompson et al. 1966
Shelikhova Bay	670	—	—	30	—	—	—	—	"Nests among rock outcrops and snow fields"	Kischinskii 1965
Frosty Peak	760	ENE	—	13	200 (small) 1,000 (sizeable)	yes	3	—	Nest on steep moraine between two snow banks and below a hanging glacier	Bailey 1973; pers. comm.
Tin Creek	370	SSE	30	6.4	—	yes	25	150	On mountain	R. J. Gordon, pers. comm.
Windy River	550	east	90	8	200	yes	0	100-200	On rocky slope beside steep snow slope	J. K. Wilson, pers. comm.
Chukchi Sea	300	N	30	75	200-250	yes	0	—	On talus slope	E. C. Murphy, D. G. Roseau, and P. J. Bente (unpubl. data)
Humphrey Creek	1,070	east	45	5.6	1,000	yes	5	75	Rock outcrop on scree slope	Fox and Hall 1982
Atka Island	670	WNW	25	5.6	500	yes	0	125	Nest on scree slope	R. H. Day and D. R. Barnard
Probable nests										
East Amatuli Island	140	N	—	—	—	—	—	—	Near cliff edge	E. P. Bailey, pers. comm.
Harris Bay	920	S	35-40	3	1,500	yes	0	60-90	At foot of large granite outcrop surrounded by glaciers	R. and E. Elsner, pers. comm.

The elevation of one tree-nest was 310 m. In areas where trees are present, nests were found above treeline (Kodiak Island, Port Chatham) two of three times, indicating that Marbled Murrelets will also fly over trees to nest at high elevations, as do Kittlitz's Murrelets. The mean elevation of nests in regions beyond tree limit was approximately 100 m, and the mean elevation of all nests was 304 m.

Four of six nests faced the two northerly quadrants; however, data are few, so we are not certain if this is a definite tendency. Sample sizes for slopes at the nests were too small for analysis, as were those for the distances of nests from streams. The mean distance from the sea for eight nests was 6.0 km.

The mean percentage of vegetative cover at six nests was about 67%, with four of these in 100% vegetative cover; the two other nests were essentially in bare rock, the primary habitat used by Kittlitz's Murrelets. Seven of nine nests found were on the ground, probably because ground nests are easier to find than those high in tree branches. The mean vertical distance below a peak or ridge where three ground nests were found was approximately 110 m.

EGGS

So few Kittlitz's and Marbled murrelet eggs have been found that it has not previously been feasible to compare them for species-specific characters. The eggs from the more recent Kittlitz's Murrelet nests have been described here, and some eggs of Marbled Murrelets have been described by Kiff (1980). The dimensions and ground colors of eggs as described and as they would appear to an observer in the field are summarized for the two species in Tables 5 and 6, respectively.

Two of the three eggs taken from the oviducts of Kittlitz's Murrelets have been shades of yellow and the third was green (Table 5). This variation may be the result of the ground color's not having been completely laid down when the bird was collected. In contrast, most of the eggs from definite Kittlitz's Murrelet nests have been shades of olive-green, with the remainder blue-green.

Marbled Murrelet eggs have been described as Ridgway's (1912) *glass green*, *clear green*, and *chalcedony yellow*, all of which are colors on the yellow side of the boundary between yellow and green (L. F. Kiff, pers. comm.; J. P. Angle, U.S. National Museum of Natural History, pers. comm.). These greenish-yellow colors most closely approximate *sulfur yellow* in Smithe 1975 (L. F. Kiff, pers. comm.). Other eggs have been creamy yellow, bluish-green, or olive-green.

TABLE 4. Nesting habitat and nest-site characteristics of definitely known and probable Marbled Murrelet nests.

Location	Elevation (m)	Aspect	Slope (°)	Distance to nearest		Vegetative cover (%)	Nest in tree or on ground?	Vertical distance below top of mountain (m)	Other	Source
				Coastline (km)	Stream (m)					
Definite nests										
Nooksack River	—	—	—	24	—	100	ground	—	Nest of lichens	Booth 1927, Kiff 1980
Augustine Island	120	N or NW	10	<1	—	<5	ground	—	Bare lava	R. E. Baxter, pers. comm.
Okhotsk	—	—	—	6-7	200	100	tree	—	On branch 6.8 m above ground	Kuz'yakin 1963
Kodiak Island	690	SE/S	—	6.2	—	—	ground	45	In shallow niche	Hoeman 1965
Big Basin State Park	310	SSW	—	10	215	100	tree	—	On branch 45 m above ground	Binford et al. 1975
East Amatuli Island #1	68	N	—	0.075	—	—	ground	—	Below ledge	Simons 1980
East Amatuli Island #2	80	NE	—	0.075	—	—	ground	—	—	Simons 1980, Hirsch et al. 1981
Port Chatham	710	—	—	—	—	0	ground	55	In small grotto	S. Johnston, pers. comm.
Probable nests										
Pyc Islands	150	E	90	0.25	—	100	ground	200-250	In heavy grass	Bailey 1977, pers. comm.

TABLE 5. Ground color and dimensions of Kittlitz's Murrelet eggs.

Location	Ground color		Dimensions		Source
	Described	Appearance to observer	Length (mm)	Width (mm)	
From oviduct					
Pavlof Bay, AK	<i>yellow glaucous</i> ¹	yellow	62.5	36.8	Thayer 1914
Pavlof Bay, AK	<i>yellow glaucous</i> ¹	yellow	—	—	Thayer 1914
Adak Island, AK	<i>oural green</i> ¹	green	57.8	36.0	Byrd et al. 1974; E. A. Cardiff, pers. comm.
Definite nests					
Pavlof Volcano	<i>olive lake</i> ¹	olive-green	58.2	35.6	Thayer 1914
Wales Mountain	—	—	62.1	36.8	Ford 1936
Tin City	<i>pale olive buff</i> ¹	pale olive-green	59.5	37.0	Bailey 1948; E. A. Cardiff, pers. comm.
Angmakrog Mountain	greenish-olive	olive-green	—	—	Thompson et al. 1966
Shelikhova Bay	bluish-green	blue-green	62.0	38.7	Kischinskii 1965
Frosty Peak	olive-green	pale olive-green	—	—	Bailey 1973; this study
Tin Creek	green	green	—	—	R. J. Gordon, pers. comm.
Windy River	<i>pale parrot green</i> ²	pale olive-green	—	—	J. K. Wilson slides; this study
Chukchi Sea	<i>pale lime green</i> ²	pale olive-green	58	39	D. G. Roseneau slides; this study
Humphrey Creek	<i>pale lime green</i> ²	pale olive-green	59.8	37.9	Fox and Hall 1982
Atka Island	<i>pale paris green</i> ²	pale blue-green	—	—	This study
Probable nests					
Iron River	<i>massicot yellow</i> ¹	pale yellowish	60.5	37.5	Bent 1919
Harris Bay	<i>pale lime green</i> ²	pale olive-green	—	—	R. and E. Elsner slides; this study
Mean ± SD			60.0 ± 2.0	37.3 ± 1.1	

¹ Color from Ridgway (1912).² Color from Smithe (1975).

Apparently Kittlitz's Murrelets lay eggs with less diverse ground colors than do Marbled Murrelets, although eggs of the two species show considerable overlap. The creamy yellow Marbled Murrelet egg from Augustine Island has a color not found previously in either species, although the color is not extremely different from that of other Marbled Murrelet eggs (L. F. Kiff, pers. comm.).

Although sample sizes are small and some measurements not exact, the mean dimensions of eggs of both species are not significantly different (Student's *t*-test: length, $T = 0.211$, $P > .50$; width, $T = 0.524$, $P > .50$; 18 df; Tables 5 and 6).

DISCUSSION

The distribution of records of Kittlitz's Murrelet nests compiled here essentially outlines the suspected breeding range of the species: from Le Conte Bay, southeastern Alaska (Gabrielson and Lincoln 1959), through the northern Gulf of Alaska and Alaska Peninsula to the Aleutian Islands (Murie 1959, Byrd et al. 1974), from Wrangel Island to Kresta Bay, eastern USSR (Vaurie 1965), and northward along the Bering and Chukchi sea coasts of Alaska to somewhere between Cape Lisburne

and Point Barrow (Bailey 1948, Pitelka 1974). Oddly, however, the species has not been considered as a regular summer bird in the Sea of Okhotsk (Dement'ev and Gladkov 1951, Kozlova 1957, Vaurie 1965), where one nest has been found.

All records of Marbled Murrelet nests discussed here lie within the suspected breeding range of the species: from northwestern California (A.O.U. 1957), to southeastern Alaska (Gabrielson and Lincoln 1959), through the Gulf of Alaska and at scattered locations on the Pacific coast of the Alaska Peninsula and in the Aleutian Islands (Kessel and Gibson 1978), and in eastern Siberia from the Tatar Strait and the Sea of Okhotsk to southeastern Koryak Land (Dement'ev and Gladkov 1951, Vaurie 1965). Six of the nine records are from one small area of the northern Gulf of Alaska.

Although data on both species are few, the available evidence suggests that Kittlitz's Murrelets generally nest at higher elevations than do Marbled Murrelets: (1) the mean elevations of all nests (570 m, Kittlitz's; 304 m, Marbled), (2) the mean elevation of all nests in regions where trees are present (800 m, Kittlitz's; 570 m, Marbled), and (3) the mean elevation of all nests in regions beyond tree limit (520 m,

TABLE 6. Ground color and dimensions of Marbled Murrelet eggs.

Location	Ground color		Dimensions		Source
	Described	Appearance to observer	Length (mm)	Width (mm)	
From oviduct					
Howkan, AK	<i>clear green;</i> <i>chalcidomy yellow</i> ¹	greenish-yellow	63	35	Cantwell 1898, Bent 1919
Mittlenach, BC	<i>pale glass green</i> ¹	pale greenish-yellow	58.5	39.5	Sutton and Semple 1941
Pleasant Island, AK	<i>pale glass green</i> ¹	pale greenish-yellow	60.5	39.0	Jewett 1942
Montague Island, AK	—	yellowish-green	57	38	J. Bull, pers. comm.
Definite nests					
Nooksack River	<i>pale glass green</i> ¹	pale greenish-yellow	58.3	36.5	Booth 1927, Kiff 1980
Augustine Island	<i>marguerite yellow</i> ¹	pale creamy-yellow	58.3	37.5	L. F. Kiff, pers. comm.
Okhotsk	bluish-green	bluish-green	63.6	39.3	Kuzyakin 1963
Kodiak Island	—	greenish-yellow	60.2	37.8	Hoeman 1965
Big Basin State Park	<i>pale glass green</i> ¹	pale greenish-yellow	—	—	Binford et al. 1975
East Amatuli Island #1	pale olive-green	pale olive-green	61.2	36.3	Simons 1980
East Amatuli Island #2	<i>pale glass green</i> ¹	pale greenish-yellow	58.9	36.3	Simons 1980, Kiff 1980, Hirsch et al. 1981
Port Chatham	—	pale green	—	—	S. Johnston, pers. comm.
Probable nests					
Pye Islands	pale chartreuse	pale greenish-yellow	58.3	38.3	R. C. Banks, pers. comm.
Mean ± SD			59.8 ± 2.1	37.6 ± 1.4	

¹ Color from Ridgway (1912).

Kittlitz's; 100 m, Marbled; only includes Kittlitz's Murrelet nests in zone of sympatry with the Marbled Murrelet). In addition, Kittlitz's Murrelets tend to nest at higher elevations in the southern part than in the northern part of their range; their preferred rocky habitat appears to occur only at higher elevations in the south, especially in those areas where trees occur coastally.

Both species appear to prefer north-facing nest sites. Such a location may help to prevent an unattended chick from overheating; behavioral avoidance of direct sunlight has been observed in Marbled Murrelet chicks (Binford et al. 1975). Northerly slopes may also be less densely vegetated and may provide protection from storms, which come from the south in much of this region.

Although we cannot yet compare the slopes of the nest sites of the two species, we believe that the steep slopes found at most Kittlitz's Murrelet nests are necessary for producing scree and talus, and do not indicate a direct preference for a particular slope angle.

On average, Kittlitz's Murrelet nests have been about twice as far from the sea (11 km) as those of the sympatric Marbled Murrelet (6 km); in the northern part of their range, Kittlitz's nests averaged 23 km, and were a maximum of 75 km, from the sea. This great distance for most nests underscores the importance of nearby streams for movement of (at least) these far-inland chicks to the sea. It is highly improbable, for example, that the Chukchi Sea chick could fly the entire 75 km to the sea on its maiden flight. No alcids are strong fliers at fledging, and chicks of many species leave their nests without actually flying strongly to the sea (Tuck 1960; Day, pers. observ.; Oakley, pers. observ.; D. H. S. Wehle, Trumansburg, NY, pers. comm.). In this context, it is important to discuss a Kittlitz's Murrelet fledgling found by Oakley and A. A. Hoover (University of Alaska, Fairbanks) on its way to the ocean at Pedersen Lagoon (59°53'N, 149°43'W), Kenai Peninsula, on 8 August 1980. The chick (40% adult weight, 79% adult wing chord length) showed no willingness to fly and eventually swam out of the lagoon and into Aialik Bay; its tarsi and feet showed no sign of wear. These findings support Kuzyakin's (1963) suggestion that Kittlitz's Murrelet chicks travel from their nests to the sea primarily by fluttering down hillsides and into nearby stream drainages (to which they would be funneled by topography) and eventually make their way to the coast. In contrast, Binford et al. (1975), Sealy (1975), and Simons (1980) suggested that young Marbled Murrelets fly directly from their nests to the sea, at about 70% adult weight and

about 86% adult wing flat length (Sealy 1975); the shorter distances of this species' nests from the sea would also make it easier for them to do so.

Kittlitz's Murrelets average much less vegetation around their nests than do Marbled Murrelets; most Kittlitz's nests have been found on bare or nearly bare rock. The vegetation around Marbled Murrelet nests is also frequently lusher than that around Kittlitz's Murrelet nests, ranging in size from lichens to lush grasses, shrubs, and trees.

The placement of the Kittlitz's Murrelet nests (and some of the Marbled Murrelet nests) at the base of a rock could have several advantages. For birds nesting in mountainous areas near snowfields, the rock could protect the birds and egg from downward winds or falling rocks. The rock also probably functions as a landmark for adults returning to a large scree slope, and conceals the nest from ground predators. Also, Sealy (1968) indicated that placement of a nest in a crevice in the shelter of rocks provides a more stable microclimate than is found in exposed nests. The proximity of most Kittlitz's Murrelet nests and the ground nests of Marbled Murrelets to the top of a ridge or mountain may be explained in two ways. First, talus and scree slopes are generally found on steep slopes just below peaks and ridges. Second, the ridge or peak itself may be used by the adults for orientation to the nest.

The overlap in ground color and size of murrelet eggs and the occurrence of ground-nesting Marbled Murrelets indicates that extreme caution is necessary when identifying a ground nest in areas of sympatry between the species. Kittlitz's and Marbled murrelet eggs are indistinguishable by size and exhibit much overlap in ground colors (Tables 5 and 6), although most Kittlitz's eggs are olive-green and most Marbled eggs are greenish-yellow. In areas of sympatry beyond tree limit, Marbled Murrelets appear to nest primarily at low-to-medium elevations in generally heavily-vegetated areas, while Kittlitz's Murrelets nest at medium-to-high elevations in rocky, unvegetated areas. Marbled Murrelets, however, may nest in habitat similar to that used by Kittlitz's Murrelets, with an overlap of at least 140–710 m in elevation. We thus believe that, in areas of sympatry, the only certain way to identify the ground nests of these species is to positively recognize an adult at the nest.

A discussion of the supposed Kittlitz's Murrelet nest in the Pye Islands (Bailey 1977, pers. comm.) amplifies the necessity of observing adults at ground nests. The nest was in an area of overlap in elevation between the two species, although at the lower end of Kittlitz's nesting

range, and was in a heavy growth of grasses, alders, and flowers on a cliff ledge (Bailey, pers. comm.). Bailey never saw an adult at the nest and he saw only Marbled Murrelets in the area. The elevation of the nest, the presence of lush vegetation around it, and the ground color of the egg (approaching a yellowish-green) are more characteristic of Marbled than of Kittlitz's murrelets; hence, we believe that this record is that of a Marbled Murrelet.

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