National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Boston Harbor Islands National Recreation Area Coastal Breeding Bird Monitoring

2010 Field Season Summary

Natural Resource Technical Report NPS/NETN/NRTR—2011/459

ON THE COVER
Least Tern (*Sterna antillarum*) feeding chick in Lovells Island Colony, 2010.
Photograph by: Carol Lynn Trocki

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June 2011

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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This report is available from the Northeast Temperate Network Inventory & Monitoring Program (http://scinece.nature.nps.gov/im/units/netn/) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/).

Please cite this publication as:

Trocki, C. L. 2011. Boston Harbor Islands National Recreation Area coastal breeding bird monitoring: 2010 field season summary. Natural Resource Technical Report NPS/NETN/NRTR—2011/459. National Park Service, Fort Collins, Colorado.

NPS 035/107833, June 2011

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Acknowledgements

Thanks to the incredible volunteers: Pat Dolan, Tim Factor, Sally Ferbert, Carl Johnson, Bob Kelley, Andy Leahy, Arthur Pearson, Wayne Petersen, Rob Sheridan, Polly Stevens, Bob Stymeist, and Heather Warchalowski. These volunteers helped gather this year's data *and* made the work a lot of fun! Massachusetts Department of Conservation and Recreation (DCR) Rangers William Bryan, Nate Robbins, and Tim Lee-Chuvala were also a wonderful addition to the 2010 field season.

Thank you to park staff, Valerie Wilcox, Mary Raczko and Marc Albert, for their support and help with data collection. And thanks especially to Mary Raczko for her efforts recruiting and coordinating volunteers.

We greatly appreciate Russ Bowles and his capable and professional staff at University of Massachusetts, Boston Marine Operations for providing transportation on the water. This project was supported and funded by the Northeast Temperate Network Inventory & Monitoring Program. Thanks to Brian Mitchell, Adam Kozlowski, and Ed Sharron for their helpful input and assistance.

Introduction

In 2002, Boston Harbor Islands National Recreation Area (BOHA) was designated as a Massachusetts Important Bird Area (IBA) because it provides habitat for a significant number of colonial-nesting waterbirds, including Least Terns (*Sterna antillarum*) and Common Terns (*Sterna hirundo*), which are both listed as species of special concern in the State of Massachusetts (Massachusetts Natural Heritage and Endangered Species Program 2007). BOHA also provides habitat for breeding wading birds including Snowy Egrets (*Egretta thula*) and Black-crowned Night-Herons (*Nycticorax nycticorax*) which are, respectively, species of high and moderate continental conservation concern (Kushlan et al. 2002). American Oystercatchers (*Haematopus palliates*) have expanded their range northward into Massachusetts and now have a substantial breeding population in the Boston Harbor Islands (Paton et al. 2005). The North American population of American Oystercatchers is listed as a high priority shorebird species with high conservation concern in the U.S. Shorebird Conservation Plan (2004). In addition, eiders, cormorants, several other wading and shorebird species, and gulls regularly nest on the islands.

Although much is known about the spatial distribution and abundance of breeding birds in Massachusetts (Veit and Petersen 1993), less has been published on the avifauna of the Boston Harbor Islands. Although not part of a consistent monitoring program until recently, periodic records of breeding waterbirds on the islands do exist (see Andrews 1990, Hatch 1984, Blodget and Livingston 1996, Parsons et al. 2001, Hatch 2001 and Nove 2001).

In 2001-2003, Paton et al. (2005) conducted an avian inventory of BOHA, which in part established the need for a long-term coastal breeding bird monitoring protocol in the park. When compared with previous studies, the Paton et al. (2005) waterbird inventory suggested that:

- Common Eiders (*Somateria mollissima*) have a small, but established colony of approximately 70 nests on islands in the Outer Harbor, primarily Calf Island.
- Double-crested Cormorants (*Phalacrocorax auritus*) have redistributed themselves among the islands of the Outer Harbor, but have maintained fairly stable numbers since the 1980s (Andrews 1990, Hatch 1984).
- Wading birds have experienced a significant decline on Sarah Island where the population declined from 725 nests in 1994 (Parsons et al. 2001) to 112 nests in 2003. The number of nesting wading birds on Middle Brewster Island has varied from 124 nests in 1984-5 (Andrews 1990), to 207 nests in 1994 (Blodget and Livingston 1996), to only 14 pairs present in 2003. Wading birds are no longer present on Spectacle, Peddocks, or Gallops islands (Nove 2001).
- American Oystercatchers have increased from only several pairs in the early 1990s (Veit and Petersen 1993; Nove 2001) to approximately 16 pairs on 14 islands in 2003.
- Herring Gulls (*Larus argentatus*) have declined in BOHA (Andrews 1990), as they have regionally (Rome and Ellis 2004), which may be due in part to the restoration of Spectacle Island, a former landfill and gull nesting site.
- Great Black-backed Gulls (*Larus marinus*) have maintained a stable population in BOHA (Andrews 1990), though regional data suggests they may be increasing (Rome and Ellis 2004).

- Least Terns have a small but relatively stable population (less than 100 pairs), usually on Rainsford or Lovell's islands (Hatch 2001, Nove 2001).
- Common Terns have declined from a peak of 100 pairs in 1993 (Hatch 2001) to approximately a dozen pairs on Snake Island in 2003.

Additional waterbird surveys were conducted in BOHA in 2005 and 2006 using similar techniques and providing generally similar results (Trocki et al. 2007). However, because waterbird populations can fluctuate widely, it was deemed necessary to establish a consistent and comprehensive long-term monitoring protocol in order to accurately measure population trends over time (Trocki et al. 2010). In 2007 and 2008, waterbird surveys were conducted in BOHA in support of the development of this long-term monitoring protocol (Trocki and Paton 2007, Trocki 2009). In 2009, these efforts continued (Trocki 2010), as they did in 2010 (this report).

The following objectives provide the basis for the coastal breeding bird monitoring protocol for Boston Harbor Islands National Recreation Area (Trocki et al. 2010):

1) Determine annual changes and long-term trends in abundance of high priority coastal breeding bird species (Least Terns, Common Terns, and American Oystercatchers).
2) Conduct an annual surveillance program within the park to identify future use by threatened or endangered coastal breeding bird species, such as Piping Plover (*Charadrius melodus*) or Roseate Tern (*Sterna dougallii*). If discovered in the park, these species would be a high priority for monitoring.
3) Determine long-term trends in species composition and abundance of priority coastal breeding bird species (eiders, cormorants, wading birds, shorebirds, and gulls).

In addition to these measurable objectives, we also seek to improve our understanding of breeding waterbird – habitat relationships in BOHA and the effects of habitat changes and management actions (such as invasive plant control, predator control, or visitor restrictions) on waterbird species composition and abundance. Waterbird monitoring data can be correlated with ancillary data on park management actions, rocky intertidal communities, water quality, climate, and other available data to assist park managers in their efforts to protect and, in some cases, encourage the recovery of coastal breeding birds in the park.

Volunteers assisted the lead scientist in conducting waterbird surveys in the park in 2007-2010. It is the intent of the Northeast Temperate Inventory and Monitoring Network (NETN) and the park to use volunteers to implement this protocol in the future, both to enhance community involvement with park islands and to provide a cost-effective implementation method for long-term monitoring.

Methods

The survey methods recommended in the protocol focus on obtaining information on the relative abundance of coastal breeding species by estimating or directly counting all nests, incubating adults, or territorial nesting pairs (methods vary by species, see Trocki et al. 2010 for details). These methods were selected based on their ability to:

- Accurately detect changes in species richness, relative abundance of nesting pairs, and nesting location for each high priority and priority species.
- Create minimal disturbance to nesting colonies and/or nesting pairs.
- Be implemented by trained volunteers working with a lead scientist and park staff.
- Be carried out with an annual budget of approximately $16,000.

According to the protocol, long-term monitoring surveys will be conducted annually for high priority species (terns and oystercatchers), while a complete survey, that includes all priority and high priority species, will be conducted on a 3-year rotation (Table 1). The first rotation began in 2008 (the 2007 pilot data did not match the final rotation), and the second will begin in 2011. Surveillance surveys for new species and new colony sites will be ongoing, in conjunction with all coastal breeding bird monitoring efforts.

Table 1. Boston Harbor Islands National Recreation Area coastal breeding bird monitoring 3-year survey rotation schedule, based on annual effort and park priorities.

	Year 1: 2008 and 2011			Year 2: 2009 and 2012			Year 3: 2010 and 2013		
Survey Tasks[1]	May 15-31	June 1- 15	Jun 15 – Jul 15	May 15-31	June 1- 15	Jun 15 – Jul 15	May 15-31	June 1- 15	Jun 15 – Jul 15
common eiders	x		x			x			x
cormorants & gulls	x								
wading birds				x	x				
large shorebirds	x	x	x	x	x	x	x	x	x
small shorebirds / surveillance							x	x	x
terns		x	x		x	x		x	x

[1] see Trocki et al. 2010 for complete information on methods and target dates established for this protocol.

The priority and high priority species surveyed in this protocol are all highly visible and most nest in colonies, which makes them relatively easy to locate. Though coastal waterbirds nest in a variety of habitats, the specific requirements of each individual species are well understood and fairly predictable. Colonial-nesting waterbirds also exhibit a high degree of site fidelity, so colony locations are likely to remain similar from year-to-year. However, to accurately understand long-term trends, it is critical to have periodic and comprehensive surveys of all islands in the park to avoid a sampling bias for known locations. A regular surveillance program ensures that all nesting species are detected and that shifts in colony locations are not incorrectly recorded as losses. A comprehensive approach to sampling also allows for the detection of new colony sites or nesting by new species (such as Piping Plover [*Charadrius melodus*] or Roseate Tern [*Sterna dougallii*]).

A map of BOHA is provided for reference (Figure 1). Survey effort in 2010, which was 'Year 3' in the survey rotation, is summarized in Table 2. In addition to the tasks prescribed in a Year 3 survey rotation (eider crèches, shorebirds, terns, and general surveillance) time allowed for additional effort refining gull and cormorant boat-based survey methods early in the season. Descriptions of the methods used to survey priority and high priority species in 2010 are given below.

Table 2. Boston Harbor Islands National Recreation Area coastal breeding bird monitoring survey effort in 2010. Note that 'B' indicates boat-based survey, while 'G' indicates ground-based survey. Surveys for eider chicks included counts of attending females.

BOHA Island	5/18	5/24	6/11	6/16	6/23	7/2	7/7	7/22	8/5	2010 Species Focus
Calf	B	B	B	B	B		B		B	gulls, cormorants, eider crèches, AMOY[1]
Little Calf	B	B	B	B	B		B		B	gulls, cormorants, eider crèches, AMOY
Green	B	B	B	B	B		B		B	gulls, cormorants, eider crèches, AMOY
Graves	B	B	B	B	B		B			gulls, cormorants, eider crèches, AMOY
Middle Brewster	B	B	B	B	B		B		B	gulls, cormorants, eider crèches, AMOY
Outer Brewster	B	B	B	B	B		B		B	gulls, cormorants, eider crèches, AMOY
Shag Rocks	B	B	B	B	B		B		B	gulls, cormorants, eider crèches, AMOY
Little Brewster	B	B	B	B	B		B			gulls, cormorants, eider crèches, AMOY
Great Brewster							G			AMOY, SPSA
Lovells	G		B		G	G		G	G	AMOY, terns, SPSA[1]
Georges		G								SPSA
Gallops										Not surveyed in 2010
Rainsford			B	G	G			B	G	AMOY, terns, SPSA
Snake			G							AMOY, terns, Willets
Spectacle			G							AMOY, SPSA
Peddocks				B						AMOY
Thompson										(AMOY surveyed by trained volunteer outside of a scheduled group field work)
Sarah						B		B		AMOY
Ragged						B		B		AMOY
Langlee						B		B		AMOY
Button						B		B		AMOY
Slate						B				AMOY
Grape						B				AMOY
Bumpkin						B				AMOY
Sheep						B		G		AMOY
Hangman								B		AMOY
Spinnaker			B							terns

[1] AMOY = American Oystercatcher; SPSA = Spotted Sandpiper

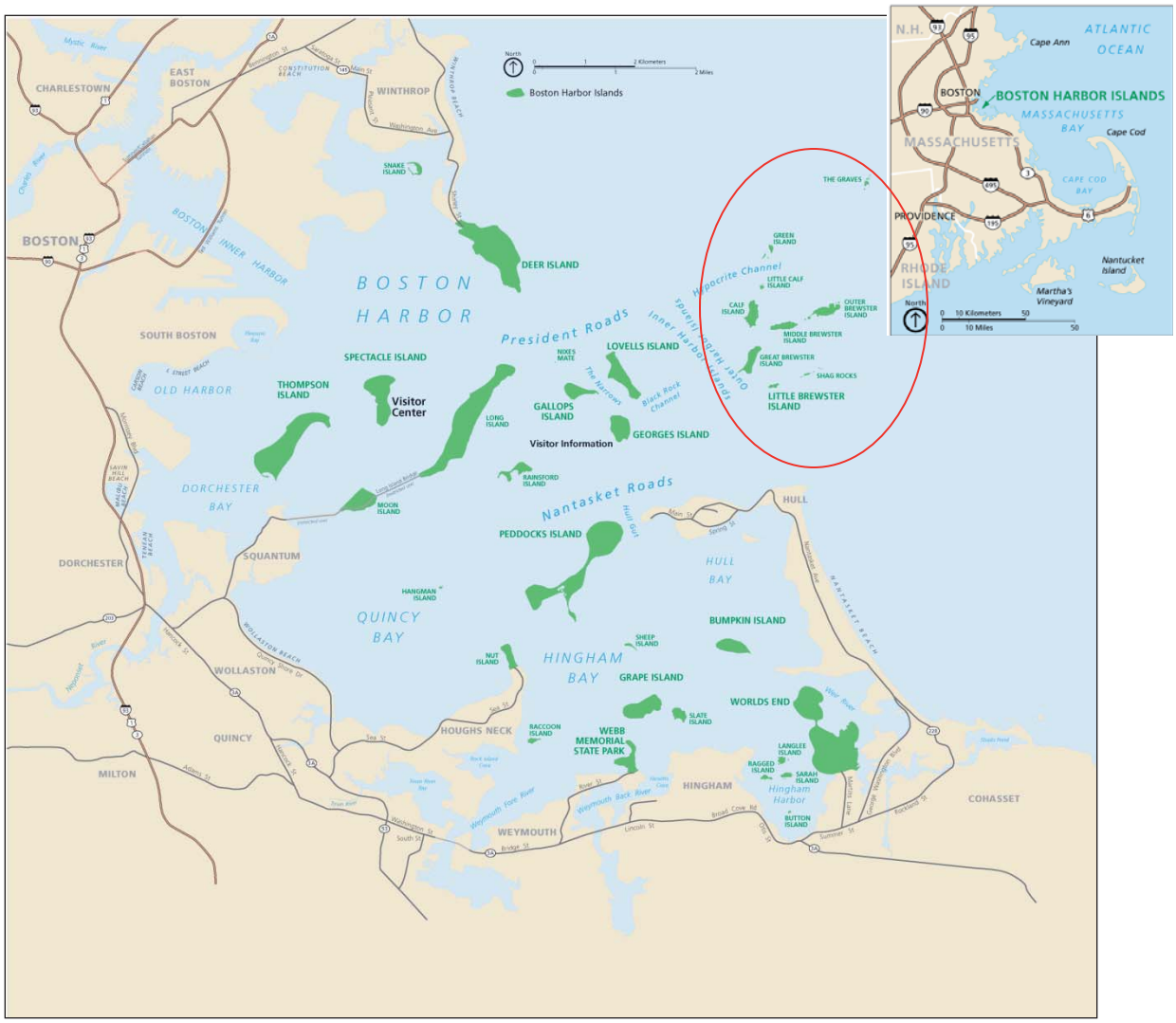

Figure 1. Boston Harbor Islands National Recreation Area (note the red circle enclosing the 'Outer Islands' which are frequently referred to collectively in the text).

Common Eiders

Common Eiders nest semi-colonially in BOHA and have generally been found nesting in tall grass or under overhanging vegetation, primarily staghorn sumac (*Rhus typhina*), on rocky islands in the Outer Harbor ('Outer Islands'). Common Eiders were surveyed with complete, ground-based nest counts in 2008. Only boat-based surveys for Common Eider crèches were conducted in 2010.

Beginning approximately 2-3 weeks following peak incubation, Common Eider chicks can be observed rafting in crèches offshore near nesting islands, protected by attending females. Chicks cluster together in this way for protection from predators. The number of female Common Eiders and chicks on the water were counted by surveyors circling the islands by boat at approximately 5 km per hour from a distance of approximately 9-46 m offshore (or as close as the boat captain felt safe boat operation was feasible). Preliminary boat-based crèche counts were conducted during surveys focusing on gulls and cormorants in the Outer Islands on 18 May and 24 May. Boat-based surveys specifically focused on Common Eider crèche counts were conducted on 11 June, 16 June, 23 June, and 7 July (Table 2). Figure 2 shows a sample track from a boat-based survey of the Outer Islands on 11 June.

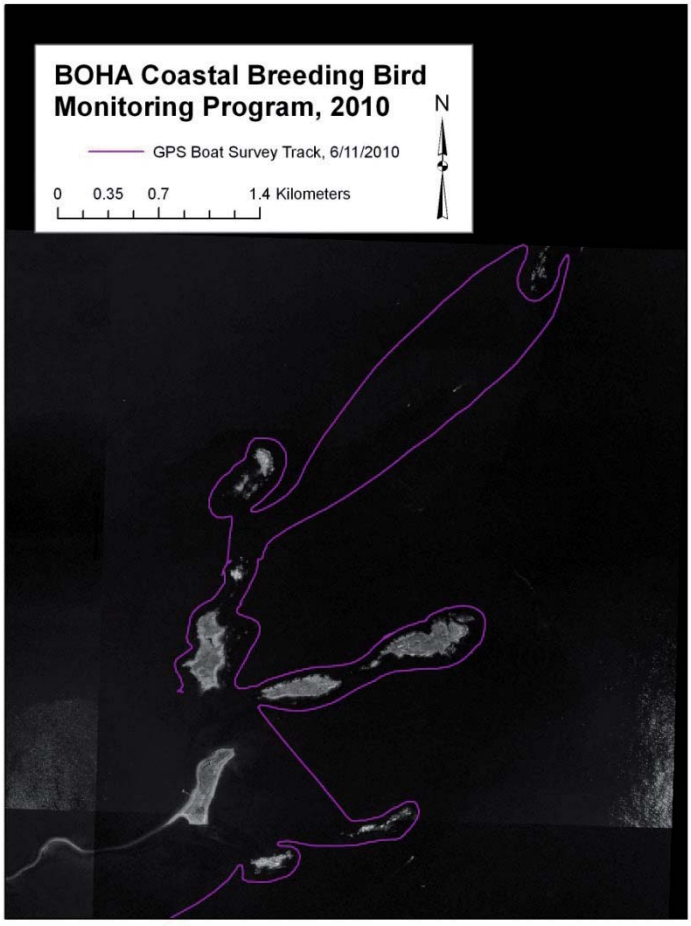

Figure 2. A sample GPS track from boat-based surveys for Common Eider crèches on 11 June during the 2010 monitoring season in Boston Harbor Islands National Recreation Area (BOHA).

Cormorants and Gulls

The majority of gulls and cormorants breeding in the Boston Harbor Islands National Recreation Area nests on the Outer Islands (Paton et al. 2005). Boat-based surveys of nesting Double-crested Cormorants (DCCO), Herring Gulls (HERG), and Great Black-backed Gulls (GBBG) were conducted on Calf, Little Calf, Green, Middle Brewster, Outer Brewster, and Little Brewster islands, The Graves, and Shag Rocks on 18 May and 24 May in 2010 (Table 2). The boat track was similar to that shown in Figure 2. Visible active nests, as evidenced by the presence of an incubating adult or visible chicks, were counted by surveyors circling each island by boat at approximately 5 km per hour from a distance of approximately 9-46 m offshore (or as close as the boat captain felt safe boat operation was feasible). Two independent observers recorded their observations of nesting adults on each survey. Ground-based surveys of nesting cormorants and gulls were not conducted in 2010.

Beginning in 2009, we also explored the feasiblity of using a high-resolution digital camera to photograph the colonies from the boat so that numbers of nesting individuals of each species could be verified in the office following boat-based surveys. Efforts to refine photography techniques for this purpose were continued in 2010 during boat-based gull and cormorant surveys.

Wading Birds

Wading birds have previously been documented in five mixed-species wading bird colonies in BOHA on Calf, Middle Brewster, Outer Brewster, Sheep, and Sarah islands (Paton et al. 2005). A complete ground-based survey of each colony site was conducted during the peak of incubation in 2009. Wading birds were not comprehensively surveyed in 2010.

American Oystercatchers and Willets

Boat-based surveys were used to estimate the number of nesting pairs of adult American Oystercatchers on each island where complete ground-based surveys were not conducted. American Oystercatcher surveys of all islands were conducted simultaneously with cormorant and gull, Common Eider, or tern surveys throughout the breeding season in 2010 (Table 2). When American Oystercatcher nests were detected during ground-based surveys for other species, location (GPS coordinates) and nest contents were recorded. A complete nest search of all islands was not undertaken due to the effort and disturbance involved in finding individual oystercatcher nests. On islands where American Oystercatchers pairs were detected early in the season, repeated boat-based surveys were undertaken to try and gain information about the fate of nests and juveniles.

Willets are conspicuously vocal when breeding and have only been detected nesting in BOHA on Snake Island (Paton et al. 2005). We estimated the total number of nesting pairs of Willets on Snake Island during a visit on 11 June.

Spotted Sandpipers

Spotted Sandpipers were suspected to be nesting on nine islands in the park during inventory surveys conducted in 2002 and 2003 (Paton et al. 2005). Since that time, during all boat-based and ground-based waterbird surveys, observations of Spotted Sandpipers have been recorded. In 2010, a substantial ground-based survey effort of suspected Spotted Sandpiper nesting habitat

was conducted and callback surveys were used to attract this secretive species. Ground-based surveys were conducted on Georges Island on 24 May, on Lovells Island on 18 May, on Spectacle Island on 11 June, on Great Brewster Island on 7 July, and on Rainsford Island on 16 June, 23 June, and 5 August. These islands were selected because of recent and repeated Spotted Sandpiper sightings (Rainsford, Spectacle, Great Brewster, Lovells) and because they include islands where Spotted Sandpipers have been reported that are not regularly surveyed for other waterbird species during the 3-year survey rotation (Peddocks and Georges).

Terns

In recent years terns have nested on Lovells, Rainsford, and Snake Islands in BOHA (Paton et al. 2005). These three islands were visited periodically throughout the breeding season to observe any evidence of tern colony formation. In addition, volunteers, rangers, and park staff regularly communicated and reported on tern nesting harbor-wide throughout the season, which greatly enhanced our ability to target survey activities.

Rainsford Island was surveyed on 11 June, 16 June, 23 June, 22 July, and 5 August. Snake Island was visited on 11 June; two attempts to revisit Snake later in the season were prevented by passing LNG (liquefied natural gas) tankers which restrict boat traffic in portions of Boston Harbor. Lovells Island was surveyed on 18 May and 11 June.

By 23 June, a Least Tern colony had formed on Lovells Island, presumably comprised of re-nesting individuals from the depredated Winthrop Beach colony that had broken up several days earlier. The Lovells Island tern colony was revisited on 2 July, 22 July, and 5 August to monitor progress. Visits on 23 June and 2 July consisted of complete nest counts, where four to six volunteers lined up across the beach, dividing the area from the wrack line (the line of debris left on the upper beach by the last high tide) to the beginning of heavy vegetation, and worked as a team proceeding slowly through the colony locating and counting nests. Nest contents (eggs and chicks) were also recorded during these two visits. On subsequent visits, observations were made from outside the colony to limit disturbance during chick-rearing.

Common Terns are also known to nest on a platform near Spinnaker Island. Although this nesting area is outside of park boundaries, these terns undoubtedly rely on BOHA for foraging habitat. Nesting was confirmed on the Spinnaker platform and the number of adults attending the colony was estimated on 11 June 2010.

Finally, in an effort to assess our ability to adequately count cryptic tern nests, an experiment using a Least Tern ‘dummy colony’ was conducted on Rainsford Island on 5 August. The ‘dummy’ colony contained 25 nests and was constructed in beach strand habitat in a location previously used by nesting Least Terns. Wooden eggs, approximately 2 cm x 3 cm, were hand-painted to closely resemble tern eggs. Twelve 2-egg nests and thirteen 1-egg nests were placed with realistic spacing along the beach to establish a ‘colony’. Five experienced volunteers were then brought into the area and instructed to follow the standard tern survey protocol (see survey description above).

Volunteer Training, Recruitment, & Coordination

Volunteers interested in participating in this project were recruited by park staff and asked to attend a training session led by the lead scientist. The training session, held at NPS offices in Boston on 3 May 2010, focused on species identification and survey techniques.

Park staff coordinated volunteers to participate in field surveys according to a schedule provided by the lead scientist in advance of the field season. Weather make-up days were assigned in advance to allow for some flexibility if weather prevented surveys. The lead scientist trained and supervised participating volunteers while in the field. This program attracts volunteers with varying level of experience; field tasks are thus assigned based on individual skills, with less experienced volunteers assigned to supervised tasks accordingly.

Communication & Outreach

In 2010, efforts were made to increase mid-season volunteer communication through regular e-mail updates and postings to the park website and NETN blog, which are publicly viewable. Massachusetts Department of Conservation and Recreation (DCR) park rangers, stationed on islands in BOHA, were also encouraged to participate in monitoring efforts. Data gathered during the 2010 field season was shared with the State of Massachusetts Natural Heritage Program and the Southern New England Waterbird working group.

Data Management

In 2010, preliminary efforts were undertaken to move to an electronic data collection process for this project. Primary data sheets were developed into a Cybertracker database by the lead scientist, but limited electronic data were collected in the field. Following the field season, the lead scientist entered data from field data sheets into this preliminary Cybertracker database. The NETN Data Manager then reviewed and processed these data for archiving.

While electronic data collection has many potential benefits, implementation is still developing. The NETN Data Manager is currently refining and re-developing a Cybertracker database to best meet the needs of this project. It is anticipated that this new data collection tool will be implemented in 2011.

Results

Common Eiders

Boat-based surveys of the Outer Islands were conducted four times during the latter half of the nesting season to search for adult female eiders tending chicks. Some chicks were also incidentally observed on the water during gull and cormorant surveys on 18 May and 24 May, and on boat-based surveys for American Oystercatchers in the Outer Islands on 5 August. Results are given in Table 3; see Figure 2 for a sample boat-based survey track.

Table 3.Total number of adult female Common Eiders (COEI) and chicks detected during 2010 boat-based surveys in the Outer Islands of Boston Harbor Islands National Recreation Area.

Survey Date	Adult Female COEI Tending Chicks	COEI Chicks	Range of Crèche Size	Average Crèche Size (± 1 SD)	Total Number of Female COEI Observed[1]
11 June	192	253	1-32	8.7 ± 7.9	276
16 June	219	341	1-36	7.9 ± 7.5	316
23 June	185	269	1-77	6.7 ± 12.6	366
7 July	270	329	1-60	5.9 ± 8.4	332

[1] Indicates the total number of female Common Eiders detected near shore in the Outer Islands, both those attending chicks and those without (presumably nesting females whose nests or chicks were lost).

Cormorants and Gulls

Boat-based surveys of nesting cormorants and gulls on the Outer Islands produced variable results (Table 4). Estimates differed between observers and varied between days. The overall number of each species detected on islands in the Outer Islands is given in Table 5.

Overall mean Coefficients of Variation (CV; SD/Mean*100) for the three primary species we monitored were fairly high, with Double-crested Cormorants = 15, Great Black-backed Gulls = 19 and Herring Gulls = 13. It should also be noted that boat-based surveys only estimate nesting activity that is visible from the water, and therefore underestimate the total number of nests.

Because boat-based surveys of gulls and cormorants are known to produce highly variable results, due to observer differences and the challenges of counting incubating birds from a moving boat, a high-resolution, image-stabalizing camera was used to photograph the shoreline of the nesting islands during boat-based surveys in 2009 and 2010. Efforts were made to shoot overlapping photographs in a steady and consistent manner. Although photographs taken in 2010 were a dramatic improvement from 2009, the photographing methods need additional development before they can be used regularly. Field work in 2011 will further refine these methods. Results of nest counts made from photo counts on 18 May are provided in Table 6. A sample of a marked photo mosaic from Green Island on 18 May is provided in Figures 3 and 4.

Table 4. Inter-observer variation in estimates of nesting cormorant and gull pairs surveyed from 2010 boat-based surveys of the Outer Islands of Boston Harbor Islands National Recreation Area.

		18 May 2010					24 May 2010				
Island	**Species[1]**	**RS[2]**	**TF[2]**	**Average**	**STDEV**	**CV**	**RS[2]**	**WP[2]**	**Average**	**STDEV**	**CV**
Calf	DCCO	77	67	72	7	10	66	63	65	2	3
	GBBG	19	23	21	3	13	17	14	16	2	14
	HERG	18	69	44	36	83	68	64	66	3	4
Little Calf	DCCO	149	166	158	12	8	186	230	208	31	15
	GBBG	19	10	15	6	44	8	15	12	5	43
	HERG	6	8	7	1	20	15	8	12	5	43
Green	DCCO	104	103	104	1	1	131	146	139	11	8
	GBBG	14	13	14	1	5	16	15	16	1	5
	HERG	20	20	20	0	0	32	19	26	9	36
Middle Brewster	DCCO	564	585	575	15	3	586	675	631	63	10
	GBBG	2	18	10	11	113	8	5	7	2	33
	HERG	86	79	83	5	6	95	58	77	26	34
Outer Brewster	DCCO	72	66	69	4	6	75	80	78	4	5
	GBBG	10	22	16	8	53	13	10	12	2	18
	HERG	93	100	97	5	5	92	90	91	1	2
Shag Rocks	DCCO	121	119	120	1	1	124	247	186	87	47
	GBBG	1	7	4	4	106	5	6	6	1	13
	HERG	3	1	2	1	71	0	0	0	0	n/a

[1] DCCO = Double-crested Cormorant, GBBG = Great Black-backed Gull, HERG = Herring Gull
[2] Observers: RS = Robert Stymeist, TF = Tim Factor, WP = Wayne Petersen

Table 5. Overall mean number of nesting cormorant and gull pairs detected during 2010 boat-based surveys of the Outer Islands of Boston Harbor Islands National Recreation Area. Numbers reflect all surveys by all observers.

Outer Islands, 2009			
Species[1]	**Average**	**STDEV**	**CV**
DCCO	1097	164	15
GBBG	73	14	19
HERG	261	35	13

[1] DCCO = Double-crested Cormorant, GBBG = Great Black-backed Gull, HERG = Herring Gull

Table 6. Overall sum of nesting cormorant and gull pairs as counted from photo mosaics taken during boat-based surveys of the Outer Islands of Boston Harbor Islands National Recreation Area on 18 May 2010.

Island	Species[1]	Photo Count
Calf	DCCO	69
	GBBG	16
	HERG	108
Little Calf	DCCO	120
	GBBG	9
	HERG	20
Green	DCCO	238
	GBBG	32
	HERG	40
Middle Brewster	DCCO	600
	GBBG	7
	HERG	169
Outer Brewster	DCCO	47
	GBBG	21
	HERG	186
Shag Rocks	DCCO	71
	GBBG	3
	HERG	2
Little Brewster	DCCO	0
	GBBG	0
	HERG	1
Grand Total	**DCCO**	**1145**
	GBBG	**88**
	HERG	**526**

[1] DCCO = Double-crested Cormorant, GBBG = Great Black-backed Gull, HERG = Herring Gull

Figure 3. A sample photo mosaic comprised of several photos of the west side of Green Island, taken on 18 May 2010, during a boat-based survey of the Outer Islands in Boston Harbor Islands National Recreation Area.

Figure 4. A close-up of the photograph in Figure 3, showing incubating Double-crested Cormorants marked in green, incubating Great Black-backed Gulls marked in blue, and incubating Herring Gulls marked in red. This photo mosaic was taken from the west side of Green Island during a boat-based survey of the Outer Islands on 18 May 2010.

Wading Birds

Wading birds were not comprehensively surveyed in 2010. Wading bird nesting activity was noted on Sarah Island and Sheep Island during other surveys. Wading birds were observed during boat-based surveys in the Outer Islands, but no nesting information is available.

American Oystercatchers and Willets

A combination of boat-based and ground-based surveys detected a total of 21 American Oystercatcher pairs on nine islands in BOHA (Table 7 and Table 8, Figure 5). On Rainsford Island one American Oystercatcher nest location was documented. Three pairs of territorial Willets were detected on Snake Island on 11 June, but no nests were located and only a limited survey effort was conducted due to disturbance concerns.

Table 7. Territorial pairs of American Oystercatchers observed during 2010 surveys of Boston Harbor Islands National Recreation Area.

Island	American Oystercatcher pairs	Outcomes
Calf	3	1 pair with 2-3 chicks, 1 pair with 1+ chick, 1 pair present 7/7
Little Calf	0	
Green	1	unknown, last observed 7/7
Graves	0	
Middle Brewster	1	unknown, last observed 8/5
Outer Brewster	1	unknown, last observed 7/7
Shag Rocks	0	
Little Brewster	0	feeding observations only
Great Brewster	2	1 pair with 2-3 chicks 7/7
Lovells	0	feeding observations only
Georges	0	
Gallops	~	not surveyed
Snake	5	2 pairs with 1 chick each on 6/11
Rainsford[1]	2	1 pair with 1 fledged chick 8/5, 1 pair without chicks 8/5
Thompson	1	abandoned effort early June
Spectacle	0	
Hangman	0	
Peddocks	1?	1 pair reported, but only feeding adult observed; outcomes unknown
Sheep	3	1 pair with 1 fledged chick on 7/22
Grape	0	feeding observations only
Slate	0	
Bumpkin	0	
Sarah	0	
Langlee	0	
Ragged	0	
Button	1	1 pair observed 7/2 - may have been same pair observed on Sarah
Total	**21**	

[1] Nest locations were documented on this island.

Table 8. Summary of American Oystercatcher 2010 survey effort in Boston Harbor Islands National Recreation Area. B = boat-based survey, G = ground-based survey, A = adult, P = pair, CH = chick.

	Survey Date								
Island	**18-May**	**24-May**	**11-Jun**	**16-Jun**	**23-Jun**	**2-Jul**	**7-Jul**	**22-Jul**	**5-Aug**	**Productivity Notes**
Calf	B, 1P	B, 2P	B	B, 1A	B, 1A		B, 3P		B	On 7/7 we detected 1P with 2-3CH, 1P with at least 1CH, and 2-3 additional adults
Little Calf	B	B	B	B	B		B		B	
Green	B, 2A feeding	B	B	B, 1A	B		B, 2A feeding			
Graves	B	B	B	B	B		B			On 7/7 we passed 1A in flight that appeared to be headed to Graves
Middle Brewster	B, 1A	B, 1P	B	B	B, 1P		B, 1A		B, 2A	
Outer Brewster	B	B, 1P	B	B	B, 1P		B, 1P		B	
Shag Rocks	B	B	B	B	B		B		B, 2A feeding	
Little Brewster	B	B	B	B	B, 1A feeding		B			
Great Brewster							G, 2P			1P with 2-3CH
Lovells	G, 6-7A feeding only		B		G	G		G		
Georges		G								
Gallops										
Snake			G, 5P							2 of the pairs observed on 6/11 had 1 chick each; no banded birds were observed
Rainsford			B, 1A	G, 2P	G-partial survey			B, 1P - partial survey	G, 1P w/ 1 fledged CH, 1P w/out CH	1 nest located with 3 eggs; partial surveys were tern beach only
Thompson										1P reported by volunteer early in season, but was not successful

Table 8. Summary of American Oystercatcher 2010 survey effort in Boston Harbor Islands National Recreation Area. B = boat-based survey, G = ground-based survey, A = adult, P = pair, CH = chick (continued).

	Survey Date									
Island	**18-May**	**24-May**	**11-Jun**	**16-Jun**	**23-Jun**	**2-Jul**	**7-Jul**	**22-Jul**	**5-Aug**	**Productivity Notes**
Spectacle			G							
Hangman								B		
Peddocks				B, 1A feeding						NPS staff member reported sighting a pair in early June, but the 6/16 survey detected only 1 feeding adult
Sheep						B, 1P with 1CH + 1A		G, 1P with 1CH + 2P		On 7/7, 1 A of pair with CH was banded on Sheep in 2009 (yellow, CK)
Grape						B, 2A feeding				
Slate						B				
Bumpkin						B				
Sarah						B		B		Report of 1P on Sarah in early July
Langlee						B		B		
Ragged						B		B, 2A flying to Button		
Button						B, 1P		B		

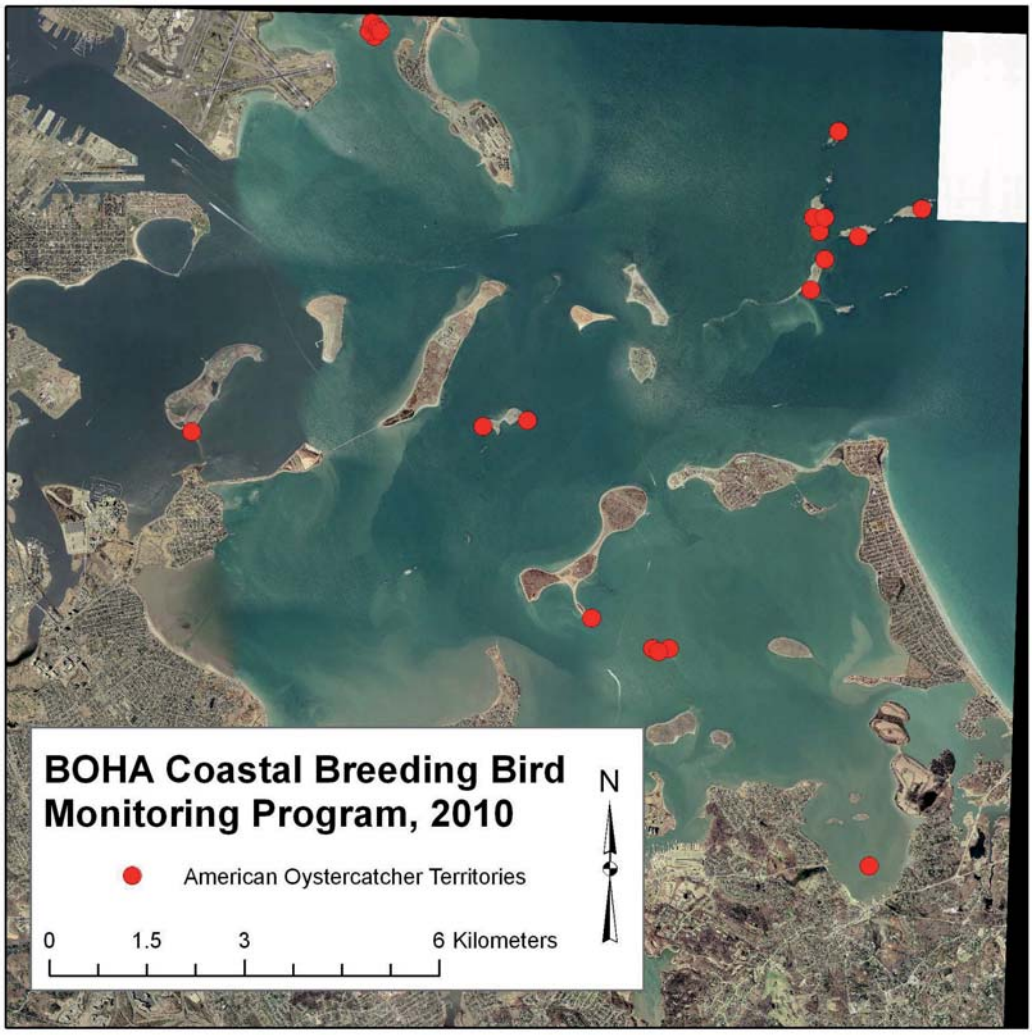

Figure 5. Location of American Oystercatcher pairs detected during 2010 surveys in Boston Harbor Islands National Recreation Area (BOHA).

Terns

In 2010, Least Terns were detected nesting on Lovells Island midway through the season, presumably pursuing a re-nesting effort following a depredation event at the nearby Winthrop Beach colony site (Figure 6; Winthrop Beach is located approximately 7 km northwest of Lovells Island, in the mainland Town of Winthrop). When visited on 23 June, the Lovells colony had a total of 34 nests, most with two eggs, and eight empty scrapes. During a second visit on 2 July, 35 active nests were located. Subsequent observations from outside the colony on 22 July indicated good productivity with 26 adults defending the colony site, several adults still incubating, and many chicks present. A final visit on 5 August yielded four adults and one fledged chick still in the area, suggesting a productive season.

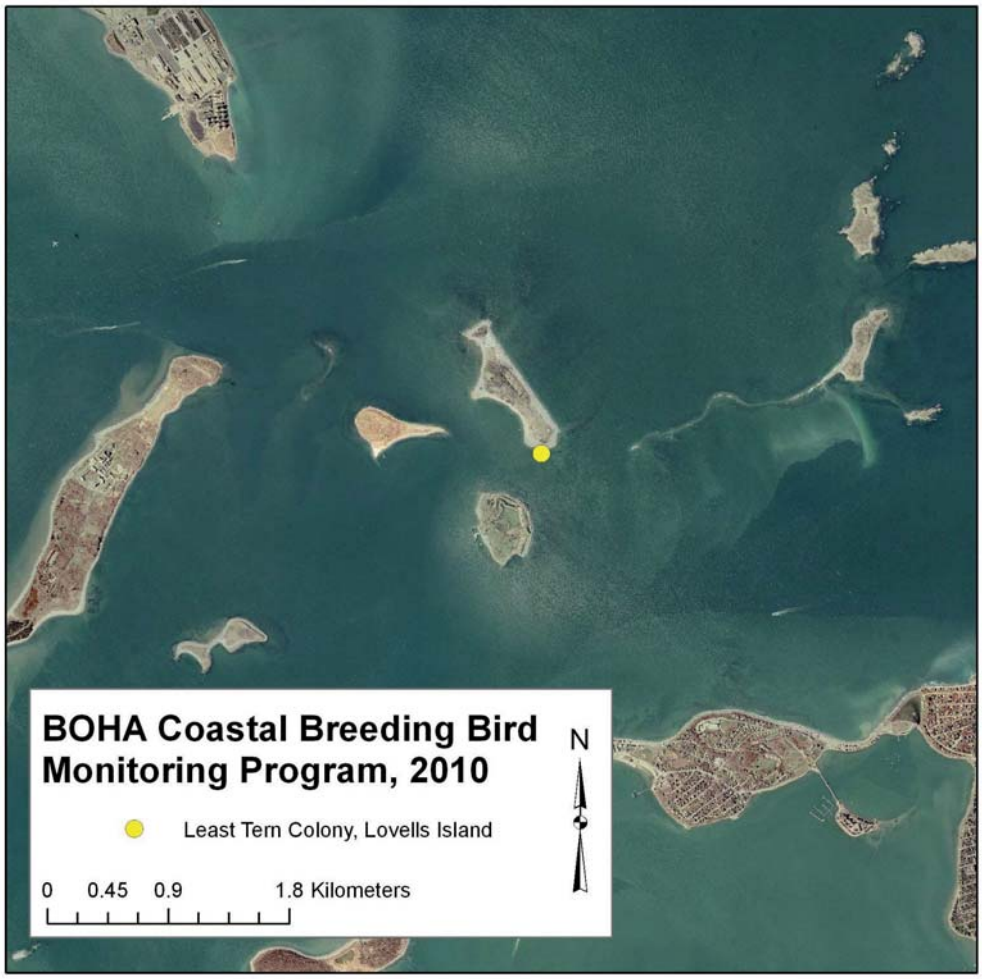

Figure 6. Location of Least Tern nesting colony on Lovells Island detected during 2010 surveys in Boston Harbor Islands National Recreation Area (BOHA).

The nesting platform on Spinnaker Island was visited on 11 June, and 250 to 270 Common Terns were estimated to be nesting there. Common Terns were also observed on Lovells Island on 22 July. Though no Common Terns nested on Lovells Island in 2010, appropriate habitat exists and this island should be monitored for potential use in the future.

During the experimental tern colony survey on Rainsford Island, volunteers located ten 2-egg nests and ten 1-egg nests on their first pass through the colony, for a total detection of 80% (20 out of 25 nests found). On their second pass, an additional four nests were located. The final remaining nest took additional search time to locate.

Spotted Sandpipers

Comprehensive surveys for nesting Spotted Sandpipers were undertaken in 2010, with a focus on trying to locate nests in areas where previous observations indicated nesting was likely (Rainsford and Spectacle, specifically). Spotted Sandpipers were observed on Little Calf, Outer Brewster, Rainsford, Sheep, and Lovells islands and Shag Rocks but no nests were found.

Spotted Sandpiper chicks were reported from Spectacle Island in 2009 by a well-trained and reliable observer; no Spotted Sandpipers were detected on Spectacle Island in 2010. Behavioral cues strongly indicated that nesting was occurring on Rainsford Island, but no direct evidence was observed.

Volunteer Training, Recruitment, & Coordination

A total of 12 volunteers, four National Park Service staff members, and three DCR park rangers participated in waterbird surveys in BOHA in 2010. Eleven of these were returning volunteers who had been involved in monitoring in 2007, 2008, and/or 2009. Although volunteers varied in their levels of experience, all demonstrated an eagerness to participate and willingness to learn. Volunteer scheduling and coordination was well orchestrated by park staff. Efforts to increase communication during the field season sparked much positive feedback from volunteers.

Discussion

Common Eiders

The number of eider chicks we observed in 2010 reached a peak of 341 in mid-June, but remained high all season. Comparatively, in 2009, a high count of 196 was obtained on 3 June, and by 6 July only 34 chicks remained in the area.

In general, Common Eider experience high annual adult survival rates (over 80% in several studies), but generally experience a highly variable degree of reproductive success in any given year and years of 'near disaster' are not uncommon (Goudie et al. 2000). In a stable population, low survival of young is compensated by their comparatively long average life span (5 to 6 years). The consistently high number of chicks observed in 2010 would seem to suggest that this was an unusually successful season for nesting eider.

To better understand the reproductive success of Common Eiders in BOHA, more invasive tracking methods would be needed.

Cormorants and Gulls

Boat-based surveys of incubating cormorants and gulls are safe and efficient to conduct, but produce variable results. Preliminary investigations into the use of high-resolution digital photography to document nesting were promising, but the methods require additional refinement. A comparison of boat-based surveys with photo scoring suggests that Herring Gulls were underrepresented in the counts of boat-based observers. This is not surprising since Herring Gulls generally nest further back in the vegetation and are very difficult to spot from a moving boat. The use of consistent photo stations and differences in photo scoring among observers are two areas that will be explored in 2011.

Wading Birds

Wading birds were not comprehensively surveyed in 2010.

American Oystercatchers and Willets

Boat-based surveys were successful in detecting territorial pairs of American Oystercatchers and Willets, but ground-based surveys of beach strand habitat undoubtedly provide more reliable results by reducing the chance of missing pairs. A combination of annual boat-based surveys and periodic walking surveys that cover all islands on a three-year rotation may be the best balance of effort. Regular surveillance of all islands should be undertaken. Many nest locations appear to be used repeatedly, which should increase search efficiency for known nesting locations in the future. Although we were not able to systematically track all individual nests, we did conduct repeated boat-based surveys on islands where American Oystercatchers pairs were observed, and thus have some incidental information about nest fate. These efforts should continue in the future.

In addition, statewide efforts to track banded American Oystercatchers have been extended to BOHA and will hopefully provide valuable information on population parameters, allowing for improved management of this species. Currently, BOHA supports a significant portion of the state's nesting oystercatchers, an estimated 11% in 2010, based on preliminary data from the

State of Massachusetts Natural Heritage staff shared at the annual Massachusetts waterbird meeting in August 2010.

Willets were once again observed defending territory on Snake Island in 2010, but have not been observed on any of the other islands in the park. Regular surveillance of all islands will be undertaken on a 3-year rotation and should be sufficient to detect new Willet territories elsewhere in the park.

Terns

Thirty-five Least Terns were observed nesting on Lovells Island in 2010, after being absent from the park since a predation event on Lovells Island in 2007. Since 2008, Least Terns have been nesting on nearby Winthrop Beach, outside the park boundary. It is presumed that the terns that appeared on Lovells Island midway through this season were pursuing a re-nesting effort following a predation event on Winthrop Beach.

This highlights the importance of region-wide communication during and between nesting seasons. Reports of the predation event on Winthrop Beach were immediately communicated to the lead scientist by colleagues and volunteers, allowing for increased vigilance in survey efforts within the park. In addition, this underscores the need to continue to manage for terns in the park, even in years when they may not be present. It is highly recommended that island managers continue to post informational signage and employ all other reasonable efforts to reduce human disturbance at previously known colony sites on Rainsford, Lovells, and Snake islands every season so that appropriate habitat remains available for future use.

The tern colony experiment conducted on Rainsford Island provided valuable insight into the efficacy of colony survey efforts. The ‘dummy’ colony was created to be as realistic as possible, with cryptic eggs, simple scrape nests, and spacing that resembled colonies that were previously located in this area. Volunteers did not have the benefit of cues from adult birds, but were also surveying under conditions far less stressful then is typical for an active colony site. A detection accuracy of 80% suggests that even when trained and experienced volunteers work through a colony as systematically as possible, some percentage of nests may be missed. If the 80% detection probability is applied to the active colony on Lovells Island in 2010, it suggests that more than 35 nests (43-44 nests) may actually have been present. This experiment was also useful as a training exercise and reinforced to volunteers the importance of following a consistent survey protocol in order to ensure reliable and accurate results.

Spotted Sandpipers

Comprehensive surveys for nesting Spotted Sandpipers were undertaken with limited results in 2010. It is assumed that the asynchronous nesting cycle and secretive nature of this species made survey efforts problematic, even with the use of callback techniques and significant search effort. Future monitoring efforts for Spotted Sandpipers in the park will focus on estimating the number of adults that are suspected to be nesting based on behavioral cues.

Volunteer Training, Recruitment, & Coordination

Although a volunteer training session was conducted prior to the initiation of the field season, nearly all of this year's volunteers were returning individuals who had participated in previous years and were familiar with the survey methods. Overall, volunteer communication and coordination appeared to improve in 2010, based on experience gained in previous seasons. More extensive volunteer communication (via e-mail, the park website, and the Northeast Temperate Network blog) took considerable time during the field season, but resulted in much positive feedback from volunteers and other interested parties. Nesting waterbirds are a dynamic resource. Regular surveillance and enhanced communication can improve the likelihood of detecting new species and nesting locations, as well as help to better inform management within the park and attract a consistent group of qualified observers to participate annually.

Literature Cited

Andrews, R. (Compiler). 1990. Coastal waterbird colonies: Maine to Virginia 1984-85. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts.

Blodget, B. G., and J. E. Livingston. 1996. Coastal colony-nesting waterbirds: the Massachusetts status report 1994-1995. Massachusetts Wildlife **4**:10-20.

Goudie, R. I, G. J. Robertson, and A.Reed. 2000. Common Eider (*Somateria mollissima*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Online. (http://bna.birds.cornell.edu/bna/species/546). Accessed 21 April 2009.

Hatch, J. J. 1984. Rapid increase of Double-crested Cormorants nesting in southern New England. American Birds **38**:984-988.

Hatch, J. J. 2001. Tern nesting in Boston Harbor: the importance of artificial sites. Bird Observer **29**:187-193.

Kushlan, J. A., M. J. Steinkamp, K. C. Parsons, J. Kapp, M. Acosta Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird conservation for the Americas: The North American waterbird conservation plan, Version 1. Waterbird Conservation for the Americas, Washington, D.C.

Massachusetts Natural Heritage and Endangered Species Program. 2007. Massachusetts list of endangered, threatened, and special concern species. Massachusetts Division of Fisheries and Wildlife, Westborough, Massachusetts. Online (http://www.mass.gov/dfwele/dfw/nhesp/nhrare.htm). Accessed 1 June 2011.

Nove, J. 2001. Birding the Boston Harbor Islands. Bird Observer **29**:173-186.

Parsons, K. C., S. R. Schmidt, and A. C. Matz. 2001. Regional patterns of wading bird productivity in Northeastern U.S. estuaries. Waterbirds **24**:323-330.

Paton, P. W., C, R. J. Harris, and C. L. Trocki. 2005. Distribution and abundance of breeding birds in Boston Harbor. Northeastern Naturalist **12**:145-168.

Rome, M. S., and J. C. Ellis. 2004. Foraging ecology and interactions between Herring Gulls and Great Black-backed Gulls in New England. Waterbirds **27**:200-210.

Trocki, C. L., B. Mitchell, and P. W. C. Paton. 2010. Coastal breeding bird monitoring protocol for Boston Harbor Islands National Recreation Area: Northeast Temperate Network. Natural Resources Report NPS/NETN/NRR—2010/176. National Park Service, Fort Collins, CO.

Trocki, C. L. 2010. Boston Harbor Islands National Recreation Area coastal breeding bird monitoring: 2009 Field Season Summary. Natural Resources Report NPS/NETN/NRTR—2010/336. National Park Service, Fort Collins, CO.

Trocki, C. L. 2009. Boston Harbor Islands Coastal Breeding Bird Monitoring: 2008 Field Season Summary. Natural Resources Report NPS/NETN/NRTR—2009/209. National Park Service, Fort Collins, CO.

Trocki, C. L., and P. W. C. Paton. 2007. Boston Harbor Islands coastal breeding bird monitoring: 2007 field season summary. Natural Resources Report NPS/NER/NRR—2007/16. National Park Service. Boston, Massachusetts.

Trocki, C. L., N. W. Talancy, P. W. C. Paton. August 2007. An inventory of amphibians, reptiles, nonvolant mammals, and select bird species on islands in Boston Harbor. Technical Report NPS/NER/NRTR-2007/094. National Park Service. Boston, Massachusetts.

U.S. Shorebird Conservation Plan. 2004. High Priority Shorebirds ─ 2004. Unpublished Report, U. S. Fish and Wildlife Service, 4401 N. Fairfax Dr., MBSP 4107, Arlington, VA.

Veit, R. R., and W. R. Petersen. 1993. Birds of Massachusetts. Natural History of New England Series. Massachusetts Audubon Society.

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NPS 035/107833, June 2011

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