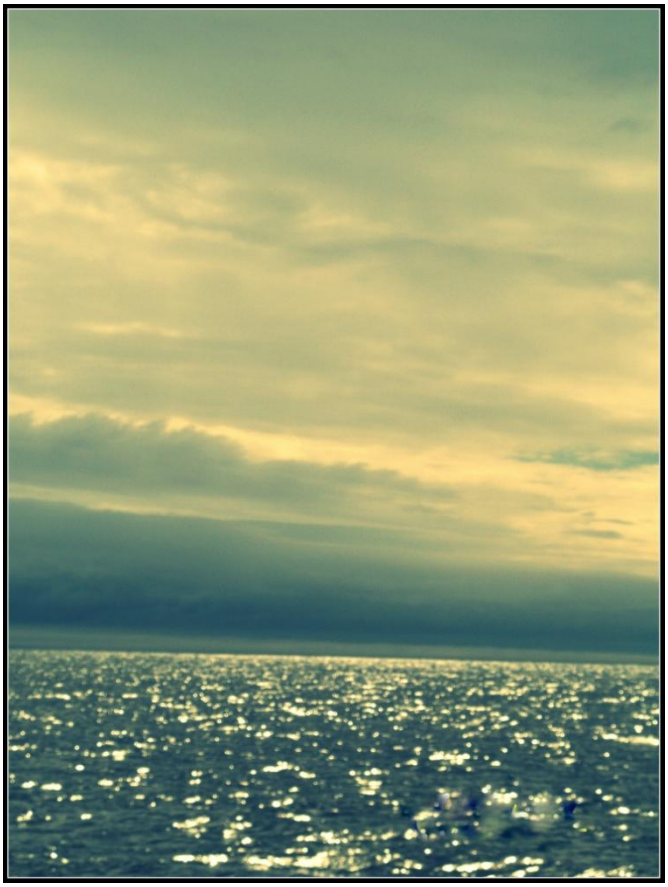
Visual Observations for Birds, Turtles, and Marine Mammals at the University of Maine Test Site near Monhegan, Maine.



A report submitted to the University of Maine's Advanced Structures and Composites Center

APRIL - JUNE 2013

by

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Executive Summary

Eleven boat-based surveys were conducted from 21 April through the 26 June, 2013 at the Deepwater Offshore Wind Test Site near the island of Monhegan, Maine. This is the proposed offshore location of the University of Maine's two full-scale 6MW Semi-Submersible Turbine Platform test units. Previous surveys were conducted in the fall of 2011 (Kennedy & Holberton 2012) and late summer of 2012 (Kennedy 2012b) at Monhegan with primary objectives to record observations of seabirds and other wildlife at the test site during the pre-deployment stage of the project. This year, an additional set of surveys were conducted during the pre-deployment stage to fulfill the same objectives. Observations included species, number, behavior, flight height and direction, as well as weather and sea conditions.

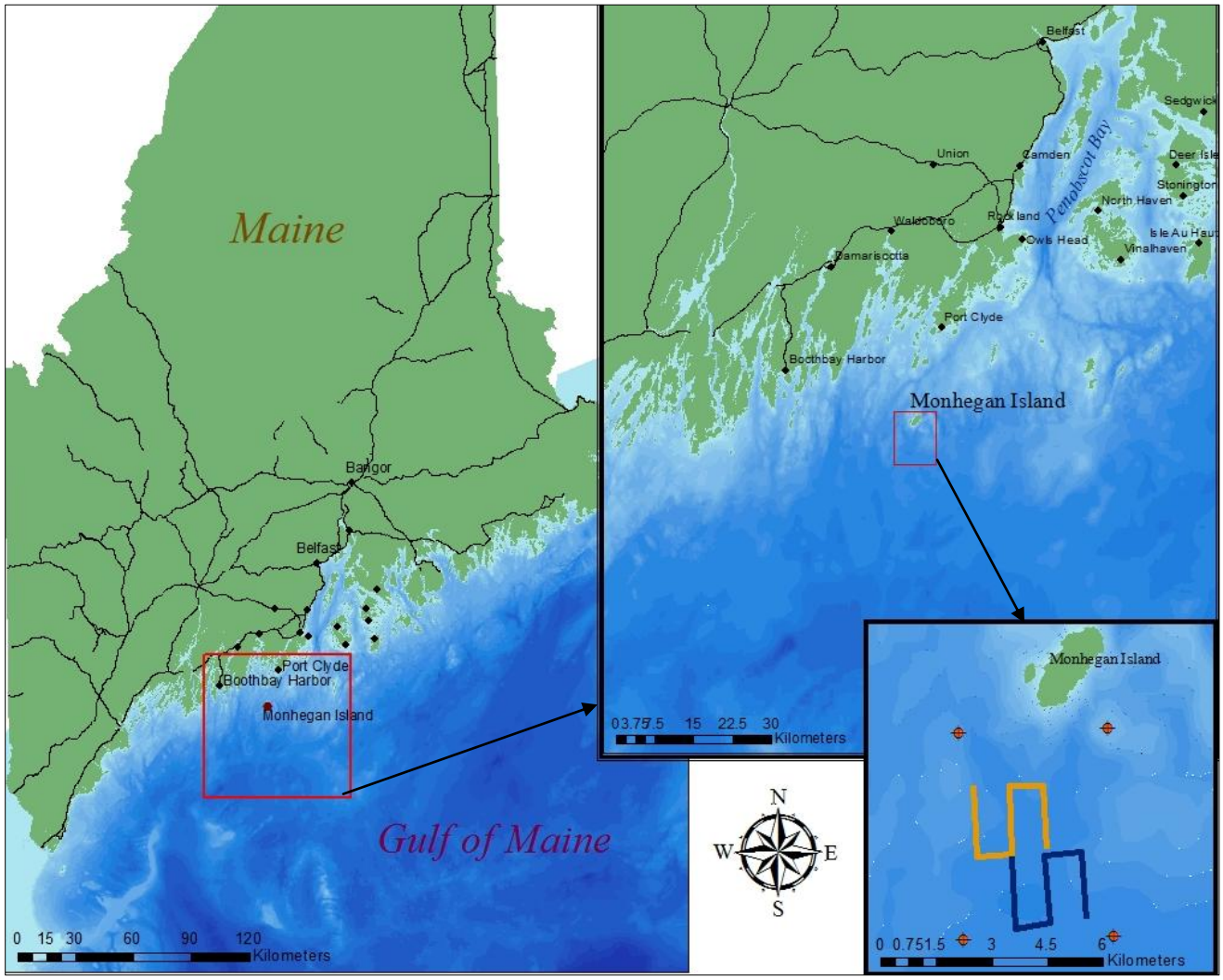
A total of 608 birds were recorded (5.53 birds/km^2), consisting of 21 identifiable species. The most abundant species were Herring gulls (HERG; *Larus argentatus*) at 2.84/km^2 followed by Northern gannets (*Morus bassanus*) at 0.6/km^2. Species of Conservation Concern (SCC) included five Razorbills (*Alca torda*), five Atlantic puffin (*Fratercula arctica*), one Great shearwater (*Puffinus gravis,* GRSH), six "Unidentified" terns, and 11 "Unidentified" alcids. Other recorded wildlife included two species of seal, Harbor porpoise (*Phocoena phocoena*), and a school of baitfish.

The most common bird behaviors included direct flight (32% were HERG), sitting (60% were HERG), milling (55% were HERG), and scavenging (94% were HERG). Of the flying birds, the vast majority flew at one meter, consisting of 44% Order Charadriiformes and 39% Order Anseriformes. With the proposed height of the test turbine's rotor-sweep zone being 35-164m high, none of the birds during this season's survey were observed in this zone.

Potential sources of impact may include direct collision with the platform or tower by the large gulls due to attraction to the structure for loafing habitat or increased foraging opportunities due to additional fish habitat from the floating platform. Sea ducks, loons, and alcids are known to avoid turbine structures, therefore habitat displacement and disturbance associated with the presence of the two turbines may occur. However, the small spatial scale of the proposed turbines may realistically reduce the effect of that reaction, and therefore is a minor concern.

INTRODUCTION

The Gulf of Maine (GOM) is a well-known avian corridor for the millions of songbirds, raptors, shorebirds, wading birds, and waterfowl to pass through during the spring and fall migration (Goodale & Divoll 2009). Over 300 documented species of all major avian taxa frequent the GOM region and more data is currently being accumulated that supports a growing list of known-wintering species. In particular, Monhegan Island is well known for its abundant bird species that migrate through in the spring and fall each year due to its offshore location. Our area of focus lies near Monhegan Island, one-third the way up Maine's coast roughly 40km southwest from the mouth of Penobscot Bay and only 16km south of the mainland from Port Clyde (Map 1). In this report, the data presented represents a third season of pre-deployment seabird surveys, corresponding to the proposed deployment timeframe of the University of Maine's Offshore floating turbine test units at the Monhegan Test Site.



Map 1. Location of the Monhegan test site.

This Monhegan survey was initiated as a request for data in the environmental assessment for the University of Maine's Deepwater Offshore Wind Test Site Units. Detailed information pertaining the flight heights, behaviors, and species found near the Monhegan Island area helps to better understand the birds' habitat use of the site (e.g., feeding, resting, and passing through the area). It also helps to assess potential risks as a result of human activities associated with the siting, construction, operation, and removal of turbine structures. Resource agencies such as the Maine Department of Inland Fisheries and Wildlife (MDIFW) and the United States Fish and Wildlife Service (USFWS) consider monitoring bird activity with respect to offshore wind development a high priority (USFWS Wind Turbine Guidelines Advisory Committee, 2012).

The primary objectives of this study include 1) determining bird and marine wildlife species compositions and their current activities and habitat use of the Monhegan Test Site and 2) using this information to assess potential risk or behavior conflicts that may occur due to the presence of the two 6MW wind turbines and their operations and maintenance. These risks will include potential collision with both above and below surface structures such as blades and platform, and platform anchoring lines. Other potential behavioral conflicts may arise due to the operational boat traffic and other sources of increased human presence, and potential displacement due to the structures' presence.

This report includes observations made only during the pre-deployment period that corresponds with the proposed calendar period of installation and operation at the University of Maine's Monhegan Test Site. Two pre-deployment surveys were conducted at this same location during the fall months of September through October of 2011 (Kennedy & Holberton 2012) and during the late summer months of June through August 2012 (Kennedy 2012b). Development and design for the two full-size turbines that will be deployed at this Monhegan Test Site is currently underway, with proposed deployment dependent upon funding, which is at this time of writing, still pending.

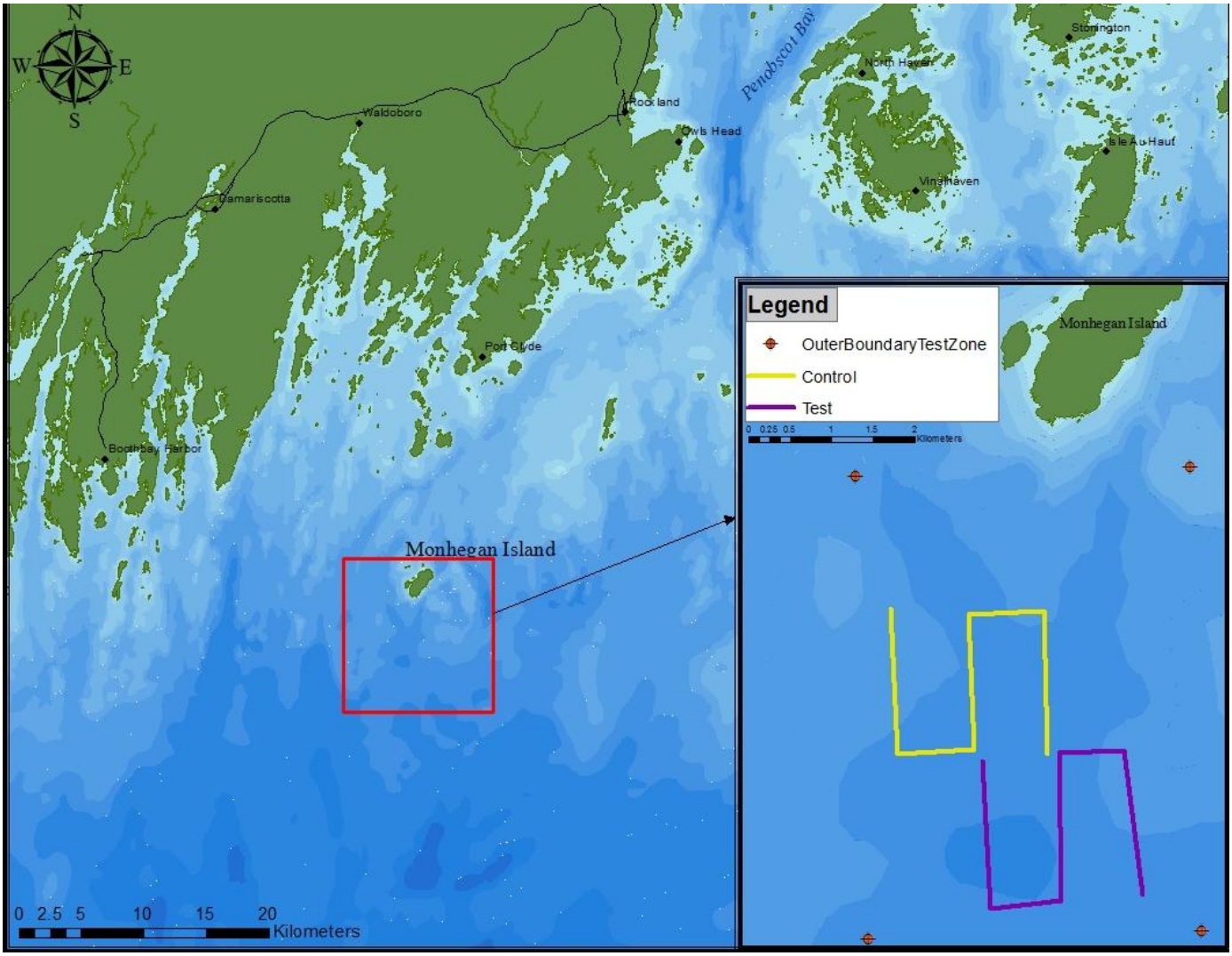
Boat-based survey protocols vary across different studies, with the selection of the final methodology entirely dependent on the objectives of the study. Additional observations will occur following installation during operation. This report, and the two preceding reports (Kennedy & Holberton 2012, Kennedy 2012b), are perhaps some of the very few studies in existence that, to date, have initiated the pre-deployment baseline studies and rumination of potential effects of offshore wind turbines on the marine wildlife, particularly birds.

LOCATION

Monhegan is a small rocky island that is home to no more than 65 year-round residents that rely on the short summer tourist season, but, more importantly, the prolific lobstering and fishing industries. Located about 10 miles (16.1 km) from the mainland of Maine, ferry service and private charter out of Port Clyde, New Harbor, or Boothbay Harbor provide the only access to this unique treasure.

Visual boat-based observations were conducted at the University of Maine's Deepwater Offshore Wind Test Site that is located three miles off Monhegan Island. The survey area consists of a two-square mile section (5.18 km^2, centered at approximately N 43.719° W 69.333°) further divided into a "Test" and "Control" Quadrat for purposes of surveying (Map 2). The University of Maine's two-6MW full-scale floating offshore wind turbines will be placed within the Test Quadrat, in the near future. Surveying both the Test and Control Quadrats during the pre-deployment stage of the project will provide behavioral and species distribution baseline data that will be compared once the two test units are deployed and subsequential surveys are conducted.

The Audubon Society and the Biodiversity Research Institute recognize Monhegan Island as a "hotspot" for migratory songbirds, raptors, and off-course vagrants due to its size and offshore location (Audubon 2013, BRI 2010). The annual avian southward migration typically begins in March, although certain groups of birds begin leaving as late as June. The peak migration season, however, is reliably from late August through mid-October for the last of the returning species. Breeding species in the past consist of large numbers of Herring gulls, Great black-backed gulls, and Double-crested cormorants who utilize the rocky cliffs and shoreline of the island for safe nesting areas. One pair of Bald eagles has nested on Monhegan Island, and it is believed Sharp-shinned hawks (*Accipiter striatus*) may breed there as well (D. Lovitch, Owner & Operator of Freeport Wild Bird Supply, *pers. comm.,* 24 Jan 2013).



Map 2. Location of Monhegan Island in relation to Maine's coast, with the Test and Control Survey Quadrats shown in inset.

METHODS

At-sea surveys occurred within an area located three miles south of the island, consisting of a two-square mile section (5.18 km^2, centered at approximately N 43.719˚ W 69.333˚) further divided into two separate survey quadrats, one each for the "Test" and "Control" sites, designated as such by the DeepCwind Environmental Task group for all related monitoring activities. Map 2 Inset shows the Monhegan Test Site area and the generalized tracks used for conducting these surveys. To prevent confusion, the distinction of "Monhegan Test Site" refers to the full two-square mile area, and the smaller individual quadrats that lie within this larger area will be hereafter called the "Test" and "Control" sites, or quadrats.

Each quadrat covered a survey area of five square kilometers, thereby each totaled 55km^2, and transects were performed with the vessel running at an average speed of 8.6 knots (16 k/h) for approximately 1,800 m beginning in a N-S direction and documenting all birds, mammals, and other wildlife observed on both sides of the boat and out to a distance of 500 m. At the end of this run, surveying would stop and the boat would turn 90˚ along an E-W line and motor to the next waypoint located approximately 800 m away. After arriving at this next position and turning again 90˚, surveying would resume for the next 1,800 m as mentioned previously, heading in the N-S direction. This pattern was repeated a third time, driving an average linear distance of 7.3 kilometers. Immediately following the Test quadrat, the boat was repositioned in the Control area, located adjacent to and slightly to the north and west of the Test site, and the procedure was repeated.

Surveys were conducted aboard the F/V *Priscilla Earl*, a 38-ft Osmond Beal monohull boat used for lobster fishing and captained by Christina Cash. Observations were conducted from the stern using binoculars and unaided vision. Observations were made from a height of 1.6 m above sea level. All data were recorded into an RCA digital voice recorder, synchronized with time on a Garmin GPS unit that simultaneously logged the boat's tracks and waypoints at the beginning and end of each transect line. Codes used to document species behaviors and other observation and weather conditions followed Gould & Forsell (1989) and Tasker et al. (1984). Examples of common bird behaviors include but are not limited to sitting on the water, flying in direct and consistent headings, flying with changing directions, and feeding at the water's surface. See Appendix 1 for a complete list of behaviors although brief descriptions are provided below. Other information included flight height, estimated using unaided eye and recorded in single meters when under five meters high or otherwise compartmentalized into five meter bins (10, 15, 20, 25, etc.) up to 50 m. Observations were documented as "> 50 m" for all those above 50 m. The number of birds, species, gender and age (if known), and flight direction (see details below) were recorded. The data were transcribed into Excel and mapped with ArcMap 10.1 software.

Maps and tables summarize species and behaviors observed during the 11 pelagic surveys at the Deepwater Offshore Wind Monhegan Test Site during the 2013 survey period are provided. Appendix 1 explains the bird and other marine animal behavior (numerical) codes used in each survey day's summaries. Some of the most common behaviors documented (highlighted in Table 1) have lengthy definitions; therefore a shortened descriptive behavior term is used in the following summary sections.

Table 1. Example of most common codes used to document behaviors observed during transects (Gould & Forsell, 1989).

Bird Behavior
01 = Sitting on water
20 = Flying in direct and consistent heading
32 = Flying, following ship
35 = Flying, milling or circling (foraging)
48 = Flying, meandering
61 = Feeding at or near surface while flying (pattering)
65 = Feeding at surface (scavenging)
70 = Feeding below surface (pursuit diving)
Mammal & Fish Behavior
00 = Undetermined

These behavior types include the following: code #20, described as "flying in a direct and consistent heading" but hereafter shortened to "direct flight"; #35, described as "flying, milling or circling" which typically involves flight associated with foraging behavior and is erratic in height and location, hereafter called "milling"; #48, described as "flying, meandering" which involves indirect flight that changes direction but not necessarily height, hereafter called "meandering"; #61, described as "feeding at or near the surface while flying (dipping or pattering)" which typically describes scavenging or the act of picking food from the water's surface, hereafter called "dipping"; #65, described as "feeding at or near surface, not diving or flying (surface scavenging)" which differs from dipping in that the bird is sitting in the water while foraging, hereafter called "scavenging"; and #71, described as "feeding below surface (plunge diving)" which involves the bird plunging into the water from a defined height, as if to glean food under the water's surface, hereafter called "plunge diving." (In most cases, the bird that was recorded as plunge diving was previously flying either direct flight or milling, but after one plunge into the water, it was recorded once and repeated plunges were not typically observed due to the need to scan the horizon for other activities by birds and other wildlife as the transect continued.)

At the top of each survey days' section, a list of the species and numbers observed for that day, separated into Test and Control Quadrats, is presented. Appendix 2 provides a combined species total for the entire Monhegan Test Site, per square kilometer tally, number of observations in which they were recorded, and most common behavior observed. Four-letter species "alpha" codes are also used in the following tables to simplify table content. Species codes, common and scientific names are summarized in Table 3 (as well as Appendix 2 and Appendix 3) also providing dates on which each species were recorded. Flight directions, given in cardinal direction such as NE, SW, WNW, represent the direction in which the bird was flying at the time of observation.

The following sections will discuss each survey's results, grouped by location, starting with birds, and ending with other wildlife. Tables will present species numbers, locations, and each species' behaviors.

RESULTS

Surveys were conducted on 11 days from April through June 2013. Five surveys (45%) occurred in the morning hours and the remaining six (55%) occurred in the afternoon. Table 2 provides the breakdown of surveys by date, time of day, and weather conditions.

Table 2. Survey date, period, and weather conditions.

	DAY PERIOD		SEA CONDITION			
DATES	**AM**	**PM**	**Sea Height (ft)**	**Wind Dir**	**Wind (kt)**	**Sky**
April						
21		X	2 to 4	NNE	4	Clear
27	X		0.5 to 2	E	7	Clear
May						
2	X		0.5 to 2	ENE	8 to 15	Overcast
8		X	2 to 4	SE	5	Clear
14	X		2 to 4	NW	5	Partly Cloudy
19		X	4 to 5	E	10	Overcast
28	X		flat	S	3	Clear
June						
5		X	2 to 4	SSW	11	Clear
15		X	2 to 4	SW	13	Clear
16	X		2 to 4	SW	5 to 10	Clear
26		X	Flat to 1	E	1 to 3	Partly Foggy

The vast majority of the days provided favorable weather. Winds on average were light, with seven surveys averaging winds around five knots (~9.3 kph) and the remaining four surveys had winds from 10 to 15 knots (18.5 to 27.8kph). Five of the survey days had winds coming from a southerly direction (such as SSW, SW, SE, or S), five surveys were winds of a combination of E and N (NNE, ENE, and E), and only one day had winds from the NW.

Table 3 provides all species recorded and on which date, with the four-letter species code and scientific names for reference. Among the 21 bird species identified, which included 608 individual birds counted, only three definite State Threatened (MESA) or Birds of Conservation Concern (BCC; BCC 2008) species were observed: five razorbills (*Alca torda*; RAZO), five Atlantic puffin (*Fractercula arctica*; ATPU), and one great shearwater (*Puffinus gravis*; GRSH). However, six unidentified terns were recorded that may or may not include the Arctic tern (*Sterna hirundo*; ARTE), as well as 11 unidentified alcids that may or may not include the razorbill or Atlantic puffin, that are also listed as state threatened species under MESA. To prevent confusion, when these four species are discussed as a group of species warranting conservation concern, they will be collectively called Species of Conservation Concern, or SCC, and will include the state threatened species as well as BCC.

One gray seal (*Halichoerus gypus*), two harbor seals (*Phoca vitulina*), and 16 harbor porpoise (*Phocoena phocoena*) were also noted during these surveys. For a more complete summary of species, refer to Appendices 2, 3, and 4, which include abundances, behaviors, common and scientific names, the time of day observed, and numbers of each species, by date.

Table 3. All observed species with code, common name, scientific name, and dates sighted.

			April		May					June			
Species code	**Common name**	**Scientific name**	**21**	**27**	**2**	**8**	**14**	**19**	**28**	**5**	**15**	**16**	**26**
ATPU*	Atlantic puffin	*Fratercula arctica*					X			X		X	X
BLGU	Black guillemot	*Cepphus grylle*	X						X				
BLSC	Black scoter	*Melanitta nigra*		X									
COEI	Common eider	*Somateria mollissima*		X		X							
COLO	Common loon	*Gavia immer*		X	X	X	X	X				X	
COMU	Common murre	*Uria aalge*	X		X								
COTE	Common tern	*Sterna paradiseae*											X
DCCO	Double-crested cormorant	*Phalacrocorax auritus*			X		X		X				X
GBBG	Great black-backed gull	*Larus marinus*			X				X	X	X	X	
GRSH*	Great shearwater	*Puffinus gravis*										X	
RNGR	Red-necked grebe	*Podiceps grisegena*		X									
HAWK	Unidentified hawk species										X		
HERG	Herring gull	*Larus argentatus*	X	X	X	X	X	X	X	X	X	X	X
LAGU	Laughing gull	*Larus atricilla*			X			X	X	X	X	X	
NOGA	Northern gannet	*Morus bassanus*	X	X	X	X	X	X	X	X	X	X	
RAZO*	Razorbill	*Alca torda*		X	X				X				
SOSH	Sooty shearwater	*Puffinus griseus*								X			
SUSC	Surf scoter	*Melanitta perspicillata*	X	X			X						
UNAL*	Unidentified alcid		X		X			X					
UNTE*	Unidentified tern	*Sterna sp.*									X	X	
WISP	Wilson's storm-petrel	*Oceanites oceanicus*											X
GrayS	Gray seal	*Halichoerus gypus*	X										
HAPO	Harbor porpoise	*Phocoena phocoena*		X					X				X
Hseal	Harbor seal	*Phoca vitulina*							X				
FISH	Bait fish species								X				

*Red text indicates SCC, or potential SCC.

APRIL 21, 2013 AFTERNOON SURVEY (14:50 PM)

Table 4. Numbers of species observed during the afternoon survey of April 21st.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Grand Total**
Black guillemot		2	2
Common murre	1		1
Herring gull	1	4	5
Northern gannet		1	1
Surf scoter	2		2
Unidentified alcid*		7	7
Gray seal		1	1
Grand Total	**4**	**15**	**19**
Spp/km^2	**0.07**	**0.27**	**0.17**

*Indicates a SCC, or potential SCC

Table 5. Test Quadrat species, behavior code, and flight height, on April 21st.

Behavior	**20**		**32**	
Height (m)	**1**	**2**	**10**	**Total**
COMU		1		1
HERG			1	1
SUSC	2			2
Total	**2**	**1**	**1**	

On April 21st, conditions were rated as "Maximum" with seas averaging between two to four feet (0.6 to 1.2m), with winds from the NNE at four knots and a clear sky. Map 3 shows the general survey tracklines with the location and number of animals recorded. The Test Quadrat is in the lower right location and the Control Quadrat is in the upper left. Twenty-two percent of all birds were observed in the Test Quadrat.

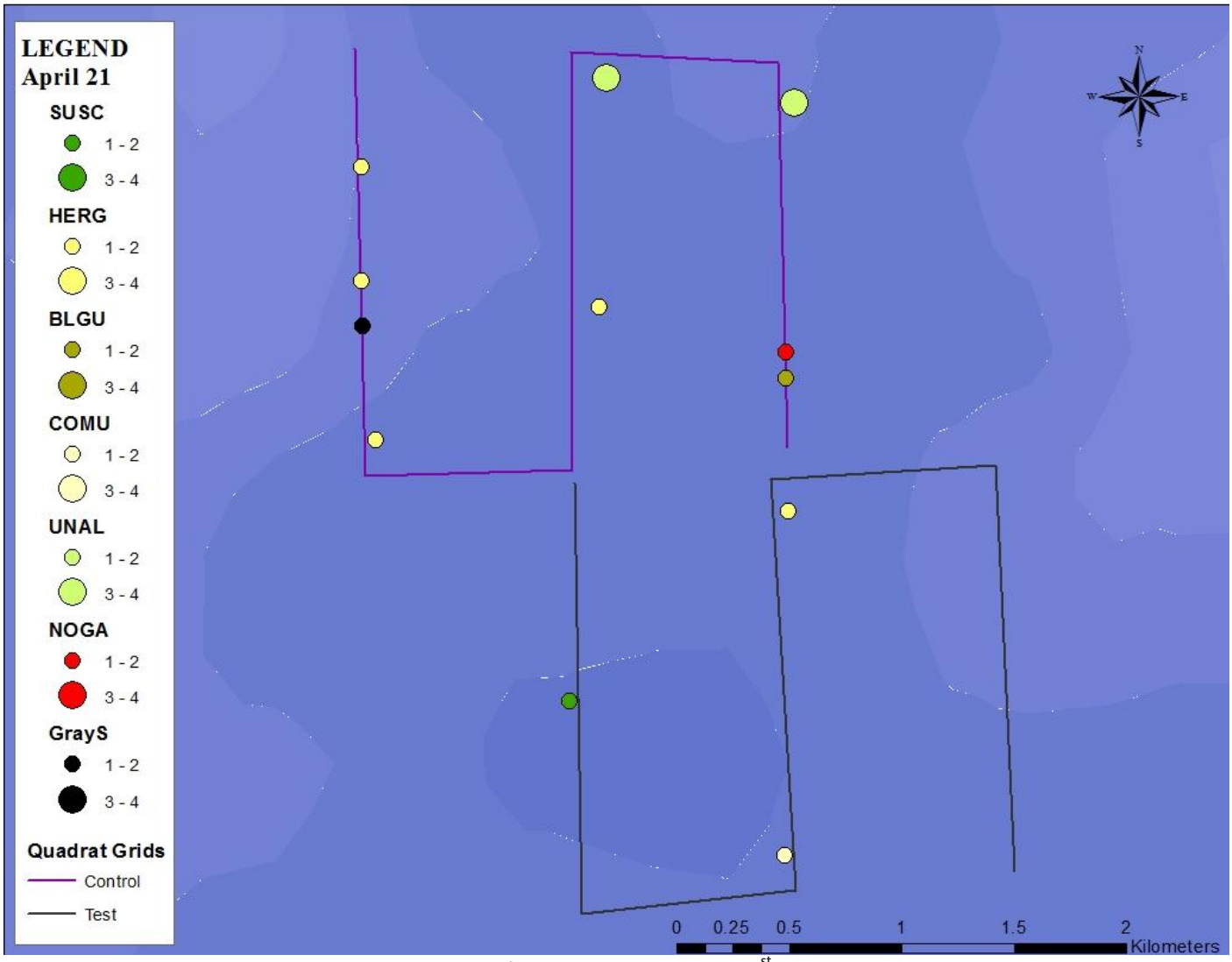
Test Quadrat

Of the four identified bird species within the Test Quadrat, one was a common murre (*Uria aalge;,* COMU), one herring gull (*Larus argentatu;,* HERG), and one observation of a pair of surf scoters (*Melanitta perspicillata;* SUSC) (Table 4) consisting of a male and female flying low to the ENE.

Table 5 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. The COMU and two SUSC flew direct at only one meter above the water, whereas the one HERG flew at 10m while following our survey vessel.

Control Quadrat

Of the four species of birds observed in the Control Quadrat, 50% were unidentified alcids (UNAL), 29% were HERG, and 14% consisted of the two black guillemots (*Cepphus grylle*) (Table 4). Only one northern gannet (*Morus bassanus*; NOGA) and one gray seal was recorded.



Map 3. Wildlife observations on April 21st.

Ninety-three percent of the bird behavior involved direct flight, with another incident of a HERG following our survey vessel at 10m (Table 6). The BLGU, NOGA, and all seven UNAL flew at one meter flying direct. One HERG flew direct at 10m and two others flew at 15m.

Table 6. Control Quadrat species, behavior code, and flight height, on April 21st.

Behavior	20			32	
Height (m)	1	10	15	10	Total
BLGU	2				2
HERG		1	2	1	4
NOGA	1				1
UNAL*	7				7
Total	10	1	2	1	14

*Indicates a SCC, or potential SCC

APRIL 27, 2013 MORNING SURVEY (10:30 AM)

Table 7. Numbers of species observed during the morning survey of April 27th.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Grand Total**
Black scoter	2		2
Common eider	9		9
Common loon	1		1
Herring gull	7	5	12
Northern gannet	5		5
Razorbill*		2	2
Red-necked grebe		6	6
Surf scoter		19	19
Harbor porpoise		1	1
Grand Total	**24**	**33**	**57**
Spp/km²	**0.44**	**0.6**	**0.52**

*Indicates a SCC, or potential SCC

Table 8. Test Quadrat species, behavior code, and flight height, on April 27th.

Behavior	**20**				**32**			**35**	
Height (m)	**1**	**5**	**10**	**15**	**1**	**5**	**15**	**30**	**Total**
BLSC		2							2
COEI		9							9
COLO			1						1
HERG	1			1	1	1	2	1	7
NOGA			5						5
Total	**1**	**11**	**6**	**1**	**1**	**1**	**2**	**1**	**24**

On April 27th, conditions were rated as "Maximum" with seas averaging between one half to two feet (0.15 to 0.6m), with winds from the East at seven knots and a clear sky. Twenty-two percent of all birds were observed in the Test Quadrat. Only one marine mammal was observed on this survey day, located in the Control Quadrat (Map 4).

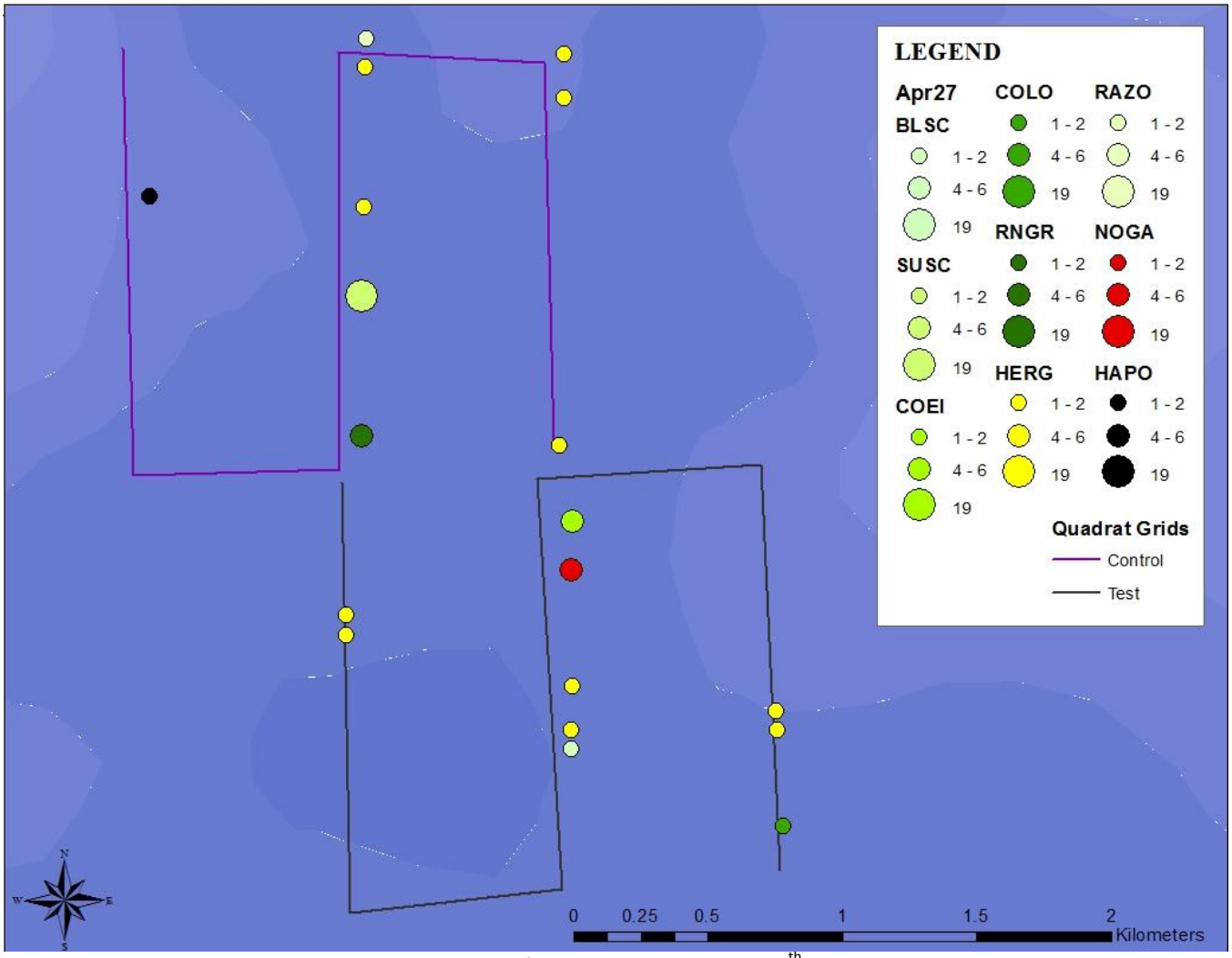
Test Quadrat

Of the five identified bird species within the Test Quadrat, 38% were common eider (*Somateria mollissima;* COEI), and 29% were HERG, followed by 21% of the birds being NOGA (Table 7). A pair of black scoter (*Melanitta nigra*; BLSC) was observed flying together at five meters heading WSW, and a single common loon (*Gavia immer;* COLO) flew 10m high, heading NNE.

Table 8 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. All of the sea ducks (BLSC and COEI) flew direct at five meters above the water, whereas the one COLO and all five NOGA flew direct at 10m. Herring gulls were observed flying direct at one meter, milling at 30m, and four birds followed our survey vessel from one to 15m.

Control Quadrat

Of the four species of birds observed in the Control Quadrat, 59% were Surf scoters, 19% were red-necked grebes (*Podiceps grisegena*; RNGR), and 16% were HERG (Table 7). The pair of razorbills were observed sitting together in the water. Only one harbor porpoise was recorded in this quadrat.



Map 4. Wildlife observations on April 27th.

Ninety-one percent of the bird behavior involved direct flight, which involved all six RNGR flying at five meters and all 19 of the SUSC flying at one meter (Table 9). All of the HERG flew direct, with heights from five to 15m, and another single HERG flew at one meter while following our survey vessel.

Table 9. Control Quadrat species, behavior code, and flight height, on April 27th.

Behavior	1	20				32	
Height (m)	0	1	5	10	15	1	Total
HERG			1	1	2	1	5
RAZO*	2						2
RNGR			6				6
SUSC		19					19
Total	2	19	7	1	2	1	32

*Indicates a SCC, or potential SCC

MAY 2, 2013 MORNING SURVEY (8:39 AM)

Table 10. Numbers of species observed during the morning survey of May 2nd.

	QUADRAT		
SPECIES	TEST	CONTROL	Grand Total
Common loon	4	3	7
Common murre		4	4
Double-crested cormorant		17	17
Great black-backed gull	1	1	2
Herring gull	56	10	66
Laughing gull	1		1
Northern gannet	5		5
Razorbill*		2	2
Unidentified alcid*		3	3
Grand Total	**67**	**40**	**107**
Spp/km^2	**1.22**	**0.73**	**0.97**

*Indicates a SCC, or potential SCC

Table 11. Test Quadrat species, behavior code, and flight height, on May 2nd.

Behavior	1	20			32	35	48		
Height (m)	0	1	5	10	5	5	5	10	Total
COLO			3	1					4
GBBG	1								1
HERG	47		3	1	1	2	1	1	56
LAGU			1						1
NOGA		3	1	1					5
Total	**48**	**3**	**8**	**3**	**1**	**2**	**1**	**1**	**67**

On May 2nd, conditions were rated as "Maximum" with seas averaging between one-half to two feet (0.15 to 0.6m), with winds from the ENE, starting at eight knots but finishing with 15kts, and an overcast sky. Sixty-three percent of all birds were observed in the Test Quadrat; however 84% of these birds were HERG. No marine mammals were observed on this day (Map 5).

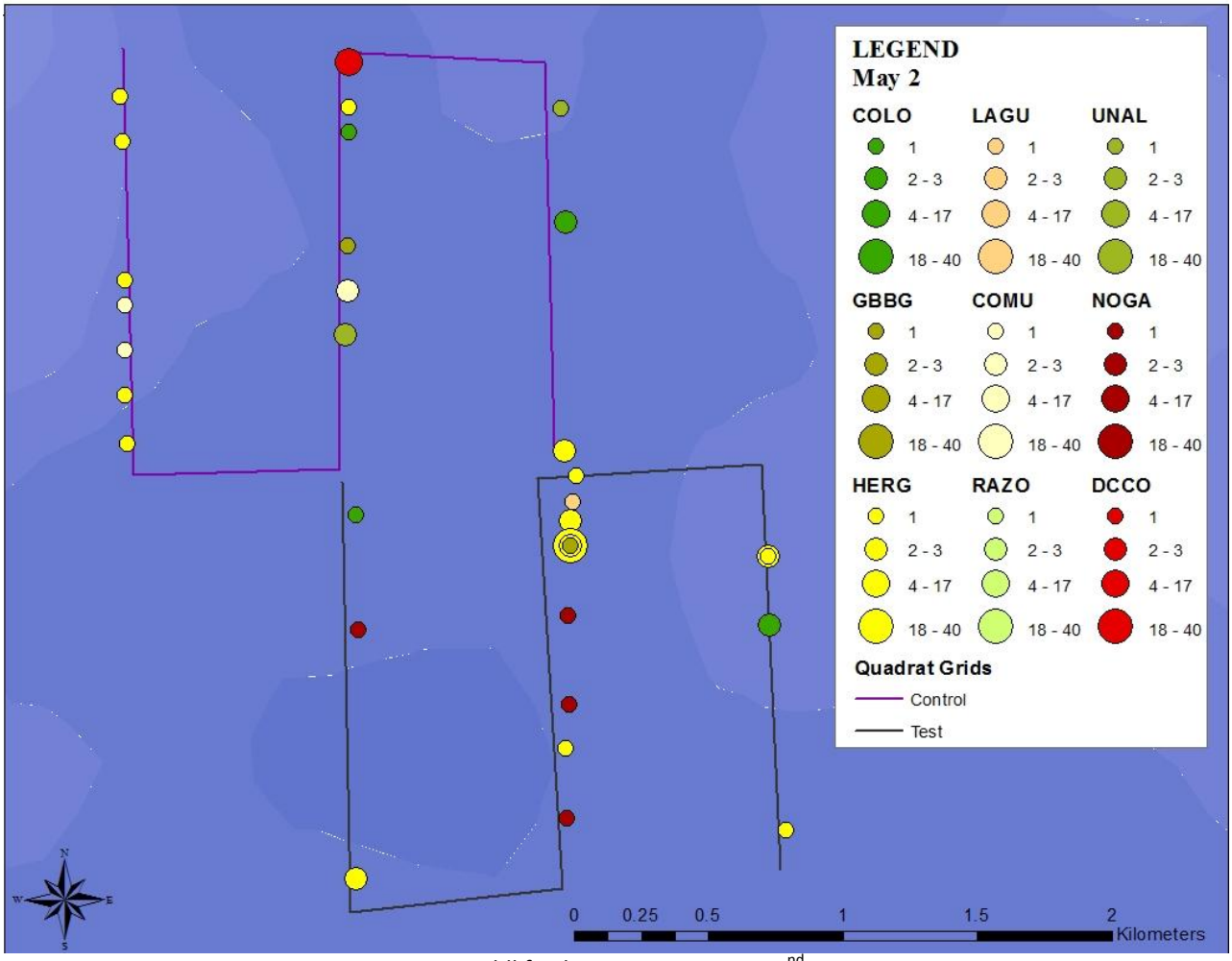
Test Quadrat

Of the five identified bird species within the Test Quadrat, 84% were HERG, and seven percent were NOGA, followed by six percent of the birds being COLO (Table 10). Only one great black-backed gull (*Larus marinus*; GBBG) and one laughing gull (*L. atricilla*; LAGU) was observed.

Table 11 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. Three COLO flew direct in one flock at five meters, and another individual flew at 10m in another observation. All five NOGA flew direct at heights from one to 10m, and the one LAGU flew direct at five meters. Forty-three of the 47 total HERG recorded in this quadrat involve one large flock of 43 HERG and one sitting GBBG aggregated around a working lobster boat. Also, the two milling HERG at five meters were in close vicinity of the lobster boat. Again, one HERG followed our survey vessel while flying at five meters.

Control Quadrat

Of the seven species of birds observed in the Control Quadrat, 43% were double-crested cormorants (*Phalacrocorax auritus;* DCCO), 25% were HERG, and 10% were COMU (Table 10). Of the alcids, two razorbills, three COMU, and three unidentified alcids were all observed flying direct, but all in varying directions. Two of the three COLO flew together direct to the NE at one meter.



Map 5. Wildlife observations on May 2nd.

Eighty percent of the bird behavior involved direct flight. This involved all 17 DCCO flying at five meters, all three unidentified alcids flying at one meter, all two RAZO flying at three meters, and the one GBBG at 10m (Table 12). One COMU was sitting and three others flew direct at one meter. Two of the COLO flew at one meter and one was at 10m. Six of the HERG followed our survey vessel, from one to 10m high, but three flew direct at 10 and 15m, with one meandering at one meter.

Table 12. Control Quadrat species, behavior code, and flight height, on May 2nd.

Behavior	1	20					32			48	
Height (m)	0	1	3	5	10	15	1	5	10	1	Total
COLO		2			1						3
COMU	1	3									4
DCCO				17							17
GBBG					1						1
HERG					2	1	4	1	1	1	10
RAZO*			2								2
UNAL*		3									3
Total	**1**	**8**	**2**	**17**	**4**	**1**	**4**	**1**	**1**	**1**	**40**

*Indicates a SCC, or potential SCC

MAY 8, 2013 AFTERNOON SURVEY (12:05 PM)

Table 13. Numbers of species observed during the afternoon survey of May 8th.

	QUADRAT		
Row Labels	**TEST**	**CONTROL**	**Grand Total**
Common eider		23	23
Common loon		3	3
Herring gull	65	5	70
Northern gannet	3	3	6
Grand Total	**68**	**34**	**102**
Spp/km^2	**1.24**	**0.62**	**0.93**

Table 14. Test Quadrat species, behavior code, and flight height, on May 8th.

Behavior	**1**	**20**			**32**	**35**	**65**	
Height (m)	**0**	**1**	**5**	**10**	**5**	**10**	**0**	**Total**
HERG	2	10	5	1	1	1	45	65
NOGA			1	2				3
Total	**2**	**10**	**6**	**3**	**1**	**1**	**45**	**68**

On May 8th, conditions were rated as "Maximum" with seas averaging between two to four feet (0.6 to 1.2m), with winds from the SE at five knots, and a clear sky. Sixty-seven percent of all birds were observed in the Test Quadrat; however 96% of these birds were HERG. No marine mammals were observed on this day (Map 6).

Test Quadrat

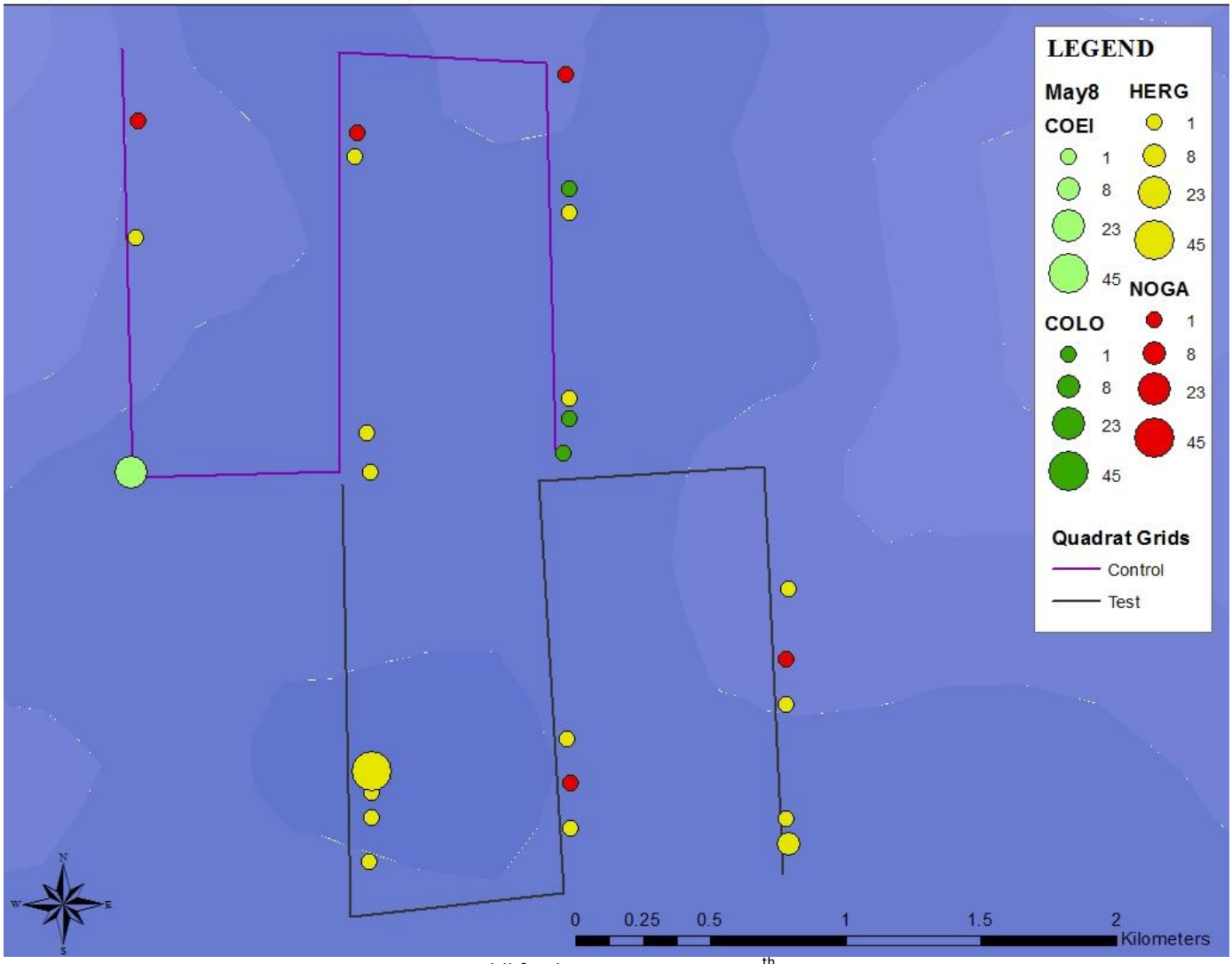
Of the two identified bird species within the Test Quadrat, 96% were HERG, and the remaining three birds were NOGA (Table 13).

Table 14 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. All three NOGA flew direct at heights from five to 10m. All 45 HERG were scavenging (feeding while sitting in the water) in one observation associated with a working lobster boat. Again, one HERG followed our survey vessel while flying at five meters, one HERG milled at 10m, and two separate HERG were recorded as sitting in the water.

Control Quadrat

Of the four species of birds observed in the Control Quadrat, 68% were COEI, 15% were HERG, three COLO (9%) and three NOGA (9%) (Table 13).

Eighty-eight percent of the bird behavior involved direct flight, which involved one large flock of 23 COEI flying at one meter and three COLO flying from five to 15m (Table 15). Three of the HERG flew direct from 10 to 15m, and another gull followed our survey vessel at 10m. A total of three NOGA were seen sitting in the water, flying direct at one meter, and meandering at 10m.



Map 6. Wildlife observations on May 8th.

Table 15. Control Quadrat species, behavior code, and flight height, on May 8th.

Behavior	1	20				32	48	65	
Height	0	1	5	10	15	10	10	0	Total
COEI		23							23
COLO			1	1	1				3
HERG				1	2	1		1	5
NOGA	1	1					1		3
Total	1	24	1	2	3	1	1	1	34

MAY 14, 2013 MORNING SURVEY (9:22 AM)

Table 16. Numbers of species observed during the morning survey of May 14th .

	QUADRAT		
SPECIES	TEST	CONTROL	Grand Total
Atlantic puffin*	1		1
Common loon	2		2
Double-crested cormorant	1		1
Herring gull	11	3	14
Northern gannet		2	2
Surf scoter	7		7
Grand Total	**22**	**5**	**27**
Spp/km²	**0.4**	**0.09**	**0.25**

*Indicates a SCC, or potential SCC

Table 17. Test Quadrat species, behavior code, and flight height, on May 14th.

Behavior	1	20		29	32	48	61	65	
Height (m)	0	1	5	<5	10	5	5	0	Total
ATPU*	1								1
COLO		2							2
DCCO		1							1
HERG	2	2	1	2	1	1	1	1	11
SUSC		7							7
Total	**3**	**12**	**1**	**2**	**1**	**1**	**1**	**1**	**22**

*Indicates a SCC, or potential SCC

On May 14th, conditions were rated from "Good" to "Maximum" due to seas averaging between two to four feet (0.6 to 1.2m), with an average of a three foot swell. Winds were from the NW around five knots and the partly cloudy sky created a glare which added to the reduction in survey condition rating. Eighty-one percent of all birds were observed in the Test Quadrat. No marine mammals were observed on this day (Map 7).

Test Quadrat

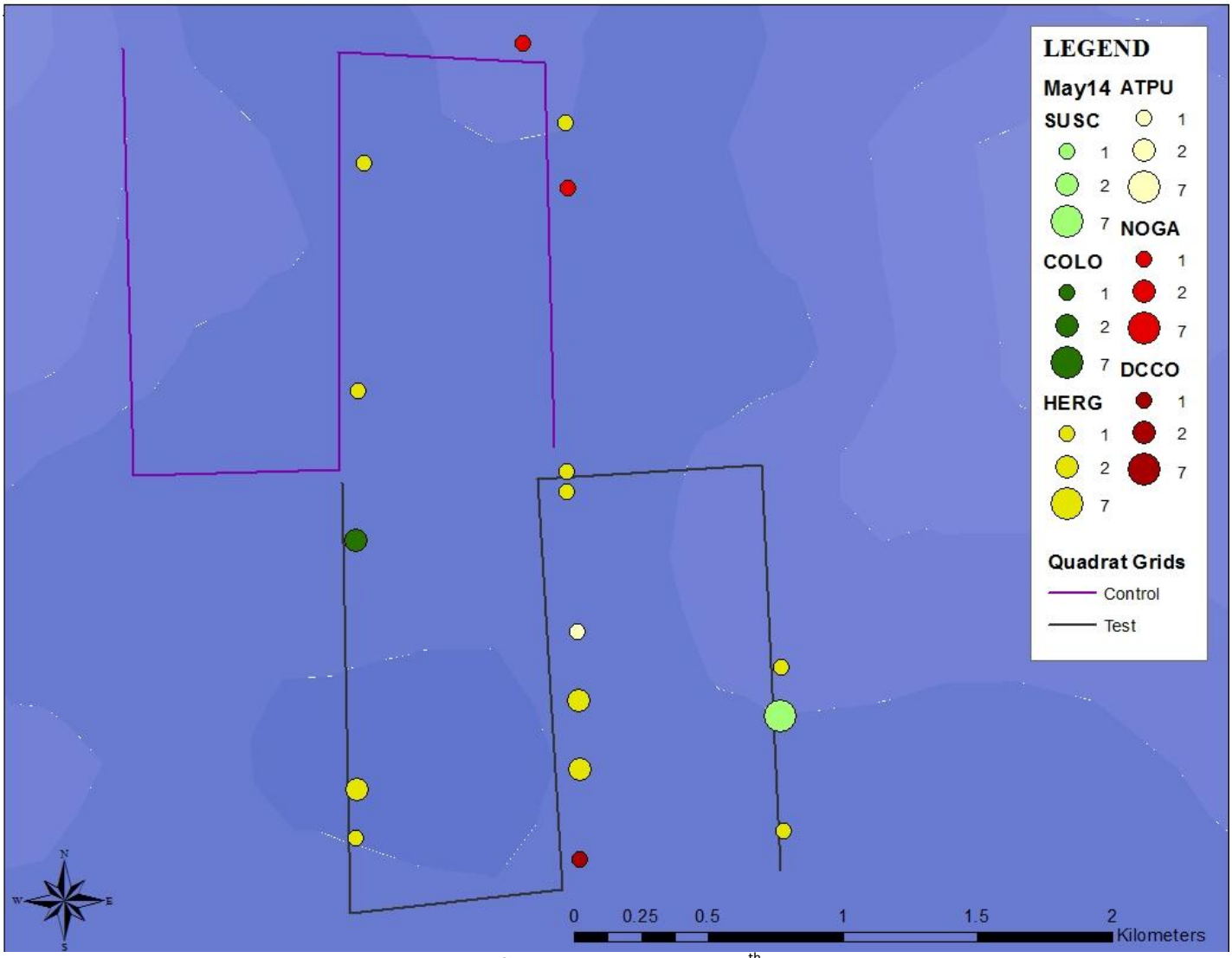
Of the five identified bird species within the Test Quadrat, 50% were HERG, and 32% were SUSC (Table 16). Two COLO, one ATPU, and one DCCO were also observed.

Table 17 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. Fifty-nine percent of the birds flew direct, which included a single flock of seven SUSC flying at one meter heading SW. Two COLO and one DCCO flew direct one meter. The one puffin of undetermined age was sitting in the water. The 11 HERG displayed a range of behaviors that included sitting in the water, flying direct and flying with variable heights, meandering at five meters, foraging while flying at five meters, and sitting while eating. Also, one HERG followed our survey vessel while flying at 10m.

Control Quadrat

Of the two species of birds observed in the Control Quadrat, 60% were HERG, and the remaining two birds were NOGA (Table 15).

Eighty percent of the bird behavior involved direct flight, which involved both of the NOGA flying at 15m and two of the three HERG flew at one meter (Table 17). One HERG was observed sitting in the water.



Map 7. Wildlife observations on May 14th.

Table 17. Control Quadrat species, behavior code, and flight height, on May 14th.

Behavior	**1**	**20**		
Height (m)	**0**	**1**	**15**	**Total**
HERG	1	2		3
NOGA			2	2
Total	**1**	**2**	**2**	**5**

MAY 19, 2013 AFTERNOON SURVEY (12:19 PM)

Table 19. Numbers of species observed during the afternoon survey of May 19th.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Grand Total**
Common loon	5	2	7
Herring gull	10	8	18
Laughing gull		3	3
Northern gannet		8	8
Unidentified alcid*	1		1
Grand Total	**16**	**21**	**37**
Spp/km²	**0.29**	**0.38**	**0.34**

*Indicates a SCC, or potential SCC

Table 20. Test Quadrat species, behavior code, and flight height, on May 19th.

Behavior	**20**				**32**	**35**		**48**		
Height (m)	**1**	**5**	**10**	**20**	**5**	**1**	**10**	**5**	**15**	**Total**
COLO	3	2								5
HERG		1	1	1	2	2	1	1	1	10
UNAL*	1									1
Total	**4**	**3**	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**16**

*Indicates a SCC, or potential SCC

On May 19th, conditions were rated as "Average" with seas between four to five feet (1.2 to 1.5m), with winds from the East at 10kts, and an overcast sky that created a low to medium glare. Forty-three percent of all birds were observed in the Test Quadrat; however 63% of these birds were HERG. No marine mammals were observed on this day (Map 8).

Test Quadrat

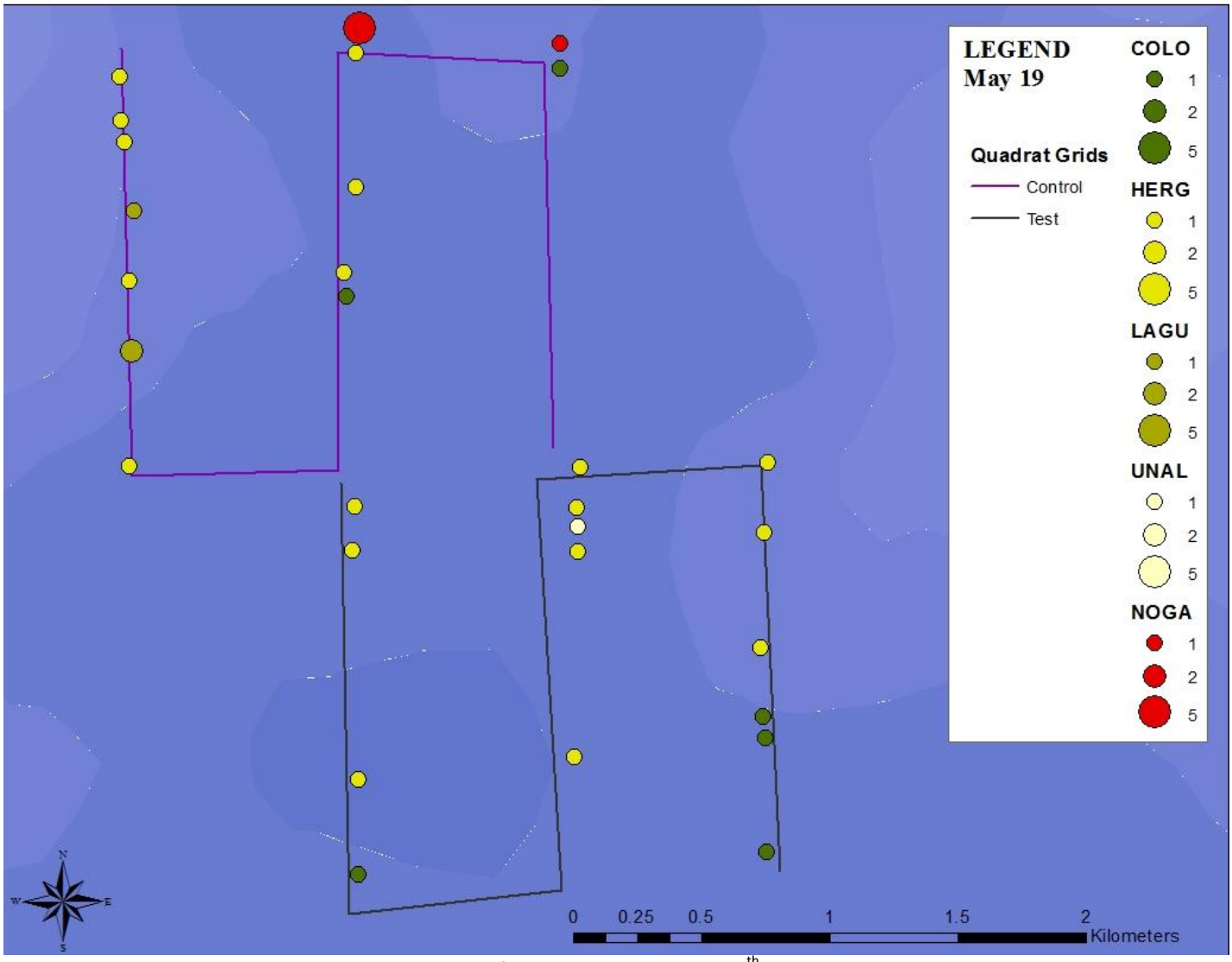
Of the three identified bird species within the Test Quadrat, 63% were HERG, five were COLO (31%), and one unidentified alcid flew by at one meter (Table 19).

Table 20 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. All five COLO flew direct at heights from one to five meters. Three HERG flew direct at heights from five to 20m, three milled from one to 10m, and two meandered at five and 15m. Two HERG followed our survey vessel at five meters.

Control Quadrat

Of the four species of birds observed in the Control Quadrat, 68% were COEI, 15% were HERG, three COLO (9%) and three NOGA (9%) (Table 19).

Only 43% of the bird behavior involved direct flight, with 38% involving milling flight (Table 21). Two COLO flew direct at one meter and one at five meters. Two LAGU flew direct at 10m and another LAGU pattered (flew while foraging) at five meters. Seven NOGA milled at five and 10m, whereas only one HERG milled at one meter. Two HERG meandered while at 10m and the remaining HERG flew direct at flight heights from one to 25m.



Map 8. Wildlife observations on May 19th.

Table 21. Control Quadrat species, behavior code, and flight height, on May 19th.

Behavior	1	20					35			48	61	
Height (m)	0	1	5	10	15	25	1	5	10	10	5	Total
COLO		1	1									2
HERG		1	2		1	1	1			2		8
LAGU				2							1	3
NOGA	1							2	5			8
Total	**1**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**5**	**2**	**1**	**21**

MAY 28, 2013 MORNING SURVEY (9:40 PM)

Table 22. Numbers of species observed during the morning survey of May 28th.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Total**
Black guillemot	1		1
Double-crested cormorant	3		3
Great black-backed gull	7	2	9
Herring gull	5	13	18
Laughing gull	2	4	6
Northern gannet	10	7	17
Razorbill*	1		1
Harbor porpoise		5	5
Harbor seal	3		3
Fish	1		1
Grand Total	**32**	**31**	**63**
Spp/km^2	**0.58**	**0.56**	**0.57**

*Indicates a SCC, or potential SCC

Table 23. Test Quadrat species, behavior code, and flight height, on May 28th.

Behavior	**1**	**20**					**35**	**48**	**65**	**71**	
Height (m)	**0**	**1**	**2**	**5**	**10**	**20**	**10**	**1**	**5**	**15**	**Total**
BLGU		1									1
DCCO		3									3
GBBG	4		1	1					1		7
HERG	1				1	2		1			5
LAGU	2										2
NOGA	6			1	1		1			1	10
RAZO*	1										1
Total	**14**	**4**	**1**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**29**

*Indicates a SCC, or potential SCC

On May 28th, conditions were rated as "Maximum" with flat calm seas, very light winds from the south at three knots, and clear skies. Fifty percent of all birds were observed in the Test Quadrat. Two species of marine mammal and bait fish were observed during this survey day, found only in the Test Quadrat (Map 9).

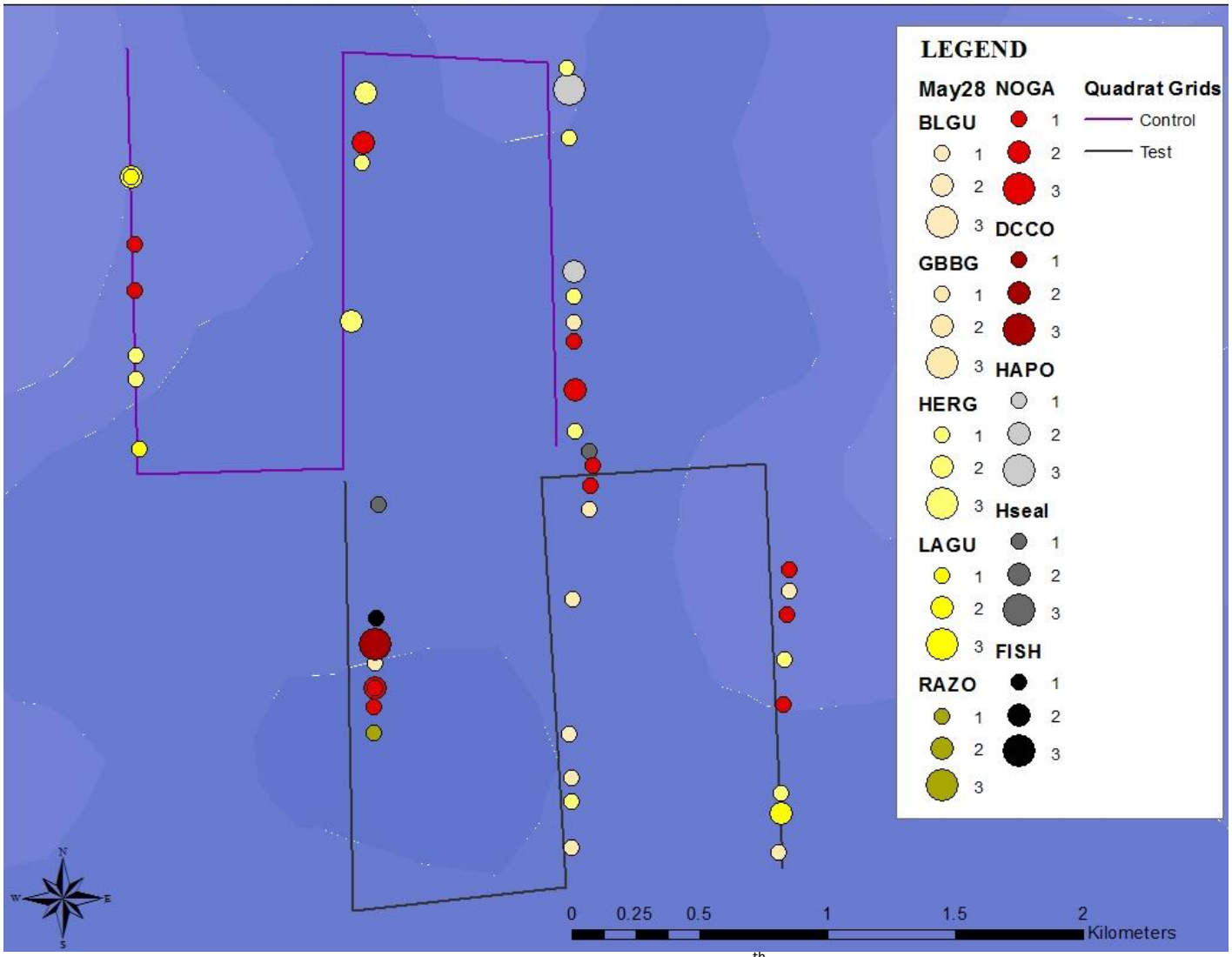
Test Quadrat

Of the seven bird species within the Test Quadrat, 34% were NOGA, 24% were GBBG, and only 17% were HERG (Table 22). Two alcid species, one BLGU and one RAZO, were also observed. Three harbor seals were recorded, as well as a distinct schooling mass of bait fish just under the water's surface.

Table 23 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. Forty-eight percent of the behaviors involved sitting birds of various species, potentially correlated to the bait fish present in this Quadrat. Thirty-eight percent of the birds were flying direct, including the one BLGU and three DCCO, all at one meter, two GBBG flying from two to five meters, and two NOGA flying at five and 10m. One NOGA also milled at 10m, one HERG meandered at one meter, one GBBG fed while sitting in the water after landing from five meters, and one NOGA plunge dived from a height of 15m.

Control Quadrat

Of the four species of birds observed in the Control Quadrat, 50% were HERG, 27% were NOGA, four LAGU, and two GBBG (Table 22). Five harbor porpoise were observed in two separate pods of two and three, respectively.



Map 9. Wildlife observations on May 28th.

Sixty-nine percent of the bird behavior involved direct flight (Table 24). Four HERG and two NOGA were sitting on the water, with two other NOGA plunge diving from a height of 10m, and three gannets flying direct at heights of one and five meters. All four LAGU flew direct from 10-15m and the two GBBG also flew direct at 10 and 15m. The HERG flew from heights of 10m up to 30m.

Table 24. Control Quadrat species, behavior code, and flight height, on May 28th.

Behavior	**1**		**20**						**71**	
Height (m)	**0**	**1**	**1**	**5**	**10**	**15**	**20**	**30**	**10**	**Total**
GBBG					1	1				2
HERG	2	2			3	3	2	1		13
LAGU					3	1				4
NOGA	2		1	2					2	7
Total	**4**	**2**	**1**	**2**	**7**	**5**	**2**	**1**	**2**	**26**

JUNE 5, 2013 AFTERNOON SURVEY (2:29 PM)

Table 25. Numbers of species observed during the afternoon survey of June 5th.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Total**
Atlantic puffin*		1	1
Great black-backed gull	2	2	4
Herring gull	11	8	19
Laughing gull	2	2	4
Northern gannet	9	4	13
Sooty shearwater	1		1
Grand Total	**25**	**17**	**42**
Spp/km²	**0.45**	**0.31**	**0.38**

*Indicates a SCC, or potential SCC

Table 26. Test Quadrat species, behavior code, and flight height, on June 5th.

Behavior	**1**	**20**			**32**		**35**				**48**		**71**		
Height (m)	**0**	**1**	**10**	**15**	**5**	**10**	**1**	**5**	**10**	**30**	**1**	**5**	**5**	**10**	**Total**
GBBG				1				1							2
HERG			1	1	1	2		2		1		3			11
LAGU	1										1				2
NOGA	3	1					1		1		1		1	1	9
SOSH											1				1
Total	**4**	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**1**	**1**	**3**	**3**	**1**	**1**	**25**

On June 5th, conditions were rated as "Maximum" with two to four foot seas (0.6 to 1.2m), winds from the SSW at 11kts, and clear skies. Sixty percent of all birds were observed in the Test Quadrat. No marine mammals were observed on this survey day.

Test Quadrat

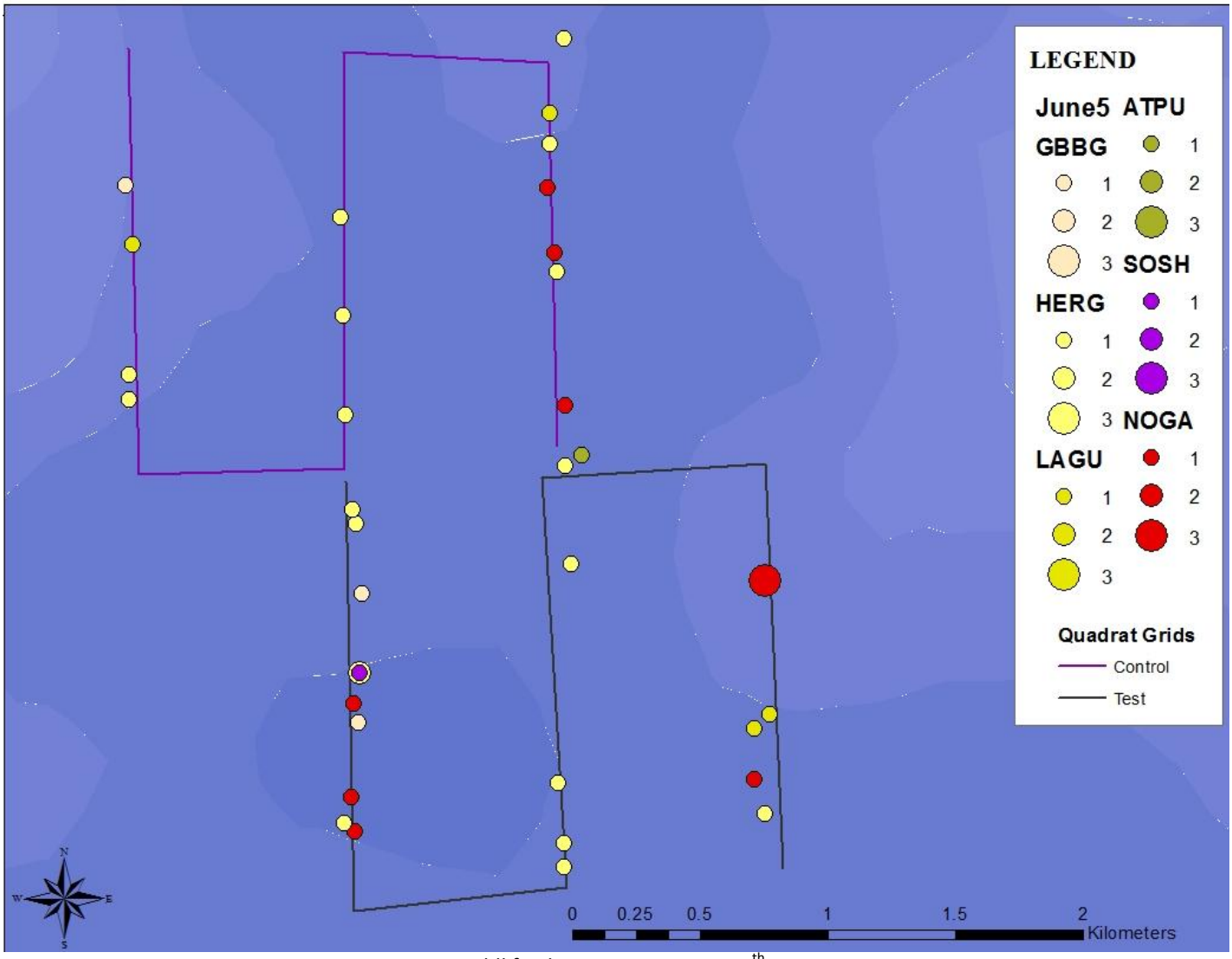
Of the five bird species within the Test Quadrat and 44% were HERG (Table 25). Two GBBG and two LAGU were observed, but also the only sooty shearwater (*Puffinus griseus;* SOSH) of the season was recorded in this Test Quadrat on this day.

Table 26 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. All species showed a wide variation of behaviors, with almost similar distributions among milling and meandering, followed by direct flight. Recorded in one particular location during this survey, two NOGA plunge dived from five and 10m, one GBBG milled at five meters, two HERG milled at five meters, and the one SOSH meandered by this feeding activity, as seen in Map 10.

Control Quadrat

Of the five species of birds observed in the Control Quadrat, 47% were HERG, 24% were NOGA, two LAGU, two GBBG, and one ATPU (Table 25).

Fifty-three percent of the bird behavior involved direct flight (Table 27). The ATPU flew direct at one meter to the SE, and was identified as an adult. One GBBG flew direct at 30m and one milled at five meters, whereas the two LAGU flew direct, one at one meter and one at 20m. The four NOGA each displayed a different behavior: direct flight at one meter, milling at five meters, meandering at 10m, and plunge diving from 20m.



Map 10. Wildlife observations on June 5th.

Table 27. Control Quadrat species, behavior code, and flight height, on June5th.

Behavior	1	20					35		48		71	
Height (m)	0	1	5	10	20	30	5	20	5	10	20	Total
ATPU*		1										1
GBBG						1	1					2
HERG	1	2	1	1			1	1	1			8
LAGU		1			1							2
NOGA		1					1			1	1	4
Total	1	5	1	1	1	1	3	1	1	1	1	17

*Indicates a SCC, or potential SCC

JUNE 15, 2013 AFTERNOON SURVEY (4:57 PM)

Table 28. Numbers of species observed during the afternoon survey of June 15th.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Grand Total**
Great black-backed gull	4	1	5
Unidentified hawk		1	1
Herring gull	11	12	23
Laughing gull	1	4	5
Northern gannet	1	2	3
Unidentified tern		1	1
Grand Total	**17**	**21**	**38**
Spp/km^2	**0.31**	**0.38**	**0.35**

*Indicates a SCC, or potential SCC

Table 29. Test Quadrat species, behavior code, and flight height, on June 15th.

Behavior	**1**	**20**				**29**		**32**		**48**	
Height (m)	**0**	**1**	**5**	**10**	**15**	**5**	**<5**	**1**	**5**	**1**	**Total**
GBBG	1	1	1				1				4
HERG	2	2	1	2	1	2		1	1		12
LAGU			1								1
NOGA										1	1
Total	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**18**

On June 15th, conditions were rated as “Good” to "Excellent" with seas between two to four feet (0.6 to 1.2m), with winds from the SW at 13kts, and a clear sky that created a medium glare. Forty-five percent of all birds were observed in the Test Quadrat; however 65% of these birds were HERG. No marine mammals were observed on this day (Map 11).

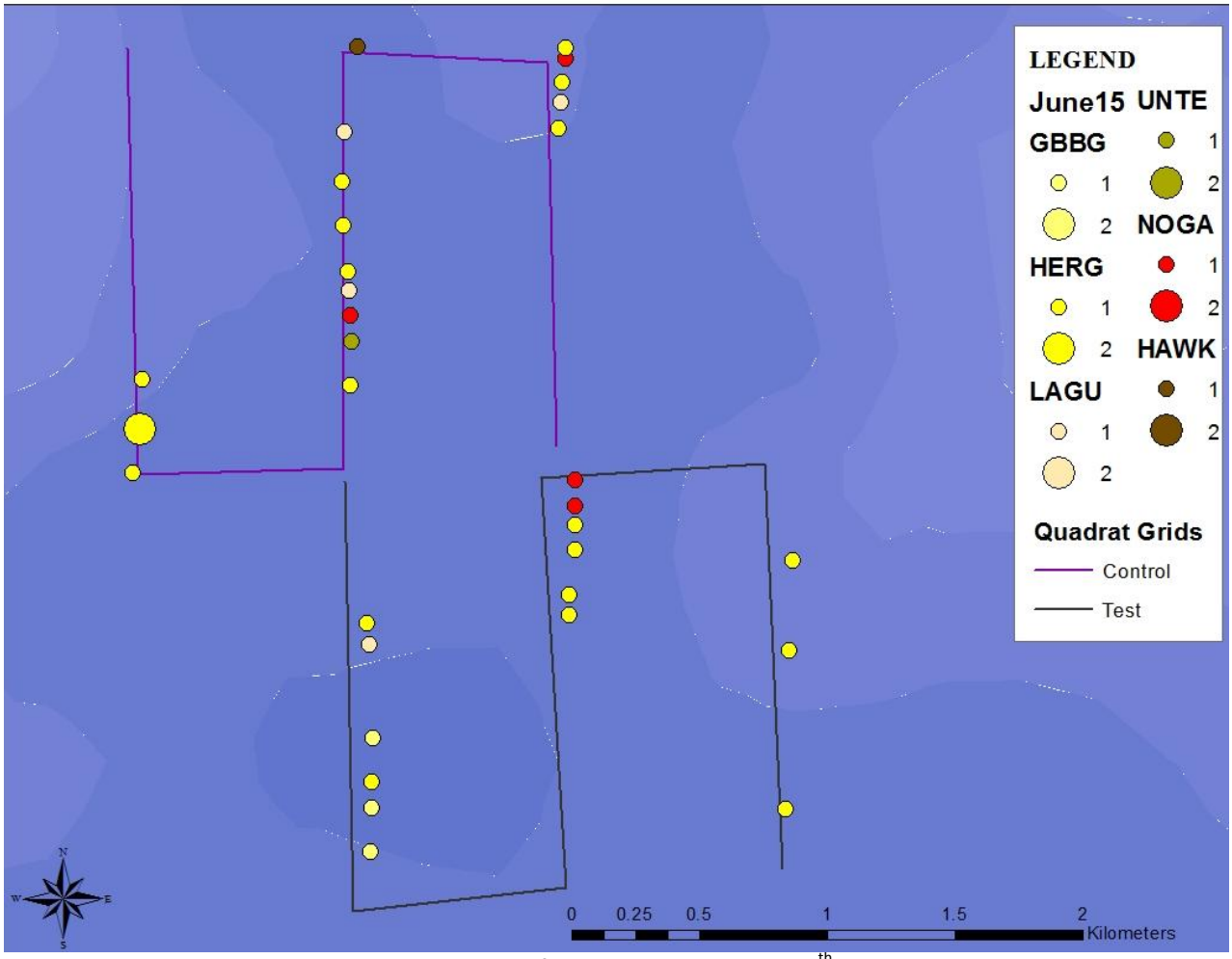
Test Quadrat

Of the four bird species within the Test Quadrat, 67% were HERG, four were GBBG (22%), and one LAGU and one NOGA were observed (Table 28).

Table 29 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. Half of all observed behaviors were direct flight, which included the one LAGU at five meters, two GBBG at one and five meters, and six of the HERG flying from one to 15m. Two HERG and one GBBG sat in the water, and the same numbers and species flew at or below five meters in variable heights. Two HERG followed our survey vessel, one at one meter and another at five meters. The single NOGA meandered at one meter.

Control Quadrat

Two partially identified species, a hawk flying directly N towards Monhegan Island at 15m and an unidentified tern, meandering at 5m, were observed (Table 28). Four other identified species of birds were also observed in the Control Quadrat, 57% were HERG, four LAGU (19%), two NOGA (10%), and one GBBG (Table 29).



Map 11. Wildlife observations on June 15th.

Thirty-three percent of the birds observed were sitting in the water, and 14% meandered (Table 30). One of the sitting birds was a NOGA, and the other gannet was seen plunge diving from a height of five meters. One LAGU sat, one meandered at five meters, and two foraged while sitting after landing on the water from an initial height of one and another from five feet. Herring gulls displayed a variety of behaviors from five birds sitting, three flying direct from one to 10m, two birds followed our survey vessel at five meters, one milled at 10m, and one meandered at five meters.

Table 30. Control Quadrat species, behavior code, and flight height, on June 15th.

Behavior	1	20				32	35	48	65		71	
Height (m)	0	1	5	10	15	5	10	5	1	5	5	Total
GBBG		1										1
HAWK					1							1
HERG	5	1	1	1		2	1	1				12
LAGU	1							1	1	1		4
NOGA	1										1	2
UNTE*								1				1
Total	**7**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**1**	**1**	**1**	**21**

*Indicates a SCC, or potential SCC

JUNE 16, 2013 MORNING SURVEY (5:33 AM)

Table 31. Numbers of species observed during the morning survey of June 16th.

	QUADRAT		
SPECIES	TEST	CONTROL	Total
Atlantic puffin*	1		1
Common loon		1	1
Great black-backed	2	1	3
Great shearwater*	1		1
Herring gul	26	27	53
Laughing gull	9	17	26
Northern gannet	2	3	5
Unidentified tern*	4	1	5
Grand Total	45	50	95
Spp/km^2	0.82	0.91	0.86

*Indicates a SCC, or potential SCC

Table 32. Test Quadrat species, behavior code, and flight height, on June 16th.

Behavior	1	20				32		35			48	61		
Height (m)	0	1	5	10	15	5	10	5	10	20	15	1	5	Total
ATPU*		1												1
GBBG		1	1											2
GRSH*	1													1
HERG	8		5	1	1	3	1	1	1	4	1			26
LAGU			2					1	1			4	1	9
NOGA	1		1											2
UNTE*			4											4
Total	10	2	13	1	1	3	1	2	2	4	1	4	1	45

*Indicates a SCC, or potential SCC

On June 16th, conditions were rated as "Maximum" with seas between two to four feet (0.6 to 1.2m), with winds from the SW from five to 10kts, and a clear sky. Forty-seven percent of all birds were observed in the Test Quadrat; however 58% of these birds were HERG. No marine mammals were observed on this day (Map 12).

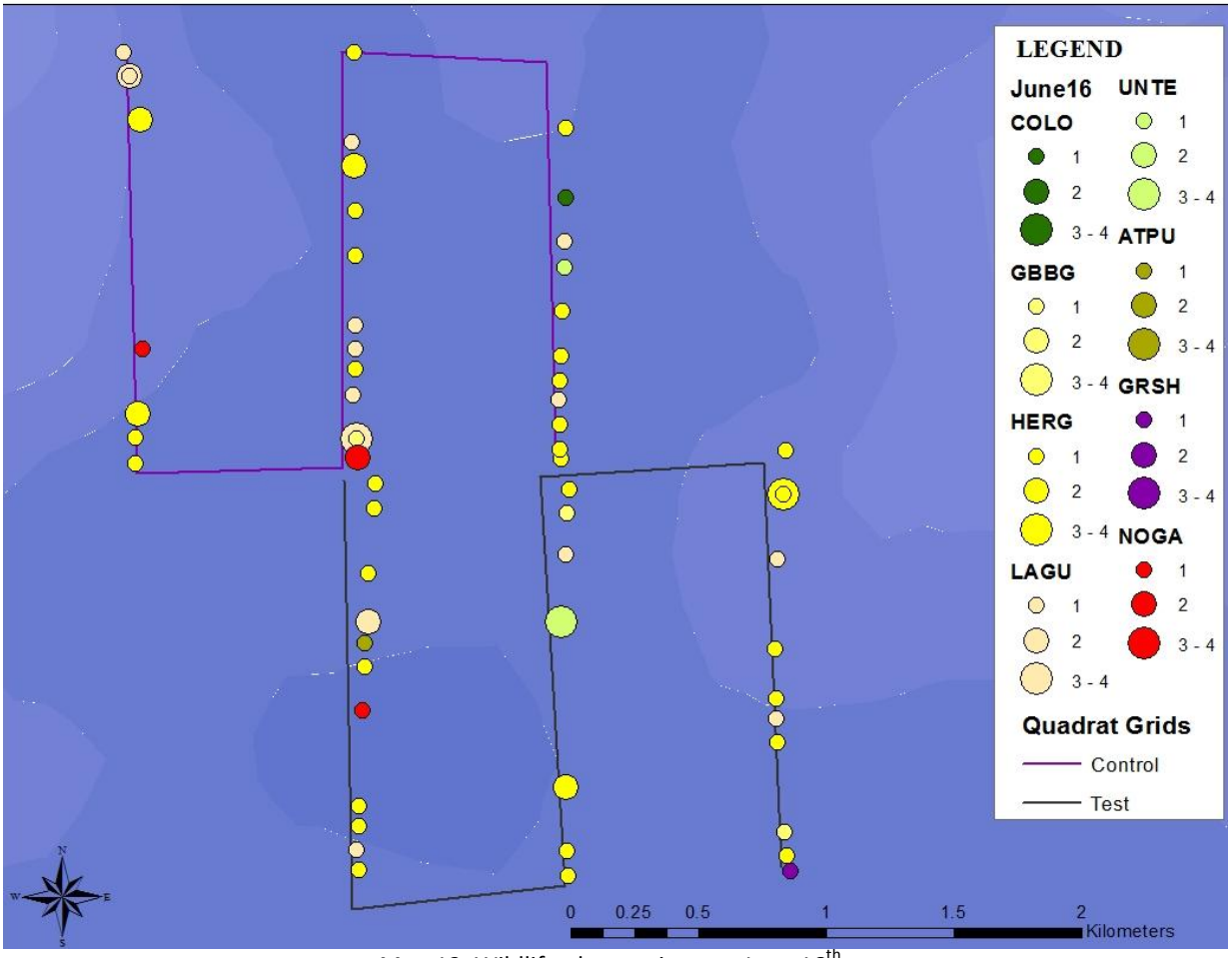
Test Quadrat

Of the seven bird species within the Test Quadrat, 58% were HERG, 20% were LAGU, and four unidentified terns (9%) were the majority (Table 31). One adult ATPU flew due north at one meter and the only Great shearwater (GRSH) of the survey season was sitting on the water in this Test Quadrat.

Table 32 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. Thirty-eight percent of all observed behaviors were direct flight, with 22% of the birds observed sitting. All four unidentified terns were in a single flock heading due north at five meters. One NOGA sat, and one flew direct at five meters. Both of the GBBG flew direct while at one and five meters. Herring gulls and laughing gulls both displayed direct flight and milling, but there were eight HERG that sat, one meandering at 15m, and four that followed our survey vessel at five and 10m. Two LAGU milled at five and 10m, and five pattered at one and five meters.

Control Quadrat

Of the six bird species within the Control Quadrat, 54% were HERG, followed by 34% LAGU (Table 31).



Map 12. Wildlife observations on June 16th.

Thirty-two percent of the birds observed were milling, 28% flew direct, and 26% sat in the water (Table 33). One of the sitting birds was a NOGA, and the other two gannets milled at five meters. The single COLO flew direct at 10m heading WSW. Five LAGU sat, six flew direct at one meter, three milled at one and five meters, one meandered at five meters, and two pattered at one meter. Herring gulls displayed a variety of behaviors from seven birds sitting, seven flying direct from one to 15m, nine milling from heights of five to 15m, and one scavenging after landing from an initial height of 10m.

Table 33. Control Quadrat species, behavior code, and flight height, on June 16th.

Behavior	1	20				32		35				48	61	65	
Height (m)	0	1	5	10	15	5	10	1	5	10	15	5	1	10	Total
COLO				1											1
GBBG									1						1
HERG	7	1	2	1	3	2	1		6	2	1			1	27
LAGU	5	6						1	2			1	2		17
NOGA	1								2						3
UNTE*								1							1
Total	13	7	2	2	3	2	1	2	11	2	1	1	2	1	50

*Indicates a SCC, or potential SCC

JUNE 26, 2013 AFTERNOON SURVEY (12:40 PM)

Table 34. Numbers of species observed during the afternoon survey of June 26th.

	QUADRAT		
SPECIES	**TEST**	**CONTROL**	**Grand Total**
Atlantic puffin*	2		2
Common tern	3		3
Double-crested cormorant		2	2
Herring gull	7	6	13
Wilson's storm-petrel	5	4	9
Harbor porpoise	1	9	10
Grand Total	**18**	**21**	**39**
Spp/km²	**0.33**	**0.38**	**0.35**

*Indicates a SCC, or potential SCC

Table 35. Test Quadrat species, behavior code, and flight height, on June 26th.

Behavior	**1**	**20**		**32**	**35**		**48**		**61**	
Height (m)	**0**	**1**	**15**	**5**	**1**	**10**	**1**	**15**	**3**	**Total**
ATPU*		2								2
COTE									3	3
HERG	3		1	1		1		1		7
WISP		1			2		2			5
Total	**3**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**3**	**17**

*Indicates a SCC, or potential SCC

On June 26th, conditions were rated as "Good" to "Maximum" with seas beginning as flat calm and rising to one foot (0.3m), with winds from the East from one to three knots. It began as partly foggy in the southern Test Quadrat but cleared in the northern Control Quadrat as the winds also picked up. Fifty-nine percent of all birds were observed in the Test Quadrat. Ten Harbor porpoise were observed on this day, with 90% found in the Control Quadrat. Additionally, two days prior Captain Chris Cash said whales were observed breaching near the island to the NE, although species was not identified (C. Cash, *pers. comm.,* 26 June 2013*)*.

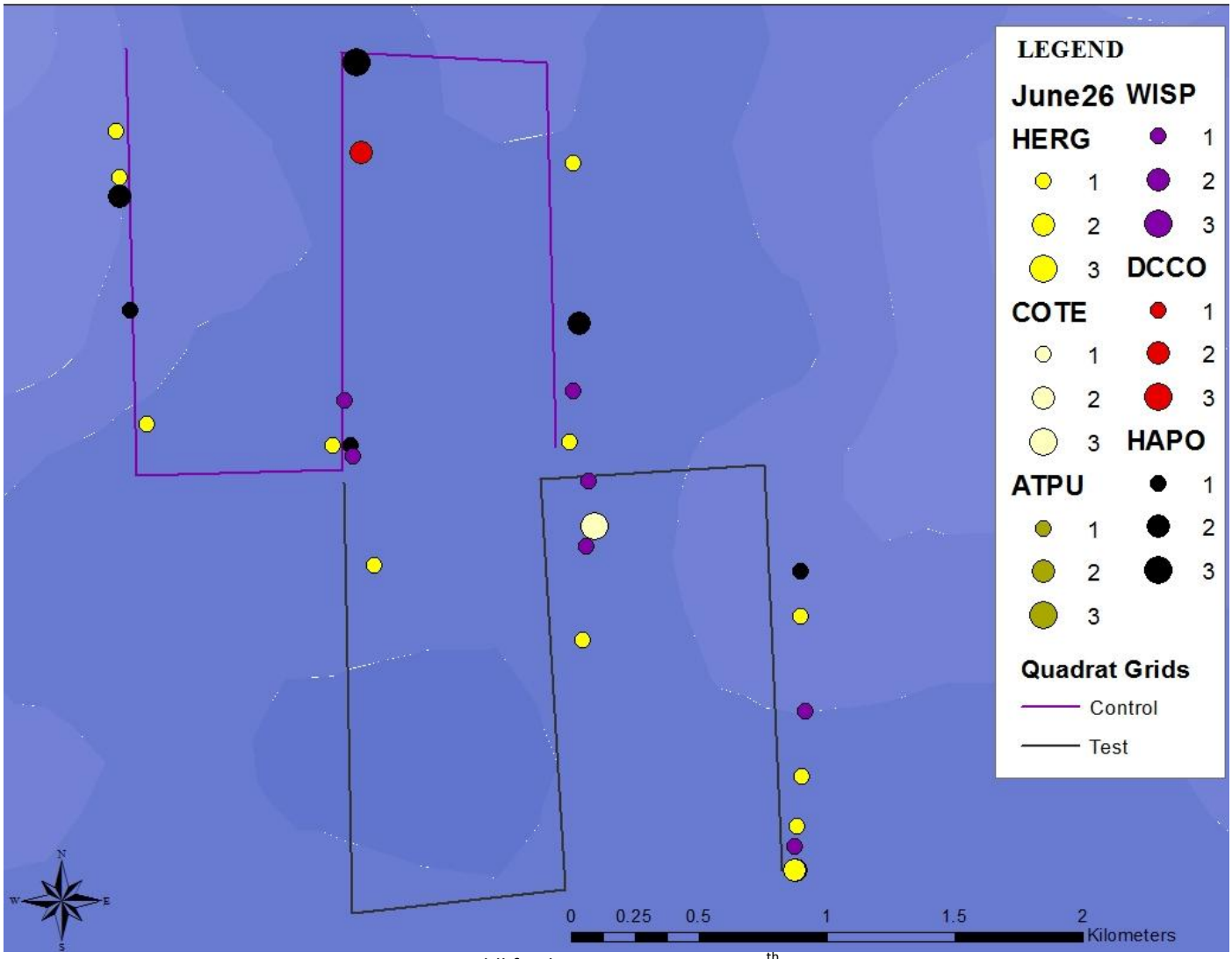
Test Quadrat

Of the four bird species within the Test Quadrat, 41% were HERG, 29% were Wilson's storm-petrel (*Oceanites oceanicus;* WISP). The remaining birds included three pattering common terns (*Sterna paradise;,* COTE) and a pair of ATPU flying one meter heading SSW (Table 34). One Harbor porpoise was recorded.

Table 35 shows all behaviors and flight heights by all bird species observed in the Test Quadrat. The HERG included three sitting birds, one flying direct at 15m, one milling at 10m, and one meandering at 15m. One WISP flew direct at one meter, two milled at one meter, and two meandered at one meter.

Control Quadrat

Of the three bird species within the Control Quadrat, six birds (50%) were HERG, followed by four (33%) WISP, and two DCCO flying one meter heading south (Table 34). A total of 10 harbor porpoise were recorded across five sightings consisting of pods of two or one.



Map 13. Wildlife observations on June 26th.

One-third of the birds observed were flying direct and one-third meandered (Table 36). One HERG sat, two flew direct from 15 to 30m, one gull followed our survey vessel at five meters, and two meandered at 10m. All at one meter, two WISP pattered, one milled, and one meandered.

Table 36. Control Quadrat species, behavior code, and flight height, on June 26th.

Behavior	1	20			32	35	48		61	
Height (m)	0	1	15	30	5	1	1	10	1	Total
DCCO		2								2
HERG	1		1	1	1			2		6
WISP						1	1		2	4
Total	1	2	1	1	1	1	1	2	2	12

BEHAVIOR CATEGORIES

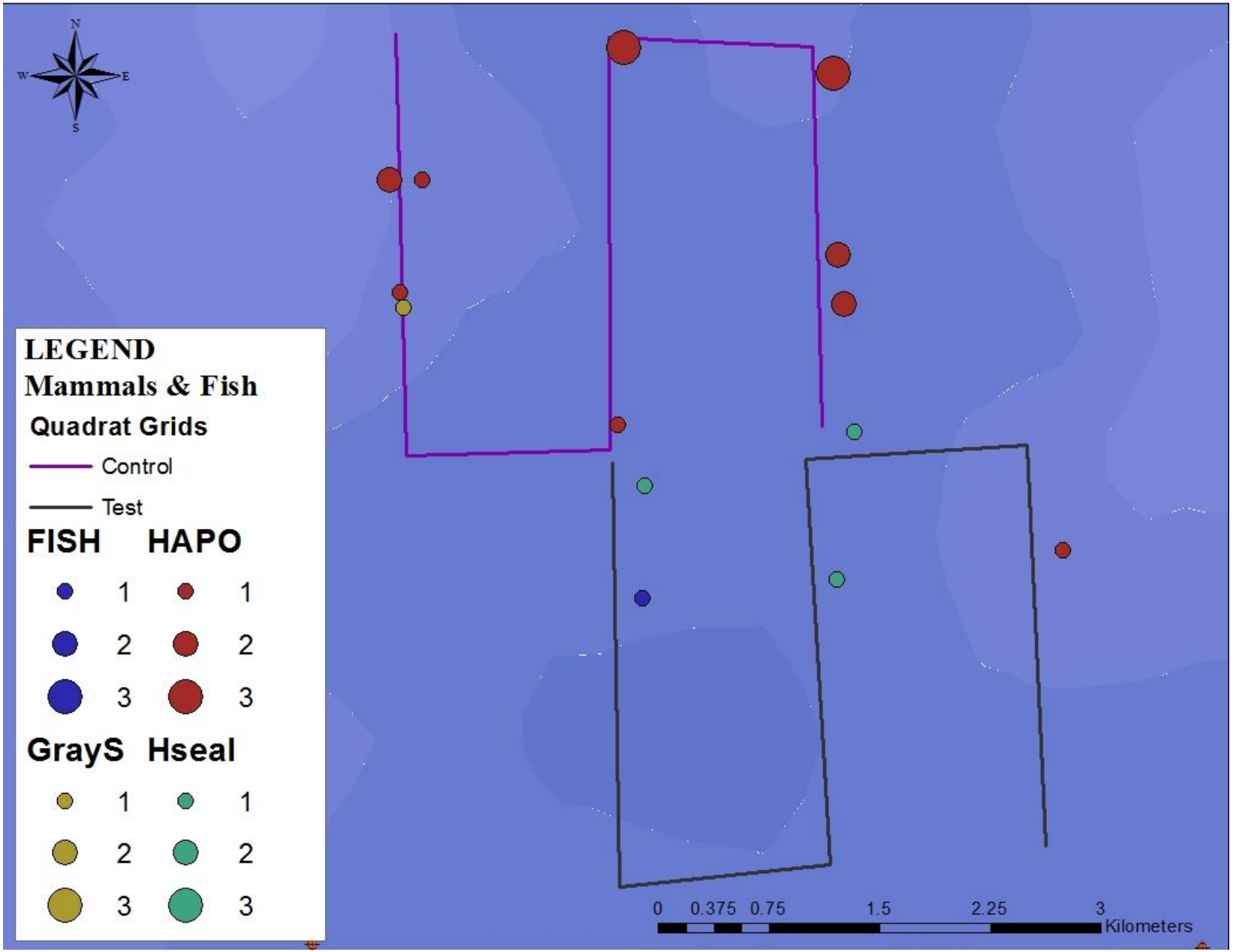
MARINE MAMMALS & OTHER NON-BIRD SPECIES SUMMARY

A complete list of all species observed was provided in Table 3 and also in Appendices 2 and 3 summarizing the species and the dates on which they were documented. Neither large baleen whales nor tuna were observed throughout the season. Only two days produced harbor seals, and gray seals were observed on one day. Table 36 summarizes the seals, porpoise, and fish numbers by date observed in the Test and Control survey quadrats. All of these non-bird species were recorded as "Undetermined behavior"; they may have been sleeping, breathing, observing our vessel's activity, or any other behavior that caused their head to be above the surface when they were recorded.

The season's total of three harbor seals (0.03 Hseals/km^2) were found exclusively in the Test Quadrat and only one gray seal was recorded (0.009 Gseals/km^2) in the Control (Map 14). Sixteen harbor porpoise were observed in both Quadrats, but only one (0.009 HAPO/km^2) was found in the Test Quadrat and the remaining 90% in the Control (0.14 HAPO/km^2). One large boiling mass of baitfish was observed in the Test Quadrat, which coincided with a flurry of foraging activity by a number of bird species.

Table 37. Marine mammals and other non-bird species observed by date and quadrat.

QUADRAT	DATE					
SPECIES	**4/21**	**4/27**	**5/28**	**6/26**	**Total**	#/km^2
TEST			**4**	**1**	**5**	**0.091**
Harbor porpoise				1	1	0.018
Harbor seal			3		3	0.055
Bait fish			1		1	0.018
CONTROL	**1**	**1**	**6**	**9**	**16**	**0.291**
Gray seal	1				1	0.018
Harbor porpoise		1	5	9	15	0.273
Grand Total	**1**	**1**	**9**	**10**	**21**	**0.191**



Map 14. Marine mammals and bait fish observed throughout the season.

BIRD SPECIES BEHAVIOR SUMMARIES

To further discuss the bird behaviors during these surveys, bird species will be generally grouped by a taxonomical classification at the Order level. Six orders within the Class Aves were observed utilizing this region within the Gulf of Maine during the course of our study. They are grouped into five groups as follows:

-Order Anseriformes	(eider and scoters)
-Order Podicipediformes	(grebe)
-Order Gaviiformes	(loon)
-Order Charadriiformes	(large and small gulls, terns, alcids)
-Order Procellariiformes	(shearwaters and storm-petrels)
-Order Suliformes	(gannets and cormorant)
-Order Falconiformes	(hawk)

The Orders Charadriiformes, Procellariiformes, and Suliformes provided adequate numbers of individuals within their categories to be compared in the following section as individual Orders, hereby called "Group 2," "Group 3," and "Group 4," respectively. The first group, hereby called "Group 1," has been combined due to the low bird counts constituting only one species in each of the latter two Orders.

The maps in the previous section that discusses each survey day's bird observations have been colored using a consistent scheme that groups each of these five Orders into color groups. Group 1 (eider, scoters, loons, and grebe) is represented by shades of green, Group 2 (gulls, terns, alcids) have yellows, Group 3 (shearwaters & storm-petrels) have purples, Group 4 have reds, and Group 5 is brown. This color scheme will continue to be used in the following figures and other maps discussing bird behaviors, foraging species, and birds of conservation concern, as seen below. It does not include marine mammals or other maps.

Table 38 has the total numbers of all birds recorded in each quadrat, tallied by behavior. Direct flight was the most common behavior type recorded during the surveys, with 38% recorded in the Test Quadrat and 61% in the Control. The second most common behavior was sitting on the water, with 26% and 12.5%, respectively. For analysis purposes, the category called "Variable Heights" (code 29) has been combined with Direct Flight (code 20) in the following discussion because it is a form of flight that also involves a

direct path; however the bird tends to vary in height within the brief moment of observation that one height cannot be claimed.

The high number of scavenging (sitting while eating) birds found in the Test Quadrat (14%) were mostly associated with the actively fishing lobster vessels that were also found in the southern half of the Test Quadrat, as seen in Map 1 and discussed below in the section *"Other Miscellaneous Observations: Boats and Buoy Observations*."

Table 38. Numbers of each bird behavior type, by quadrat.

QUADRAT	BEHAVIOR	1	20	29	32	35	48	61	65	71	Grand Total
TEST		87	122	5	20	25	18	9	47	3	336
CONTROL		34	167		15	30	13	5	4	4	272
Total		**121**	**289**	**5**	**35**	**55**	**31**	**14**	**51**	**7**	**608**
Birds per km^2		**1.1**	**2.63**	**0.05**	**0.32**	**0.5**	**0.28**	**0.13**	**0.46**	**0.06**	**5.53**

❖ ***Sitting on the Water***

Throughout the surveys, 20% (1.1 birds/km^2) of all the recorded birds in the Monhegan Test Site were observed sitting on the water, which is a behavior category not meant to suggest or exclude feeding activity. Behaviors described as 'sitting' may include sleeping, preening, or resting. For each quadrat, 1.6 birds/km^2 were sitting in the Test and 0.62 birds/km^2 were sitting in the Control. In the Test Quadrat, HERG, NOGA, and GBBG were the top three species observed sitting, whereas HERG, NOGA, and LAGU were the top three in the Control.

❖ ***Flying Behaviors***

Flight height and behavior were recorded in the two quadrats, and the following figures will show flight heights for the three most common flight behavior categories, separated into Test and Control Quadrats: Direct Flight, Milling, and Meandering.

DIRECT FLIGHT (Code #20 & 29)

Direct flight is described as a bird flying consistently through the area, not actively involved in foraging or other activities. The designation of this behavior during the survey is taken at the precise moment it is noticed by the surveyor.

Of all bird behaviors, direct flight was the most common behavior observed throughout the entire Monhegan Test Site (46%; 2.67 birds/km^2) as well in each of the Quadrats with 2.31 birds/km^2 recorded in the Test and 3.04 birds/km^2 in the Control. In

the Test Quadrat, listed in order from greatest to lesser, the top six species demonstrating direct flight were HERG, NOGA, COLO, SUSC, COEI, and GBBG. In the Control, the top six included HERG, COEI, DCCO, SUSC, LAGU, and UNAL. Table 39 shows these species, numbers, and average flight height during this behavior type in both Quadrats.

Table 39. Numbers and average flight height of the top six species in Direct flight.

TEST Quadrat	Number Observed	Average Height (m)
HERG	51	6.5
NOGA	17	6.7
COLO	12	4.2
SUSC	9	1
COEI	9	5
GBBG	8	4.6

CONTROL Quadrat	Number Observed	Average Height (m)
HERG	45	11.2
COEI	23	1
SUSC	19	1
DCCO	19	4.6
LAGU	14	6.8
UNAL*	10	1

*Indicates a SCC, or potential SCC

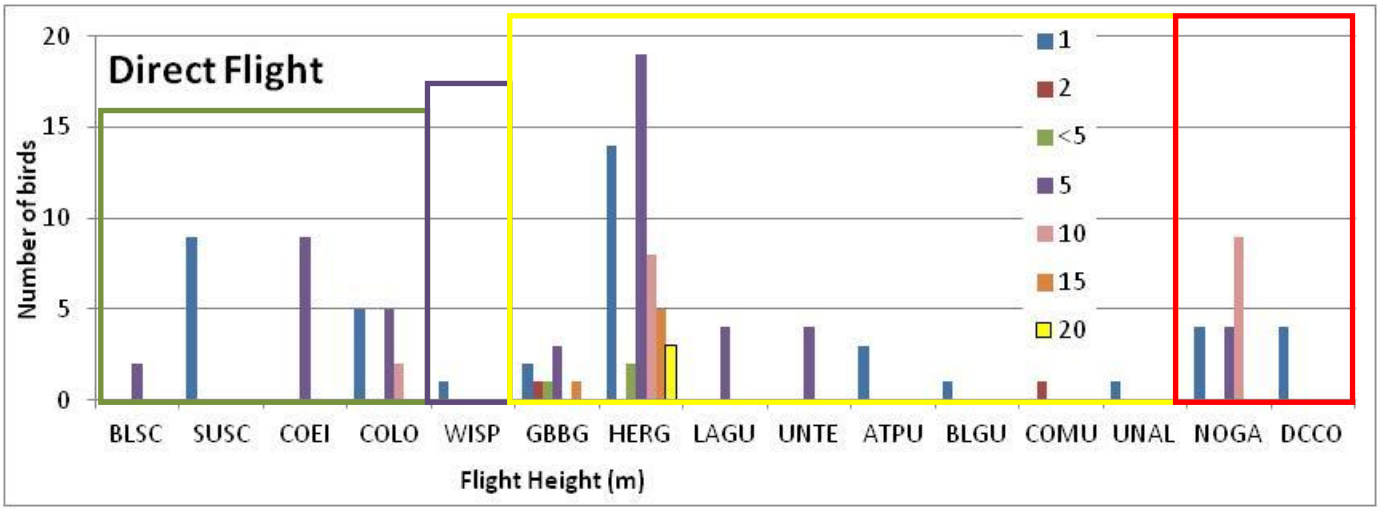


Figure 1. Direct flight by species, group, and flight height in the Test Quadrat.

In the Test Quadrat, Group 1 flew most often from one to five meters, with only the COLO flying occasionally at 10m (Figure 1). Group 2 was mostly represented by HERG and GBBG that mostly flew from one to 10m. All the alcids flew direct from two meters or less. Only the WISP represented Group 3, with all its direct flight occurring at one meter. In Group 4, most gannets and cormorants flew from one to five meters, with eight gannets flying at 10m.

In the Control Quadrat, the vast majority of Group 1 flew at one meter, consisting mostly of SUSC and COEI (Figure 2). The COLO flew from one to 15m and the flock of RNGR all flew at five meters. Group 2 again was dominated by HERG, GBBG, and LAGU who flew at all heights from one to 30m but averaged at 11.2m (Table 39). All the alcids flew under

three meters. Group 4 birds flew from one to 15m but the NOGA averaged at 5.6m and DCCO at 4.6m. The single unidentified hawk that represents Group 5: Falconiformes was observed flying direct at 15m.

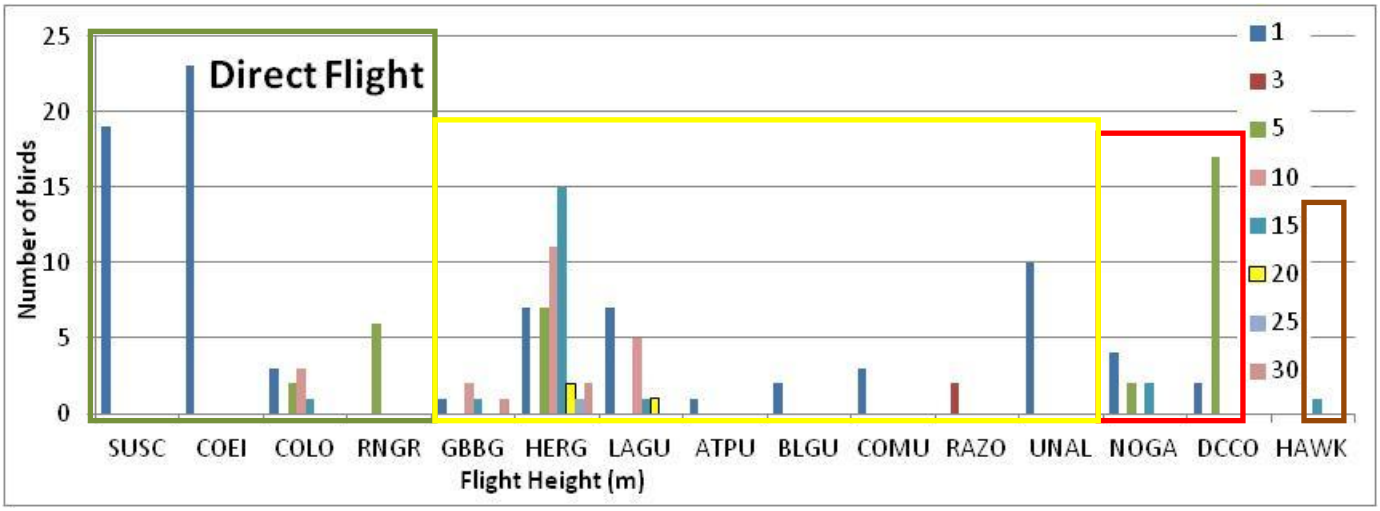


Figure 2. Direct flight by species, group, and flight height in the Control Quadrat.

Direct Flight Behavior Summary

Throughout the entire Monhegan Test Site, 43% of all birds demonstrating Direct Flight flew within one meter of the water's surface (Figure 3). The next most frequented height ranges of direct flight exhibited by all the groups was between five and 15m (51%). Charadriiforms represented the vast majority of the species in direct flight for both Quadrats, with 57% in the Test and 49% in the Control. The second most common species consisted of Group 1, with 25% and 34%, respectively.

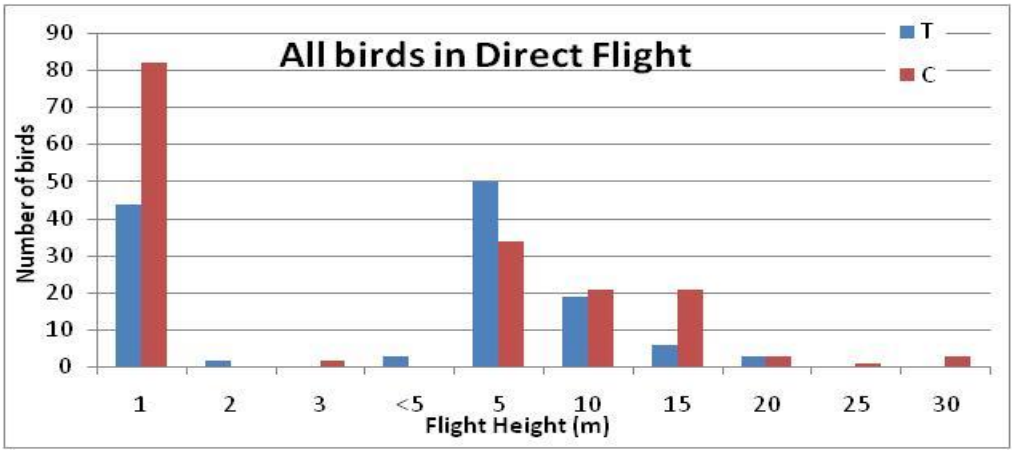


Figure 3. Direct flight by all species and flight height in the Monhegan Test Site.

MILLING FLIGHT (Code #35)

Milling flight is described as a bird flying in a more distinct circling or milling path that is usually associated with foraging search patterns. Similar to meandering flight, general direction of milling flight constantly changes, thus flight direction is rarely noted in the survey data for these birds.

Of all bird behaviors, milling flight was the third most common behavior observed throughout the entire Monhegan Test Site (9%; 0.5 birds/km^2), as seen in Table 41. It also ranked as the third most common behavior in the Control Quadrat with 11% (0.55 birds/km^2) but ranked fourth most common behavior in the Test Quadrat (7.4%; 0.45 birds/km^2) due to the large number of scavenging (Code#65) birds associated with the actively fishing lobster vessels (0.85 birds/km^2). Listed in order from greatest to lesser only five species demonstrated milling flight in the Test Quadrat and were as follows: HERG, NOGA, LAGU, WISP, and GBBG. In the Control, only six species demonstrated this behavior: HERG, NOGA, LAGU, GBBG, WISP, and UNTE. Table 43 shows these species, numbers, and average flight height during this behavior type in both Quadrats.

Table 40. Numbers and average flight height of the species observed in Milling flight.

TEST Quadrat	Number Observed	Average Height (m)
HERG	17	12.176
NOGA	3	7
LAGU	2	7.5
WISP	2	1
GBBG	1	5

CONTROL Quadrat	Number Observed	Average Height (m)
HERG	13	7.769
NOGA	10	7.5
LAGU	3	3.667
GBBG	2	5
WISP	1	1
UNTE*	1	1

*Indicates a SCC, or potential SCC

In the Test Quadrat, only Groups 2, 3, and 4 displayed milling behavior (Figure 4). Group 2 was mostly represented by HERG with only two LAGU and one GBBG. The average flight height of the HERG was 12.2m (Table 40). Again, only the WISP represented Group 3, with all its milling flight occurring at one meter. Group 4 was only represented by three NOGA milling at an average height of seven meters.

In the Control Quadrat, as seen in the Test Quadrat, only Groups 2, 3, and 4 displayed milling behavior (Figure 5). Also, Group 2 was mostly represented by HERG with only three LAGU, two GBBG, and one UNTE. The average flight height of the HERG was 7.8m (Table 40). Again, only the WISP represented Group 3, with all its milling flight occurring at one meter. Group 4 was represented by five NOGA milling at five meters and the remaining five NOGA milling at 10m.

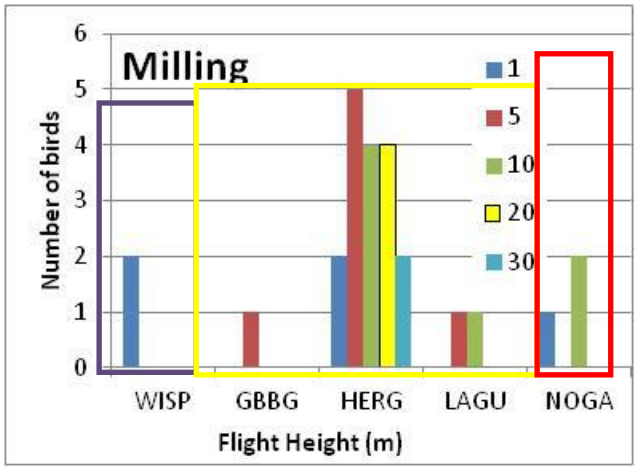


Figure 4. Milling flight by species, group, and flight height in the Test Quadrat.

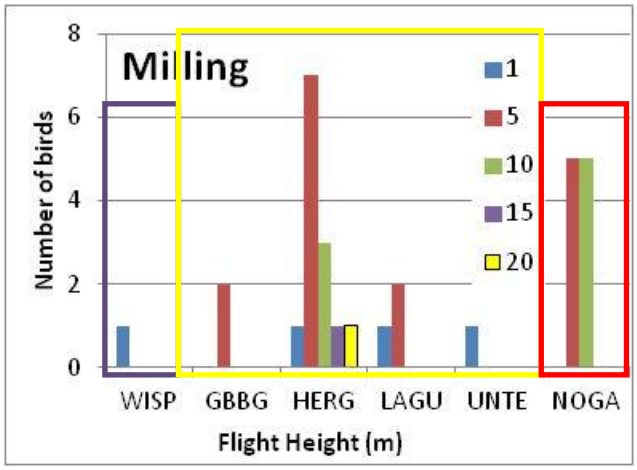


Figure 5. Milling flight by species, group, and flight height in the Control Quadrat.

Milling Flight Behavior Summary

Throughout the entire Monhegan Test Site, 42% of all birds demonstrating milling flight flew at five meters above the water's surface (Figure 6). The next most frequented height ranges exhibited by all the groups was at 10m (27%). However, in the Control Quadrat, 93% of the milling birds were from one to 10m, whereas only 76% were at those heights in the Test. Group 2 represented the vast majority of the species in milling flight for both Quadrats, with 68% in the Test and 43% in the Control. The second most common species were NOGA, with 12% and 33%, respectively.

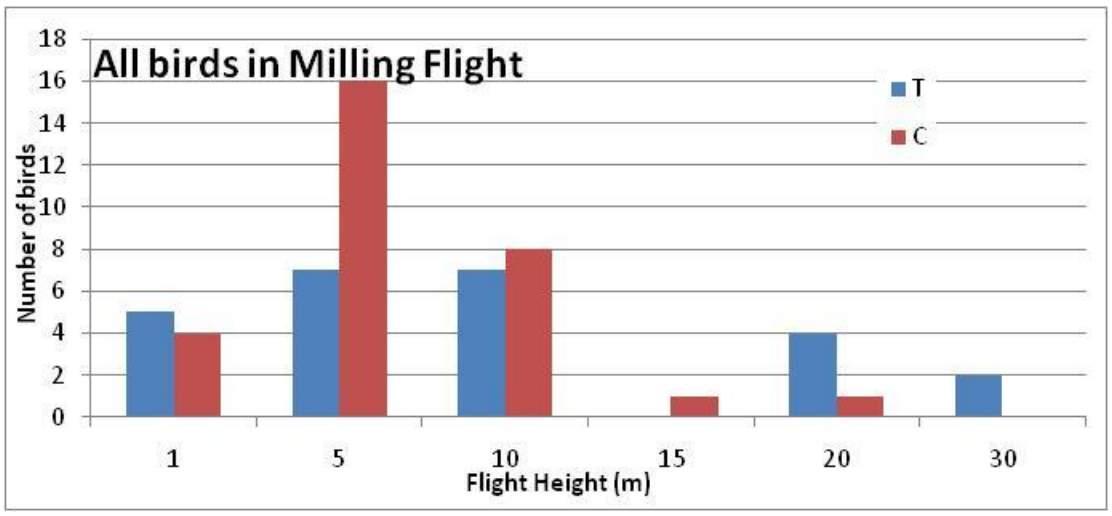


Figure 6. Milling flight by all species and flight height in the Monhegan Test Site.

MEANDERING FLIGHT (Code #48)

Meandering flight is defined as a bird flying in a 'wandering' manner, not directly feeding or moving in any particular direction or with any obvious purpose. Flight direction constantly changes, thus flight direction is rarely noted in the survey data for these birds. The designation of this behavior during the survey is taken at the precise moment it is noticed by the surveyor.

Although the next most common bird behavior after sitting, direct flight, and milling flight, is "Following a Vessel" (Code #32) (Table 38), it will not be thoroughly discussed. Birds demonstrated "Following a Vessel" 5.9% of the time, in which they all involved *our* survey vessel, and observed in six percent of the Test and 5.5% in the Control Quadrats. Meandering flight occurred 5.1% of the time throughout the entire Monhegan Test Site, with occurrences of 5.4% in the Test Quadrat and 4.8% in the Control Quadrat (Table 41).

Table 41. Numbers and average flight height of the species observed in Meandering flight.

TEST Quadrat	Number Observed	Average Height (m)
HERG	11	7.818
NOGA	3	1
WISP	2	1
SOSH	1	1
LAGU	1	1

CONTROL Quadrat	Number Observed	Average Height (m)
HERG	7	7.286
NOGA	2	10
LAGU	2	5
WISP	1	1
UNTE*	1	5

*Indicates a SCC, or potential SCC

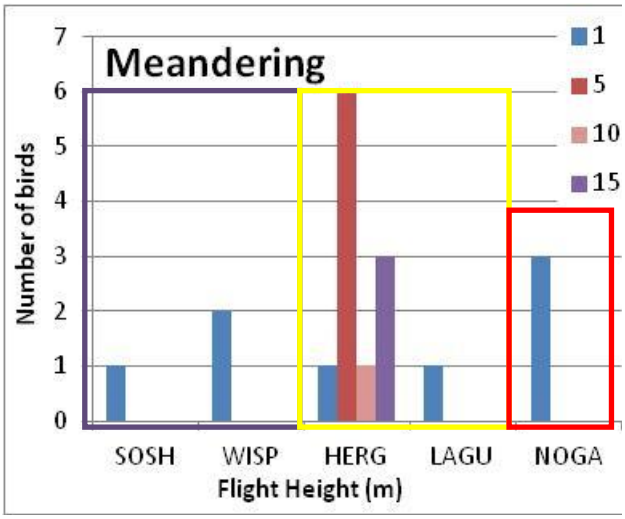


Figure 7. Meandering flight by species, group, and flight height in the Test Quadrat.

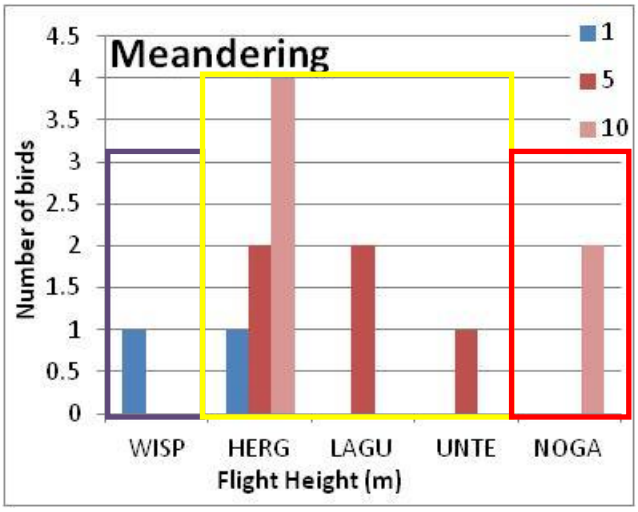


Figure 8. Meandering flight by species, group, and flight height in the Control Quadrat.

In the Test Quadrat, only Groups 2, 3, and 4 displayed meandering behavior (Figure 7). Again, Group 2 was mostly represented by HERG with only one LAGU. The average flight height of the HERG was 7.8m (Table 41). For Group 3, one SOSH and two WISP meandered entirely at one meter. Group 4 was only represented by three NOGA, all meandering at a height of one meter.

Again, in the Control Quadrat, only Groups 2, 3, and 4 displayed meandering behavior (Figure 8). Also, Group 2 was mostly represented by HERG with only two LAGU and one UNTE. The average flight height of the HERG was 7.3m (Table 41) whereas the LAGU and UNTE all flew at a height of five meters. Once again, only the WISP represented Group 3, with all its meandering flight occurring at one meter. Group 4 was represented by two NOGA, all meandering at five meters high.

Meandering Flight Behavior Summary

Throughout the entire Monhegan Test Site, 35% of all birds demonstrating meandering flight flew at five meters above the water's surface (Figure 9). The next most frequented height ranges of meandering flight was at one meter above the surface (32%). However, in the Test Quadrat, 78% of the meandering birds were from one to five meters, whereas 85% were meandering between five and 10m in the Control. Again, Group 2 represented the vast majority of the species in meandering flight for both Quadrats, with 67% in the Test and 77% in the Control. The second most common species were NOGA, with 17% and 15%, respectively.

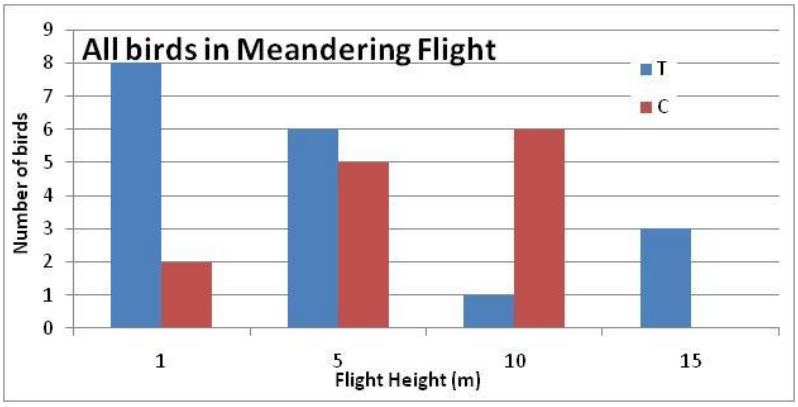


Figure 9. Meandering flight by all species and flight height in the Monhegan Test Site.

❖ ***Foraging and All Other Behaviors***

The previous discussion focused on many behaviors that most likely are not associated with, or due to the brief period of the observed moment, cannot be determined as, foraging activities. Other behaviors are, however, evident activities that involve effort to forage for food either at the surface or below the water. These include dipping or pattering (behavioral code #61), surface scavenging (#65), and pursuit diving (#70). Milling flight (#35) is also considered as a foraging behavior; it has been discussed in the previous section regarding flight behaviors.

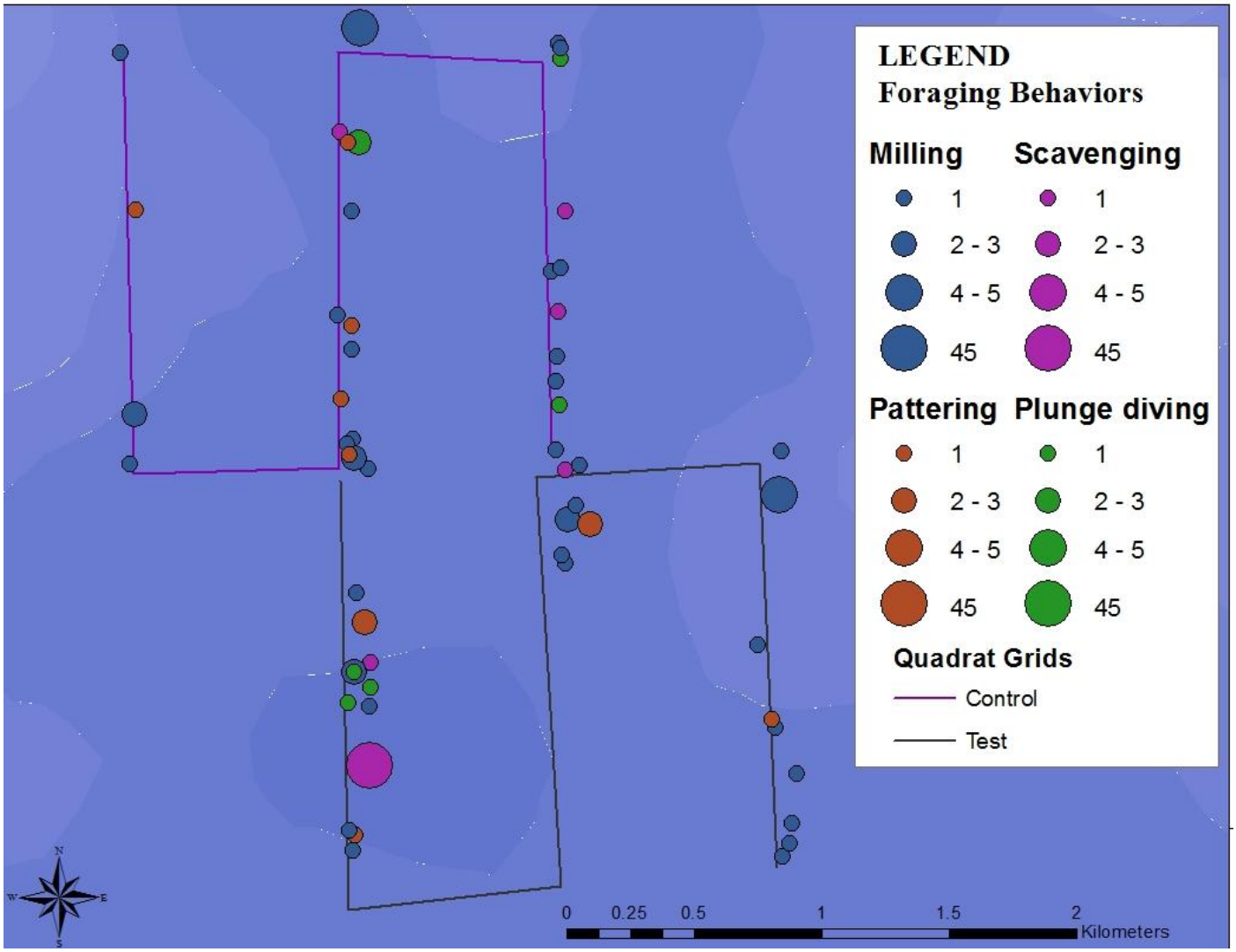
For behavioral category comparisons, we will focus on the combination of all four foraging behaviors in this following discussion. Table 42 shows the species and locations of these foraging activities which involved 25% of the birds in the Test Quadrat (1.53 birds/km^2) and 16% in the Control (0.78 birds/km^2) (Map 15). Slightly more birds milled in the Control Quadrat (0.45 birds/km^2) than the Test (0.55 birds/km^2), yet active feeding (combining pattering, scavenging, and plunge diving) was observed by more birds in the Test Quadrat (1.07 birds/km^2) than in the Control (0.24 birds/km^2).

Throughout the overall Monhegan Test Site, the majority of these foraging activities were displayed by the Charadriiformes (80%) followed by 16% NOGA, and four percent WISP. As provided earlier in Table 37, scavenging was the third most common overall behavior in the Test Quadrat (14%), followed by milling (seven percent), but in the Control Quadrat, milling was the third most common overall behavior (11%) followed by 'Following a Vessel' at six percent. Among these foraging behaviors, 56% were scavenging (foraging while sitting) attributable entirely by the Charadriiformes; other than one GBBG, these birds consisted entirely of HERG.

Table 42. Species numbers and Quadrat locations of birds displaying foraging activities.

	TEST					CONTROL					
Species	**Behavior**				**Total**	**Behavior**				**Total**	**Grand Total**
	35	**61**	**65**	**71**		**35**	**61**	**65**	**71**		
WISP	2				2	1	2			3	5
GBBG	1		1		2	2				2	4
HERG	17	1	46		64	13		2		15	79
LAGU	2	5			7	3	3	2		8	15
COTE		3			3						3
UNTE*						1				1	1
NOGA	3			3	6	10			4	14	20
Total	**25**	**9**	**47**	**3**	**84**	**30**	**5**	**4**	**4**	**43**	**127**

*Red text denotes SCC, or potential SCC.



Map 15. Location of foraging bird species throughout the entire survey season.

Again, due to the large number of gulls scavenging behind active lobstering vessels in the Test Quadrat, the majority of heights in the Test are at 0-m (55%), referring to them sitting on the water. However, the remaining common heights of foraging flight activities were predominantly from one to 10m in both Quadrats (Figure 10). Of these birds at one meter, 74% and 63% were WISP, whereas gulls and NOGA were the only species of birds found from five meters to 30m in both Quadrats.

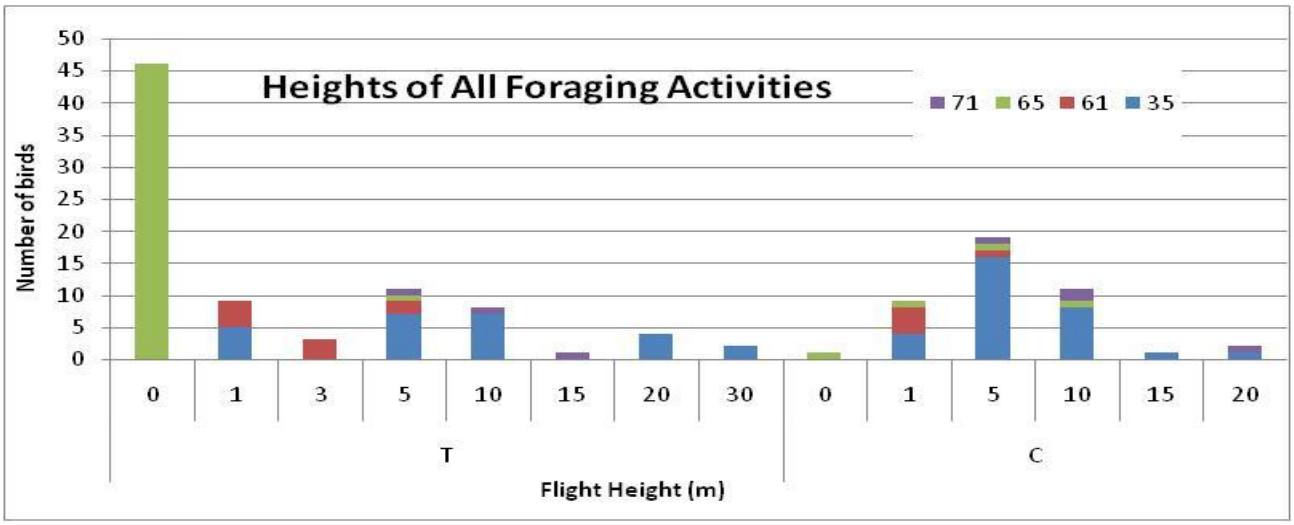


Figure 10. Heights of all foraging activities, by quadrat.

Foraging activities often coincide with the presence of humans, and are commonly associated with the lobster and fishing industry that is prevalent in the GOM. Large gulls such as HERG, GBBG, and LAGU commonly search for easy, reliable foraging opportunities and therefore are attracted to vessels that commonly discard offal or bycatch (Schwemmer & Garthe 2005).

Throughout the survey season, 29 observations of 35 HERG were recorded 'Following a Vessel' (behavior code #32) which involved following *our* survey vessel and were not associated with a fishing vessel or food. These occurred in six percent and 5.5% in the Test and Control Quadrats, respectively. Due to these birds' influence being directly related to our survey vessel and its activities, no further discussion, in any depth, will be made regarding these five gulls. Further discussion regarding boat and buoy observations will follow in the section titled "Other Miscellaneous Observations."

ENDANGERED, THREATENED, AND
BIRDS OF CONSERVATION CONCERN

There are two ESA-listed birds that have the potential to occur in the project area, federally endangered Roseate tern (*Sterna dougallii)* and federally threatened piping plover (*Charadrius melodus*). The red knot (*Calidris canutus*) is a candidate species for federal listing. A number of bird species are also listed under the Maine ESA. In addition, the U.S. Fish & Wildlife Service (USFWS) created a list of species requiring special conservation action and awareness: the *Birds of Conservation Concern 2008* (BCC 2008).

Bird species of these conservation designations (SCC) are discussed in this following section and are shown in Map 16. Observed during the Monhegan Test Site surveys from April through June of 2013, only state threatened species and one BCC were identified. They include three identified species specified on these lists: five Atlantic puffins, five razorbills, and one great shearwater. The ATPU and RAZO are considered state threatened under the MDIFW's Maine Endangered Species Act (MESA) of 1975.The GRSH is listed as a BCC in Bird Conservation Region (BCR) #14: Atlantic Northern Forests; BCR #30: New England/Mid Atlantic Coast; and USFWS Region 5: Northeast Region (BCC 2008).

Two other potential species of concern may have been sighted, but due to the inability to determine the specific species, they were designated as six "unidentified terns" and 11 "unidentified alcids." The UNTE may have been either a common tern or an Arctic tern, but only the Arctic tern is the state threatened species under the MESA. The UNAL could have been one of many common alcid species, but both the ATPU and razorbill are listed as state threatened species under the MESA. Marine mammals and other non-bird species were recorded during the surveys but no species that are listed as Federally Threatened or Endangered under the ESA were recorded.

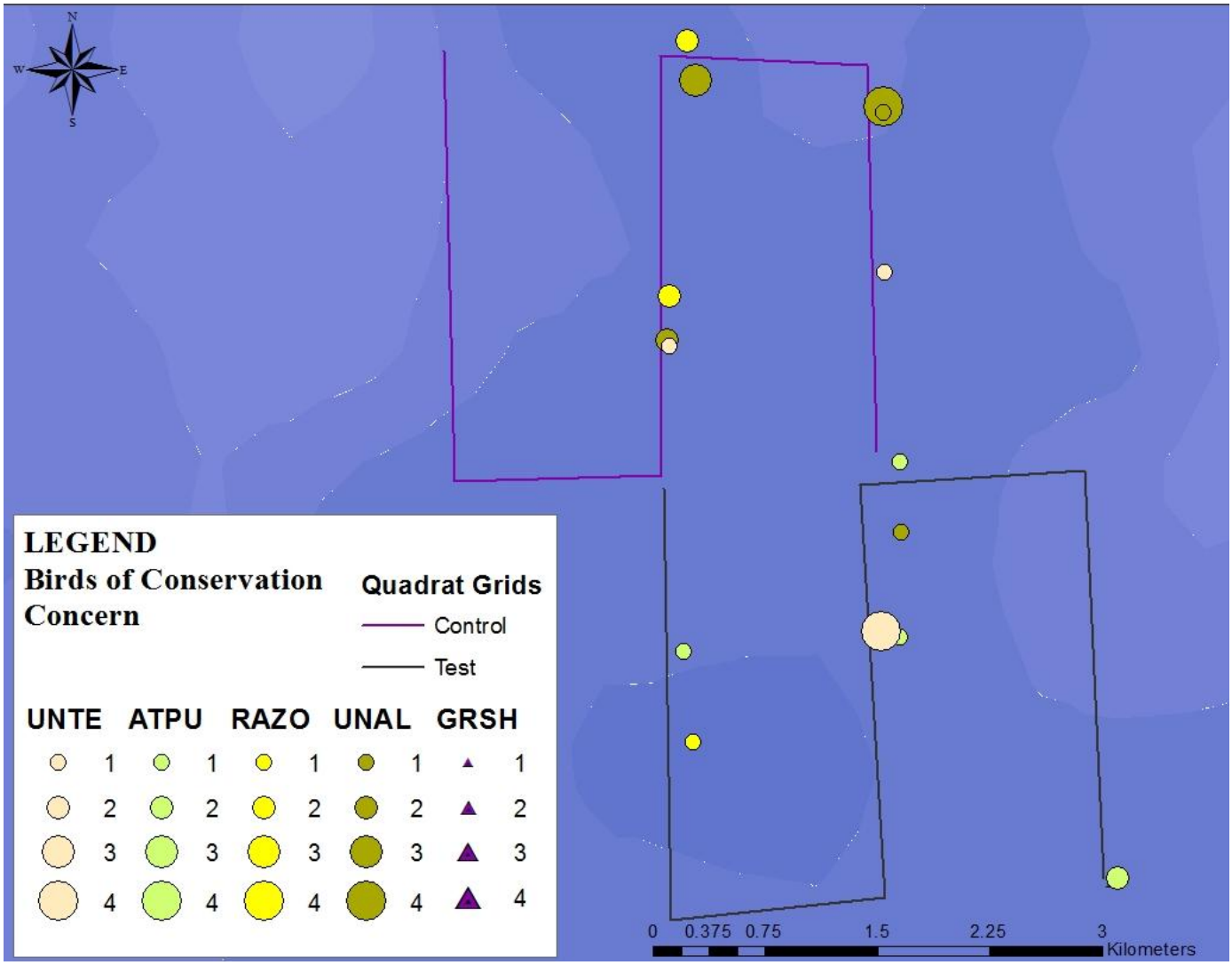
Total numbers of every species per quadrat and density, and overall count and density, is presented in Appendix 2, with SCC denoted by red text. Unidentified alcids were the 9th most numerous bird species observed in the Monhegan Test Site overall, with only 0.1 birds/km^2, but they were the most numerous of the SCC. Unidentified terns were the second most numerous (0.055 birds/km^2) of the SCC species, followed by 0.045 ATPU/km^2, 0.045 RAZO/km^2, and 0.009 GRSH/km^2 (one bird). Within the Test Quadrat, 3.3% of the total bird count consisted of SCC (0.2 birds/km^2); 6.3% were in the Control Quadrat (0.31 birds/km^2).

Seen below, Table 43 shows the summary of these species of concern and the behaviors they were observed performing. Four particular behavior types were observed by these SCC, which included the following: 48- meandering; 35- milling; 20- direct flight; and 1- sitting on the water. Of these behaviors among the SCC, direct flight was the most

common activity with 73% in the Test Quadrat and 76% in the Control. All flying-associated behaviors by these SCC were at or below five meters. Only one UNTE milled and one UNTE meandered in the Control; these activities were not observed by SCC in the Test Quadrat.

Table 43. Behaviors displayed by SCC in each Quadrat.

	TEST			CONTROL					Grand
Species	1	20	Total	1	20	35	48	Total	Total
GRSH	1		1						1
UNTE		4	4			1	1	2	6
ATPU	1	3	4		1			1	5
RAZO	1		1	2	2			4	5
UNAL		1	1		10			10	11
Total	**3**	**8**	**11**	**2**	**13**	**1**	**1**	**17**	**28**



Map 16. Birds of Conservation Concern observed throughout the entire survey season.

OTHER MISCELLANEOUS OBSERVATIONS

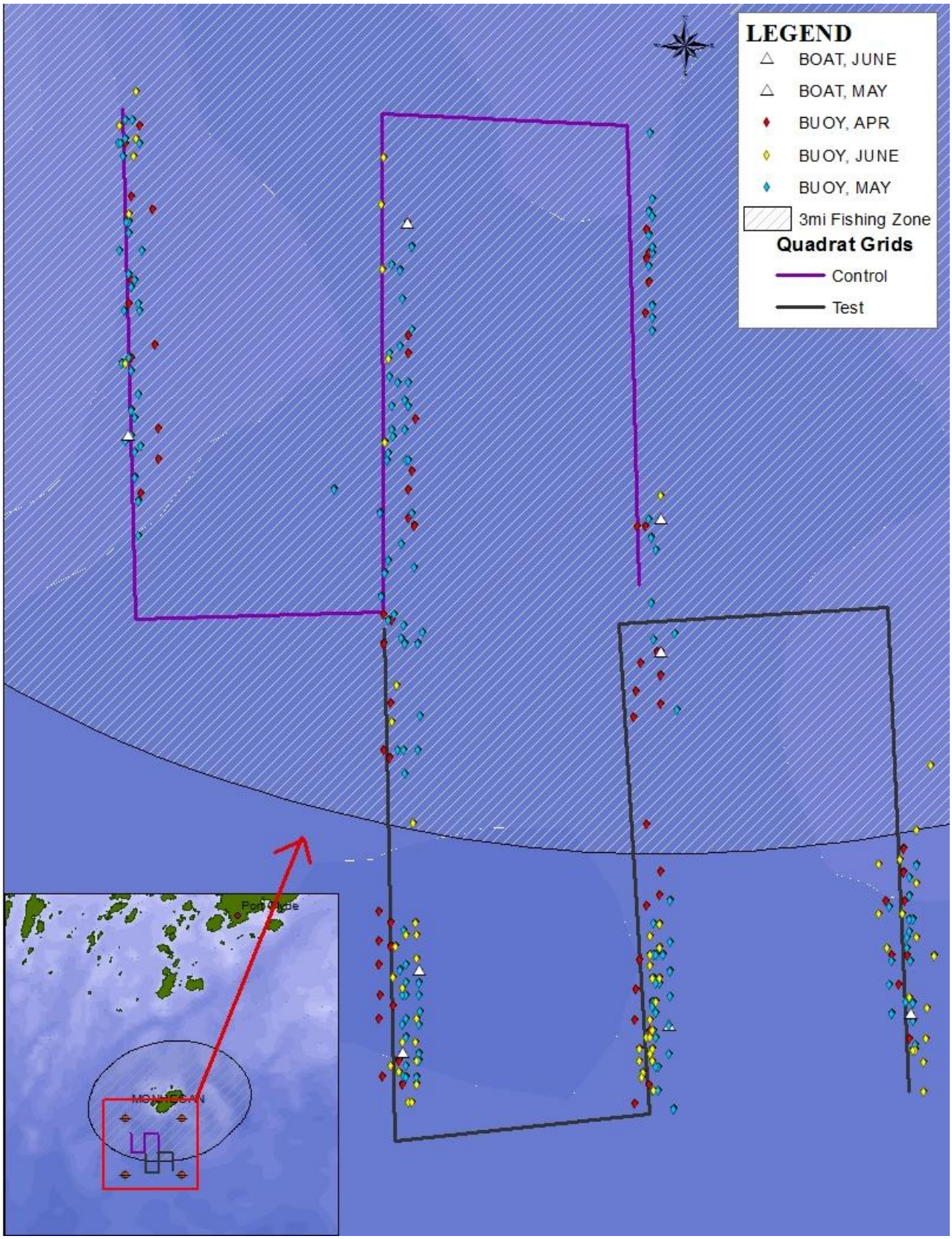
BOATS & BUOY OBSERVATIONS

Additional observations of boat traffic and lobster buoy presence were also recorded during the surveys. A total of eight boats were observed while surveys were performed. One boat was a private vessel (motorized) and the remaining seven were lobster fishing vessels. Table 44 provides a breakdown of the buoy count and location in each of the Quadrats. Buoy concentration was primarily in the Test Quadrat, as provided in Map 16, with occasional buoys found in the Control.

Table 44. Number and location of buoys observed in the Monhegan Test Site.

DATE	TEST	CONTROL
4/21	43	19
4/27	30	16
5/2	23	19
5/8	33	24
5/14	27	25
5/19	34	13
5/28	38	24
6/5	24	10
6/15	36	
6/16	31	
6/26	23	2

Starting on the last day of September each year, the winter lobster season begins for Monhegan residents, and ends June 1st. This corresponds exactly with the reduction and eventual disappearance of buoys in the Control Quadrat, which lies entirely within the Monhegan Lobster Conservation Area. This area encircles Monhegan Island out to three miles (4.8 km) where no other fisherman may impede (Map 17, Inset). This also coincides with the documented lobster buoys that begin precisely at the boundary of the three-mile buffer zone, as seen in Map 17. Three lobstering vessels did appear to attract birds in three separate observations associated with feeding: near one of the lobster boats, 43 gulls sat in the water near an actively fishing boat; at another lobster-fishing vessel, 45 HERG scavenged near the active vessel; and another incident had one HERG pattering near the vessel. All of these events occurred in the Test Quadrat.



Map 17. Locations of fishing vessels, lobster buoys, and the three-mile buffer called the Monhegan Lobster Conservation Zone.

SUMMARY

April through June of 2013 was the third season of surveys at the Monhegan Test Site during the pre-deployment stage of the University of Maine's proposed two-6MW Deepwater Offshore Wind Turbines on a Floating Platform. The previous surveys at this test location occurred from September through November of 2011, gathering data on six survey days during the fall migration season (Kennedy & Holberton 2012), and then again on ten survey days from late June through August, 2012 (Kennedy 2012b). A total of 11 boat-based visual surveys were performed at a rate of one per week. Data were gathered on species of birds and, occasionally, marine mammals and fish to include location, occurrence, numbers, behaviors, flight direction, and flight heights. The previous sections of this report summarized the species numbers and activities by date and behavior categories, presented maps and tables of their sightings, and summarized species listed under Maine ESA and BCC, and other observations. This following section will further summarize the highlights of this season's surveys, regarding the project's objectives.

Objective #1: Determining bird and marine wildlife species compositions and their current activities and habitat use of the Monhegan Test Site.

Recorded in the Test Quadrat, there were a total of 201 observations representing 19 identifiable species of birds, three species of marine mammals, and a school of bait fish. The Control Quadrat had 188 observations representing 17 species of birds and two marine mammals, with an overall total 608 individual birds counted throughout the entire Monhegan Test Site surveys. Table 45 lists each survey quadrat by total individuals counted and total survey area for birds and marine mammals.

Table 45. Numbers of bird and other species per kilometer surveyed in each quadrat.

		TEST	CONTROL	Monhegan Test Site Total
BIRDS	**# of Individuals**	336	272	608
	Area	55km^2	55km^2	110km^2
		6.11 birds/km^2	**4.95 birds/km^2**	**5.53 birds/km^2**
MARINE MAMMALS	**# of Individuals**	5	16	21
	Area	55km^2	55km^2	110km^2
		0.091 mammals/km^2	**0.291 mammals/km^2**	**0.191 mammals/km^2**

Twenty-one identifiable species of birds were documented overall (Appendix 2), with herring gulls being by far the most abundant species (2.84/km^2), followed by

northern gannets (0.6/km^2), and laughing gulls (0.41/km^2). Abundance of HERG was significantly higher in the Test Quadrat with 1.91/km^2 and 0.92/km^2 in the Control. Between the two Quadrats, however, 55% of all the birds were observed in the Test (6.11/km^2) and 76% of the marine mammals were recorded in the Control (0.29/km^2).

The most common avian activities observed throughout the entire Monhegan Test Site were direct flight (46%), followed by sitting on the water (20%), milling flight (9%), and scavenging (8%). For individual behaviors within the Quadrats, both the Quadrats had the same first two in the order of most common behaviors, however, variation appeared as of the third most common behavior. In the Test Quadrat, 36% of all birds flew direct, 29% sat, 14% scavenged, 7% milled, and 6% followed our vessel; in the Control Quadrat, 61% flew direct, 12.5% sat, 11% milled, and 5.5% followed our vessel. The active lobstering in the Test Quadrat undoubtedly drove this significant difference.

Bird Order-groupings revealed a few notable differences among behaviors observed. “Group 1” (eider, scoters, loons, and grebe) only ever flew direct, with 66% flying at one meter and 27% at five meters. “Group 2” (Charadriiformes) mostly flew direct (36%) with 34% of those fliers recorded at one meter and 24% at five meters, followed by sitting (25%). “Group 3” (Procellariiformes) mostly meandered (36%) and milled (27%), with 91% of all flight at one meter. “Group 4” (Suliformes) mostly flew direct (54%) with 34% of flight behaviors recorded at five meters and 24% at 10m. The one unidentified hawk species (Group 5) flew direct to the north at 15m high, heading to Monhegan Island. Figure 11 presents overall flight heights across the two Quadrats. Eighty-eight percent of all flight was recorded from one to 10m, with 87% and 90% in these heights in the Test and Control Quadrats, respectively.

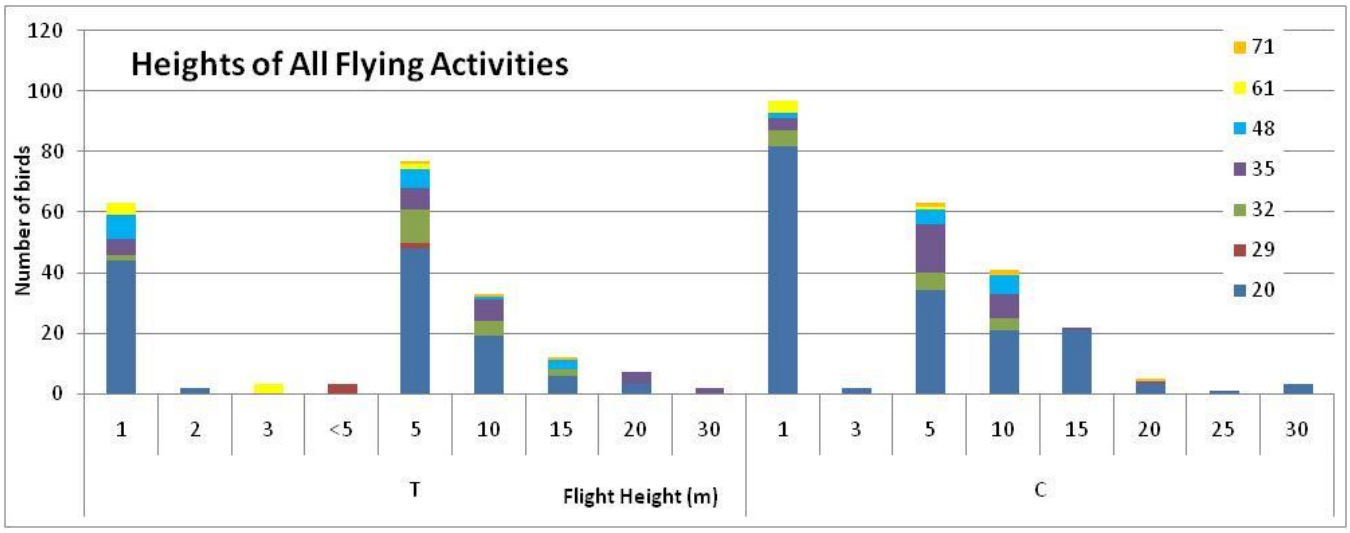


Figure 11. Flight heights for all flying behaviors for all birds.

In summary of foraging behaviors across the four major Order-Grouping represented in this survey, a higher percentage of foraging birds were found in the Test Quadrat (66%), compared to the Control (34%). Again, these numbers are due to the high concentration of HERG scavenging near working lobster vessels found in that quadrat. Northern gannets, however, were more numerous in the Control Quadrat with 10 birds milling between five and 10m and four birds plunge diving. Only three NOGA milled in the Test between one and 10m and three birds were plunge diving.

Endangered, threatened, and Birds of Conservation Concern (SCC) sightings included one great shearwater, five Atlantic puffin, five razorbills, and potential SCC that included 11 unidentified alcids and six unidentified terns (seen previously in Map 16). The one GRSH sat on the water at the very starting point of the Test Quadrat. Most of the UNTE and ATPU were located in the Test Quadrat but most of the UNAL and RAZO were located in the Control. All flight heights recorded by these flying SCC were at or below five meters.

Seasonal variation presented a few potential patterns among a few species groups. As provided in Appendices 3 & 4, it appears that alcid species were most common early in the season, generally present up until the first week of May. The duck species, cormorants, and grebes were also present mostly early in the season, generally present up until the middle of May before disappearing. Terns and gulls generally appeared more abundant after the middle of May, increasing in numbers until the survey season ended. Later arrival was also observed in the Procellariids, arriving after the 5th of June. These patterns align well with breeding patterns and migration tendencies to this area of the Gulf of Maine.

<u>Objective #2:</u> Use the initial baseline inventory of the species composition, behaviors, and habitat use for assessment of potential risks to the wildlife in relation to the University of Maine's two proposed 6MW Test Turbines at the Deepwater Offshore Wind test site off Monhegan Island.

Although two previous studies have been conducted at this Monhegan Test Site, they will neither be discussed nor compared to the results of this current survey. This is largely due to the incongruous seasonal difference of the previous studies that occurred in the fall and another in mid-summer and this current study occurring in late-spring into early-summer.

Birds may experience four major types of impact caused by offshore wind farms: direct collision, displacement due to disturbance, displacement due to the barrier effect, and direct habitat loss (Drewitt & Langston 2006, Goodale & Divoll 2009). A fifth impact involves habitat enhancement due to the underwater structure acting as an artificial reef

and potentially attracting piscivorous seabirds; however this can only be a net benefit if the birds are not frightened away or killed by the structure itself (Drewitt & Langston 2006). In the case of the Monhegan Test Site, the project will only ever consist of two 6MW turbines that stand 100m tall, and the overall spatial footprint is relatively small in area. Nevertheless, discussion will follow that summarizes any potential impact that the University of Maine's proposed floating turbine platform test units may present to wildlife at the Deepwater Offshore Wind test site off Monhegan Island.

The protocol and analysis used in this project encompasses both the focused region of the two turbines' location but also considers the larger region, which could potentially cover dispersal by species if the impact of displacement from disturbance occurs (Drewitt & Langston 2006). This was accomplished using the two Quadrats from which data were uniformly collected and analyzed: the Test Quadrat, within which the two full-scale turbines on a floating platform are to be placed, and the adjacent Control Quadrat.

Because bird behavior is not a random event, it would be advised to incorporate the influence of wind patterns and topography of the area that birds use for foraging, migration, and other movements in future studies utilizing this data (Drewitt & Langston 2006, Ferrer et al. 2012, Garthe & Hüppop 2004). The general region around Monhegan Island is characterized by its offshore location within the GOM and experiences marine-influenced weather patterns and climate variation. Found 16km from the nearest mainland, the island is situated south of Muscongus Bay which is formed by two peninsulas: Boothbay Harbor is on the northwest and Port Clyde is on the northeast peninsula. Monhegan Island's fishermen are familiar with the summer's typical light southwest breezes in the afternoon and winds primarily blow from the southwest or northwest. Open ocean from the southwest winds can build the seas higher, whereas the northwest winds have less fetch and the seas may stay calmer, yet the Canadian air is cooler (C. Cash, *pers. comm.*, 20 Jan 2013). The Monhegan Test Site (Map 2) is positioned three miles south of the island proper, therefore likely to experience direct forces of all prevailing winds with minimal deflection from the 168ft (51.2m) high cliffs that make up the eastern headlands on the island's "backside." Although these are among the highest ocean cliffs on Maine's coastline, Monhegan encompasses barely one square mile (2.59km^2) of total land and the winds are minimally altered by this island's presence.

As provided in Table 2, the wind directions across the 11 surveyed days can be generalized in which five of the survey days had winds coming from a southerly direction (such as SSW, SW, SE, or S), five surveys were winds of a combination of E and N (NNE, ENE, and E), and only one day had winds from the NW. Unfortunately, without the use of in-depth multivariate analysis comparing each species' flight habits, wind direction and

strength, time of day, tide, observed flight directions, and behavior categories, no apparent patterns could be discerned at this time.

Numerous Wind farm Sensitivity Index (WSI) studies in Europe and North America generally agree that the species most affected by offshore wind farms include gulls, grebes, loons, seaducks, and migrating waterfowl and passerines (Drewitt & Langston 2006, Garthe & Hüppop 2004). Radar studies at a Danish location revealed significant avoidance behavior (by a factor of 4.5) within the wind farm array by geese and common eider, and increasing their distance to the turbines, thereby reducing the risk of collision (Desholm & Kahlert 2005). A newer analysis by Furness & Wade further categorized impacts to particular species, concluding high disturbance scores for common eider, loons, and scoter species (easily disturbed, high tendency to flush); high collision impact scores for gulls, terns, and loons; and high overall disturbance and displacement scores for loons, sea ducks, and alcids (Furness & Wade 2012).

Current literature discusses how the probability of impacts from wind turbines, particularly with collisions, is more dependent upon individual species and their unique behaviors (Drewitt & Langston 2006, Ferrer et al. 2012, Fox et al. 2006, Furness & Wade 2012). These considerations should also take into account the local topographic factors which influence wind patterns and prey availability, as opposed to the common investigation of local abundance (Ferrer et al. 2012). However, the mortality rate due to direct collisions will nevertheless be directly proportional to the volume of migrating birds passing through the area at any given site, season, and weather conditions (Desholm 2006).

Flight height was determined to be a substantial factor in assessing collision probabilities by Furness & Wade in their review of Scottish seabird sensitivity to offshore wind farms (2012). The proposed development at this Monhegan site is for two-6MW full-scale offshore wind turbines on a floating platform with proposed height of the full-scale turbines to be 100m (328ft) at the hub and rotor diameter of 129m (423ft). For the full-size turbines, this equals a total height from waterline to highest blade tip to be ~164.5m (540ft), and the rotor sweep zone ranging from 35.5m (116ft) above the water's surface to 164.5m. For purposes of bird collision and other risks, since no birds were recorded as flying at these heights within the Monhegan Test Site, this is not considered to be a serious source of impact to these seabirds of the Monhegan area during this period of the year.

The proposed blades of the twin 6MW turbines have a full diameter of 129m, which provide the potential of injury or death with a swiftly moving object through the air. It is also widely understood that birds are documented as colliding with a wide variety of stationary man-made objects. These have included lighthouses, bridges, windows, high wires, etc., and flying birds particularly become susceptible under poor visibility and

environmental conditions (Fox et al. 2006). Data presented in this report involve bird activity observed during prime weather conditions; therefore we can only discuss the variation in the birds' activities as a potential distraction or attraction in the turbine test areas. Regardless of spinning turbines at this location and during this period, in consideration of future structures placed in this vicinity, it is discussed by Dierschke and Daniels that over 90% of loons, sea ducks, gulls, and terns habitually fly higher over the ocean (at or below 50m) and are more likely to be at the heights at which turbine blades would be spinning, thereby putting them more at risk (Dierschke & Daniels 2003 *in* Furness & Wade 2012).

Other seasonal factors should objectively be considered in the analyses regarding these gulls, terns, loons, sea ducks, and alcids who are defined as susceptible to impact by turbines (Drewitt & Langston 2006, Fox et al. 2006). Large numbers of HERG and GBBG nest on Monhegan Island (D. Lovitch, *pers. comm.* 24 January 2013); therefore some of the birds flying throughout the area may have been actively foraging to provision chicks back at the nest. Also, gulls are well known for investigating boats for the opportunity of finding easy food from discards (Schwemmer & Garthe 2005). This was likely the driving force behind the significantly higher abundance of gulls in the Test Quadrat, with the two particular instances of large aggregations of gulls associated with a working lobster boat: on May 2, 40 HERG were sitting behind the boat and on May 8, 45 HERG scavenged behind the boat. Also, following our vessel (code #32) during our surveys was a common behavior for the HERG, representing the fourth most common behavior and included six percent of all bird activities.

Although the cause was not clear regarding the increased numbers of HERG and terns at the Horns Rev wind farm in Denmark post construction (Drewitt & Langston 2006), explanation may have included increased loafing structures, increased fish abundance due to habitat modification, increased boat traffic looking like potential food sources, or a combination of any of these factors (Christensen et al. 2003, Kahlert et al. 2004, Petersen et al. 2004; *in* Fox et al. 2006). For this reason, gulls in the Monhegan Test Site may be attracted to the turbine itself for a loafing structure, for potentially increased foraging opportunities resulting from additional fish habitat, or the habituation of gulls responding to additional boat traffic in hopes of a feeding opportunity (Fox et al. 2006).

As for our SCC that namely included GRSH, terns, and alcids (Table 42), none were documented as flying within the potential rotor-sweep zone between 35.5m and 160m above the water. The largest percentage of SCC throughout the entire Monhegan Test Site flew direct (n=26, 4%) that never exceeded five meters above the surface. Of these 26 flying SCC, 61% were alcids, at 0.15 birds/km^2. According to the study by Furness & Wade,

alcids were part of the group that was rated moderately likely to be disturbed and displaced due to their tendency for flushing easily (Furness & Wade 2012).

All terns, like the gulls, were more numerous in the Test Quadrat than in the Control, collectively including seven birds versus two, respectively (Table 46). If the resulting test turbine's floating platform and structure becomes an attractant for fish, terns in particular may be attracted to a turbine site because of their piscivorous preferences (Drewitt & Langston 2006, Fox et al. 2006). This could lead to increased attendance near the turbines and therefore lead to a higher probability of collision with the blades (Drewitt & Langston 2006). At a study of ecological changes at a windfarm off the shore of the Netherlands, numbers of gulls, terns, and cormorants increased as the birds actively used the area for foraging (Lindeboom et al. 2011 *in* Furness & Wade 2012). A similar increase in gulls and terns at the Horns Rev windfarm was also documented (Petersen et al. 2004 *in* Fox et al. 2006).

Table 46. Observations of tern species in the Monhegan Test Site.

DATE	QUADRAT	SPECIES	NUMBER	ACTIVITY	HEIGHT (m)
15-Jun	Control	UNTE*	1	Meandering	5
16-Jun	Test	UNTE*	4	Direct flight	5
16-Jun	Control	UNTE*	1	Milling	1
26-Jun	Test	COTE	3	Pattering	3

*Denotes a potential SCC.

Seasonal factors influencing a significant portion of these seabirds' lives involve their breeding season. Alcids and terns begin to arrive to the Gulf of Maine around April and begin laying eggs throughout May. Chick hatch and parental provisioning for the terns begins mid-June and lasts from 21-29 days before most terns chicks fledge in mid- to late-July. On average, terns begin to depart to their wintering grounds throughout September. Alcid chicks hatch around mid- to late-June and the adults and young are around until late August before final departure (Ainley et al 2002, Lowther et al 2002, Hatch 2002, Nisbet 2002).

Observed tern and alcid flights through the Monhegan Test Site may have involved provisioning adults, although no birds were close enough to the surveyor or had large enough visible prey in their beaks to support this idea. Our Test Quadrat did not provide any SCC foragers but there were three pattering COTE that occurred on June 26th, as seen earlier in Table 45. This date coincides directly with ideal timing for provisioning tern adults. Only one milling UNTE was observed in the Control, on June 16th.

Atlantic puffins are believed to fly 25-50km from their nesting colony in search of food for a nestling (Wanless et al. 1999), and terns may forage 10-30km from their colony to feed their chicks (Hatch 2002, Nisbet 2002). In relation to Monhegan Island, the closest

nesting colony for both terns and alcids could be Eastern Egg Island which lies 12 km NNE. Matinicus Island is 35km ENE from Monhegan where ATPU also nest, and Metinic Island is only 20km NE from Monhegan where terns also nest, providing a population of provisioning adults that could theoretically scan the area of Monhegan for a food source. In Furness & Wade (2012) gulls, terns, and alcids scored medium to low on a ranking score for disturbance effects. Again, the two test turbines, although full 6MW units, will occupy a minimal footprint of area within the terns' and alcids' foraging habitat as compared to the full scale wind farms in Europe discussed in the literature. Therefore, the concern of increased avoidance of the site which theoretically increases energy expenditure caused by altered flight routes thereby reducing these breeders' fitness over the season is thereby not a viable concern in our situation.

Again, only three state threatened species under the Maine ESA were observed during this April through June of 2013 survey, and a single GRSH listed only as a Bird of Conservation Concern (BCC 2008) was also observed. Although none of these species are of Federal listing status, these 28 SCC birds have been highlighted due to concern regarding their population trends and the need to prevent further status listing. It is theoretically possible to suggest that these four species are out of harm's way regarding direct impact due to collision based on these three considerations: none flew within the heights of the rotor sweep zone; the vast majority of these birds flew direct, but were at or below five meters and are therefore out of the rotor sweep zone; and a very small percentage of SCC demonstrated activities associated with foraging (none in the Test Quadrat and 0.74% in the Control). Also, indirect effects such as habitat loss due to potential avoidance of the area are less of a concern because fewer alcids were present this summer in the Test Quadrat (six birds) versus the Control (18 birds), but more importantly, because the proposed twin turbines' area is minimal in size, thereby reducing the area of habitat that may be lost. A potential concern for the future deployment of the turbines, however, would be an increase in tern foraging or use of the Test Quadrat due to habitat enhancement. All tern numbers currently reflect higher abundance in the Test (seven birds, 0.13 terns/km^2) than in the Control (two birds, 0.04 terns/km^2), although this difference is likely insignificant.

Herring gulls, northern gannets, laughing gulls, common eider, surf scoters, great black-backed gulls, double-crested cormorants, and common loons were recorded as the eight most abundant species during our surveys from April through June 2013 (Table 3 and Appendix 2). Again, according to the European literature discussed above, the species regarded as "most at risk" by turbines and that were also observed in our surveys include large gulls, terns, loons, sea ducks, and alcids.

If the birds found in these previous European studies react similarly to turbines here in the GOM, our large gull species are the bird species most at risk for collision

impacts with the structure. Large gull species included 51% of all birds recorded throughout the Monhegan test site, consisting of 63% (3.84 gulls/km^2) of all birds in the Test Quadrat and 37% (1.84 gulls/km^2) in the Control. Another factor for concern regarding the large gulls and their presence near the turbines include the attraction to the platform as a location for loafing, but also the potential for increased foraging opportunities due to enhanced fish habitat under and around the semi-submersible floating platform (Drewitt & Langston 2006, Fox et al. 2006).

The sea ducks, loons, and grebes (Group 1) counted in this study totaled 89 birds across five species, at 0.81/km^2 (Appendix 4). According to the research, they are at most risk for impacts due to disturbance, attributable to being easily flushed and strongly demonstrating significant avoidance behavior of the human structures, therefore perpetuating the loss of habitat near wind farms (Desholm & Kahlert 2005, Furness & Wade 2012, Larsen & Guillemette 2007). However, as discussed earlier, the overall spatial scale of this 12MW project is reduced, compared to the European wind parks, and the loss of duck habitat is likely minor in this case. Alternately, the documented avoidance factor by waterfowl in the study by Desholm & Kahlert identifies significant reduction in the potential for collision (Desholm & Kahlert 2005), which can be interpreted as a potentially positive result in our Monhegan area ducks' favor.

Although abundance alone is not a factor of concern for impact to the birds of the University of Maine's Deepwater Offshore Wind Test Site, the high numbers of large gulls observed during this season's surveys will be an interesting subset of data to compare to the upcoming deployment season. For example, numbers of common eider, loons, alcids, and sea ducks decreased after installation of wind farms at two Danish wind farms (Petersen et al. 2004 *in* Drewitt & Langston 2006). In our situation, species abundance during the early-summer survey season involved a minimal number of eider (0.29/km^2), loons (0.19/km^2), scoters (0.27/km^2), and alcids (0.26/km^2). Due to carcasses sinking or being consumed by opportunistic predators, detection probabilities are low for birds that may be killed by collision, *if* they do occur with the proposed twin 6MW turbines. However, the high abundance of herring and laughing gulls recorded in this season's survey coincide with the high level of concern for collision impact rankings developed by Furness & Wade (2012).

Maine-specific considerations for wind farm development have been suggested by the BioDiversity Research Institute to include three main criteria: 1) avoid critical breeding, wintering, and migratory areas, 2) avoid offshore islands that provide breeding areas for seabirds and are essential migratory staging areas, and 3) avoid areas within three kilometers of these first two criteria to prevent serious impact to birds of special concern (Goodale & Divoll 2009). Monhegan Island is transited by migratory birds,

particularly raptors and neotropical migrants (BRI 2010). Herring gulls, great black-backed gulls, and double-crested cormorants are abundant breeders that also utilize Monhegan's rocky cliffs (D. Lovitch, *pers. comm.,* 24 Jan 2013). In accordance with these suggested steps for minimizing impact to these birds, the Test Quadrat appropriately begins at about four kilometers from the southern-most tip of Monhegan Island, as seen in Map 2. The State of Maine consulted with many stakeholders in an effort to minimize environmental effects of the selected test sites, and the Monhegan test site was selected because, in part, the testing of wind turbines at this site would minimize effects to offshore birds, fishing grounds, and other considerations of the area. Fortunately, in this case, this should alleviate impacts which Goodale & Divoll believe may occur due to these circumstances (Goodale & Divoll 2009).

A future objective regarding the planned deployment of the two full-scale floating platform turbines will be to compare this season's data to the data collected following deployment of the turbines. Data will assess species composition and behavior changes, if any, to the presence of the structure and its necessary maintenance. Appropriate monitoring in both the pre- and post-deployment stages provides the data necessary to recognize if impacts to species of concern exist.

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APPENDIX 1

SURVEY CODES
(Gould & Forsell 1989)

Code 2. Survey Type (15)
1 = General observations: These are records of large flocks, rare or unusual sightings, transects that cannot be used to derive density indexes, or any record that will not fit another format.
7 = Station count: The criteria for a station count are that the platform is stationary and that all birds are counted in a 360° circle from the platform.
9 = Ocean transect: The criteria for a transect are a visibility of at least 1,000m and a moving platform with a constant speed and direction. An oceanic-transect is conducted outside well-defined headlands.

Code 3. Observation Conditions (75)
1 = Bad (general observations only)
2 = Poor (no quantitative analysis)
3 = Fair
4 = Average
5 = Good
6 = Excellent
7 = Maximum

Code 5. Sea State (49)
0 = Calm
1 = Rippled (0.0 1-0.25 ft)
2 = Wavelet (0.26-2.0 ft)
3 = Slight (2-4 ft)
4 = Moderate (4-8 ft)
5 = Rough (8-13 ft)
6 = Very rough (13-20 ft)
7 = High (20-30 ft)
8 = Over 30 ft

Code 6. Weather (55-56)
00 = Clear to partly cloudy (0-50% cloud cover)
03 = Cloudy to overcast (51-100% cloud cover)
41 = Fog (patchy)
43 = Fog (solid)
68 = Rain
71 = Snow
87 = Hail

Code 14. Age (32)
P = Pullus (flightless young)
J = Hatching year (hatching date to spring molt: a bird capable of sustained flight)
S = Subadult (last year before adult plumage)
A = Adult

Code 17. Bird Behavior (56-57)
00 = Undetermined
01 = Sitting on water
10 = Sitting on floating object
15 = Sitting on land
20 = Flying in direct & consistent heading
29 = Flying, height variable
31 = Flying, circling ship
32 = Flying, following ship
34 = Flying, being pirated
35 = Flying, milling or circling (foraging)
48 = Flying, meandering
61 = Feeding at or near surface while flying (dipping or pattering)
65 = Feeding at surface (scavenging)
66 = Feeding at or near surface, not diving or flying (surface seizing)
70 = Feeding below surface (pursuit diving)
71 = Feeding below surface (plunge diving)
82 = Feeding above surface (pirating)
90 = Courtship display
98 = Dead

Code 18. Mammal Behavior (56-57)
00 = Undetermined
01 = Leaping
02 = Feeding
03 = Mother with young
04 = Synchronous diving
05 = Bow riding
06 = Porpoising
07 = Hauled out
08 = Sleeping
09 = Avoidance
14 = Curious/following
15 = Cetacea/pinniped association
16 = Pinniped/bird association
17 = Cetacea/bird association
18 = Breeding/copulation
19 = Moribund/dead

APPENDIX 2

Species listed by most abundant to least abundant in the Test and Control Quadrats, including total numbers, total observations, and most common behavior type.

Overall Total per km^2	TEST Quadrat Species	Abundance per km^2	Total number	Number of observations	Most common behavior	CONTROL Quadrat Species	Abundance per km^2	Total number	Number of observations	Most common behavior
	Total	**3.073**	**338**	**198**	**Direct flight**	**Total**	2.618	**288**	**188**	**Direct flight**
2.836	HERG	1.909	210	105	Sitting	HERG	0.918	101	93	Direct flight
0.600	NOGA	0.318	35	28	Direct flight	NOGA	0.273	30	23	Direct flight
0.209	GBBG	0.145	16	16	Direct flight	LAGU	0.273	30	25	Direct flight
0.409	LAGU	0.136	15	13	Direct flight	COEI	0.209	23	1	Direct flight
0.191	COLO	0.109	12	9	Direct flight	DCCO	0.173	19	2	Direct flight
0.255	SUSC	0.082	9	2	Direct flight	SUSC	0.173	19	1	Direct flight
0.291	COEI	0.082	9	2	Direct flight	HAPO	0.136	15	8	n/a
0.082	WISP	0.045	5	5	Milling and Meandering	UNAL*	0.091	10	4	Direct flight
0.055	UNTE*	0.036	4	1	Direct flight	COLO	0.082	9	8	Direct flight
0.209	DCCO	0.036	4	2	Direct flight	GBBG	0.064	7	7	Direct flight
0.045	ATPU*	0.036	4	3	Direct flight	RNGR	0.055	6	1	Direct flight
0.027	Hseal	0.027	3	3	n/a	RAZO*	0.036	4	2	Sitting and Direct flight
0.027	COTE	0.027	3	1	Pattering	WISP	0.036	4	4	Pattering
0.027	BLSC	0.018	2	1	Direct flight	COMU	0.036	4	3	Direct flight
0.045	COMU	0.009	1	1	Direct flight	BLGU	0.018	2	1	Direct flight
0.009	SOSH	0.009	1	1	Meandering	UNTE*	0.018	2	2	Milling and Meandering
0.045	RAZO*	0.009	1	1	Sitting	GrayS	0.009	1	1	n/a
0.145	HAPO	0.009	1	1	n/a	HAWK	0.009	1	1	Direct flight
0.1	UNAL*	0.009	1	1	Direct flight	ATPU*	0.009	1	1	Direct flight
0.027	BLGU	0.009	1	1	Direct flight					
0.009	GRSH*	0.009	1	1	Sitting					

*Red text indicates SCC, or potential SCC.

APPENDIX 3

All observed species, by date, time of day, and number recorded.

	DATE	21-Apr	27-Apr	2-May	8-May	14-May	19-May	28-May	5-Jun	15-Jun	16-Jun	26-Jun
	TIME	PM	AM	AM	PM	AM	PM	AM	PM	PM	AM	PM
Total	SPECIES											
2	BLSC		2									
28	SUSC	2	19			7						
32	COEI		9		23							
21	COLO		1	7	3	2	7				1	
6	RNGR		6									
1	GRSH*										1	
1	SOSH								1			
9	WISP											9
23	GBBG			2				9	4	5	3	
311	HERG	5	12	66	70	14	18	18	19	23	53	13
45	LAGU			1			3	6	4	5	26	
3	COTE											3
6	UNTE*									1	5	
5	ATPU*					1			1		1	2
3	BLGU	2						1				
5	COMU	1		4								
5	RAZO*		2	2				1				
11	UNAL*	7		3			1					
23	DCCO			17		1		3				2
65	NOGA	1	5	5	6	2	8	17	13	3	5	
1	HAWK									1		
1	GrayS	1										
16	HAPO		1					5				10
3	Hseal							3				
1	FISH							1				
627	**Grand Total**	**19**	**57**	**107**	**102**	**27**	**37**	**64**	**42**	**38**	**95**	**39**

*Red text indicates SCC, or potential SCC.

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