An assessment of the Common Eider propagation program in Hare Bay, Newfoundland after six years of operation

Draft final report

Scott Gilliland

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Environment Canada
Environmental Conservation Branch
Atlantic Region
17 Waterfowl Lane
P.O. Box 6227
Sackville, New Brunswick
E4L 1G6

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Scott Gilliland
Canadian Wildlife Service
Environmental Conservation Branch
St. John's, NF

and

~~Bruce Pollard~~
Institute for Wetland and Waterfowl Research
Ducks Unlimited Canada
Stonewal, MB

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BACKGROUND:

In an eider propagation program conducted by the White Bay Central Development Association approximately 2200 Common Eider ducklings (*Somateria mollissima*) were hatched, reared, and released in Hare Bay Newfoundland between 1988 and 1993 (Fig. 1). Eider eggs were collected from various sources, incubated to hatching, and the ducklings brooded to four weeks of age at rearing facilities in Main Brook. This aspect of the project has been successful as indicated by high rearing-to-release rates over the last five years.

The primary objective of the propagation program was to increase the breeding population of eiders in Hare Bay to a level that would be resilient to localized sources of mortality, such as gull and mink depredation, poaching, and gill net bycatch. A goal of 500 to 1000 breeding pairs was set to meet this objective (Goudie 1988). Goudie also hypothesized that this population was unlikely to reach 200 breeding pairs by 1993 without management intervention.

We are currently approaching the end of the 5-year period set for the release program. Accordingly, it is necessary to evaluate the program so decisions can be made regarding project focus, future resourcing, and the success of the technique as a management tool. Hence, in the spring of 1992 Ducks Unlimited and Canadian Wildlife Service initiated a two-year evaluation of the eider release program. The objectives of the evaluation were:

1) to document the return and nesting of released females in Hare Bay
2) to conduct an initial assessment of the effects of the release program on the Hare Bay eider population
3) to develop methodology and a database to be used in future assessments
4) to determine the size of the breeding population of eiders in Hare Bay

The propagation program is one of a number of initiatives being undertaken to increase the breeding population of Common Eiders in insular Newfoundland to 3000 pairs by the year 2000. Toward a long term goal of 20,000 pairs in keeping with the federal-provincial Newfoundland and Labrador Eider Management Plan.

METHODS:

We conducted breeding pair surveys and surveys of nesting islands to estimate the size of the Common Eider population breeding in Hare Bay (Fig. 2), and used observations of banded eiders to verify the return of released birds. All hand-reared ducklings have been banded with standard USFWS metal alloy bands and most have been fitted with colour bands to indicate the year released. As there have been a few native birds banded in Hare Bay, all sightings of banded birds were assumed to be released birds.

Band Observations- From the last week of May and the first week of June in 1992 and 1993, during the laying and early incubation periods, we observed eiders near nesting islands. Observations were made with spotting scopes and binoculars near sites where eiders loafed and in areas that could be approached with minimum disturbance to nesting females. We only recorded information for birds whose band status could be determined. For each bird observed we noted the presence or absence of metal and colour bands, the band's colour and location, and the sex and age of the bird.

Observations were limited to periods of two to four hours or the time it took to determine the band status of all eiders in the area. On occasions when we lost track of the band status of individual birds due to an influx of new birds, or the movement of existing birds, we terminated the observation. If there was an opportunity to determine the band status of a greater number of birds a new observation was started. Observations were limited to one period per site per day.

On most days we had observers at two to four locations. We assumed that there was little movement of eiders between sites over an observation period and lumped all observations for each day. All observations for the day were totaled and daily ratios of marked to unmarked birds were calculated by sex and age.

Surveys- Surveys were conducted on most islands where eiders were suspected to have nested. To limit the impact of gull depredation on eider eggs, we restricted visitations of non-forested islands to the post-hatch period. However, we surveyed forested islands during mid-

to late-incubation so females flushed from their nests could be used to locate nests. When possible we noted the presence or absence of metal and colour bands on females flushed from nests.

Surveys for breeding and non-breeding eiders in Hare Bay were conducted by boat and from the air during the nesting and incubation period. During these surveys we recorded the location of the observation on a map, and attempted to record breeding status (paired/unpaired), sex, age, and numbers of eiders observed. Following Lock (1986), we used the number of adult males as a measure of indicated pairs.

Surveys were conducted from a 6.5 m open boat with a crew that consisted of an observer/recorder, a second observer, and a driver. These surveys were conducted during days when there was little wind and visibility was good. The surveys covered the area west of Green Island and east of Western Grassy Rock, and north of Main Brook and south of Brent Islands (Fig. 2). On 24 May, 1992 the Black Duck Joint Venture crew (see Bateman 1992) surveyed the waters around Duck, Apron and Nancy's Islands, and Western Grassy, Eastern Grassy, Inner Harbour, and Outer Harbour Rocks from a Bell 206 L helicopter. On 17 June, 1992, the area of Hare Bay from Green Island west to Lock's Cove and St. John Bay were surveyed with DH2-Beaver on floats at altitudes between 90 and 250 m, and at speeds of 90 to 100 kts. This crew consisted of a pilot, navigator/recorder/observer, and two observers.

Historical Analysis- We used information from CWS files and internal reports (Goudie, 1986, 1988, 1989) and the White Bay Central Development Association (Hogan 1990, Bryne 1991) and this study to analyze population trends for Hare Bay eiders from 1986 to 1993.

RESULTS:

Band Observations- We located four sites from which most observations for banded birds were conducted. These were:

1). Duck Island at a point on west-side of a cove on the north-side of the island

2). West Nancy's Island in the tickle on east-side facing north

3). Main Nancy's Island in the tickle on east-side facing north

4). Main Nancy's Island in the tickle on west-side facing north

We observed banded birds over seven days in 1992 and five days in 1993. Observations in 1993 were limited due to poor weather and heavy ice conditions in Hare Bay. The mean daily percentage of observed banded birds was 11.6± 2.5 (± se) for females and 8.4± 4.5 for sub-adult males in 1992, and 17.3± 4.8 for females in 1993 (Table 1). These observations likely represent repeat sightings of birds over the entire observation period. However, it is unlikely that they represent repeat sightings on the same day. None of the adult males observed in either year, or sub-adult males observed in 1993, were banded (Table 1).

Nest Surveys- We conducted surveys for eider nests on most forested sites in mid- to late-June and on the remainder of the islands in mid- to late-July in both years. A total of 162 and 225 Common Eider nests were found in 1992 and 1993 respectively (Appendix I).

In 1992 very few eiders nested on Nancy's Islands. This was probably due to a red fox observed there. Three dead eider hens were found on the most easterly Nancy's Island. One hen was killed 1992 while the other two appeared to have died in the previous year. One of the hens was sitting on an old nest with two eggs; it may have been killed by a mink or died of malnutrition on the nest during incubation.

We observed a high proportion of abandoned nests (26% in 1992, and 38.1% in 1993) and small clutches ($\bar{x}$ =3.1 and 3.33 eggs/nest in 1992 and 1993 respectively) on Outer Harbour Rock. The nest initiation period was extremely prolonged for all islands in Hare Bay during 1992. Nests consisting of freshly laid eggs were observed on 26 May and 14 July surveys, and only one hatched nest was observed on the 14 July nest surveys in 1992 (Appendix I) . Hence, surveys of eider nests that were intended for the post-hatch period in fact occurred during late-incubation in 1992.

Low nest densities and long flushing distances made capture of females impractical. However, we observed a female with a yellow colour band on her left leg and second female with a metal band flushing from their nests during the survey on Duck Island in 1992.

Breeding Pair Surveys- We conducted a total of five breeding pair surveys for eiders in the Hare Bay area in 1992 and four in 1993. Sea and sun conditions made it difficult to count females during sections, mainly Hare Bay, of the fixed-wing survey in 1992, hence only data for males should be considered accurate. A detailed database for all surveys is maintained at CWS-St. John's.

In 1992, the numbers of eiders using the Hare Bay area peaked at 1,221 birds on 7 June (Fig. 3). We observed many of the birds in three rafts of 120 to 200 birds each in open water. Identification to sex and age of birds in these rafts was difficult, but adult males made up only 5 to 10 % of the flocks. We suspect that most of these birds were non-breeders, as evidenced by the presence of 1st-year males, or migrant birds. Many smaller flocks of 25 to 40 birds were observed over the survey period. These flocks consisted of approximately four female and sub-adult eiders to one adult male. It was necessary to combine counts of adult females an sub-adults since they all have a similar brown plumage. The count of adult males also peaked on the 7 June survey at 266 birds.

The numbers of eiders using the Hare Bay area was lower in 1993 than in 1992 and peaked on the 9 June at 530 birds (Fig. 3). The large rafts of eiders were not common in 1993. The number of adult males, were consistent over the two years with peak levels at about 280 birds (Fig. 3).

Figure 4 compares the ratio of adult male eiders to the nest count over the survey period. This comparison indicates that the optimal period for conducting breeding pair surveys for eiders in Hare Bay was from second to third week of June. In 1992, the ratio of males to nests peaked at 1.64: 1, as discussed above this probably represents a buildup of migrant and non-breeding birds in Hare Bay. With this survey and surveys conducted prior to the second week of June left out, the ratios of males to nests were similar (~1.2:1) to those observed by Lock (1986) in Labrador.

DISCUSSION:

Nest Surveys- Evidence of 162 eider nests were found in Hare Bay in 1992 and 225 in 1993. (Table 2). The nest initiation period extended late into the breeding season in 1992; mid-incubation nest surveys would have better represented nesting of eiders if delayed by two weeks. This would have allowed enough time for late nesters to have been censused. Hence, the actual number of nests on forested islands are probably under-estimated. The timing of mid-incubation nest surveys relative to breeding was better in 1993 than 1992 and more accurately represents the numbers of nesting eiders.

When searching eider colonies, some nests are inadvertently missed; Kaldac and Dury (1968) showed that in gull colonies only 90% of nests were found in the first search. Also, nests that were destroyed by predators or nests that were abandoned prior to our surveys may not have been counted (see Mayfield, 1961). Hence, our estimates of breeding pairs are conservative. However, many islands lacked tree cover and nest counts on these islands are probably accurate.

Observations of two marked hens flushing from nests confirmed that hand-reared birds were nesting in Hare Bay. In addition, there was circumstantial evidence indicating a high frequency of first time breeders. For example, on Outer Harbour Rock, where nesting densities were highest, we observed a high incidence of abandoned nests and small clutches in both years, and a prolonged nest initiation period on all islands in 1992. This is contrary to observations of nesting phenology reported by Goudie (1988) when nesting was highly synchronous and the modal nest initiation date was 30 May. This may reflect nesting behaviour of first time breeders (see Spurr and Milne, 1976). If so, it may suggest a high recruitment rate to the breeding population. However, these observations may also occur when breeding condition of females is poor (P. Hicklin, pers. comm.). There was evidence to support this hypothesis as Hare Bay, and Newfoundland in general, have experienced cold springs and delayed ice-outs for the past three summers. We also observed dead hens on

previous years' nests which suggests that some females may have reached critically low energy levels.

Breeding Pair Surveys- Maximum counts of male eiders in 1992 and 1993 suggest a potential of about 280 breeding pairs in both years (Fig. 3). Using the maximum count for adult males to estimate the numbers of nesting pairs ~~probably~~ may have over-estimated the number of breeding pairs in 1992 as a large proportion of eiders observed ~~were~~ was probably non-breeding and migrant birds. The numbers of eiders observed on 7 June, 1992, ~~was~~ were in ~~access of~~ excess of five times the numbers that would be expected from nests found. A similar phenomenon was recorded by Goudie (1986) and Hogan (1990) when large numbers of northern race (*S. m. borealis*) and sub-adult male eiders were observed in Hare Bay. If this observation is ignored, the ratios of adult males to nests ~~were~~ was approximately 1.2:1 which is similar to ~~those~~ ratio observed by Lock (1986) in Labrador (Fig. 4).

Band Observations- Observations of banded birds indicated that released females comprised 11.6% and 17.3% of the eider population of Hare Bay in 1992 and 1993 respectively (Table 1). As it was not possible to distinguish adult and sub-adult females, the observations of females probably represent both adults and non-breeding sub-adults. This was supported by the presence of banded sub-adult males in the observation data in 1992. These observations are important as they provide a direct measure of recruitment of eiders to the Hare Bay population from the release program. They also provide the strongest link between the releases of eiders and the subsequent increases in nesting eiders. The current pattern suggests that the proportion of released females in the local population has increased at a rate of 6%/year since 1990.

Historical Analysis- Nest surveys of Hare Bay have been conducted for most years (Table 2). However, survey effort has been inconsistent. Figure 5 summarizes known information on nest surveys in Hare Bay and indicates that the colony was stable from 1986 to 1991 and increased thereafter. However, survey effort has also increased over this period.

Nest searches have become more intensive and the number of islands surveyed has varied from 6 in 1987 to 22 in 1993.

Although the overall trend indicates that the eider colony has been increasing since 1992, nests counts on individual islands have shown a more varied response. For purposes of interpretation, islands have been divided into two groups, islands with stable or declining nesting populations (Fig. 6a), and islands that show increasing nesting populations (Fig. 6b).

Nest counts in the first group have been highly variable. For example, counts on Nancy's Islands have fluctuated widely over the years. This is likely due, in part, to the difficulty in surveying such a large area with low nest densities and the periodic presence of foxes on these islands. Green Island is the only island that shows a consistent and significant decline (2.5 nests/year, p=0.012) since the initiation of nest surveys in 1986. There are no clear trends on the remainder of these islands; however, nesting effort on Western Grassy Rock has been very low in 1992 and 1993 (Fig. 6a).

Nest counts on Apron, Duck and Hooper's Islands, and Eastern Grassy and Outer Harbour Rock were relatively stable up to 1991 after which they have shown dramatic increases of up to five times the long term average (Fig. 6b). Assuming that the age of first breeding for eiders was three years (Swennen 1991), these increases correspond to the expected return dates for eiders released from 1988 (when the release program was initiated) to 1990.

We have attempted to relate the number of eider nests in Hare Bay with the number of ducklings released. We have assumed that all female eiders would breed at three-years-of-age and compared the number of released ducklings that were three-years or older in the year of the nest survey. The relationship was significant (p=0.002) and indicated that for every duckling released there was an increase of 0.108 eider nests three years later (Fig. 7). It must be emphasized that factors other that release may be attributed to this relationship; for example natural production and/or decreases in the non-breeding component of the adult population (see below) may result in the same relationship. Although the increases were positively

correlated to the release of eider ducklings (r= 0.986), they cannot be attributed solely to the return of released birds. For instance the proportion of released females in the breeding population has increased at a rate of 6%/year (Table 1) which can only partially explain the observed increases in colony size since 1991.

The size of eider colonies under long-term study have fluctuated up and down. For example, P. Hicklin (unpub. data) reports yearly variation in size of a relatively large eider colony in New Brunswick of ± 55% over a three year period. Other researchers have observed similar fluctuations, i.e. short spurts of high growth or declines in colony size, while the long term trend has been a consistent and moderate increase (Coulson 1984, Swennen 1991). Coulson (1984) indicates that these short-term fluctuations may result from variations in the proportions of adults that breed in any year and not an absolute increase in adult birds; absolute increases in the adult population appear to be related to periods of relatively high recruitment to the breeding population (Coulson 1984, Swennen 1991).

In summary, the breeding eider population of Hare Bay has been increasing since 1991 and is currently at an all time high (since 1991?) of 225 nests. The fluctuations in numbers of nesting birds may have resulted from higher recruitment rates, increased survey effort, natural fluctuations, or any combination thereof. We are certain that released females are returning to, and nesting in, Hare Bay and current observations indicate that released females may make up as much as to 17% of the local breeding population. Although we are not able to state positively the effect of the release program on the local eider population, all evidence to date support the conclusion that releases of eider ducklings in Hare Bay are responsible, at least in part, for increases in eider colony size. Only with carefully planned monitoring over the next few years will we be able to tease out the effects of the release program relative to natural production and adult non-breeding.

PROJECTIONS:

The growth of the eider colony can be projected based on information collected to date. However we must caution that these extrapolations are based on major assumptions which may be violated, and on a very limited time series of data.

A model can be built using the relationship between colony size and the number of released ducklings that are a least three-years-of-age (Fig. 7). Using the number of ducklings released up to 1993 (2200; Fig. 1) we estimate a return of 240 nesting females in 1996 for a total population of about 350 breeding pairs. This would represent a tripling of colony size over a five year period.

The model assumes that the natural production and the rate of adult non-breeding is constant, and linearly related with time. It also makes an unrealistic assumption that all female eiders breed at three-years-of-age. This is not necessarily true; for example Spurr and Milne (1976) observed a small proportion of two-year-olds nesting in the Ythan estuary in Scotland. Recent communications with an experienced eider researcher in Europe (C. Swennen) suggests that a more realistic age-to-first-breeding for eiders in the wild is four to seven years. If so, the response of the breeding eider population to releases will be greater than predicted and occur over a longer period of time, hence the current estimates should be conservative.

RECOMMENDATIONS:

We recommend at least one more year of duckling releases in Hare Bay. Based on current projections a release of 600 to 700 additional ducklings should bring the colony within the population goals set by Goudie (1988).

Although there is strong evidence that released birds are returning to breed in Hare Bay, our ability to measure the response on the local breeding population is confounded by other factors. Only with careful monitoring over the long term will the full effects of the eider propagation program be known. We recommend the colony be monitored at two year intervals until the year 2000. Additional information on natural brood production, which was

not collected as a part of this study, would be useful in teasing out the effects of releases and natural production on colony growth.

Of particular concern are the birds nesting on Green Island and to a lesser extent those nesting on at Western Grassy Rock. Trends on these islands are opposite to those observed on other islands. Also, the high proportion of abandoned nests on Outer Harbour Rocks was unusual. Currently, we can we can only guess at the causes and these situations warrant closer investigation.

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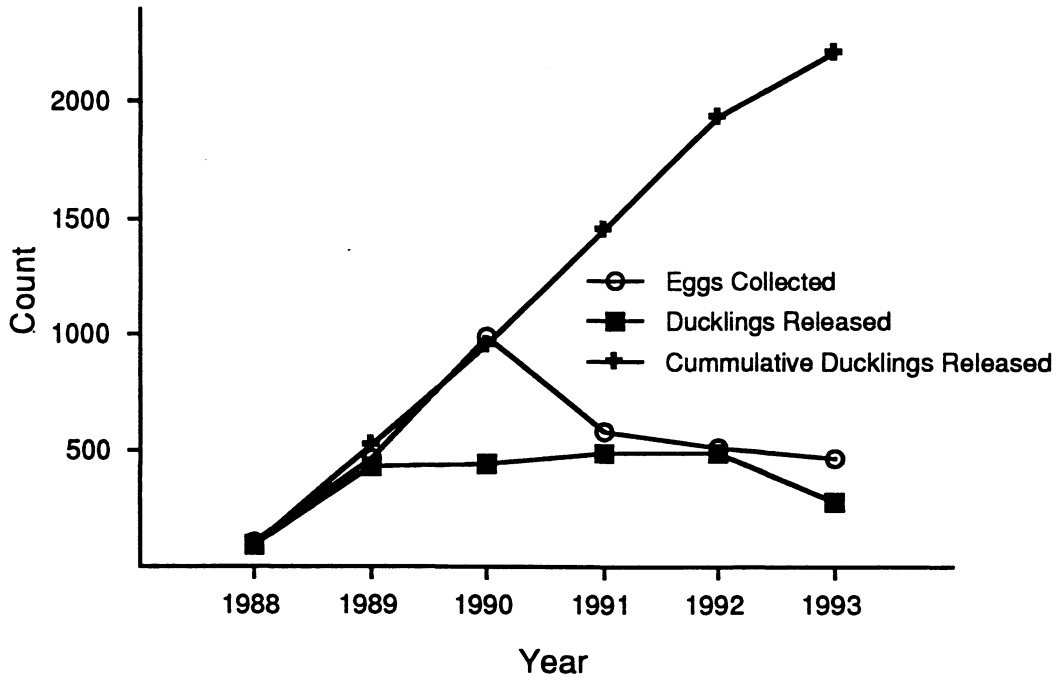

Figure 1. Counts of Common Eider eggs collected for, and ducklings released from, the Hare Bay eider propagation program from 1988 to 1993.

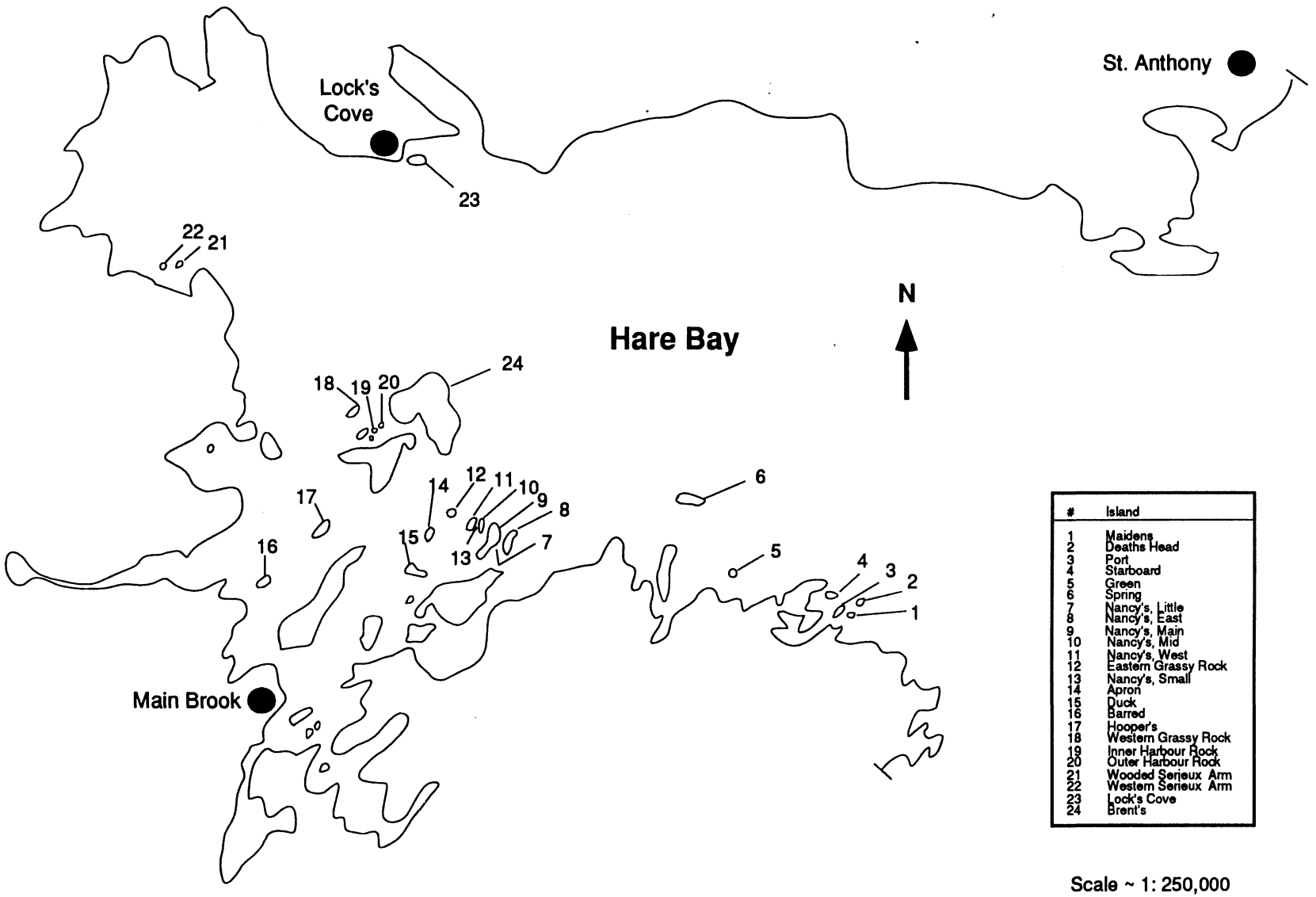

Figure 2. Map of Hare Bay, Newfoundland showing locations and names of islands surveyed for Common Eider nests.

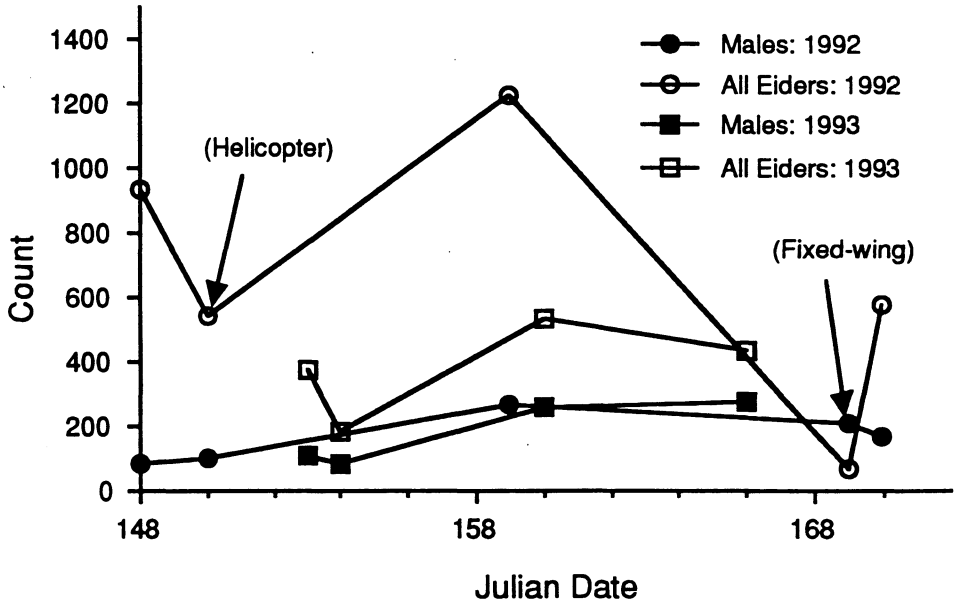

Figure 3. Counts of Common Eiders observed on surveys of Hare Bay in late-May and June 1992 and 1993; except as indicated surveys were conducted by boat.

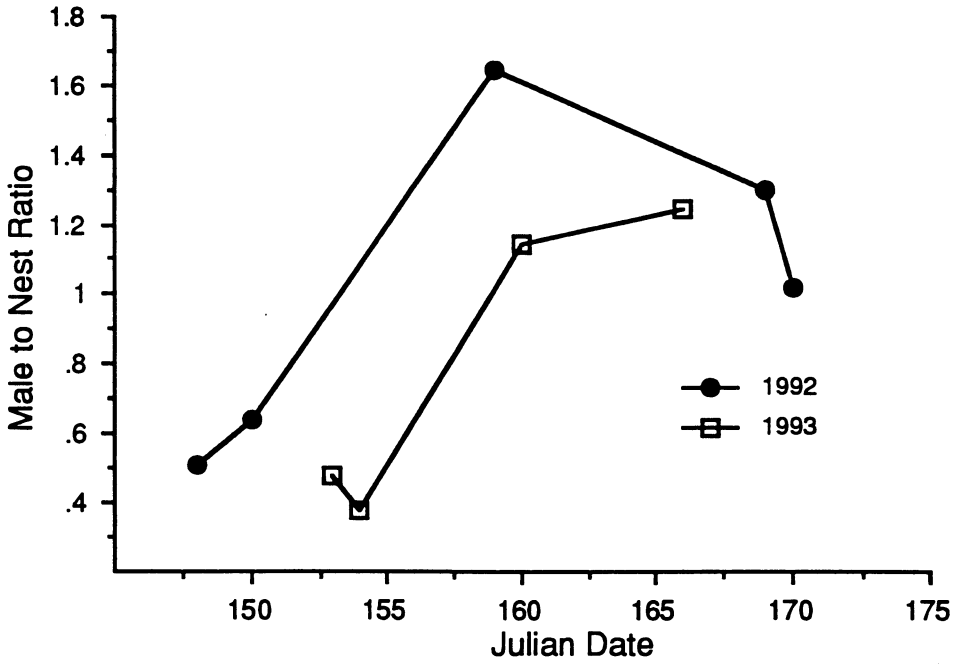

Figure 4. The relationship between the ratio of adult males to total nest counts of Common Eiders in Hare Bay and date of male surveys for 1992 and 1993.

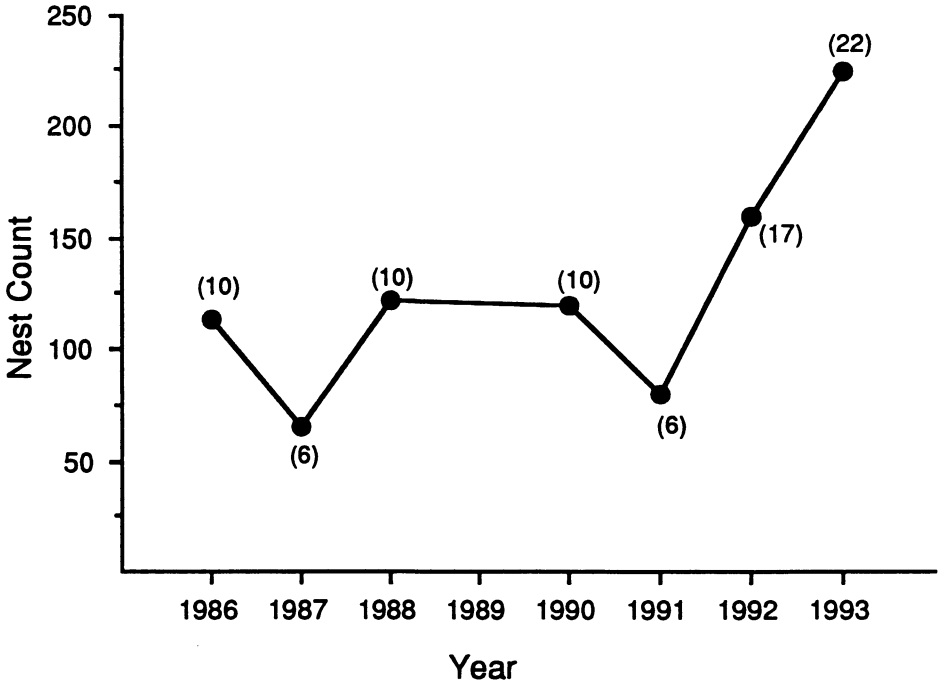

Figure 5. Common Eider nest counts for the Hare Bay archipelago from 1986 to 1993. Numbers in parenthesis indicate the number of islands surveyed.

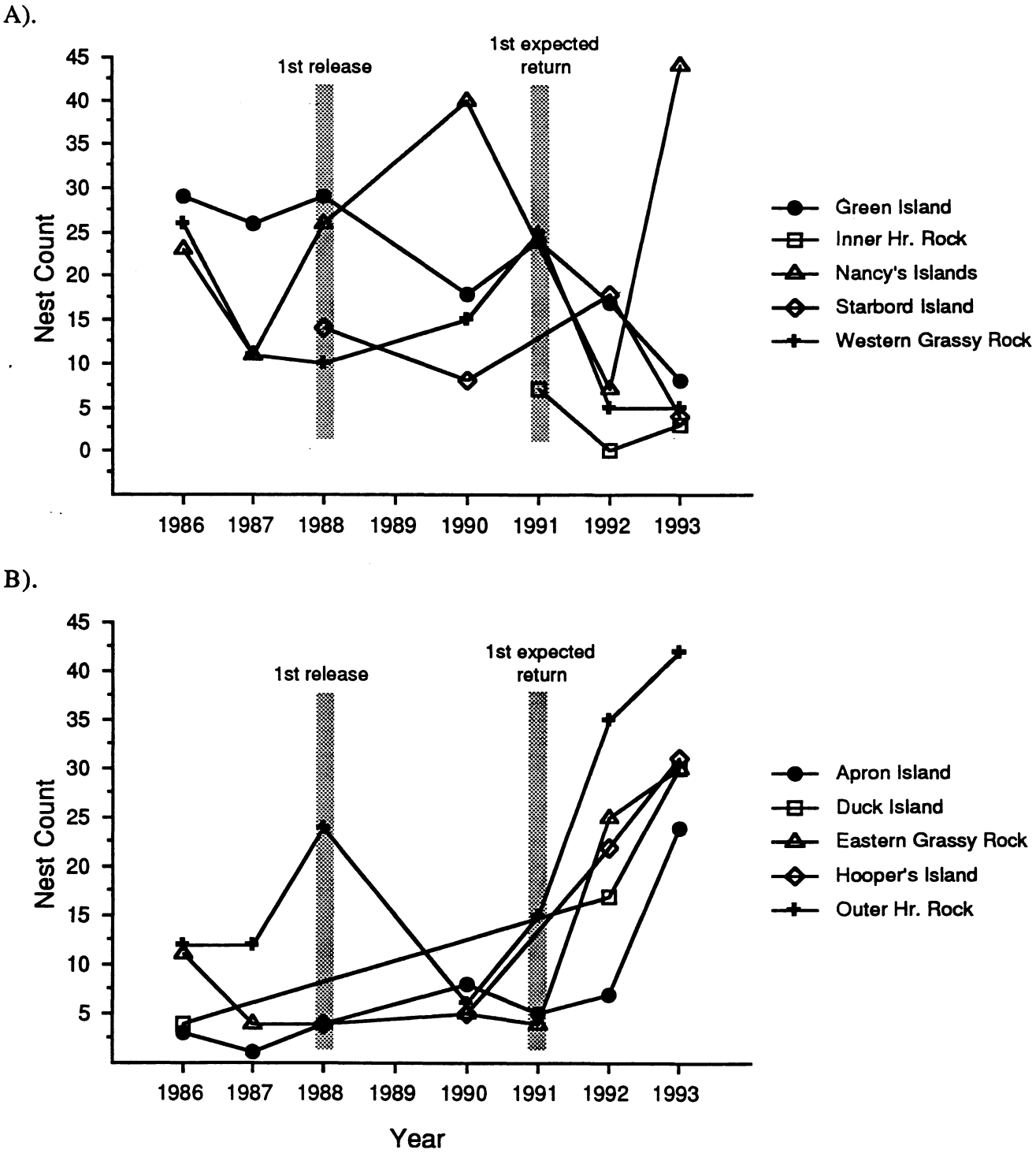

Figure 6. Common Eider nest counts by island for the Hare Bay archipelago from 1986 to 1993. Lines indicate initiation of duckling releases and expected return of three-year-old breeders.

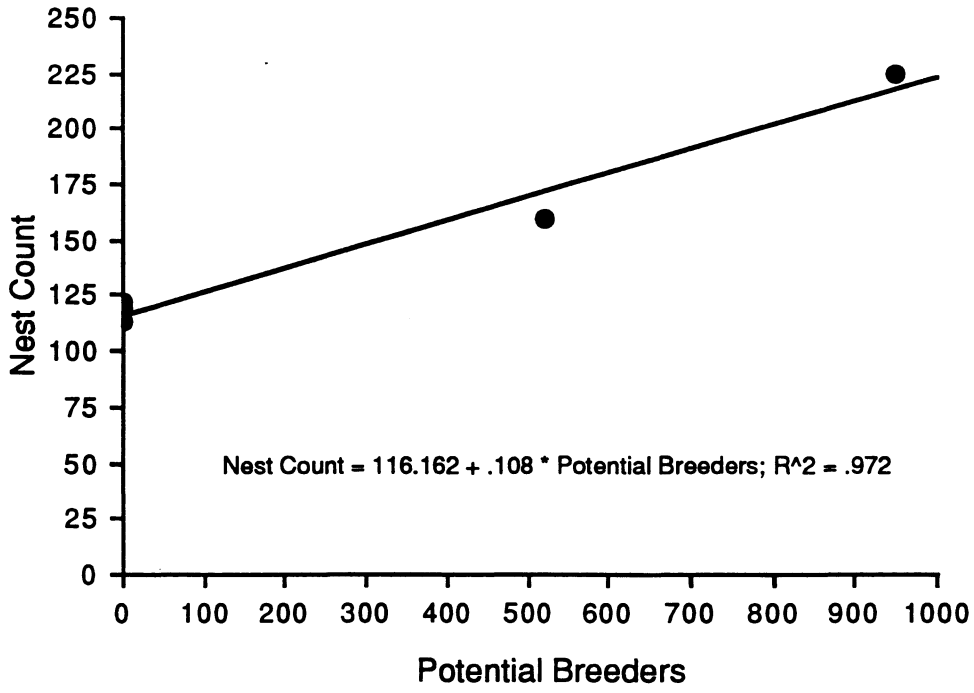

Figure 7. Regression of nest counts of Common Eiders in Hare Bay on released ducklings that were least three-years-old in the nest survey year.

Table 1. Mean daily observation ratios of banded to unbanded Common Eiders in Hare Bay, May-June (1992 n=7 days, 1993 n=5 days).

Year	Cohort	Total Observed	$\bar{x}$ Percent Banded	SE
1992	Females	158	11.6	2.5
	Sub-adult males	35	8.4	4.5
	Adult Males	114	0.0	0.0
1993	Females	63	17.3	4.5
	Sub-adult males	0	-	-
	Adult Males	43	0.0	0.0

Table 2. Common Eider nest counts for the Hare Bay archipelago from 1986 to 1992.

	Year						
Island	1986	1987	1988	1990	1991	1992	1993
Apron	3	1	4	8	5	7	24
Barred	-	-	-	-	-	0	0
Brent	2	-	-	-	-	-	-
Deaths Head	-	-	-	5	-	-	0
Duck	4	-	-	8	-	17	30
Eastern Grassy Rock	11	4	4	5	4	25	30
Green	29	26	29	18	24	17	8
Hooper's	-	-	4	5	-	22	31
Inner Hr. Rock	-	-	-	-	7[2]	0	3
Lock's Cove	-	-	-	-	-	1	1
Long Island	-	-	1	-	-	-	-
Nancy's	23	11	26	40	-	7[3]	44
Outer Hr. Rock	12	12	24	6[1]	15[2]	35	42
Western Serieux Arm	1	-	-	-	-	6	2
Spring	2	-	-	-	-	-	-
Starbord	-	-	14	9	-	18	4
Western Grassy Rock	26	11	10	15	25	7	5
White Arm	-	-	6	0	-	-	-
Total	113	65	122	119	80	162	225

[1] Heavy mink depredation.
[2] Only nest boxes were surveyed.
[3] Red fox observed on Nancy's Island.
Note: (-) indicate islands that were not surveyed

Appendix I.

Nest counts of Common Eider by island and nest fate at time of survey for the Hare Bay archipelago in 1992 and 1993.

		Nest Fate					
Island	Date	Eggs	Pred	Down	Aband	Hatch	Total
Apron	15 Jun, 92	6	1	0	0	0	7
Barred	19 Jun, 92	0	0	0	0	0	0
Death's Head		-	-	-	-	-	-
Duck	15 Jun, 92	15	2	0	0	0	17
Eastern Grassy Rock	14 Jul, 92	21	2	0	2	0	25
Green	14 Jul, 92	5	12	0	0	0	17
Hoopers	19 Jun, 92	22	0	0	0	0	22
Inner Harbour Rock	14 Jul, 92	0	0	0	0	0	0
Locks Cove	15 Jul, 92	1	0	0	0	0	1
Maiden's		-	-	-	-	-	-
Nancy's East	16 Jun, 92	0	1	0	0	0	1
Nancy's Little	16 Jun, 92	0	0	0	0	0	0
Nancy's Mid	15 Jun, 92	0	0	0	0	0	0
Nancy's, Small		-	-	-	-	-	-
Nancy's West	15 Jun, 92	0	1	0	0	0	1
Nancy's Main	16 Jun, 92	1	4	0	0	0	5
Outer Harbour Rock	14 Jul, 92	25	1	0	9	0	35
Port		-	-	-	-	-	-
Starboard	14 Jul, 92	16	0	0	2	0	18
West Serieux Arm	15 Jun, 92	6	0	0	0	0	6
Western Grassy Rock	14 Jul, 92	6	1	0	0	0	7
Wooded Serieux Arm		-	-	-	-	-	-
Total		124	25	0	13	0	162

Appendix I Continued

		Nest Fate					
Island	Date	Eggs	Pred	Down	Aband	Hatch	Total
Apron	23 Jul, 93	0	1	0	2	21	24
Death's Head	24 Jul, 93	0	1	0	0	0	1
Duck	26 Jun, 93	25	1	0	2	2	30
Eastern Grassy Rock	24 Jul, 93	0	0	1	3	26	30
Green	24 Jul, 93	4	3	0	1	0	8
Hoopers	25 Jul, 93	0	2	1	0	28	31
Inner Harbour Rock	24 Jul, 93	0	0	0	0	3	3
Locks Cove	24 Jul, 93	0	0	0	0	1	1
Maiden's	24 Jul, 93	0	0	0	0	0	0
Nancy's East	28 Jun, 93	5	0	0	0	1	6
Nancy's Little	28 Jun, 93	0	0	0	0	0	0
Nancy's Mid	25 Jul, 93	0	0	0	0	0	0
Nancy's, Small	25 Jul, 93	0	0	0	0	1	1
Nancy's West	28 Jun, 93	9	2	0	0	1	12
Nancys Main	28 Jun, 93	1	3	0	0	21	25
Outer Harbour Rock	24 Jul, 93	0	0	0	16	25	42
Port	24 Jul, 93	0	0	0	0	0	0
Starboard	24 Jul, 93	1	1	0	0	2	4
West Serieux Arm	27 Jul, 93	0	0	2	0	0	2
Western Grassy Rock	24 Jul, 93	0	1	0	0	4	5
Wooded Serieux Arm	27 Jul, 93	0	0	0	0	0	0
Total		45	15	4	24	136	225

Note: Nest fate categories; Eggs- nests with eggs; Pred- depredated nests; Down- nests bowls with down but no signs of depredation; Aband- abandoned nests; Hatch- hatched nests