
**Distribution and Abundance of Marine Mammals in
Berners Bay During Spring, 2005**

Final Report

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Submitted by:

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INTRODUCTION

Harbor seals (*Phoca vitulina richardii*) are an important marine resource in Alaska. Formerly abundant throughout Alaska, harbor seal populations declined dramatically during the 1970s and 1980s in the Gulf of Alaska and possibly also the Bering Sea (Frost *et al.* 1999; Pitcher 1990; Small 1995; Small *et al.* 2003). Although harbor seal numbers in southern southeastern Alaska are stable or increasing (Small *et al.*, 2003), harbor seals in nearby Glacier Bay declined by 63%–75% between 1992 and 2002 (Mathews and Pendleton, in press). Harbor seals on haulouts in Lynn Canal were counted during August aerial surveys in 1993, 1997 (Loughlin 1994; Withrow and Cesarone 1998) and 2002 (D. Withrow, NMFS, Seattle, WA, unpublished data). These surveys are part of an area wide survey designed to estimate overall abundance, but not trend, of harbor seals in Alaska conducted by the National Marine Fisheries Service. Very little is known about the seasonal distribution, abundance, timing of pupping, or population trend for harbor seals in the Lynn Canal area, including Berners Bay. Recent genetic studies indicate that harbor seals exhibit fine-scale population structure (O'Corry-Crowe *et al.* 2003) and raise the possibility that harbor seals in this region could constitute a demographically isolated population. Because isolated populations are particularly vulnerable to local depletion and extinction, potential disturbance from increasing human activity in Lynn Canal is cause for concern.

Berners Bay is the site of several mining-related development projects and also lies along the proposed Juneau Access road and is therefore an area of particular concern. Concentrations of harbor seals and Steller sea lions occur in Berners Bay in April and May in association with the eulachon and herring runs (Gende *et al.* 2001; Sigler *et al.* 2004; Womble *et al.* 2005). Pre-spawning aggregations of eulachon occur in the northern and western sections of Berners Bay

(Sigler *et al.* 2004). These aggregations, which appear to form inside the bay, move from Pt. St. Mary to Slate Creek Cove before ascending the rivers to spawn (Sigler *et al.* 2004). Herring spawning sites vary from year to year, but since the early 1990s most of the spawn in southern Lynn Canal has been confined to the eastern shore of Berners Bay, from the Cascade Point area to north of Sawmill Creek (unpublished summary, ADFG, Commercial Fisheries, Douglas, Alaska). Harbor seals haul out at the entrance to Slate Creek Cove and are known to aggregate near the confluence of the Antler and Berner/Lace rivers during the spring eulachon run (Marston *et al.* 2002). Steller sea lions do not haul out within the bay, but form large groups of up to several hundred animals that cooperatively forage on eulachon before the fish enter the river system (Gende *et al.* 2001, Sigler *et al.* 2004). Steller sea lions respond in smaller numbers to herring spawn and aggregations of sea lions are used by ADFG researchers to locate spawning areas during aerial surveys (Kevin Monagal, ADFG, personal communication). Humpback whales are also seen in the bay during the spring spawning runs (Marston *et al.* 2002).

The Kensington Gold Mine Project has proposed building marine ferry facilities at Slate Creek Cove and Cascade Point in Berners Bay to shuttle workers and supplies to and from the mine. The potential impacts of ferry traffic on harbor seal haulout use and marine mammal foraging activity in the bay, particularly during the spring spawning runs, are unknown. In late spring and early summer 2005 we conducted a pilot study of marine mammal abundance and distribution in Berners Bay during the eulachon and herring runs to establish a baseline prior to the start of ferry service.

METHODS

We used a combination of boat-based and aerial surveys to determine the distribution and

abundance of harbor seals. Boat-based surveys were conducted to assess fine-scale distribution patterns of harbor seals, Steller sea lions (*Eumetopias jubatus*), and humpback whales (*Megaptera novaeangliae*) within the bay. Surveys were conducted by 2-3 observers from a 17 ft or 24 ft skiff. A complete survey consisted of a near-shore survey followed by a mid-bay survey (Fig. 1). For the near-shore survey the skiff followed the coastline at a distance of 250 m from shore. Laser range-finder binoculars were used to help maintain the proper distance. Although every effort was made to keep the distance to shore constant, following every little contour of the shoreline was difficult and we tended to be <250 m away when rounding points and >250 m away where the shoreline curved in. The survey route also varied with the tide, particularly across the shallows at the northern and southern end of the bay. Marine mammal use of the deeper waters of the bay was assessed by a mid-bay survey, which consisted of a pair of 10-km transects, spaced roughly 3 km apart, that ran approximately north-south down the center of the bay, splitting the northern half into thirds (Fig. 1).

During a survey, one observer scanned the water between the boat and the shore and the other observer scanned a 250 m strip on the other side of the boat. When an animal or group of animals was spotted, the species, number of individuals, and GPS location was recorded. During later surveys the perpendicular distance from the boat to the animal was also estimated. Humpback whales and rafts of Steller sea lions were visible from up to several kilometers away and were always recorded. Individual animals and smaller groups of 2 or 3 were also visible at distances >250 m, but the sightability was strongly affected by light conditions and sea state; these animals were also recorded, but as off-transect. Typically, most of the harbor seals were scattered over a large area in the shallows at the mouth of the Antler and Berner Rivers. Because the water was so shallow here, the boat was always >250 m from shore; this fact combined with

the large numbers of seals in the water made counting difficult. The best method was to keep the boat moving steadily parallel to the shore, with one observer facing perpendicular to the shore and counting seals as they came into view. Although sightability was an issue in this area during boat-based surveys, this part of the bay is fairly well protected and the water was calm during most surveys making visibility generally quite good.

Because of the difficulties involved in counting large numbers of seals in the water, we assessed abundance using photographic aerial surveys flown near low tide. We attempted to time the aerial surveys to coincide with the peak of the eulachon run (as determined by USFS fish catch rates), the peak of the herring spawn, and after harbor seal pupping. We surveyed the entire bay as well as the lower reaches of the river drainages. Aerial surveys were flown at approximately 305 m in a single engine *Heliocourier* aircraft. If seals were observed on a haulout they were photographed with a Nikon D1X digital camera equipped with a 200-400 mm lens. The location and number of seals and other marine mammals observed in the water were noted on a chart of the area. For all surveys (boat-based and aerial), we recorded weather conditions at the start of the survey. Sea state was also recorded during boat surveys.

Seals photographed during aerial surveys were scored as pups based on their much smaller size, tendency to be more silvery or gray in color, and in some cases, characteristic position relative to their presumed mothers. Counts of pups presented in this report are minimal estimates because pup assessments were conservative.

RESULTS

We conducted 13 surveys, including 9 from a boat and 4 from an aircraft between April 20 and July 12, 2005. Five of the boat-based surveys were complete surveys of both the

shoreline and the mid-bay; two boat surveys included the shoreline only, one surveyed only the northwest coast, and the last surveyed the eastern and northern shores of the bay (Table 1).

Abundance

Numbers of harbor seals detected during both aerial and boat-based surveys fluctuated throughout the survey period and ranged from a low of 80 seals on April 25 to a high of 345 on July 12 (Table 1). As expected, more seals were resting on haulouts during surveys conducted close to low tides compared to those near high tides (Fig. 2; nearshore and complete surveys combined). In general, more seals were observed in Berners Bay during low tide surveys (mean = 188 seals, SD = 103, n = 5) than during high tides (mean = 126, SD = 60, n = 5; complete surveys only). During the May 31 aerial survey 4 very large seals, most likely pregnant females close to parturition, and 17 small animals, possibly yearlings, were observed and photographed among 93 seals on tidally awash mud flats. The July 12 survey included at least 47 pups hauled out in the same area.

Steller sea lion abundance, which peaked at 192 animals on April 27, declined by 80% during the next two surveys, then dropped further to ≤ 5 animals on subsequent surveys (Table 1).

The maximum number of humpback whales observed during a single survey was 3 whales on April 24 (Table 1). Between April 20 and May 18, at least one humpback whale was observed during every survey except one (on April 27). No whales were observed after May 18.

Distribution

Harbor seals hauled out at three locations within the bay: Pt. St. Mary; the eastern side of the entrance to Slate Creek Cove; and 3-4 sandbars at the confluence of the Antler and Berner rivers (Fig. 1). Pt. St. Mary, which was occupied only in April and early May, was the smallest

of the haulout sites, with a high count of 24 seals on May 4. Slate Creek Cove was the main haulout during that same period, with a high count of 244 seals, also on May 4. After May 20, seals were observed out of the water only on the river sandbars, with a high count of 327 seals, including at least 47 pups, on July 12.

Seal foraging activities were heavily concentrated in the northwestern section of Berners Bay, particularly along the extensive tidal mud flats at the mouth of the Antler/Berner river complex and in the lower reaches of the river system itself (Fig. 3-7). During the eulachon run, groups of seals were also observed in and around Slate Creek Cove (Fig. 3 and 4). On April 20, during the early part of the run, harbor seals were observed near foraging Steller sea lions and humpback whales in the deeper waters south of Slate Creek Point (Fig. 3), the only occasion when they were sighted that far offshore. Small numbers of seals were present on the south shore during the herring spawn, the only time that seals were observed in this area (Fig. 5). Sightings of single seals in the middle of the bay and along the eastern shore were also most common during this period (Fig. 5).

In contrast to the harbor seals, Steller sea lions did not haul out in Berners Bay and their distribution within the bay shifted over time. During the early part of the eulachon run, large groups of >100 sea lions actively foraged over large areas in the northwestern corner of the bay (Fig. 3). Later in the run, smaller groups of sea lions were widely distributed over the northern half of the bay, including along the eastern shoreline (Fig. 4); although groups of sea lions were still present in the middle of the bay, no active foraging was observed. During the herring spawn, Steller sea lion activity was concentrated in the spawning areas along the south shore (Fig. 5); the few individuals sighted after the spawn dissipated were scattered throughout the bay (Fig. 6 and 7). In general, harbor seals were restricted to the shallow waters along the northern

and western shores of the bay, whereas Steller sea lions ranged throughout the northern half of the bay and made greater use of the southern shore (Fig. 8).

Humpback whale distribution within the bay also changed across the survey period. Whales were observed near Slate Creek Cove during the early part of the eulachon run (Fig. 3) and further south and along the eastern shore later in the run (Fig. 4). Whales moved to the southern half of the bay during and after the herring spawn (Fig. 5 and 6).

The distribution and abundance of harbor seals, Steller sea lions, and humpback whales is graphically depicted for each survey date in Appendix 1. On April 20, the foraging path of a group of Steller sea lions and a humpback whale was observed, and this track is also included.

DISCUSSION

High counts of harbor seals fluctuated over the course of the study and ranged from a low of 80 seals on April 25 to a pre-pupping high of 276 seals just 10 days later on May 4 (Table 1). As expected, the maximum number of seals observed was during the post-pupping survey on July 12 (Table 1). The minimum number of pups present during that survey was 47, close to the difference between the 345 seals counted on July 12 and the previous high count. It is not known whether there is a stable group of seals that are resident in the bay during the spring and summer or whether the fluctuating counts reflect movement of different seals in and out of the bay. To address this important question would require following marked individuals. Photographic identification using natural markings does not require physically capturing animals and can be used in conjunction with mark-recapture models to estimate abundance (Moran 2003). It may be possible to conduct a photographic identification study in Berners Bay by stationing observers with high-powered cameras in blinds near the two main haulouts in the bay

and this possibility should be explored.

We found no other data available on harbor seal abundance in Berners Bay during spring. Marston et al. (2002) reported maximum counts of 450 and 422 marine mammals (primarily Steller sea lions and harbor seals) during the eulachon runs in 1996 and 1997 respectively, but did not provide counts for individual species. A 1997 NMFS aerial survey reported a high count of 752 harbor seals in the Berners river (Site 6) during 16–24 August (Withrow and Cesarone, 1998), more than twice the maximum observed during this study and equal to 38% of all harbor seals observed on haulouts in Lynn Canal on that survey date (August 22, 1997, from Table 3). The higher count during August 1997 may result from differences in the timing of the surveys, as the number of harbor seals out of the water in some areas (such as Glacier Bay) is higher during the August molt than during pupping (Mathews and Pendleton in press). The mean count for the entire Berners Bay area during the 1993 NMFS survey, when surveys were flown in September, was 129 seals (Loughlin 1994). Counts conducted this late in the season most likely reflect a shift in seal behavior, with animals spending more time in the water, or a shift in distribution (Mathews and Kelly 1996). It is unknown whether seals overwinter in Berners Bay or whether they leave after the fall salmon runs end and return when the spring spawning runs begin. Monthly aerial surveys would be helpful both in answering this question and in determining if the differences between the 1997 and 2005 counts reflects seasonal variation in harbor seal use of Berners Bay or a potential decline.

In contrast to harbor seals, the number of Steller sea lions in Berners Bay declined sharply over the study period. Steller sea lions were most abundant during the eulachon run, with a high count of 192 sea lions toward the end of the run on April 27 (Table 1). Sea lion numbers were lower than the 946 sea lions observed in the bay in 2002, but comparable to the

maximum number observed in 2003 (Womble *et al.* 2005). Sea lion numbers in Berners Bay typically peak as eulachon abundance in the bay peaks and decline once the eulachon enter the river (Sigler *et al.* 2004). During 2003 and 2004, fish traps set in the river caught the first eulachon on April 19; this year, the traps were not set until April 23 and were full when checked on the 24th (Robbie Piehl, USFS, personal communication). This and the fact that active foraging was observed only during the first survey suggests that Steller sea lion abundance may have peaked before the surveys started on April 20. However, few Steller sea lions were observed by participants in an Audobon Society cruise to Berners Bay on April 17 (A. Lindekugel, personal communication). On April 12, 21-24 Steller sea lions were observed in the water in Berners Bay during a marine mammal survey of the area (Mathews, unpublished data). During the latter half of April, sea lion numbers at the nearby haulout at Benjamin Island decreased while numbers at the Gran Point haulout near Haines increased (Lauri Jemison, ADFG, unpublished data), a pattern also observed by Sigler *et al.* (2004) in 2002 and 2003. Berners Bay likely represents an important stopover for sea lions en route from Benjamin Island to Gran Point.

Although sea lions exhibited a strong numerical response to the eulachon run, they exhibited a more limited response to the herring. This year, herring schools were present in the main spawning area north of Sawmill Creek and the increase in numbers of sea lions in this area during the later stages of the eulachon run suggests they were seeking to exploit that resource (Fig. 4). However, there was only 1.5 miles of active spawn, all of it along the southern shore of Berners Bay near Pt. Bridget or south of the bay near Maab Island (Alaska Department of Fish and Game 2005). Spawn was first observed near Pt. Bridget on May 8 and had largely dissipated by May 12 (Alaska Department of Fish and Game 2005). Prior to the spawn on May 4, 33 sea

lions were observed in the spawning area, most rafted in 3 groups offshore of Pt. Bridget (Appendix 1-g). On May 12, 22 sea lions were observed singly or in small groups in the area of the spawn (Appendix 1-h). Womble *et al.* (2005) found a positive correlation between biomass of spawning herring and number of sea lions in the water, suggesting that sea lion abundance during this low-spawn year was also low. Harbor seals also showed a response to the herring spawn, with 17 seals observed foraging at the spawning site on May 12 (Fig. 5), the only time seals were observed in that part of the bay. Herring also appeared to be important to humpback whales in the bay; several whales were seen foraging along the eastern shore where the herring were schooled (Fig. 3 and 4) and whales were also observed in the southern portion of the bay around the time of the spawn (Fig. 5). During the 1970s, herring spawned from Auke Bay to Point Bridget, with occasional spawn around Sawmill Creek and Pt. St. Mary. By the early 1990s, most of the herring spawn was restricted to the eastern side of Berners Bay, from the Cascade Point area to north of Sawmill Creek (Kevin Monagle, ADFG, unpublished data). During this same time, ADFG survey records reveal a significant decline in the miles of active herring spawn, from an average of 9.5 statute miles to only 3.5 statute miles during 2000–2005 (calculated from an unpublished summary compiled by Kevin Monagle, ADFG, Commercial Fisheries, Douglas, Alaska). Given the importance of herring to marine mammals and the apparent loss of spawning areas further south, care should be taken to protect spawning sites within Berners Bay.

Harbor seals and Steller sea lions use Berners Bay in different ways and mine-related impacts on these species are also likely to differ. Steller sea lions are most vulnerable to human disturbance during the relatively short period in late April and early May when pre-spawning aggregations of eulachon are present in the bay. This year, as in previous years, large groups of

sea lions actively foraged and rested in the northwest corner of the bay along the proposed ferry route between Cascade Point and Slate Creek Cove (Fig. 3 and 4). Although the pre-spawning aggregations do not last long, eulachon may be critical prey resource for sea lions, particularly lactating females (Marston *et al.* 2002; Sigler *et al.* 2004; Womble *et al.* 2005). Herring did not spawn on the eastern shore this year and ferry traffic should have few or no impacts on marine mammals foraging at spawning sites near Pt. Bridget. However, both Steller sea lions and humpback whales appeared to forage on herring schools along the eastern shore, even in the absence of spawn. Humpback whales, which foraged both along the shoreline and in the middle of the bay, would be most vulnerable to disturbance when herring schools (but not spawn) are present. During years when herring spawn in or around Cascade Point, the potential for disturbance will be high for all marine mammal species.

Although most of the research on marine mammal use of Berners Bay has focused on Steller sea lions, this study suggests that harbor seals may be even more vulnerable than sea lions to human impacts. Harbor seals were present in Berners Bay over the entire study period with a high count of 345, and the 1993 and 1997 NMFS surveys suggest that harbor seals continue to use Berners Bay through at least September. Furthermore, pregnant and lactating females with dependent young were present in the bay during the study. The sandbars used as resting (and possibly pupping) sites by pregnant and lactating females lie close to the proposed route of the Juneau Access Road, leaving seals potentially vulnerable to disturbance both in the water and on land. Harbor seals foraged primarily in the nearshore areas in the northern and western sections of the bay, including in and around Slate Creek Cove, site of the existing mine road and proposed ferry terminal. This foraging activity extends at least through late May; no high tide surveys were conducted in June or July and their summer foraging areas are still not known.

Furthermore, the haulout at the entrance to Slate Creek Cove was the main haulout in April and May and the seals resting there are highly vulnerable to repeated disturbance from ferry traffic. It is not known whether seals overwinter in Berners Bay or how early in the spring or winter that seals begin to use the Slate Creek Cove haulout, but if there is a resident group of seals in the bay, the potential for disturbance will be much greater. Harbor seals in Berners Bay constituted 38% of the total in Lynn Canal during the 1997 NMFS survey (on the day when the peak count of seals was observed), suggesting that Berners Bay is critical to this northern population. Given that harbor seals in nearby Glacier Bay are in decline (Mathews and Pendleton, in press) and that little is known about the status or trend of harbor seals in Lynn Canal, we highly recommend that harbor seals in Berners Bay continue to be monitored by both boat and aerial surveys on a year-round basis.

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Table 1. Survey parameters and counts of harbor seals (Total), Steller sea lions (SSL), and humpback whales (HW) observed during boat-based and aerial surveys of Berners Bay, Alaska during spring and summer, 2005. For harbor seals, the number of seals on haulouts (HO) and number of seals in the water (InWtr) is also given.

Date	Start	End	Type	Area	Observers	Tide*						Harbor Seals				
						Time	Near	Height (ft)	Start (ft)	End (ft)	Tide	Total	HO	InWtr	SSL	HW
20-Apr	10:35	12:44	Boat	NW shore	KB, CO	11:32	High	13.3	12.8	12.4	Rising/Falling	104	55	49	130	1
22-Apr	12:47	15:30	Boat	Shore	KB, LJ, GP, CO	12:53	High	15.0	15.0	9.6	Falling	99	3	96	116	2
23-Apr	14:01	17:26	Boat	Complete	KB, JW	13:30	High	15.5	15.2	4.7	Falling	134	0	134	56	2
24-Apr	9:49	12:44	Boat	Complete	KB, CO	14:08	High	15.7	2.0	13.8	Rising	225	0	225	58	3
25-Apr	13:06	16:00	Boat	Complete	KB, CO	14:47	High	15.8	12.8	14.2	Rising/Falling	80	0	80	133	2
27-Apr	11:28	14:38	Boat	Complete	KB, CO	9:50	Low	-2.6	0.2	12.1	Rising	213	0	213	192	0
4-May	13:39	14:34	Aerial	Complete	KB, LJ, LB	17:16	Low	0.8	9.6	6.3	Falling	276	268	8	36	2
12-May	12:44	15:55	Boat	Complete	KB, JB	16:55	High	12.8	3.7	12.1	Rising	84	0	84	35	1?
14-May	13:29	15:30	Boat	Shore	KB, JB, AB	11:58	Low	1.7	3.0	7.3	Rising	136	24	112	4	2
18-May	14:30	16:00	Boat	East shore	KB, AE, Dione	15:59	Low	3.1	4.4	3.1	Falling	164	2	162	2	2
20-May	8:32	9:05	Aerial	Complete	KB, LB	11:39	High	13.1	7.4	9.0	Rising	105	0	105	1	0
31-May	13:57	14:35	Aerial	Complete	EAM, LB	14:37	Low	1.6	2.0	1.6	Falling	103	93	10	4	0
12-Jul	11:49	12:45	Aerial	Complete	KB, LB, JS	11:26	Low	1.2	1.3	2.5	Rising	345	327	18	5	0

*Tide information for Auke Bay obtained from the WWW Tide and Current Predictor at: <http://tbone.biol.sc.edu/tide/tideshow.cgi?site=Auke+Bay%2C+Alaska&db=o>

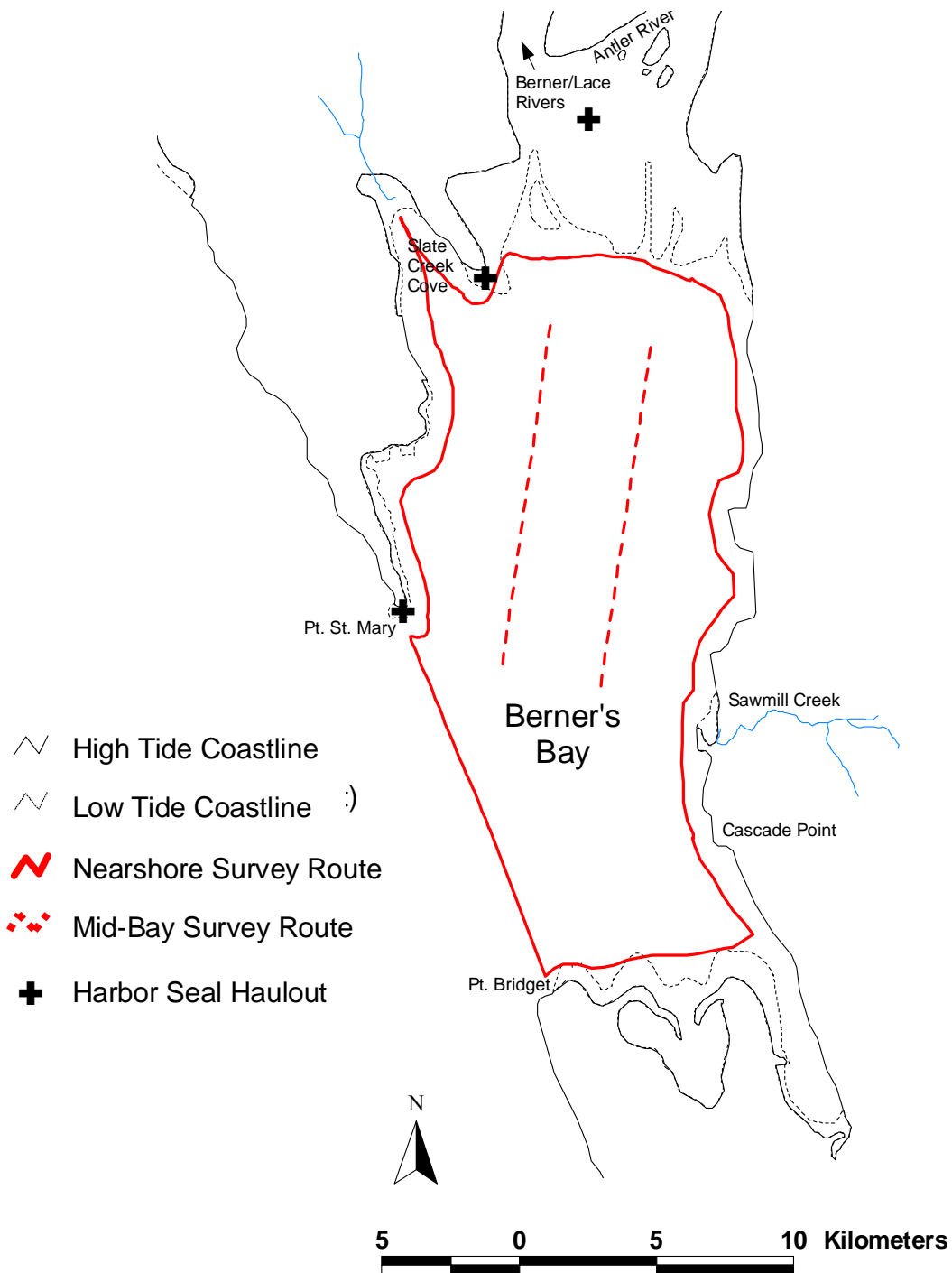


Figure 1. Location of harbor seal haulouts and route of boat-based surveys for marine mammals in Berner's Bay, Alaska, 2005.

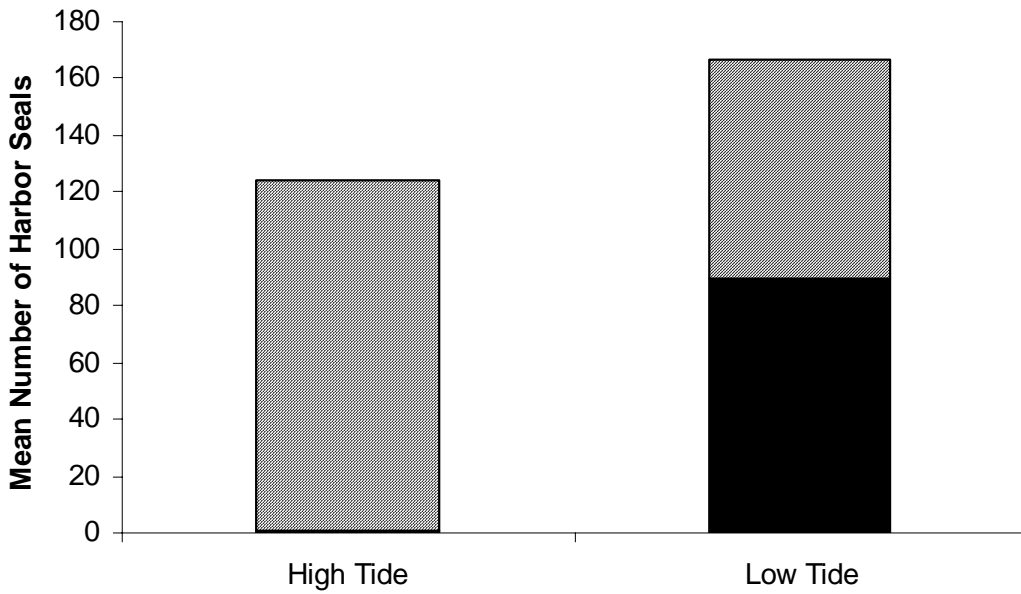


Figure 2. Mean number of harbor seals in the water (hatched) and hauled out (solid) during nearshore and complete boat and aerial surveys conducted near high tides ($n = 5$) and near low tides ($n = 5$) in Berners Bay, Alaska.

Distribution of Marine Mammals in Berner's Bay, Early Eulachon Run, 20 - 23 April, 2005

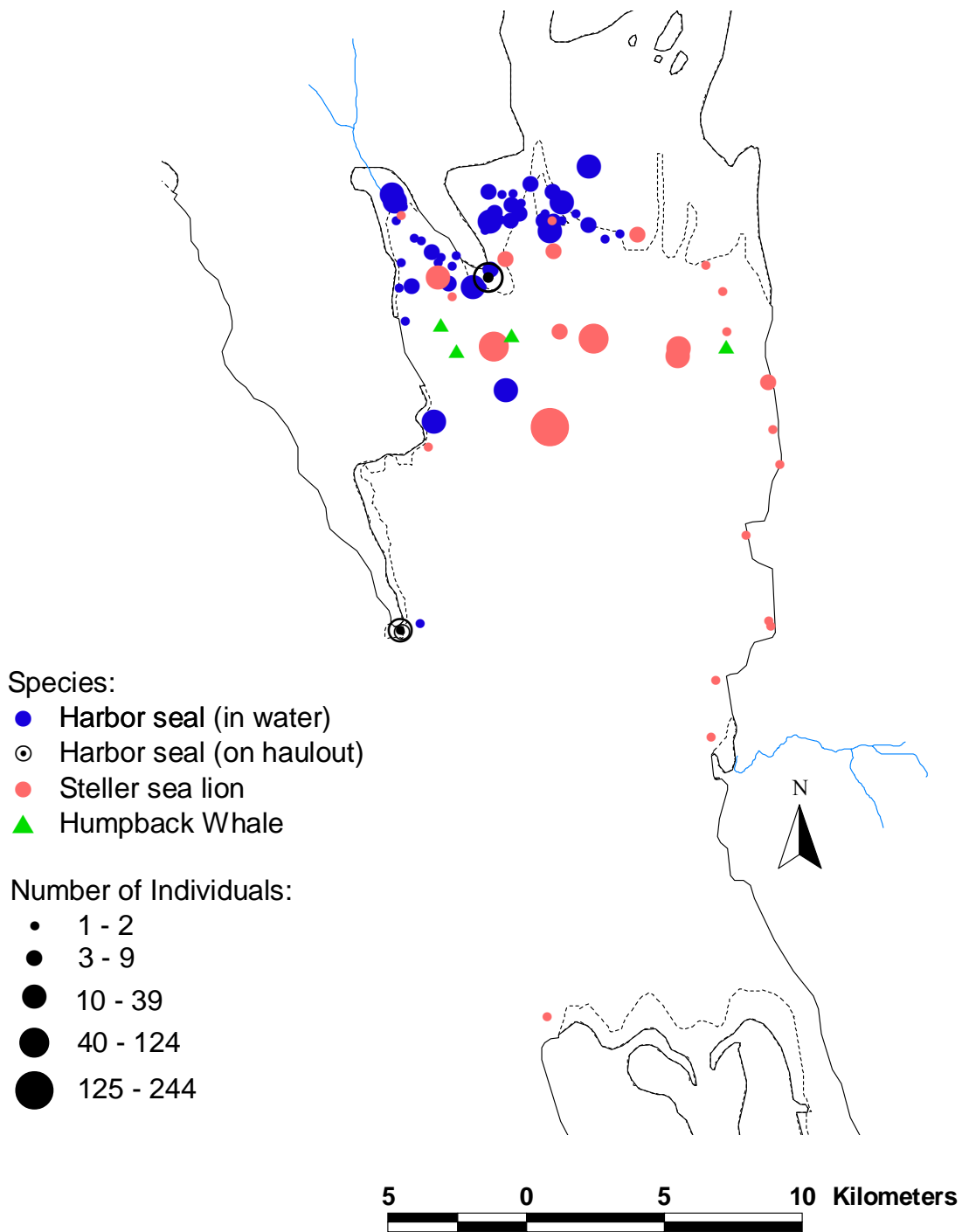


Figure 3. Cumulative distribution of marine mammals in Berners Bay, Alaska, during the early part of the eulachon run, 20– 23 April, 2005. All three surveys were conducted by boat.

Distribution of Marine Mammals in Berner's Bay, Late Eulachon Run, 24 - 25 April, 2005

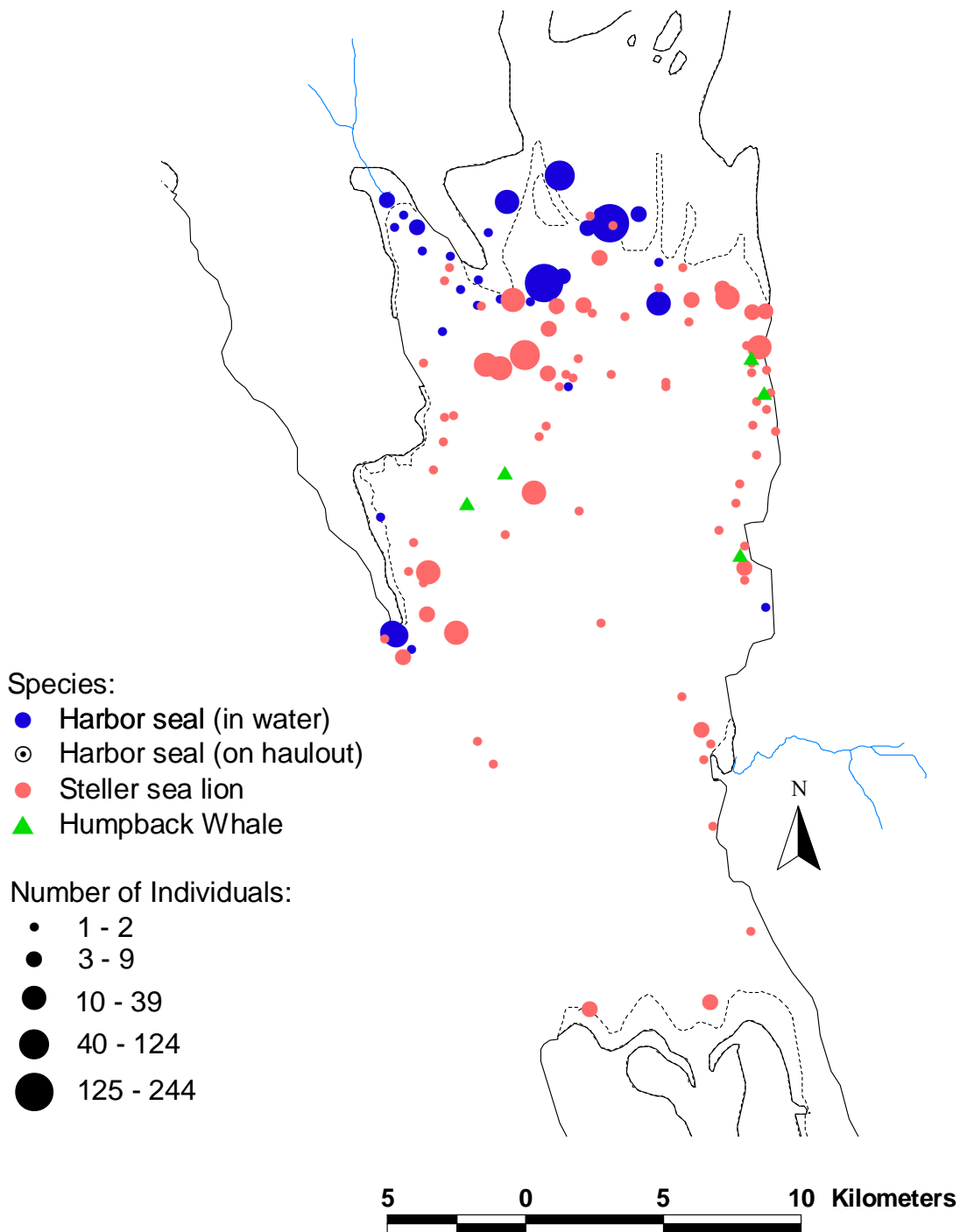


Figure 4. Cumulative distribution of marine mammals in Berners Bay, Alaska during the last part of the eulachon run, 24 – 27 April, 2005. All three surveys were conducted by boat.

Distribution of Marine Mammals in Berner's Bay, Herring Spawn, 4 - 14 May, 2005

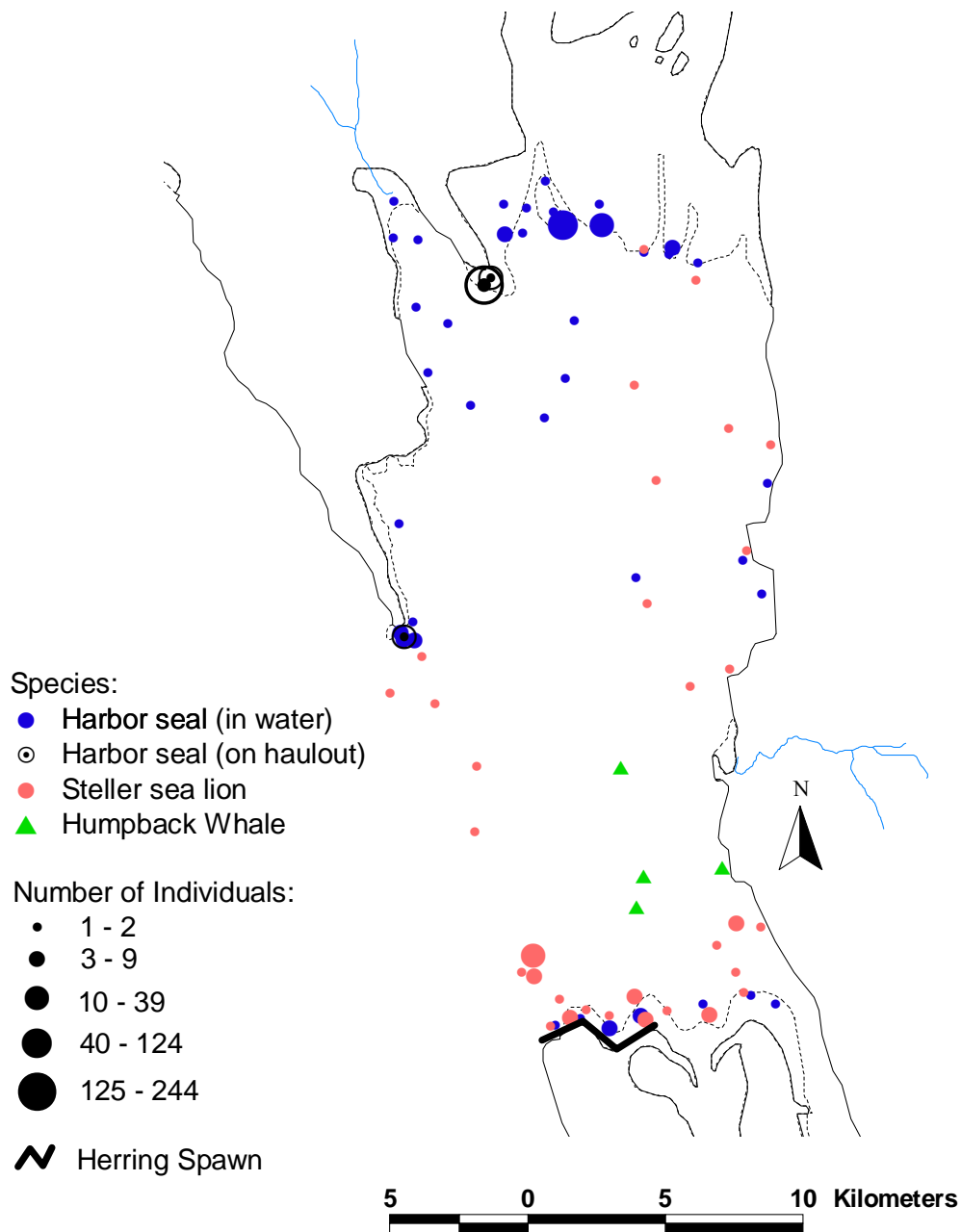


Figure 5. Cumulative distribution of marine mammals in Berners Bay during the herring spawn, 4 – 14 May, 2005. Two surveys were conducted by boat and one from the air.

Distribution of Marine Mammals in Berner's Bay, Post-Herring Spawn, 18 - 31 May, 2005

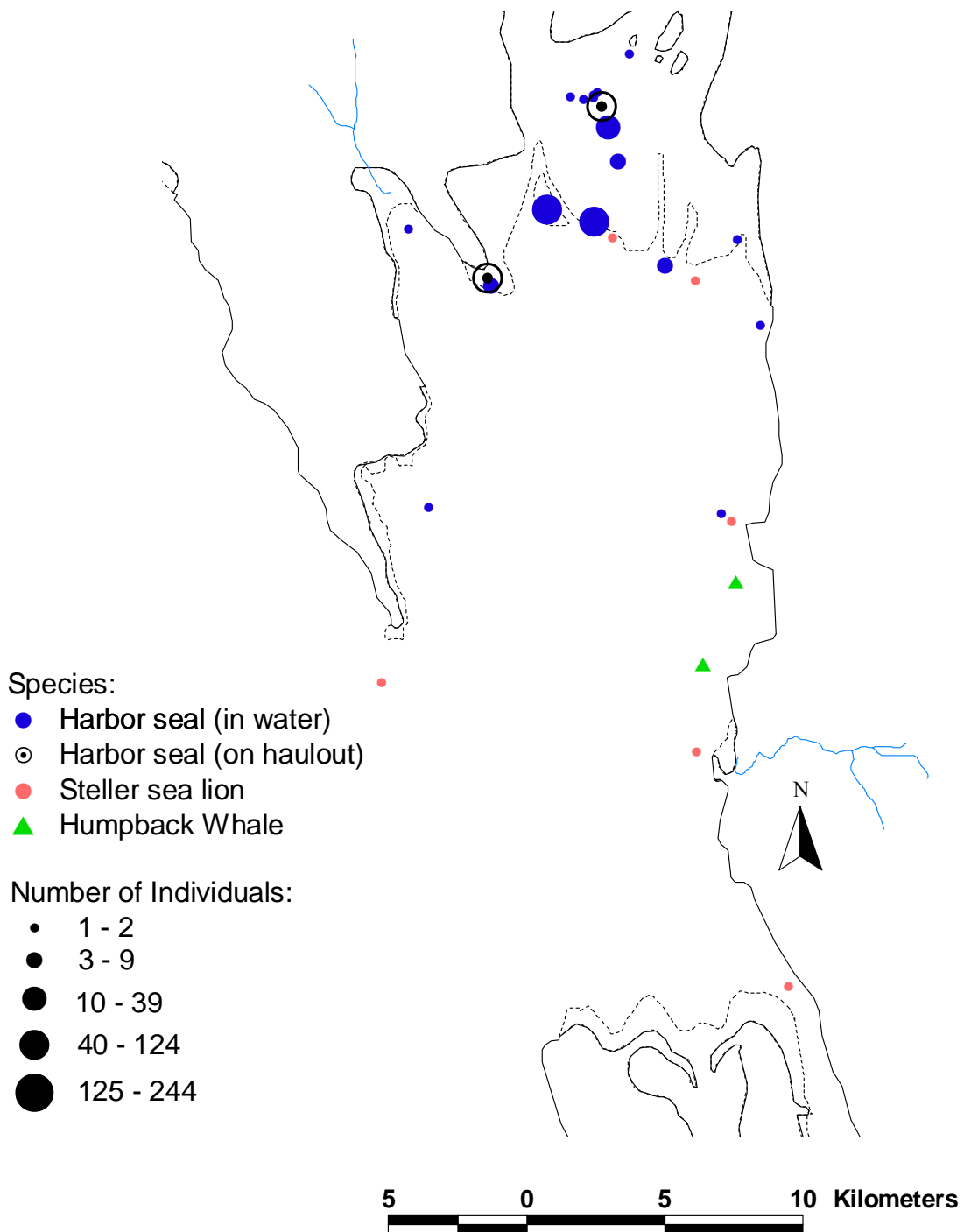


Figure 6. Cumulative distribution of marine mammals in Berners Bay after the herring spawn and before pupping, 18 – 31 May, 2005. One survey was conducted by boat and two from the air.

Distribution of Marine Mammals in Berner's Bay, Post-Pupping, 12 July, 2005

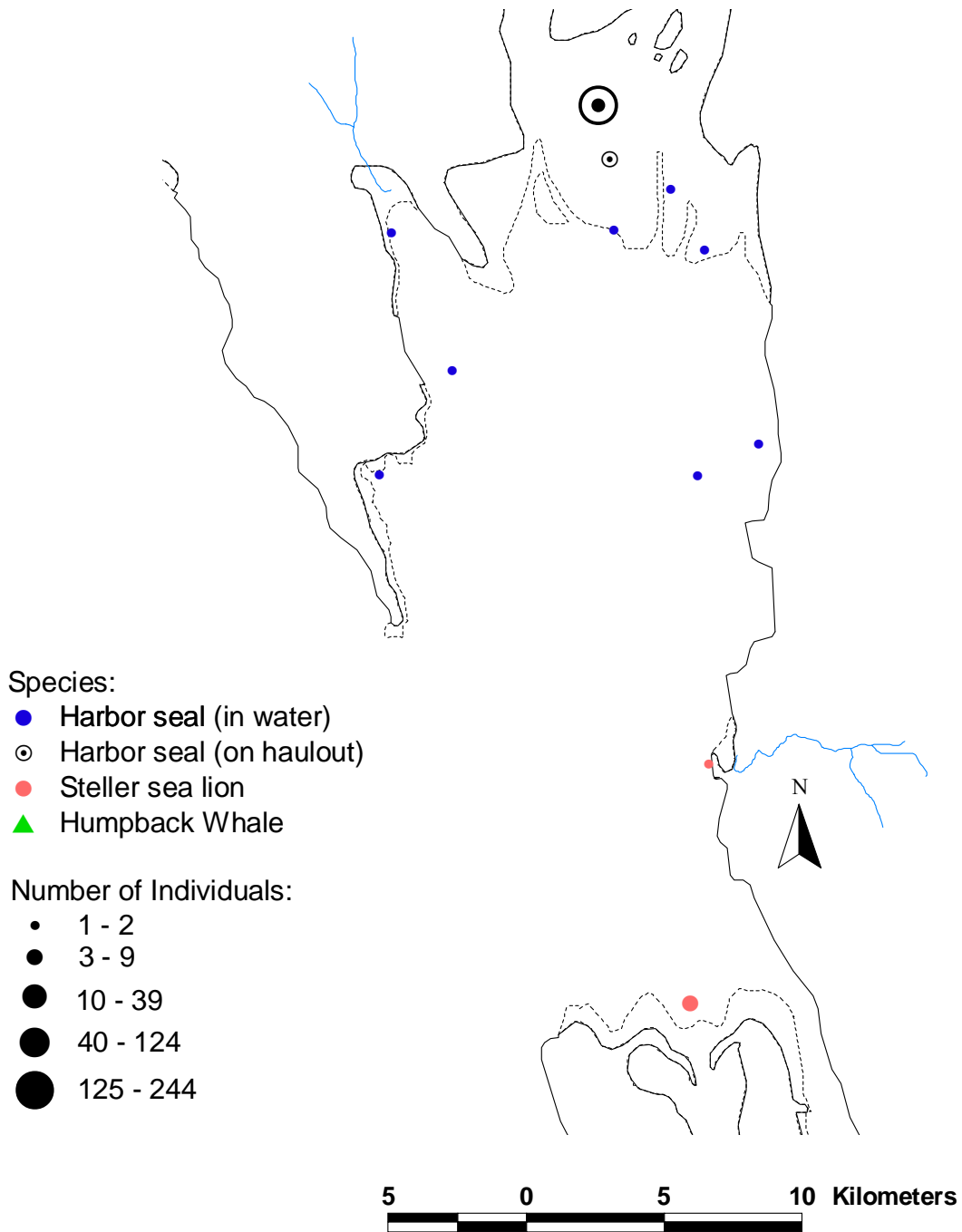


Figure 7. Distribution of marine mammals in Berners Bay during an aerial survey on July 12, 2005, after harbor seal pupping.

Harbor Seal and Steller Sea Lion Distribution, 20 April - 12 July 2005

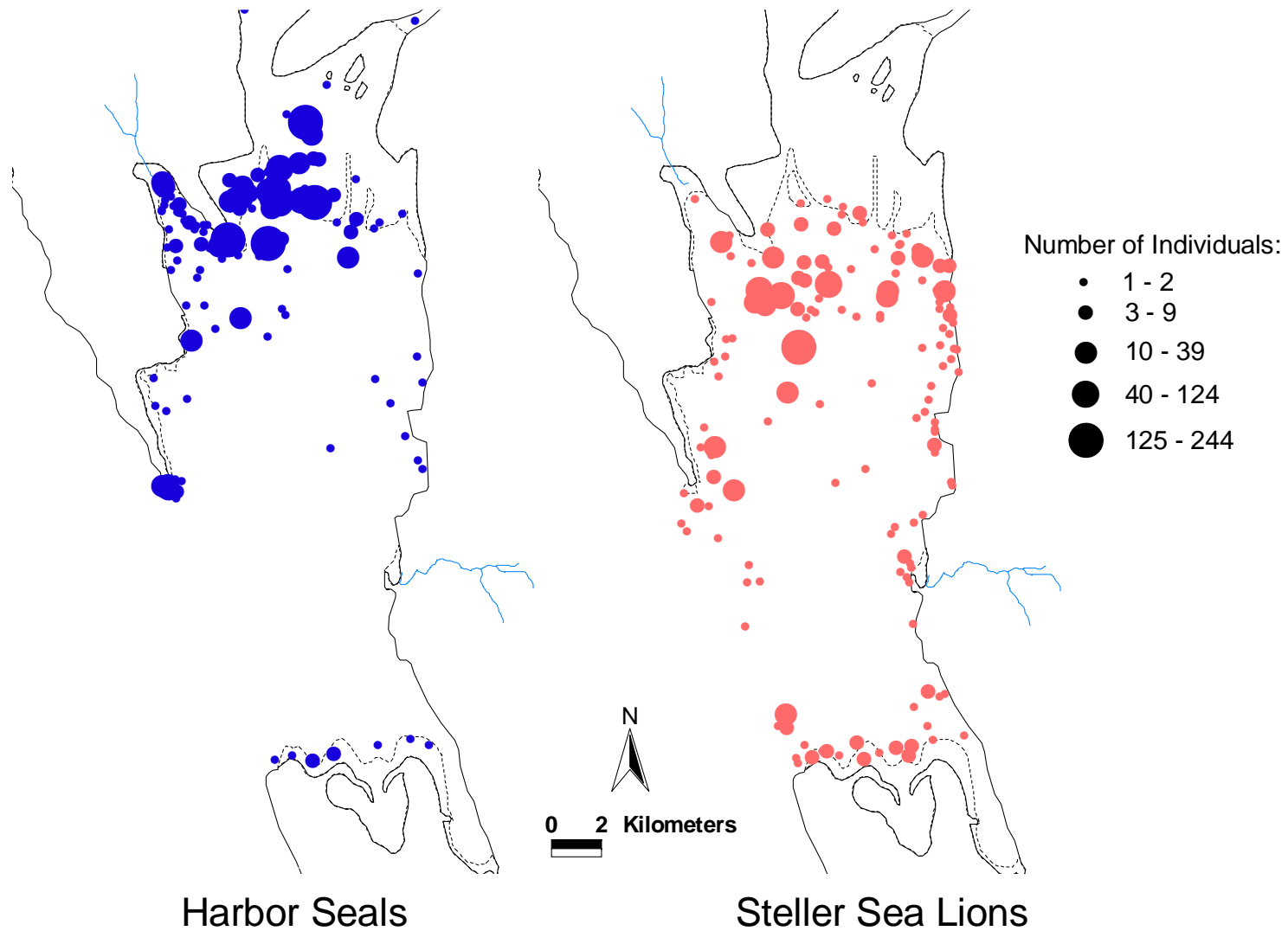
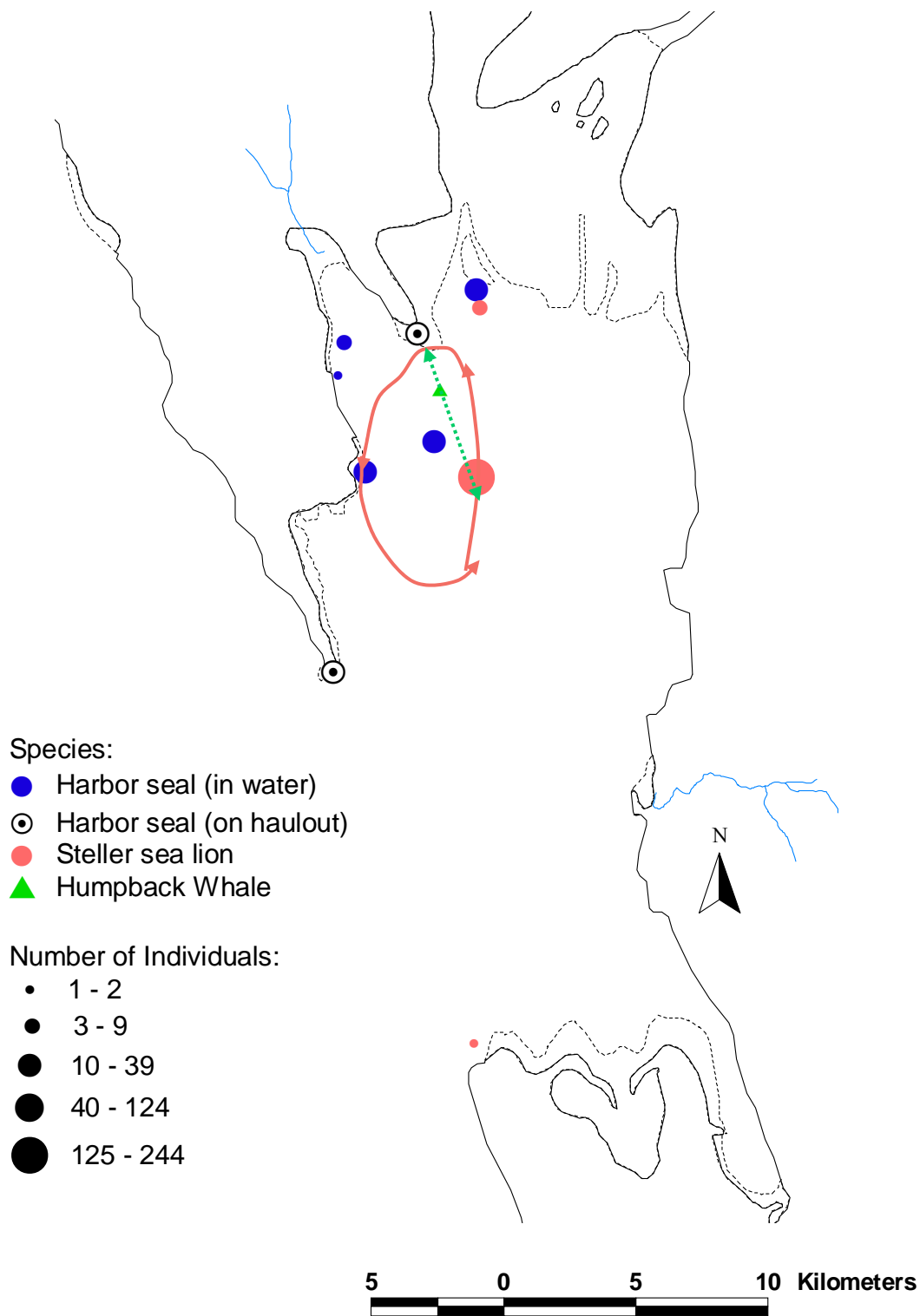
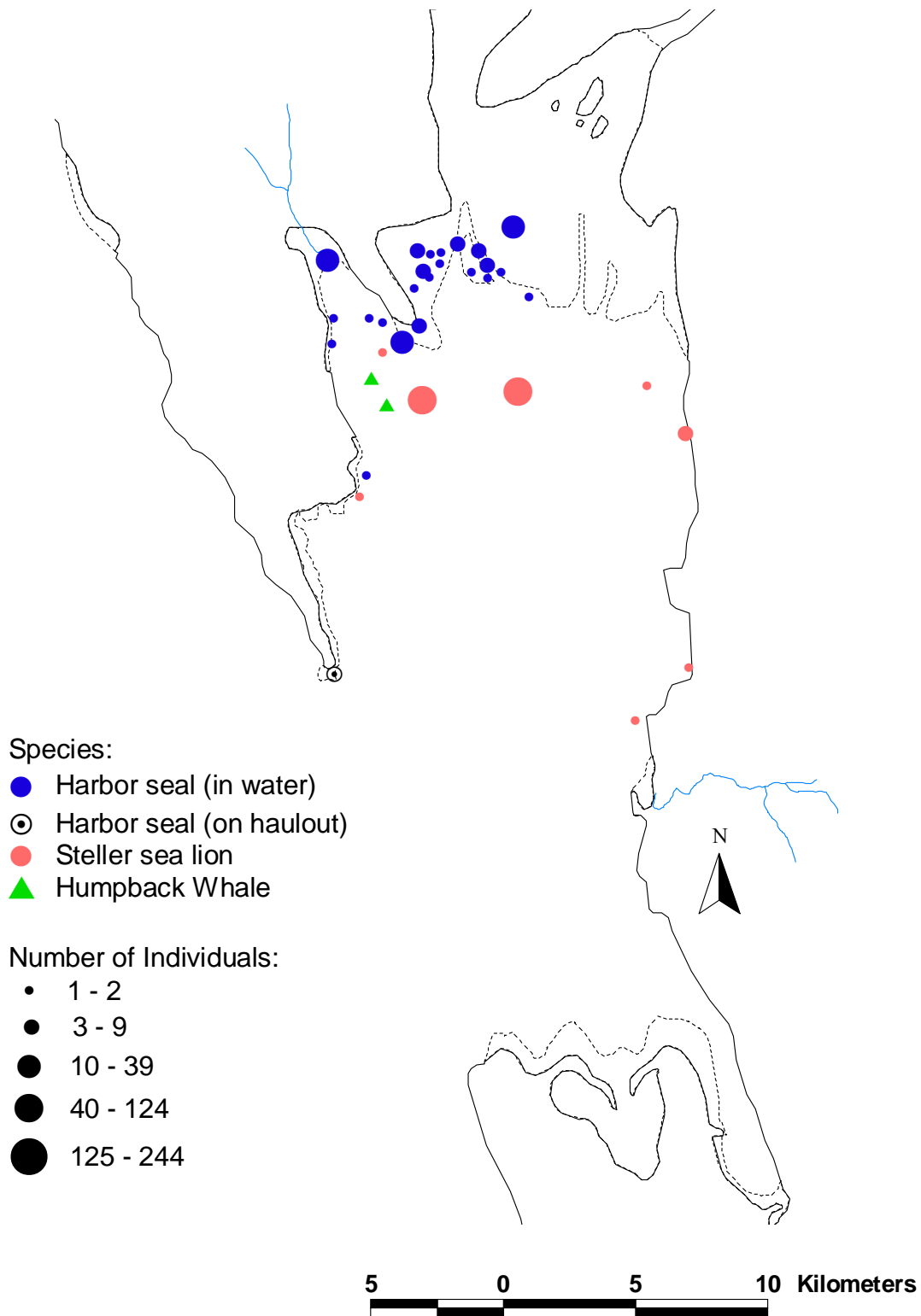


Figure 8. Cumulative distribution of harbor seals and Steller sea lions during April – July, 2005 in Berners Bay, Alaska.

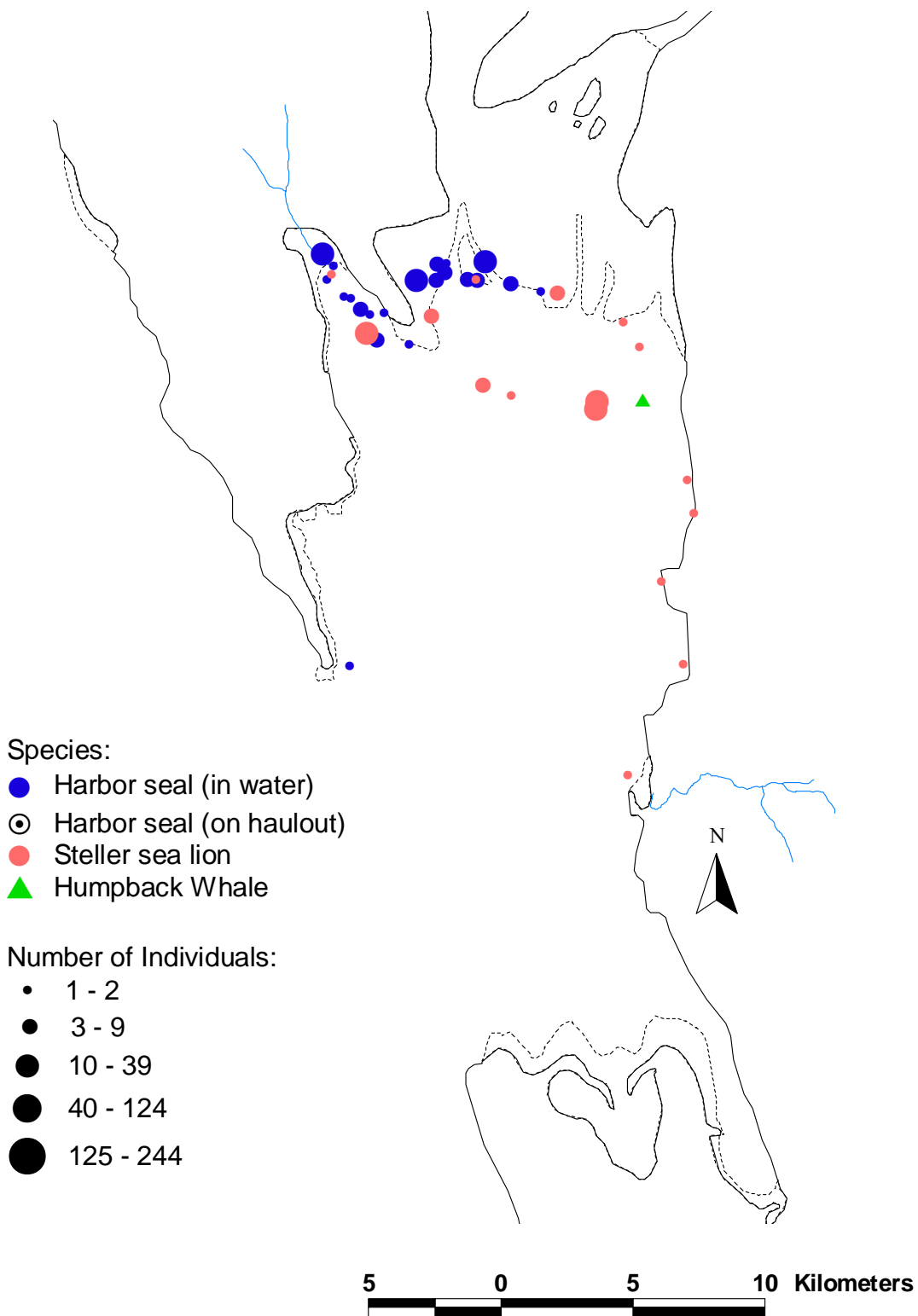
Appendix 1-a. Distribution of marine mammals during a boat survey on April 20, 2005. Only the north and western shores of Berners Bay were surveyed, from Pt. St. Mary to the tidal flats at the mouth of the Antler and Berner/Lace river systems. Arrows indicate the foraging tracks of a humpback whale (dashed line) and a group of Steller sea lions (solid line).



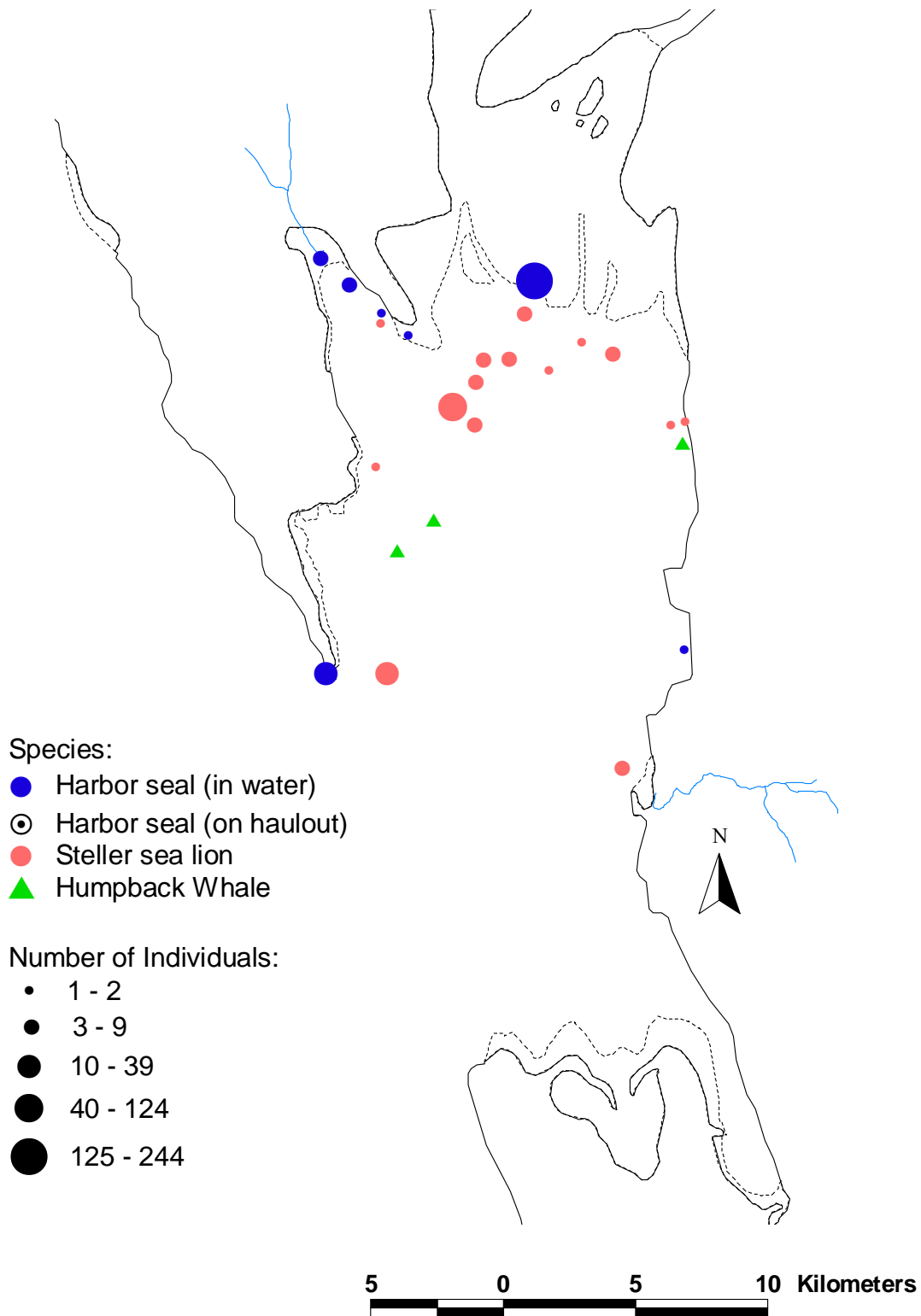
Appendix 1-b. Distribution of marine mammals during a nearshore boat survey of Berners Bay on April 22, 2005.



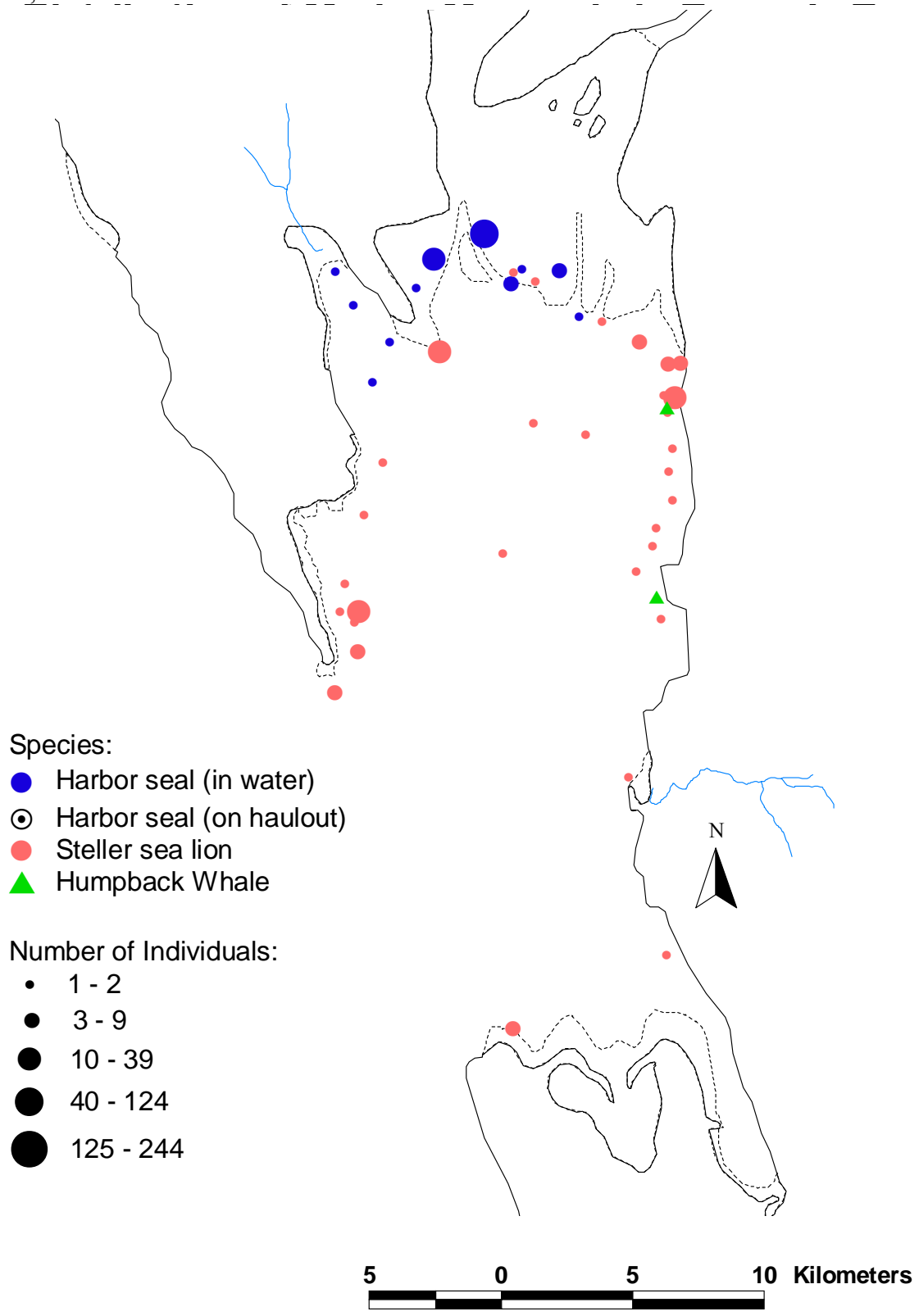
Appendix 1-c. Distribution of marine mammals during a complete boat survey of Berners Bay on April 23, 2005.



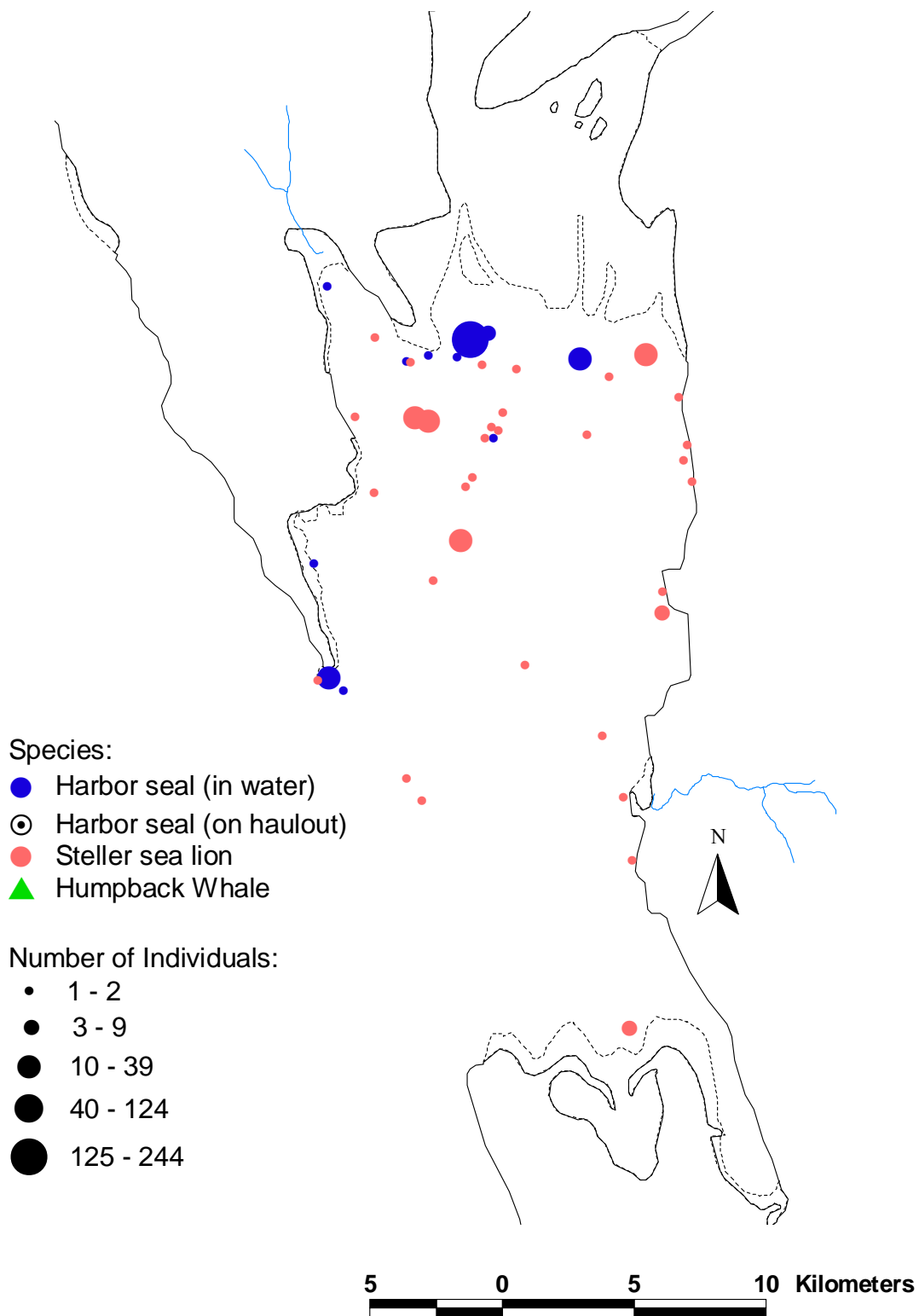
Appendix 1-d. Distribution of marine mammals during a complete boat survey of Berners Bay on April 24, 2005.



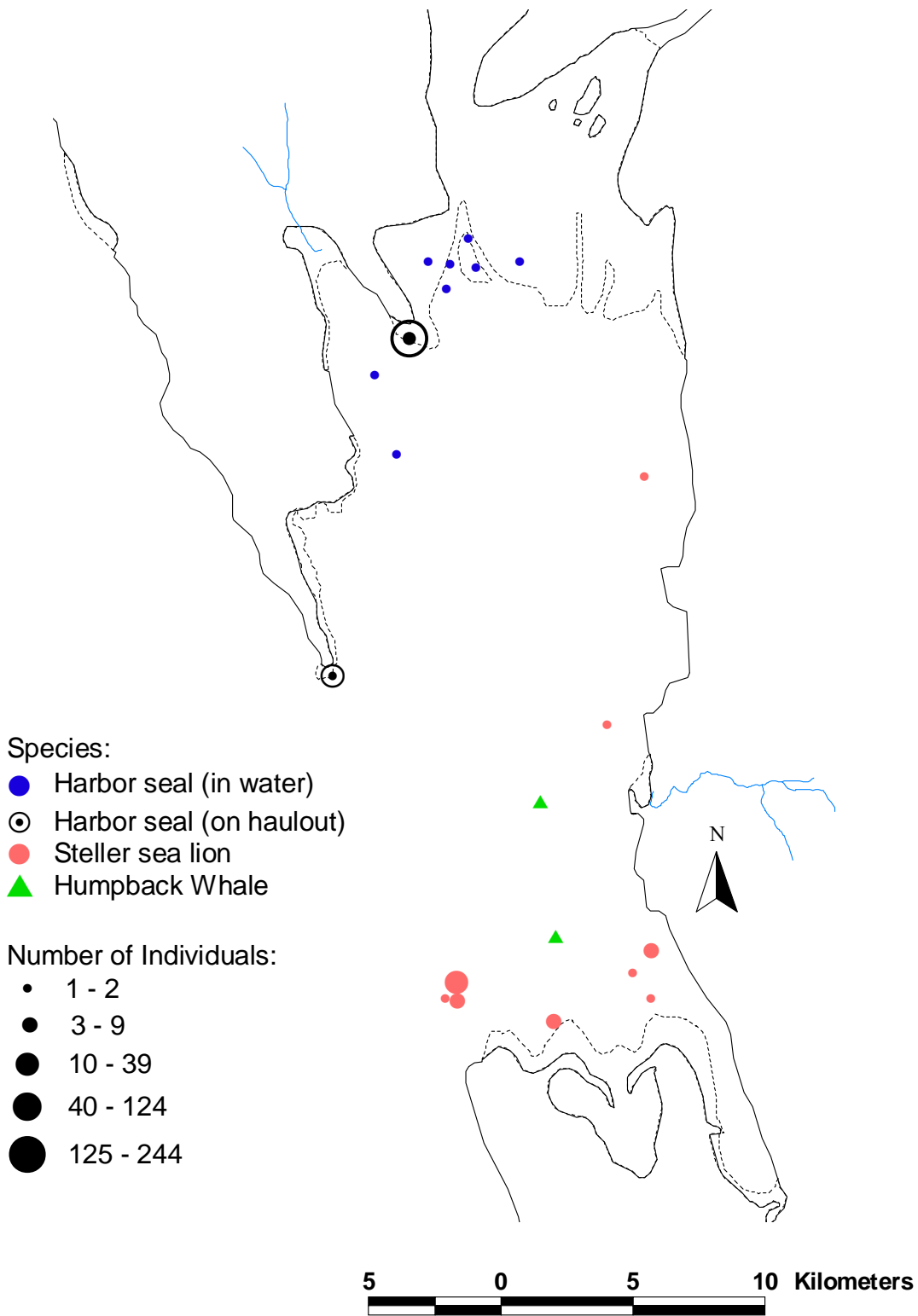
Appendix 1-e. Distribution of marine mammals during a complete boat survey of Berners Bay on April 25, 2005.



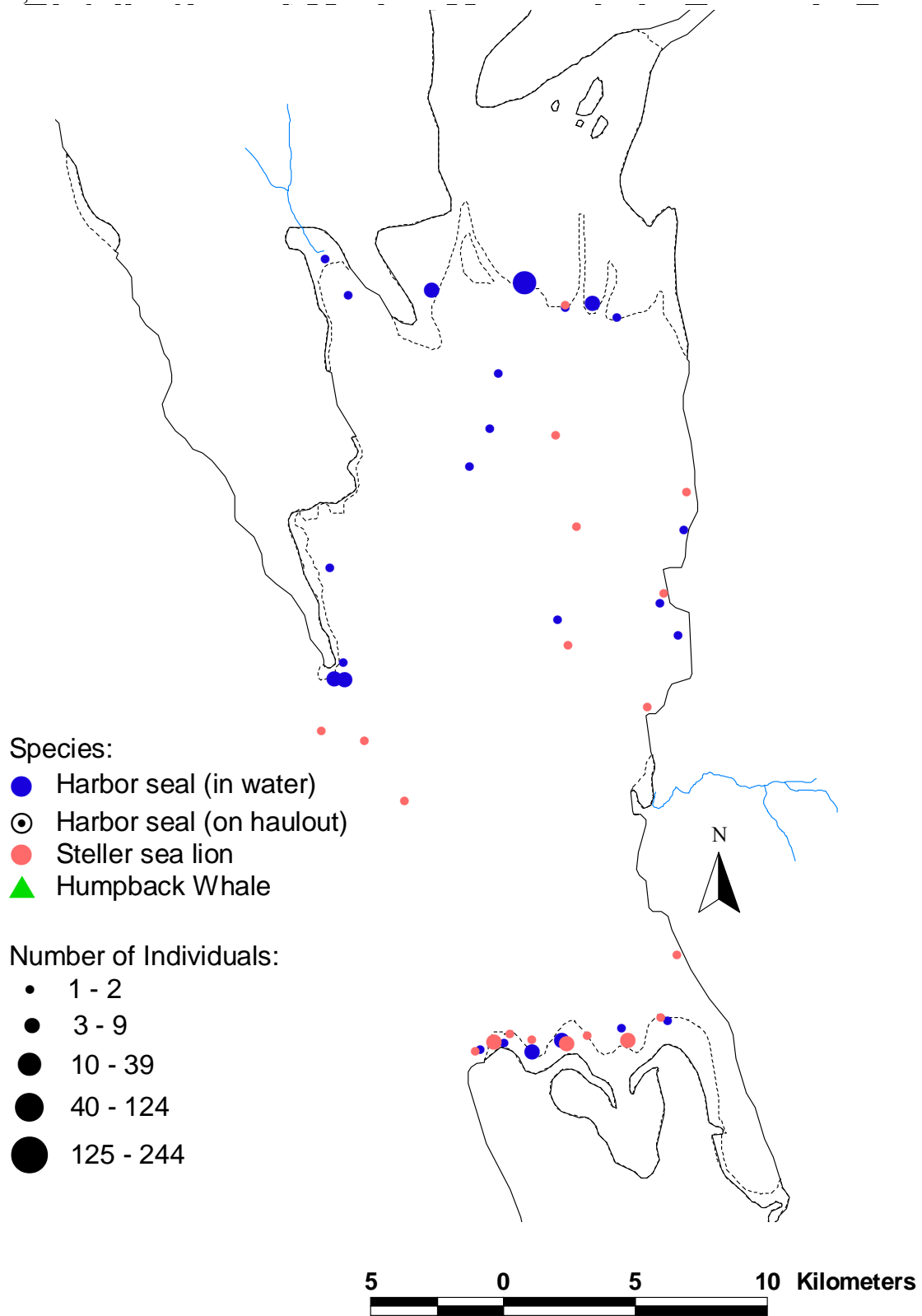
Appendix 1-f. Distribution of marine mammals during a complete boat survey of Berners Bay on April 27, 2005.



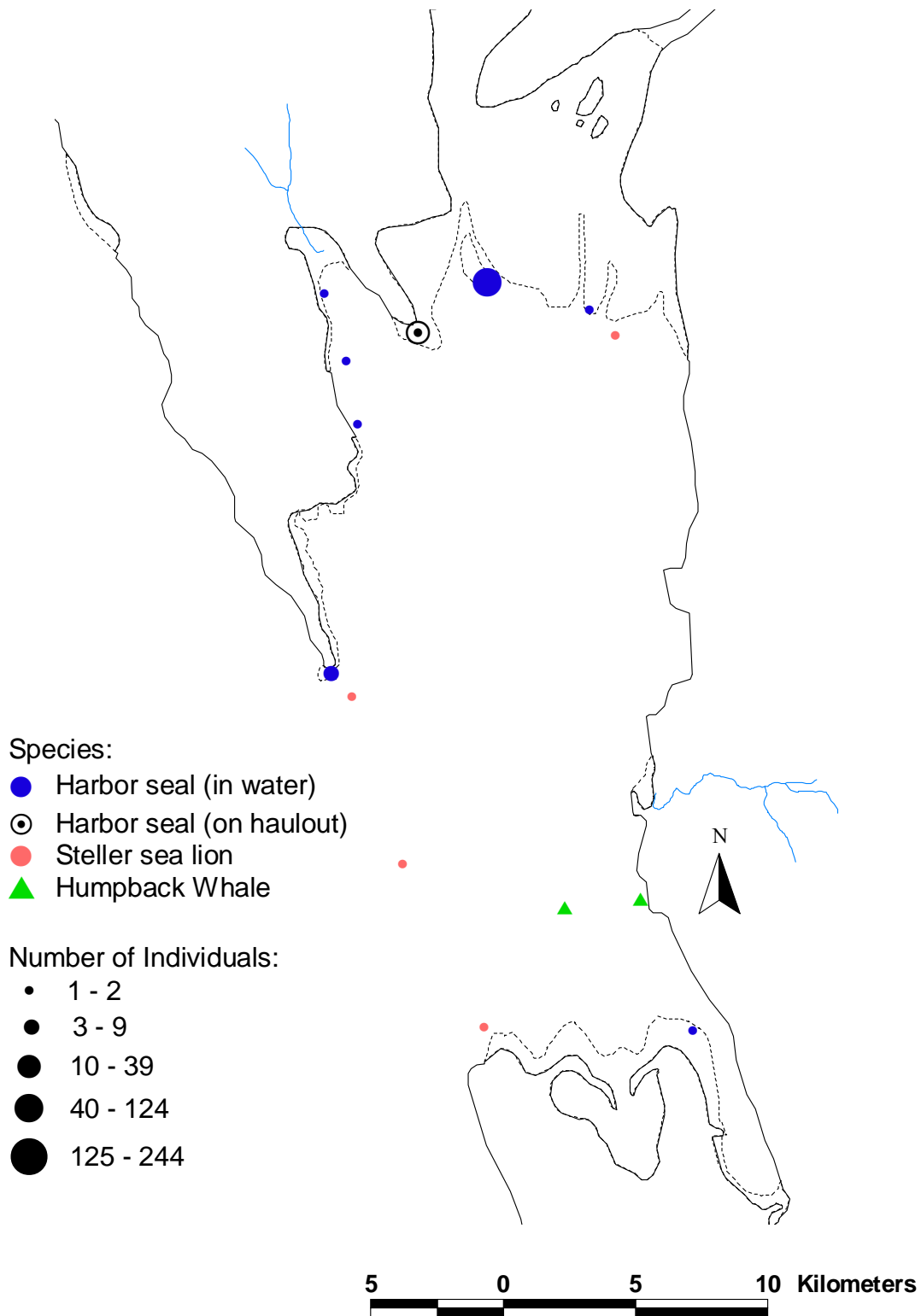
Appendix 1-g. Distribution of marine mammals during an aerial survey of Berners Bay on May 4, 2005.



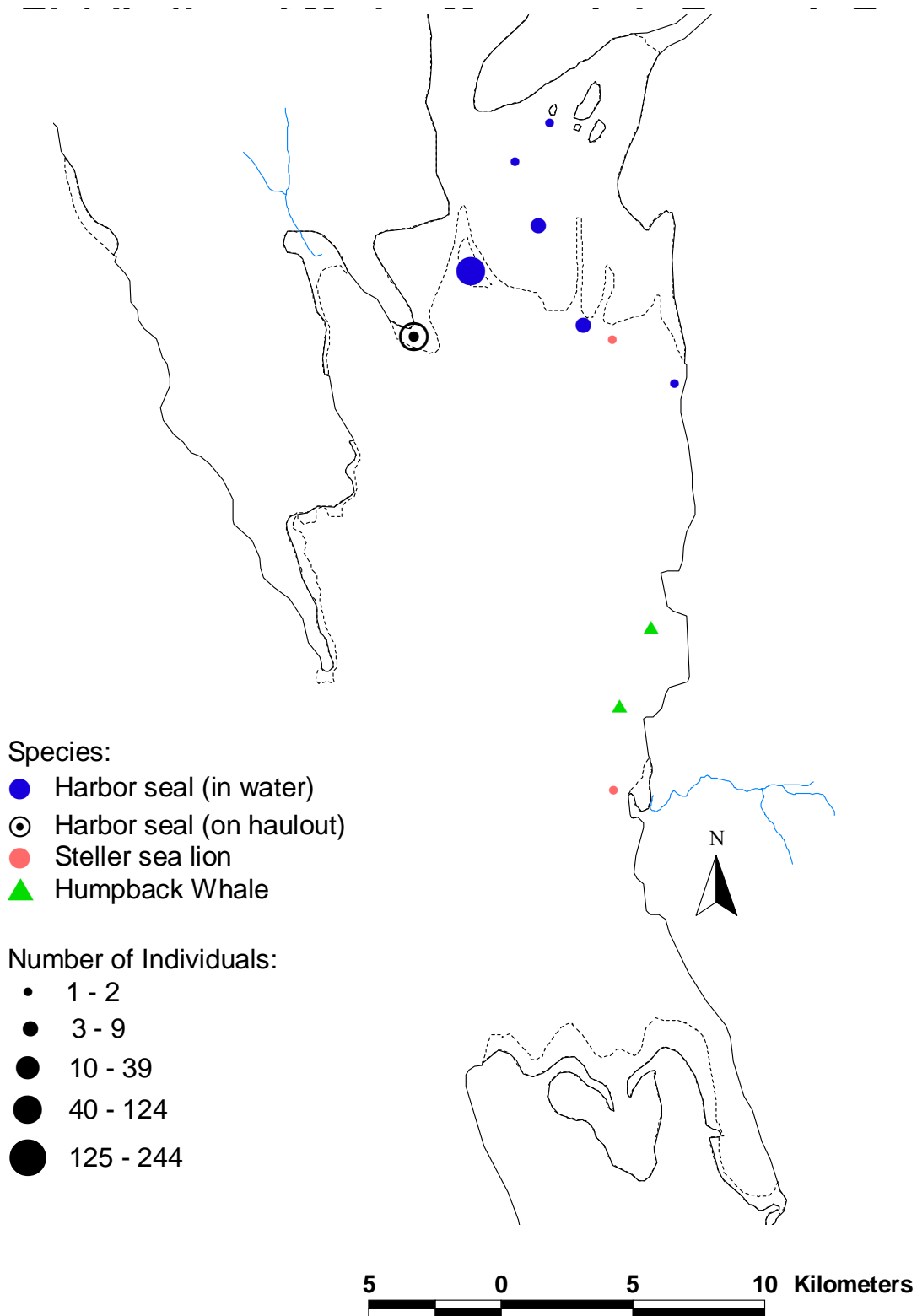
Appendix 1-h. Distribution of marine mammals during a complete boat survey of Berners Bay on May 12, 2005.



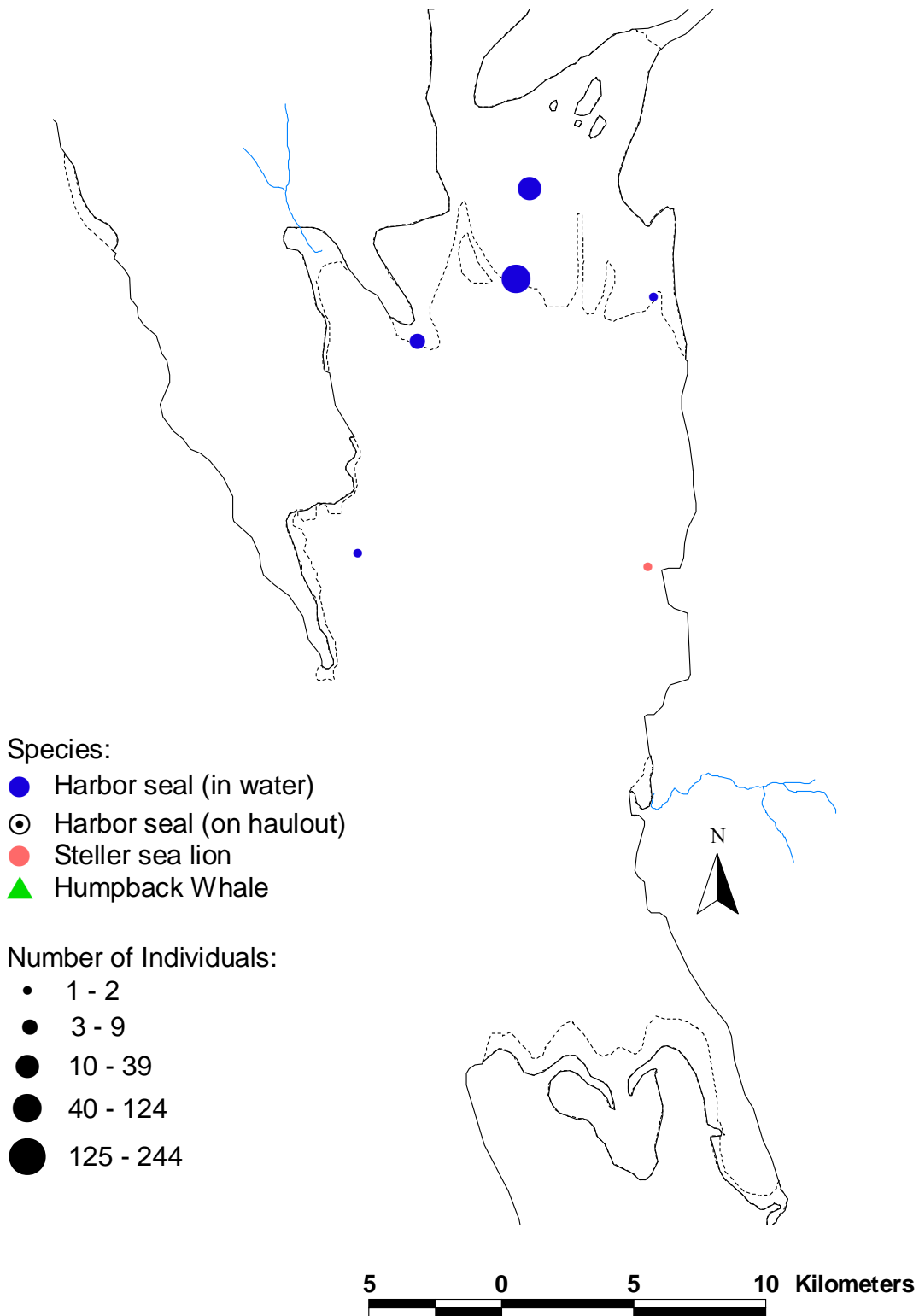
Appendix 1-i. Distribution of marine mammals during a nearshore boat survey of Berners Bay on May 14, 2005.



Appendix 1-j. Distribution of marine mammals during a boat survey of the eastern and part of the northern shore of Berners Bay on May 18, 2005. The survey covered the entire east shore from Echo Cove to the mouth of the Antler River and extended west along the northern shore to the haulout at Slate Creek Cove.



Appendix 1-k. Distribution of marine mammals during an aerial survey of Berners Bay on May 20, 2005.



Appendix 1-I. Distribution of marine mammals during an aerial survey of Berners Bay on May 31, 2005.

