



# **Boston Harbor Islands National Recreation Area Coastal Breeding Bird Monitoring**

## *2009 Field Season Summary*

Natural Resource Technical Report NPS/NETN/NRTR—2010/336



**ON THE COVER**

Great Egret (*Ardea alba*) chicks in Sarah Island Colony, 2009.

Photograph by: Carol Lynn Trocki

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May 2010

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

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Please cite this publication as:

Trocki, C. L. 2010. Boston Harbor Islands National Recreation Area coastal breeding bird monitoring: 2009 field season summary. Natural Resource Technical Report NPS/NETN/NRTR—2010/336. National Park Service, Fort Collins, Colorado.

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## **Acknowledgements**

Thanks to the incredible volunteers: Amanda Ciardi, Susannah Corona, Pat Dolan, Tim Factor, Sally Ferbert, Carl Johnson, Bob Kelley, 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!

Thank you also to park staff for their support and help with data collection: Valerie Wilcox, Marc Albert, and Sheila Colwell. Thanks especially to Mary Raczko for her tremendous 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 Inventory & Monitoring Network. Thanks to Brian Mitchell and Adam Kozlowski for their helpful input and assistance.



## Introduction

In 2002, Boston Harbor Islands National Recreation Area (BOHA; Figure 1), was designated as a Massachusetts Important Bird Area (IBA) because the islands provide 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 palliatus*) 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.

Much is known about the spatial distribution and abundance of breeding birds in Massachusetts (Veit and Petersen 1993), but less has been published on the avifauna of the Boston Harbor Islands. Although not part of a consistent monitoring program, 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 long-term coastal breeding bird monitoring in the park. When compared with previous studies, the Paton et al. (2005) waterbird inventory suggested that:

- Common Eiders have a small, but established colony of approximately 70 nests on islands in the Outer Harbor, primarily Calf Island.
- Double-crested Cormorants 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 1984-85 (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 (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).



**Figure 1.** Boston Harbor Islands National Recreation Area. Note the red circle, or ‘Outer Harbor’ area, that encloses the ‘Outer Islands’ which are frequently referred to collectively in the text.

- Least Terns have a small but relatively stable population (< 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 as outlined here.

The following objectives provide the basis of coastal breeding bird monitoring for Boston Harbor Islands National Recreation Area:

- 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*).
- 3) Determine long-term trends in species composition and abundance of lower priority coastal breeding bird species (eider, cormorants, wading birds, shorebirds, and gulls)

In addition to these measurable objectives, we also seek to improve our understanding of breeding waterbird to habitat relationships in BOHA and the effects of habitat changes and management actions (such as invasive plant control or predator control) 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 2007-2009. It is the intent of the Northeast Temperate 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 focal 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 total budget of approximately \$15,000.

Long-term monitoring surveys will be conducted annually for high priority species (terns and oystercatchers), while a complete survey that includes all priority species will be conducted on a 3-year rotation (Table 1). 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.

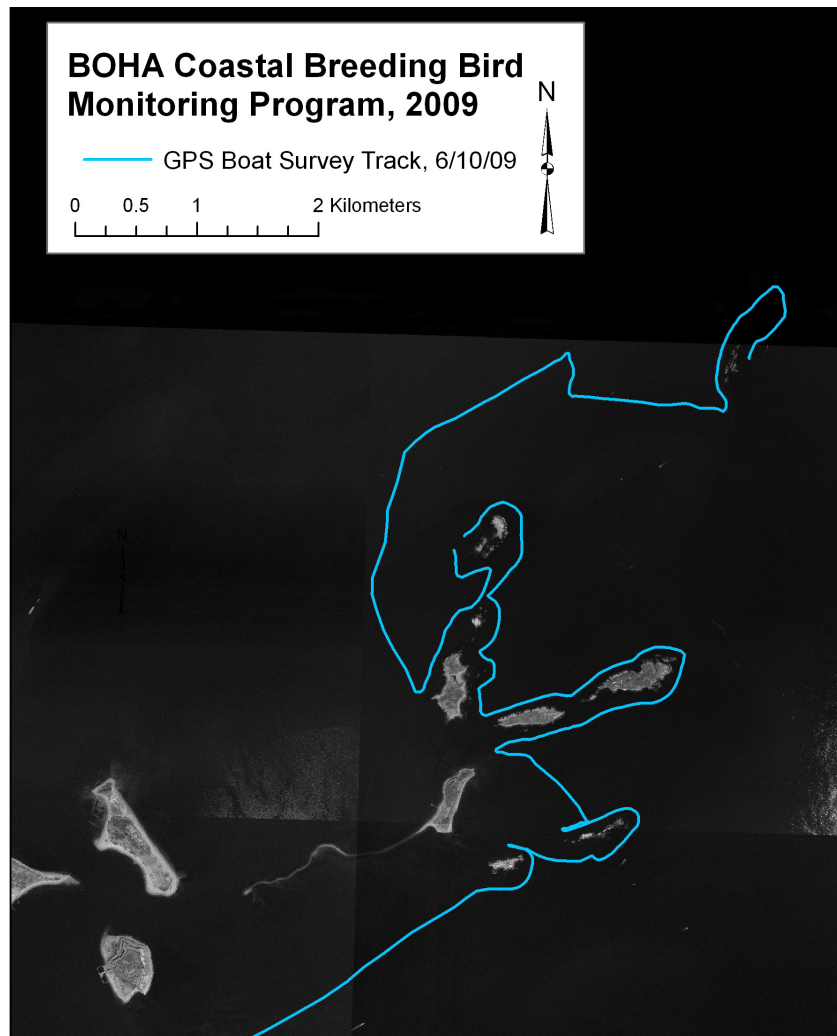
Survey Tasks <sup>1</sup>	Year 1			Year 2			Year 3		
	May 15-31	Jun 1-15	Jun 15 to Jul 15	May 15-31	Jun 1-15	Jun 15 to Jul 15	May 15-31	Jun 1-15	Jun 15 to Jul 15
common eiders	x		x			x			x
cormorants & gulls	x								
wading birds				x	x				
large shorebirds	x	x	x	x	x	x	x	x	x
small shorebirds / surveillance							x	x	x
terns		x	x		x	x		x	x

<sup>1</sup> see Trocki et al. 2010 for detailed information on methods and target dates.

The priority species for 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 will ensure that all nesting species are detected and that shifts in colony locations are not incorrectly recorded as losses. A comprehensive approach to sampling will also allow for the detection of new colony sites or nesting by new species (such as Piping Plover [*Charadrius melodus*] or Roseate Tern [*Sterna dougallii*]). Detailed descriptions of the methods used to survey focal species in 2009 are given below.

## Common Eiders

Common Eiders (COEI) 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. Common Eiders (COEI) were surveyed with complete, ground-based nest counts in 2008. Beginning approximately 2-3 weeks following peak incubation, Common Eider chicks can be observed rafting in crèches offshore near nesting islands. Chicks cluster together in this way for protection from predators. In 2009, the number of female Common Eiders and chicks on the water were counted by surveyors circling eight to nine of the Outer 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). Females were identified as either tending or not tending chicks. Boat-based crèche counts were conducted in the Outer Islands on 3 June, 10 June, 17 June, and 6 July. Figure 2 shows a sample track from a boat-based survey of the Outer Islands on 10 June. In 2009, The Graves was included in surveys taking place after 3 June.



**Figure 2.** A sample GPS track from boat-based surveys for Common Eider chicks on 10 June during the 2009 monitoring season in Boston Harbor Islands National Recreation Area (BOHA).



## **Cormorants and Gulls**

The majority of gulls and cormorants breeding in Boston Harbor Islands National Recreation Area nest in the Outer Harbor (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 and Shag Rocks on 19 May and 3 June 2009. The boat track was similar to that shown in Figure 2 above. 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). At least two independent observers recorded their observations of active nests on each survey.

Beginning in 2009, we also explored the feasibility 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.

## **Wading Birds**

Wading birds had previously been documented in five mixed-species wading bird colonies in BOHA on Calf, Middle Brewster, Outer Brewster, Sheep, and Sarah islands (Figure 3; Paton et al. 2005). A complete ground-based survey of each colony site was conducted during the peak of incubation, between 19 May and 4 June. Survey methods targeted nesting Great Egrets (*Ardea alba*), Snowy Egrets (*Egretta thula*), Black-crowned Night-Herons (*Nycticorax nycticorax*), and Glossy Ibis (*Plegadis falcinellus*), all of which are known to nest in BOHA. During each colony visit, observers working in teams of two or three moved through the colony systematically, recording species, GPS location, and nest contents, whenever possible. For the large, dense colonies on Sarah, Outer Brewster, and Sheep islands, an independent observer stood outside the colony at a location with a clear view to identify and count the number of adults flushing from the colony site while the other observers were conducting the survey.



**Figure 3.** Wading bird colony locations surveyed during the 2009 monitoring season in Boston Harbor Islands National Recreation Area (BOHA).

In an effort to quantify a measure of error in nest counting, nest trees on Sarah Island were marked with water-soluble paint and uniquely numbered wooden popsicle sticks during a thorough colony search on 26 May. The intention of this effort was to conduct a mark-and-recapture experiment by conducting a second, equally thorough search on the following day and recording relocated nests and ‘new’ nests. This information could then be used to estimate the actual number of nests present based on the detection probability, or percentage of nests likely to be found during a single search effort (see Common Eider Survey Methods, Trocki 2009). However, given the time needed to thoroughly search the island (approximately 4 hours) and the

disturbance caused while in the colony – as well as the predicted weather – the colony site was not revisited a second time during the active nesting season in 2009. We attempted to revisit the site in early August to assess our ability to obtain information on nesting effort using a post-season visit, which would dramatically reduce the disturbance caused by surveying. Unfortunately, site conditions prevented this effort (see Wading Birds in Results, below).

### **American Oystercatchers and Willets**

Boat-based surveys were used to estimate the number of nesting pairs of adult American Oystercatchers (AMOY) on nine islands 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 2009. 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 Oystercatcher 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.

Willetts (WILL) 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 17 June.

### **Spotted Sandpipers**

Spotted Sandpipers (SPSA) have been previously documented nesting on nine islands in the park (Paton et al. 2005). During all boat-based and ground-based surveys, observations of Spotted Sandpipers were recorded. A complete ground-based survey of potential Spotted Sandpiper nesting habitat will be conducted in 2010.

### **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. Rainsford Island was surveyed on 3 June, 4 June, and 6 July, while Lovells Island was surveyed on 20 May, 3 June, 17 June, 5 July, and 15 July. Snake Island was visited on 17 June. In addition, various volunteers, rangers, and park staff regularly reported tern nesting harbor-wide throughout the season.

Common Terns (COTE) are also known to nest on a platform near Spinnaker Island. Although this nesting area is outside of the park, 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 10 June 2009.

### **Volunteer Training, Recruitment, and 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 on Thompson Island on 6 May, 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.

### **Communication and Outreach**

In 2009, significant efforts were made to increase mid-season volunteer communication through regular, weekly e-mail updates and postings to the park website and NETN blog, which are publicly viewable. Data gathered during the 2009 field season were shared with the State of Massachusetts Natural Heritage Program and the Gulf of Maine Waterbird working group. In addition, presentations were given at the annual conferences of the Waterbird Society and the Massachusetts Marine Educator's Association.

### **Data Management**

The lead scientist entered data from field data sheets into a Microsoft Access database created by the NETN Data Manager. Data were reviewed for discrepancies and passed to the NETN Data Manager for additional review and archiving. Dated copies of the database reside in multiple locations for archival and security purposes. Significant efforts were made to revise field datasheets following the field season to improve data organization and storage.

# 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 15 May. Results are given in Table 2; see Figure 2 for a sample boat-based survey track.

**Table 2.** Total number of adult female Common Eiders (COEI) and chicks detected during 2009 boat-based surveys in the Outer Harbor of Boston Harbor Islands National Recreation Area.

Survey Date	Adult Female COEI Tending Chicks	COEI Chicks	Range of Crèche Size	Average Crèche Size ( $\pm 1$ SD)	Total Number of Female COEI Observed <sup>1</sup>
3 June	148	196	1-25	8.2 $\pm$ 6.9	215
10 June	118	140	1-18	5.2 $\pm$ 4.4	222
17 June	162	142	1-19	3.3 $\pm$ 3.0	340
6 July	108	34	1- 8	3.8 $\pm$ 2.3	483

<sup>1</sup> indicates the total number of female Common Eiders detected near shore in the Outer Islands, both those tending chicks and those without (presumably nesting females whose chicks were lost).

## Cormorants and Gulls

Boat-based surveys of nesting cormorants and gulls on the Outer Islands produced variable results (Table 3). Estimates differed between observers and varied between days. The overall number of each species detected on islands in the Outer Harbor is given in Table 4.

Overall mean Coefficients of Variation (CV; standard deviation divided by the mean times 100) for the three primary species we monitored were: DCCO = 6, GBBG = 30 and HERG = 17, thus there is more variation in counts of nesting gulls than cormorants. In addition, 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 camera was used to photograph the shoreline of the nesting islands during boat-based surveys in 2009. Efforts were made to shoot overlapping photographs in a steady and consistent manner. Although this method appears promising, considerable refinement in photographing strategy is needed. In 2009, too many photos were taken and too much variability in position and overlap existed, which made interpreting the photographs extremely challenging. It was impossible to stitch photos together in such a way that a complete and consistent count could be obtained. However, the use of photomosaic software (such as Panoramic 4 by ArcSoft) and more consistent photography methods should allow for more successful future implementation of this method. A sample of a marked photomosaic from Green Island on 3 June is provided in Figure 4 and Figure 5.



**Figure 4.** A sample photo mosaic comprised of several photos of the east side of Green Island, taken on 3 June 2009, during a boat-based survey of the Outer Islands in Boston Harbor Islands National Recreation Area.



**Figure 5.** A close-up of the photograph in Figure 4, showing incubating Double-crested Cormorants marked in green, incubating Great Black-backed Gulls marked in blue, and incubating Herring Gulls marked in red. This photomosaic was taken from the east side of Green Island during a boat-based survey of the Outer Islands on 3 June 2009.

**Table 3.** Inter-observer variation in estimates of nesting cormorant and gull pairs surveyed from 2009 boat-based surveys in the Outer Harbor of Boston Harbor Islands National Recreation Area.

Island	Species <sup>2</sup>	19 May 2009						3 June 2009					
		Observer <sup>1</sup>			Average	Standard Deviation	Coefficient of Variation	Observer <sup>1</sup>			Average	Standard Deviation	Coefficient of Variation
		RS	RK	CJ				TF	RK	CJ			
Calf	DCCO	59	54	43	52	8	16	57	71	63	64	7	11
	GBBG	14	13	13	13	1	4	17	27	12	19	8	41
	HERG	55	47	59	54	6	11	93	82	84	86	6	7
Little Calf	DCCO	247	220	269	245	25	10	248	263	252	254	8	3
	GBBG	9	24	3	12	11	90	10	9	4	8	3	42
	HERG	2	6	4	4	2	50	9	6	11	9	3	29
Green	DCCO	92	87	96	92	5	5	76	107	114	99	20	20
	GBBG	19	8	14	14	6	40	18	28	6	17	11	64
	HERG	16	19	16	17	2	10	32	31	25	29	4	13
Middle Brewster	DCCO	453	402	378	411	38	9	430	520	490	480	46	10
	GBBG	9	8	12	10	2	22	7	22	6	12	9	77
	HERG	97	60	66	74	20	27	83	65	74	74	9	12
Outer Brewster	DCCO	77	78	85	80	4	5	67	79	7	51	39	76
	GBBG	26	12	11	16	8	51	9	13	12	11	2	18
	HERG	96	69	106	90	19	21	111	86	112	103	15	14
Shag Rocks	DCCO	141	98	165	135	34	25	173	75	175	141	57	41
	GBBG	4	1	5	3	2	62	8	6	3	6	3	44
	HERG	0	0	1	0	1	173	2	1	5	3	2	78

<sup>1</sup> RS = Robert Stymeist, RK = Robert Kelly, CJ = Carl Johnson, TF = Tim Factor.

<sup>2</sup> DCCO = Double-crested Cormorant, GBBG = Great Black-backed Gull, HERG = Herring Gull

**Table 4.** Overall mean number of nesting cormorant and gull pairs detected during 2009 boat-based surveys in the Outer Harbor of Boston Harbor Islands National Recreation Area. Numbers reflect all surveys by all observers.

Species <sup>1</sup>	Average	Standard Deviation	Coefficient of Variation
DCCO	1,052	63	6
GBBG	70	21	30
HERG	272	46	17

<sup>1</sup> DCCO = Double-crested Cormorant, GBBG = Great Black-backed Gull, HERG = Herring Gull

## Wading Birds

Wading birds were a primary focus of survey effort in 2009. All known wading bird colonies in BOHA were surveyed with complete ground-based nest counts during peak incubation, between 19 May and 4 June. Four species (Great Egret, Snowy Egret, Black-crowned Night Heron and Glossy Ibis) were observed nesting in five locations within the park. Calf Island was surveyed on 19 May, Middle and Outer Brewster islands were surveyed on 20 May, Sarah Island was surveyed on 26 May, and Sheep Island was surveyed on 4 June. Park-wide nest count results are provided in Table 5.

**Table 5.** Wading bird nests detected during a complete ground-based survey of all five known nesting colonies in Boston Harbor Islands National Recreation Area in 2009.

Colony Location	GREG <sup>1</sup>	SNEG	BCNH	GLIB	UNKN
Calf Island (5/19)	0	0	38	0	0
Middle Brewster Island (5/20)	0	0	2	0	0
Outer Brewster Island (5/20)	1	12	36	6	1
Sarah Island (5/26)	77	37	247	3	3
Sheep Island (6/4)	1	2	9	0	0
Park-wide Total	79	51	332	6	7

<sup>1</sup> GREG = Great Egret, SNEG = Snowy Egret, BCNH = Black-crowned Night Heron, GLIB = Glossy Ibis, and UNKN = Unknown

No new colony sites or species were detected. Nest trees on Sarah Island were marked with blue, water soluble spray paint and uniquely numbered popsicle sticks. The Sarah Island colony site was revisited on 6 August in an attempt to recount empty nests after chicks had fledged, however, Pokeweed (*Phytolacca americana*) was pervasive, preventing passage through the colony and obscuring earlier marks. In addition, immense amounts of guano made conditions unsuitable for volunteers without appropriate safety equipment.

During visits to the three most concentrated colony sites (Outer Brewster, Sarah, and Sheep islands) an independent observer stood outside the colony at a location with a clear view to count flushing adults while the nest count was underway. Flush counts from Outer Brewster yielded 5-6 Great Egrets, 8 Snowy Egrets, 38 Black-crowned Night Herons, and 16 Glossy Ibis. Flush counts from Sarah Island were highly dissimilar from results obtained on the ground, presumably because dense vegetation offered within-colony refuge and may have obscured visibility to the boat-based observer counting flushing birds; Sarah Island flush counts yielded 6 Great Egrets, 12 Snowy Egrets, and 20 Black-crowned Night Herons. Sheep Island flush counts yielded 1 Great Egret, 9 Snowy Egrets, 25 Black-crowned Night Herons, and 3 Glossy Ibis, suggesting that this colony may have still been building at the time of our visit.

## American Oystercatchers and Willets

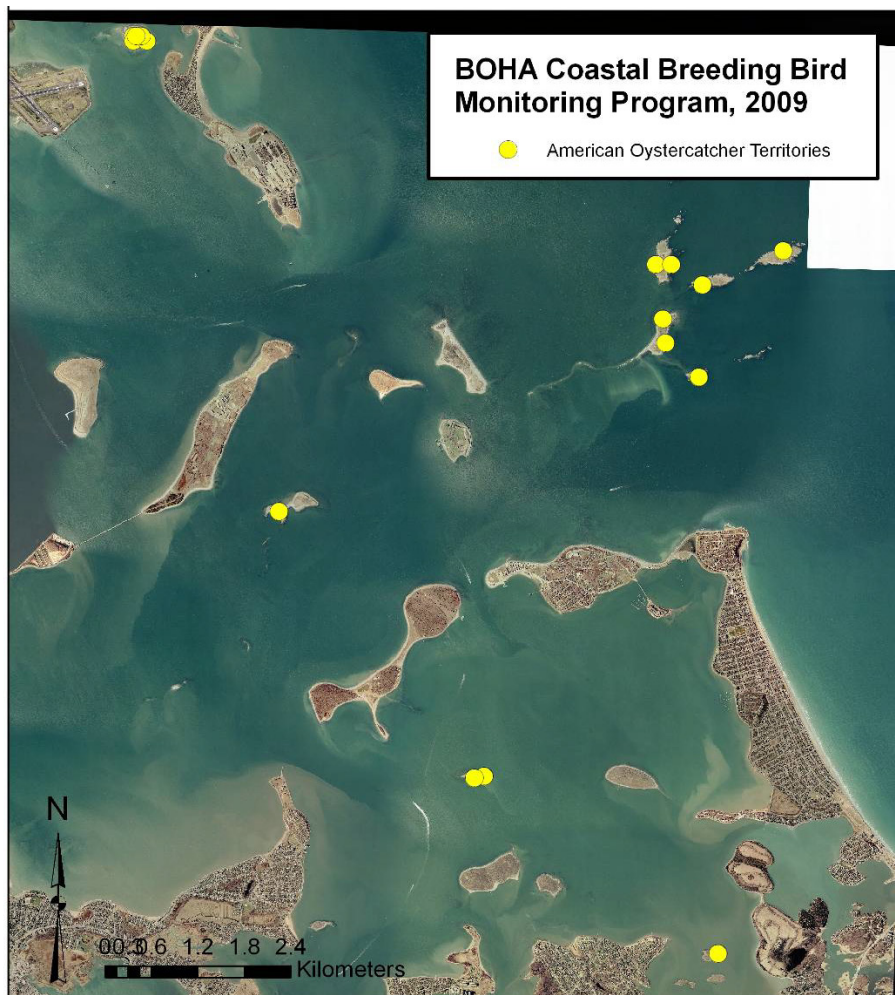
A combination of boat-based and ground-based surveys detected a total of 16 American Oystercatcher pairs on nine islands in BOHA (Table 6, Figure 6). On Calf and Middle Brewster islands, actual nest locations were documented. No nesting American Oystercatchers were detected during boat-based surveys of Little Calf, Green, Georges, Gallops, Lovells, Peddocks, Sarah, Ragged, Grape, Slate, Bumpkin, Thompson, or Hangman islands, although feeding American Oystercatchers were observed on Gallops, Hangman, and Lovells islands.



**Table 6.** Territorial pairs of American Oystercatchers that were presumed to be nesting as observed during 2009 surveys of Boston Harbor Islands National Recreation Area.

<b>Island</b>	<b>American Oystercatcher pairs</b>
Calf <sup>1</sup>	2
Great Brewster	2
Langlee	1
Little Brewster	1
Middle Brewster <sup>1</sup>	1
Outer Brewster	1
Rainsford	1
Sheep	2
Snake	5
Grand Total	16

<sup>1</sup> Nest locations were documented on these islands.



**Figure 6.** Location of American Oystercatcher pairs detected during 2009 surveys in Boston Harbor Islands National Recreation Area (BOHA).

Follow-up surveys of Langlee, Middle Brewster, Outer Brewster, and Little Brewster islands indicated that American Oystercatcher nests there were unsuccessful. Two chicks were observed with adults on Calf Island on 3 June, and again on 10 June. Later surveys of Calf Island indicated increased adult activity, though chicks were not seen again during boat-based surveys. Two chicks were observed with adults on Snake Island on 17 June; the island was not revisited and fates are unknown. One fledged chick was observed with two adults on Rainsford Island on 6 July.

Four pairs of territorial Willets were detected on Snake Island on 17 June, but no nests were located.

### **Terns**

In 2009, no Common or Least Terns were detected nesting anywhere in BOHA, though Rainsford, Lovells, and Snake islands were visited on multiple occasions throughout the nesting season. The nesting platform on Spinnaker Island was visited on 10 June, and approximately 130 Common Terns were estimated to be nesting there.

### **Spotted Sandpipers**

Comprehensive surveys for nesting Spotted Sandpipers were not undertaken in 2009. However, while conducting boat and ground-based surveys for other species, Spotted Sandpipers were observed on Calf, Little Calf, Outer Brewster, Little Brewster, and Rainsford islands and Shag Rocks. Spotted Sandpiper chicks were also reported from Spectacle Island by a well-trained and reliable volunteer (R. Kelley, trained BOHA Waterbird Observer, pers. comm., 14 June 2009).

### **Volunteer Training, Recruitment, and Coordination**

A total of 13 volunteers and three National Park Service staff members participated in waterbird surveys in BOHA in 2009. Eight of these were returning volunteers who had been involved in monitoring in 2007 or 2008. 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 declined steadily from a high count of 196 on 3 June to a low count of 34 on 6 July. This suggests a high degree of juvenile mortality (which is not uncommon for this species), since young chicks are likely to remain fairly close to their nesting area during the period of our surveys. However, by mid-June, volunteers also reported sightings of eider chicks along the mainland coast, indicating that chicks hatched from BOHA were large enough to travel greater distances (T. Factor & R. Stymeist, trained BOHA waterbird monitoring volunteers, pers. comm., 2009). By our final survey on 6 July, it was difficult to tell the difference between large chicks and adult females from a distance. The large increase in the number of female eiders detected during later surveys could be the result of confusion between large chicks and adults, which would indicate higher survival rates than suggested by our data. In the future, high-resolution photography may be used to document eider chick observations.

In general, Common Eiders 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. More invasive tracking methods would be needed to better understand the reproductive success of BOHA eiders.

### **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 are promising, but the methods require additional refinement. A detailed SOP has been developed for use during the 2010 field season.

### **Wading Birds**

Wading birds were a primary focus of survey efforts in 2009. More effort was expended on thorough colony counts in 2009 than in previous years. Although it still appears that BOHA wading birds have experienced significant declines since the mid-1990s, the current nesting effort is greater than indicated by recent counts (Paton et al. 2005).

The effect of observer disturbance on the breeding success of colonial waterbirds remains a controversial topic (see Carney and Sydeman 1999, Nisbet 2000). Although we would like to obtain more information about detection probabilities with a mark-and-recapture experiment, repeat colony counts may cause unnecessary distress. Future efforts should explore creative options for monitoring the wading bird population in BOHA, while minimizing colony disturbance.

### **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 3-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 Oystercatcher pairs were observed, and so have some incidental information about nest fate. These efforts should continue in the future. In addition, statewide efforts to track banded American Oystercatcher have been extended to BOHA and will hopefully provide valuable information on population parameters, allowing for improved management of this species.

Willetts were once again observed defending territory on Snake Island in 2009, 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.

### **Spotted Sandpipers**

Comprehensive surveys for nesting Spotted Sandpipers were not undertaken in 2009. It is anticipated that the asynchronous nesting cycle and secretive nature of this species may make survey efforts problematic, but a thorough investigation is planned for 2010.

### **Terns**

No terns were observed nesting in BOHA in 2009. A Least Tern colony on Lovells Island was destroyed in June of 2007 (Trocki and Paton 2007) and Common Tern nesting effort on Snake Island has generally been limited in recent years (Trocki 2009, Trocki and Paton 2007, Trocki et al. 2007, Paton et al. 2005). We highly recommend 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 so that appropriate habitat remains available for future use. Efforts to identify and prevent nest predators should also be pursued.

### **Volunteer Training, Recruitment, and Coordination**

Although a volunteer training session was conducted prior to the initiation of the field season, many of this year's volunteers were returning individuals who had participated in 2007 or 2008 and were familiar with the survey methods. It is the opinion of the author that, overall, volunteer communication and coordination improved in 2009, based on experience gained in 2007 and 2008. Added communication via e-mail, the park website, and the Network blog took considerable time during the field season, but were worthwhile efforts that 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.

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NPS 035/102764, May 2010

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