



Boston Harbor Islands Coastal Breeding Bird Monitoring: 2008 Field Season Summary

Natural Resource Technical Report NPS/NETN/NRTR—2009/209



ON THE COVER

Incubating female Common Eider (*Somateria mollissima*).

Photograph by: Carol Lynn Trocki

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Contents

	Page
Figures.....	v
Tables.....	v
Acknowledgements.....	vii
Introduction.....	1
Methods.....	3
Results.....	9
Discussion.....	17
Literature Cited.....	21

Figures

	Page
Figure 1. Boston Harbor Islands, a National Park Area.	4
Figure 2. Common Eider nest locations observed during 2008 monitoring in Boston Harbor Islands, a National Park Area.....	10
Figure 3. A sample GPS track from boat-based surveys for Common Eider chicks during the 2008 monitoring season on Boston Harbor Islands, a National Park Area.	11
Figure 4. Location of American Oystercatcher pairs detected during 2008 surveys.....	15

Tables

	Page
Table 1. Boston Harbor Islands coastal breeding bird monitoring 3-year survey rotation schedule, based on annual effort and park priorities.....	3
Table 2. Total number of Common Eider (COEI) nests detected during complete ground-based surveys of Boston Harbor Islands, a National Park Area, 2008.	9
Table 3. Total number of adult female Common Eiders and chicks detected during 2008 boat-based surveys in the Outer Harbor of Boston Harbor Islands, a National Park Area.....	10
Table 4. Inter-observer variation in estimates of nesting cormorant and gull pairs surveyed from boats in the Outer Boston Harbor Islands, 2008.	13
Table 5. Overall mean number of nesting cormorant and gull pairs detected on islands in the Outer Harbor of Boston Harbor Islands, a National Park Area, during 2008 boat-based surveys. Figures reflect all surveys by all observers.....	13
Table 6. Inter-observer variation in numbers of nesting cormorant and gull pairs surveyed on Sarah Island on 23 May 2008.	14
Table 7. Territorial pairs of American Oystercatchers that were presumed to be nesting as observed during 2008 surveys of Boston Harbor Islands, a National Park Area.	14

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Introduction

In 2002, the Boston Harbor Islands, a National Park area (BOHA), were designated as a Massachusetts Important Bird Area (IBA) because they provide habitat for a significant number of colonial-nesting waterbirds, including Common Terns (*Sterna hirundo*) and Least Terns (*Sterna antillarum*), which are both listed as species of special concern in the State of Massachusetts (Massachusetts Natural Heritage and Endangered Species Program 2007). The Boston Harbor Islands also provide habitat for breeding American Oystercatchers (*Haematopus palliatus*), a species of high continental conservation concern with a high level of regional responsibility (Dettmers and Rosenberg 2000), and several species of wading birds including Black-crowned Night-heron (*Nycticorax nycticorax*) and Snowy Egret (*Egretta thula*), which are, respectively, species of moderate and high continental conservation concern (Kushlan et al. 2002). In addition, cormorants, gulls, Common Eider (*Somateria mollissima*) and several other wading and shorebird species regularly nest on the islands.

Although not part of a consistent monitoring effort, periodic records of breeding waterbirds exist for the islands (see Andrews 1990, Hatch 1984, Blodget and Livingston 1996, Parsons et al. 2001). In 2001-2003, Paton et al. (2005) conducted an inventory of waterbirds and landbirds breeding in the Boston Harbor Islands, 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:

- Least Terns have a small but relatively stable population (<100 pairs), usually on Rainsford or Lovell's Islands (Hatch 2001, Nove 2001).
- Common Terns declined from a peak of 100 pairs in 1993 (Hatch 2001) to approximately a dozen pairs on Snake Island in 2003.
- American Oystercatchers increased from only several pairs in the early 1990s (Veit and Petersen 1993; Nove 2001) to approximately 16 pairs on 14 islands in 2003.
- Wading birds experienced a decline on Sarah Island where the population dropped from 725 nests in 1994 (Parsons et al. 2001) to 112 nests in 2003. The wading bird population on Middle Brewster Island varied from 124 nests in 1984/1985 (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).
- Common Eiders have a small, but established colony of approximately 70 nests on islands in the Outer Harbor, primarily Calf Island.
- Herring Gulls (*Larus argentatus*) 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 land fill and gull nesting site.
- Great Black-backed Gulls (*Larus marinus*) maintained a stable population in BOHA (Andrews 1990), though other data suggests they may be increasing regionally (Rome and Ellis 2004).
- Double-crested Cormorants (*Phalacrocorax auritus*) redistributed themselves among the islands of the Outer Harbor, but have maintained fairly stable numbers since the 1980s (Andrews 1990, Hatch 1984).

Additional waterbird surveys conducted at BOHA in 2005 and 2006 (Trocki et al. 2007) used similar techniques and obtained generally similar results to those of Paton et al. (2005). However, a consistent and comprehensive long-term monitoring protocol is needed to accurately measure population trends over time. In 2007, waterbird surveys were again conducted in BOHA as part of the development of a long-term monitoring protocol for coastal breeding birds in the park (Trocki and Paton 2007). This effort was continued in 2008 and a final coastal breeding birds monitoring protocol for Boston Harbor Islands is anticipated for 2009.

The objectives of the Boston Harbor Islands coastal breeding bird monitoring program are to:

- 1) Determine annual changes and long-term trends in relative abundance of high priority coastal breeding bird species (i.e., Least Tern, Common Tern, and American Oystercatcher).
- 2) Establish an annual surveillance program within the park to identify use by threatened or endangered coastal breeding bird species, such as Piping Plover (*Charadrius melodus*) or Roseate Tern (*Sterna dougallii*), which are not currently present but could be in the future.
- 3) Determine long-term trends in species composition and relative abundance of priority coastal breeding bird species (cormorants, gulls, wading birds, eider, sandpipers, and Willets [*Catoptrophorus semipalmatus*])
- 4) Improve our understanding of breeding waterbird – habitat relationships and the effects of habitat changes and management actions (such as invasive plant control or predator control) on waterbird species composition and abundance by correlating bird monitoring data with ancillary data on park management actions, rocky intertidal communities, water quality, climate, and other available data.

Volunteers assisted the cooperating/contracting researchers in conducting waterbird surveys in the park in both 2007 and 2008. 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 used during protocol development focused on obtaining information on the relative abundance of coastal breeding species by estimating or directly counting all nests, incubating adults, or territorial nesting pairs, and were selected based on their ability to meet the following criteria:

- 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.
- be carried out with an annual 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 focal 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.

The focal 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. Most colonial-nesting species also exhibit a high degree of site fidelity, so colony locations are likely to remain similar from year to year. However, a regular surveillance program has been incorporated into annual monitoring efforts to ensure that all nesting species are detected and that shifts in colony locations are not inadvertently recorded as losses. This comprehensive approach to sampling will also allow for the detection of new colony sites or nesting by new species (such as Piping Plovers or Roseate Terns).

Detailed descriptions of the methods used to survey focal species in 2008 are given below. A map of Boston Harbor Islands, a National Park Area is provided for reference (Figure 1).

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

Group to be Surveyed	2008			2009			2010		
	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
Tern colonies		x	x		x	x		x	x
Large shorebirds	x	x	x	x	x	x	x	x	x
Small shorebirds / surveillance							x	x	x
Cormorants & gulls	x								
Common eider	x		x						
Wading birds				x	x				



Figure 1. Boston Harbor Islands, a National Park Area.

Common Eiders

Common Eiders (COEI) were surveyed with complete, ground-based nest counts on Calf (14 and 15 May), Great Brewster (15 May), Outer Brewster (29 May), and Middle Brewster (30 May) Islands. A safe landing on Little Calf and Green Islands was not possible and these sites were not surveyed. Common Eiders nest semi-colonially in BOHA and have generally been found nesting under overhanging vegetation, primarily staghorn sumac (*Rhus typhina*). During surveys, five to six observers spread out in a line (approximately 3-4 m apart) and proceeded through vegetation, flushing incubating females and locating nests. Ground-based nest counts were targeted for the peak incubation period determined from previous years' data, however, access to the Outer Islands also depends on weather conditions and tidal cycle.

To better quantify a measure of error in nest counting, a sub-sample of nests was counted using a mark-and-recapture technique in 2008. In previous years, the highest concentration of nesting eiders occurred on the northern end of Calf Island (Paton et al. 2005), making this an ideal place to evaluate error rates. On 14 May, the area of Calf Island north of the landing beach was thoroughly searched by six trained observers. For each eider nest that was located, nest contents and location (GPS coordinates) were recorded. In addition, each nest was unobtrusively marked with a numbered popsicle stick. On 15 May, the same area of Calf Island was thoroughly searched a second time by six trained observers and the contents of each observed nest was recorded. Marked nests (those previously located on 14 May) were recorded by number. The location (GPS coordinates) of 'new' nests, those not marked with a popsicle stick on 14 May, were also recorded.

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. 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 10-45 m offshore (or as close as the boat captain felt safe boat operation was feasible). Boat-based crèche counts were conducted in the Outer Islands on 29 May, 30 May, 13 June, 1 July, and 15 July.

Cormorants and Gulls

The majority of gulls and cormorants nesting in the Boston Harbor Islands occur 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 Islands and Shag Rocks on 29 May and 30 May in 2008. 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 10-45 m offshore (or as close as the boat captain felt safe boat operation was feasible).

In 2008, boat-based surveys for nesting gulls and cormorants were also conducted on Langlee, Ragged, and Sarah Islands on 23 May and on Gallops, Georges, and Lovells Islands on 19 May. The absence of nesting gulls on other harbor islands was confirmed during American Oystercatcher surveys throughout the harbor on various dates in 2008.

A complete ground-based count of nesting gulls was conducted on Great Brewster Island on 15 May because rocks and shallow waters around Great Brewster Island make it difficult to circle the island in a boat. Complete ground-based counts of nesting gulls and cormorants were also conducted on Sheep Island on 23 May.

American Oystercatchers and Willets

Boat-based surveys were used to estimate the number of nesting pairs of adult American Oystercatchers (AMOY) 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 2008. 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.

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 13 June.

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 and Lovells were specifically surveyed on 19 May, 5 June, 1 July, and 15 July. Snake Island was visited on 13 June and 15 July. 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 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 13 June in 2008.

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). During 2008 surveys for gulls, cormorants, eiders, terns, and oystercatchers, any indication of nesting wading birds was recorded. Colony size, species composition, and individual nests were also recorded when the information was readily available during the course of other work. A complete ground-based survey of potential wading bird nesting habitat will be conducted in 2009.

Spotted Sandpipers

Spotted Sandpipers (SPSA) have been previously documented nesting on nine islands in the park (Paton et al. 2005). During tern and oystercatcher surveys, any indication of nesting Spotted Sandpipers (such as flushing an adult from grassy habitat) was recorded. A complete ground-based survey of potential Spotted Sandpiper nesting habitat will be conducted in 2010.

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 on Spectacle Island on 7 May, focused on species identification and survey techniques.

Park staff coordinated volunteers to participate in field surveys according to a schedule provided by the author in advance of the field season. Weather make-up days were assigned in advance to allow for some flexibility if weather prevented surveys. Park staff facilitated volunteer communication and took the lead role in coordinating volunteer participation. The lead scientist trained and supervised participating volunteers while in the field.

Data Management

The lead scientist entered data from field data sheets into a Microsoft Access database created by the NETN Data Manager. Data was 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.

Results

Common Eiders

A total of 200 Common Eider nests were detected on Outer Harbor Islands (Table 2 and Figure 2), however not all islands were searched with the same degree of effort. A thorough search was conducted on only the eastern half of Outer Brewster, due to weather and tide constraints which limited access. Common Eiders may also nest on Little Calf and Green Island, which were not searched due to safety considerations.

On 14 May, 77 nests were detected and marked by a team of six trained observers on the northern end of Calf Island. On 15 May, the same area was searched again and 60 nests were detected, 43 of which had been previously marked. Given this information, the following ratio can be constructed:

$$\frac{\text{nests marked on visit 1}}{\text{total number of nests}} = \frac{\text{number of nests found marked on visit 2}}{\text{total number of nests found on visit 2}}$$

$$77 \text{ nests} / X \text{ nests} = 43 \text{ nests} / 60 \text{ nests}; \text{ where } X = \text{the total number of nests on the north end of Calf Island}$$

This calculation indicates a detection rate of 72%, which allows us to estimate that there were 107 nests on the North end of Calf Island. Applying this same detection rate to the entire Outer Island population results in a total estimate of 278 nests. However, these estimates assume that the likelihood of detecting nests and the search effort was equal on all islands, which is unlikely.

Of the nests detected on north end of Calf Island on 14 May (N = 77), contents ranged from 0 to 7 eggs with the majority holding 3 (19%), 4 (30%), or 5 (31%) eggs. Four of the nests observed (5%) on 14 May had been recently predated. During investigations on 15 May, an additional 5 depredated nests were observed; most were located near previously depredated nests.

Boat-based surveys of the Outer Islands (Figure 3) were conducted 5 times during the latter half of the nesting season to search for adult female eiders tending chicks; results are given in Table 3.

Table 2. Total number of Common Eider (COEI) nests detected during complete ground-based surveys of Boston Harbor Islands, a National Park Area, 2008.

Island	Total COEI nests
Calf	111
Great Brewster	4
Middle Brewster	28
Outer Brewster	57
Grand Total	200

Table 3. Total number of adult female Common Eiders and chicks detected during 2008 boat-based surveys in the Outer Harbor of Boston Harbor Islands, a National Park 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*
29 May	104	225	3 - 85	25 ± 28.8	not recorded
30 May	87	279	4 - 120	27.9 ± 37.6	not recorded
13 June	155	122	1 - 54	17.4 ± 19.5	not recorded
1 July	30	51	2 - 16	4.5 ± 3.7	151
15 July	17	49	1 - 17	4.9 ± 4.6	99

* indicates the total number of female Common Eiders detected near shore in the Outer Island, both those attending chicks and those without (presumably nesting females whose chicks were lost).

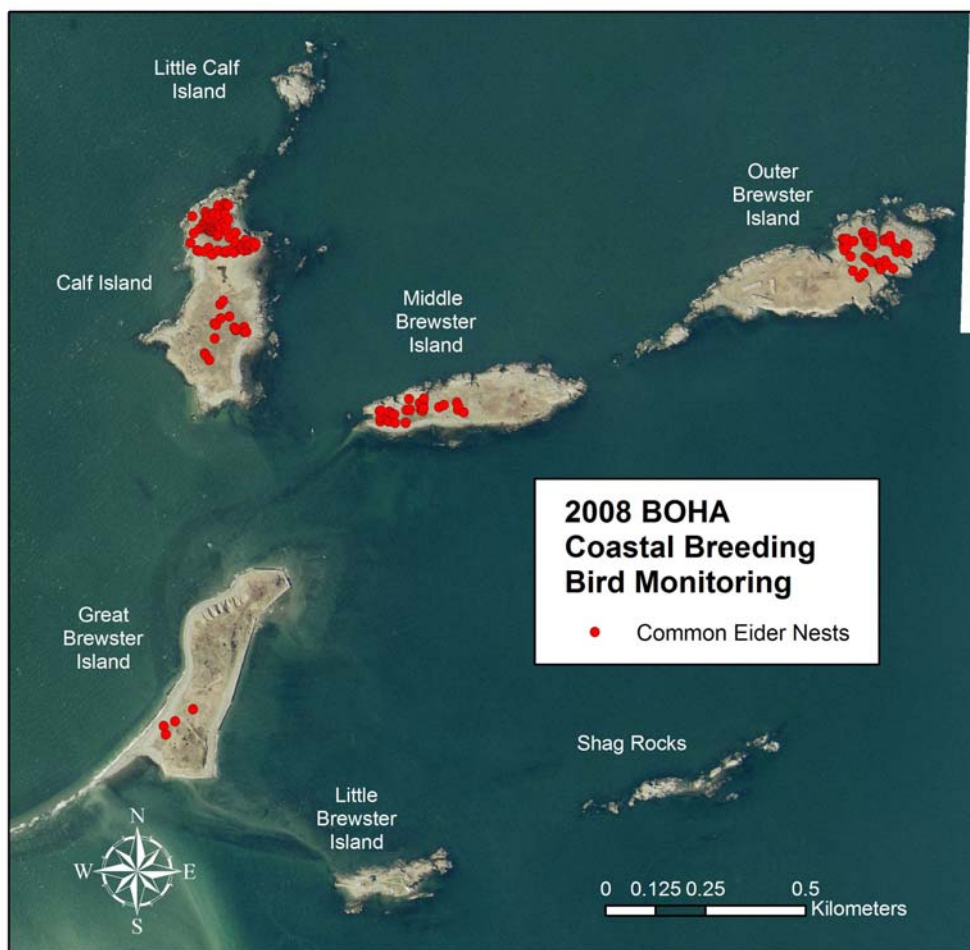


Figure 2. Common Eider nest locations observed during 2008 monitoring in Boston Harbor Islands, a National Park Area.

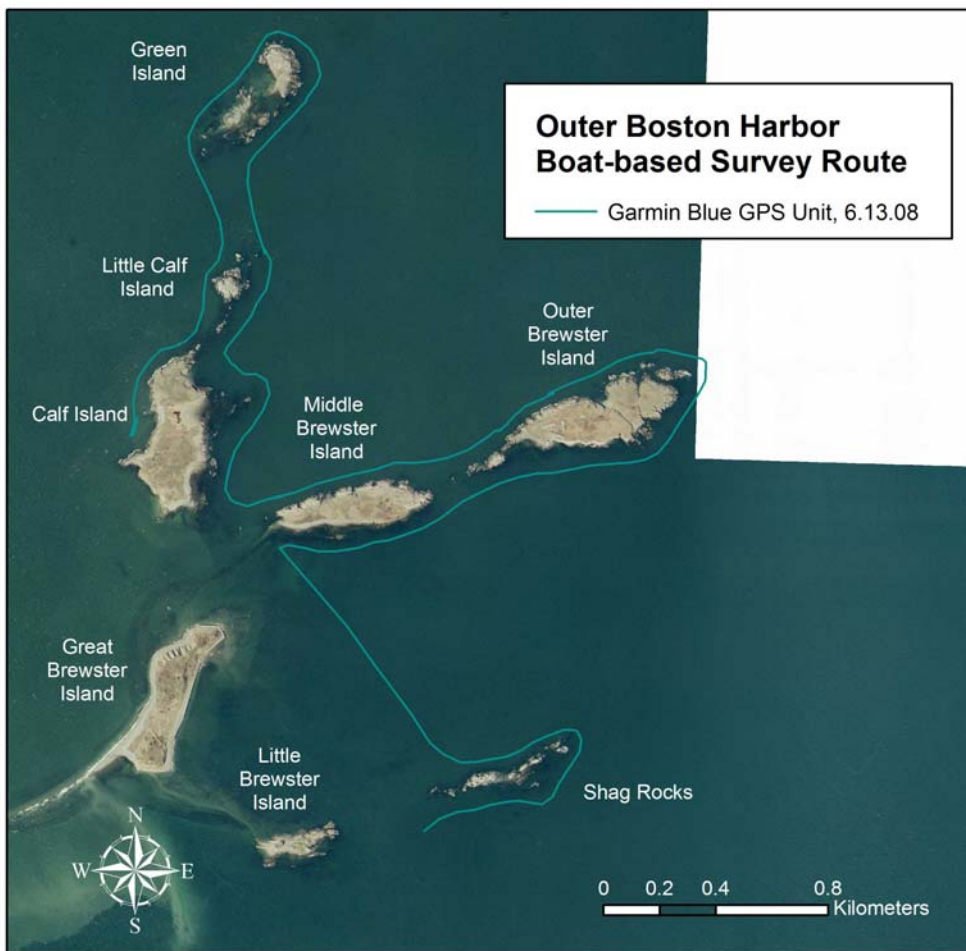


Figure 3. A sample GPS track from boat-based surveys for Common Eider chicks during the 2008 monitoring season on Boston Harbor Islands, a National Park Area.

Cormorants and Gulls

Boat-based surveys of nesting cormorants and gulls on the Outer Islands produced highly variable results (Table 4). Estimates differed markedly between observers, but also varied greatly between days, presumably due to changes in the number of individuals attending the colony at any given time since the weather conditions were similar on both occasions. The overall number of each species detected on islands in the Outer Harbor is given in Table 5.

Overall mean Coefficients of Variation (CV; $SD/Mean \times 100$) for the three primary species we monitored were: DCCO = 12, GBBG = 25 and HERG = 30, 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.

During boat-based surveys on 19 May, six Great Black-backed Gulls and 16 Herring Gulls were observed incubating or attending nests on Gallops Island. Boat-based surveys of nesting

cormorants and gulls were also conducted on Sarah Island on 23 May (Table 6). On that day, two trips around Sarah Island were conducted in immediate succession to allow all observers an opportunity to participate (i.e., switch roles observing and recording). Two of the observers (CLT and SC) conducted two successive counts which were still quite variable, indicating that variation is occurring between observers and between counts (Table 6).

Ground-based surveys are expected to produce more precise estimates, but require considerably more time and effort. Ground-based surveys were conducted on Great Brewster Island on 15 May and 162 Herring Gull nests and 15 Great Black-backed Gull nests were detected. Most nests held three eggs, indicating the peak of incubation.

On 23 May, during a complete ground-based survey of Sheep Island, five Double-crested Cormorant nests, 24 Great Black-backed Gull nests, and 223 Herring Gull nests were detected. One additional gull nest observed on Sheep Island was not identifiable to species.

On 5 June, during a complete ground-based survey of Rainsford Island, approximately 44 Herring Gulls were observed nesting on the cliff face on the east end of the island. During a boat-based survey of Hangman Island conducted on 1 July we observed 13 Great Black-backed Gull broods, one incubating Great Black-backed Gull and one incubating Herring Gull.

American Oystercatchers and Willets

A combination of boat-based and ground-based surveys detected a total of 17 American Oystercatcher pairs on ten islands in BOHA (Table 7, Figure 4). On Great Brewster and Middle Brewster Islands, actual nest locations were documented. No nesting American Oystercatchers were detected during boat-based surveys of Little Calf, Green, Outer Brewster, Georges, Lovells, Sarah, Langlee, Ragged, Grape, Slate, Bumpkin, or Hangman, although feeding American Oystercatchers were observed on Sarah and Lovells.

Follow-up surveys on Calf Island and first hand reports from volunteers on Spectacle and Thompson Islands indicate that nests there were unsuccessful. One American Oystercatcher chick was observed with an adult on the east end of Rainsford on 5 June, but was not seen again. Two adults with three chicks were observed on the west end of Rainsford on 1 July and again on 15 July. Three chicks were also observed with adults on Snake Island on 15 July.

Three pairs of territorial Willets were detected on Snake Island on 13 June, but no nests were located.

Table 4. Inter-observer variation in estimates of nesting cormorant and gull pairs surveyed from boats in the Outer Boston Harbor Islands, 2008.

Island	Species	29 May 2008						30 May 2008						
		CLT	RS	CJ	Average	STDEV	CV	CLT	CJ	RS	RK	Average	STDEV	CV
Calf	DCCO	86	96	74	85	11	13	111	63	87	122	96	26	27
	GBBG	16	17	16	16	1	4	14	12	19	10	14	4	28
	HERG	115	41	59	72	39	54	74	60	40	42	54	16	30
Little Calf	DCCO	227	205	248	227	22	9	231	186	203	226	212	21	10
	GBBG	6	4	5	5	1	20	6	6	8	6	7	1	15
	HERG	7	5	7	6	1	18	13	7	6	10	9	3	35
Green	DCCO	92	85	84	87	4	5	79	98	88	96	90	9	10
	GBBG	19	14	4	12	8	62	16	11	15	15	14	2	16
	HERG	16	14	28	19	8	39	29	29	13	18	22	8	36
Middle Brewster	DCCO	564	460	509	511	52	10	524	399	396	440	440	60	14
	GBBG	7	4	4	5	2	35	17	0	5	6	7	7	102
	HERG	76	55	68	66	11	16	68	60	53	39	55	12	22
Outer Brewster	DCCO	89	77	76	81	7	9	71	70	72	73	72	1	2
	GBBG	19	10	9	13	6	43	12	9	14	9	11	2	22
	HERG	138	54	68	87	45	52	75	94	59	56	71	17	25
Shag Rocks	DCCO	164	112	145	140	26	19	161	125	115	116	129	22	17
	GBBG	3	0	1	1	2	115	3	0	0	1	1	1	141

CLT = Carol Trocki, RS = Robert Stymeist, CJ = Carl Johnson , RK = Robert Kelly.

Table 5. Overall mean number of nesting cormorant and gull pairs detected on islands in the Outer Harbor of Boston Harbor Islands, a National Park Area, during 2008 boat-based surveys. Figures reflect all surveys by all observers.

Outer Island, 2008			
Species	Average	STDEV	CV
DCCO	1078	107	10
GBBG	53	13	25
HERG	228	68	30

Table 6. Inter-observer variation in numbers of nesting cormorant and gull pairs surveyed on Sarah Island on 23 May 2008.

Species	Observer								Average	STDEV	CV
	CLT1	SC1	CLT2	SC2	PS	RK	AK	RS			
DCCO	62	-	59	64	38	19	55	64	52	17	33
GBBG	17	13	17	9	8	20	14	18	15	4	30
HERG	114	87	130	86	97	91	98	98	100	15	15

CLT = Carol Trocki, SC = Sheila Colwell, PS = Polly Stevens, RS = Robert Stymeister, RK = Robert Kelly, AK = Adam Kozlowski.

Table 7. Territorial pairs of American Oystercatchers that were presumed to be nesting as observed during 2008 surveys of Boston Harbor Islands, a National Park Area.

Island	AMOY
Calf	1
Gallops	1
Great Brewster*	2
Middle Brewster*	1
Peddocks	1
Rainsford	2
Sheep	2
Snake	5
Spectacle	1
Thompson	1
Grand Total	17

*Nest locations were documented on these islands.

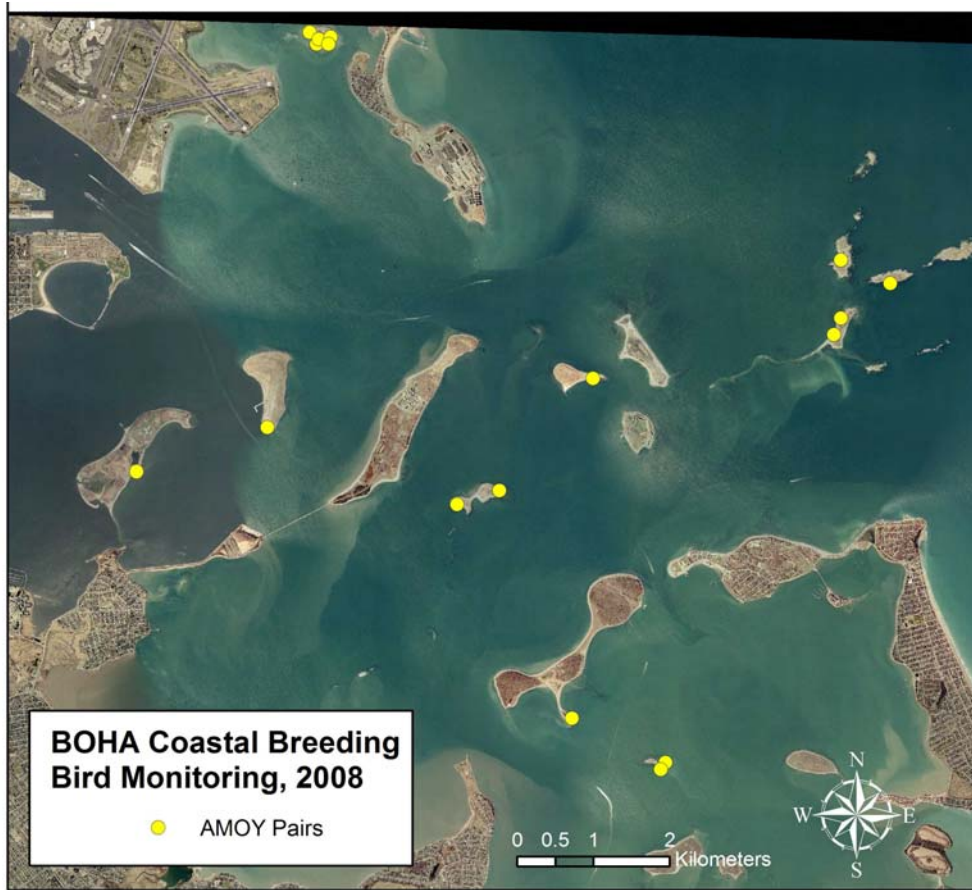


Figure 4. Location of American Oystercatcher pairs detected during 2008 surveys.

Terns

In 2008, 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 13 June, and 250 Common Terns were estimated to be nesting there.

Wading Birds

Although wading birds were not a primary focus in 2008, active wading bird colonies were observed on four islands. Approximately 30 Black-crowned Night Herons were flushed from the colony site on Calf Island during eider surveys there in mid-May; active Black-crowned Night Heron nests were observed. Four Great Egrets and one Black-crowned Night Heron were flushed from the colony site on Sheep Island, and Great Egrets, Snowy Egrets, and Black-crowned Night Herons were observed on Sarah Island on 23 May. A Yellow-crowned Night Heron was observed feeding near Ragged Island, and could possibly have also been nesting on Sarah Island. Thirty-three Black-crowned Night Herons, two Snowy Egrets, and two Glossy Ibis were flushed from the colony site on the east side of Outer Brewster during eider surveys on 30 May (the west side of Outer Brewster was not visited due to time and tide constraints). No active wading bird

activity was observed on Middle Brewster Island in 2008, though complete ground-based surveys for nesting Common Eider were conducted there on 30 May.

Spotted Sandpipers

Comprehensive surveys for nesting Spotted Sandpipers were not undertaken in 2008. However, while conducting boat and ground-based surveys for other species, Spotted Sandpipers were observed on Calf, Little Calf, Green, Middle Brewster, Great Brewster, Outer Brewster, and Rainsford Islands. Some searching for Spotted Sandpiper nests was undertaken on Rainsford during ground-based surveys on 5 June and 15 July. On both occasions, 11 adult Spotted Sandpipers were flushed from nesting habitat, but no nests were found.

Volunteer Training, Recruitment, & Coordination

A total of 11 volunteers and four National Park Service staff members participated in waterbird surveys in BOHA in 2008. Six of these were returning volunteers who had been involved in monitoring in 2007. 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.

Discussion

Common Eiders

Teams of six volunteers were used to conduct comprehensive surveys of the Outer Islands for nesting eider and we believe these methods are effective. Overall, there was a similar number of eider nests detected in 2008 ($N = 200$) as in 2007 ($N = 196$), though fewer nests were found on Middle, Outer, and Great Brewster and increased efforts on Calf Island resulted in an increase in the number of nests detected there. A mark-recapture study implemented on the north end of Calf Island quantified a detection rate of 72%. Although this is lower than expected, it provides us with an important basis for evaluating the effectiveness of our search methods. All efforts at a complete ground-based nest count will inherently provide an underestimate of true nesting effort, since not all nests will be detected.

At this time, we are unclear if our survey efforts may have contributed to eider nest depredation or if there are just naturally very high daily rates of depredation from gulls (especially before the sumac overhanging most nests leafs out). In addition, we flushed many fewer female eiders when we revisited the colony on the northern end of Calf Island on 15 May, which made nests more difficult to locate. Our 15 May visit was approximately two hours later in the morning on a ebbing tide and many of the nests we did locate were carefully covered over with down, suggesting that a greater number of females may have been off the nest already at the time of our second visit; however, we feel it is unlikely that females were feeding. Other research indicates that incubating female eiders generally do not feed during incubation (Goudie et al. 2000). An explanation for the female's absence from the nest will require further investigation.

More effort was invested in counting females and chicks on the water in 2008 than in previous years. During a late season count in 2007, over 200 female eiders were still observed on the water near shore in the Outer Islands, but only 19 chicks were detected (Trocki and Paton 2007). Repeated counts in 2008 allowed us to better describe changes in the number of chicks and female eiders observed over the course of June and early July. The number of chicks we observed declined steadily from a high count of 279 on 30 May to a low of 49 on 15 July. This suggests a high degree of juvenile mortality, which is not uncommon for this species. Young chicks are likely to remain fairly close to their nesting area for several weeks. A decline in the number of chicks detected with a fairly constant number of females detected appears to support the supposition of high juvenile mortality. In the future, efforts should be made to count all female eiders detected in the area during crèche counts, even those not attending chicks.

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.

Cormorants and Gulls

Boat-based surveys of incubating cormorants and gulls are safe and efficient to conduct, but produce variable results. Most of the observers participating in boat-based gull and cormorant surveys in 2008 participated in these same surveys in 2007. Additional experience may have reduced count variability; participating volunteers expressed noticeably higher confidence in

their observations in 2008. In addition, we were able to conduct boat-based surveys around the Outer Islands on two consecutive days in late May that were both clear and calm. Unfortunately, weather conditions did not allow for repeated weekly counts this season. In future years, we will explore the possibility of obtaining digital photography during boat-based surveys to allow for additional post-survey analysis. In the future, I suggest that all islands with nesting cormorants and gulls be surveyed once per week for three consecutive weeks during the peak of incubation (mid-May to early June), if at all possible, to reduce interannual variation in results.

While we expect that ground-based gull and cormorant surveys produce more reliable results, they require tremendous time and effort to conduct and pose unacceptable safety risks to volunteers in some locations. Since the species targeted by these methods are all abundant in the region and their populations do not appear to be experiencing either great growth or decline in the park, I still believe that boat-based surveys are adequate to track changes in the relative abundance and spatial distribution of Double-crested Cormorants, Herring Gulls, and Great Black-backed Gulls in the Boston Harbor Islands.

American Oystercatchers and Willets

Boat-based surveys were successful in detecting territorial pairs of American Oystercatchers and Willets, however, 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.

In 2008, two additional field surveys were added during the month of July. These late-season surveys allowed us to confirm the presence of American Oystercatcher chicks on Rainsford and Snake Islands. Although we were not able to systematically track all individual nests, we did gather follow-up information incidentally and it appears that nest success may be quite low. Additional banding research that is being proposed for the park in 2009 will provide valuable information on population parameters, allowing for improved management of this species.

Willetts were once again observed defending territory on Snake Island in 2008, but have not been observed on any of the other islands in the park. Regular surveillance of all islands will be undertaken on a three-year rotation and should be sufficient to detect new Willet territories elsewhere in the park.

Terns

No terns were observed nesting in BOHA in 2008. 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 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 be pursued

Wading Birds

Wading birds were not a focus of survey efforts in 2008, but anecdotal observations indicated that numbers may have been somewhat reduced from previous years. A complete count of wading bird nests will be conducted in 2009.

Spotted Sandpipers

Comprehensive surveys for nesting Spotted Sandpipers were not undertaken in 2008. 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.

Volunteer Training, Recruitment, & 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 and were familiar with the survey methods. In addition, several of the new volunteers that were recruited had extensive waterbird monitoring experience, which made training easy. Overall, I felt that volunteer communication and coordination improved in 2008, based on experience gained in 2007.

In the future, I would like to continue this improvement with a targeted effort to better develop the network of communication between park staff, monitoring staff, volunteers, island managers, and other interested individuals, especially during the field season when shared information can help inform strategic allocation of effort.

Nesting waterbirds are a dynamic resource. Regular surveillance and enhanced communication can improve the likelihood of detecting new species and new nesting locations. In 2008, a project volunteer spotted Manx Shearwaters (*Puffinis puffinis*), a pelagic seabird, mating just offshore near BOHA in May. This prompted an overnight effort to detect nesting Manx Shearwaters on Middle Brewster in early June, and heightened awareness for possible nesting activity while conducting other survey work in potential Outer Island nesting habitat. Although no Manx Shearwaters were found to be nesting in the Outer Islands in 2008, this type of communication and flexibility is critical to maintaining an effective monitoring program.

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