

**CAHOW RECOVERY PROGRAM**  
**Breeding Season Report for 2008**  
**And Update on the Cahow Translocation Project**

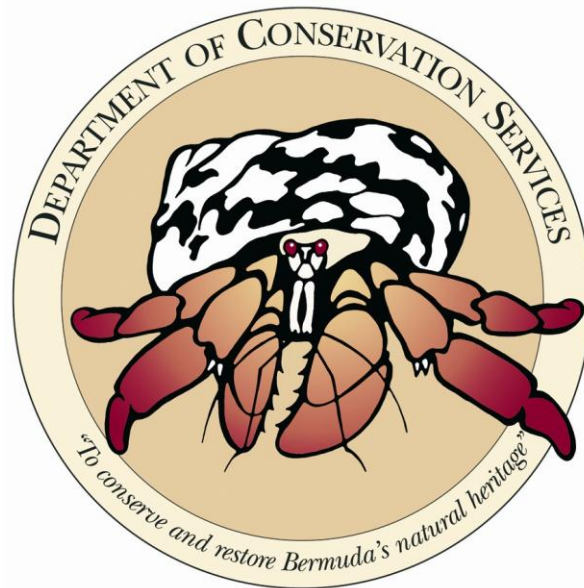


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**BERMUDA GOVERNMENT**



**Fig. 1. Bermuda petrel (Cahow) *Pterodroma cahow* fledglings exercising outside burrow entrances on nesting islet, June, 2008**

**DEPARTMENT OF CONSERVATION SERVICES**  
**Terrestrial Conservation Division**  
**Applied Ecology Section**



**CAHOW (BERMUDA PETREL)**  
*Pterodroma cahow*  
**RECOVERY PROGRAM**

**NESTING SEASON REPORT**

**For the Nesting Season October 2007 - June 2008**  
**And**  
**Update on the 5<sup>th</sup> and Final Year of the**  
**Cahow Translocation Project**

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\*Photos by Jeremy Madeiros except where indicated

# 1: Introduction and Executive summary

The following report summarizes the 2008 Nesting Season of Bermuda's national bird, the endemic and critically endangered Bermuda petrel or Cahow *Pterodroma cahow*.

2008 has been highlighted by the first return of Cahows translocated or moved to Nonsuch Island as part of a five-year project to establish a new nesting colony on Nonsuch. Four Cahows translocated to Nonsuch in 2005 were recaptured on the ground or in artificial burrows at the new colony site, and a total of six burrows at this site received prospecting visits. Up to six Cahows at one time were observed flying and carrying out courtship activity over the site at night during February and March. There was also positive news on the four present nesting islands, with the number of confirmed nesting pairs reaching a record high number of 85, compared to 18 breeding pairs in 1951, when the Cahow was first rediscovered (Murphy and Mowbray, 1951).

The Cahow continues to be subject to a number of threats and limiting factors, including nest site competition from the native White-tailed Tropicbird *Phaethon lepturus catsbyii* (Wingate, 1978), the threat of introduced mammal predators, especially Rats, swimming out to the nesting islets, lack of available nest sites and habitat at the present suboptimal nesting areas, and the yearly threat of damage to nest sites and the present nesting islets by hurricane waves and storm surge. Much of the present management program for the species is focused on addressing and overcoming these issues (Madeiros, 2005), and the importance of such management was emphasized by the loss of five young chicks to a single rat that managed to swim out to one of the nesting islets in April, 2008.

The high probability of further damage to the nesting islets from severe hurricanes and storms continues to be the single most serious threat to the Cahow. This threat cannot be fully addressed on the present tiny nesting islets, highlighting the need to establish new nesting colonies on nearby larger, managed predator-free islands.

There were a number of highlights for this nesting season, which extended from mid-October 2007 with the first arrival of adult Cahows on the breeding islets until mid-June 2008 with the departure of the last chicks. These include the following:

- 1) A record total of 40 Cahow chicks successfully fledged in 2008, compared with 39 chicks in 2007, 36 in 2006, 35 in 2005 and 29 in 2004.
- 2) The fifth and final year of a translocation project to establish a new breeding colony of Cahows on Nonsuch Island was carried out with 23 chicks moved to the new site, of which 22 fledged successfully out to sea. This brings the total number of chicks fledging successfully from Nonsuch in the last 5 years to 102.
- 3) This year saw the continued return of Cahows banded as fledglings in their nest burrows back to the nesting islets as adults after spending several years at sea. In 2006 and 2007, a total of 15 first-return birds banded as fledglings in the 2002, 2003, 2004 and 2005 seasons were recorded as returning to the nesting islands.



During 2008, an additional 16 first-return Cahows were recorded, banded as fledglings during the 2002 (3), 2003 (6), 2004 (3) and 2005 (4) nesting seasons. This raises the number of banded first-return Cahows confirmed as returning to the nesting islands to 31.

- 4) Some 5 new nest burrows were occupied by prospecting pairs of young Cahows during this nesting season, with at least two others prospected by single birds.
- 5) A total of 29 fledgling Cahows were regularly monitored, weighed and measured during 2008 to indicate when fledglings chosen for the translocation project are ready to be moved (section 8: Update on growth study of Cahow chicks).
- 6) The total number of active nesting burrows reached a new record high of 85 during 2008, up from 80 in the 2007 nesting season.

Full details on the 2008 breeding season are given in the following report; a brief summary of the Cahow Recovery Program is also included in addition to research and management proposals for the next several years.



**Fig. 2: Translocated cahow chick being readied for feeding on Nonsuch Island, June 2008**

## 2: Objectives of Cahow Recovery Program

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The short and long-term objectives of the Cahow Recovery Program are covered in full in the Cahow Recovery Plan (Madeiros, 2005); Briefly put, they are as follows:

1. To prevent nest-site competition with the White-tailed Tropicbird through the provision of wooden “baffler” plates to the entrances of all Cahow nest burrows, and by providing additional artificial “Igloo” nests to meet the nesting requirements of the Tropicbirds and reduce pressure on the Cahow burrows.
2. To regularly monitor all nesting and nearby islands for the presence of rats (*Rattus rattus* and *R. norvegicus*) and, when their presence is detected, to eradicate them with the use of anticoagulant rodenticide, using bait boxes purchased from the Bermuda Government Health Department.
3. To learn more about the biology of the species through an ongoing banding program initiated in 2002; also by carrying out growth studies of Cahow chicks from hatching to fledging and by morphometric measurements of adult Cahows.
4. To establish new breeding colonies of Cahow on larger, more elevated islands free of mammal predators which are safer from hurricane erosion and damage and have the potential of supporting larger populations of the birds; this is already underway on Nonsuch Island using translocation of near-fledged chicks and sound attraction; if successful here, also planned in the future for Southampton Island. (See section 9, page 26: Update on Cahow translocation project).
5. To continue the program of building additional artificial nest burrows on appropriate nesting islets and at locations where new nesting colonies are being established (see Fig. 3); to support continued increase in the breeding population.
6. To initiate studies of the oceanic and foraging ranges of the Cahow away from the nesting islets, by using miniature Data Loggers, fitted to the legs of individual Cahows for varying periods during the future 2009 and 2010 nesting seasons. These will record daily position fixes to determine the foraging range of Cahows when at sea, information that at present is largely unknown, as well as recording water temperature and the time spent on or in the water.
7. To use an infra-red burrow-scope to monitor deep natural nest sites, representing 25% of the active nest sites, where it has been previously impossible to observe the nest chamber. This will finally enable monitoring of essentially the entire breeding population.



**Fig. 3: Artificial Cahow nest burrows being constructed on nesting islet by terrestrial conservation crew foreman Barry Smith.**

### **3: Methods and Protocols used in Cahow Recovery Program:**

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The most fundamental management aspect of the Cahow Recovery Program is regular monitoring of the entire breeding population on the breeding islets for the following purposes: (1) to confirm breeding success; (2) check for potential problems so that remedial action can be taken; (3) carry out banding and morphological measurement of both chicks and adult birds; (4) record frequency of adult prospecting and feeding visits.

Checks of the nesting islets are carried out 2 to 3 times weekly (every 2 to 4 days), depending on weather conditions. These checks are carried out in the Terrestrial Conservation Division's 17' Guardian Boston Whaler boat, which is light and agile enough to make the close approaches to the islets, over shallowly submerged rocks and reefs, which are involved in landings.

Because of the exposed nature of the islets, they are often subject to strong ocean swell or waves, which, along with strong winds, may make landings impossible for up to several days at a time. The protocols for landings stipulates that sustained winds exceeding 20 – 25 knots generally render landings unsafe, although this is somewhat affected by the wind direction. Landings on the two western nesting islets are not safe with southerly or



westerly winds over 25 knots, or with northwesterly or northerly winds over 18 knots, although it is usually still possible to land on the two eastern nesting islets, which are protected by Coopers Island in these wind directions. It may also not be possible to land on the two eastern nesting islets with strong northeasterly or easterly winds exceeding 20 to 25 knots. Strong southeasterly winds or ocean ground swell from hurricanes passing to the south of Bermuda may render it unsafe to land on any of the islets or travel around the southern tip or headland of Coopers Island (Coopers Point). Large breakers may form without warning between the reef line and the headland and extreme caution should be exercised at these times.

During landings, a quick check of the island is made, followed by systematic inspection of all active and potential nesting burrows. Over three-quarters of the nest burrows have removable concrete observation lids which enable inspection of birds in the nest chambers. These lids are removed for a brief time (no more than 1 minute is usually necessary) and a note is made of the number of adults present (if any), nest-building activity, and the presence of an egg or chick. It is particularly important to determine the date of egg-laying and the date of egg hatching, as these will help to determine when the chick will be ready to fledge. The nests are also checked for the presence of rocks or small stones which could cause breakage or cracking of the single egg and are still a significant cause of breeding failure. Any rocks or stones detected should be carefully removed. Adult Cahows can be briefly removed from nest chambers through the observation lids for morphometric measurement and checking of band numbers. If unbanded, birds are fitted with an identification band (Section 7, page 18: Cahow banding program). The bird should not be removed for more than 5 minutes, and these checks are best carried out during the nest-building stage in November or during egg brooding in February. Only single birds should be removed, with pairs of adults generally being left alone unless an assistant is present.

After hatching, chicks are also weighed and measured as part of an ongoing growth study (see Section 8, page 23; Update on Growth Study of Cahow Fledglings) and in support of the ongoing translocation project (see Section 9, page 26; Update on Translocation Project). Chicks are only removed from their nests if no adults are present, to avoid undue disturbance to the birds. Chicks are measured regularly from the earliest time after hatching that they are left alone in the nests by the adults, until their final departure out to sea. Since 2004, all Cahow chicks included in the Translocation Project have been measured throughout their development in this way. In addition, a smaller number of non-translocated chicks which are raised normally to fledging by the adult birds are also measured throughout their development. These act as a control or check to ensure that the translocated birds are fledging at the same weights, wing lengths, and body condition as non-translocated birds, and that they depart at the same age and point of development.

Although it is not necessary to be present at the final departure of chicks, an effort is made to carry out a number of night watches during the period when chicks are out of their burrows to exercise prior to departure, both on the nesting islets and at the Nonsuch Island translocation site. The nesting islet night watches are useful for capturing chicks from nest burrows that are not accessible, and enable banding and morphometric measurements to be carried out. The night watches at the translocation site are mainly

carried out to enable study to be made of behavior of the chicks in their new habitat during the exercise phase of their development.



**Fig. 4: Carrying out Cahow nest check on nesting islet; boat used for landings in background (photo: A. Dobson).**

## **4: Review of Management Actions for 2008 Cahow Nesting Season**

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The first action for the impending nesting season was the removal of Tropicbird exclusion baffles from the entrances of all Cahow nest burrows during the first week of October, 2007. This is carried out at this time because by this point the Tropicbird nesting season is finished and there is no longer any danger of nest takeover by this aggressive species. The baffles are removed to provide greater ease of access for the returning adult Cahows during the important courtship, nest-building and egg-laying periods of the nesting season. Checks of all the nesting islets to ensure that rats have not swum out to them during the summer months are also carried out at this time.

The first adult Cahows were confirmed as having returned to nest burrows on Green Island and Horn Rock by the 17<sup>th</sup> October, 2007. The rest of the established nesting Cahows arrived at their nest burrows on the nesting islets through the end of October, with all birds having returned by the first week of November. At this time, bags of St. Augustine Grass *Stenotaphrum secundatum* have to be collected on Nonsuch Island and

taken out to the nesting islets. This has to be done because these islets are so barren and rocky that the Cahows have insufficient material to gather to make a good nest. This can result in eggs being laid directly on the rocky floor of the nest chambers, making them much more susceptible to cracking and failure. The grass is broken into shorter 4" to 6" lengths and placed in piles to the sides of the burrow entrances, where it can be collected and pulled into the nest chambers by the adult birds at night.

The main nest-building and courtship period for established Cahow nesting pairs extends through the month of November. In addition to the usual nesting islet checks carried out during daylight hours, 5 'night-watch' checks were carried out after dark during November 2007 to observe courtship behavior and activity by the adult birds. These night checks are useful for behavioral observations as Cahows only fly over the nesting islets at night, remaining out on the open ocean or in their nest burrows during the day.

During the month of December, the Cahow breeding population departed to sea for several weeks on a 'pre-egg laying exodus' so that the female can feed intensively to enable her relatively large single egg to develop. The male uses the same period to build up fat reserves needed to carry out extended periods of incubating the egg.

The Cahows returned to the nesting islets by the beginning of January, 2008 with the first eggs being confirmed as having been laid by the 7<sup>th</sup> January. All nesting pairs were back in their nest burrows, with most brooding eggs, by the 22<sup>nd</sup> January 2008.

Following the long 53-day egg incubation period, the first chicks were confirmed as having hatched by the 26<sup>th</sup> February. Over 35 chicks were confirmed as having hatched by the 20<sup>th</sup> March. At this point, regular monitoring of the growth and development of the chicks became the most important component of the nesting islet checks. Note was also taken where possible of the frequency and number of adult feeding visits.

As an additional aspect of the nest checks, 29 Cahow chicks were regularly weighed and their wing chord growth recorded during the 2008 nesting season, to be able to determine when chicks were mature enough to translocate. 23 of these chicks were eventually translocated to Nonsuch Island, while 6 more chicks served as 'controls' to be able to compare fledging weights and wing development of naturally-fledging chicks with translocated birds (see page 23; 'Update on Growth Study of Cahow Fledglings').

During the first week of March, the Tropicbird exclusion baffles were fitted back on the entrances of all cahow nest burrows in preparation for the return of White-tailed Tropicbirds to the Castle Harbour Islands for the start of their own nesting season. This is an essential procedure to prevent burrow invasions by prospecting Tropicbirds, which would otherwise kill the Cahow chicks and take over the nest sites.

2008 marked the fifth and final year of the Cahow Translocation Project to establish a new nesting colony on Nonsuch Island, and resulted in 23 fledglings being moved from the present nesting islets to a new complex of artificial nest burrows on Nonsuch (see Fig. 11), with 22 fledging successfully. This is covered in full later in this report (see page 26; 'Update on 2008 Cahow Translocation Project'). One beneficial effect of the translocation

project has been that it has enabled tour groups of students from local schools to see the translocated Cahow chicks undergoing daily feeding, weighing and measurement while visiting Nonsuch Island on natural history tours. As a result, nine tour groups with over 150 school children, as well as 3 Bermuda Zoological Society (BZS) 'Nature Encounter' tours with almost 75 people, have been able to see Cahow fledglings during 2007 and 2008, and observe them being fed, measured and banded. This represents the largest number of people experiencing a close encounter with the Cahow since the 1600s!

The first Cahow chick to fledge left for the open sea on the night of 15<sup>th</sup> May, 2008. The last Cahow chick left from the # 829 nest at the translocation site on Nonsuch Island on the night of 13<sup>th</sup> to 14<sup>th</sup> June, 2008, bringing the nesting season to a close.

The first part of the nesting season, October 2007 through January 2008, was marked by milder than normal weather conditions with weekly cold front passages causing windy conditions and rain, but very few true gales. Gale conditions were recorded on the 19<sup>th</sup> February, with winds gusting as high as 45 knots. Gale warnings were posted from the 16<sup>th</sup> to the 18<sup>th</sup> March, 2008 with winds up to 60 knots (70 mph) affecting the islands. Monitoring visits to the Castle Harbour Islands had to be discontinued on this occasion, and an adult Black Rat that had swum out to Long Rock evidently just before the beginning of the gale was able to kill at least five young Cahow chicks before being discovered. Extra bait boxes with rodenticide were put out and the rat was quickly killed.

Heavy rains and thunderstorm activity occurred during the early stages of fledgling exercise activity and departure during late May, 2008. Exercising chicks were observed by the author on two occasions (see Fig. 5) in rain and intense lightning activity during night watches at the Nonsuch translocation site. The chicks did not seem unduly concerned and continued exercising and preening through the worst of this weather (at least until this very soggy researcher gave up and ran for cover!).





**Fig. 5: Translocated Cahow fledgling out exercising at night in rain and thunderstorm activity on Nonsuch Island, night of May 22<sup>nd</sup>, 2008.**



**Fig. 6: Exercising Cahow fledgling in front of nest entrance on Nonsuch Island, night of May 15<sup>th</sup>, 2008**

## 5: Summary of 2008 Cahow Nesting Season

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During the 2008 Cahow nesting season, there were some important developments in the recovery of this critically endangered species. Despite the loss of at least 5 young chicks to rats swimming out to one of the nesting islets, a total of 40 chicks successfully fledged out to sea, compared with 39 in 2007, 36 in 2006 and 29 in 2004. In addition, a total of 5 new nest burrows were colonized by new nesting pairs of Cahows (Horn C25, Green 3-4, IPO B5, Long D4, and Long D8), bringing the total number of active nest sites to a record high number of 85.

Following is a brief summary of the nesting season:

|  |    |
|--|----|
| Total number of occupied nest sites with nesting activity confirmed.....   | 85 |
| Number of new nest sites occupied for first time by establishing nesting pairs that had attempted breeding and built nests, produced eggs and/or raised chicks ..... | 5  |
| Total number of confirmed successfully fledged Cahow chicks.....   | 40 |
| Number of successfully fledged chicks from nest sites where observation of the nest chambers was possible.....   | 33 |
| Number of successfully fledged chicks from non-observable nests.....   | 7  |
| Total number of occupied nest sites with unsuccessful breeding.....  | 45 |
| Number of confirmed failures from nest sites where observation of nest chambers was possible.....  | 38 |
| Breakdown of causes of breeding failure from nest sites where observation of nest chambers was possible:   |    |
| Chick died from Rat predation .....  | 5  |
| Chick died hatching .....  | 0  |
| Chick died later in development from unknown causes .....  | 1  |
| Chick died from lack of parental care .....  | 1  |
| Broken or pipped eggs .....  | 11 |
| Non-hatching/infertile eggs .....  | 10 |
| Egg buried/knocked off nest .....  | 1  |

In addition, no eggs were produced at 9 nest sites where otherwise normal nest-building and courtship activity was observed.

Number of breeding failures from burrows where nest chambers were not visible ..... 7

## **6: Details of Breeding Success on Individual Nesting Islets:**

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### **6.1. HORN ROCK**

- 35 confirmed nest sites with breeding activity (including 1 newly occupied nest sites – B6);
- 19 nest sites with successfully fledging chicks, 18 from nests with observable nest chambers: (B5, C9, C11, C12, C13, C15, C18, C19, C20, C21, C22, C23, \*C24, \*C25, D4, D5, F3, F4); (\* = 1<sup>st</sup> chick for nest) and 1 chick from nest site with non-observable nest chamber (D5);
- 16 nest sites not producing chicks;
- 13 confirmed failures from nests with observable nest chambers (B3 – egg broken; C5 – unhatched egg; C6 - broken egg; C7 – broken egg; C8 – chick died late in development; C10 – no egg produced; C14 – egg broken; C17 – unhatched egg; F2 – unhatched egg; F5 – unhatched egg; F6 – no egg produced; F8 – unhatched egg; G2 – egg broken.
- 3 failures from non-observable nests (B6, D3, E1).
- 2 nest burrows with prospecting activity (F7, C16)

### **6.2. GREEN ISLAND**

- 21 nest sites with confirmed breeding activity (including 1 newly occupied nest site - # 3/4);
- 9 nest sites with confirmed successfully fledging chicks, 7 from sites with observable nest chambers (#4, # 5, #5/6, # 6, #8, # 10, # 11), and 2 from nest sites with non-observable nest chambers (F1, F3);
- 12 confirmed failures from nests with observable nest chambers (A1 – broken egg; A2 – no egg produced; D1 – unhatched egg; F2 unhatched egg; # 1 – chick died 2-thirds fledged from unknown causes # 2 – unhatched egg; # 3/4 – no egg produced; # 4/5 – no egg produced; # 7 – egg broken; # 9 – no egg produced; #12 – egg broken; #13 – unhatched egg.
- 1 nest site with prospecting visits (# 14)

### **6.3. INNER PEAR ROCK (OUTER)**

- 18 nest sites confirmed with nesting activity (including 1 newly occupied nest sites – B5);
- Total of 10 chicks confirmed as successfully fledging; 9 nest sites with chicks confirmed as fledging successfully from nests with observable nest chambers (B1; B3; B4; B6; B7; C4; D2; D3; E2); and 1 nest site with chick fledging successfully from non-visible nest chamber (B5);
- 8 nest sites not producing a chick; 7 confirmed failures from sites with observable nest chambers (A1 – unhatched egg; B8 – unhatched egg; B9 – egg broken; C2 – no egg produced; C3 – egg broken; D1 – egg broken; D4 – no egg produced).
- 1 failure from non-observable nest site (E1);
- 2 new nest sites with prospecting visits (B2; B10).

### **6.4. LONG ROCK**

- 11 nest sites confirmed with nesting activity;
- 2 nests confirmed with chicks fledging successfully, 1 from nest with observable nest chamber (D5); and 1 nest with chick confirmed fledging successfully with non-observable nest chamber (C);
- 6 confirmed failures from nests with observable nest chambers (D4, D7, D8, E1, E4 – chicks predated by rat); (H1) – no egg produced);
- 3 confirmed failures from nest sites with non-observable nest chambers (A; B; D1).



## 7: Cahow Banding (Ringing) Program

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A banding (ringing) program for the Cahow was first started in 2002, using identification bands (rings) made and supplied by Porzana Ltd. (U.K. Wetlands Trust affiliation). These bands are made of incoloy, a strong, light and corrosion-resistant alloy proven to last for 30 or more years. These bands each have a unique identification code and postal address, and are the easiest method to positively identify individual Cahows as the sexes and individual birds are virtually identical in appearance.

The main objectives of the banding program are described as follows:

- (a) To band at least 75% of all Cahow fledglings produced annually by the entire breeding population; this is considered a priority as it results in identifiable birds of known age and origin that can essentially be followed through all of their breeding lifespan (see Section 7.2., page 20). This target has been met or exceeded every year since the commencement of the program 6 years ago.
- (b) To band breeding adult Cahows, with an emphasis on banding both members of individual breeding pairs. This is enabling various aspects of the Cahow's breeding biology to be researched and/or confirmed.



**Fig. 7: Cahow chick being fitted with identification band (ring)**

During the 2007 – 2008 Cahow nesting season, a total of 30 fledglings were fitted with identification bands out of 40 that successfully fledged. In addition, a total of 12 adult Cahows were also banded. This makes a total of 296 Cahows that have now been banded since the program commenced in January 2002. This consists of 171 birds banded as fledglings (of which 31 have been confirmed as returning to the nesting islands by June 2008) and 95 birds which were banded as adults.

### **7.1: Report on Returning Cahows Banded as Fledglings**

During the 2005/2006 nesting season, the first return to the nesting islets of Cahows banded as fledglings in their nest burrows was confirmed. This involved 8 birds, which were identified from their leg bands, from both the 2002 and 2003 cohorts of fledglings. 5 of these birds originally fledged from Green Island (3 from the 2002 season, 2 from 2003) and 3 fledged originally from Horn Rock (all from the 2002 nesting season). 5 of the 8 first-return birds were recaptured on the island they had originally fledged from, involving all 3 Horn Rock birds and 2 of the Green Island birds; while 3 were recaptured on different islands/rocks than they originally fledged from. These 3 were all from Green Island, 2 of which were recaptured on Horn Rock and 1 on Inner Pear Rock.

During the 2006/2007 nesting season, 7 additional Cahows originally banded as fledglings were recaptured and confirmed as returning to the nesting islets for the first time. These include 4 birds banded on Horn Rock, 3 which were recaptured back on Horn Rock, and 1 which was recaptured over on Green Island. 3 of these birds fledged during the 2003 nesting season, and 1 (surprisingly) fledged during the 2005 nesting season. This last one is of particular interest, having fledged only 2 years before recapture, with all other first-return birds being at least 3 or 4 years old. Of the remaining 3 birds, two originated from Green Island, one from the 2002 nesting season, and the other from the 2004 nesting season. Both birds returned to and were recaptured on Green Island, with both pairing up with other first-return birds in new nest burrows. The third bird was banded as a fledgling on Long Rock during the 2002 nesting season, and was recaptured in a nest burrow on Inner Pear Rock in 2007, where it had paired up with another first-return bird originating on Green Island, where it had fledged from during the 2002 nesting season.

These results have resulted in a major rethinking of the age of Cahow chicks when they first return to the nesting grounds upon maturity. Whereas it was originally thought that Cahows needed at least 5 to 8 years to mature and return to the nesting grounds, it is now known that the majority of birds first return at three to four years of age, although at least one bird returned only two years after fledging. Another major finding involves the belief that all Cahows return to the same island that they had originally fledged from. The recaptures over the last two years have shown that although the majority (two-thirds) of birds do indeed return to the same island, that one-third of all returning Cahows were recaptured on different islands than their original point of origin.

This highlights the importance of the banding program for confirmation of even basic knowledge of Cahow breeding biology. The fact that some major objectives of the banding program are already being realized after just five years points out the importance of using a simple, safe and proven technique to carry out life studies of individual birds over long periods. It also indicates that there is great potential in the use of new technologies such as data loggers and satellite trackers to enable investigation of the birds range and behavior while at sea, which has not been possible up to this point. All of this new information and data will be vital in determining recovery and management strategy to ensure the survival and recovery of this critically endangered and historic species.

## **7.2. 2008 Update on First-return Birds Banded as Chicks**

During the 2008 nesting season, first-return Cahows banded as chicks continued to show up in increasing numbers, with another sixteen recorded during the season (November 2007 through June 2007). An extremely important development for this season was the return of the first birds that were translocated from the original nesting islets to the new colony site on Nonsuch Island (see section 9.3, page 33 for full details). Three of these, all from the trial 2004 translocation year, did not return to Nonsuch as hoped but were recaptured on Horn Rock. One was lured to the ground while flying at night over Horn Rock, but has not since been found in a nest burrow. The other two occupied a nest burrow together on Horn Rock (Horn F5 burrow), where they made their first nesting attempt in 2008 and produced an egg (which did not hatch).

Another four first-return birds had all been translocated to Nonsuch Island during the 2005 season, with all returning to the Nonsuch translocation site. Two of these were recaptured on the ground at night at the new colony site, and the other two were recaptured in nest burrows on Nonsuch. These birds appear to have ‘claimed’ these burrows, as they were recaptured several times in them over the remainder of the season; one of these birds returned to the same nest burrow (R833) that it had been originally translocated to, and fledged from, in 2005 as a chick, representing a perfect return back to the point of departure. The second bird returned to the burrow adjacent to, and 5’ away from the burrow it was originally translocated to (see Fig. 8).

As for the remaining first-return Cahows, three were from the 2002 cohort of chicks, and six were from the 2003 cohort. Of these birds, five returned to the islet that they had originally fledged from, while four were recaptured on different islets than they had fledged from. When the translocated birds are included in this calculation, the figures rise to nine Cahows returning to the islands they fledged from, while seven birds returned to other islands than their original fledging points.

As of the 2008 season, a total of thirty-one Cahows originally banded as fledglings in nest burrows have now returned to the nesting islets, including eleven from the 2002 season, eleven from the 2003 season, four from the 2004 season and five from the 2005 nesting season.



**Fig. 8: First-return Cahow translocated as chick in 2005 and recaptured in # R834 burrow on Nonsuch Island, 10<sup>th</sup> April, 2008. (Photo: Billy Mitchell)**

### **7.3: Summary of Results from Returning Cahows Banded as Fledglings**

A total of 31 Cahows banded as fledglings since the start of the banding program in 2002 have been recorded returning to the nesting islets as of June, 2008. These birds have known histories and can now be followed for the rest of their breeding lifespan. This is a primary aim of the banding program and has already begun to provide a great deal of interesting results and findings, which are outlined as follows:

- Out of 29 Cahow chicks banded from the 2002 cohort of 36 chicks, a total of 11 have returned as prospecting adults, 6 during the 2006 season, 2 during the 2007 season, and 3 during the 2008 season. This represents a total of 38 % of chicks banded in 2002 that have now been confirmed as returning to the nesting islets.
- Out of 33 Cahow chicks banded from the 2003 cohort of 39 chicks, a total of 11 have now returned as prospecting adults, 2 returning during the 2006 season, 3 during the 2007 season, and 6 during the 2008 season. This represents 33 % of chicks banded in 2003 that have been confirmed as returning to the nesting islets.



- 24 of the returned birds were captured in nest burrows, while 7 have been recaptured on the ground at night on the nesting islets or Nonsuch Island.
- 5 of the returned birds have paired up with older adult birds, already occupying nest burrows for 2 or more years, that had lost their original partners; one of the resulting pairs (Horn C14) successfully raised a chick in the 2006 season, while 2 of the pairs (in both Horn C14 and Horn C21) successfully raised chicks in 2007. During the 2008 season, the Horn C14 pair had failed breeding while the Horn C21 pair successfully raised another chick.
- 19 first-return Cahows were captured in new nest burrows not previously occupied by established adult pairs; 12 of these paired up with other first-return birds, while 5 paired up with unbanded birds of unknown age or origin (presumably birds which had fledged from known, inaccessible nests where they could not be banded as chicks). The partners of 2 of these birds have not yet been captured and checked.
- 1 returned bird was captured in a nest burrow (Horn C21) already occupied by an established pair of banded adult Cahows which failed for the 2006 season. During the 2007 season, this bird evidently replaced one of the adult birds from the established pair, pairing up with the remaining bird and successfully raising a chick together during both the 2007 season and the 2008 season.
- 19 of the 31 returned birds were recaptured on the same island they had originally fledged from, while the other 12 were recaptured on other islands.
- Of the 31 returned birds, 11 originated from Horn Rock, while 7 originated from Green Island, 3 from Inner Pear Rock and 3 from Long Rock. Out of the translocated birds, originating on different islands but fledging from and counted as Nonsuch Island Nonsuch birds, a total of 7 have been recaptured by June 2008, 3 of which were recaptured on Horn Rock (all from the 2004 cohort), and 4 which were recaptured back on Nonsuch Island (all from the 2005 cohort).
- To date, 9 of the 11 returned Horn Rock birds (81%) were recaptured on the island of their birth; 1 was recaptured on Green Island, and 1 on Inner Pear Rock. In contrast, 4 of the 7 returned Green Island birds (57%) returned to Green Island, while 2 were recaptured on Horn rock and 1 was recaptured on Inner Pear Rock. Of the 3 returned birds from Long Rock, 2 were recaptured in nest burrows on Long Rock, while 1 was recaptured in a burrow on Inner Pear Rock, where it has paired up with a returned bird from Green Island.

## **8: Update on Growth Study of Fledglings**

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### **8.1. Objectives and Methodology**

In 2002 a growth study of Cahow fledglings was initiated to investigate various aspects of fledgling development in the species which were not well understood. This study is being carried out in tandem with the banding program, and aims to track the development of a sample of each breeding season's cohort of chicks from hatching until final departure out to sea. The study involves removing chicks briefly from their nest chambers through the removable inspection lids which approximately 80% of all Cahow nest burrows are fitted with. The chicks are measured for body mass (weight), wing chord (outer wing length), plumage development and occasionally other morphometric body measurements to determine development and rate of growth.

This study has several objectives:

- 1) To determine the normal range of weight and body size among a representative sample of fledglings over a number of years, and how this affects survival rates;
- 2) To support the translocation project by determining how close the fledgling is to final departure, and thus when the chick is ready to be translocated;
- 3) To identify any fledgling that is dangerously underweight, through abandonment or mortality of one or both adults or insufficient adult feeding visits, and to help determine when to remove such chicks for care in the Wildlife rehabilitation Centre at BAMZ before the chick is beyond hope of recovery;
- 4) To help determine the general productivity of the oceanic foraging grounds of the Cahow; by determining the mean maximum weights achieved by all Cahow fledglings which are part of the study during any one year, and comparing this to the mean maximum weights achieved by samples of fledglings during other years.

All equipment used for growth studies are obtained from AFO (Association of Field Ornithologists) Banding Supplies, Box 1770 Manomet, MA 02345 508/224-6521, USA. Weighing of fledglings is carried out using small Pesola spring scales with a range of 0 to 600 grams. Measurement of wing chord length is carried out using a specialized stainless steel wing chord ruler. Measurement of other morphometrics (bill length, bill depth at gonys, total head length, tarsus length, and total foot length) is carried out using a Scherr-Tumico caliper. To facilitate the weighing, measurement and banding of the birds, cloth bird weighing bags obtained from AFO Banding Supplies have been found to be very effective in gently holding and calming birds, while immobilizing them to enable measurement and banding to be carried out.

### **8.2. Results and Utilization of Findings from Growth Study**

A total of 21 fledglings were used in the study during its first year in the 2001 – 2002 nesting season. Body mass (weight) was the only measurement taken of fledglings during this season, with checks carried out every 2 to 4 days on average. 21 fledglings were also



**Fig. 9: Carrying out growth measurements of Cahow chick on nesting islet  
(Photo C. Burville)**

studied during the 2002 – 2003 nesting season, with measurement of wing chord growth also being taken of fledglings from about 60 days of age onwards. Checks of fledglings were also carried out on consecutive days to determine the amount of food provided during adult feeding visits. 20 chicks were studied during the 2003 – 2004 nesting season, of which 14 were translocated to the new nesting colony site on Nonsuch Island in the first year of the Cahow Translocation Project (see page 26: Update on Cahow Translocation Project). The other 4 chicks were used as controls to determine if there were any differences between naturally fledging chicks (raised entirely by the adult Cahows) and those which were translocated and artificially fed during their final fledging period. The weight studies were crucial in determining that translocated chicks were fledging over 40 grams lighter on average than birds which were not moved. It is as yet unknown how this would affect chick survival during the post-fledging period, but the amount of fat reserves that the chicks fledge with are most likely important during the crucial period after fledging when the chicks are still learning how to locate and catch food. This resulted in the decision to provide larger amounts of food during feeding of translocated chicks over the remainder of the translocation project.

During the 2004 – 2005 nesting season, a total of 24 Cahow fledglings were measured for the growth study, of which 21 were eventually translocated to Nonsuch Island. As a result of the feed size adjustments, the chicks fledged at weights comparable to the control (non-translocated) birds.

For the 2005 – 2006 Cahow nesting season, a total of 26 fledglings were measured for the growth study. 21 of these birds were eventually translocated to Nonsuch Island, while 5 birds were used as controls. The results again indicated that the translocated Cahow fledglings fledged at essentially the same weight, wing chord and age as the control birds (see section 9.1. page 27: review of translocation project to date).

The 2006 – 2007 nesting season saw a record number of 31 chicks measured as part of the growth study. A total of 24 of these were eventually translocated to Nonsuch Island at the appropriate point in their development, with growth measurements continuing after translocation until their final departure. The remaining 7 chicks were used as controls for comparison purposes. This was the first year that translocated Cahow chicks fledged at substantially higher mean weights (306 grams) than the control chicks (286 grams).

During the most recent, 2007 – 2008 nesting season, a total of 29 chicks were regularly measured for the growth study, of which 23 were translocated to Nonsuch Island. The remaining 6 were used as controls for comparison with the translocated birds. During the 2008 season, the translocated birds fledged at a mean weight of 279 grams, which was almost identical with the naturally fledging (non-translocated) Cahow chicks, which fledged at a mean weight of 282 grams.

In addition to providing data to support the Cahow Translocation Project and enable fledglings to be moved at the optimal time to imprint on the new colony site, the growth survey has made it possible to determine the following points;

- 1) That Cahow chicks that attain lower maximum weights of less than 300 grams during their development can take up to 10 -20 days longer to fledge than chicks that exceed 400 grams peak weight during their development;
- 2) That mean weights for all Cahow chicks produced during a breeding season can vary considerably from year to year, as shown in the following table:

**Table showing no. of chicks in annual weight survey and maximum mean wt.**

| <b>Year</b>                         | <b>2002</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> |
|-------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>No. of chicks weighed</b>        | 21          | 19          | 20          | 23          | 26          | 32          | 28          |
| <b>Maximum wt. of chicks (Mean)</b> | 386gm       | 345gm       | 350gm       | 406.7gm     | 382.6gm     | 388.5gm     | 367.1gm     |

- 3) That the maximum and average weights attained by chicks during their development have little effect on their overall survival rates until they mature and return to the nesting islands;
- 4) The weights at which chicks fledge and depart to sea do seem to have an effect on their overall survival rates, in that chicks that have fledged grossly overweight or underweight (more than 325 grams or less than 235 grams) do not appear to survive to return to the nesting island.



## 9: Update on Cahow Translocation Project – 2008 Season

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**Fig. 10: Translocated Cahow fledgling exercising on nest entrance at Nonsuch Island, night of 15<sup>th</sup> May, 2008**

During 2008, the fifth and final year of the Cahow Translocation Project was carried out, completing a project aiming to establish a new breeding colony of Cahows on the Nonsuch Island Nature Reserve. Translocation of seabirds is an emerging technique in establishing new colonies (Kress and Nettleship, 1988; Serventy et al., 1989; Miskelly and Taylor, 2004; Priddel and Carlile, 2006). This project is being carried out for two main reasons:

- (1) The present nesting islets have suffered severe erosion and damage from several recent hurricane events, and remain vulnerable to further erosion and damage to nest sites. There exists the real possibility of catastrophic collapse of large sections of some of the nesting islets in the event of a severe hurricane.
- (2) The small size and low elevation of the present nesting islets place physical restraints on the future growth and recovery of the Cahow population.

The main objective of the Translocation Program has been to move a minimum of 100 Cahow fledglings over a five-year period from nest sites on all 4 of the present nesting islets to a new complex of artificial burrows (Priddel and Carlile, 1995), built at a new

colony site on Nonsuch Island (see Fig. 11). These translocated chicks were then to be fed every other day and their growth monitored until they were fully mature, after which feeding was discontinued. At this point, chicks normally begin to come out of their nests at night, during which they exercise their flight muscles, explore the area around their nest burrows and hopefully imprint upon their surroundings. The chicks were monitored and their weight, wing chord and plumage development recorded through this period until their final departure out to sea, where they are now known to remain for 3 to 5 years until they reach sexual maturity. A Sound System playing back recorded Cahow courtship vocalizations was installed at the translocation site by 2007 in order to encourage returning Cahows to land at the site, hopefully to prospect and occupy the artificial nest sites originally constructed at the site to hold the translocated chicks.

### **9.1. Review of Translocation Project Results to Date (2004–2007):**

During the trial year of the project in 2004 a total of 14 Cahow fledglings were moved to the nest complex on Nonsuch, with all fledging successfully. A smaller initial number of birds were moved during this trial year to check the methodology and techniques used for the project, to look for any possible problems and to fine-tune the exact time to best move the fledglings, feed size and food items used etc. Nicholas Carlile, a petrel and seabird specialist from the New South Wales Department of Parks and Wildlife with experience in the translocation of *Pterodroma* petrel species (Priddel and Carlile, 2001; Priddel and Carlile, 2006), was engaged to come to Bermuda for 5 weeks and oversee the trial translocation. The trial year was considered a success as all chicks fledged successfully, with mean age at fledging (89 days) and mean wing chord at fledging (250 mm) very similar to that of 10 non-translocated control chicks (93 days and 251 mm respectively). The only concern was that translocated chicks fledged on average about 49 grams lighter (mean weight = 231 grams) than the control chicks (mean weight = 280 grams). It was unknown how this would affect chick survival after fledging.

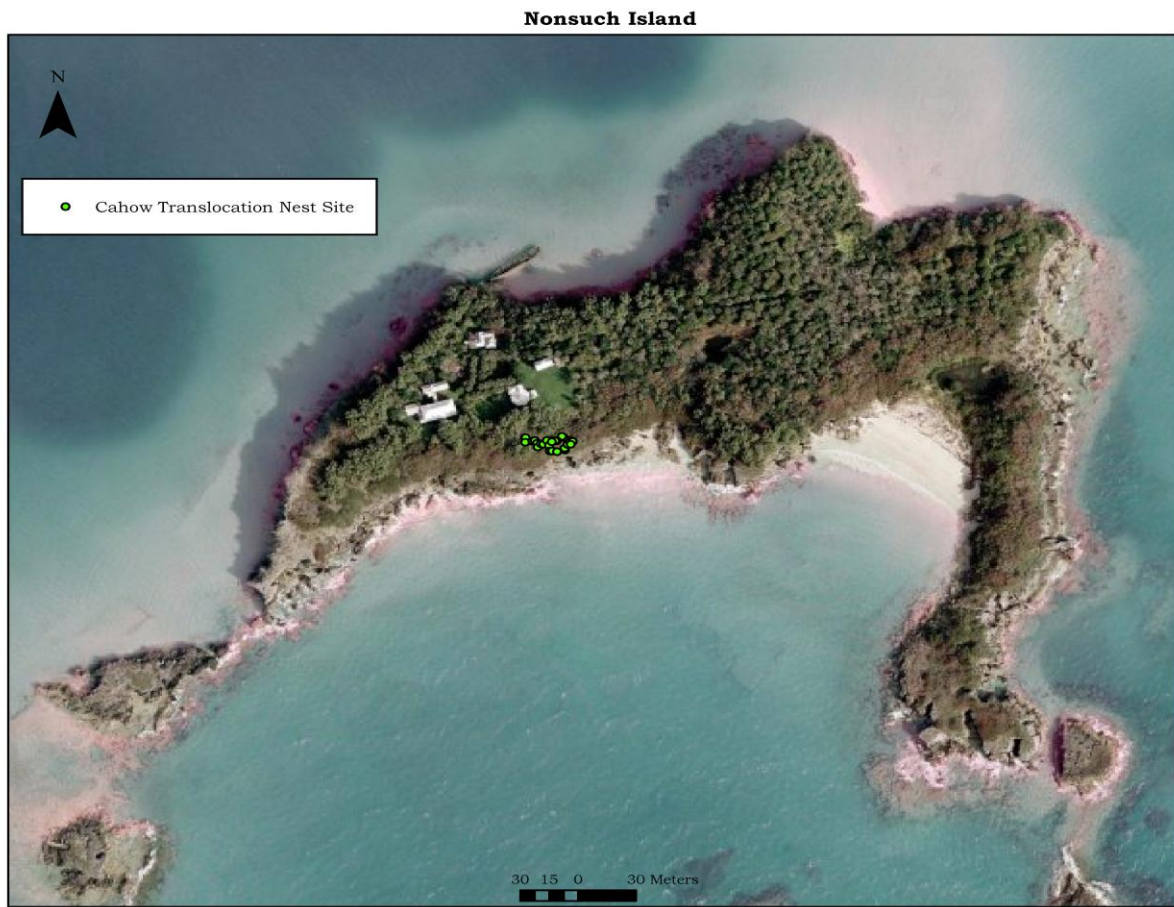
In 2005, the second year of the translocation project resulted in 21 Cahow chicks being moved to the nest burrow complex on Nonsuch Island, with all 21 again fledging successfully out to sea. Experience from the 2004 season resulted in slightly larger feed amounts being given to the chicks, averaging 50 to 90 grams of squid and fresh anchovies (range 34 – 108 grams). This resulted in chick departure weights essentially identical to, or slightly heavier than those of departing non-translocated chicks which were raised solely by the adult birds (mean weight of non-translocated birds in 2002 and 2003 was 280 grams and 290 grams respectively). Mean weight of translocated chicks in 2005 at fledging was 302 grams (range 232 – 375 grams), while mean wing chord at fledging was 258 mm (range 245 mm – 267 mm). The median date for the departure of chicks was the 31<sup>st</sup> May, 2005 (range 21<sup>st</sup> May – 16<sup>th</sup> June), while the mean age of the chicks at fledging was 92 days (range 86 – 99 days).

For the 2006 and 2007 nesting seasons, the third and fourth years of the translocation project resulted in 22 and 25 Cahow chicks being translocated to Nonsuch Island, of which 21 and 24 respectively fledged out to sea. One chick in the 2006 cohort drowned

after falling into the ocean while attempting to fledge. An autopsy determined that a deformed outer wing joint, which was very difficult to detect externally, made it impossible for the bird to fly any distance. One chick from the 2007 cohort also died from undetermined digestive problems most likely arising from lack of parental care during the early stages of its development.

All other chicks translocated during these two years fledged in good condition, with weight and wing development at departure very similar to non-translocated, control chicks. The median date of translocation for chicks in these two years was 17<sup>th</sup> May (range 6<sup>th</sup> May – 31<sup>st</sup> May) for 2006 and 20<sup>th</sup> May (range 4<sup>th</sup> May – 1<sup>st</sup> June) for 2007. The mean age of the chicks was at translocation was 78 days (range 67 – 92 days) for 2006 and 76 days (range 70 – 83 days) for 2007.

Chicks departed with mean weights identical to non-translocated chicks in 2006 and slightly heavier on average in 2007. Mean weights of the chicks at fledging were 281 grams for 2006 and 306 grams for 2007, while mean wing chord length at fledging was 257 mm for both 2006 and 2007. Mean age of the translocated chicks at fledging for these two years was 91 days for the 2006 chick cohort, and 92 days for the 2007 cohort.



**Fig. 11: Nonsuch Island showing location of Translocation nest burrows (green points)**



## 9.2: Results of 2008 Cahow Translocation:

2008 was the fifth and final year that Cahow chicks were moved to Nonsuch Island for the translocation project. A total of 23 chicks were moved to Nonsuch, of which 22 successfully fledged to sea from the island. The Cahow chicks chosen for translocation were monitored after hatching through their development and assessed for weight, wing chord length and plumage development. They were then translocated when (1) their weight had peaked and begun to drop, (2) when their wing chord had exceeded 190mm, and (3) when they had developed adult plumage on at least five of the following eight body parts: face, wings, tail, shoulder, rump, chest, belly and head.

The first Cahow chick was translocated from the Horn Rock C20 nest on 4<sup>th</sup> May, 2008, with the last from Horn Rock C23 nest translocated on the 2<sup>nd</sup> of June (see Section 9.4., page 36 for summary of all results from 2008 translocation). The median date for chick translocations was the 19<sup>th</sup> May, 2008. This compares to the 20<sup>th</sup> May for the median date in 2007 (range 4<sup>th</sup> May to 1<sup>st</sup> June); 17<sup>th</sup> May for 2006 (range 6<sup>th</sup> May to 31<sup>st</sup> May); 20<sup>th</sup> May for 2005, (range 8<sup>th</sup> May to 2<sup>nd</sup> June); and 22<sup>nd</sup> May for 2004 (range 13<sup>th</sup> May to 1<sup>st</sup> June). For 2008, the chicks had a mean age of 80 days when translocated to Nonsuch Island, with a range from 71 to 89 days, compared to a mean of 76 days in 2007 (range 70 to 83 days of age), 78 days in 2006 (range 69 to 92 days), 81 days in 2005, (range 73 to 87 days) and 77 days in 2004, (range 68 to 88 days).



**Fig. 12: Conservation officer and assistant Peter Drew moving Cahow chicks in boxes from nesting islet to boat for translocation to Nonsuch Island (photo C. Burville)**



Food provided to the Cahow chicks during the 2008 translocation consisted of fresh unfrozen Squid (*Loligo sp.*) obtained from Miles Supermarket, Pitts Bay Road, Pembroke, and fresh fish which was netted locally and provided by Chris Flook, chief collections officer for the Bermuda Aquarium, Museum and Zoo (BAMZ). Fish provided was mainly fresh Anchovy *Sardinella anchovia*, but also included some Redear Sardine *Harengula humeralis*. A typical meal for one chick consisted of 2 Squid bodies (with or without heads), and 4 to 10 Anchovies or equivalent, averaging between 45 and 65 grams, with a mean weight of 60 grams (range 18 grams to 92 grams). A total of 133 meals or feeds were hand-fed to the translocated chicks, with a total weight of 7.987 Kg fed to the translocated chicks while they were on Nonsuch Island (see Fig. 13).

The mean departure weight of the 22 successfully fledging translocated chicks in 2008 was 279 grams (range 243 grams to 341 grams). The mean wing chord length of the translocated chicks at departure was 257.3mm (range 247mm to 267mm)

For comparison, five Cahow chicks included in the chick growth survey during the 2008 nesting season were not translocated but were fed by the adult birds until they fledged out to sea. These acted as 'controls' which could be compared with the translocated chicks, ensuring that these were fledging as close as possible in weight, wing chord length etc. to the naturally fledging birds. The mean departure weight of the control chicks was 282.2 grams (range 250 grams to 317 grams) and the mean wing chord length at departure was 257.8mm (range 247mm to 267mm).

These figures demonstrate that the translocated chicks were essentially fledging with average weights and wing chord lengths that were identical to the naturally fledging birds, although of necessity the sample size for the latter group was considerably smaller (5 birds compared to 22 translocated birds). Nevertheless, this is reasonable proof that translocated Cahow chicks can be raised with a good expectation of fledging with comparable body condition and development. They should hopefully have similar fledging success and survival rates as naturally fledging birds.

Once the translocated Cahow chicks were fully fledged (determined when wing chord length exceeds 250mm and/or when all natal down is shed and the chick develops all adult plumage), feeding was discontinued and the chicks allowed to complete development from their fat reserves. At this point, the chicks begin to emerge from their nest burrows at night to exercise their flight muscles and explore and imprint upon the area surrounding their nests. During these nocturnal wanderings, the chicks can range quite far from their burrows, up to 30' to 50' being quite common, while some chicks have been followed wandering up to 100' away from their nests. The chicks can be out for periods ranging from 10 minutes to more than two hours, with some chicks remaining out more than 5 hours, returning to their burrows only as day approaches.

At the end of these night excursions, the chick almost invariably finds its way back to its proper nest burrow, not always by the same route that it left by. Scent appears to play an important, if difficult to quantify, role in the chick recognizing its own nest. Chicks were often observed sticking their heads into other burrow entrances encountered on the way

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**Fig. 13: Translocated Cahow chick being fed Anchovy on Nonsuch Island (photo: C. Burville)**



back to their own burrow, appearing to sniff the air within, before abruptly resuming their journey back to their own nest, which they find with almost unerring accuracy.

Studies of non-translocated chicks since 2001 indicate that the mean period between first emergence and final fledging out to sea can range between 5 and 8 days. Translocated chicks have proven to generally fledge within this range, averaging 7 days in the 2004 translocation, 4 days in the 2005 translocation, and 5 days in the 2006 and 2007 translocations. For the 2008 translocation, the mean exercise period for fledging birds was 4 days (Section 9.4).

Most of the Cahow chicks that were observed departing to sea during night watches at the translocation site did so from the edge of the shoreline cliff along the bottom edge of the site. Two chicks were observed making short ‘practice’ flights, ranging from 5’ to 35’ in distance, before they fledged to sea. One chick departed from the top of a Cedar stump in the footpath through the site, while at least two others were observed taking off from the footpath itself. Two chicks were also observed climbing 15’ up into trees at the site.



**Fig. 14: Translocated Cahow fledgling exercising at night on Nonsuch Island, May, 2008.**

One chick died after being translocated after refusing or regurgitating all food fed to it. This chick had not been fed regularly by the parent birds and had been severely underweight through much of its development, most likely causing problems with its digestive system. This may have resulted in an inability to properly digest food, although there may have been other, unknown factors involved.



### 9.3. Importance of Sound Attraction System in attracting prospecting Cahows:

One concern associated with the Translocation Project was the possibility that Cahow chicks moved to the new colony site on Nonsuch would return as adults to the site to prospect for their own nest sites and partners, only to be attracted back to the present tiny nesting islets by the activity of the breeding pairs there. This is thought to be a potential problem due to the fact that although returning Petrels tend to return to the point from which they originally fledged, social facilitation is also a strong motivating factor for this family of seabirds (Miskelly and Taylor, 2004). There is strong evidence that prospecting Cahows can be attracted to concentrations of nest burrows that are currently active.

In order to encourage returning Cahows to stay at the translocation site, prospect for nest burrows and attract mates at that location, the ‘Murremaid’ Sound Attraction System has now been moved to Nonsuch and set up at the Translocation site (see Fig. 15). This Sound System was first set up during 2004 and 2005 on Horn Rock (Madeiros, 2004) at a new artificial nest burrow complex built on the highest section of the island to replace nest burrows destroyed during hurricane Fabian in 2003. This Sound System, which plays back recordings of Cahow courtship calls, coupled with the physical transfer of adult birds found at the destroyed nest sites into the new nest burrows, was successful in attracting Cahows to the new nest complex, with 3 burrows occupied by nesting pairs by the 2005 nesting season and 6 burrows by the 2007 season. This new complex of nest burrows has continued to grow despite the sound system being moved to Nonsuch, with almost all available nest burrows at this location now either occupied or being actively prospected.



**Fig. 15: Sound Attraction System installed on Nonsuch Island, February 2008**



During the first season that the Sound System was set up at the Nonsuch translocation site in 2007, it was not functional for most of the time because of corroded wiring and the failure of the DVD player. Very little activity was recorded at the site during the season, although there were a few sightings of single Cahows overflying the site at night. There was no evidence of birds landing and carrying out prospecting of nest burrows. An electrician was engaged to carry out repairs to the system to ensure it was fully operational by January, 2008, and a new DVD player with an 'auto-replay' feature was purchased at the 'Q - Tech' electronics shop in Hamilton, Bermuda.

Upon repair of the Sound System, the results appeared to be almost immediate. After problems with the DVD player (which was turning off prematurely) were fixed by the beginning of February, 2008, a sudden surge in cahow activity over the translocation site was noted. On the night of 10<sup>th</sup> February, up to 6 Cahows were observed flying at night over the site, surrounding areas of Nonsuch Island and offshore over Nonsuch Bay. Cahows were observed flying in pairs or small groups in fast acrobatic flight with a good deal of antiphonal calling between birds, which is typical of courtship behavior. One of the Cahows flying over the site eventually landed close to where I was observing the aerial activity, and was easily captured so that its band number could be checked and details of general body condition (weight, wing chord length, plumage condition) could be recorded. The bird was confirmed as being one of the translocated chicks moved to the Nonsuch translocation site during 2005, the second year of the translocation program.



**Fig. 16: 'First-return' Cahow in nest burrow entrance on Nonsuch Island, Feb. 2008**

Additional Cahows were recaptured on the ground or in nest burrows during additional night checks at the Nonsuch translocation site during February, March and April, 2008, with four Cahows eventually being captured and checked. All of these proved to be birds translocated to nest burrows on Nonsuch Island during the 2005 season. Two of these birds were captured on the ground at night at the translocation site, with one being recaptured four times over an 8-week period. The other two birds were recaptured in nest burrows at the translocation site. Remarkably, one of these returned Cahows was recaptured in the same nest burrow that it had originally been translocated to as a chick in 2005. This bird was seen repeatedly in this burrow over a 5 – week period between 19<sup>th</sup> March and the 22<sup>nd</sup> April, and began to excavate a large amount of soil out of the entrance of the burrow. The other Cahow was recaptured several times over the same period in a nest burrow 2.3m (7’ 6”) from the nest burrow that it had been translocated to and fledged to sea from in 2005.

This activity marks an exciting development in the translocation project and indeed, for the Cahow Recovery Program. It represents the first time that Cahows have carried out courtship activity and prospecting of nest sites on Nonsuch Island since the early 1600s. In addition, the fact that all birds recaptured at the site have been individuals that were translocated as chicks to Nonsuch confirms the following: (1) that translocated Cahow chicks can indeed survive to maturity and return to the nesting sites, and (2) that translocated birds will indeed return to the site that they are translocated to, rather than the natal island they originally hatch on, provided that the absence of established nesting pairs is compensated for with a system that mimics the vocalizations from established nesting pairs. This development has already attracted international interest (Anon, Birdlife International, 2008).

There is some disappointment that none of the translocated Cahows from the trial year of 2004 have as yet returned to the translocation site on Nonsuch Island. As of July, 2008 only three of the fourteen translocated birds from that year have been recaptured, all on Horn Rock. This is the present nesting islet with the largest breeding population of Cahows at 34 nesting pairs. Two of these birds were recorded together on that islet in the F5 nest burrow, which is located in the new complex of nest burrows built in late 2003 after hurricane ‘Fabian’ destroyed at least five nest burrows on that islet. These birds attempted to nest in 2008 and both built a nest together and laid their first egg, which however did not hatch. The other bird was recaptured on top of the islet at night after it was lured down to the ground, but so far it has not been recaptured in any nest burrow.

There are two possible reasons why all of the translocated Cahows from 2004 returned to Horn Rock rather than Nonsuch Island; (1) the sound system at the Translocation Site was not working for most of the time during the first year it was installed on Nonsuch in 2007, and so there was no apparent activity at the site to lure birds into landing; (2) It is possible that the number of chicks moved to Nonsuch during the first trial year was simply not a large enough cohort size for the surviving birds to be attached to their point of departure. The chicks would then presumably head for the activity on the nearest present nesting islet to prospect for nests in close proximity to already active nests.

## 9.4: Summary of Results for 2008 Cahow Translocation Project

**Date of Translocation of Bermuda Petrel Chicks to Nonsuch Island, Age at Translocation, Number of Feeds and Total Feed Weight, Period of Emergence to Fledging, Date of Fledging, Age from hatching at fledging, weight at fledging and wing chord at fledging**

| Individual                   | Translocation          |                       | Number of Feeds           |                           | Emergence to fledging (days) | Fledging         |                          |                            |                 |
|------------------------------|------------------------|-----------------------|---------------------------|---------------------------|------------------------------|------------------|--------------------------|----------------------------|-----------------|
| Origin – (Island & nest No.) | Date of Trans-location | Age when moved (days) | No. of feeds after moving | Total Feed weight (grams) |                              | Date of fledging | Age from hatching (Days) | Weight at fledging (grams) | Wing Chord (mm) |
| HORN C20                     | 4 May                  | 79                    | 6                         | 361g                      | 3                            | 15 May           | 90                       | 256g                       | 253mm           |
| HORN C12                     | 7 May                  | 71                    | 9                         | 493g                      | 6                            | 24 May           | 88                       | 273g                       | 266mm           |
| IPO B4                       | 11 May                 | 79                    | 7                         | 460g                      | 2                            | 25 May           | 93                       | 254g                       | 256mm           |
| GREEN 10                     | 11 May                 | 71                    | 6                         | 394g                      | 4                            | 27 May           | 87                       | 277g                       | 258mm           |
| GREEN 8                      | 14 May                 | 72                    | 5                         | 201g                      | 7                            | 29 May           | 87                       | 303g                       | 264mm           |
| HORN C18                     | 16 May                 | 78                    | 3                         | 172g                      | 4                            | 27 May           | 89                       | 279g                       | 258mm           |
| HORN C13                     | 16 May                 | 82                    | 3                         | 142g                      | 3                            | 26 May           | 92                       | 291g                       | 255mm           |
| IPO D2                       | 16 May                 | 80                    | 5                         | 304g                      | 4                            | 30 May           | 94                       | 263g                       | 264mm           |
| HORN C15                     | 16 May                 | 76                    | 4                         | 232g                      | 2                            | 28 May           | 88                       | 270g                       | 255mm           |
| GREEN 11                     | 18 May                 | 80                    | 7                         | 535g                      | 4                            | 3 June           | 96                       | 290g                       | 248mm           |
| HORN F3                      | 18 May                 | 82                    | 7                         | 424g                      | 6                            | 4 June           | 99                       | 271g                       | 255mm           |
| HORN C21                     | 20 May                 | 78                    | 4                         | 244g                      | 3                            | 1 June           | 90                       | 317g                       | 247mm           |
| HORN C22                     | 22 May                 | 78                    | 6                         | 338g                      | 3                            | 5 June           | 92                       | 295g                       | 262mm           |
| HORN F4                      | 22 May                 | 83                    | 8                         | 449g                      | 6                            | 8 June           | 100                      | 250g                       | 267mm           |
| IPO E2                       | 23 May                 | 79                    | 7                         | 454g                      | 6                            | 7 June           | 94                       | 268g                       | 256mm           |
| LONG D5                      | 23 May                 | 89                    | 5                         | 247g                      | 3                            | 2 June           | 99                       | 274g                       | 258mm           |
| GREEN 4                      | 25 May                 | 83                    | 6                         | 320g                      | 3                            | 5 June           | 94                       | *341g                      | 263mm           |
| GREEN 5/6                    | 25 May                 | 88                    | 5                         | 307g                      | 2                            | 4 June           | 98                       | 243g                       | 251mm           |
| HORN C9                      | 26 May                 | 81                    | 10                        | 637g                      | 3                            | 10 June          | 96                       | 251g                       | 255mm           |
| IPO D3                       | 29 May                 | 86                    | 7                         | 341g                      | 3                            | 10 June          | 98                       | 304g                       | 259mm           |
| GREEN 5                      | 31 May                 | 89                    | 5                         | 342g                      | 4                            | 11 June          | 100                      | 295g                       | 255mm           |
| HORN C23                     | 2 June                 | 80                    | 6                         | 426g                      | 5                            | 14 June          | 92                       | 278g                       | 256mm           |
|                              |                        |                       |                           |                           |                              |                  |                          |                            |                 |
| Mean                         |                        | 80                    | 5.9                       | 355.6g                    | 4                            |                  | 93.45                    | 279g                       | 257.3mm         |
| Median                       | 19 May                 |                       |                           |                           |                              | 2 June           |                          |                            |                 |

\* = Chicks which were not weighed on last 2 days before departure; amount given is last weight taken.

## 10: Future Management and Research Proposals

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The Cahow Recovery Program is committed to using new techniques and technological advances to aid in the recovery of Bermuda's national bird, provided that they have already been field-tested and proven. There are a number of new or ongoing management and research proposals anticipated for the next two Cahow nesting seasons; the most important are outlined as follows:

- 1) The Sound Attraction System should be used at the Nonsuch translocation colony site for at least the next three to four years (until 2011 – 2012), in order to encourage returning translocated chicks to stay at the site to prospect for and occupy nest burrows. It is hoped that this will counteract any tendency for returning birds to be attracted back to the present nesting islets by the activity around the existing Cahow breeding colonies.
- 2) It is proposed to initiate studies of the almost entirely unknown oceanic range of the Cahow away from Bermuda through the deployment of Geolocational Tags or Loggers, which weigh less than 9 grams and have been field-tested and used with an increasing number of seabirds in the Pacific and Southern Oceans during the last two years. These include Albatross, Shearwater and Petrel species, with very interesting results already obtained regarding foraging and migratory ranges and diving depths during foraging. At present it is proposed that this should take place during the 2008 – 2009 Cahow nesting season, and that an overseas expert in deployment, use and recovery of the Tags and downloading and interpretation of information they have recorded be engaged to come to Bermuda to assist and lend advice in this project.
- 3) At present some 20% of Cahow nest burrows are unusually deep and their nest chambers can not be observed or accessed in any way. This makes it difficult to interpret what is happening in the burrow, and often it is difficult to even know if the burrow contains a chick until the last few days before the chick fledges. Some of these burrows also habitually fail, for unknown reasons but possibly due to rocks in the nest chambers causing egg breakage. This represents a significant percentage of nest sites where simple management procedures that can increase breeding success cannot be carried out due to lack of information. It is proposed that a 'Burrow-scope' instrument is purchased to solve this problem, the instrument basically being an endoscope with flexible, maneuverable cable that has an infra-red light and mini- camera. This can penetrate up to 15' into a burrow and allow the user to see what is happening inside. This equipment also has potential for use with other species, including Tropicbirds, Bermuda Skinks and burrow-dwelling Crab species.
- 4) In the event that a new nesting colony of Cahows is successfully established on Nonsuch Island, then the next priority would be to investigate methods for the establishment of an additional nesting colony on Southampton Island (Madeiros, 2004). This island is located only 100m from the nesting islet with the largest population of nesting pairs, and is the only island other than Nonsuch which has been identified as being suitable as a potential future nesting site for the Cahow.



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## 12: Acknowledgements:

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**Fig. 17: Ronald Burchall and Conservation Officer moving Cahow chicks to translocation site on Nonsuch Island – May, 2008 (Photo: C. Burville)**

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**Fig. 18: South coastline of Nonsuch Island near translocation site.**