Marine Bird Winter Surveys in Prince William Sound

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A Schaefer and MA Bishop

Prince William Sound Science Center, PO Box 705, Cordova, AK

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Contents

Acronym List

AOOS: Alaska Ocean Observing System

ERMA: Environmental Response Management Application, NOAA

ESI: Environmental Sensitivity Index, NOAA

EVOS: Exxon Valdez oil spill

EVOSTC: *Exxon Valdez* Oil Spill Trustee Council

GPS: Global positioning system

GWA: Gulf Watch Alaska, a survey program funded by EVOSTC

km: Kilometers

m: Meters

NOAA: National Oceanic and Atmospheric Administration

NW: Northwest

PPOR: Potential place of refuge

PWS: Prince William Sound

PWSRCAC: Prince William Sound Regional Citizens' Advisory Council

s: Second

SS: Sea state

USFWS: U.S. Fish and Wildlife Service

WS: Weather conditions

Executive Summary

Of the marine birds that overwinter in Prince William Sound (PWS), Alaska, nine species and one species group were initially injured by the 1989 Exxon Valdez oil spill (EVOS; *Exxon Valdez* Oil Spill Trustee Council, 2014). This Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) commissioned study, now in its third year, conducted marine bird and marine mammal surveys in under-surveyed areas in and around the PWS tanker escort zone. The survey was designed to complement the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) funded Gulf Watch Alaska surveys conducted from 2007-2022 by the PWS Science Center. Marine bird and mammal distribution and density around much of the tanker lane, Valdez Arm, and Port Valdez is largely unknown as the EVOSTC funded surveys did not cover these regions and many of these areas had not been surveyed in over a decade.

We conducted at-sea transect surveys between March 2-7, 2023, using the PWS Science Center's research vessel, the New Wave. Transects varied in length from 7.4 kilometers (km) (Rocky Bay) to 26.2 km (Central PWS). We added two transects because of their proximity to the tanker lane: Northwest Hinchinbrook Island (8.4 km) and Zaikof Bay (16.1 km) for a grand total of 11 transects and 205 km. For each transect we recorded all marine birds and marine mammals observed within a 300-meter (m) survey strip.

Across all transects, 646 birds representing 23 species were counted. *Brachyramphus* murrelets were the most recorded species (38% of observations), followed by pelagic cormorants (*Urile pelagicus,*12%), and common murre (*Uria aalge,* 7%). The 2023 survey results correspond with the seasonal patterns observed during the EVOSTC Gulf Watch surveys. During our surveys we also recorded 162 marine mammals representing four species, including observations of individuals beyond the 300-m survey strip. Observations were dominated by sea otter (*Enhydra lutris*).

Our 2023 results underscore the importance of protected nearshore habitat for marine birds and mammals during the winter. We found areas of repeated high marine bird density that may warrant prioritized protection in the event of anthropogenic disturbance, such as an oil spill. The primary areas for protection include Hinchinbrook Entrance (Port Etches, Zaikof Bay, Rocky Bay, and outer coastlines) and the head of Port Valdez between the Valdez Container Terminal and the outflow of Lowe River. Additional areas meriting heightened protection include Tatitlek Narrows and nearshore areas in Port Fidalgo and Port Gravina. These surveys do not include all areas that potentially may be impacted by an oil spill, nor do they capture all marine bird winter habitat or temporal variation in marine bird community structure throughout winter. With that said, continued monitoring in and around the tanker escort lane, as well as throughout Prince William Sound, is important for understanding marine bird and marine mammal vulnerability to environmental change and anthropogenic disturbance and could be used to update oil spill response planning tools and refine response efforts during the non-breeding season.

Introduction

In Alaska, and specifically Prince William Sound (PWS), most studies on marine birds are conducted during the breeding season when marine birds congregate at or near colonies to nest and forage. However, breeding season dynamics are not representative of the community composition or spatial distribution during the winter. The non-breeding season is a critical period of survival for marine birds overwintering at higher latitudes as food tends to be relatively scarce or inaccessible, the climate more extreme, light levels and day-length reduced, and water temperatures cooler.

From 2007-2021 as part of the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) funded Gulf Watch Alaska (GWA) program, personnel from the PWS Science Center conducted marine bird surveys in PWS during fall and winter (September – March). Results from 15 winters (2007-2022) demonstrated seasonal differences for all 11 focal avian species groups, indicating movements into and out of PWS over the course of the non-breeding season (Schaefer and Bishop, 2023). For the most abundant marine bird species, including common murre (*Uria aalge*), marbled murrelet (*Brachyramphus marmoratus*), black-legged kittiwake (*Rissa tridactyla*), and large gulls (*Larus* spp.), consistent temporal and spatial patterns were documented (Zuur et al. 2012; Dawson et al. 2015; Stocking et al. 2018; Schaefer et al. 2020; Schaefer and Bishop 2023).

Nevertheless, many regions of PWS remain under-surveyed during winter, including the areas in and around the Alyeska Pipeline Service Company's Valdez Marine Terminal and the associated tanker escort zone. Marine bird distribution and density around much of the tanker lane, Valdez Arm, and Port Valdez is largely unknown as the GWA surveys did not cover these regions and many of these areas have not been surveyed since 2010.

This report describes the density, distribution, and community composition of marine birds and marine mammals in and around the tanker escort zone in PWS as observed during March 2023 at-sea surveys. The report also compares the 2023 survey observations with those from 2021 and 2022 and provides recommendations for prioritizing oil spill response efforts in and around the tanker escort lane.

Methods

At-sea marine bird and mammal surveys were conducted during daylight hours along fixed transects in and around the tanker escort zone in PWS and followed established U.S. Fish and Wildlife Service (USFWS) protocols (USFWS 2007). We surveyed the same Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) transects around the tanker zone as during 2021 and 2022, except that in 2023 we added two transects because of their proximity to the tanker lane: Northwest Hinchinbrook Island coastline (8.4 kilometers or km) and Zaikof Bay (16.1 km; Figure 1). Both the Northwest Hinchinbrook Island coastline and Zaikof Bay transects had previously been surveyed as part of the EVOSTC GWA program.

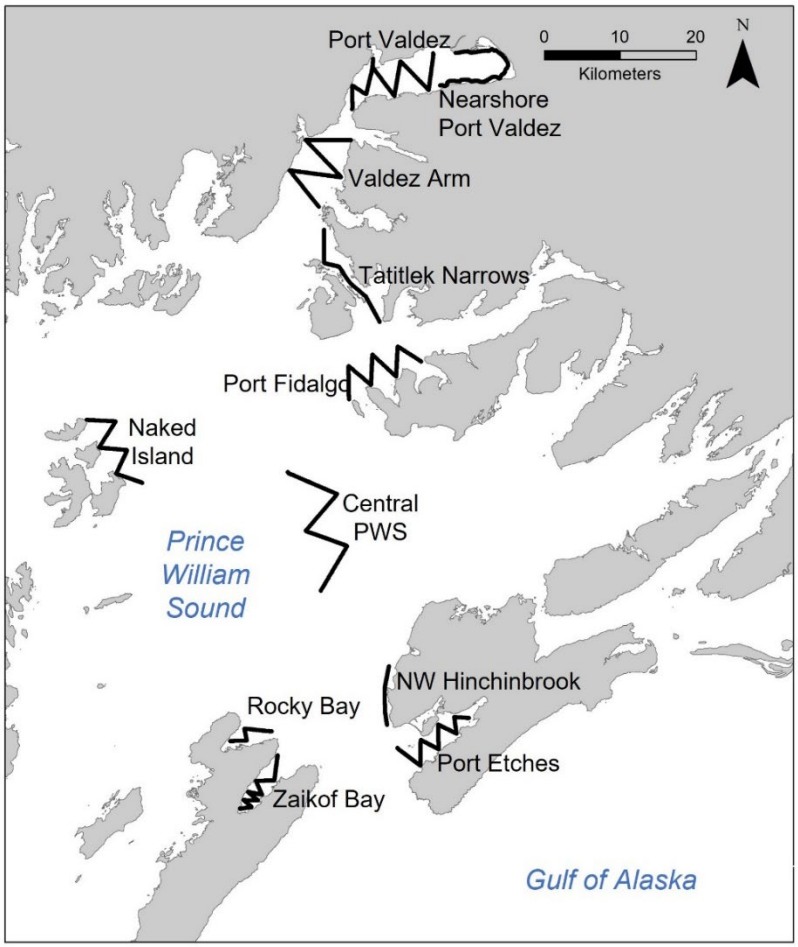

Figure 1. Map of marine bird and marine mammal transects in and around the tanker lanes surveyed in PWS during March 2023. Zaikof Bay and Northwest (NW) Hinchinbrook Island transects were previously part of the EVOSTC GWA program. Both transects were added to this survey effort in 2023.

For the surveys, one observer using 10x binoculars recorded the number, species, and behavior of all marine birds and mammals occurring within a 300-meter (m) fixed-width strip (150-m both sides and ahead of boat) from a clear observation platform ~3 m above the water line while the vessel traveled at a constant speed between 5 and 10 knots. Noteworthy observations (e.g., marine mammals, forage flocks) were recorded out to 1 km. For this study, a forage flock was defined as an aggregation of greater than 10 marine birds of one or more species actively foraging or flying but showing a clear interest in the water surface by either circling or hovering (Anderwald et al., 2011). Observations were recorded

into a laptop computer integrated with a global positioning system (GPS) using the program SeaLog (ABR, Inc). Location data (latitude, longitude) were automatically recorded at 15-second (s) intervals and for every entered observation. Additionally, sea state (SS) and weather conditions (WS) were tracked on-site by the observer.

Following the standard methods used for seabird survey data processing across the region, we divided each transect into 3-km segments and aggregated marine bird observations within each segment for summary. To make data comparable between the three survey years, we included 2021 and 2022 transect results from Northwest (NW) Hinchinbrook Island and Zaikof Bay transects collected as part of the EVOSTC GWA program. We grouped taxonomically similar species into 14 groups (Table 1) and calculated relative density (birds/km^2) for each 3-km segment. Data processing was performed using the program QA/QSea (ABR, Inc) and analyzed using the program R v. 4.1.3 (R Core Team, 2022). Mapping was performed using ArcMap 10.8.1 (ESRI, 2020). Marine mammals were not aggregated by 3-km segment, but are presented as recorded along the transect and in some instances beyond the survey strip out to 1-km.

Table 1. Taxonomically similar marine bird species combined for density analysis and mapping, Prince William Sound, Alaska.

Species group	**Common Name(s)**
Loons	Common, Pacific
Grebes	Horned, Red-necked
Cormorants	Double-crested, Pelagic
Harlequin Ducks	Harlequin
Long-tailed Ducks	Long-tailed
Scoters	Surf, White-winged, Black
Inshore Ducks	Barrow's Goldeneye, Common Goldeneye, Bufflehead
Mergansers	Common, Red-breasted
Large Gulls	Glaucous-winged, American Herring
Small Gulls	Short-billed
Kittiwakes	Black-legged
Murres	Common
Murrelets	Marbled
Guillemots	Pigeon

Results & Discussion

At-sea marine bird and mammal surveys were conducted in and around the PWS tanker escort zone from 2-7 March 2023 from the PWS Science Center's research vessel, the New Wave (Figure 1). Data from the 2023 survey have been uploaded to the Alaska Ocean Observing System (AOOS) data portal and will be available at https://gulf-of-alaska.portal.aoos.org/#metadata/771492cd-94b6-47ab-952a-02b152a535cf/project/files in January 2024 following proper data and metadata quality controls. Overall, we surveyed 205 km of transects (Table 2). Sea state conditions were calm, ranging from smooth and mirror-like (SS 0) up to large, 2-ft wavelets (SS 3). Weather conditions were mostly clear and sunny (WS 0) with overcast skies (WS 1) occurring only during the Port Fidalgo transect.

Table 2. Prince William Sound marine bird and marine mammal transects surveyed for Prince William Sound Regional Citizens' Advisory Council during March 2023. The mode for sea state (SS) and weather conditions (WS) is reported. * = transect added in 2023.

Transect Name	Length (km)	Area Sampled (km^2)	SS	WS	Mean bird density ($birds/km^2$)	# Mammals (within 1 km)
Central PWS	26.2	7.9	1	0	0.5	0
Port Etches	19.7	5.9	1	0	17.5	37
Port Fidalgo	23.9	7.2	2	1	6.3	16
Naked Island	18.6	5.6	1	0	5.2	8
NW Hinchinbrook Island*	8.3	2.5	2	0	13.0	0
Nearshore Port Valdez	18.6	5.6	0	0	26.3	43
Port Valdez	25.0	7.5	1	0	1.9	11
Rocky Bay	7.4	2.2	1	0	49.5	3
Tatitlek Narrows	15.5	4.6	1	0	4.6	10
Valdez Arm	25.6	7.7	3	0	0.8	0
Zaikof Bay*	16.1	4.8	1	0	27.2	34

Marine Birds

We recorded 646 birds representing 23 species within the 300-m survey strip across the 11 PWSRCAC) transects (Table 3; Figure A1-1). Compared to the two previous years, we recorded 22.8% and 31.3% fewer birds on the 2023 transects (2021 = 837 birds; 2022 = 941 birds). The 2023 survey was also dominated by one species group (*Brachyramphus* murrelets, 38.1% of observations), followed by pelagic cormorants (*Urile pelagicus*), and common murre (12.2% and 7.2%, respectively; Figure 2). Distribution of both the murrelets and murres was restricted. Areas of high murrelet density included the four transects in Hinchinbrook Entrance (Port Etches, Zaikof Bay, Rocky Bay, and NW Hinchinbrook Island), Port Valdez, and southeast Port Fidalgo (Figure A1-14). Areas of high murre density were similar to *Brachyramphus* murrelets and included Hinchinbrook Entrance (Zaikof Bay, Rocky Bay, and Port Etches) and southeast Port Fidalgo (Figure A1-13). In contrast to murrelet and murre distribution, pelagic cormorants were widespread and were recorded on 10 of 11 transects (Figure A1-4).

The most abundant species on 2023 surveys were comparable to the 2021 surveys when *Brachyramphus* murrelets dominated (31.2%) followed by common murre (15.7%) and pelagic cormorant (10.5%). Importantly, both the 2021 and 2023 survey results match the seasonal patterns observed during the EVOSTC GWA surveys. Over a 15-year period we found that murrelets, cormorants, and murres, along with the less numerous mergansers (*Mergus* spp.) and grebes (*Podiceps* spp.), were all more likely to occur in PWS from early- through late-winter compared to fall (Schaefer and Bishop, 2023).

Interestingly, black-legged kittiwakes, the most-recorded species in 2022 (n = 97 birds) had negligible numbers on the 2023 transects (n = 7 birds). Kittiwakes are more likely to be present in PWS during fall (September-October; Stocking et al., 2018; Schaefer and Bishop, 2023) whereas by early winter most have departed for offshore wintering habitats (McKnight et al., 2011). We suggest that the fluctuating kittiwake numbers observed during our annual March surveys are related to variability in the timing of their return from their offshore wintering grounds.

Among the 11 transects surveyed, 4 of the 5 highest bird densities (birds/km^2) were recorded on the four transects around Hinchinbrook Entrance (Figure A1-1). Densities around the Entrance ranged from 13.0 birds/km^2 along the NW Hinchinbrook Island transect to 49.5 birds/km^2 at Rocky Bay. While the Nearshore Port Valdez transect had the third highest densities recorded (26.3 birds/km^2), the nearby Port Valdez and Valdez Arm transects both had some of the lowest densities recorded during 2023 surveys, 1.9 and 0.8 birds/km^2, respectively (Table 2).

Table 3. Total number of birds observed by species on PWSRCAC transects within the 300-m survey and beyond the 300-m survey strip (shown in parentheses). March 2021-2023, Prince William Sound, Alaska. Data summaries across all years include observations from NW Hinchinbrook Island and Zaikof Bay. Please refer to Appendix 1 for distribution maps of each species group. Unid. = Unidentified.

Common name	Scientific name	2023 Count within 300-m strip (count beyond strip)	2022 Count within 300-m strip (count beyond strip)	2021 Count within 300-m strip (count beyond strip)
American Crow	*Corvus brachyrhynchos*	7 (0)	41 (0)	
American Herring Gull	*Larus smithsonianus*	1 (0)	1 (0)	
Bald Eagle	*Haliaeetus leucocephalus*	2 (7)	10 (2)	3 (2)
Barrow's Goldeneye	*Bucephala islandica*		25 (6)	6 (6)
Black-legged Kittiwake	*Rissa tridactyla*	7 (123)	97 (0)	86 (3)
Brachyramphus Murrelet		93 (33)	20 (4)	76 (17)
Bufflehead	*Bucephala albeola*	20 (26)	43 (3)	5 (39)
Common Goldeneye	*Bucephala clangula*	21 (0)	24 (1)	6 (1)
Common Loon	*Gavia immer*	1 (1)		
Common Merganser	*Mergus merganser*	29 (42)	30 (3)	12 (0)
Common Murre	*Uria aalge*	46 (10)	143 (87)	129 (39)
Common Raven	*Corvus corax*			2 (0)
Double-crested Cormorant	*Nannopterum auritum*	4 (1)	3 (0)	2 (0)
Glaucous-winged Gull	*Larus glaucescens*	38 (23)	92 (20)	74 (1)
Harlequin Duck	*Histrionicus histrionicus*		8 (0)	2 (0)
Horned Grebe	*Podiceps auritus*	13 (0)	4 (0)	17 (0)
Long-tailed Duck	*Clangula hyemalis*	4 (0)	37 (0)	6 (4)
Mallard	*Anas platyrhynchos*	5 (0)		0 (85)
Marbled Murrelet	*Brachyramphus marmoratus*	153 (1)	88 (3)	185 (9)
Pacific Loon	*Gavia pacifica*	28 (1)	35 (6)	2 (0)
Pelagic Cormorant	*Urile pelagicus*	79 (17)	57 (15)	88 (20)
Pigeon Guillemot	*Cepphus columba*	17 (1)	11 (2)	17 (1)
Red-breasted Merganser	*Mergus serrator*	5 (0)	29 (4)	3 (0)
Red-necked Grebe	*Podiceps grisegena*	1 (4)	1 (0)	

Short-billed Gull	*Larus brachyrhynchus*	23 (1)	36 (3)	14 (0)
Surf Scoter	*Melanitta perspicillata*	3 (17)	5 (0)	36 (1)
Trumpeter Swan	*Cygnus buccinator*	0 (4)		0 (3)
Unid. Cormorant		7 (40)	0 (1)	5 (44)
Unid. Duck		0 (328)	0 (124)	0 (105)
Unid. Goldeneye		10 (67)	13 (25)	36 (6)
Unid. Grebe		8 (2)	1 (0)	7 (0)
Unid. Large Gull		1 (0)	2 (1)	
Unid. Loon		4 (8)	2 (74)	4 (8)
Unid. Merganser		5 (34)	37 (9)	11 (0)
Unid. Murre				2 (0)
Unid. Scoter		3 (0)	5 (1)	1 (13)
Unid. Small Gull		1 (0)		0 (2)
White-winged Scoter	*Melanitta fusca*	7 (16)	41 (160)	0 (3)
Grand Total		**646 (+807)**	**941 (+554)**	**837 (+412)**

During nearshore transects, we typically try to maintain the vessel ~150-200 m from the shoreline. However, on the nearshore Port Valdez transect our vessel remained 500-1000 m from the shoreline due to the shallow and extensive mudflats emanating from the Lowe and Valdez Glacier rivers. While on this transect, we recorded large aggregations of ducks beyond the survey strip for a total of 333 ducks (mallard [*Anas platyrhynchos*] + unidentified ducks). This was more than 2.6x and 1.7x the number of ducks recorded in 2022 and 2021, respectively (2022: 124 unidentified ducks; 2021: 190 mallard + unidentified ducks). Similar to 2022, ducks during the 2023 survey were distributed between the outflows of the Valdez Glacier Stream and Allison Creek. In 2021, ducks were located along the northeast shoreline between the Valdez Container Terminal and the outflow of Valdez Glacier Stream.

Across all PWSRCAC surveys we recorded only one forage flock. On the Port Etches transect, a small forage flock was observed consisting of 12 glaucous-winged gulls (*Larus glaucescens*), 12 black-legged kittiwake, and 1 bald eagle (*Haliaeetus leucocephalus*). There were no marine mammals associated with the flock.

Marine Mammals

In addition to marine birds, we also recorded marine mammals within the 300-m strip during the surveys. When possible, we recorded marine mammal observations out to 1 km, but this is not uniform across all species as whales are much easier to observe at larger distances compared to sea otter (*Enhydra lutris*), harbor seal (*Phoca vitulina*), Steller sea lion (*Eumetopias jubatus*), or porpoises (*Phocoenoides dalli* or *Phocoena phocoena*). Observations recorded beyond the 300-m strip should be considered minimum counts for these species in these areas.

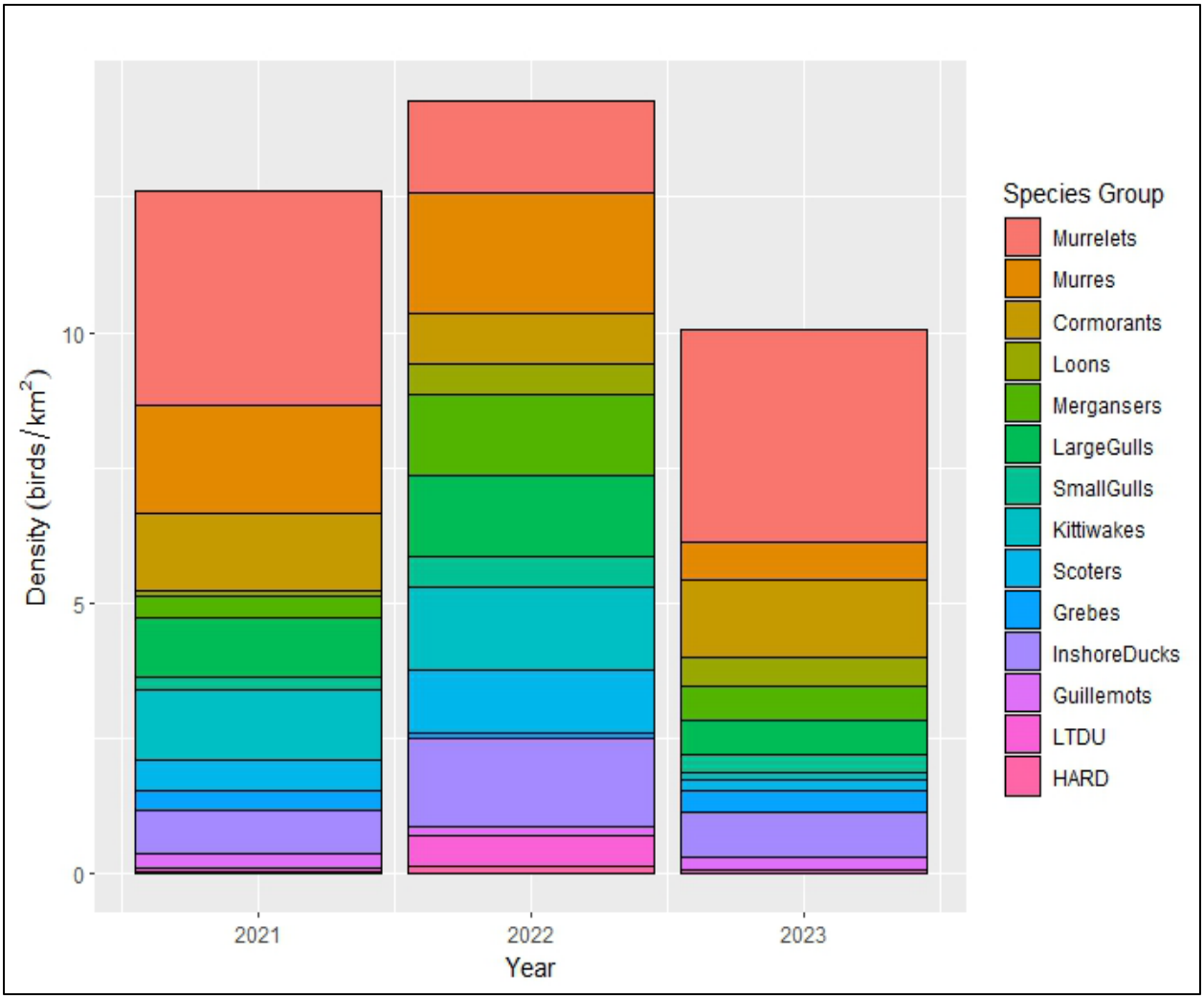

Figure 2. Mean density of each species group observed on March 2021-2023 PWSRCAC transects. See Table 1 for species groupings. “LTDU” refers to long-tailed duck and “HARD” refers to Harlequin Duck.

Sea otter was the most abundant marine mammal observed during the survey. Sea otters were recorded in small group sizes, ranging from one to six individuals, and occurred in most nearshore areas except Valdez Arm, Northwest Hinchinbrook Island, and the offshore Central PWS transects (Table 4; Figure A2-4). Similar to March 2022, most harbor seals observed were close to or on the nearshore Port Valdez transect, including one group numbering nine individuals. The only other harbor seals observed were two individuals in Rocky Bay (Figure A2-3). For porpoises, our 2023 count was 11, an increase over the seven porpoises observed during 2022 (Table 4). Porpoises were recorded only at two transect locations: Naked Island and the Port Valdez zigzag (Figure A2-1). Dall's porpoise

(*Phocoenoides dalli*) sightings, but no harbor porpoise (*Phocoena phocoena*), were confirmed in 2023.

We recorded Steller sea lion only around Hinchinbrook Entrance with several groups recorded in Port Etches around Porpoise Rocks, a major sea lion haul-out. Smaller sea lion numbers were also recorded in Zaikof Bay. Interestingly, we observed neither killer whales (*Orcinus orca)* nor humpback whales (*Megaptera novaengliae*) during our PWSRCAC transects. However, during the return transit to Cordova, a pod of an estimated five killer whales were observed northeast of Hinchinbrook Entrance in Orca Bay.

Table 4. Total number of marine mammals observed by species on PWSRCAC transects within and beyond the 300-m survey strip, March 2023. Prince William Sound, Alaska. Data summaries across all years include observations from NW Hinchinbrook Island and Zaikof Bay.

Common name	**Scientific name**	**2023 Count within 300-m strip (count beyond strip)**	**2022 Count within 300-m strip (count beyond strip)**	**2021 Count within 300-m strip (count beyond strip)**
Dall's Porpoise	*Phocoenoides dalli*	2 (4)	2 (0)	15 (0)
Harbor Porpoise	*Phocoena phocoena*		2 (0)	
Harbor Seal	*Phoca vitulina*	12 (4)	13 (19)	3 (53)
Humpback Whale	*Megaptera novaengliae*		2 (0)	0 (1)
Killer Whale	*Orcinus orca*		0 (2)	0 (2)
Sea Otter	*Enhydra lutris*	81 (27)	105 (34)	70 (19)
Steller Sea Lion	*Eumetopias jubatus*	2 (25)	7 (68)	3 (22)
Unidentified Porpoise		5 (0)	3 (0)	2 (2)
Grand Total		**102 (+60)**	**134 (+123)**	**93 (+99)**

Conclusions

Because marine bird density and distribution can vary widely across years, multiple years of surveys are necessary to understand natural variation. However, the patterns observed during this survey are consistent with patterns reported previously for PWS during the non-breeding season. Marine birds tend to prefer shallow and protected habitats that are closer to shore compared to deep offshore habitats (Dawson et al., 2015; Stocking et al. 2018; Schaefer et al., 2020; Schaefer and Bishop, 2023). During our three years of March

surveys (2021-2023), we identified multiple areas of consistently high and low marine bird densities and other areas that may warrant continued evaluation. The highest densities of birds were indeed observed in bays and nearshore areas (e.g., head of Port Valdez, Port Etches), while the lowest densities were recorded in Valdez Arm and more exposed habitats that were farther from shore (e.g., central PWS, Naked Island).

The 2023 results provide further support for protection of the region around Hinchinbrook Entrance. The four Hinchinbrook Entrance transects: Port Etches, Zaikof Bay, Rocky Bay, and NW Hinchinbrook Island, were all high-density areas for multiple marine bird species (Figure A1-1). The high numbers of marbled murrelets and presence of pigeon guillemots, two species that were injured by Exxon Valdez oil spill and whose populations have not yet recovered (EVOSTC 2014), were both recorded on each of these transects and further emphasize the importance of these protected (i.e., not exposed) waters to sensitive marine bird species during the non-breeding season. Hinchinbrook Entrance is particularly vulnerable to anthropogenic disturbance because it is where tankers enter and exit PWS and because of the importance of Porpoise Rocks to marine wildlife. Located at the mouth of Port Etches, Porpoise Rocks supports an important seabird colony for black-legged kittiwakes, common murres, and tufted puffins (*Fratercula cirrhata*; see North Pacific Seabird Data Portal http://axiom.seabirds.net/maps/north-pacific-seabirds/. In addition, Porpoise Rocks also serves as a roost-site for cormorants and as a haul-out site for Steller sea lions.

Consistent with our two previous surveys, our 2023 results also justify support for the protection of the head of Port Valdez due to the high marine bird density, including large flocks of inshore ducks and other waterfowl species. Importantly, the head of Port Valdez is vulnerable to disturbance because of the proximity to human infrastructure, including the Valdez Marine Terminal, harbor, and fuel dock. Other areas with relatively high marine bird density, including that of sensitive species, include the nearshore waters of Port Fidalgo and Tatitlek Narrows.

While currently not included in our PWSRCAC survey efforts, Port Gravina also supports high densities of marine birds and marine mammals (Schaefer and Bishop 2023). Port Gravina may also merit increased priority for protection because it is adjacent to the anchorage at Knowles Head used by oil tankers. On our most recent 2022 survey, we observed higher densities of marine birds primarily driven by increased densities of murrelets. Moreover, the use of this area by pigeon guillemots and killer whales, both species heavily impacted by the Exxon Valdez spill that have not recovered, and the importance of this area as spawning grounds for Pacific herring (*Clupea pallasii*), also an EVOS-injured species, further underscore the importance of the Port Gravina habitat to marine communities in PWS.

Our PWSRCAC surveys do not include all areas that potentially may be impacted by an oil spill, nor do they capture all marine bird winter habitat or variation in marine bird community structure throughout the nonbreeding season. With that said, continued

monitoring of marine birds in and around the tanker escort lane during late winter will help determine marine bird and mammal vulnerability to environmental change and future perturbations, including oil spills.

In addition, these surveys could be used to update oil spill response planning tools and refine response efforts in and around the tanker escort lane during the non-breeding season. For example, these data could be used to update National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index (ESI) maps, which are used by responders, managers, and planners to identify coastal resources at risk in the case of oil or chemical spills, or added to the NOAA Environmental Response Management Application (ERMA), which is an online tool to aid resource managers to make informed decisions for environmental response, damage assessment, and recovery/restoration. Unfortunately, the ESI maps for PWS are over 20 years old and contain very limited winter bird and mammal information for many of the areas identified here for prioritized protection (e.g., Zaikof Bay, Rocky Bay, Port Etches, NW Hinchinbrook Island coastline, Port Gravina, Port Fidalgo, Tatitlek Narrows, Port Valdez). Similarly, the additional data integrated within ERMA is also lacking for marine bird distribution within PWS during the non-breeding season.

Recommendations

We recommend the head of Port Valdez as well as the bays and island coastlines around Hinchinbrook Entrance for special protection in the event of a perturbation, such as an oil spill. These areas all host consistently high numbers of marine birds and marine mammals, including species that have yet to recover from the 1989 EVOS. Other areas with high densities of marine birds that could warrant priority protection Tatitlek Narrows and Port Fidalgo. Fortunately, there is an oil spill response barge staged in Port Etches and oil response equipment located in Valdez and Tatitlek, which should facilitate rapid and efficient response in the event of a spill in these areas.

While currently not included in our PWSRCAC survey efforts, Port Gravina also supports high densities of marine birds and marine mammals (Schaefer and Bishop 2023) and is adjacent to the anchorage at Knowles Head used by oil tankers. In May 2022 written comments provided to Alaska Department of Environment, PWSRCAC recommended that the Knowles Head anchorage not be used between March and June as a Potential Place of Refuge (PPOR) for distressed tankers due to its proximity to the primary Pacific herring spawn population in PWS. We suggest that, in addition to Pacific herring, marine birds and marine mammals be included in future recommendations to not use Knowles Head as a PPOR from March through June. This is because the presence of herring attracts high densities of both marine mammals and birds.

The loss of the EVOSTC GWA fall/winter marine bird surveys, which occurred annually in September, November, and March, has also resulted in a loss of temporal survey coverage of the PWS marine bird community. These time periods represent three distinct marine bird communities (Figure 3) and stages in the annual cycle, thus the impacts caused by

natural or anthropogenic perturbations in the marine environment would also vary by time of the year. We recommend further expanding the PWSRCAC marine bird and mammal surveys to one early winter survey (November) to more fully evaluate marine bird and mammal sensitivity to environmental change or anthropogenic disturbance, and to more effectively guide oil spill planning and response efforts.

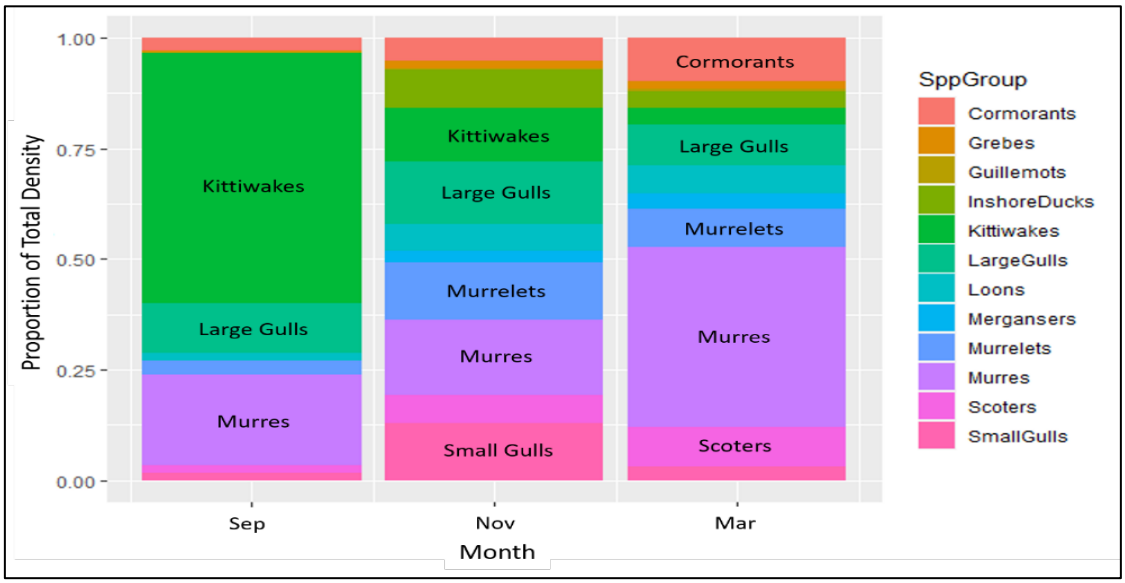

Figure 3. Marine bird community composition in PWS, during EVOSTC funded surveys, September, November, and March 2007 – 2020. Species comprising the largest proportions within each month are labeled.

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Appendix 1: Marine bird density and distribution in Prince William Sound, Alaska, March 2023.

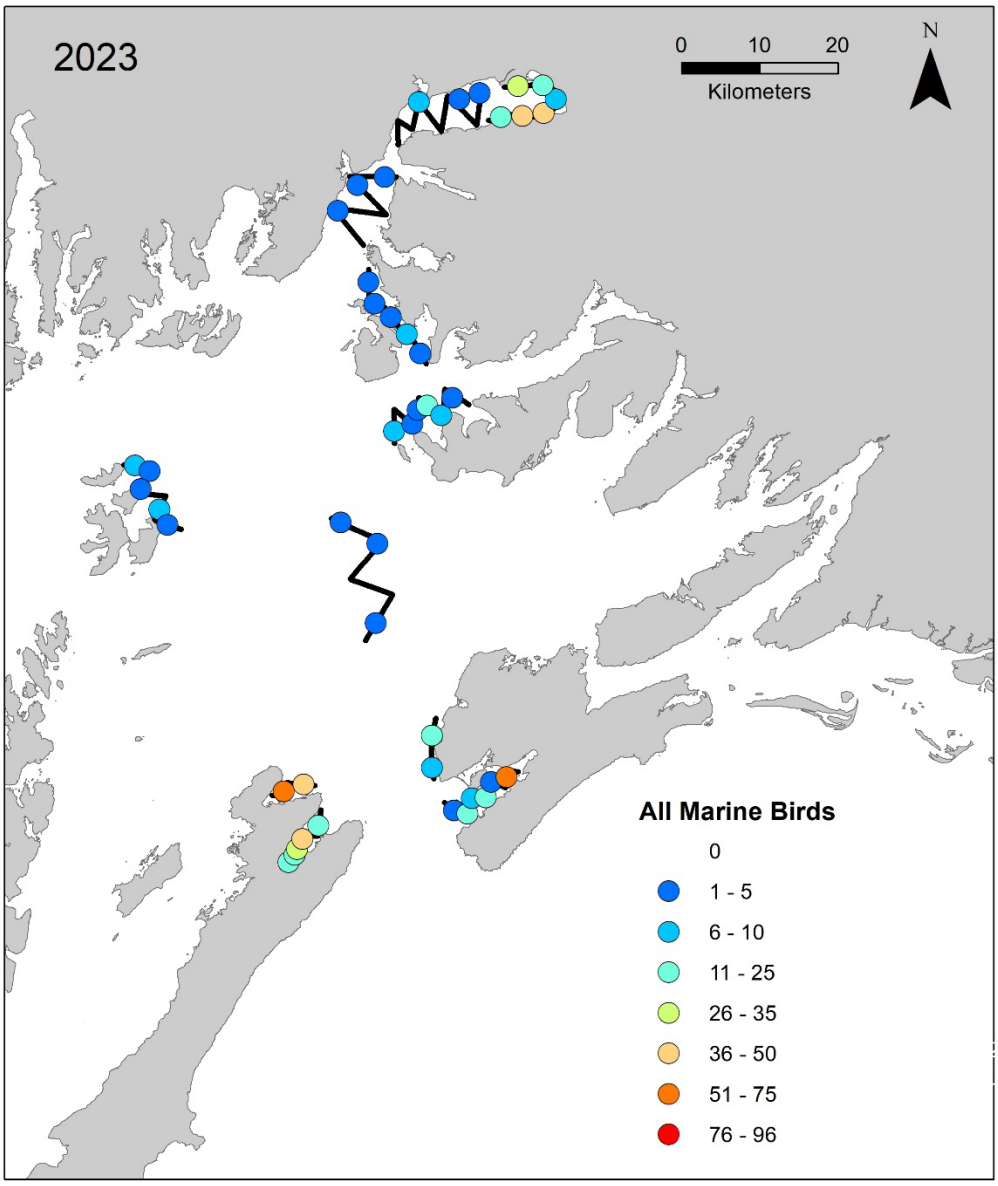

Figure A1-1. Total marine bird distribution and density (birds/km^2) observed in the 300-m survey strip in Prince William Sound, Alaska, March 2023.

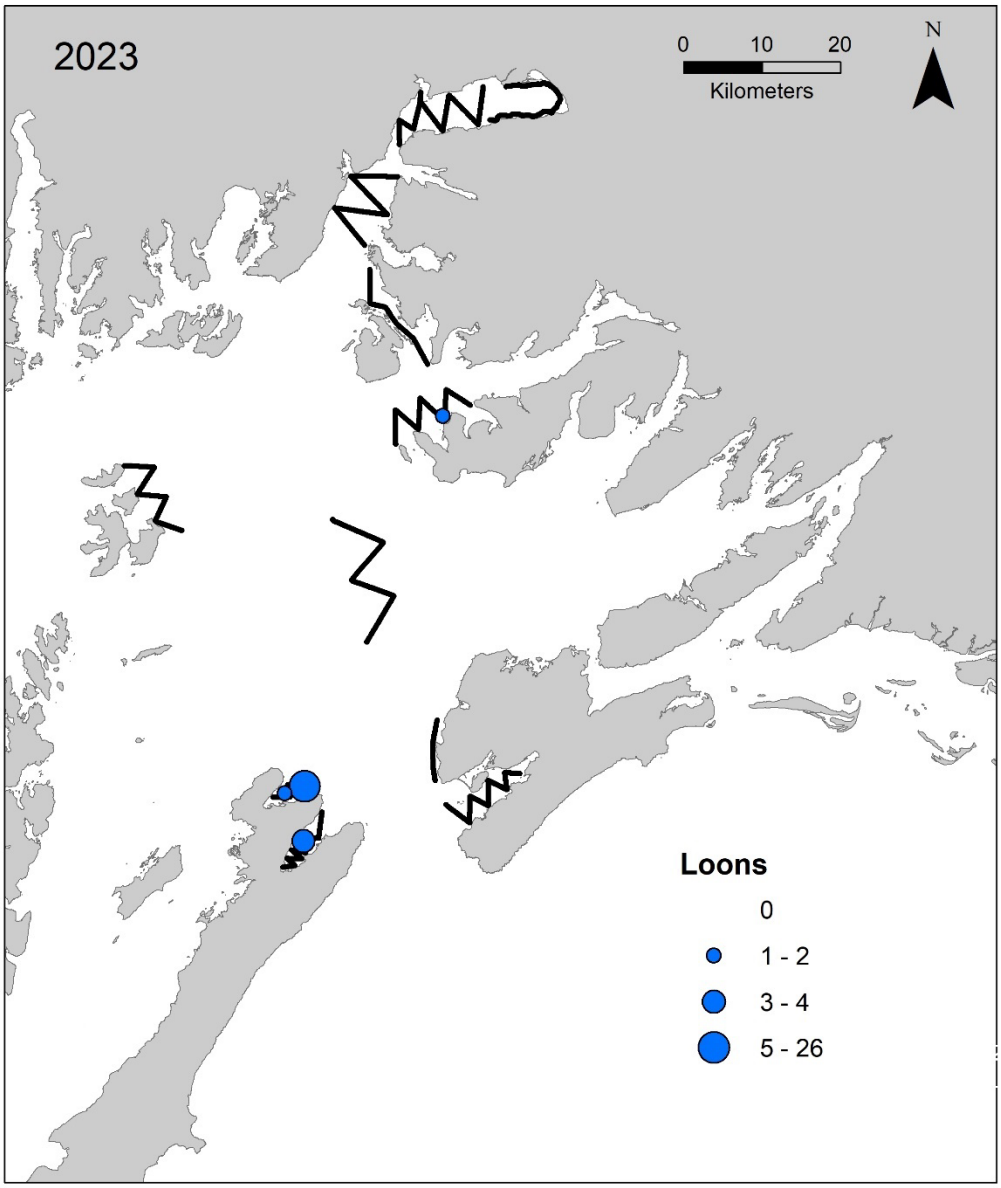

Figure A1-2. Distribution and density (birds/km^2) of loons (common, Pacific, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

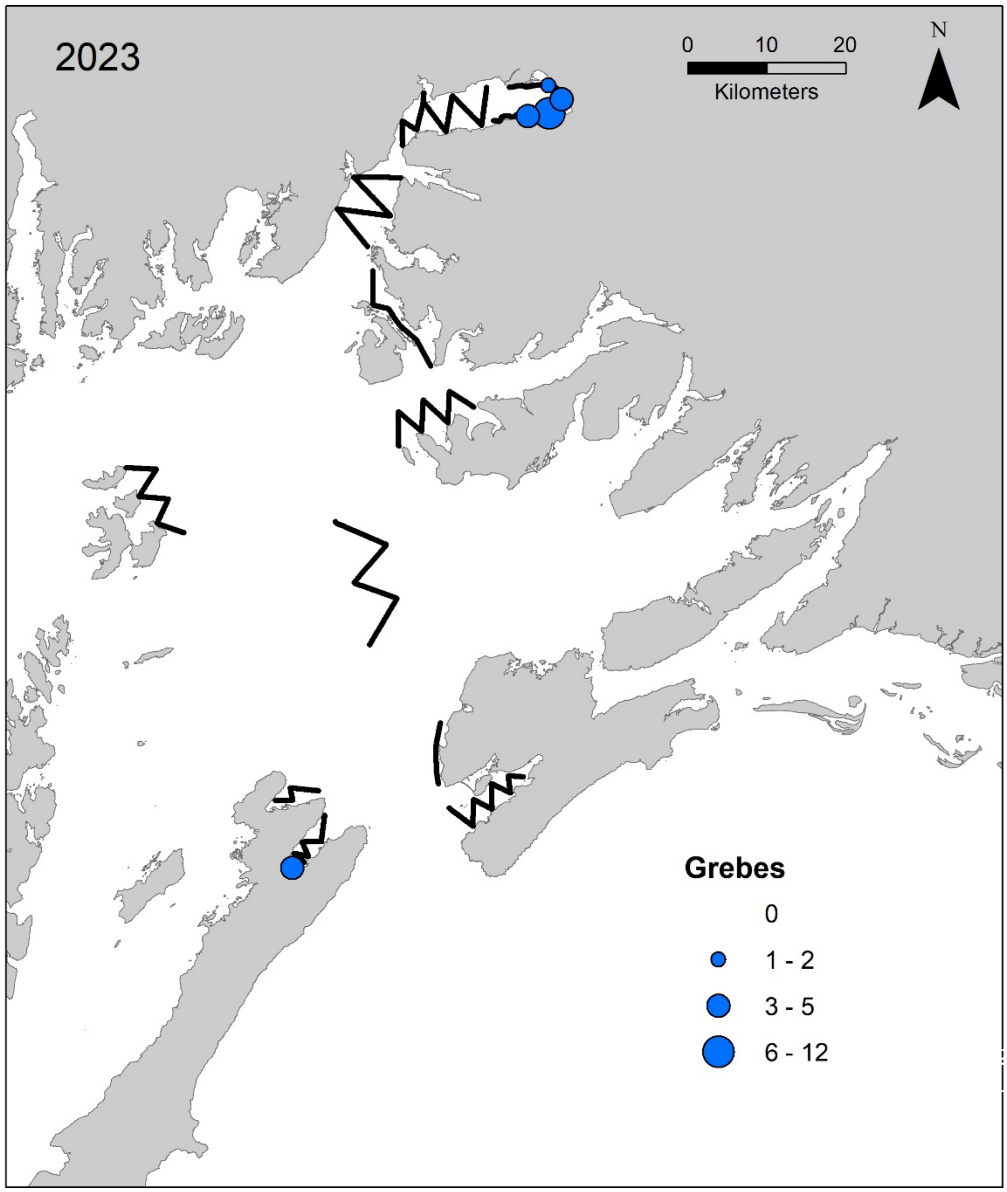

Figure A1-3. Distribution and density (birds/km^2) of grebes (horned, red-necked, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

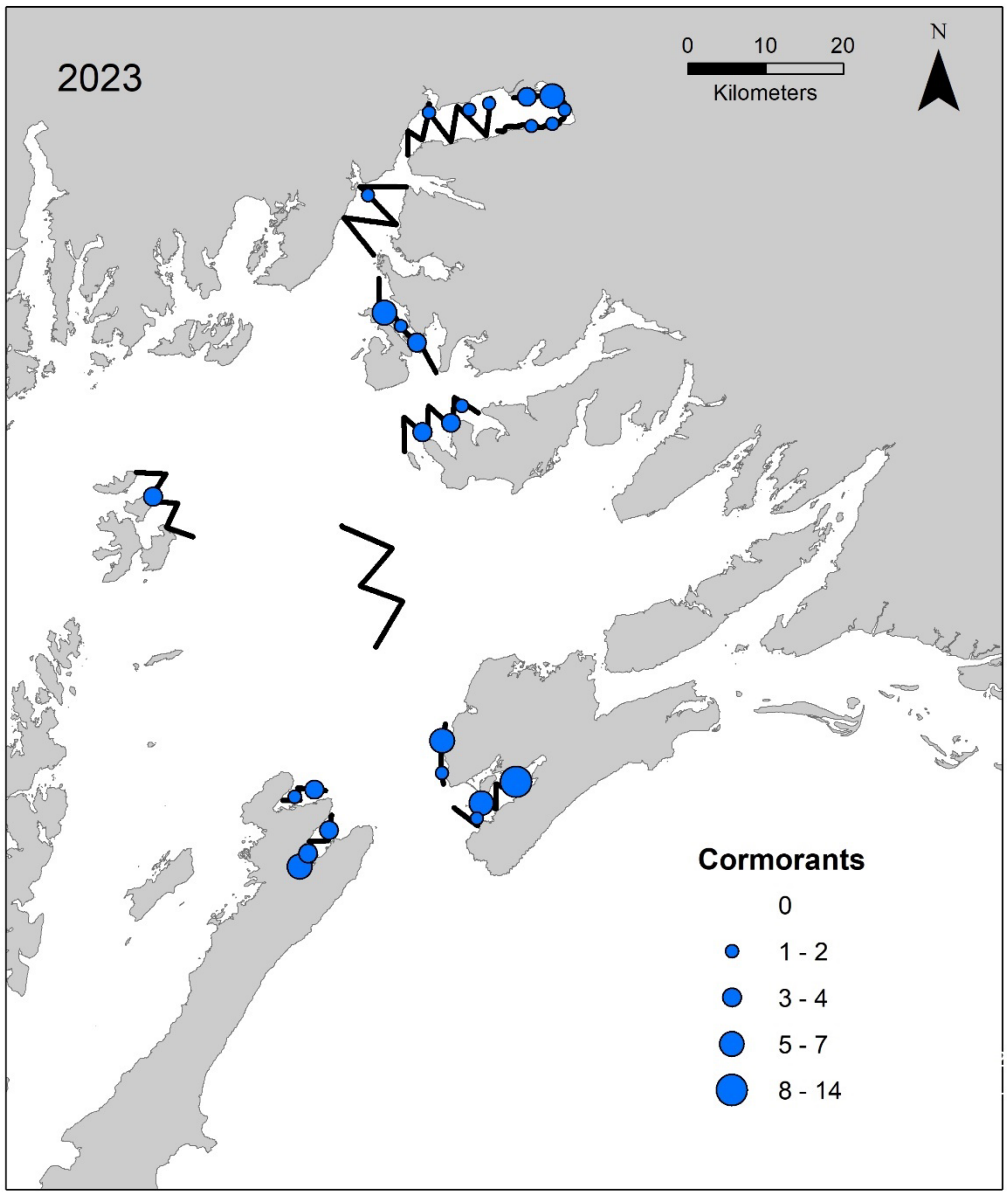

Figure A1-4. Distribution and density (birds/km^2) of cormorants (double-crested, pelagic, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

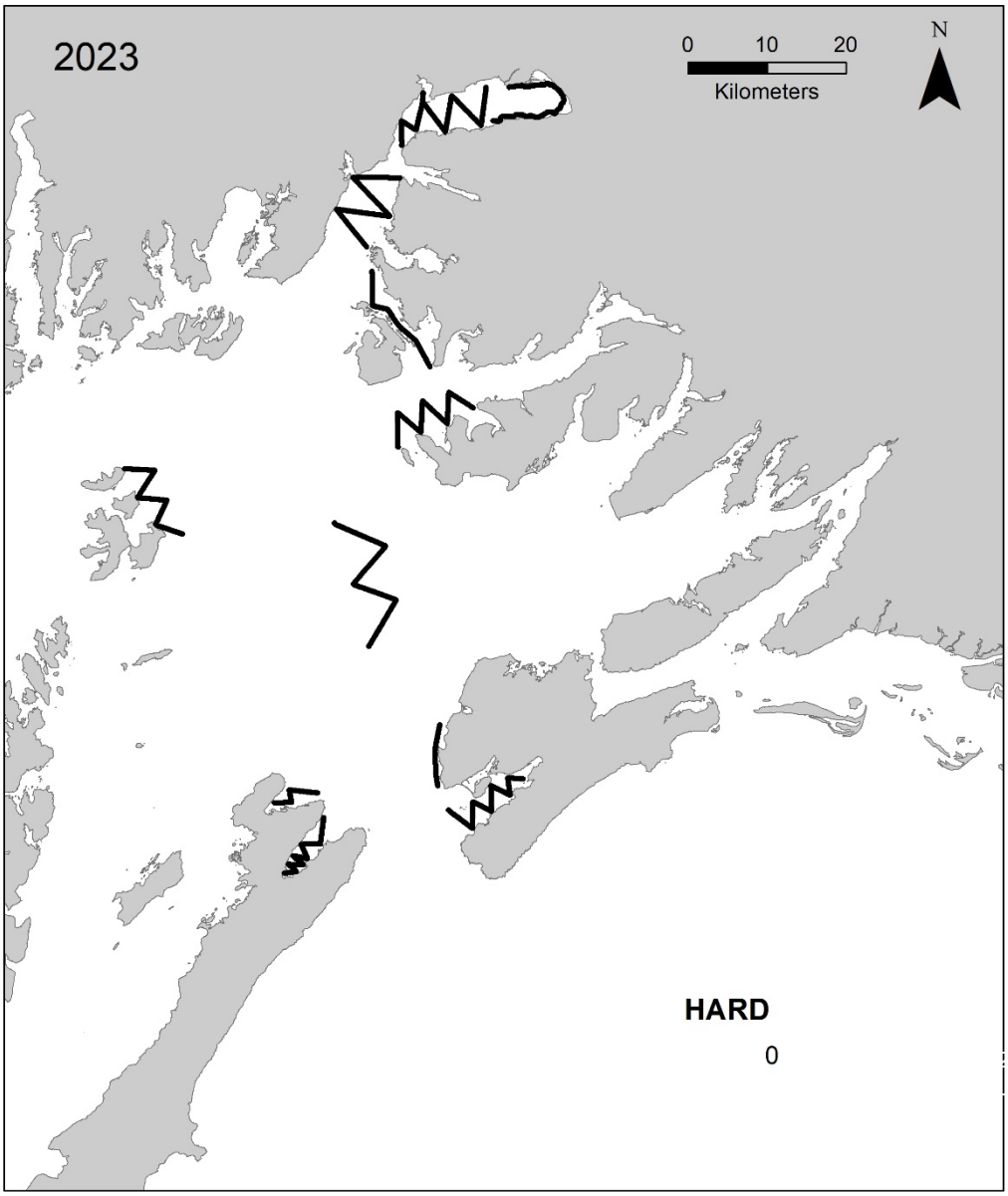

Figure A1-5. Distribution and density (birds/km^2) of harlequin ducks (HARD) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

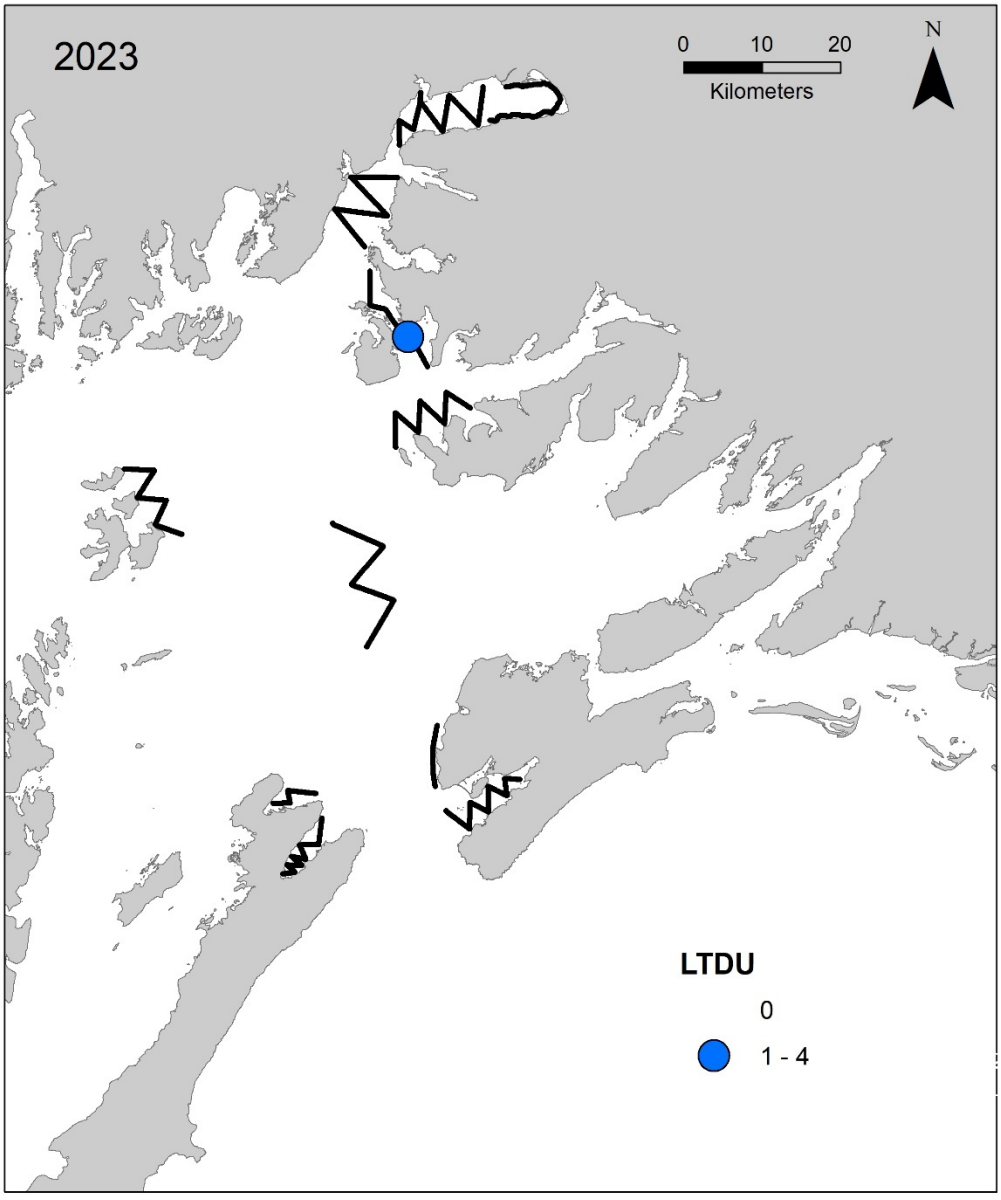

Figure A1-6. Distribution and density (birds/km^2) of long-tailed ducks (LTDU) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

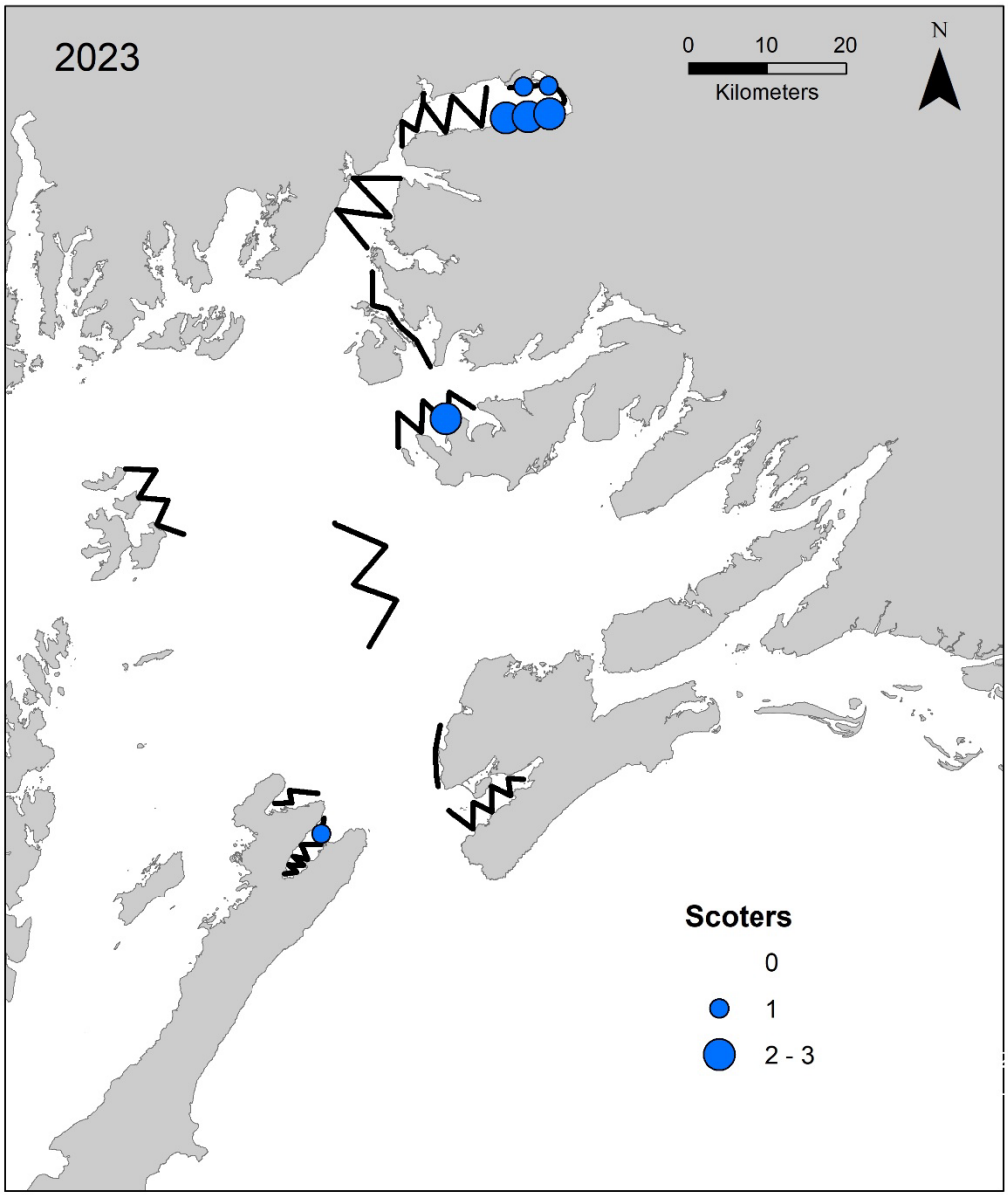

Figure A1-7. Distribution and density (birds/km^2) of scoters (black, surf, white-winged, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

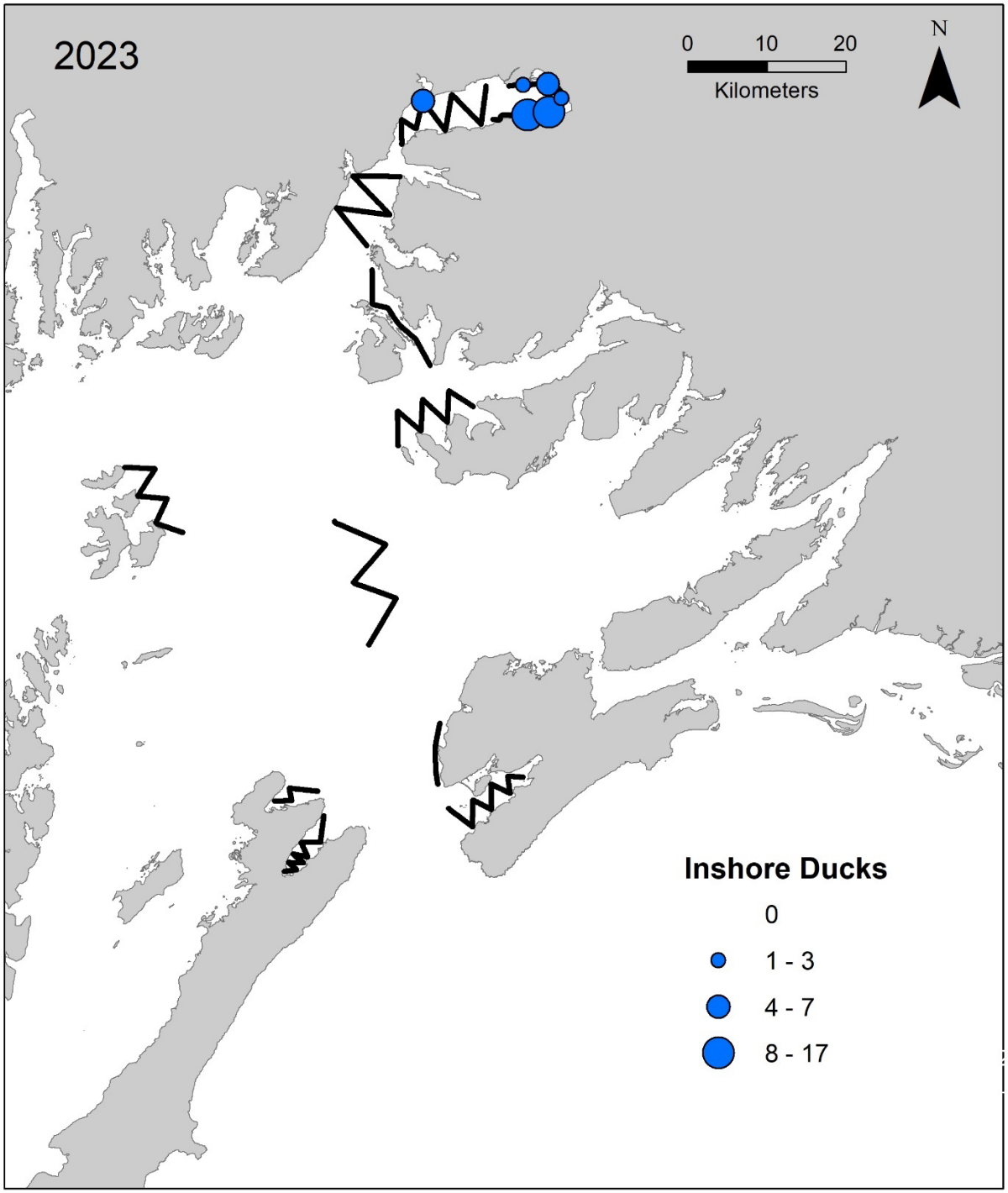

Figure A1-8. Distribution and density (birds/km^2) of inshore ducks (Barrow's goldeneyes, common goldeneyes, unidentified goldeneyes, buffleheads) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

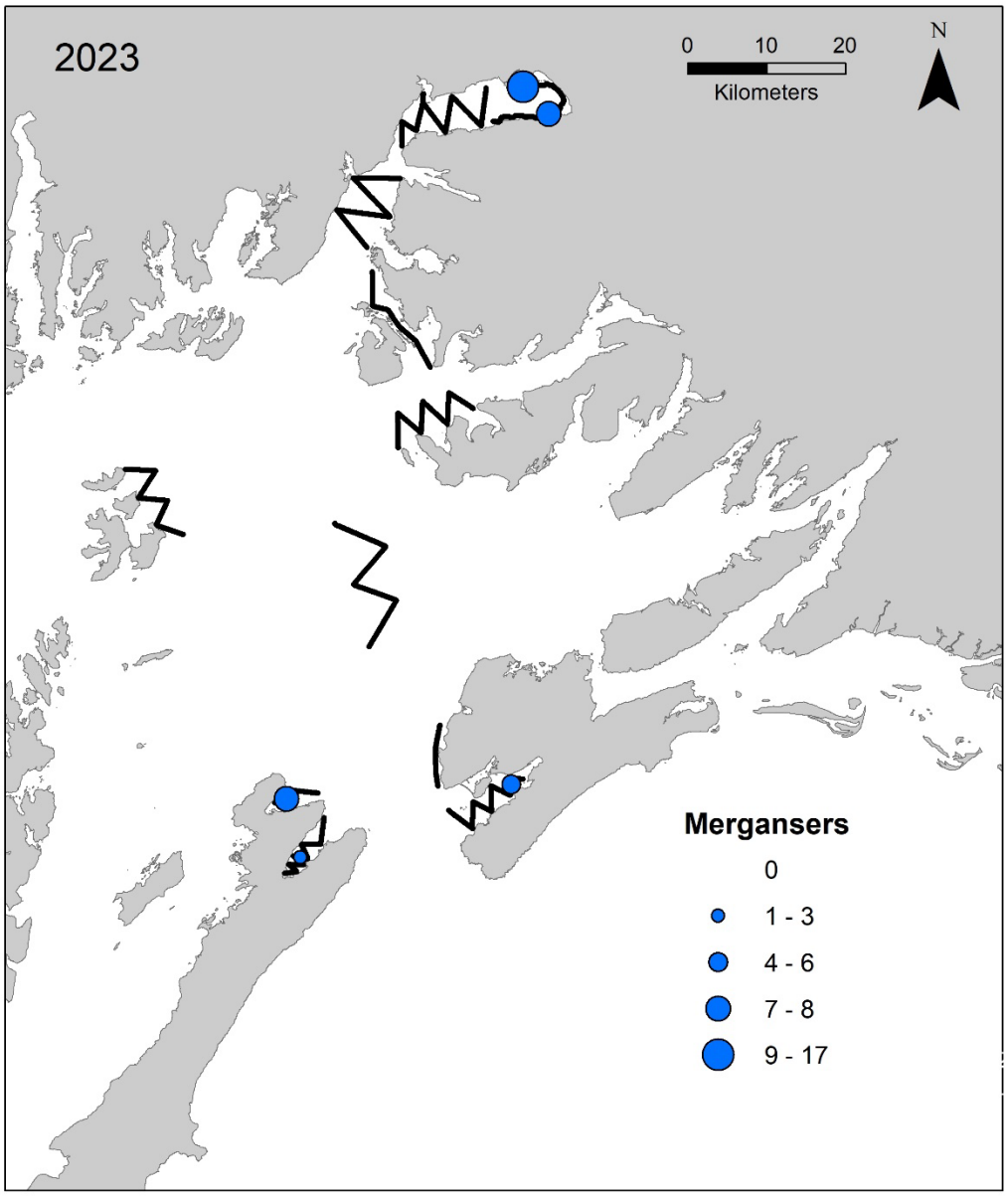

Figure A1-9. Distribution and density (birds/km^2) of mergansers (common, red-breasted, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

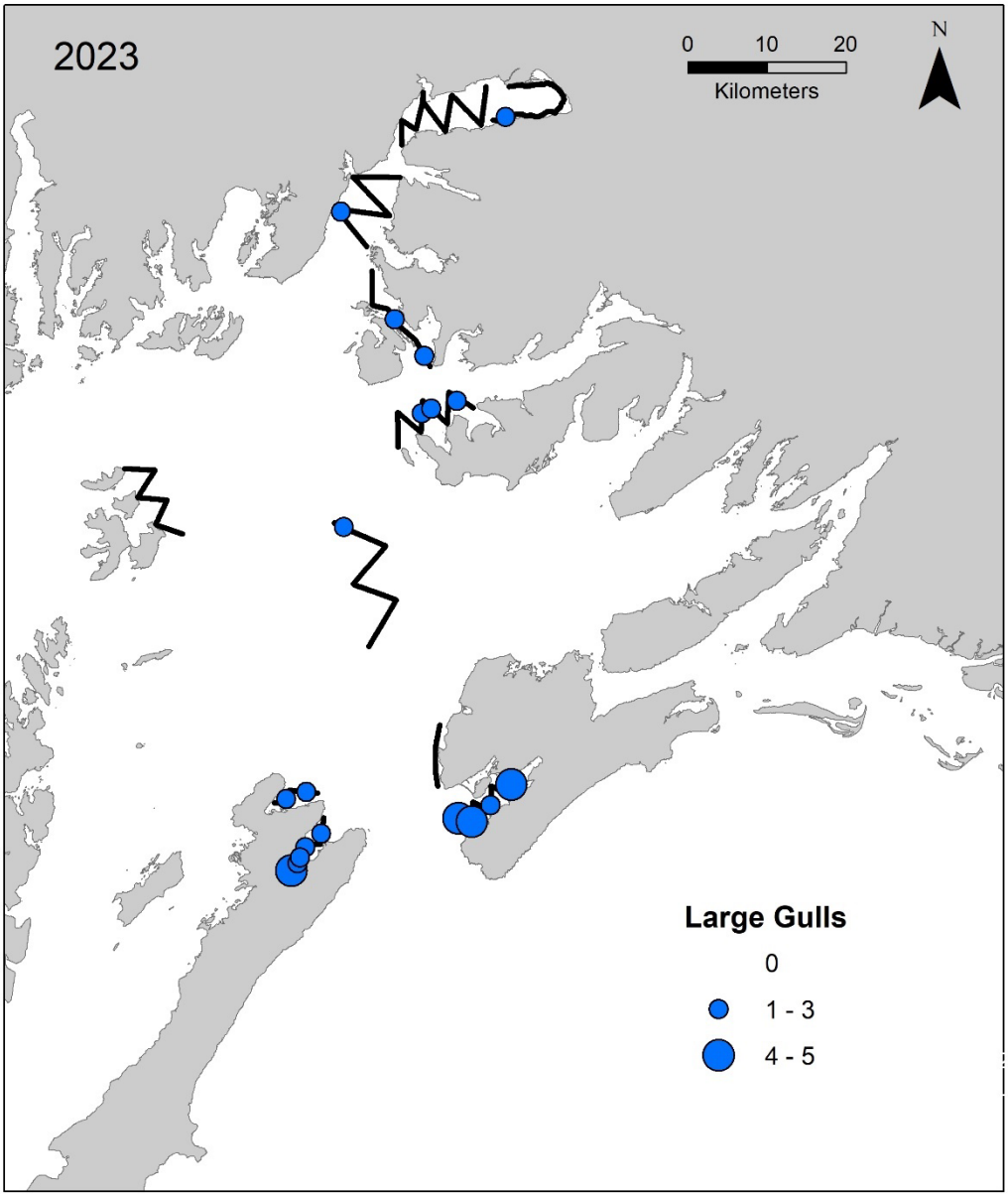

Figure A1-10. Distribution and density (birds/km^2) of large gulls (glaucous-winged, herring, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

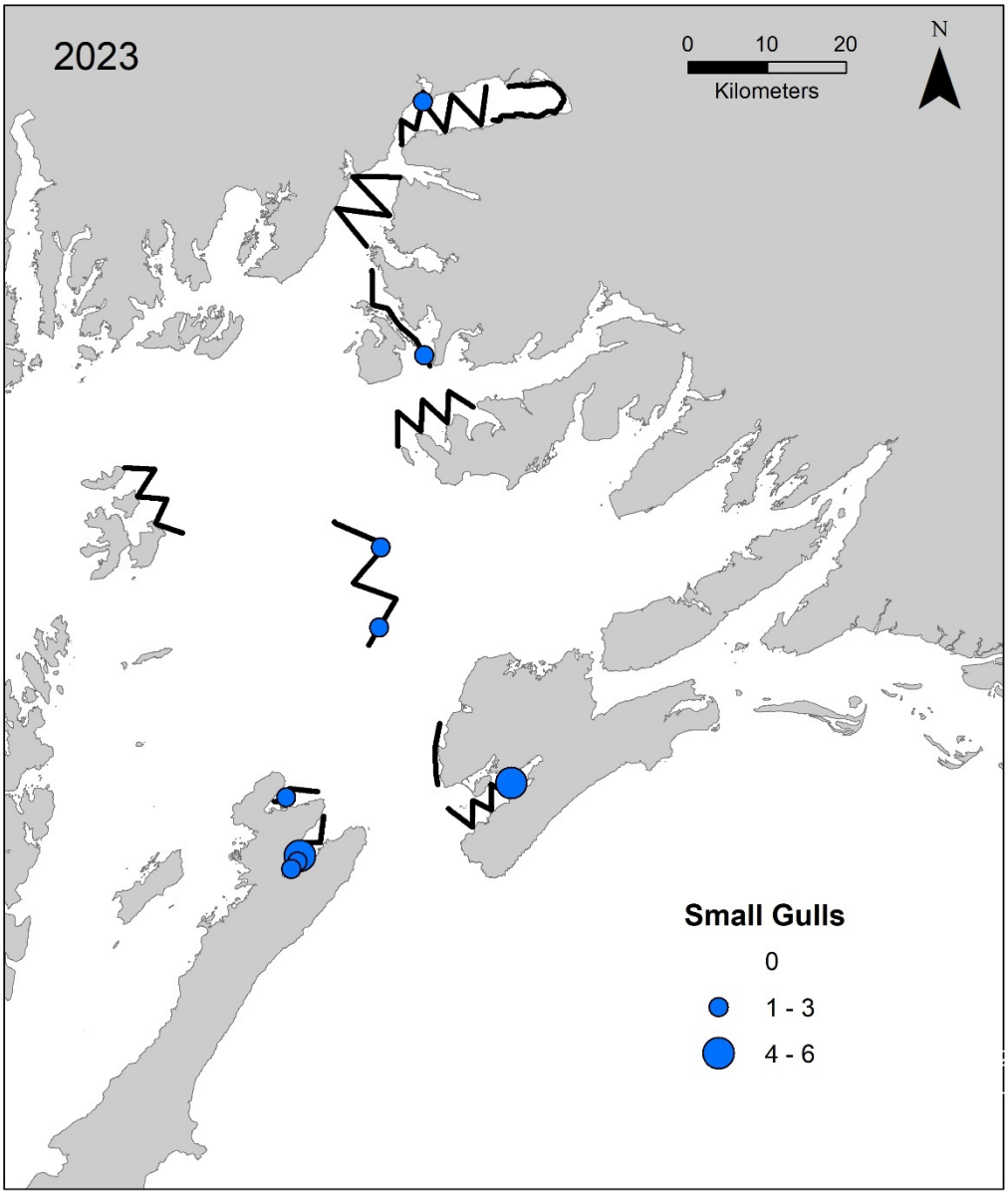

Figure A1-11. Distribution and density (birds/km^2) of small gulls (short-billed, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

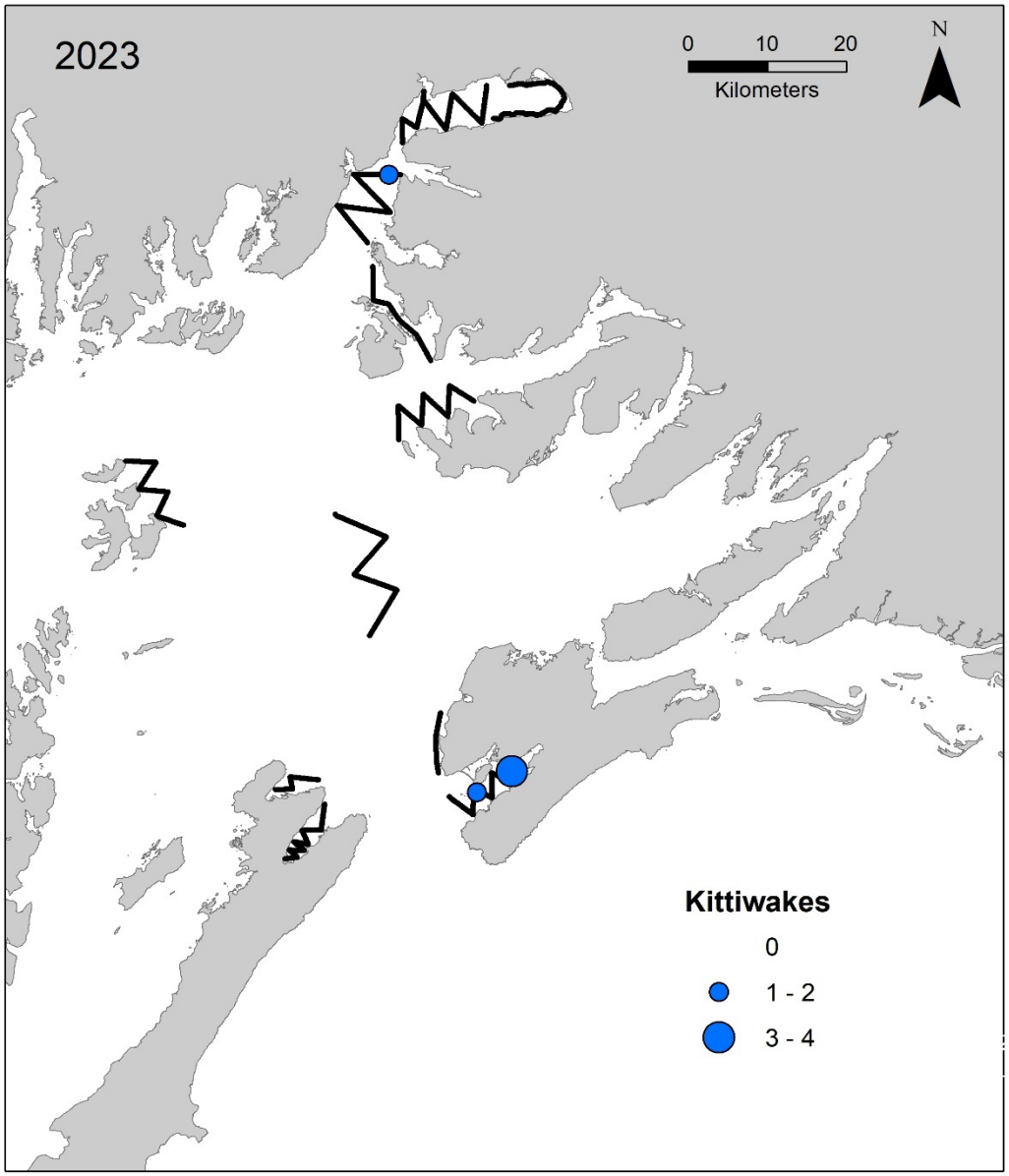

Figure A1-12. Distribution and density (birds/km^2) of black-legged kittiwakes observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

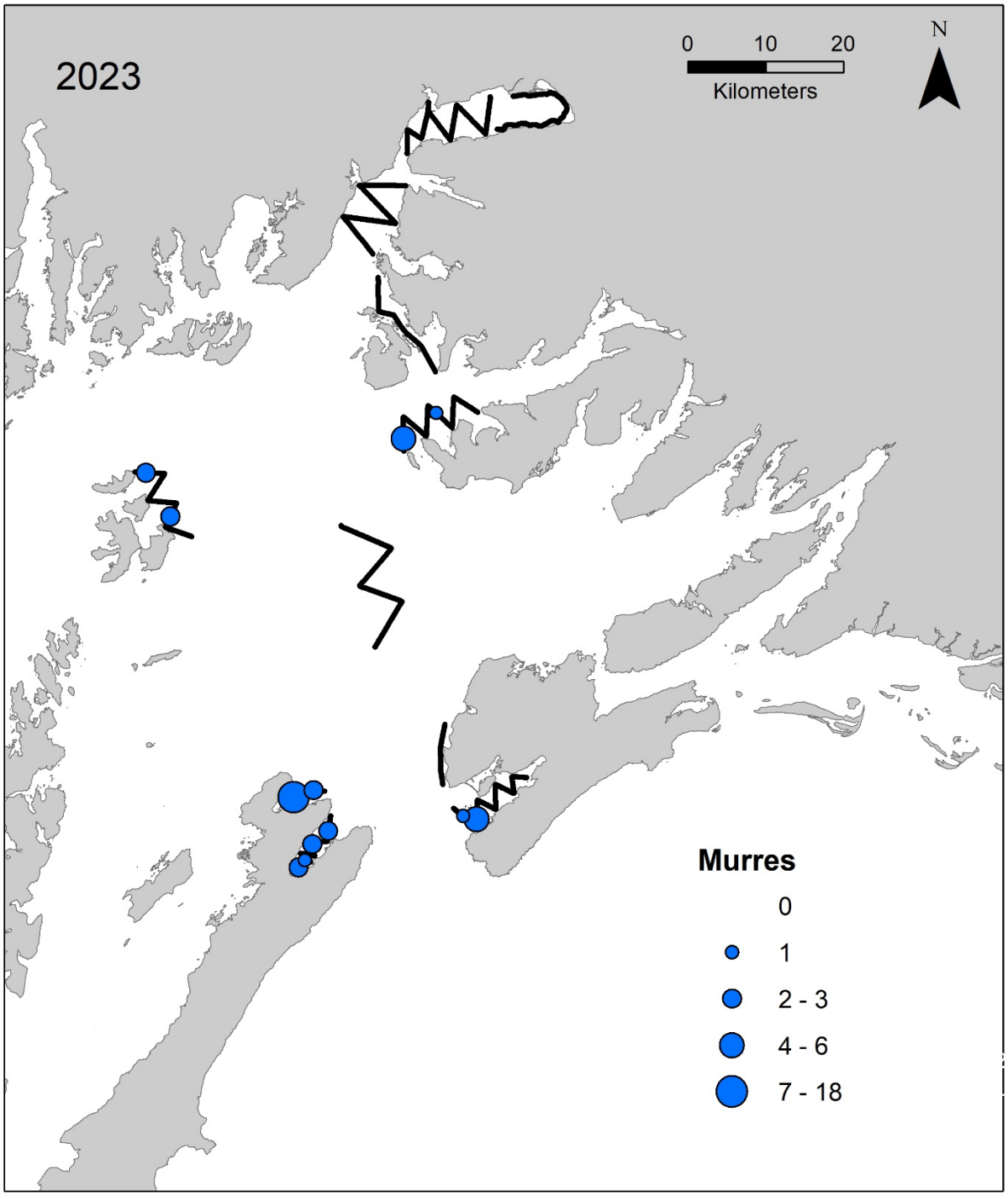

Figure A1-13. Distribution and density (birds/km^2) of common murres observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

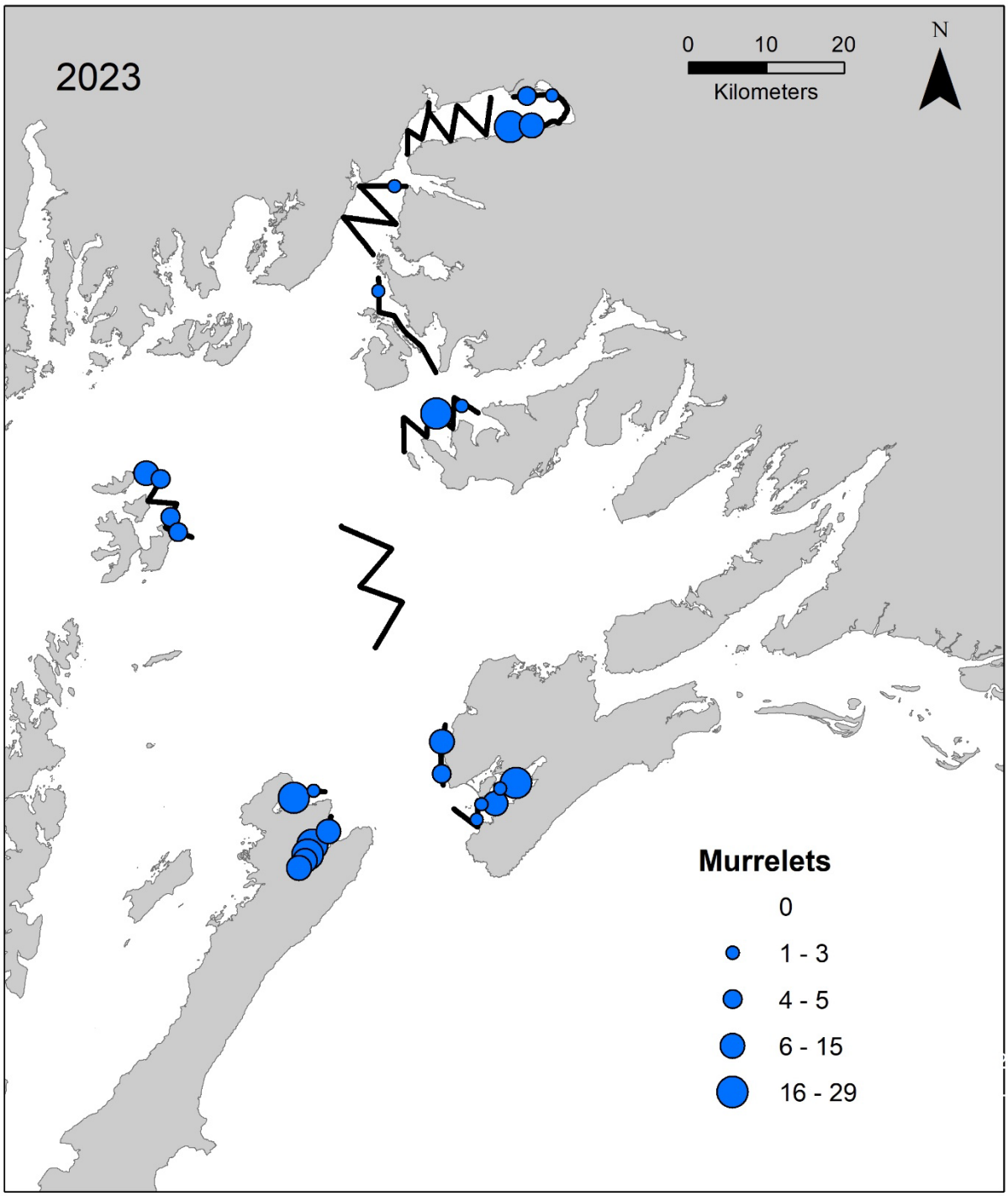

Figure A1-14. Distribution and density (birds/km^2) of murrelets (marbled, unidentified) observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

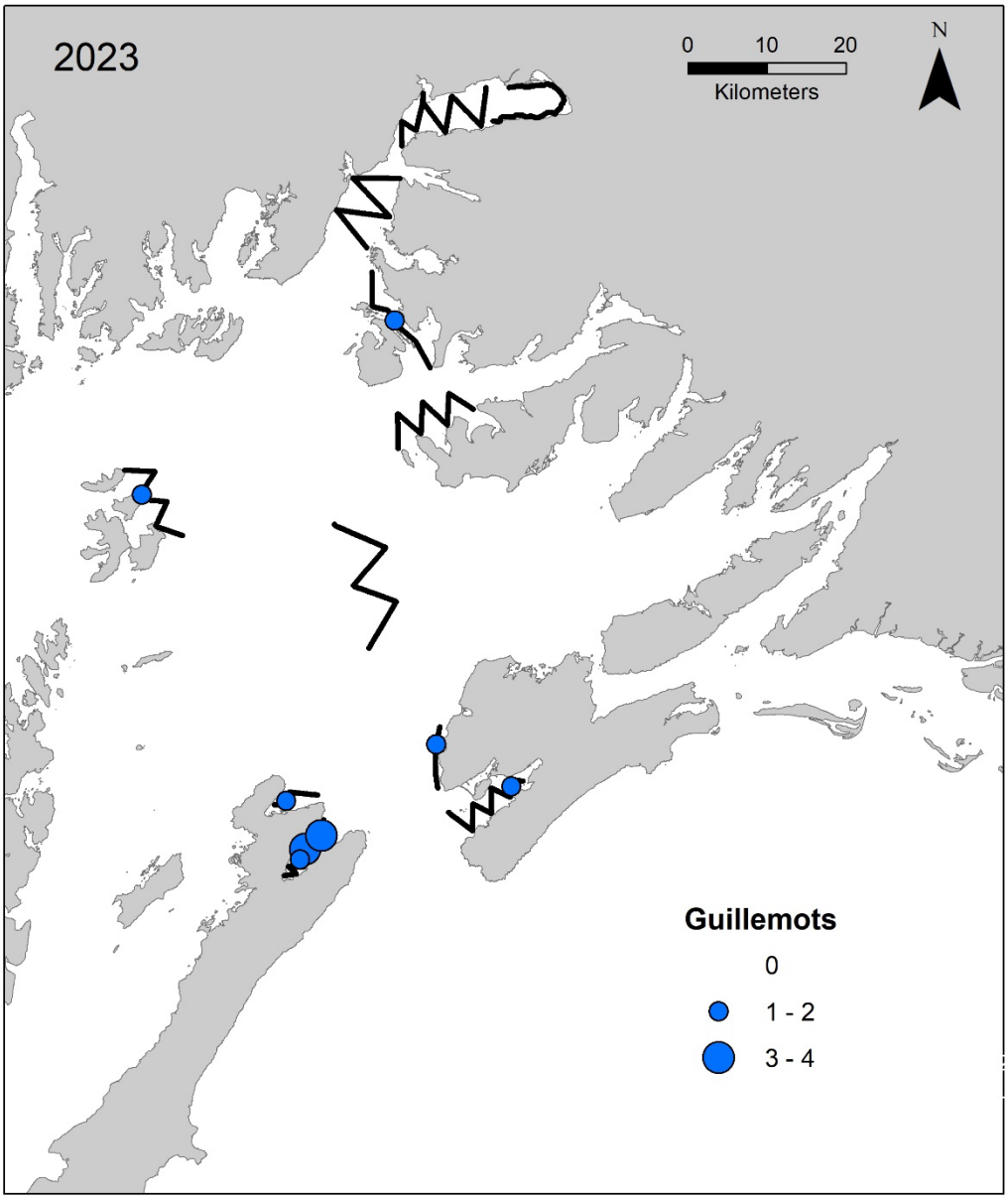

Figure A1-15. Distribution and density (birds/km^2) of pigeon guillemots observed within the 300-m survey strip in Prince William Sound, Alaska, March 2023.

Appendix 2: Marine mammal counts and distribution in Prince William Sound, Alaska, March 2023.

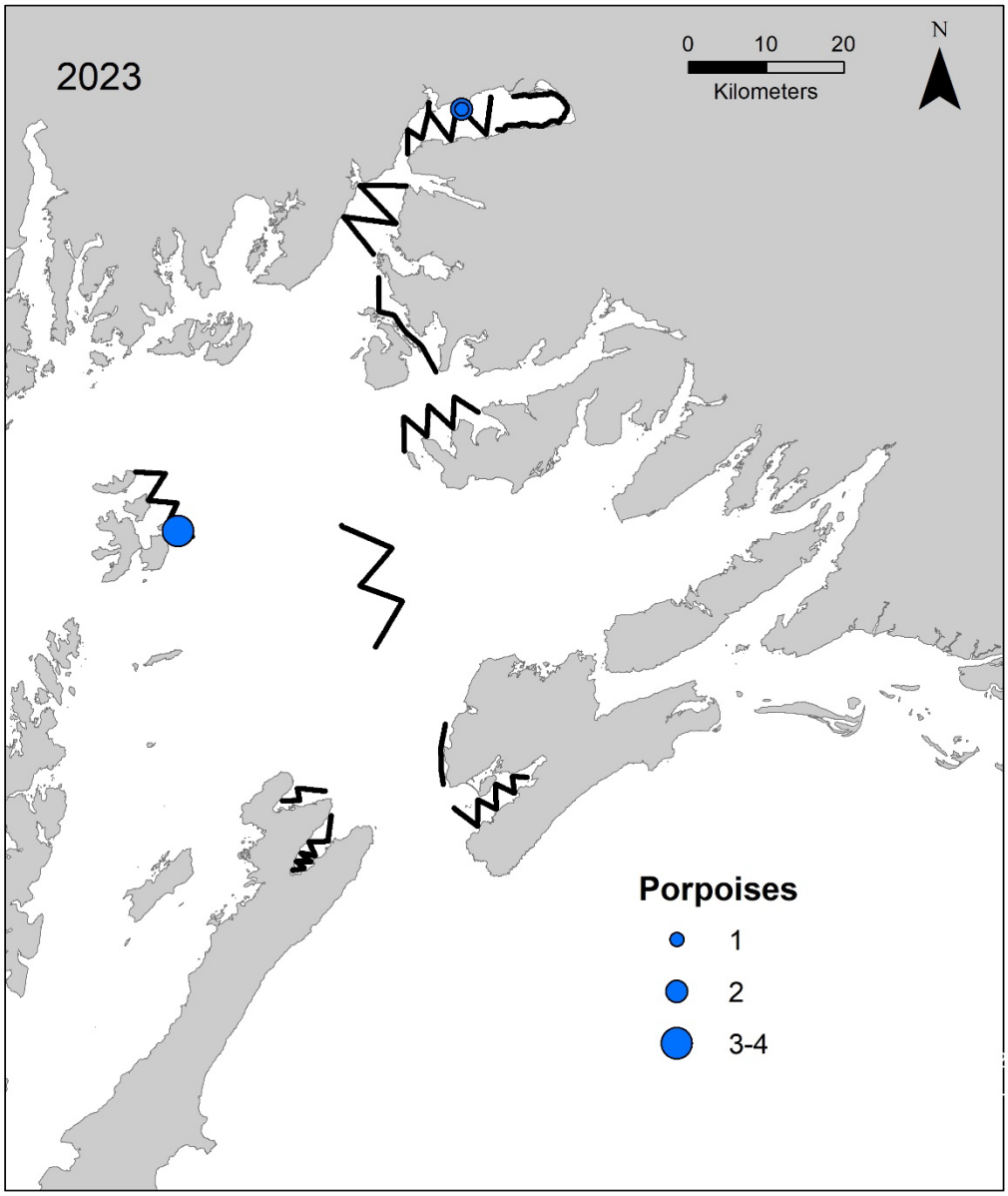

Figure A2-1. Distribution and number of porpoises (Dall's and unidentified) observed in Prince William Sound, Alaska, March 2023. No harbor porpoises were observed in and around transects in 2023.

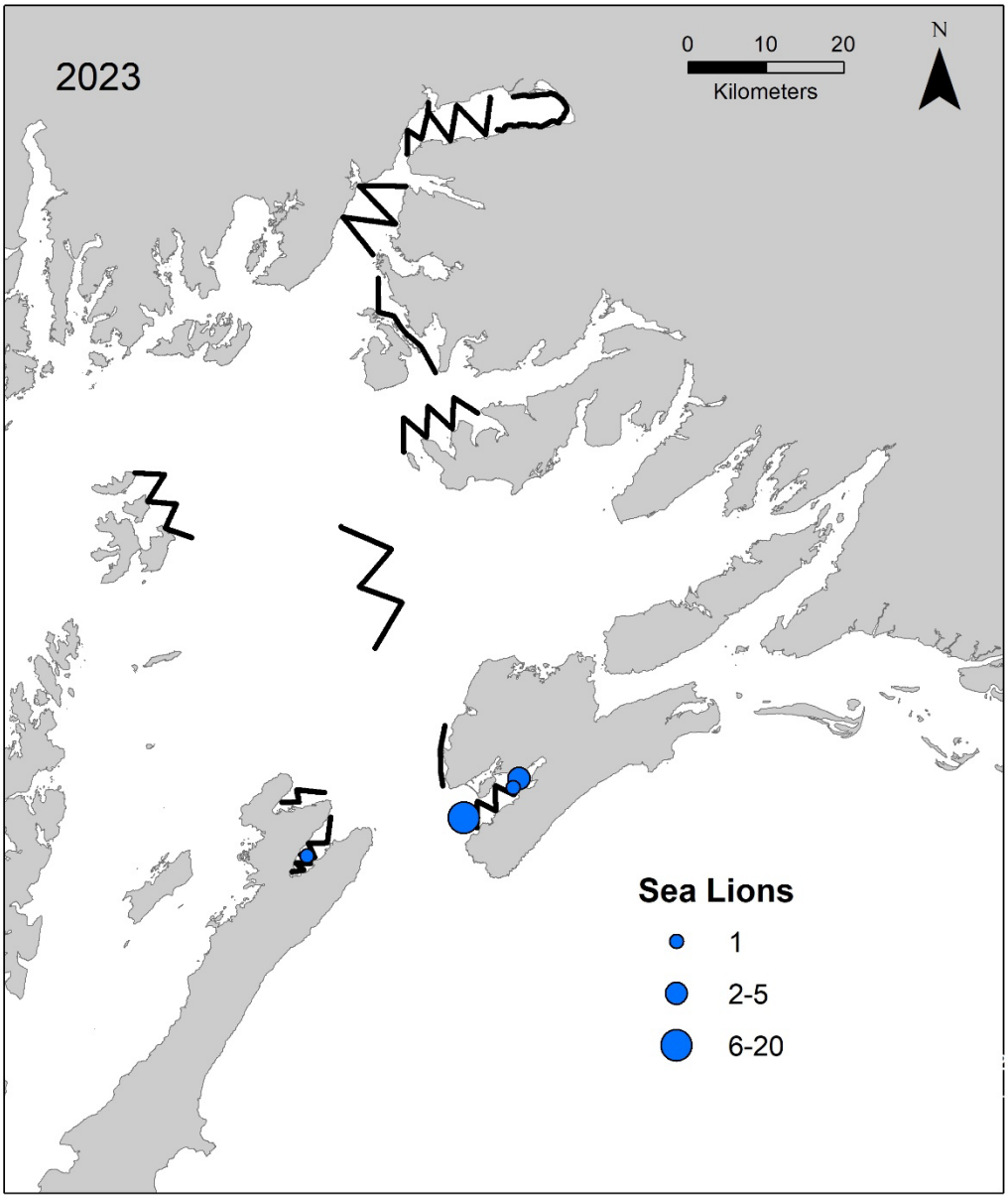

Figure A2-2. Distribution and number of Steller sea lions observed in Prince William Sound, Alaska, March 2023.

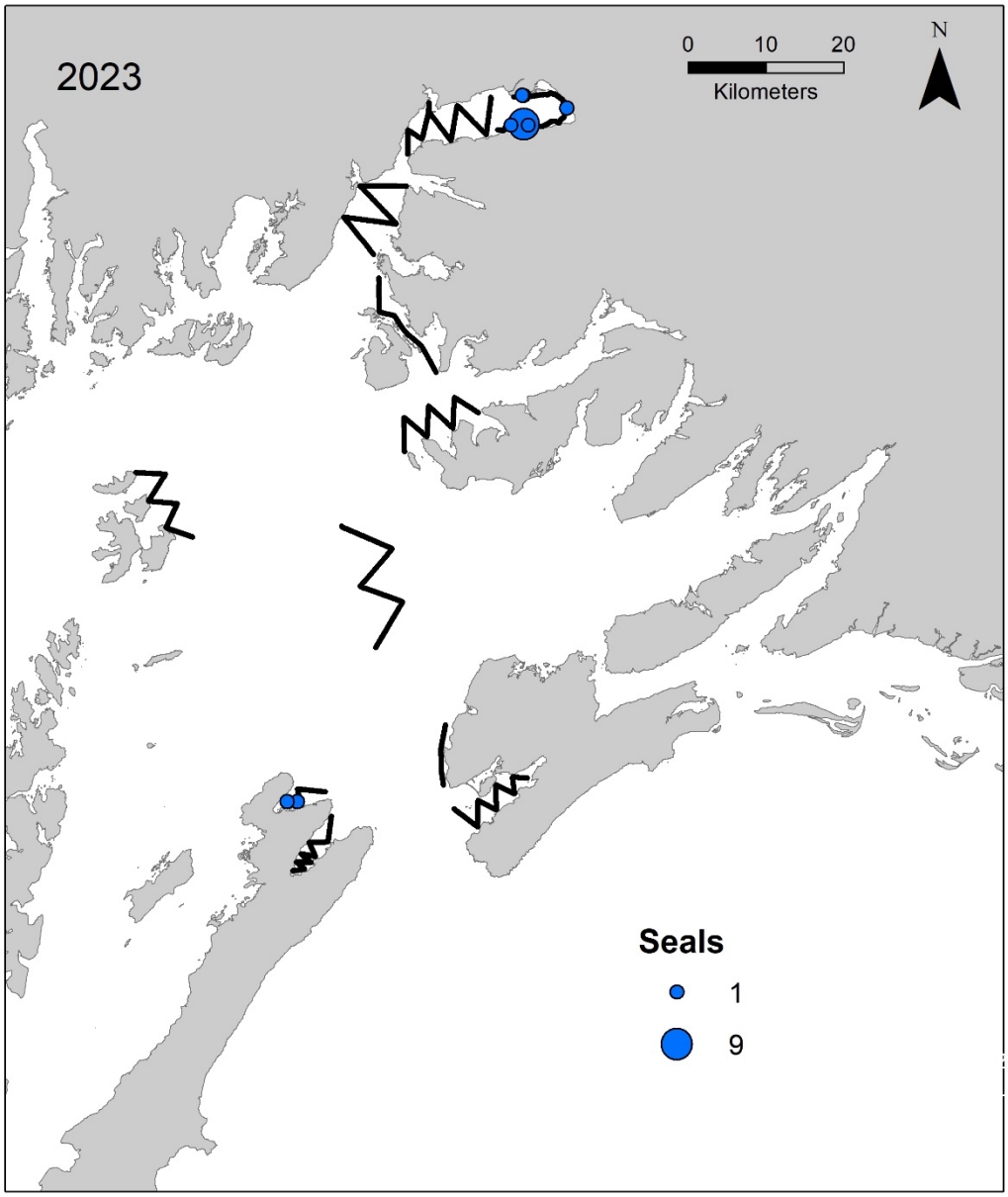

Figure A2-3. Distribution and number of harbor seals observed in Prince William Sound, Alaska, March 2023.

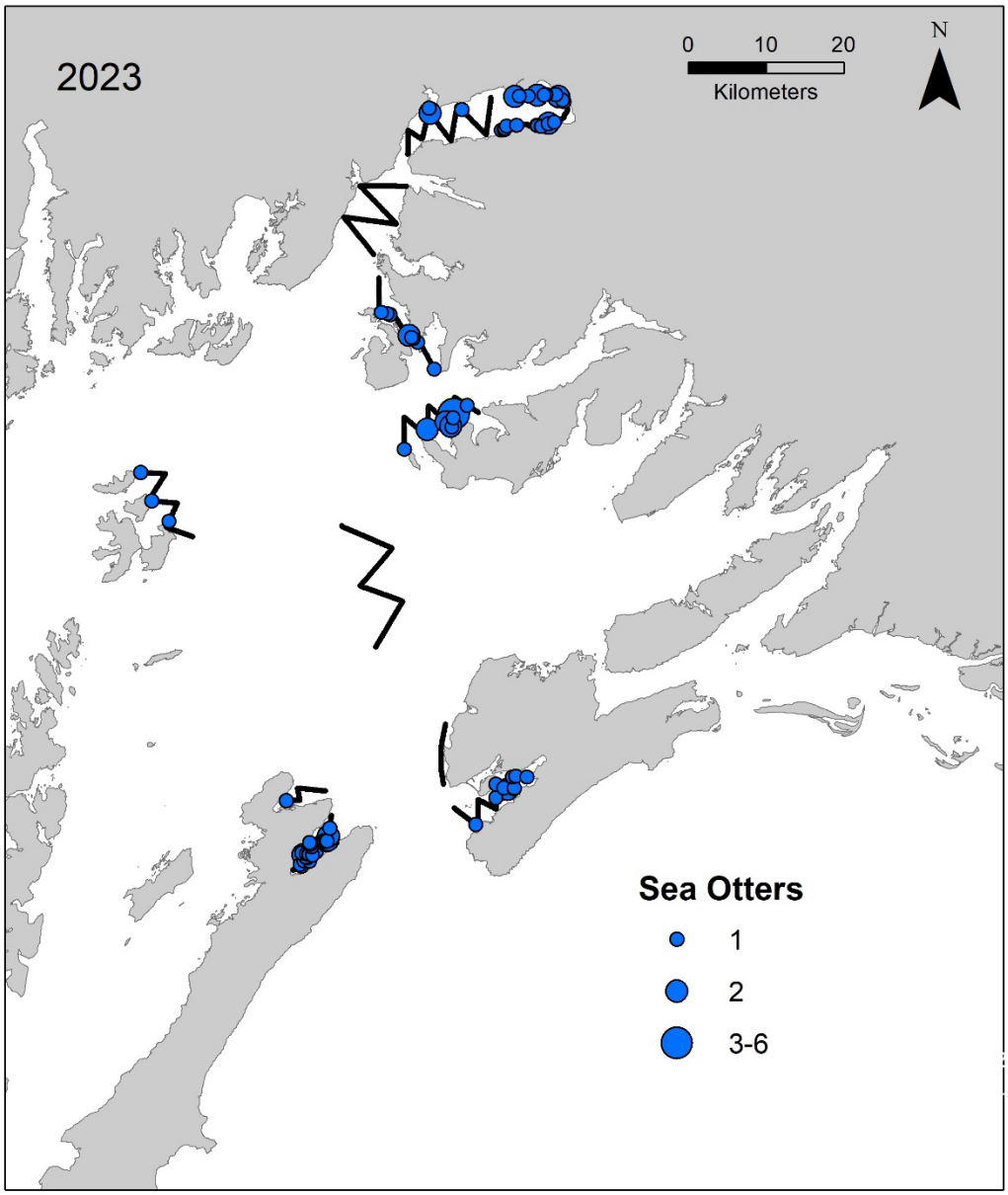

Figure A2-4. Distribution and number of sea otters observed in Prince William Sound, Alaska, March 2023.

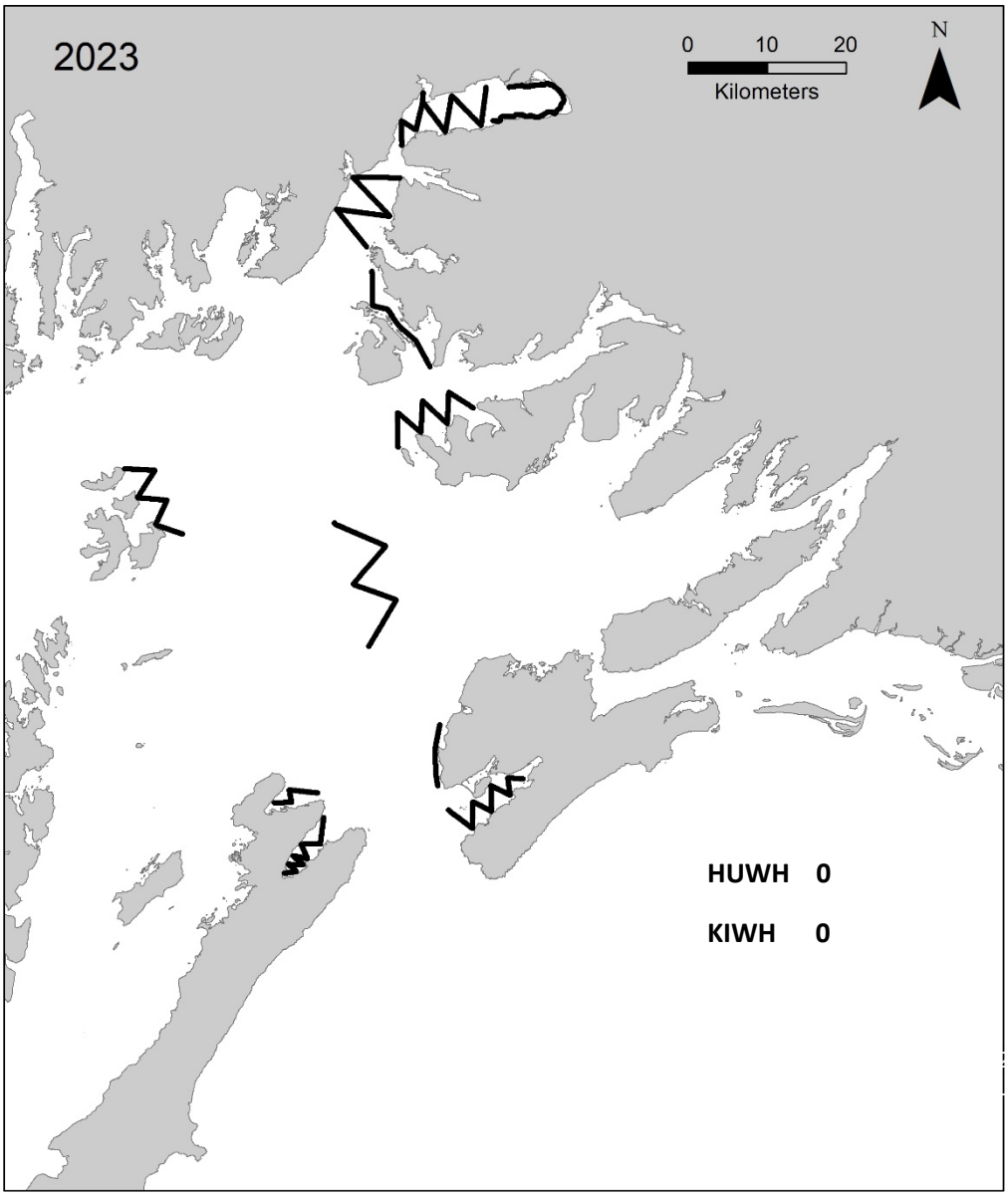

Figure A2-5. No humpback whales (HUWH) or killer whales (KIWH) were observed in Prince William Sound, Alaska, March 2023, including no individual whales observed beyond the 300-m survey strip.