Pacific Barrier Island and Spit Biophysical Setting

Southern Alaska

Conservation Status Rank: S4 (apparently secure)

Introduction

Barrier islands and spits are elongate, broadly-arcuate features that may be separated from each other by inlets and from the mainland by lagoons, estuaries or bays (Figure 1). Unlike barrier islands, spits maintain connection to the mainland and are thought to represent continuations of coastal dunes into the ocean (Ritter 1986). Due to similarities in landform, geomorphic process, and parent material, barrier islands and spits are treated here as a single biophysical setting. Within the Gulf of Alaska, barrier islands and spits are typically associated with large river deltas. While barrier islands are created by processes similar to those that create spits, they are unique in that their separation from the mainland reduces access by predators such as brown bears and wolves. As a result, these islands provide protected haulouts for harbor seals, stopover feeding grounds for migrating shorebirds, and they support a variety of bird species, including some of conservation concern, such as the sanderling (*Calidris alba*) and Dusky Canada Goose (*Branta Canadensis occidentalis*; Sowls et al. 1978).

Figure 1. Coastal dunes on Egg Island, Copper River Delta, Alaska (photo by M. Bishop).

Distribution

Barrier islands are uncommon in southern Alaska (Hayes and Ruby 1994, Boggs 2000, DeVelice et al. 2007), occupying less than 1% of the coastline (Figure 2). Occurrences cluster on the exposed, northern shoreline of the Alaska Peninsula in the vicinity of Izembek Lagoon, along the coastlines of the Tugidak, Sitkinak and Southern Kodiak Islands, at the mouth of sediment-laden rivers such as the Katmai and Copper Rivers (Figure 2, inset map), as well as the Homer Spit. Barrier islands and spits become more common along the western and northern coasts of Alaska, and occupy 13% of the coastline worldwide (King 1972).

The distribution of barrier islands and spits in southern Alaska and the Aleutian Islands was extracted from the Alaska Department of Natural Resources coastline map for Alaska (2015); additional barrier islands and spits were hand-digitized from remotely-sensed imagery.

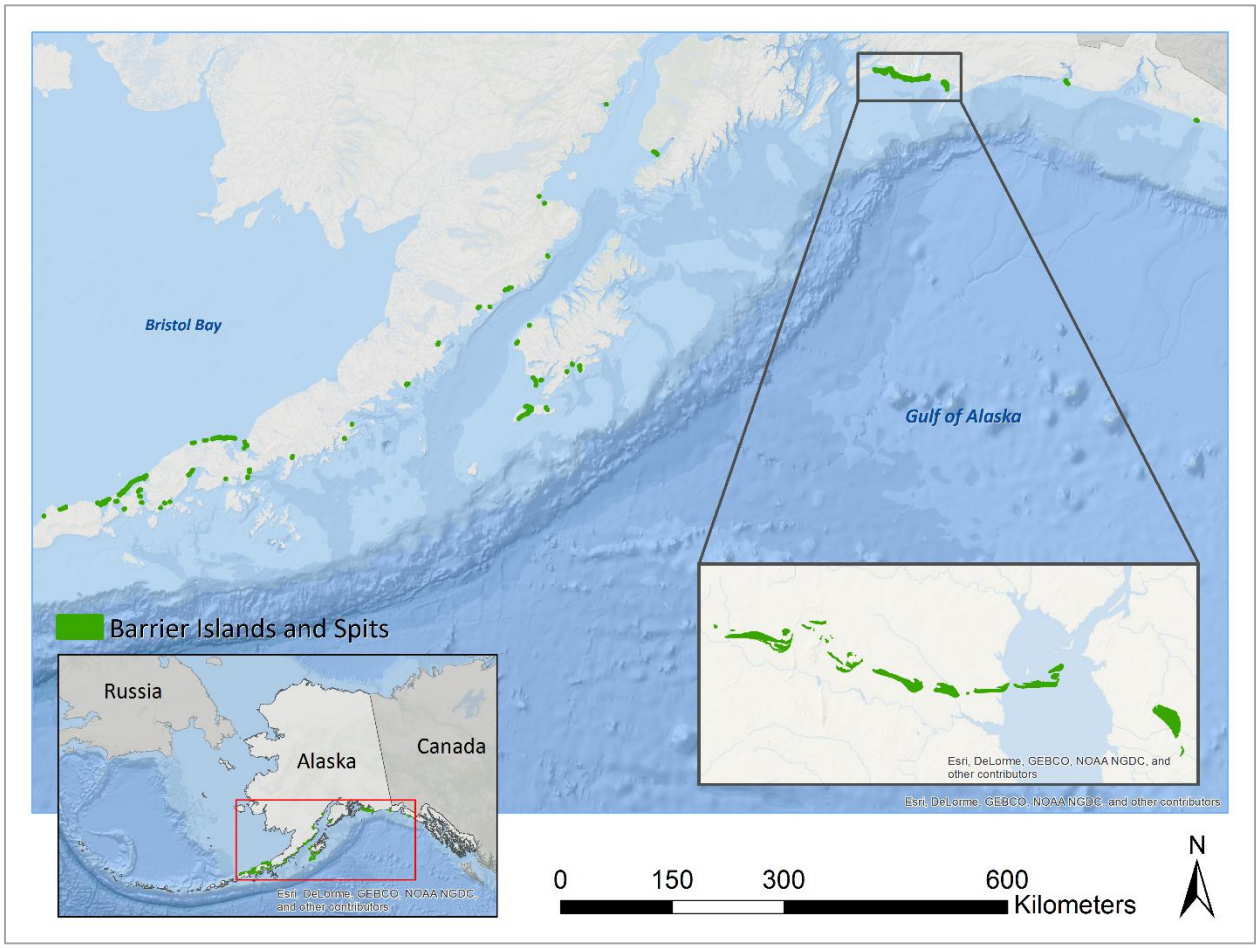

Figure 2. Distribution of the Pacific Barrier Island and Spit Biophysical Setting. Note that the areas of occupancy in this map are buffered for greater visibility.

Climate

Southern Alaska has a cool, wet maritime climate and is generally free of permafrost (Gallant et al. 1995, Nowacki et al. 2001). Mean annual precipitation ranges from 135 to 390 cm with 80 to 600 cm falling as snow. Average summer temperatures range from 7 to 18°C; average winter temperatures are between -3 and 3°C.

Environmental Characteristics

Barrier islands and spits are temporary in location and shape with their geomorphology controlled by the amount and type of sediment, the magnitude of natural processes and the stability of sea level (Dolan 1980). While several major river systems deliver sediment to the Gulf of Alaska, there are few areas of the outer coast that are characterized by low offshore gradients, tidal range and wave energy, which contributes to the regional rarity of barrier islands in southern Alaska. This suite of conditions is met at the Copper River Delta, where the riverine sediment load is transferred to the marine environment across the delta. Minor amounts of sediment are delivered by wind from various sources or by onshore transport of sediment sourced from sea

cliffs or the ocean shelf (Ritter 1986). Here barrier islands range up to13 km in length, 2 km in width and typically rise less than 10 m above sea level (Thilenius 1990).

Longshore currents, which generate waves that strike beaches obliquely, tend to move sediment along the shoreline for considerable distances. Islands, spits and inlets thus migrate parallel to these currents. Storm surges may breach low-relief barrier islands and spits. During such overwash events, material is transported from the island or spits' high-energy; erosive environment on the windward side to the low-energy, depositional environment on the leeward side and in this way form gravel beaches backed by sandy dunes that grade to fine sand beaches and washover fans (Ritter 1986).

Vegetation

Distinct landform and vegetation patterns are common among barrier islands (Figure 3). Low-gradient beaches emerge from the ocean and transition to sparsely-vegetated dunes, taller back dunes dominated by herbaceous plants, and shrub associations interspersed with slacks dominated by low herbaceous vegetation and wetlands. Landward from the tall back dunes, elevation tapers towards the estuary where vegetation grades to uplifted tidal marshes, tidal marshes and tide flats.

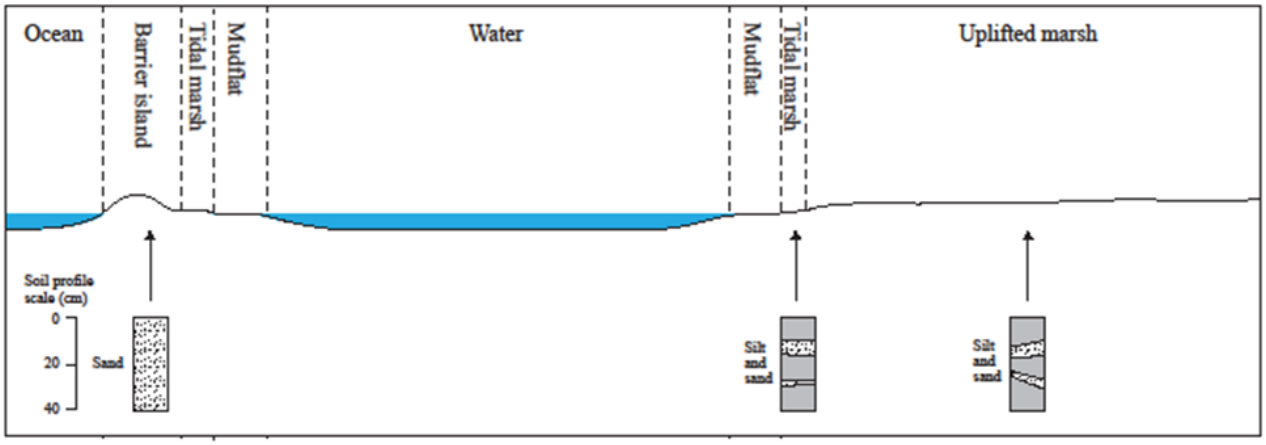

Figure 3. Schematic physiography and vegetation profile of a barrier island on the Copper River Delta, Alaska.

The barren or sparsely-vegetated dunes located toward the ocean receive significant windblown sand. Pioneer species such as *Leymus mollis* stabilize the sand with roots that penetrate 1 m and deeper to water (Boggs 2000, DeVelice et al. 2007). Species and plant association diversity increases with dune stability. Herbaceous associations include *Chamerion angustifolium, Fragaria chiloensis, Leymus mollis/Achillea borealis* and *Lupinus nootkatensis*. Low to tall shrub associations may include *Alnus viridis* ssp. *sinuata, Salix barclayi,* and *Salix alaxensis.* Dune slacks are often wet and are colonized by *Equisetum variegatum* and other wet-site herbaceous species. Progressive deposition of tidal and wind-blown sand and in some areas, isostatic uplift, elevates sites tidal and storm surge influence and allows shrubs such as *Myrica gale* to establish. Increased vegetation and decreased disturbance allows organic material to accumulate and mats to develop. The tidal marshes support typical plant associations of the region, such as *Carex lyngbyei* and *Puccinellia nutkaensis*.

Conservation Status

Rarity: Barrier islands and spits are uncommon in southern Alaska, occupying a total area of 178 km^2 and representing less than 1% of the coastline.

Threats: Due to their landscape position, barrier islands and spits are highly susceptible to damage from oil spills human use. Degree of damage from an oil spill to nearshore waters will likely vary with factors such as tidal range and level, and location, season, extent and duration of the spill. All-terrain vehicle traffic also impacts some spits.

Trend: In general, barrier islands and spits represent dynamic habitats capable of repositioning, growing and shrinking in response to changing conditions. Change in extent and condition is not expected in the short- or long-term.

Figure 4. Semipalmated plover (*Charadrius semipalmatus*) (photo by T. Bowman).

Species of Conservation Concern

Barrier islands, spits and their associated dunes, swales, lagoons, estuaries and bays provide a wide variety of habitats that, where separated from the mainland, reduces access by predators (Boggs 2000). The mammal, bird, and plant species listed below are designated critically imperiled or vulnerable either globally (G1-G3) or within Alaska (S1-S3) and are known or suspected to occur in this biophysical setting (Table 1, Table 2). Numerous species that are not considered species of conservation concern use barrier islands in the Copper River Delta area as a stopover during migration (Figure 4). Please visit the Alaska Center for Conservation Science website for species descriptions (ACCS 2016).

Table 1. Mammal and bird species of conservation concern within the Pacific Barrier Island and Spit Biophysical Setting.

Common Name	Scientific Name	Global Rank	State Rank	Habitat Description
Mammals				
Steller's sea lion	*Eumetopias jubatus*	G3	S3	Sea lions use beaches of remote islands and uninhabited areas of southeast Alaska for haulouts and rookeries.
Birds				
Aleutian Tern	*Sterna aleutica*	G4	S3B	Nests usually on sand spits, sandbar islands, sand dunes, and flat vegetated summits of more rugged islands; on low wet coastal marsh and tundra in some areas.
Black Oystercatcher	*Haematopus bachmani*	G5	S2S3B	Breeding habitat is exclusively associated with the high tide margin of the inter-tidal zone. In Alaska, the highest breeding densities occur on nonforested islands dominated by sloping beaches of shell or gravel (Andres 1998).
Black Scoter	*Melanitta americana*	G5	S3S4BS3N	Nests near lakes and pools on grassy or bushy tundra (AOU 1983).
Black Turnstone	*Arenaria melanocephala*	G5	S3NS4B	Nonbreeding: rocky seacoasts and offshore islets, less frequently in seaweed on sandy beaches and tidal mudflats (AOU 1983).

Common Name	Scientific Name	Global Rank	State Rank	Habitat Description
				Nests mainly in salt-grass tundra; breeds along the coast or on offshore islands.
Double-crested Cormorant	*Phalacrocorax auritus*	G5	S3	Habitat includes: lakes, ponds, rivers, lagoons, swamps, coastal bays, marine islands, and seacoasts; usually within sight of land. Nests on the ground or in trees in freshwater, and on coastal cliffs (usually high sloping areas with good visibility).
Dusky Canada Goose	*Branta canadensis occidentalis*	G3G4	S3S4	Breeding range restricted to the Cooper River Delta. Common on tidal marshes, uplifted tidal marshes and barrier islands.
Eurasian Wigeon	*Anas penelope*	G5	S3N	Winters primarily in freshwater (marshes, lakes) and brackish situations in coastal areas but migrates through inland regions. Rare in Southcoastal Alaska.
Gray-crowned Rosy-finch	*Leucosticte tephrocotis*	G5	S3NS5B	Barren, rocky or grassy areas and cliffs among glaciers or beyond timberline; in migration and winter also in open fields, cultivated lands, brushy areas, and around human habitation (AOU 1983).
Hudsonian Godwit	*Limosa haemastica*	G4	S2S3B	Nests on grassy tundra, near water – bogs, marshes, coastal or riverine areas. Nonbreeding habitat includes marshes, beaches, flooded fields, and tidal mudflats (AOU 1983); lake and pond shores, inlets.
Killdeer	*Charadrius vociferus*	G5	S3S4B	Habitat includes various open areas such as fields, meadows, lawns, pastures, mudflats, and shores of lakes, ponds, rivers, and seacoasts (AOU 1983).
King Eider	*Somateria spectabilis*	G5	S3B, S3N	Known to nest in arctic coastal tundra. Nearshore marine waters provides wintering and migration habitat.
Kittlitz's Murrelet	*Brachyramphus brevirostris*	G2	S2B, S2N	Wintering areas largely unknown for most birds. Populations in the Bering and Chukchi Seas probably move south away from pack ice (Day et al. 1999). Nests on coastal cliffs, rock ledges.
Marbled Murrelet	*Brachyramphus marmoratus*	G3G4	S2S3	Nest in old-growth hemlock and Sitka spruce on moss-covered trunks, or on ground near sea-facing talus slopes or cliffs. Likely forages in nearshore waters of barrier islands and spits.
Red-faced Cormorant	*Phalacrocorax urile*	G5	S3	Closely associated with rock-bottom coastlines of North Pacific marine islands and isolated areas of mainland Alaska, Kamchatka and Japan; often close to shore in water less than 200 m deep. Nests on steep, relatively inaccessible slopes.

Common Name	Scientific Name	Global Rank	State Rank	Habitat Description
Red Knot	*Calidris canutus*	G5	S2S3B	Nests on ground of barren tundra and well vegetated moist tundra in Northwest Alaska including the Seward Peninsula and less commonly near Point Barrow. Likely uses barrier island and spits for migration and staging.
Rock Sandpiper	*Calidris ptilocnemis*	G5	S3NS4B	Winters on rocky seacoasts, breakwaters, and mudflats. Nests in the open on the ground, prefers grassy or mossy tundra in coastal or montane areas (AOU 1983).
Sanderling	*Calidris alba*	G5	S2B	Breeds in small area of high arctic tundra on the Arctic Coastal Plain near Barrow. Likely uses barrier island and spits for migration and staging.
Snowy Owl	*Bubo scandiacus*	G5	S3S4	Suspected to winter in open areas near shorelines. Breeds in tundra from near treeline to the edge of polar seas.
Steller's Eider	*Polysticta stelleri*	G3	S2BS3N	During molting, utilize tidal flats and deeper bays. Winter habitat includes eelgrass, intertidal sand flats, and mudflats possibly foraging on invertebrates.
Surfbird	*Aphriza virgata*	G5	S2NS3B	Congregates on barrier islands and spits of Southcoastal Alaska during migration. Nests on dry alpine tundra.
Whimbrel	*Numenius phaeopus*	G5	S3S4B	Feeds on sandy beaches and spits during breeding season. Nests in nearby dwarf shrub tundra. Uses nearshore marine waters in Southcoastal Alaska during migration.
Yellow-billed Loon	*Gavia adamsii*	G4	S2B, S2S3N	Arctic tundra areas near open water are used as summer breeding grounds. Likely uses nearshore marine habitat provided by barrier islands and spits during migration and as winter habitat along Southern coastal Alaska.

Table 2. Plant species of conservation concern known or suspected to occur in the Pacific Barrier Island and Spit Biophysical Setting.

Scientific Name	Global Rank	State Rank	Habitat Description
Cochlearia sessilifolia	G1G2Q	S2Q	Grows in intertidal gravel and fines that typically are submersed at high tide (Nawrocki et al. 2013).
Glehnia littoralis ssp. *leiocarpa*	G5T5	S2S3	Copper Sands barrier island, Copper River Delta.
Poa macrantha	G5T5	S1S2	The northern most range of this species is the barrier islands of the Copper River Delta.
Polygonum fowleri	G5TNR	S3S4	Copper Sands barrier island, Copper River Delta.

Plant Associations of Conservation Concern

No plant associations of conservation concern are known or suspected to occur within this biophysical setting. Additional study is required to evaluate whether this biophysical setting supports plant associations of conservation concern.

Classification Concept Source

The classification concept for this biophysical setting is based on Thilenius (1990).

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