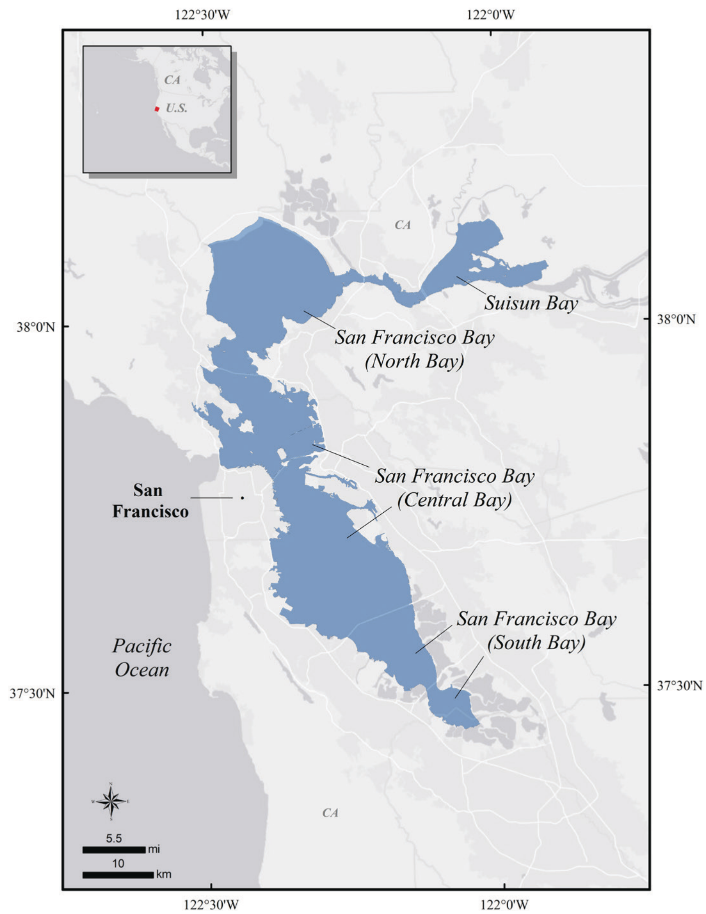
California, Washington, and British Columbia Key Sites

Figure 3. **Key habitat sites for sea ducks in California, Washington, and British Columbia.**

Key Site 1: San Francisco Bay, California

Location: 37°47'39"N, 122°20'60"W

Size: 1081 km^2



Description: San Francisco Bay and Delta is the largest estuary on the Pacific Coast of North America and drains nearly 40% of California's watersheds, including those in the Sierra Nevada mountains (Conomos 1979). San Francisco Bay-Delta has long been recognized as a site of continental importance to waterfowl by the North American Waterfowl Management Plan (North American Waterfowl Management Plan 2018) and is designated a Ramsar Wetland of International Importance (Ramsar 2021). San Francisco Bay is comprised of four adjacent regions that facilitate freshwater runoff from the Sacramento and San Joaquin rivers and smaller regional creeks, with regular tidal interchange through the Golden Gate strait to the Pacific Ocean. Each of the open bay regions, including Suisun Bay, North (or San Pablo) Bay, Central Bay, and South Bay, are characterized by a unique combination of tidal range, water depth, salinity, and sediments, as well as adjacent tidal channel networks, marsh and intertidal mudflats creating a rich diversity of wetland habitats and food resources. For consistency and comparison with long-term Mid-Winter Waterfowl Surveys (MWS), the San Francisco Bay key habitat site is limited to these four open bay portions of the estuary (Accurso 1992), which constitute the most important areas for sea ducks within San Francisco Bay-Delta. Suisun Bay (116.9 km^2), with a mean depth of 4.3 m (Monroe et al. 1992), experiences relatively small fluctuations in salinity dependent upon the amount of freshwater runoff coming through the Sacrament-San Joaquin Delta. An adjacent network of channels interspersed among managed wetlands of the Suisun Marsh provide shelter and food for Bufflehead (*Bucephala albeola*) and goldeneyes (*Bucephala clangula* and B. *islandica*), while the open shallow waters of Suisun Bay provide benthic foods for Surf Scoter (*Melanitta perspicillata*) and other diving ducks.

North Bay, also referred to as San Pablo Bay (303.7 km^2), with a mean depth of 2.7 m, is characterized by broad shallow mudflats to the north and large eelgrass beds along the southern shoreline, with the greatest fluctuation in salinity levels between the Carquinez Strait and the San Rafael-Richmond bridge. The shallow mudflats of northern San Pablo Bay and adjacent Napa-Sonoma marshes provide an extensive network of sloughs and protected shorelines between the Napa and Petaluma Rivers. Seasonal fresh water from smaller regional creeks create ideal habitats for bivalve beds, which are critical to foraging sea ducks. Bufflehead and goldeneyes, and other waterfowl, likely move between open bay and adjacent marsh and pond habitats depending on seasonal and daily wind and tide conditions.

Central Bay (528.2 km^2), between San Rafael-Richmond and San Mateo bridges, has a mean depth of 10.7 m and is the deepest of the four regions with strong alternating tidal currents, which limit suitable foraging habitats to shorelines and protected embayments, particularly along the western shoreline. Notably, Richardson Bay supports about 80% of all spawning Pacific herring in San Francisco Bay and contains the second largest eelgrass bed in San Francisco Bay and is the most consistently used herring spawning site (California Department of Fish and Game 2019), supporting large concentrations of scoters, Bufflehead and scaups (*Aythya affinis* and *A. marila*) during spawning events. Additionally, the eastern shoreline between San Leandro and the San Mateo bridge consistently supports Surf Scoters throughout the season (Accurso 1992, De La Cruz et al. 2014). For these reasons, both sites are listed as Audubon Important Bird Areas (IBA Audubon 2021).

South Bay (130.8 km^2), includes the open waters and intertidal mudflats south of the San Mateo Bridge South Bay and is characterized by shallow waters (mean depth of 3.4 m) ringed by intertidal mudflats and adjacent ponds including some that are managed for migratory birds.

Precision and Correction of Abundance Estimates Presented: Bird abundance and density estimates presented for this key habitat site are based upon aerial surveys designed to maximize coverage of shallow subtidal and intertidal waters in the four open bay regions of San Francisco Bay (Accurso 1992, Richmond et al. 2014, Strong 2018). No species-specific visibility correction factors (VCF) have been generated for these data. Therefore, abundance and density values provided should be considered minimum estimates.

Biological Value: Sea duck distribution and abundance data were collected through the MWS following the same transects from 1988 to 2020 (Accurso 1992), and periodically summarized by sub-region and surrounding saltmarsh and managed pond habitats (Richmond et al 2014, Strong 2018). While these counts focus on the midwinter period, Accurso (1992) and subsequent studies have demonstrated the seasonal nature of habitat use throughout San Francisco Bay. Distribution and abundance of birds among regions in San Francisco Bay is driven largely by dynamics in prey abundance and distribution (Rowan et al. 2011), which enables sea ducks to meet their energetic requirements from October through March (Accurso 1992, Lovvorn et al. 2013, De La Cruz et al. 2014).

San Francisco Bay is a dynamic and diverse estuarine system comprised of a wide variety of wetland habitats including subtidal and intertidal zones, and freshwater river estuaries, resulting in conditions especially important to Surf Scoters of the Pacific Flyway during winter and migration. The site is a major wintering location for Surf Scoter and Bufflehead, with nine other species of sea ducks observed in low abundance, or with infrequent or rare sightings, including White-winged Scoter (*Melanitta deglandi*) and Black Scoter (*Melanitta americana*), both goldeneyes, all three merganser species (*Mergus* spp.), Long-tailed Duck (*Clangula hyemalis*), and Harlequin Duck (*Histrionicus histrionicus*). The wintering count of sea ducks in the open and intertidal reaches of San Francisco Bay was estimated at 50,616 birds in 1989–1990 (Appendix 1; subset from Accurso 1992), but this estimate is a minimum count. Even these minimum estimates indicate high sea duck density, greater than 47 birds per km^2. The most abundant species were Surf Scoter and Bufflehead, with lesser abundance of goldeneyes (Appendix 1). Richmond et al. (2014) and Strong (2018) summarized more recent estimates following the same aerial survey protocols for San Francisco Bay, where the 'open bay' components of the MWS were identifiable, highlighting the variability in abundance of the less commonly encountered species groups in open water portions of San Francisco Bay (Appendix 1). Species-specific descriptions follow:

Scoters. During the MWS, scoters are lumped as a group and not identified to species. Surf Scoter is the most abundant sea duck species in San Francisco Bay. White-winged Scoter are regularly detected in low numbers and Black Scoter are a predictable rarity during winter but these two species combined make up less than 1% of the total scoter count (Accurso 1992). Repeated estimates from all four open bay regions of San Francisco Bay repeatedly report minimum densities greater than 10.0 scoters per km^2, with a high winter count of 48,203 scoters in January 1990 (Appendix 1). Richmond et al. (2014) documented 15,204 scoters in these same open bay regions during January 2012, which was 63% below scoter population target identified by the San Francisco Bay Joint Venture (SFBJV; SFBJV 1999), and reported a significant negative trend for scoter species counts in San Francisco Estuary in January between 1981–2012. A comparable survey effort was conducted in January 2018, documenting 13,068 scoters (Strong 2018). Despite these low counts, minimum scoter densities have ranged between 12.1 to 14.1 scoters per km^2 in San Francisco Bay, with highest densities documented in North (9.0 to 27.0

per km^2), Central (9.2 to 16.6 per km^2), and South Bays (12 to 16.4 per km^2; Appendix 1). Scoters were the only species group to show significant declining trends, exceeding 7% decline per year in North, Central and South Bays since 1989 (Nur et al. 2015).

Bufflehead. Bufflehead are consistently abundant in San Francisco Bay, scattered across all four regions with distribution likely influenced by the surrounding tidal sloughs, wetland and managed pond systems. Minimum densities of 7.1 birds per km^2 were recorded during January 2012, with the highest density of 18.8 birds per km^2 in South Bay (Richmond et al. 2014).

Goldeneye. Goldeneyes are thought to be predominantly Common Goldeneye, with Barrow's Goldeneye comprising less than 1% of the total goldeneye count (Accurso 1992). Peak density of goldeneyes was recorded as at least 39.9 birds per km^2 in Suisun Bay during January 2018 (Strong 2018).

Other Sea Duck Species. No reliable winter estimates exist for the other species of sea ducks encountered in San Francisco Bay. Mergansers were the only other sea ducks detected during aerial MWS surveys, but very few individuals were counted. Ancillary information from Christmas Bird Counts and eBird sightings includes limited, but confirmed, sightings of all three merganser species, Barrow's Goldeneye, White-winged Scoter, Black Scoter, Long-tailed Duck, and Harlequin Duck ranging from small flocks to individuals, particularly in the Central Bay region.

While aerial winter survey estimates clearly indicate the importance of the San Francisco Bay during winter months, this site also hosts thousands of sea ducks, particularly scoters, during fall and spring migration. De La Cruz et al. (2009, 2014) documented interannual movements among the four regions and intra-annual site fidelity by Surf Scoter marked with VHF and PTT transmitters throughout San Francisco Bay. Several studies describe seasonal distribution patterns; for example, Suisun and San Pablo Bays predictably experience use by sea ducks during periods of constrained freshwater inflows from the Sacramento and San Joaquin River Delta during the fall and early winter period. Surf Scoter distribution shifts in December and January, corresponding with declines in bivalve densities in San Pablo Bay and when seasonal patterns of precipitation and runoff lowers the salinity gradient throughout San Francisco Bay (Lovvorn et al. 2013, De La Cruz et al. 2014). Selection and use of sites within Central Bay were correlated with the seasonal presence of Pacific herring spawn, particularly in Richardson Bay near Sausalito, CA (De La Cruz et al. 2014). The most consistent use occurs along the eastern shoreline of South Bay north of the San Mateo bridge near San Leandro, CA, a region of high bivalve densities (De La Cruz et al. 2014).

Sensitivities: Sea ducks in San Francisco Bay are vulnerable to habitat degradation from chronic contaminants (Ohlendorf et al. 1986, 1991, Ackerman et al. 2014), oil spill events (De La Cruz et al. 2013, Golightly et al. 2019), changes in profitable prey due to competition with invasive species (Poulton et al. 2004, Richman and Lovvorn 2004, Lovvorn et al. 2013), and lesser documented diseases (Skerrat et al. 2005) which may be exacerbated by climate change. These perturbations may potentially cause reduced body condition and survival which in turn negatively influence migration schedules and reproductive potential. Additionally, future development around San Francisco Bay increases the likelihood that disturbance from shipping, ferry traffic, recreational boating (De La Cruz et al. 2014), and other influences will reduce roosting areas or foraging area profitability (Lovvorn et al. 2013). These threats have the greatest potential impact during spring when energetic demands are high and birds are more vulnerable to cross-seasonal impacts, and when herring spawn events concentrate birds in the Central Bay.

Potential Conflicts: This key habitat site is adjacent to major urban population centers that are inhabited by over 7.7 million people as of 2020 (U.S. Census Bureau 2020). Run-off from major port cities of San Francisco and Oakland, along with San Jose and numerous other expanding bayside urban centers, may degrade water quality and sea duck habitats, as documented by the San Francisco Bay Conservation and Development Commission (2020). Urban storm water is the largest source of pollution to San Francisco Bay, with oil, pesticides, fertilizers and household chemicals reaching Bay waters (State Water Resources Control Board 2006). Additional potential impacts on sea ducks include marine boat traffic, habitat loss, degraded food resources, oil spills, and climate change (see Sensitivities). Contaminant studies in the 1980s documented that

Surf Scoters in San Francisco Bay had high liver concentrations of mercury, selenium, certain heavy metals and organocholorines that increase the longer birds the birds were in the Bay (Ohlendorf et al. 1986, 1991). Eagles-Smith et al. (2009) showed that mercury concentrations remained elevated in Surf Scoters just prior to spring migration, inferring potential cross-seasonal burdens. It is not understood how climate change impacts including sea-level rise and salinity changes in San Francisco Bay will affect the availability and profitability of sea duck prey, food densities, and competition among sea ducks and other benthic foraging waterfowl and fish species (State Coastal Conservancy 2010, Lovvorn et al. 2013), emphasizing the need for future monitoring of benthic resources (Rowan et al. 2011).

Status: The SFBJV established population targets for focal waterfowl species in the San Francisco Bay based on peak abundance estimates from surveys conducted from October–April 1988–1990 (Accurso 1992). The SFBJV's primary waterfowl goal is to provide enough high-quality wetland and open water habitat to consistently support wintering populations of canvasback, greater and lesser scaup, and scoters at peak population levels recorded in 1989–90. Because the timing of peak abundance varies by species, the MWS tends to underestimate the actual peak abundance for some species. To account for this, Accurso's data from the 1988–1990 period was used to derive species-specific correction factors that convert MWS abundance estimates to annual peak estimates (Richmond et al. 2014). The conversion factors are based on data from three years of fall through spring surveys conducted by Accurso (1992). To obtain the annual peak estimate, the MWS abundance estimate is multiplied by the corresponding conversion factor (SFBJV 1999). Therefore, a population target of 61,248 scoters for San Francisco Bay would correspond to a MWS count of 41,481; this target has not been met since 2001 (Richmond et al. 2014).

This key site includes 10 Important Bird Areas (IBAs) associated with San Francisco Bay, with three designated as Globally Significant, justified in part because of their importance to Surf Scoters. The IBAs in this key site include extensive intertidal mudflats and adjacent marshes, but also include three open water IBAs acknowledging the importance of benthic food resources and eelgrass beds that provide substrate for Pacific herring spawn. Surf Scoter is one of ten priority bird species in the San Francisco Bay Program (Audubon 2020).

Three National Wildlife Refuges, managed by the U.S. Fish and Wildlife Service, and ten state Wildlife Areas and Ecological Reserves, managed by the California Department of Fish and Wildlife, are within the San Francisco Bay region, consisting of managed tidal wetlands, managed ponds, extensive networks of tidal sloughs, and some of the largest expanses of tidal marsh remaining on the Pacific Coast of North America. Tidal restoration projects have targeted intertidal mudflat and tidal marsh habitats that have benefits to a variety of wetland-dependent wildlife, including Surf Scoter, Bufflehead, and other benthic foraging waterfowl species. Uniquely, the San Pablo Bay National Wildlife Refuge and San Pablo Bay Wildlife Area both include open water regions of San Pablo Bay within their boundaries. The revised and updated San Francisco Bay Plan recognized that habitats of the open bay provide essential resting and feeding places for waterfowl during winter and migration (San Francisco Bay Conservation and Development Commission 2020). Restoration goals and adaptation strategies for these important habitats are guided by several regional efforts, including the San Francisco Bay Subtidal Habitat Goals Project (State Coastal Conservancy 2010), the USFWS Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (U.S. Fish and Wildlife Service 2013), the Baylands Ecosystem Habitat Goals Science Update (Goals Project 2015) and the San Francisco Bay Shoreline Adaptation Atlas (Beagle et al. 2019).

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Key Site 2: Salish Sea, Washington and British Columbia

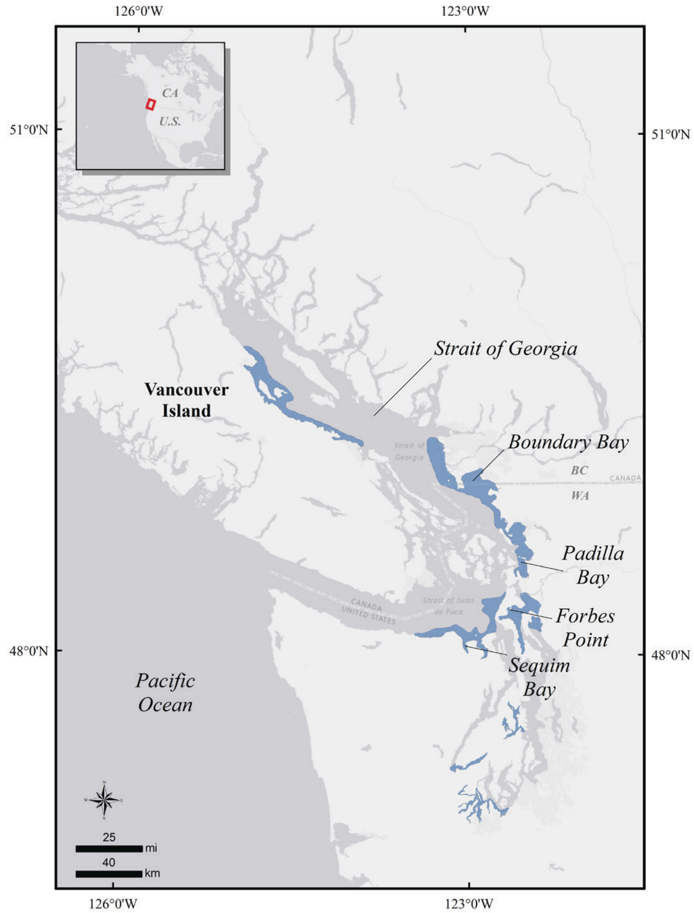
Location: 49°2'35"N, 123°4'22"W

Size: 18,000 km²

Description: The Salish Sea is a fjord estuary network of coastal marine waters located in southwestern British Columbia (BC), Canada, and northwestern Washington, United States, that includes four major water bodies: the Strait of Georgia, Desolation Sound, Puget Sound, and the Strait of Juan de Fuca (Appendix 1). The name Salish Sea is a relatively new term for the region that unifies this ecosystem across its international border. The Salish Sea extends from Desolation Sound and Discovery Passage at the northern end of the Strait of Georgia along the eastern side of Vancouver Island, and south to Olympia, Washington in Puget Sound. The northern portion is comprised of more "typical" fjord characteristics of steep slopes with deep basins and the southern portion is comprised of less steep slopes with shallower basins. To the west, the Salish Sea opens to the Pacific Ocean via the Strait of Juan de Fuca. It is one of the largest estuarine ecosystems in North America. The Salish Sea key site does not include the entire watershed, but several areas within the Salish Sea watershed that are extremely important to sea ducks. Those areas include a portion of the Strait of Georgia on the east side of Vancouver Island, and Boundary Bay in British Columbia waters, and Padilla Bay, Sequim Bay, and the Forbes Point area in Washington waters.

The Strait of Georgia is roughly 200 km long and 40 km wide, with a maximum depth of 400 m. The Vancouver Island Range to the west and the Coast Range to the east border the Strait of Georgia. Archipelagos and narrow channels mark each end of the Strait of Georgia, the Discovery Islands within Desolation Sound in the north, including a narrow ocean influence, and the Gulf Islands and San Juan Islands in the South. The Fraser River Delta, in the southeast accounts for 80% of the fresh water entering the Strait of Georgia.

Puget Sound is characterized by five deep basins including Whidbey Basin, Central Puget Sound, South Puget Sound, Hood Canal, and Admiralty Inlet. The maximum depth of Puget Sound is 280 m (Freelan 2018). The Strait of Juan de Fuca is approximately 25 km wide and 150 km long, connecting northern Puget Sound to the Pacific Ocean. The majority of ocean influence enters the Salish Sea through the Strait of Juan de Fuca. The Strait is bisected by the international boundary between the United States and Canada.



Precision and Correction of Abundance Estimates Presented: Data on the distribution and abundance of sea ducks have been collected for the inner marine waters of Washington State during a long-term annual aerial winter survey conducted by the Washington Department of Fish and Wildlife (WDFW) (WDFW 2020, Appendix 2). Canadian waters are surveyed periodically by Canadian Wildlife Service (CWS) in collaboration with the WDFW survey protocol and crew (Appendix 2). Winter bird abundance and density estimates presented for this key habitat do not account for incomplete detection by applying species-specific visibility correction factors, and do not include estimates of several known important areas for sea ducks in Canadian waters including Boundary Bay and the Fraser River estuary, therefore the winter abundance figures (Appendix 3) provided should be considered minimum estimates.

Biological Value: The Salish Sea is a biologically rich and dynamic system comprised of a wide variety of habitats including intertidal zones, pelagic waters, rocky reefs, coastal wetlands, and freshwater river estuaries. It is especially important to sea ducks of the Pacific Flyway during wintering, staging, spring migration, and molting. The site is a major wintering location for 11 species of sea ducks, including Surf Scoter (*Melanitta perspicillita*), White-winged Scoter (*Melanitta deglandi*), Black Scoter (*Melanitta americana*), Bufflehead (*Bucephala albeola*), Common Goldeneye (*Bucephala clangula*), Barrow's Goldeneye (*Bucephala islandica*), all three mergansers (*Mergus* spp.), Long-tailed Duck (*Clangula hyemalis*), and Harlequin Duck (*Histrionicus histrionicus*) (Appendix 3). The total wintering population of sea ducks in surveyed areas of the Salish Sea (Appendix 2) was estimated to be a minimum abundance of about 247,000 birds in 2013 (Appendix 3; Evenson et al. 2013, WDFW 2020). This estimate is biased low because the survey area in British Columbia did not include Boundary Bay or the Fraser River estuary, both high density sea duck areas (Evenson et al 2013). The most abundant species or species group was scoters, followed by Bufflehead, goldeneyes, mergansers, Long-tailed Duck, and Harlequin Duck (Appendix 3). Nyeswander et al. (2005) and Evenson et al. (2013) summarized abundance estimates by species and species groups in near-shore versus off-shore waters, and, in the case of Puget Sound, among basins. WDFW (2020) summarized sea duck trends in Washington marine waters of the Salish Sea from 1994 to 2019. Trends in BC areas of the Salish Sea are less understood.

While winter survey estimates clearly indicate the importance of the Salish Sea during winter, this site also hosts thousands of sea ducks, particularly scoters, during spring staging and during late summer molt. Several areas in the Salish Sea are particularly important to sea ducks at various times of the year. In British Columbia, Baynes Sound, in the northwest of the Strait of Georgia, hosts tens of thousands of sea ducks in winter and especially during herring spawning in spring, particularly around Hornby and Denman Islands (D. Esler, USGS pers. comm). Recent CWS surveys in coastal BC have identified sea duck use of estuaries and rivers where Eulachon (*Thaleichthys pacificus*) spawn. Mergansers are particularly abundant on estuaries and rivers where Eulachon spawn. Bufflehead is the most common sea duck species in BC coastal estuaries and large aggregations of goldeneyes have been observed in the estuaries at the head of some mainland coast inlets (Toba, Knight and Kingcome Inlets) in late March, suggesting that these estuaries are the last coastal stop prior to inland migration. Other areas in BC important to sea ducks in spring include Boundary Bay, Fraser River Delta, and Howe Sound (Evenson et al. 2007).

Herring spawning is important to several species of sea ducks during spring, but habitats lacking herring spawn and bivalves, like eelgrass beds where soft-bodied prey are found (e.g., polychaetes) are also important to sea ducks (Anderson et al. 2008). In Salish Sea waters in Washington, Padilla Bay supports one of the largest continuous native eelgrass (*Zostera marina*) beds on the Pacific Coast (Bulthuis 1995), and as such is important particularly for molting scoters that return in thousands during late-July and August. Areas of particular importance to sea ducks in Washington during spring included Padilla Bay north through Lummi Bay, and Boundary Bay dominated by Surf Scoter, White-winged Scoter, Harlequin Duck, and the only consistent concentrations of Long-tailed Duck found in Washington waters (Evenson et al. 2007).

Detailed information about abundance and site use for species or species groups is as follows.

Scoters. Surf, White-winged, and Black Scoters are common species in the Salish Sea, with Surf Scoter being the predominant species of the three (Evenson et al. 2013, 2020). Numbers of scoters wintering in inner marine waters of Washington have declined significantly since the late 1970s (Nysewander et al. 2005). Nysewander et al. (2005) reported higher densities of scoters in near-shore habitats (<20 m) than in deep waters (>20 m), and that scoters used most near-shore marine waters in the survey area. Highest winter densities of scoters occurred in southern and central Puget Sound. Hot spots for scoters also included the Washington portion of Boundary Bay, Bellingham Bay and Padilla-Samish Bay. Densities ranged annually from 55.0 to 70.4 scoters per km^2 in near-shore waters. In BC, the majority of Scoters are also found in near-shore waters. Hot spots in BC for scoters include Boundary Bay, the Fraser River Delta, Baynes Sound, and the east

Coast of Vancouver Island from Campbell River to Nanaimo. Numbers of scoters in Baynes Sound in the early 2000s were much higher than during a CWS survey in 1981 (D. Esler, CWS, pers. comm.).

In summer, Nysewander et al. (2005) found high densities of scoters in Padilla Bay, Crescent Harbor, Penn Cove, and in three locations in the Strait of Juan de Fuca: Dungeness Bay, Crescent Bay and Neah Bay and Boundary Bay, on the Washington border with British Columbia. Anderson et al. (2006) documented year-round use by Surf and White-winged Scoters among three sites in Puget Sound: Penn Cove, Birch Bay, and Padilla Bay. Penn Cove largely lacks vegetation and has extensive mussel beds over sand and gravel and harbors roughly 5000–7000 Surf Scoters during early winter. Scoter use of Birch Bay peaked during spring staging when herring spawn was available. Padilla Bay was used during both spring staging and molting in summer. Molt surveys in 2007–2009 revealed roughly 8000 scoters in Padilla Bay, 2500–3000 at Forbes Point (between Oak Harbor and Crescent Bay, Washington), approximately 6000–8000 in Boundary Bay, and 8000–10,000 in the Fraser River Delta (Joe Evenson, WDFW pers. comms.). Only Birch Bay held substantial numbers of White-winged Scoters. Telemetry revealed scoters that wintered from Mexico to British Columbia used the Salish Sea from mid-March to mid-May (Evenson et al. 2007). The southern Gulf Islands of British Columbia are important to Surf Scoters during spring migration including Gabriola Island, Porlier Pass, Active Pass and Saturna Island, as well as the northern entrance of Howe Sound (Evenson et al. 2007).

Bufflehead. Bufflehead occur in Washington waters in similar densities to scoters, but tend to favor shallower waters and heads of bays or inlets (Nysewander et al. 2005). The shoreline of southern Strait of Juan de Fuca is important to Bufflehead in some years. Densities of Bufflehead ranged from 34.1 to 64.3 birds per km^2 in near-shore waters. In British Columbia, Bufflehead were primarily associated with estuaries and near-shore waters, with less than 10% associated with offshore waters (Evenson et al. 2013). Wintering Bufflehead populations have been generally stable since the late 1970s (Nysewander et al. 2005).

Goldeneyes. Goldeneye species (Barrow's Goldeneye and Common Goldeneye) are widely distributed in Washington (Nysewander et al. 2005, WDFW 2020). Densities ranged from 17.3 to 38.3 birds per km^2, much lower than Bufflehead and scoters (Nysewander et al. 2005). Goldeneye densities were higher in southern and central regions than in northern areas of Puget Sound, and they were often found where no other sea duck species were present (Nysewander et al. 2005). Numbers of goldeneye have declined in Puget Sound (Nysewander et al. 2005, WDFW 2020). In British Columbia, goldeneyes were more abundant in fjords and less abundant along the exposed waters of the Strait of Georgia and Strait Juan de Fuca (Evenson et al. 2013). Hot spots for Barrow's Goldeneye in BC include Burrard Inlet, Desolation Sound, and Mainland Coast Inlets (particularly Toba, Kingcome, Knight, and Jervis Inlets).

Mergansers. Mergansers were common throughout Washington marine waters, but occurred in lower numbers compared to other sea duck species, except Long-tailed Duck and Harlequin Duck. Of the merganser species, Red-Breasted Mergansers (*M. serrator*) were most common during winter surveys, followed by Common (*M. merganser*) and Hooded Mergansers (*Lophodytes cucullatus*) in both Washington and British Columbia, but only Common and Hooded Mergansers also breed in this region (Nysewander et al. 2005, Evenson et al. 2013, WDFW 2020). In Washington, Hooded Merganser favored the San Juan Islands and selected portions of south and central Puget Sound (Nysewander et al. 2005). In British Columbia, Red-breasted Merganser were evenly distributed among coastal and fjord habitats, and Common and Hooded Mergansers were most common in near-shore habitats (Evenson et al. 2013). Mergansers in Puget Sound are considered stable to increasing (Nysewander et al. 2005), WDFW 2020).

Long-Tailed Duck. Nysewander et al. (2005) reported Long-tailed Duck distribution differed from other sea ducks in that they were found in eastern portions of Strait of Juan de Fuca and Georgia Strait in deeper near-shore waters. Similarly, in British Columbia, Evenson et al. (2013) found Long-tailed Duck exclusively near the coastline of the Strait of Georgia and Strait Juan de Fuca. Numbers of Long-tailed Duck have declined substantially over the past few decades (Nysewander et al. 2005, WDFW 2020).

Harlequin Duck. Harlequin Duck were associated with intertidal habitats as well as kelp beds along the southern shore of the Strait of Juan de

Fuca (Nysewander et al. 2005). Similarly, Evenson et al. (2013) found Harlequin Duck predominantly along coastlines of the Straits and were less commonly observed in the deeper fjords. WDFW (2020) reported relatively stable Harlequin Duck population in the Washington portions of the Salish Sea between 1999 through 2019. Harlequin Ducks are widespread throughout the BC portion of the key site. Of note, large numbers of Harlequin Ducks congregate around Hornby Island and nearby areas in BC during herring spawn. The shores of nearby Hornby Island are a major roost site for molting Harlequin Ducks (K'omoks IBA CANADA).

Sensitivities: Sea duck populations may be vulnerable to habitat loss, loss of prey due to climate change, ocean acidification, marine pollution, disease, harmful algal bloom events (Phillips et al. 2011), and disturbance from shipping and recreational boating (De La Cruz et al. 2014). These threats have the greatest potential impact during the flightless molt period in late summer and spring foraging events when energetic demands are high and birds are more vulnerable and sensitive to disturbance.

Potential Conflicts: This site is adjacent to major urban population centers with over 7 million people as of 2012 (Salish Sea Marine Sanctuary 2018) and projected to be over 9 million in 2025 (U.S. Environmental Protection Agency 2017). Major coastal cities include Victoria and Vancouver in British Columbia, and Seattle and Tacoma in Washington. These large port cities, as well as extensive coastline development of other urban centers, present many potential conflicts with sea ducks and the habitats they rely on, such as degraded water quality and habitats, as documented by the Puget Sound Partnership (2018). Specific sources of pollution include oil, gas, paint, fertilizer, flame-retardants, heavy metals, and sewage. Many of these pollutants enter the Salish Sea via storm-water runoff (Ecology and King County 2011). Additional potential impacts on sea ducks include marine boat traffic, mariculture, habitat loss, oil spills, and climate change. The Health of the Salish Sea Report, a joint initiative between the U.S. Environmental Protection Agency (2017) and Environment and Climate Change Canada, tracks ten environmental indicators such as air quality, water quality, species at risk, and toxins in the food web, and found 6 of the 10 indicators were either neutral or worsening in the Salish Sea. For instance, mussels have been used to study toxins in Puget Sound's nearshore biota, and Lanksbury et al. (2014) observed Poly-aromatic hydrocarbons (PAHs) from oil pollution were widespread with highest levels in urban areas. Willie et al. (2017) found that Barrow's Goldeneyes wintering in BC had higher exposure of PAHs in coastal areas with greater anthropogenic influence versus more pristine areas. Finally, expansion of the non-native eelgrass (*Zostera japonica*) threatens intertidal mudflats and bivalve beds, with uncertain implications for competition with the native eelgrass beds (*Z. marina*) and the invertebrate species found to provide food resources for several of the sea duck species in these zones (Ray 1997, Anderson et al. 2008).

Status: This key site includes 21 Important Bird Areas (IBAs) within the state of Washington and 14 IBAs in British Columbia. The IBAs in this key site include bays, inlets, marshes, bends, passes, harbors, coves, lagoons, and a brackish lake important for water birds (IBA Audubon 2018, and IBA Canada https://ibacanada.org/). Additionally, the Washington Department of Fish and Wildlife (WDFW) has designated Marine Protected Areas (MPAs) including Conservation Areas (no take allowed) and Marine Preserves (limited take allowed). The MPAs provide protection for important fisheries in Puget Sound that are often important to sea ducks as well (e.g., herring).

In Washington State, local governments must meet state requirements for development in near-shore waters (Shoreline Management Act (RCW 90.58) and the Growth Management Act (RCW 36.70A)). These regulations require collection of information about critical areas (MRSC website), including eelgrass beds, to characterize shoreline function and ecosystem wide processes. Adopted in 1971 as citizen's initiatives, local governments are tasked with identifying measures to protect and/or restore impacted ecosystems (Envirovision, Herrera Environmental, and Aquatic Habitat Guidelines Program 2010).

The Washington State constitution stipulated that all citizens, not individuals, own aquatic lands; however, until 1971, landowners could purchase tidelands or shore-lands from the state (Washington DNR https://www.dnr.wa.gov/). Tideland usually refers to ownership between the lower low water mark and the mean high water mark. Shore-lands are submerged lands lying along the edge of rivers or lakes. In 1971 the legislature voted to stop sale of the state's aquatic lands. At present, 70% of tidelands remain privately owned. The state monitors jurisdiction over 75% of shore-lands, all navigable waters, and all bed-lands. Bed-lands are those aquatic lands that are submerged at all times.

Additional state legislation to restore the health of Puget Sound was enacted in 2007 through the Puget Sound Water Quality Protection program (RCW 90.71), designed to use science to develop and meet measurable goals for the recovery of the sound through the Puget Sound Partnership (2018).

In Canada, the jurisdiction of near shore waters lies with both local and provincial governments (Green Shores 2009). Local governments are responsible for land use planning and regulation and the Provincial government issues permits of all near-shore areas in inland seas such as the Strait of Georgia and Strait of Juan de Fuca.

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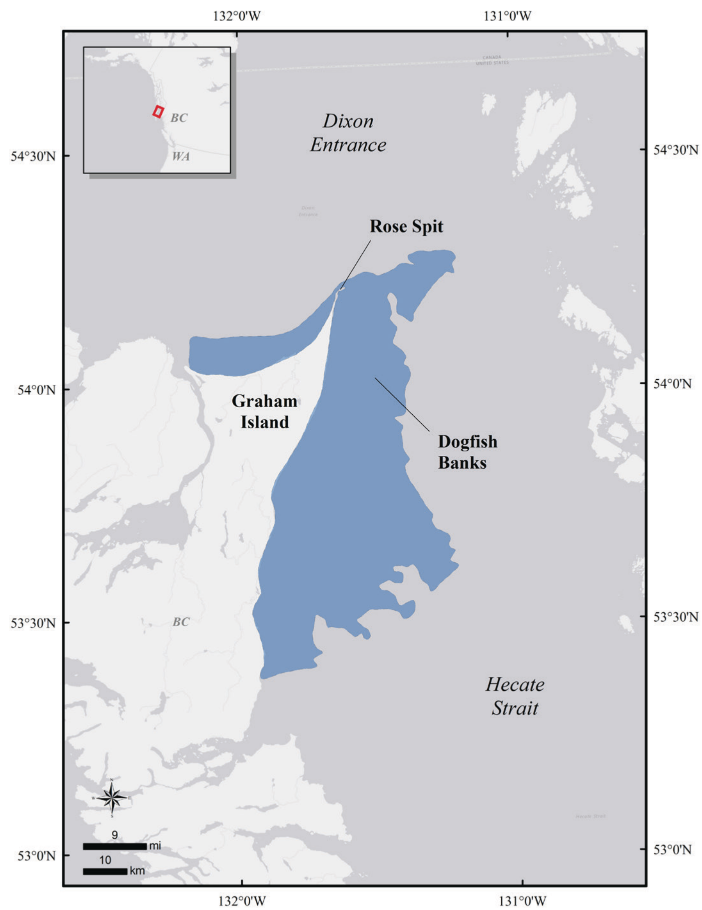
Key Site 3: Dogfish Banks and Rose Spit, Haida Gwaii, British Columbia

Location: 53°51'56"N, 131°34'53"W

Size: 2821 km^2

Description: Dogfish Banks and Rose Spit are located at the intersection of Dixon Entrance and Hecate Strait, on the north coast of British Columbia. Rose Spit is the most northeastern point of Graham Island in Haida Gwaii (formerly known as the Queen Charlotte Islands). This site includes the nearshore area of McIntyre Bay from Old Masset to Rose Spit and extends out to the northeast and south along the east coast of Graham Island, encompassing Dogfish Banks, a shallow offshore area east of Haida Gwaii. Large sandy beaches with isolated rocky headlands form the shoreline of McIntyre Bay. Rose Spit is the longest sand spit in British Columbia, with a large, well-developed dune system, extensive sandy beaches and offshore bars (IBA Canada 2016). The eastern shoreline of Graham Island consists of rocky shores, mud and sand flats, sheltered bays and points extending out into Hecate Strait (IBA Canada 2016). The waters of Dogfish Banks are unusually exposed sea duck habitat, with depths of 4 to 20 m extending over 20 km from shore (Palm et al. 2013). The waters are often turbulent, with frequent, high-intensity southeast winds and storm wave heights over 10 m, particularly during October to March (RPS Energy 2009). Glacial sands and gravels deposited adjacent to the flat coastal plain of eastern Graham Island create a sandy, gravelly seafloor with highly mobile sediment (RPS Energy 2009).

The region experiences cool, wet winters, with relatively warmer and drier summers. Average sea surface temperatures are around 6°C in winter and 12 to 13°C in summer (Irvine and Crawford 2011). The adjoining terrestrial habitat falls within the wet hypermaritime subzone of the Coastal Western Hemlock biogeoclimatic zone, with temperate rainforest dominated by Western Hemlock, Western Red Cedar, and Sitka Spruce and extensive low-lying wetland areas (Government of British Columbia 2014).



Precision and Correction of Abundance Estimates Presented: Abundance estimates from Hodges et al. (2005) have been adjusted to account for incomplete detection by applying species-specific visibility correction factors based on boat-to-air ratios calculated from similar surveys in southeast Alaska (Hodges et al. 2008) and the estimates were expanded based on transect area relative to total survey area.

Biological Value: Dogfish Banks and Rose Spit provide a wintering area for an estimated 30,000 to 50,000 sea ducks, including 15,000 to 25,000 White-winged Scoters (*Melanitta deglandi*) and 15,000 to 20,000 Long-tailed Ducks (*Clangula hyemalis*) as well as 2000 to 3000 Surf Scoters (*Melanitta perspicillata*) and 500 to 1000 Black Scoters (*Melanitta americana*) (Hodges et al. 2005). Hodges et al. (2005) speculated that the area would be used by even larger numbers of sea ducks during migration, and recommended further surveys. Satellite telemetry studies indicate that a large proportion of White-winged Scoters and Black Scoters wintering in southern British Columbia stage around Rose Spit in spring, with some individuals using the area for five to six weeks (S. Boyd unpublished data). In spring, scoters congregate to feed on eggs of spawning herring, and major aggregations of Surf Scoters have been reported at Lawn Point and McIntyre Bay (Harfenist et al. 2002). However, herring biomass in Haida Gwaii has been depressed in recent years, to the extent that fisheries have been closed (Irvine and Crawford 2011). Significant numbers of Harlequin Ducks (*Histrionicus histrionicus*) and Surf and White-winged scoters have been reported to molt off the eastern coast of Haida Gwaii (summarized in Harfenist et al. 2002). Molting Surf Scoters and White-winged Scoters in flocks of over 1000 have been observed at Rose Spit and McIntyre Bay, respectively (Savard 1988) but more recent summer surveys have not detected large numbers of scoters (LGL et al. 2009).

In December 1987, a single count of greater than 20,000 Long-tailed Ducks was recorded at Rose Spit (Harfenist et al. 2002). Scoters and Long-tailed Ducks were found throughout Dogfish Banks, but scoters were particularly abundant in the shallower areas of western Dogfish Banks while Long-tailed Ducks were more common in the deeper waters over the eastern banks (LGL et al. 2009, Hodges et al. 2005). Densities of scoters were high through autumn, winter, and spring, while Long-tailed Ducks used the area mainly in autumn and winter (LGL et al. 2009). Dogfish Banks was one of only three major wintering areas identified for scoters in northern British Columbia (Savard 1979). McIntyre Bay to Rose Spit may also be an important fall and wintering area for goldeneye, particularly Common Goldeneye (Harfenist et al. 2002). Large inter- and intra-annual fluctuations in abundance of sea ducks wintering at this site have been observed (Palm et al. 2013, LGL et al. 2009, Hodges et al. 2005). In this region, Surf Scoters commonly used areas with rocky, cobble, or sandy substrates during molt in fall and winter, while White-winged Scoters were primarily in sandy areas (Harfenist et al. 2002, Savard 1988). Surf and White-winged scoters were relatively more common in inlets during fall and winter but also continued to use open water. Long-tailed Ducks were more abundant in open water than in inlets (Harfenist et al. 2002).

While Bald Eagles are present along the shorelines of Haida Gwaii, they are almost completely absent from the offshore areas of Dogfish Banks, providing sea ducks a large foraging area with low predation danger (Palm et al. 2013). McIntyre Bay and Dogfish Banks exhibit high productivity and dense and diverse aggregations of plankton and are important larval rearing areas for invertebrates (Marine Planning Partnership Initiative 2015, Clarke and Jamieson 2006).

Sensitivities: At Dogfish Banks, White-winged Scoters were found to carry large lipid reserves, likely to buffer against reduced time for foraging and elevated thermoregulatory costs at this exposed site (Palm et al. 2013). Large aggregations of migrating or molting sea ducks may be particularly sensitive to disturbance and marine pollution events. Mortality rates may be higher during winter, especially for female and immature sea ducks wintering near the northern extent of their range (Uher-Koch et al. 2016). The value of this site during spring is greatly enhanced by herring spawn, which has declined in recent years.

Potential Conflicts: Dixon Entrance is an important transportation route, and large container ships en route between Asian ports and Prince Rupert and Kitimat often anchor near McIntyre Bay; proposed industrial projects in mainland ports may lead to increases in tanker and/or freighter traffic (Marine Planning Partnership Initiative 2015). In addition, cruise ships regularly transit waters around Haida Gwaii, and there are concerns about large vessel bilge and wastewater discharge as well as negative effects of smaller freight or log boom towing vessels (Marine Planning Partnership Initiative 2015). Long-standing concern about the risks of oil spills in this region (Marine Planning Partnership Initiative 2015, IBA Canada 2016) has been somewhat alleviated by the Canadian federal government's recent commitment to legislate a moratorium on crude oil tankers (carrying more than 12,500 tonnes) on the north coast of British Columbia (Government of Canada 2016). NaiKun Wind Energy Group maintains an active tenure license and has provincial and federal environmental assessment approval for a large-scale offshore wind energy project (up to 110 turbines) on Dogfish Banks; however, the project is stalled due to lack of an electricity purchase agreement and limited support within the Haida community (Marine Planning Partnership Initiative 2015).

Status: There are no existing marine protected areas at this site, but the Haida Gwaii Marine Plan designated several proposed marine Protection Management Zones and a marine Special Management Zone in the area (Marine Planning Partnership Initiative 2015). Much of the adjoining terrestrial areas are protected in Naikoon Provincial Park, Rose Spit Ecological Reserve, and Tow Hill Ecological Reserve; the boundary of Naikoon Provincial Park extends up to 200 m beyond the high tide line into the waters of Dixon Entrance and Hecate Strait; Rose Spit Ecological Reserve is limited to the terrestrial area while Tow Hill Ecological Reserve extends into the nearshore area of McIntyre Bay (BC Parks 2016). Waterfowl hunting is permitted within Naikoon Provincial Park but not in the ecological reserves.

The northern portion of this habitat site overlaps with the McIntyre Beach and Rose Spit Important Bird Area (IBA) and the southern portion overlaps with the Lawn Point IBA. Designation as an IBA does not confer legal protection of a site (IBA Canada 2016). McIntyre Bay and Dogfish Banks have been identified by the Department of Fisheries and Oceans as Ecologically and Biologically Sensitive Areas (EBSAs), in part because of their importance to birds, including seabirds, geese, and ducks. EBSAs do not have special legal status but identification is intended to guide management decisions (Clarke and Jamieson 2006).

This site falls within the area claimed as territory by the Haida Nation, which has never ceded rights, title, ownership, or jurisdiction over Haida Gwaii. The site is also included in the Pacific North Coast Integrated Management Area (PNCIMA), which is subject to a governance agreement between the governments of Canada, British Columbia, and First Nations (PNCIMA Initiative 2018). In British Columbia, the province owns most of the foreshore (i.e., intertidal zone) as well as coastal waters (both submerged land and the water column above it), including Dixon Entrance and Hecate Strait, but provincial legislation does not provide at-sea protection of marine birds (Harfenist et al. 2002). The Canadian federal government has jurisdiction over offshore waters (from the low water mark outwards) and over the regulation of migratory bird management, fisheries, shipping, and navigation in all marine waters.

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