CHAPTER 16-4
BIRD NESTS – NON-PASSERIFORMES, PART 1

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CHAPTER 16-4
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Figure 1. Bird nest among ferns, with mosses surrounding nest cup. Photo courtesy of JeriLynn Peck.

Anseriformes Screamers, Ducks, *etc*

Anatidae – Swans, Geese, & Ducks

Wolf (2009) found eleven species of **Anatidae** that use bryophytes in their nests in North America:

Anser brachyrhynchus (Pink-footed Goose; Figure 2-Figure 3)
Anser albifrons (Greater White-fronted Goose; Figure 4-Figure 5)
Branta bernicla (Brant; Figure 6-Figure 7)
Branta canadensis (Canada Goose; Figure 8-Figure 10)
Cygnus columbianus (Tundra Swan; Figure 11-Figure 12)
Cygnus cygnus (Whooper Swan; Figure 13)
Aythya collaris (Ring-necked Duck; Figure 14)
Clangula hyemalis (Long-tailed Duck; Figure 15-Figure 20)
Mergus merganser (Common Merganser; Figure 23)
Somateria fischeri (Spectacled Eider; Figure 24-Figure 26)
Somateria mollissima (Common Eider; Figure 27)

Pink-footed Goose (*Anser brachyrhynchus*)

The Pink-footed Goose (***Anser brachyrhynchus***) may use bryophytes in the nest in parts of North America. But in the Arctic they choose dry vegetation patches for their nests. Having moist bryophytes nearby is important in nest selection sites, however. These bryophyte areas are used for foraging (Jensen *et al*. 2008; Wisz *et al*. 2008).

Figure 2. ***Anser brachyrhynchus***, Pink-footed Goose, a bird that uses bryophytes in its nests in North America. Photo by Hilary Chambers, through Creative Commons.

Figure 3. ***Anser brachyrhynchus***, Pink-footed Goose, on mossy nest. Photo by Otto Plantema, with permission.

Figure 4. ***Anser albifrons***, Greater White-fronted Goose, a species that uses mosses in their nests in North America. Photo by John B., through Creative Commons.

Figure 5. ***Anser albifrons albifrons***, White-fronted Goose, on nest. Photo by Tim Bowman, USFWS, through public domain.

Figure 6. ***Branta bernicla***, Brant, a species that uses mosses in their nests in parts of North America Photo by Jeroen Reneerkens, through Creative Commons.

Figure 7. ***Branta bernicla***, Brant, nest with eggs. Photo by Bob Gill, USFWS, through public domain.

Figure 8. ***Branta canadensis***, Canada Goose, a species that uses mosses in their nests in North America. Photo courtesy of Eileen Dumire.

Figure 9. ***Branta canadensis***, Canada Goose, nest with eggs and down lining. Photo by James K. Lindsey, with permission.

Figure 10. ***Branta canadensis***, Canada Goose, nest with no special lining, demonstrating differences one can find among nests (compare to Figure 9). Photo by Notts Ex Miner, through Creative Commons.

Figure 11. ***Cygnus columbianus***, Tundra Swan, a species that uses bryophytes in their nests in North America and elsewhere. Photo by Tim Bowman, through public domain.

Figure 12. ***Cygnus columbianus***, Tundra Swan, on nest. Photo from USFWS, through public domain.

Figure 13. ***Cygnus cygnus***, Whooper Swans, a species that uses bryophytes in their nests in North America. Photo by Sciadopitys, through Creative Commons.

Figure 14. ***Aythya collaris***, Ring-necked Duck, on water, a species that uses bryophytes in their nests in North America. Photo by MDF, through Creative Commons.

Long-tailed Duck (*Clangula hyemalis*)

I suspect that bryophytes are not the normal nesting material for the Long-tailed Duck (***Clangula hyemalis***; Figure 15-Figure 16). Its nest is typically built on the ground near water, using vegetation and lined with down (Wikipedia 2016). But Susan Studlar (pers. comm. 12 July 2017) reported to me that they built large nests (Figure 17-Figure 20) of ***Rhytidiadelphus*** cf. ***loreus*** (Figure 21) when that was the only material provided to them at the Sealife Center in Seward, Alaska. I suspect most birds are adaptable, using the materials that are most available to them at the time of nest building. The Horned Puffin (***Fratercula corniculata***; Figure 22), on the other hand, ignores all those mosses in the landscape and lays its eggs in a crevice among the rocks (Wikipedia 2017).

Figure 15. ***Clangula hyemalis***, Long-tailed Duck, a species that uses bryophytes in their nests in North America. Photo by Wolfgang Wander, through Creative Commons.

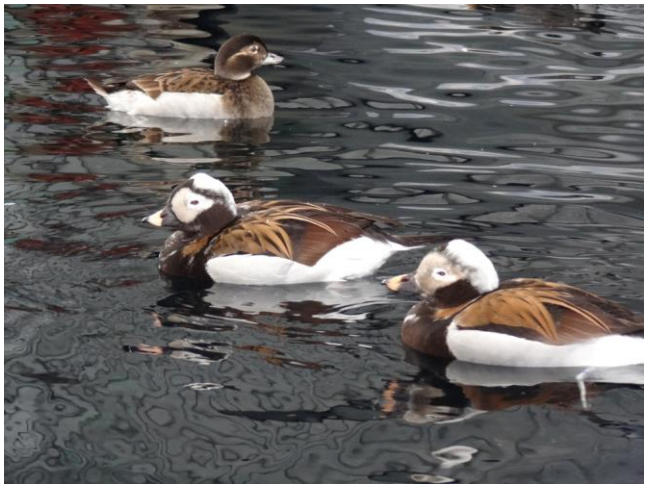

Figure 16. ***Clangula hyemalis***, Long-tailed Duck, a species that will use mosses to build a nest when other materials are not available. Photo courtesy of Sue Studlar.

Figure 17. ***Clangula hyemalis***, Long-tailed Duck, female on nest. Photo by Tim Bowman, USFWS, through public domain.

Figure 18. ***Clangula hyemalis***, Long-tailed Duck, on nest on a bed of mosses. Photo through public domain.

Figure 19. ***Clangula hyemalis***, Long-tailed Duck, nest made of ***Rhytidiadelphus*** cf. ***loreus*** – the only material available to it. Photo courtesy of Sue Studlar.

Figure 20. ***Clangula hyemalis***, Long-tailed Duck, ***Rhytidiadelphus*** cf. ***loreus*** nest lined with down. The moss was the only material provided to it. Photo courtesy of Sue Studlar.

Figure 21. ***Rhytidiadelphus*** cf. ***loreus*** in nest of ***Clangula hyemalis*** (Long-tailed Duck). Photo courtesy of Sue Studlar.

Figure 22. ***Rhytidiadelphus*** cf. ***loreus*** and Horned Puffin (***Fratercula corniculata***) in Seward, Alaska. The moss looks inviting, but the Puffin usually lays its one egg in a crevice or cavity among the rocks without a nest. Photo courtesy of Sue Studlar.

Figure 23. ***Mergus merganser***, Common Merganser, a species that uses bryophytes in their nests in North America. Photo by John Bennett, through Creative Commons.

Figure 24. ***Somateria fischeri***, Spectacled Eider female, a species that uses bryophytes in their nests in North America. Photo by Dick Daniels, through Creative Commons.

Figure 25. ***Somateria fischeri***, Spectacled Eider pair, a species that uses bryophytes in their nests in North America. Photo by Laura Whitehouse, USFWS, through public domain.

Figure 26. ***Somateria fischeri***, Spectacled Eider, nest. Photo by USFWS, through public domain.

Figure 27. ***Somateria mollissima***, Common Eider, colonial nesting with Canada geese. Photo by Caroline Bond, USGS, through public domain.

Snow Goose (*Chen caerulescens*)

It is not surprising to find that in the far north, where mosses are a prominent feature of the landscape, birds like the Snow Goose (***Chen caerulescens***; Figure 28) use mosses as a major component of their nests (Figure 29) (Gianetta 2000). The Greater Snow Goose (***Chen caerulescens atlanticus***; Figure 30) in Jungersen Bay, northern Baffin Island, uses three habitat types for nesting (Giroux *et al*. 1984). One of these is wet moss-covered meadows with up to 5 cm of standing water, dominated by *Carex aquatilis* var. *minor* (Figure 31), *Dupontia fisheri* (Figure 32), *Calamagrostis stricta* (Figure 33), and *Arctagrostis latifolia* (Figure 34).

Figure 28. ***Chen caerulescens*** (Snow Goose) grazing; this species uses mosses as a major component of their nests. Photo by Walter Siegmund, through Creative Commons.

Figure 29. ***Chen caerulescens***, Snow Goose, nest with nestlings and often containing bryophytes. Photo by James K. Lindsey, with permission.

Figure 30. ***Chen caerulescens atlanticus***, Greater Snow Geese foraging. Photo by D. Gordon and E. Robertson, through Creative Commons.

Figure 31. ***Carex aquatilis*** var ***minor*** in the Northwest Territories, common in the home of the Greater Snow Goose. Photo by Jeffery M. Saarela, through Creative Commons.

Figure 32. ***Dupontia fisheri***, common in the habitat of the Greater Snow Goose. Photo from Smithsonian Institution, National Museum of Natural History, through Creative Commons.

Figure 33. ***Calamagrostis stricta*** in the Northwest Territories, common in the habitat of the Greater Snow Goose. Photo by Matt Lavin, through Creative Commons.

Figure 34. ***Arctagrostis latifolia*** subsp. ***latifolia*** in the Northwest Territories, common in the habitat of the Greater Snow Goose. Photo by Jeffery M. Saarela, through Creative Commons.

McCracken *et al*. (1997) found that among the Ross' Geese (***Chen rossii***; Figure 35) and Lesser Snow Geese (***Chen caerulescens caerulescens***; Figure 37), the nest size (Figure 36) differed with habitat. The smallest were among heath, then rock, then mixed, with the largest nests among mosses. Temperature was an important factor for these Arctic breeders. Could it be that mosses tended to insulate the eggs, but at the same time prevented the warmer temperatures that could speed up development? Were the mosses too compact and tight to be good insulators? Or did the mosses indicate a cooler ground temperature?

Figure 35. ***Chen rossii***, Ross's Snow Goose, a species whose nest size is largest when among mosses. Photo by Dominic Sherony, through Creative Commons.

Figure 36. ***Chen rossii***, Ross' Goose, nest with mosses and eggs. Photo by James K. Lindsey, with permission.

Figure 37. ***Chen caerulescens caerulescens***, Lesser Snow Goose, a species that makes larger nests among mosses than among heath vegetation. Photo by Walter Siegmund, through Creative Commons.

Phasianidae – Quail, Pheasants, *etc*

Wolf (2009) found five species of **Phasianidae** that use bryophytes in their nests in parts of North America:

Falcipennis canadensis (Spruce Grouse; Figure 38-Figure 39)
Lagopus lagopus (Willow Ptarmigan; Figure 40-Figure 42)
Lagopus muta (Rock Ptarmigan; Figure 43-Figure 44)
Dendragapus obscurus (Blue Grouse; Figure 45-Figure 46)
Tympanuchus phasianellus (Sharp-tailed Grouse; Figure 47-Figure 48)

Figure 38. ***Falcipennis canadensis***, Spruce Grouse, on mossy log. Photo by MDF, through GNU Free Documentation.

Figure 39. ***Falcipennis canadensis***, Spruce Grouse, nest with eggs. Photo by Mark Yezbick and Willi Shrinx, through Creative Commons.

Figure 40. ***Lagopus lagopus***, Willow Ptarmigan female, among mosses in Alaska, a species that uses bryophytes for nesting. Photo by David Menke, USFWS, through Creative Commons.

Figure 41. ***Lagopus lagopus***, Willow Ptarmigan nest with eggs. Photo by James K. Lindsey, with permission.

Figure 42. ***Lagopus lagopus***, Willow Ptarmigan, nest among mosses. Photo by Mlkniemi, through Creative Commons.

Figure 43. ***Lagopus muta***, Rock Ptarmigan, a species that uses bryophytes for nesting. Photo by Friedrich Böhringer, through Creative Commons.

Figure 44. ***Lagopus muta***, Rock Ptarmigan, nest. Photo by Valugi, through Creative Commons.

Figure 45. ***Dendragapus obscurus***, Blue Grouse, a species that uses bryophytes in their nests in North America. Photo by S. King, NPS, through public domain.

Figure 46. ***Dendragapus obscurus***, Blue Grouse, male. Photo from USNPS, through public domain.

Figure 47. ***Tympanuchus phasianellus***, Sharp-tailed Grouse, a species that uses bryophytes in their nests in parts of North America. Photo by Barbara Muenchau, through Creative Commons.

Figure 48. ***Tympanuchus phasianellus***, Sharp-tailed Grouse, nest with eggs. Photo from USFWS, through public domain.

Gaviiformes: Loons

Gaviidae – Loons

Wolf (2009) found three species of **Gaviidae** that use bryophytes in their nests in parts of North America:

Gavia stellata (Red-throated Loon; Figure 49)
Gavia pacifica (Pacific Loon; Figure 50)
Gavia immer (Common Loon; Figure 51-Figure 52)

Figure 49. ***Gavia stellata***, Red-throated Loon on nest. Photo by Dave Menke, through public domain.

Figure 50. ***Gavia pacifica***, Pacific Loon, on nest. Mosses may be included in these nests. Photo from USFWS, through public domain.

Figure 51. ***Gavia immer***, Common Loon, with chick. Photo from NPS, through public domain.

Figure 52. ***Gavia immer***, Common Loon, on nest. Photo by Dana Moos, through Creative Commons.

Podicepidiformes: Grebes

Podicepididae – Grebes

Red-Necked Grebe (*Podiceps grisegena*)

Breeding populations of the **Red-necked Grebe**, ***Podiceps grisegena*** (Figure 53), in the Northwest Territories use ***Sphagnum*** (Figure 107) in addition to cattails and other emergent vegetation in nest construction (Figure 54) (Fournier & Hines 1998).

Figure 53. ***Podiceps grisegena***, Red-necked Grebe, with ducklings. Photo by Donna Dewhurst, through public domain.

Figure 54. ***Podiceps grisegena***, Red-necked Grebe, a species that includes ***Sphagnum*** in their nests. Photo by Lukasz Lukasik, through Creative Commons.

Pelecaniformes: Tropicbirds, Pelicans, *etc*

Phalacrocoracidae – cormorants

Wolf (2009) found two species of **Phalacrocoracidae** that use bryophytes in their nests in North America:

Phalacrocorax penicillatus (Brandt's Cormorant; Figure 55)
Phalacrocorax pelagicus (Pelagic Cormorant; Figure 56-Figure 57)

Figure 55. ***Phalacrocorax penicillatus***, Brandt's Cormorants, on nests. Photo by Franco Folini, through Creative Commons.

Figure 56. ***Phalacrocorax pelagicus***, Pelagic Cormorant, female and chicks on nest. This species uses bryophytes in their nests in parts of North America. Photo by Alan Vernon, through Creative Commons.

Figure 57. ***Phalacrocorax pelagicus***, Pelagic Cormorant, on nest. Photo by Alan Vernon, through Creative Commons.

Falconiformes: Vultures, Hawks, & Falcons

Accipitridae – Hawks, Old World Vultures & Harriers

Despite their large size and predatory habits, Wolf (2009) found seven species of **Accipitridae** that use bryophytes in their nests in the Pacific Northwest of the USA.:

Aquila chrysaetos (Golden Eagle; Figure 58-Figure 60)
Buteo brachyurus (Short-tailed Hawk; Figure 61)
Buteo lagopus (Rough-legged Hawk; Figure 62-Figure 63)
Buteo lineatus (Red-shouldered Hawk; Figure 64-Figure 65)
Elanoides forficatus (Swallow-tailed Kite; Figure 66)
Elanus leucurus (White-tailed Kite; Figure 67-Figure 68)
Haliaeetus leucocephalus (Bald Eagle; Figure 69)

Figure 58. ***Aquila chrysaetos***, Golden Eagle, a species that uses bryophytes in their nests in parts of North America. Photo by Richard Bartz, through Creative Commons.

Figure 59. ***Aquila chrysaetos***, Golden Eagle, nest. Photo by Wildxplorer, through Creative Commons.

Figure 60. ***Aquila chrysaetos***, Golden Eagle, egg and baby on nest. Photo by Johann Jaritz, through Creative Commons.

Figure 61. ***Buteo brachyurus***, Short-tailed Hawk, in flight, a species that uses bryophytes in their nests in parts of North America. Photo by Dario Sanches, through Creative Commons.

Rough-legged Buzzard/Hawk (*Buteo lagopus*)

The Rough-legged Buzzards (***Buteo lagopus***; Figure 62) use mosses to line their nests (Figure 63) (The Hawk Conservancy 1996-2001).

Figure 62. ***Buteo lagopus***, Rough-legged Hawk, a species that lines their nests with mosses. Photo by Walter Siegmund, through Creative Commons.

Figure 63. ***Buteo lagopus***, Rough-legged Buzzard, nest with lining of moss and hatching nestlings. Photo from USFWS, through public domain.

Figure 64. ***Buteo lineatus***, Red-shouldered Hawk, a species that uses bryophytes in their nests in parts of North America. Photo by Mike Baird, through Creative Commons.

Figure 65. ***Buteo lineatus***, Red-tailed Hawk, nest. Photo by Bill Majoros, through Creative Commons.

Figure 66. ***Elanoides forficatus***, Swallow-tailed Kite, in flight. This species uses bryophytes in their nests in parts of North America. Photo by Andrea Westmoreland, through Creative Commons.

Figure 67. ***Elanus leucurus***, White-tailed Kite, carrying nesting material. In parts of North America it includes bryophytes in the nest. Photo by Ken Penicle Jr., through Creative Commons.

Figure 68. ***Elanus leucurus***, White-tailed Kite, on nest. Photo by Maria Teresa Jaramillo, through Creative Commons.

American Bald Eagle (*Haliaeetus leucocephalus*)

It is of some consolation to those who fear extensive loss of mosses that protected birds use mosses for their nests. Even the huge **American Bald Eagle** (***Haliaeetus leucocephalus***; Figure 69) in Alaska uses mosses in old-growth forests to form nests (Figure 69) atop tall spruce trees (Holleman 1997). One can hope that in our efforts to protect our national symbol we will learn to protect those aspects of its habitat that are important to its success. This, hopefully, will protect the mosses.

Figure 69. ***Haliaeetus leucocephalus***, American Bald Eagle, landing on nest. Photo by Murray Foubister, through Creative Commons.

Gruiformes: Cranes, Rails, *etc*

Gruidae – Cranes

Wolf (2009) found one species of **Gruidae** whose members use bryophytes in their nests (Figure 70) in parts of North America of the USA: ***Grus canadensis*** (Sandhill Crane; Figure 71).

Figure 70. ***Grus canadensis***, Sandhill Crane, tending eggs in nest. Photo by Andrea Westmoreland through, Creative Commons.

Figure 71. ***Grus canadensis pratensis***, Sandhill Crane, a species that uses bryophytes in their nests. Photo by Albert Herring, USFWS, through Creative Commons.

Rallidae

Chestnut Forest-Rail (*Rallina rubra*)

The Chestnut Forest-Rail (***Rallina rubra***; see Figure 72) from the Tari Gap, Southern Highlands Province, Papua New Guinea, builds a large, globular nest (Frith & Frith 1990). This domed structure is made of mosses, leaves, and ferns. Its entrance is on the side and the nest sits ~2m above the ground in the crown of the pandanus

palm. Despite the large size of the nest, this rail places only one very large egg in the nest. Although both birds incubate the eggs for their 34-37 days of incubation, the eggs are often left alone long enough that they become cold.

Figure 72. *Rallina fasciata*, Red-legged Crake; the species ***Rallina rubra*** uses mosses in their nests in Papua New Guinea. Photo by J. Wee, through Creative Commons.

Figure 73. ***Charadrius morinellus***, Dotterel male, a species that uses bryophytes in their nests. Photo by Helwig Brunner, through Creative Commons.

Charadriiformes

Charadriidae – Plovers, *etc*

Wolf (2009) found four species of **Charadriidae** that use bryophytes in their nests in parts of North America:

Charadrius semipalmatus (Semipalmated Plover; Figure 76)
Pluvialis apricaria (European Golden-Plover; Figure 77-Figure 78)
Pluvialis dominica (American Golden-Plover; Figure 79-Figure 80)
Pluvialis squatarola (Black-bellied Plover; Figure 81)

Dotterel (*Charadrius morinellus*)

In Scotland, the rare Dotterel (***Charadrius morinellus***; Figure 73) prefers the *Carex bigelowii*-***Racomitrium lanuginosum*** (Figure 74) moss heath (Welch *et al*. 2005). It feeds largely on beetles, sawflies, and both larvae and adults of ***Tipula montana*** (a common moss inhabitant in its larval stage; see Figure 75) (Galbraith *et al*. 1993). The preferred feeding habitats for these birds are flat or gently sloping ***Racomitrium lanuginosum*** or *Juncus trifidus* heaths or the transition zone between moss heath and montane bog. The most frequently used habitats are those where the montane bogs with best food for juveniles were adjacent to the ***R. lanuginosum*** heaths with the best food for adults.

Figure 74. ***Racomitrium lanuginosum***, a moss commonly used in nests of the Dotterel. Photo by Niels Klazenga, with permission.

Figure 75. ***Tipula abdominalis*** larva, a moss dweller in a genus that provides food for the Dotterel. Photo through Creative Commons.

Figure 76. ***Charadrius semipalmatus***, Semi-palmated Plover, a species that uses bryophytes in their nests in parts of North America. Photo by Donna Dewhurst, through public domain.

Figure 77. ***Pluvialis apricaria***, European Golden-Plover. Members of this species use bryophytes in their nests in parts of North America. Photo by Bjørn Christian Tørrissen, through Creative Commons.

Figure 78. ***Pluvialis apricaria***, European Golden-Plover, nest with eggs amid lichens and bryophytes. Photo by Mike Pennington, through Creative Commons.

Figure 79. ***Pluvialis dominica***, American Golden Plover, a species that uses bryophytes in their nests in parts of North America. Photo by O. W. Johnson, USFWS, through public domain.

Figure 80. ***Pluvialis dominica***, American Golden Plover, eggs and nest. Photo by Meegs C, through Creative Commons.

Figure 81. ***Pluvialis squatarola***, Black-bellied Plover, a species that uses bryophytes in their nests in parts of North America. Photo by Peter Wallack, through Creative Commons.

Scolopacidae – Sandpipers, *etc*

Wolf (2009) found eighteen species of **Scolopacidae** that use bryophytes in their nests in parts of North America:

Tringa melanoleuca (Greater Yellowlegs; Figure 82)
Tringa flavipes (Lesser Yellowlegs; Figure 83)
Actitis macularius (Spotted Sandpiper; Figure 84-Figure 85)
Numenius phaeopus (Whimbrel; Figure 86)
Numenius tahitiensis (Bristle-thighed Curlew; Figure 87)
Limosa lapponica (Bar-tailed Godwit; Figure 88)
Arenaria interpres (Ruddy Turnstone; Figure 89-Figure 90)
Aphriza virgata (Surfbird; Figure 91-Figure 92)
Calidris mauri (Western Sandpiper; Figure 93)
Calidris minutilla (Least Sandpiper; Figure 94)
Calidris fuscicollis (White-rumped Sandpiper; Figure 95)
Calidris ptilocnemis (Rock Sandpiper; Figure 96)
Tryngites subruficollis (Buff-breasted Sandpiper; Figure 97)
Limnodromus scolopaceus (Long-billed Dowitcher; Figure 98)
Gallinago gallinago (Common Snipe; Figure 99)
Phalaropus tricolor (Wilson's Phalarope; Figure 100-Figure 101)
Phalaropus lobatus (Red-necked Phalarope; Figure 102-Figure 103)
Phalaropus fulicarius (Red Phalarope; Figure 104)

Figure 82. ***Tringa melanoleuca***, Greater Yellowlegs, a species that uses bryophytes in their nests in parts of North America. Photo by Dick Daniels, through Creative Commons.

Figure 83. ***Tringa flavipes***, Lesser Yellowlegs chicks. Members of this species use bryophytes in their nests in parts of North America. Photo by S. Kropidlowski, USFWS, through public domain.

Figure 84. ***Actitis macularia***, Spotted Sandpiper, a species that uses bryophytes in their nests in parts of North America. Photo by Mike Baird, through Creative Commons.

Figure 85. ***Actitis macularius***, Spotted Sandpiper, nest with eggs. Photo by Robert A. Hamilton, through Creative Commons.

Figure 86. ***Numenius phaeopus***, Whimbrel, a species that uses bryophytes in their nests in parts of North America. Photo by Valter Jacinto, through Creative Commons.

Figure 87. ***Numenius tahitiensis***, Bristle-thighed Curlew, a species that uses bryophytes in their nests in parts of North America. Photo by Gregory Smith, through Creative Commons.

Figure 88. ***Limosa lapponica***, Bar-tailed Godwit, a species that uses bryophytes in their nests in parts of North America. Photo by Steve Maslowski, USFWS, through public domain.

Figure 89. ***Arenaria interpres***, Ruddy Turnstone, a species that uses bryophytes in their nests in parts of North America. Photo by Dick Daniels, through Creative Commons.

Figure 90. ***Arenaria interpres***, Ruddy Turnstone, on nest. Photo by Tim Bowman, USFWS, through Creative Commons.

Figure 91. ***Aphriza virgata***, Surfbird, a species that uses bryophytes in their nests in parts of North America. Photo by Marlin Harms, through Creative Commons.

Figure 92. ***Aphriza virgata***, Surfbird, nest with young birds. Photo by Terry Hall, through public domain.

Figure 93. ***Calidris mauri***, Western Sandpiper, a species that uses bryophytes in their nests in parts of North America. Photo by Caleb Slemmons, through Creative Commons.

Figure 96. ***Calidris ptilocnemis***, Rock Sandpiper, a species that uses bryophytes in their nests in parts of North America. Photo by Alan D. Wilson, through Creative Commons.

Figure 94. ***Calidris minutilla***, Least Sandpiper, on shore rock, a species that uses bryophytes in their nests in parts of North America. Photo by Britta, through Creative Commons.

Figure 97. ***Tryngites subruficollis***, Buff-breasted Sandpiper, a species that uses bryophytes in their nests in parts of North America. Photo by Cláudio Dias Timm, through Creative Commons.

Figure 95. ***Calidris fuscicollis***, White-Rumped Sandpiper, a species that uses bryophytes in their nests in parts of North America. Photo by Cláudio Dias Timm, through Creative Commons.

Figure 98. ***Limnodromus scolopaceus***, Long-billed Dowitcher, a species that uses bryophytes in their nests in parts of North America. Photo by Tim Bowman, through Creative Commons.

Figure 99. ***Gallinago gallinago***, Common Snipe, a species that uses bryophytes in their nests in parts of North America. Photo by Alpsdake, through Creative Commons.

Figure 100. ***Phalaropus tricolor***, Wilson's Phalarope, in pond, a species that uses bryophytes in their nests in parts of North America. Photo by Blake Mathson, through Creative Commons.

Figure 101. ***Phalaropus tricolor***, Wilson's Phalarope, male on nest. Photo from NPS, through public domain.

Figure 102. ***Phalaropus lobatus***, Red-necked Phalarope, a species that uses bryophytes in their nests in parts of North America. Photo by Andreas Trepte, through Creative Commons.

Figure 103. ***Phalaropus lobatus***, Red-necked Phalarope on water. Photo by Blake Matheson, through Creative Commons.

Figure 104. ***Phalaropus fulicarius***, Red Phalarope, in shore vegetation, a species that uses bryophytes in their nests in parts of North America. Photo from USFWS, through public domain.

Broad-billed Sandpiper (*Limicola falcinellus*)

The Broad-billed Sandpiper (***Limicola falcinellus***; Figure 105) builds nests in fens dominated by mosses and wet sedges. The nests are built on shallow hummocks, typically in transition zones between vegetation types. Once the baby birds hatch, they are moved from the nest to wetter fen areas nearby. Rae *et al*. (1998) found one nest concealed between two small bryophyte hummocks – one of ***Sphagnum*** *cf.* ***capillifolium*** (Figure 107) and the other possibly ***Aulacomnium*** sp (Figure 108). One was in a *Carex* tussock in a wet fen with 30% ***Hamatocaulis*** *cf* ***vernicosus*** (Figure 109). The nests were often surrounded by a high cover of dark brown bryophytes. The eggs (Figure 106) and chicks were both colored dark chocolate brown, a coloration that Rae and coworkers suggested was an adaptation of **crypsis** (ability to avoid detection) to protect them against predation. Importance of matching color patterns is known in other birds, such as the Stone Curfew (***Burhinus oedicnemus***; Figure 110-Figure 111) (Solis & Lope 1995). These researchers demonstrated that mismatches in coloration between eggs (Figure 112) and the ground in the Stone Curfew increase the predation rate; these birds benefitted by choosing both nest building materials and nest substrate that increased camouflage.

Figure 105. ***Limicola falcinellus***, Broad-billed Sandpiper, a species that nests in mossy wetlands. Photo by Sreedev Puthur, through Creative Commons.

Figure 106. ***Limicola falcinellus***, Broad-billed Sandpiper, eggs that blend with the background of brown mosses. Photo by Klaus Rassinger and Gerhard Cammerer, through Creative Commons.

Figure 107. ***Sphagnum capillifolium***, a species often found in the nesting sites of the Broad-billed Sandpiper (***Limicola falcinellus***). Photo by Juan Larrain, with permission.

Figure 108. ***Aulacomnium palustre***, a species found in nesting sites of the Broad-billed Sandpiper (***Limicola falcinellus***). Photo by Kristian Peters through Creative Commons.

Figure 109. ***Hamatocaulis vernicosus***, one of the brown mosses common in the nesting habitat of the Broad-billed Sandpiper (***Limicola falcinellus***). Photo by Michael Lüth, with permission.

Figure 110. ***Burhinus oedicnemus***, Stone Curfew, a species that relies on matching the background colors to the coloration of its eggs. Photo by Artemy Voikhansky, through Creative Commons.

Figure 111. ***Burhinus oedicnemus***, Stone Curlew nesting, a species that relies on matching the background colors to the coloration of its eggs. Photo by Max Pixel, through Creative Commons.

Figure 112. ***Burhinus oedicnemus*** eggs matching their environment. Photo from <www.aerien.ch> through Creative Commons.

Laridae – Skuas, Gulls, Terns, & Skimmers

Wolf (2009) found seventeen species of **Laridae** that use bryophytes in their nests in parts of North America:

Stercorarius parasiticus (Parasitic Jaeger; Figure 114-Figure 115)
Stercorarius pomarinus (Pomarine Jaeger; Figure 116)
Stercorarius longicaudus (Long-tailed Jaeger; Figure 117-Figure 118)
Chroicocephalus philadelphia (Bonaparte's Gull; Figure 119-Figure 120)
Larus canus (Mew Gull; Figure 121-Figure 122)
Larus argentatus (Herring Gull; Figure 123-Figure 124)
Larus thayeri (Thayer's Gull; Figure 125)
Larus glaucoides (Iceland Gull; Figure 126-Figure 127)
Larus hyperboreus (Glaucous Gull; Figure 128-Figure 129)
Larus marinus (Great Black-backed Gull; Figure 130-Figure 131)
Rissa tridactyla (Black-legged Kittiwake; Figure 138)
Rissa brevirostris (Red-legged Kittiwake; Figure 139)
Rhodostethia rosea (Ross's Gull; Figure 140)
Pagophila eburnea (Ivory Gull; Figure 141)
Hydroprogne caspia (Caspian Tern; Figure 142)
Sterna paradisaea (Arctic Tern; Figure 143-Figure 144)
Onychoprion aleuticus (Aleutian Tern; Figure 145)

Stercorarius spp. (Figure 114-Figure 118) prefer mosses, especially ***Polytrichum juniperinum*** (syn. = ***P. alpestre***; Figure 113) (Deeming & Reynolds 2015). Over 60% of their nest material (Figure 115) is mosses.

Figure 113. ***Polytrichum juniperinum,*** a species common in nests of ***Stercorarius*** species. Photo by Vincent de Boer, through Creative Commons.

Figure 114. ***Stercorarius parasiticus***, Arctic Skua/Pomarine Jaeger, a species that uses bryophytes in their nests. Photo by Billy Lindblom, through Creative Commons.

Figure 115. ***Stercorarius parasiticus***, Parasitic Jaeger, nest with eggs and lot of moss. Photo by James K. Lindsey, with permission.

Figure 116. ***Stercorarius pomarinus***, Pomarine Jaeger, a species that uses bryophytes in their nests. Photo by Patrick Coin, through Creative Commons.

Figure 117. ***Stercorarius longicaudus***, Long-tailed Jaeger, nesting. This is a species that uses bryophytes in their nests in parts of North America. Photo by Don Henise, through Creative Commons.

Figure 118. ***Stercorarius longicaudus***, Long-tailed Jaeger, possibly nesting here. Photo through public domain.

Figure 119. ***Chroicocephalus philadelphia***, Bonaparte's Gull, on shore, a species that uses bryophytes in their nests in parts of North America. Photo by Dick Daniels, through Creative Commons.

Figure 120. ***Chroicocephalus philadelphia***, Bonaparte's Gull, nesting in Alaska. Photo by David Menke, USFWS, through public domain.

Figure 121. ***Larus canus***, Mew Gull, a species that uses bryophytes in their nests in parts of North America. Photo by Kari Pihlaviita, through Creative Commons.

Figure 122. ***Larus canus***, Mew Gull, on nest amid mosses and stones. Photo by John Haslam, through Creative Commons.

Herring/Glaucous Gull Hybrid (*Larus argentatus*/*hyperboreus*)

Ólafsson (1982) found a pair of gulls, one a Herring Gull (***Larus argentatus***; Figure 123-Figure 124) and the other a Glaucous Gull (***Larus hyperboreus***; Figure 128-Figure 129). Their nest was in a small, collapsed cave. It was constructed almost exclusively of the common moss ***Racomitrium*** (Figure 74). Only one arthropod, a mite, was found among these nest materials.

Figure 123. ***Larus argentatus***, Herring Gull, a species that uses mosses in their nests. Photo by Tony Brierton, through Creative Commons.

Figure 124. ***Larus argentatus***, Herring Gull, nest with mosses under the grass, and eggs. Photo by Finn Rindahl, through Creative Commons.

Figure 125. ***Larus thayeri***, Thayer's Gull, a species that uses mosses in their nests. Photo by Liam O'Brien, through Creative Commons.

Figure 126. ***Larus glaucoides***, Iceland Gull, a species that uses bryophytes in their nests in parts of North America. Photo by Seabamirum, through Creative Commons.

Figure 127. ***Larus glaucoides***, Iceland Gulls, in nesting area. Photo by Seabamirum, through Creative Commons.

Figure 128. ***Larus hyperboreus***, Glaucous Gull, with fledgling. Photo by A. Wieth, through Creative Commons.

Figure 129. ***Larus hyperboreus***, Glaucous Gull, nest with eggs. Photo by Peter Davis, USFWS, through public domain.

Figure 130. ***Larus marinus***, Great Black-backed Gull, a species that uses bryophytes in their nests in parts of North America. Photo by Andreas Trepte, through Creative Commons.

Figure 131. ***Larus marinus***, Great Black-backed Gull, nest and eggs. Photo by Banangraut, through Creative Commons.

Kelp Gull (*Larus dominicus*)

In the Argentine Islands the primary constituent of the Kelp Gull (***Larus dominicus***; Figure 132) nest (Figure 133) is the grass *Deschampsia antarctica* (Figure 134) (Parnikoza *et al*. 2012). The researchers postulated that in making the nests the gulls were responsible for the spread of this grass species on the islands. But the Kelp Gull also uses mosses extensively in its nests. In the Argentine Islands, ***Sanionia uncinata*** (Figure 135) was common and likewise was common in nests. It is particularly suitable because of its pleurocarpous growth form and lack of attachment to its substratum. I would expect that these gulls are similarly able to disperse the mosses.

Figure 132. ***Larus dominicus***, Herring Gull; in the Argentine Islands, this species uses ***Sanionia uncinata*** in their nests. Photo by Cláudio Dias Timm, through Creative Commons.

Figure 133. ***Larus domesticus***, Kelp Gull, nest in Patagonia in a habitat where grasses are readily available, but mosses are not. Photo by Erik Thuesen, through Creative Commons.

Figure 134. *Deschampsia antarctica* (large patch), the grass used for Herring Gull nests in the Argentine Islands. Photo by Sharon Chester, through Creative Commons.

Figure 135. ***Sanionia uncinata***, a moss commonly used in nests of the Kelp Gull. Photo by Hermann Schachner, through Creative Commons.

Lesser Black-Backed Gull (*Larus fuscus*)

When Surtsey arose from the ocean near Iceland in a volcanic explosion, no life existed (Magnússon *et al*. 2008). Slowly plants and flying animals arrived. Among the early bryophytes was the moss ***Racomitrium*** (Figure 74), and this serves as the main nesting (Figure 136) material for the Lesser Black-Backed Gull (***Larus fuscus***; Figure 137) during this austere period.

Figure 136. ***Larus fuscus***, Lesser Black-Backed Gull nest, eggs, & chicks. Photo by Sam Sam, through Creative Commons.

Figure 137. ***Larus fuscus***, Lesser Black-backed Gull, an early Surtsey colonist that uses the moss ***Racomitrium*** for nesting. Photo by Peter Ertl, through Creative Commons.

Figure 138. ***Rissa tridactyla***, Black-legged Kittiwake, on nest. Photo by Sciadopitys, through Creative Commons.

Figure 139. ***Rissa brevirostris***, Red-legged Kittiwakes, at nest. Photo by Art Sowls, through public domain.

Figure 140. ***Rhodostethia rosea***, Ross's Gull, a species that uses bryophytes in their nests in parts of North America. Photo by J. P. Siblet, through Creative Commons.

Figure 141. ***Pagophila eburnea***, Ivory Gull adult, feeding. This species uses bryophytes in their nests in parts of North America. Photo by Alan Vernon, through Creative Commons.

Figure 142. ***Hydroprogne caspia***, Caspian Tern, a species that uses bryophytes in their nests in parts of North America. Photo by B. J. Stacey, through Creative Commons.

Figure 143. ***Sterna paradisaea***, Arctic Tern, a species that uses bryophytes in their nests in parts of North America. Photo by Blake Matheson, through Creative Commons.

Figure 144. ***Sterna paradisaea***, Arctic Tern nest with eggs. Photo by James K. Lindsey, with permission.

Figure 145. ***Onychoprion aleuticus***, Aleutian Tern, a species that uses bryophytes in their nests in parts of North America. Photo by F. Deines, through Creative Commons.

Alcidae – Auks, Murres, & Puffins

Wolf (2009) found four species of **Alcidae** that use bryophytes in their nests in parts of North America:

Brachyramphus marmoratus (Marbled Murrelet; Figure 146-Figure 149)
Brachyramphus brevirostris (Kittlitz's Murrelet; Figure 154-Figure 155)
Ptychoramphus aleuticus (Cassin's Auklet; Figure 156-Figure 157)
Cerorhinca monocerata (Rhinoceros Auklet; Figure 158-Figure 160)

Marbled Murrelet (*Brachyramphus marmoratus*)

When mosses are endangered, few people care, but when a bird shows evidence of disappearance, environmentalists and nature-lovers join forces to protect them. Protecting these birds in pristine habitats can, however, protect mosses as well. The Marbled Murrelet (***Brachyramphus marmoratus***; Figure 146) provides one such story.

Figure 146. ***Brachyramphus marmoratus***, Marbled Murrelet. Photo by Kiliii Yu, through Creative Commons.

Figure 147. ***Brachyramphus marmoratus***, Marbled Murrelet, on mossy nest high in a tree. Photo by Sierra Club, permission pending, site not found.

Figure 148. ***Brachyramphus marmoratus***, Marbled Murrelet chick. Photo by Peter Halasz, through Creative Commons.

Some of our big trees have moss mats that are 30 cm deep on the old firs and Sitka spruce (Krajick 1995a). These mats take centuries to develop and supply

nourishment for canopy-specific birds such as the Marbled Murrelet (***Brachyramphus marmoratus***; Figure 147).

Tompkins (2004) reported that 17 million pounds of mosses had been harvested in 2003 in parts of North America, including Appalachia, with an estimated recovery rate of only 1% per year. The endangered and elusive seabird, the federally threatened Marbled Murrelet (***Brachyramphus marmoratus***; Figure 146), nests (Figure 149) on these moss mats (Figure 147) along the Pacific Coast of the USA (Donahue 1999; Tompkins 2004).

Figure 149. Nest of the Marbled Murrelet (***Brachyramphus marmoratus***) with common moss in the Willamette Valley of the Pacific Northwest, USA. Photo by JeriLynn Peck.

Neville Winchester (in Tompkins 2004) found more than 300 species of mosses in the canopy mats where the Murrelets live. They are so important to the Marbled Murrelet that these birds fly miles inland to build their nests on the mats (Skow 1998; Tompkins 2004). The nest is the size of a baseball and is fashioned into a cup nestled in mosses on a wide tree branch where overhanging branches hide it from its Raven (***Corvus corax***; Figure 150) and Steller's Jay (***Cyanocitta stelleri***; Figure 151) predators (Donahue 1999). The Murrelets prefer trees with high limbs that support wide moss beds. These must be camouflaged by branches to protect the chicks (Figure 148) from predators like jays (Krajick 1995b). Saving the current nesting sites of the birds is essential because these birds return to the same nesting site year after year and rarely change locations (Donahue 1999).

Figure 150. ***Corvus corax***, Raven, a predator of the Marbled Murrelet. Photo by Frank Vassen, through Creative Commons.

Figure 151. ***Cyanocitta stelleri***, Steller's Jay, eating; this is a predator on the Marbled Murrelet. Photo by Rick Leche, through Creative Commons.

The Marbled Murrelet (***Brachyramphus marmoratus***; Figure 146-Figure 148) is distributed from central California to Alaska, living in mature forests of large coastal conifers (Singer *et al*. 1991). Although most of the nests are simple depressions in the moss or lichen mats, others are more constructed. The Marbled Murrelet uses epiphytic mosses (especially ***Isothecium*** spp.; Figure 152) extensively as nesting material (Hamer & Nelson 1995). In California the Marbled Murrelet prefers the moss ***Brachythecium*** (Figure 153) instead (Brian Dykstra, pers. comm. 10 December 2011). Where it is protected, lots of bryophytes are also protected.

Figure 152. ***Isothecium myosuroides***, a species available for nests of the marbled Murrelet. Photo by Adolf Ceska, with permission.

Figure 153. ***Brachythecium rutabulum***, a species available for nests of the marbled Murrelet. Photo by Michael Lüth, with permission.

Figure 154. ***Brachyramphus brevirostris***, Kittlitz's Murrelet, a species that uses bryophytes in their nests in parts of North America. Photo by Ron Niebrugge, through Creative Commons.

Figure 155. ***Brachyramphus brevirostris***, Kittlitz's Murrelet, nest. Photo by USFWS, through public domain.

Figure 156. ***Ptychoramphus aleuticus***, Cassin's Auklet, a species that uses bryophytes in their nests in parts of North America. Photo by Blake Matheson, through Creative Commons.

Figure 157. ***Ptychoramphus aleuticus***, Cassin's Auklet, on nest. Photo by L. Lauber, USFWS, public domain.

Figure 158. ***Cerorhinca monocerata***, Rhinoceros Auklet, a species that uses bryophytes in their nests in parts of North America. Photo by Dick Daniels, through Creative Commons.

Figure 159. ***Cerorhinca monocerata***, Rhinoceros Auklet, nest burrows. Photo by through Creative Commons.

Figure 160. ***Cerorhinca monocerata***, Rhinoceros Auklet, nest burrow and female. Photo by NOAA, through public domain.

Summary

The use of bryophytes in nests is much more common among the **Passeriformes** than among the non-**Passeriformes**. The latter are mostly ground-nesting birds. Some build their nests on the mosses and others gather bryophytes to include in their nests. In the Arctic and Antarctic, use of bryophytes in nest construction is common due to the limited vegetation available. There, even water birds commonly use bryophytes.

Burrowing birds may use bryophytes as liners in the burrows, sometimes providing a nest for rodents that move in later. Hummingbirds often use mosses and lichens on the outsides of nests, presumably as camouflage. The Picaflor Rubi is one of the birds that can make its entire nest with bryophytes.

Some birds require mossy wetlands nearby their nesting sites because those wetland sites provide food needed for the young.

Protection of birds such as the Marbled Murrelet, a species that flies inland to mossy habitats to nest, may effectively protect the bryophytes as well.

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