

CAHOW RECOVERY PROGRAM 2011 – 2012 Breeding Season Report



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BERMUDA GOVERNMENT



Fig. 1: Adult Cahow removed from burrow on nesting island

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

**RECOVERY PROGRAM FOR THE CAHOW
(BERMUDA PETREL - *Pterodroma cahow*)**

**Breeding Season Report
For the Nesting Season October 2011 to June 2012**

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Section 1(A): EXECUTIVE SUMMARY:

Key Words: Cahow, Nonsuch Island, Social Attraction, Translocation, Data Logger.



Fig. 2: Adult Cahow at sea off east end of Bermuda (photo: Hadoram Shirihai)

The Cahow Recovery Program is a long-term management, research and recovery program for Bermuda's National Bird, the critically endangered Cahow, or Bermuda petrel. This program is managed by the senior conservation officer (terrestrial), Dept. of Conservation Services (Ministry of Public Works), and is focused on enabling the increase of the breeding population through the control or elimination of threats to the species, provision of additional artificial nesting burrows, and the establishment of entirely new nesting colonies. The last is underway using translocation of near-fledged chicks from their original nesting islets to artificial burrows at a new colony site on Nonsuch Island.

The Cahow, which nests only on the Islands of Bermuda and was thought to have originally numbered more than half a million birds, was catastrophically affected by the arrival of humans on the island in the early 1600s. This was due both to direct hunting by the settlers and by invasive predators introduced by man, such as Rats, Cats, Dogs and Pigs. After less than 20 years of settlement, the Cahow had declined to the point where it was thought to be extinct, a belief that persisted for over 350 years until the rediscovery in 1951 of a tiny remnant population of breeding pairs on four tiny offshore islets.

Since 1960, a conservation and recovery program has been in place that has addressed and controlled most threats to the species. This program was administered by Dr. David Wingate until his retirement in 2000, since which it has been administered by the author of this report. This program has enabled the breeding population to begin a slow, but accelerating increase from only 18 pairs producing a combined 8 chicks annually in the 1960s to a new record number of 101 breeding pairs in 2012, producing a record total of 57 fledged chicks. Increased knowledge and public interest in the Cahow has been brought about from several films and documentaries that have been completed concerning the conservation work being carried out on the species.

The main threats to the Cahow include the erosion and flooding of the present nesting islets by storm activity and sea-level rise, the threat posed by Rats and other invasive species swimming to these islets, a lack of sufficient numbers of potential nest burrows or rock crevices, and nest-site competition with the Longtail or White-tailed Tropicbird *Phaethon lepturus catsbyii*.

Following are some of the highlights for the 2011/2012 Cahow nesting season:

- The new nesting colony of Cahows established on Nonsuch Island by the translocation of chicks between 2004 and 2008 has continued to grow, with 10 pairs established in nest burrows and laying eggs. From these, seven chicks hatched and successfully fledged out to sea. New pairs and prospecting activity was noted in 2 additional nests, and a total of 41 of the translocated birds have so far returned to Nonsuch as adults, in addition to 3 non-translocated Cahows attracted to the new colony by the returned translocated birds.
- The total breeding population of the Cahow has now exceeded 100 pairs, producing 57 fledged chicks, numbers which have probably not been seen since the 1600s.
- Despite the impact of at least three passing hurricanes during 2011, there appears to have been little or no effect on breeding success.
- The third year of deployment of archival geolocational data loggers was completed with six additional tags being recovered, at least two of which were deployed on individual Cahows for two full seasons. The data from these tags is being used to create maps to establish the at-sea range of the Cahow, including favored foraging areas and migration routes.

The Recovery Program continues to achieve its primary objective of increasing the numbers of breeding pairs of Cahows and successfully fledged chicks. Two scientific papers on the Cahow produced jointly by the Government Conservation Officer and scientists from the New South Wales Department of the Environment and Climate Change were published in Bird Conservation International (Cambridge Journals Online). These papers deal with Cahow breeding biology and with the establishment of a new, secure colony of Cahows by the translocation of near-fledged chicks.

Full details on the 2011 – 2012 breeding season are given in the following report, in addition to research and management proposals for the next several years.

1(B): Objectives of Cahow Recovery Program:

The Cahow Recovery Program was formed to set up a coordinated management and research effort for the Bermuda petrel or Cahow *Pterodroma cahow*, which is recognized as one of the rarest seabirds on earth. This program has a number of short and long-term objectives, which are covered in full in the Cahow Recovery Plan (Madeiros, 2005); briefly put, these objectives are as follows:

- (1) To increase the nesting population of Cahows to 100 pairs by the 2012 breeding season; with the long-term objective to increase the nesting population to a minimum of 1000 breeding pairs, necessary to be able to down-list the status of the Cahow from “critically endangered” to “threatened” under internationally established criteria. (IUCN Red Data Book)
- (2) To prevent nest-site competition with the White-tailed Tropicbird (*Phaethon lepturus catsbyii*) through the use of wood “baffle plates” at the entrances of all Cahow nest burrows to prevent Tropicbirds from entering.
- (3) To regularly monitor all nesting and nearby islands for the presence of rats (*Rattus rattus* and *R. norvegicus*) and, when their presence is detected or suspected, to eradicate them by use of anticoagulant rodenticides, using bait and boxes provided by or purchased from the Health Department.
- (4) To continue the program of construction of additional nest burrows at all appropriate nesting islands, and at locations where new nesting colonies are being established, to support a continued increase in the breeding population.
- (5) To establish new nesting colonies of Cahows on larger, more elevated islands free of mammal predators and safer from hurricane erosion, and which have the potential of supporting larger populations of the birds; this is already being achieved on Nonsuch Island and is planned for the future on Southampton Island.
- (6) To learn more about the biology of the species through an ongoing banding program initiated in 2002; also through developmental studies of Cahow chicks and morphometric measurements of adult Cahows.
- (7) To carry out studies of the oceanic range of Cahows using archival geolocational data loggers attached to individual birds, which record daily position fixes for periods of up to 2 years. This has already been successful in recording foraging areas and migration routes used by Cahows, both when they forage for food for their chicks during the breeding season, and where they travel during the summer, non-breeding season.

1(C): Introduction – Cahow population exceeds 100 nesting pairs

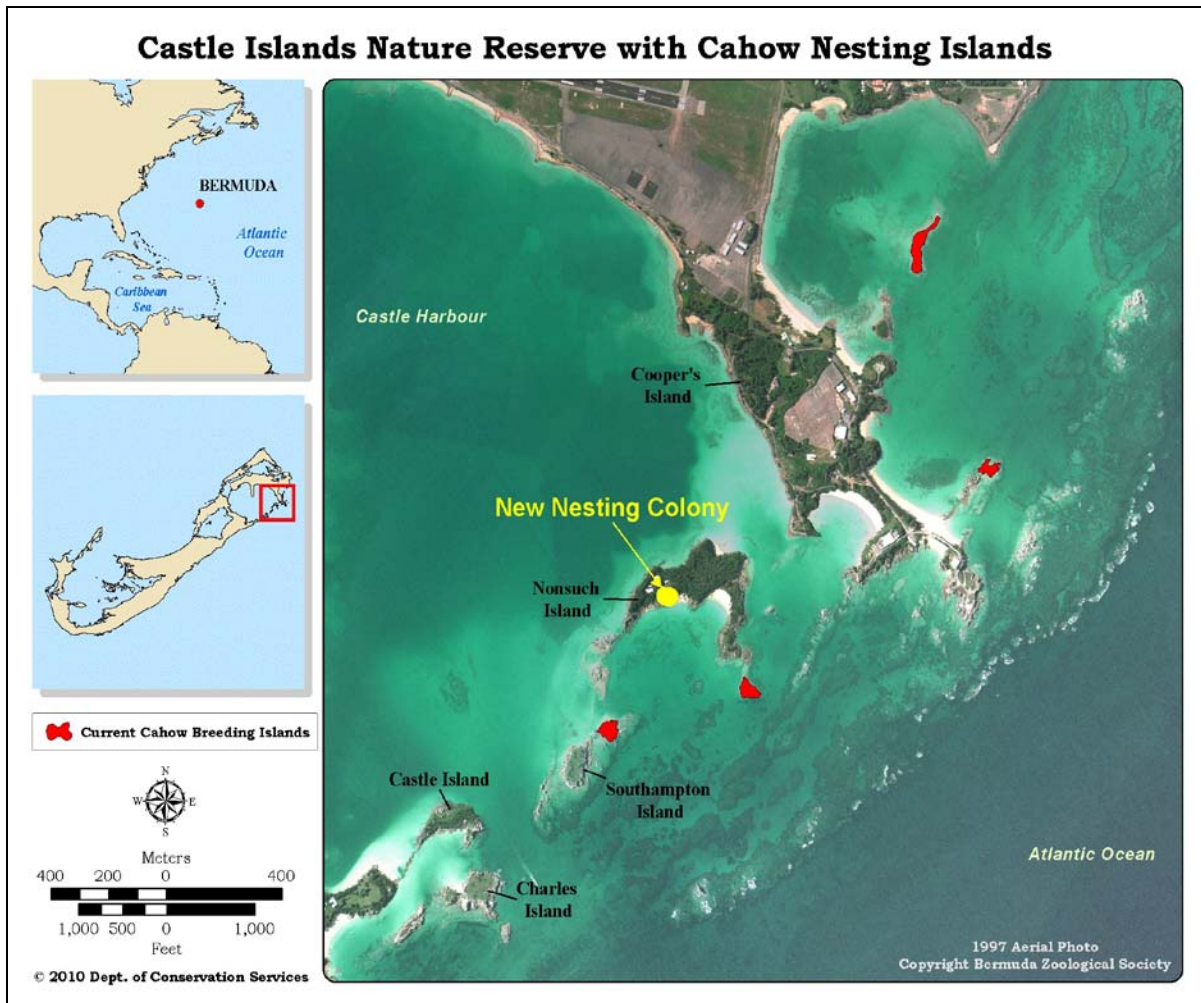


Fig. 3: Location of original nesting islands and the new colony on Nonsuch Island

The Nesting Season of Bermuda's national bird, the endemic and critically endangered Bermuda Petrel or Cahow (*Pterodroma cahow*) overlaps between two years, beginning in late October of one year with the first arrival of breeding adults on the nesting islands, and ending in mid-June of the following year with the departure of the last fledglings out to the open ocean from their nesting burrows. The Cahow is the only bird species in Bermuda to nest primarily during the winter period.

The 2011/2012 nesting season has been highlighted by the continued increase in the numbers of breeding Cahows, with numbers of breeding pairs finally exceeding the milestone 100 pair mark, with 101 breeding pairs confirmed. The Cahow Recovery Project therefore reached one of the key objectives for projected population growth outlined in The Cahow Recovery Plan (Madeiros, 2005). A total of 57 chicks successfully fledged out to sea, also a new record high number. These are up from a total of just 18 nesting pairs and 8 fledged chicks when the recovery program began in 1960.

The Cahow is subject to pressure from a number of threats and limiting factors, including nest site competition from the native White-tailed Tropicbird, the threat of introduced mammal predators (especially rats) swimming out to the nesting islets, lack of suitable nesting sites at the present islets, and the annual threat of massive erosion and damage to the islets from hurricane waves and storm surge. Much of the present management carried out on the Cahow through the Recovery Program has been focused on addressing and overcoming these various threats to the species, with a high degree of success.

The single most important threat to the Cahow is now considered to be ongoing damage and major erosion to the nesting islets from severe hurricanes and storms, coupled with accelerating sea-level rise. After a thirty-five year period (early 1950s to late 1980s) with few to no major impacts from hurricane waves and storm surge, there have no fewer than ten major hurricane impacts to the nesting islets from hurricanes between 1989 and 2011 (hurricanes “Dean” in 1989; “Lily” in 1991; “Felix” in 1995; “Gert” in 1999; “Fabian” in 2003, “Florence” in 2006; “Bill” in 2009; “Igor” in 2010; and “Katia” and “Sean” in 2011.

The impacts from these hurricanes have included the undermining and collapse of large sections of the islands, and breaking away of large chunks of limestone and cliff face, coupled with overwashing of the smaller islets, when large waves break completely over the island. This has resulted in both complete destruction of some of the nesting burrows used by Cahows, and in damage to and filling in by rocks and debris of much of the remainder. This has resulted in much dangerous and labor-intensive work needed to repair nests at the end of hurricane season in many years before the Cahows return for their nesting season. It has been important to repair as many of the original nests as possible, as loss of nests will result in long-established pairs breaking up and needing several years to re-establish new nests with new mates.

To address these threats, a major component of the recovery program is to establish new nesting colonies on islands that are both larger and more elevated than the original tiny nesting islets, which are generally only half an acre (0.2 Ha) in area each (See Fig. 3). Nonsuch Island at 16.5 acres is the largest isolated island in the Castle Harbour area, and is maintained rat-free as part of the Living museum ecological restoration project. **A new colony has now been established on Nonsuch,** with 12 active nest burrows now occupied by returned Cahows. These were originally translocated as chicks from the original nesting islands to artificial burrows on Nonsuch Island (see Section 3, page 17 for full details).

As this first effort to establish a new Cahow nesting colony has been successful, plans are now underway to establish a second colony site at another location on Nonsuch Island, followed by an attempt to establish a new colony on nearby Southampton Island. Although much smaller than Nonsuch at 2.36 acres, Southampton Island is still larger than the original nesting islets and is located only 100 meters from a current Cahow nesting colony. As at the first Nonsuch colony site, these additional colony establishment efforts will be undertaken using a combination of translocation of chicks from the original islets, and of sound attraction, using pre-recorded courtship calls played back at the new colony sites to attract returning Cahows.

Section 2: Cahow Recovery Program – 2011/2012 Season: 2(A): Management Actions for 2011 / 2012 Nesting Season:

As has become an increasingly frequent occurrence in recent years, the first management actions of the 2011/2012 Cahow nesting season were repairs to a number of nesting burrows on the smaller, offshore islets that had been damaged by high seas caused by several hurricanes which passed close to Bermuda during 2011. Further work in clearing rocks, vegetation and debris from the nests and their entrances were completed in time for the arrival of the first Cahows back to the nesting grounds. Rat poison was also set out on the nesting islands by mid-October to ensure that they were rat-free for the coming season.

During the first week of October, all Cahow nesting burrows were unblocked and the entrance Baffles which prevent nest invasions by White-tailed Tropicbirds during the spring period were removed and taken to Nonsuch Island for storage. The first Cahows were confirmed as returning to their nest burrows by the 20th October, 2011, for the start of the new nesting season. Almost all of the active nesting pairs had returned to their nest burrows by the beginning of November, 2011.



Fig. 4: Volunteers from Ascendant group of companies digging out Cahow burrows on Nonsuch Island, 30 November 2011

Grass was collected in trash bags from Nonsuch Island and transported out to the smaller nesting islets by early November to provide sufficient material for the Cahows to be able to build their nests. This is necessary as three of these islets are so rocky that they have insufficient grass and vegetation for Cahows to build good nests to cushion the eggs and reduce accidental breakage.

During November, 2011, two well-known ornithologists visited Bermuda to obtain photos, video and information on the Cahow. Mr. Robert Flood is a well-known British birder that leads pelagic seabird tours out of the Scilly Islands, southwest of Cornwall, England. He is writing a series of multimedia bird guides on the seabirds of the North Atlantic Ocean, and is gathering material for the second book in this series, on Gadfly petrels of the North Atlantic. He was able to obtain good photographs and video footage of Cahows both at sea off the east end of Bermuda, and at the nesting colony on Nonsuch Island. In addition, Mr. Hadoram Shirihai, an Israeli photographer that is known for being the first to photograph several critically endangered petrel species in the Pacific region, also visited the island during the same period and was also successful in obtaining photos of Cahows at sea off Bermuda during near-gale conditions. Mr. Shirihai kindly gave permission to use two of his photographs in this report.

During the 29th and 30th November, 2011, two groups of ten volunteer workers from the 'Ascendant' group of companies (Bermuda Electric Light Company Limited (BELCO), Bermuda Gas and Utility Company Ltd., PureENERGY Renewables Ltd., Sigma Corporate Services Company Ltd. and InVenture Limited, as well as BELCO Properties Limited and BTS Limited), carried out work projects on Nonsuch Island. These included the digging out of nine new artificial Cahow nest burrows at the second, "B" Cahow Translocation Site (see Fig. 4), where an project will be carried out to establish a second nesting colony of Cahows on Nonsuch. This is being carried out to establish a second foothold for this species on Nonsuch, to enable the Cahow to more easily spread out into the available nesting habitat on the island. This work by the Ascendant group of Companies, which also included the topping and removal of introduced Casuarina trees on the north side of Nonsuch, is part of the ongoing commitment by Ascendant towards the Living Museum Ecological Restoration Project, which is being carried out on Nonsuch by the Terrestrial Conservation Section of the Dept. of Conservation Services. In a time of limited budgets and resources, The Department is very grateful for the assistance given by Ascendant, and the Terrestrial Conservation Officer would personally like to express his sincere gratitude.

Once the first adult Cahows began to return to the nesting islands for the first stage of their nesting season in late October, visits to the nesting islands to check all Cahow burrows were carried out on average 4 to 5 days a week, as weather conditions allowed. During these checks, any Cahows found were checked for band numbers, weight and body condition. This period is when breeding pairs carry out courtship activity and build a nest in their burrows from vegetation gathered outside the burrow entrance.

During most of December, 2011, virtually all of the breeding population returned out to sea for what is termed the pre-egg laying exodus. This occurs because both partners of a

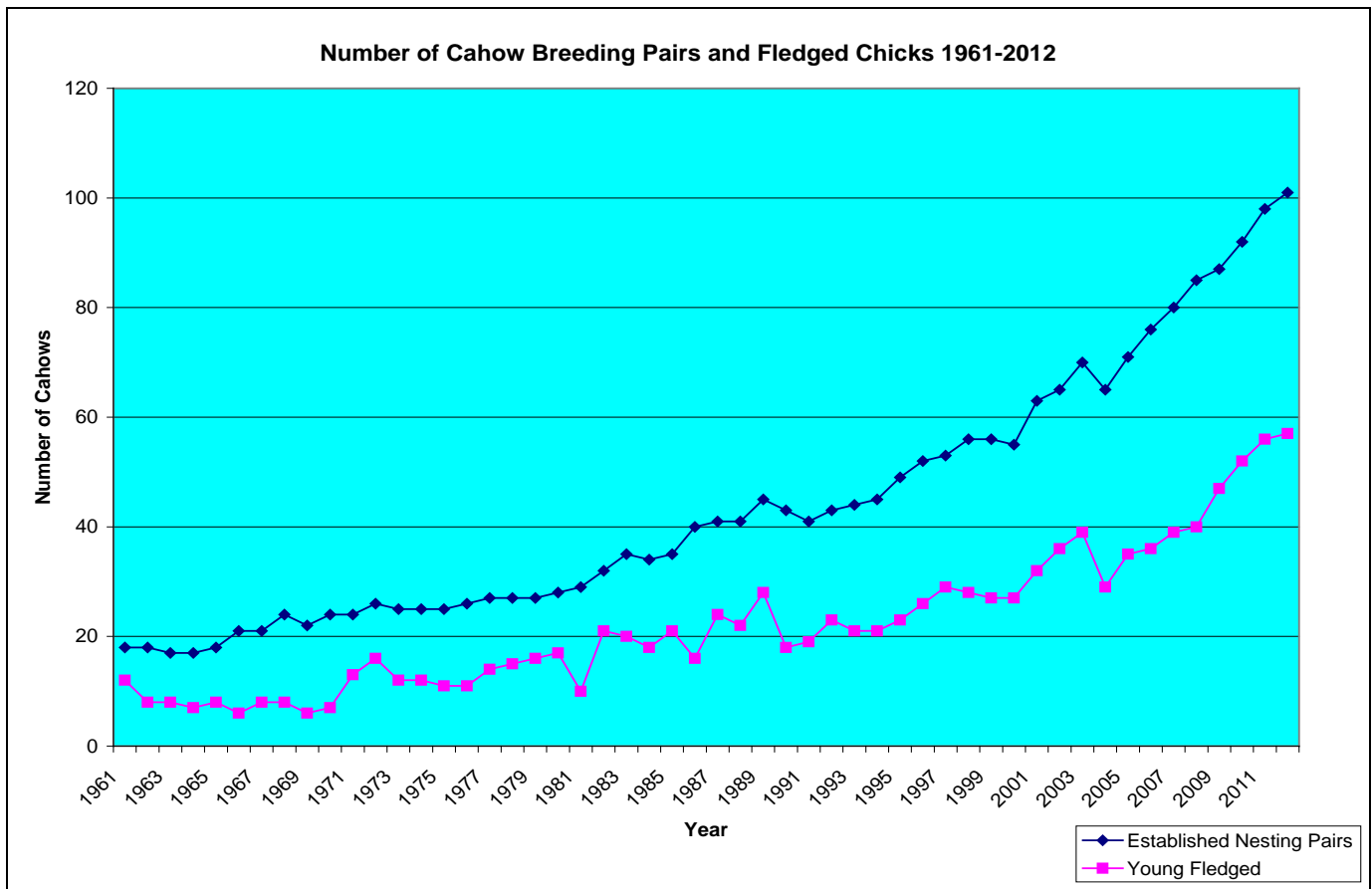


Fig. 5: Chart showing number of breeding pairs and fledged young Cahow over 51-year period

nesting pair need to carry out a 5-week period of intensive feeding, the female to develop her single large egg and the male to accumulate fat reserves for the first long shift of egg incubation, lasting up to 2 weeks with no food, while the female returns to sea to recover after laying an egg which can mass between 20 – 25 % of her own body weight.

The first Cahows returned to the nesting islands from their pre-egg laying exodus at the beginning of January, 2012, with the first eggs being confirmed on the 5th January. The egg incubation period, which lasts about 53 days, is the main period in which incubating adults are checked to determine sex and band numbers to determine which birds are returning to which nests. Checks to the nesting islands had to be cancelled at times because of frequent gale-force winds as winter storm systems passed over the Bermuda area; one low pressure system on the 12th January produced winds gusting to 54 knots (62 mph), while another on the 20th January produced winds gusting to 55 knots (64 mph).

The first Cahow chicks were confirmed hatching on the 23rd to 25th February. By the 27th March, a total of 60 chicks had hatched (not all of which survived to fledging), some of which had to be confirmed from the deepest natural nests by the use of infra-red “burrowscope” equipment purchased in 2009. Once the chicks had hatched, a sub-sample of about 35 chicks was chosen which were then checked at least twice weekly, weather conditions permitting, for weight, wing chord length, and plumage development. This information is

being used for a study of chick growth rates, but also has practical application in identifying chicks that are neglected or abandoned prematurely by the adults and need to be taken into care. It is also used for identifying when chicks that are being translocated are at the optimal age to be moved to their new nest sites. These checks of Cahow chick growth rates continue until the chicks depart to sea between mid-May to early June.

The chicks are fitted with identification bands on their left legs once their adult plumage covers more than half their body, usually at 70 days of age or older (adult birds whose ages are not known have their bands fitted to their right legs). During the 2012 Cahow nesting season, a total of 36 chicks were fitted with identification bands, out of a total of 57 chicks which successfully fledged (63 % of all chicks). As of June, 2011, a total of 445 Cahows have now been fitted with identification bands since the banding program began in 2002, the majority of which have been fledgling birds. The return and eventual nesting of these known-age birds have already given a wealth of previously unknown information on the age of first return of young adult Cahows, time of new pair establishment and first successful production of chicks, and nest site and pair fidelity (faithfulness). This information has already been used to complete a scientific paper on the breeding biology of the Cahow (Cambridge Journals Online, 2012).

Several Cahow chicks died at various points in their development, some from parental abandonment and others from unknown causes. This is a normal occurrence during a breeding season, although all efforts are made to save as many abandoned chicks as possible (See following paragraph). Despite this, a record high number of chicks fledged successfully out to sea. The first Cahow chick fledged out to sea on May 21st, from Green Island, while the last chick did not depart until 27th June, 2012, from Nonsuch Island.

Two Cahow chicks were abandoned prematurely by their parents, and had to be taken into care to feed them and enable them to mature and accumulate enough fat reserves to fledge successfully out to sea. One of these chicks was moved from the F5 nest burrow on Horn Rock, to an empty artificial nest burrow at the translocation site on Nonsuch Island. The other chick was from the R817 burrow on Nonsuch Island, and so did not need to be moved. These birds were fed daily on fresh Pilchards and fresh unfrozen squid, using the same techniques developed for the translocation project to establish the new nesting colony on Nonsuch. The chick from the Nonsuch Island R817 burrow recovered, gained weight and eventually matured and fledged successfully out to sea from Nonsuch Island. The second chick, from the Horn Rock F5 burrow died shortly after being moved to Nonsuch Island, and was determined to have been too emaciated to have been saved by the time it was brought in.

The newly established Cahow nesting colony on Nonsuch Island had a very successful year and continues to grow in both the number of nesting pairs and the number of successfully fledged chicks. A total of 10 pairs laid eggs in nest burrows, from which 7 chicks hatched and eventually fledged out to sea, while the total number of adult Cahows confirmed as returning to Nonsuch Island has now exceeded 26 (See section 3(b) for full details).

2(B): Overall Summary of 2011/2012 Cahow Nesting Season:

The 2011/2012 Cahow nesting season has been highlighted by a new record high number of successfully fledged chicks, and by the continued growth of the new nesting colony that has been established on the Nonsuch Island Nature Reserve. This new colony also produced 7 successfully fledging chicks.

The numbers of nesting pairs of Cahow have increased to a **record high number of 101**, of which **57 produced successfully fledging chicks**. This represents a breeding success rate of 56.4%. In addition, new prospecting or pre-breeding activity was recorded at 4 new nest sites, including 2 new nest sites on Nonsuch Island (See Figs. 5 – 9 for maps of nesting islands and status of nest sites).

Following is a summary of the 2011/2012 nesting season results:

Total number of nest burrows with confirmed nesting activity:	101
Number of new nest sites with prospecting activity:	4
Total number of confirmed successfully fledged chicks:	57
Total number of active nest sites with unsuccessful nesting:	44
Number of failures from nest sites with observable nest chambers:	43
Number of failures from nest sites with non-observable nest chambers:	1

Breakdown for causes of breeding failure from nests where observation of nest chambers was possible:

Chick died shortly after hatching:	1
Chick died later in development:	2
Eggs broken or pipped:	13
Egg broken during nest check:	1
Non-hatching / infertile eggs:	13
Egg buried or knocked off nest:	6
Egg washed off nest by storm waves:	1
Egg abandoned during incubation period:	3
Egg disappeared during incubation period:	2
Egg lost due to nest invasion by Tropicbird:	1

2(C): Breakdown of Nesting Season Results by Nesting Island:

LONG ROCK: (See Fig. 5)

- 13 active nest burrows with nesting confirmed (eggs laid and/or chick hatched)
- 10 nest burrows w/successfully fledged chicks: (C, D1, D2, D3, D5, D7, D8, E1, E4, H1)
- 2 nest burrows with confirmed failed nesting: (B, D4,)

INNER PEAR ROCK: (See Fig. 6)

- 19 active nest burrows with nesting confirmed:
- 1 new nest burrow prospected by confirmed pairs: (E2)
- 9 nest burrows w/successfully fledged chicks: (B1, B3, B5, B8, B10, C2, C4, D4, E1)
- 10 nest burrows with failed nesting: (A1, B2, B4, B6, B7, B9, C3, D1, D2, D3)

GREEN ISLAND: (See Fig. 7)

- 22 active nest burrows with nesting confirmed:
- 1 nest burrow prospected by confirmed pair: (16)
- 10 nest burrows with successfully fledged chicks: (A1, F2, 4, 4/5, 5, 6, 9, 11, 12, 13)
- 12 nest burrows with confirmed failed nesting: (A2, D1, F3, 1, 2, 3/4, 5/6, 7, 8, 10, 14, 15)

HORN ROCK: (See Fig. 8)

- 38 active nest burrows with nesting confirmed:
- 21 nest burrows with confirmed successfully fledged chicks: (B5, B6, C4, C8, C9, C12, C14, C15, C16, C17, C20, C21, C22, C23, C24, C25, D3, D4, E1, F6, F7)
- 16 nest burrows with confirmed failed nesting: (B3, C5, C6, C7, C10, C11, C13, C18, C19, C26, C27, D1, F2, F4, F8, G2)

NONSUCH ISLAND: (See Fig. 9)

- 10 active nest burrows with nesting confirmed:
- 2 new nest burrows prospected by confirmed pairs: (R820, R835)
- 7 nest burrows w/confirmed successfully fledged chicks: (R816, R817, R818, R830, R832, R836, R837)
- 3 nest burrows with confirmed failed nesting: (R831, R833, R834)

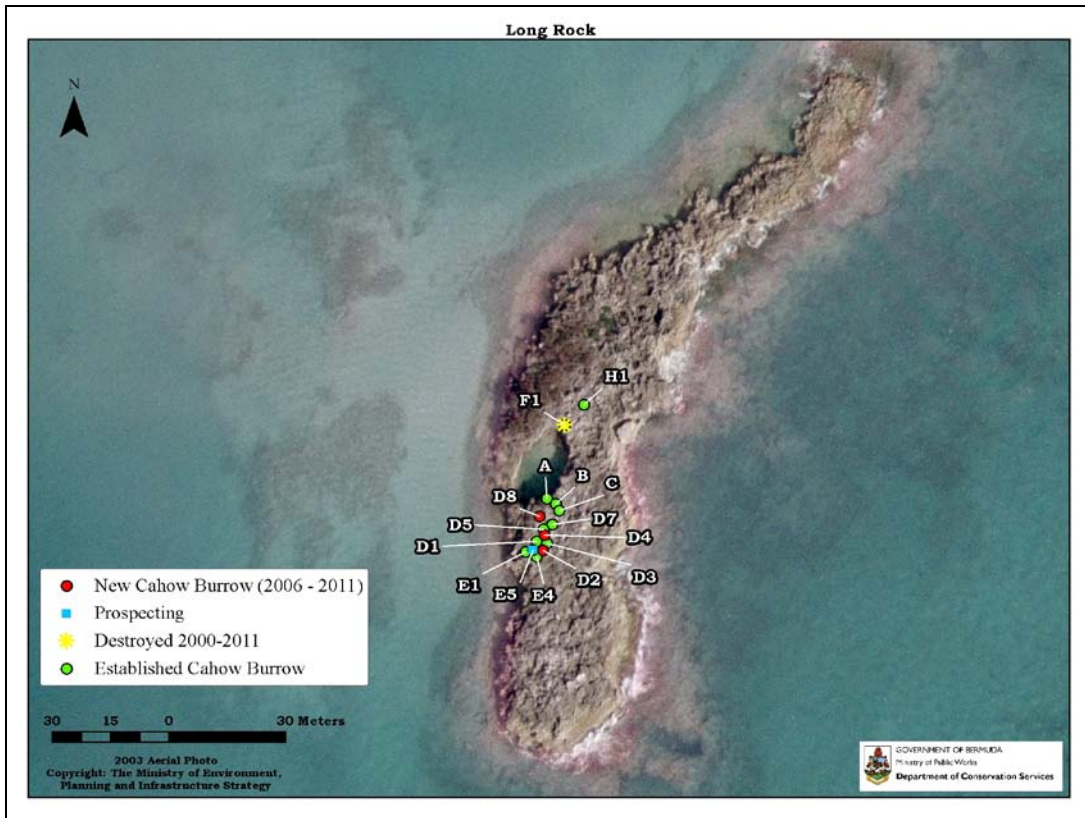


Fig. 6: Cahow nest burrows on Long Rock, 2012

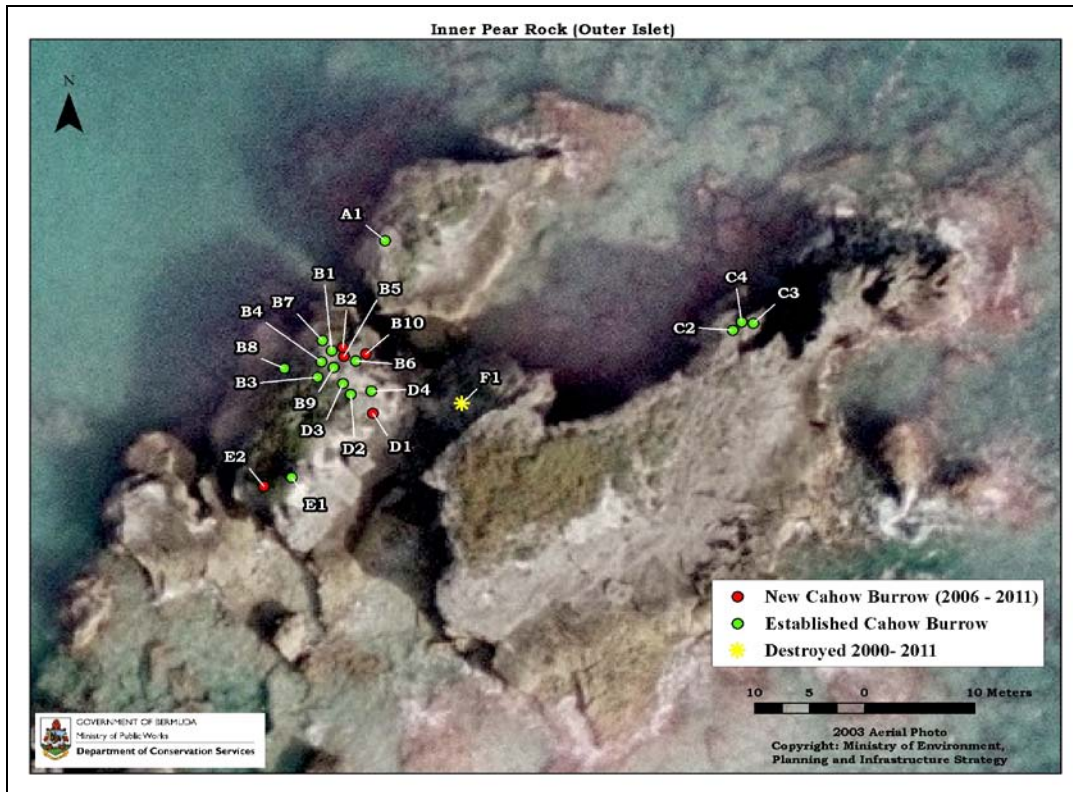


Fig. 7: Cahow nest burrows on Inner Pear Rock, 2012

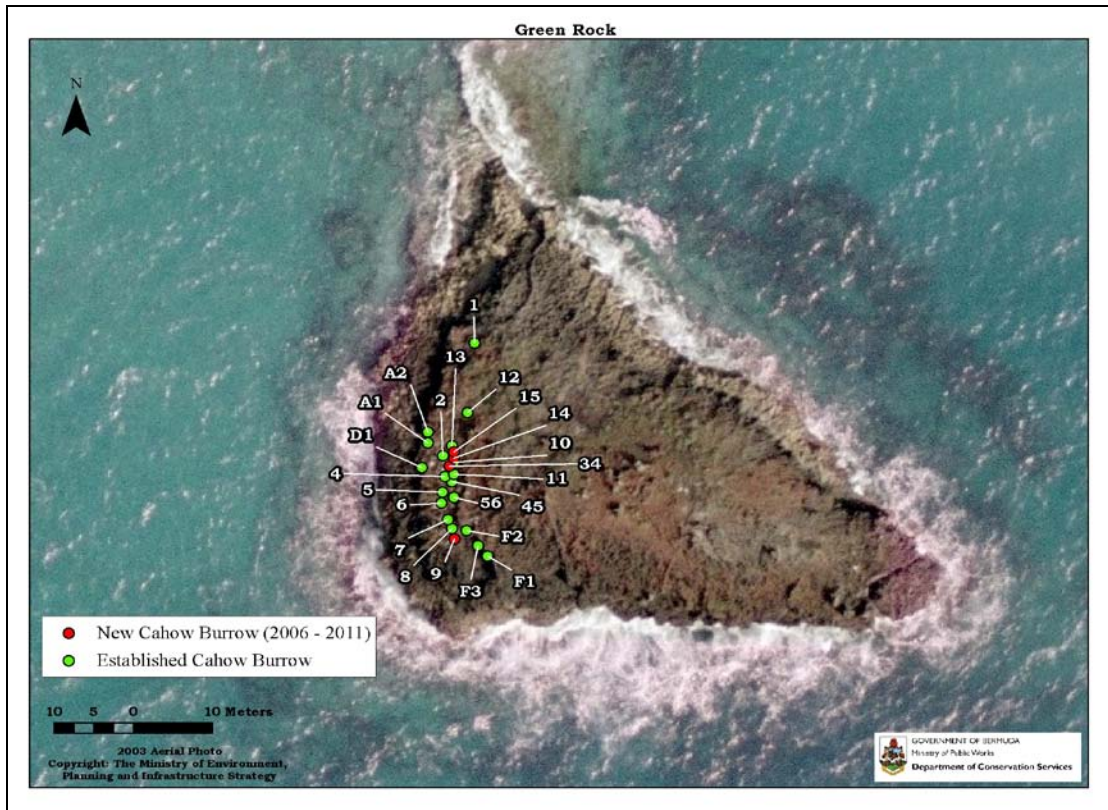


Fig. 8: Cahow nest burrows on Green Island 2012

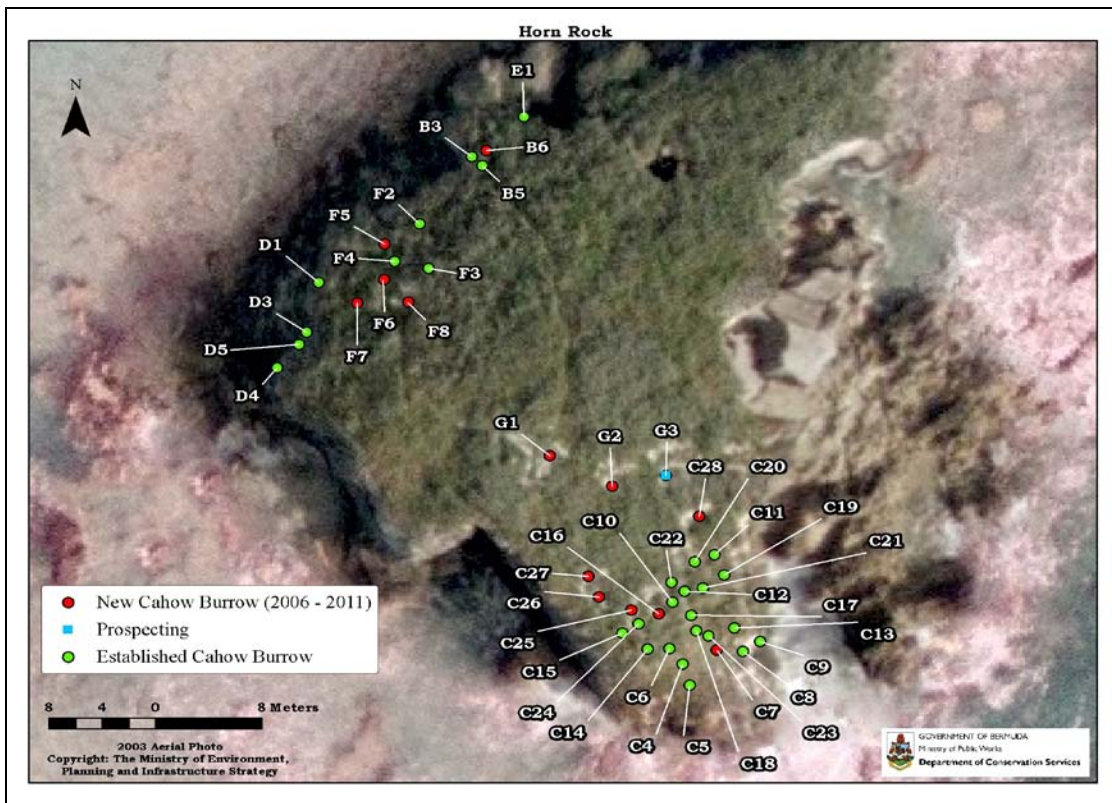


Fig. 9: Cahow nest burrows on Horn Rock in 2012

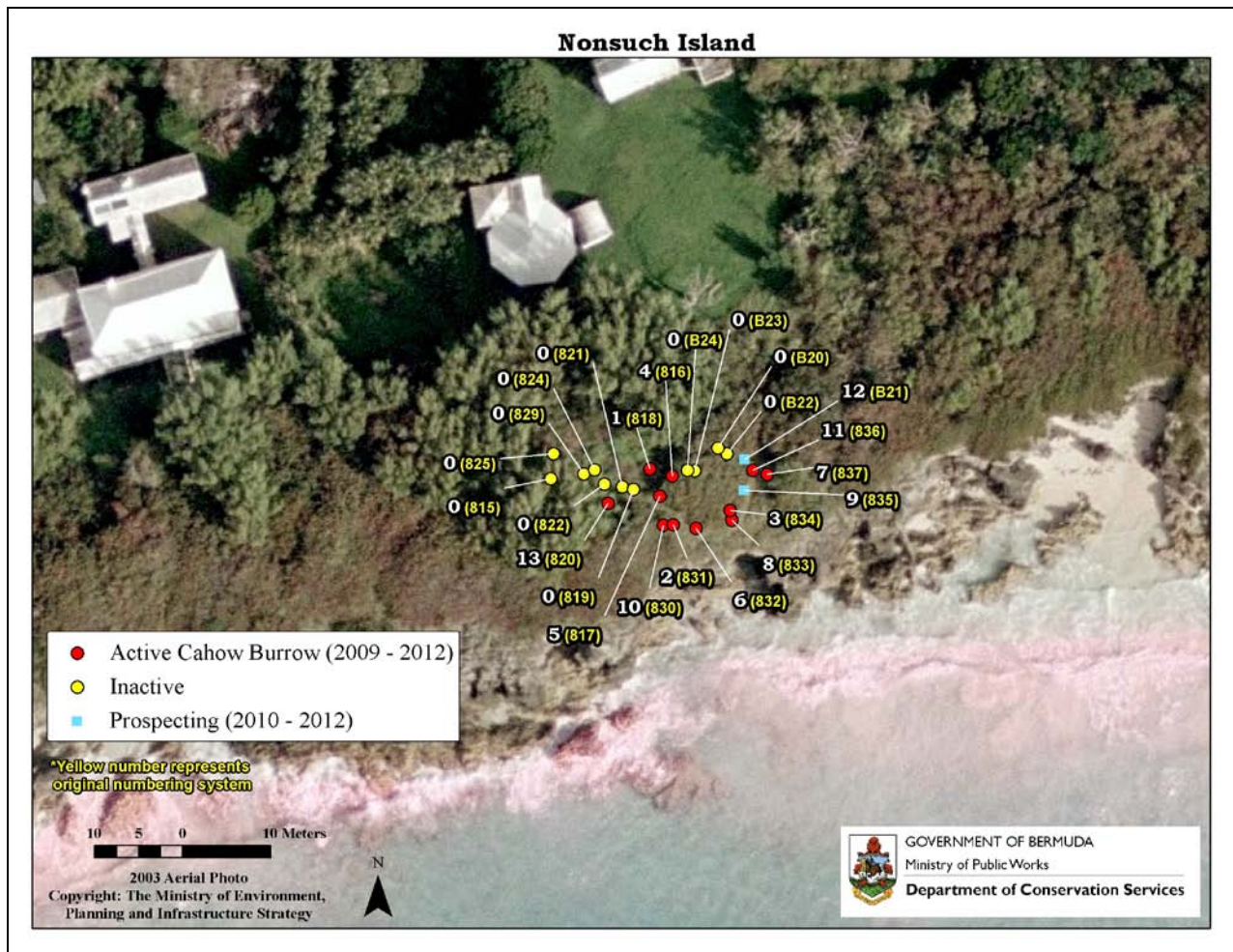


Fig. 10: Cahow nest burrows on Nonsuch Island in 2012

Section 3: Progress Report on New Nonsuch Nesting Colony:

3 (A): Brief history of Cahow translocation project 2004 - 2011:

Between 2004 and 2008 a project was carried out to attempt to establish a new nesting colony of Cahows on a larger, more elevated nesting island than the original nesting locations, which have become increasingly threatened by massive erosion and flooding caused by hurricanes. The Cahow Translocation Project involved the translocation of near-fledged Cahow chicks at approximately 18 days before fledging from their nests on the four original nesting islets to artificial burrows constructed on the Nonsuch Island Nature Reserve. Since the original nesting islands range only between 0.5 to 1.0 acres in size, with maximum elevations ranging from 15' (5m) to 32' (10m), Nonsuch Island, which is both much larger at 15.5 acres (6.5 Ha) and of higher elevation at up to 60' (19m) offers greater protection both from flooding and erosion. It also has a much larger area to allow for growth of the Cahow breeding population to self-sustaining levels, and contains adequate soil and forest cover to eventually allow the Cahows to dig out their own nest burrows.

Gadfly petrels such as the Cahow generally return when mature to the same area that they originally departed from as fledglings, a trait known as *breeding philopatry*. To this end, a total of 105 Cahow chicks selected from all four of the original nesting islets were moved to the new nest burrow complex on Nonsuch Island over a five-year period between 2004 and 2008. Once in their new nests on Nonsuch, the translocated chicks were banded and fed daily of imported squid and locally sourced fresh Anchovies and Pilchards, and their weight, wing growth and plumage development recorded daily until they were fully developed. The chicks were then monitored through their exercise period when they emerge nightly to exercise flight muscles and imprint on their surroundings until they finally fledge to the open ocean on their own. A total of 102 translocated Cahow chicks eventually fledged successfully from Nonsuch by 2008.

In addition, a **solar-powered sound attraction system** was set up at the translocation site to help attract returning birds, encouraging them to land and prospect for new, empty nest burrows. This was undertaken because while it is known that Gadfly petrels tend to return to the original site they fledged from, they also strongly prefer to nest in close proximity to already active nest sites, a trait known as *social attraction*. Until a nucleus of nesting pairs is established on Nonsuch Island, the sound system broadcasts a recording of Cahow courtship calls automatically at night to encourage returning, newly matured translocated birds that an established nesting population is in residence on Nonsuch.

3 (B) Returns of Translocated Cahows and Establishment of New Colony 2008-2011:

By 2008, the first four returning Cahows translocated three years earlier to Nonsuch were recaptured back at the translocation site on Nonsuch, and their identities confirmed from their band numbers. By the end of that year's nesting season, some of these birds had already been seen prospecting nest burrows at the translocation site.

During the 2008/2009 nesting season, the first pair of Cahows established in a nest burrow on Nonsuch, culminating in the first egg laid and chick hatched on this Island since at least the 1620s. This chick, known as "Somers" in honor of Admiral Sir George Somers, commander of the "Sea Venture" which was wrecked on reefs off Bermuda in 1609 (a event which led to the permanent settlement of Bermuda three years later), fledged successfully to sea on the 17th June of this year. In addition, a total of 15 returned translocated Cahows were recorded back at the translocation site by the end of this season. Both the Government Minister of the Environment and Sports, Mr. Eugene Blakeley and Acting Minister Mr. Nelson Bascombe travelled out to Nonsuch Island to see the chick, which was the subject of an official Government news release that drew interest from Reuters news and environmental publications around the world.

In the 2009 / 2010 season, the number of established breeding pairs carrying out nesting activity and laying eggs rose to 4, although only one of these produced a successfully fledging chick. This chick, known as "Bermudiana", was produced by the same pair from the R818 nest that had produced the "Somers" chick the previous year. The other three nests that produced unsuccessful eggs were the R831, R832 and R834 burrows. Newly

established pairs of Cahows were also confirmed in three additional nests (R816, R817 and R837). The total number of returning birds recaptured on Nonsuch Island that had been translocated as chicks rose to 17, one from the 2004 translocation cohort, nine from the 2005 cohort, six from the 2006 cohort and one from the 2007 cohort. **For the 2010 – 2011 nesting season**, the new Cahow nesting colony on Nonsuch Island continued to grow both in numbers of nesting pairs, and of successfully fledged chicks. Nesting activity with eggs laid was confirmed in a total of 7 burrows (R816, R817, R818, R831, R832, R834, R837), with chicks hatching in 4 of them (R817, R818, R832, R837). All of these chicks, which were identified by the names “Carter”, “Casper”, “Whitney” and “Lefroy” respectively, fledged successfully out to sea by the 17th June 2011.

3 (C): Results of 2011/2012 nesting season at Nonsuch Cahow colony:

The newly establishing Cahow nesting colony on Nonsuch Island has continued its growth during the 2011/2012 nesting season, with new nesting pairs becoming active and producing their first eggs and/or chicks, and additional pairs prospecting and establishing in nest burrows. Two new concrete nest burrows (R819 and R820), were constructed at the site by the conservation officer, to replace two of the recycled plastic nests that were used during the translocation between 2004 and 2008. One of these (R820) was almost immediately prospected and occupied by a new nesting pair, consisting of a 2008 translocated bird and by a non-translocated, unbanded bird. Another new pair occupied the R835 burrow, and both of these pairs should produce their first eggs in the 2012/2013 nesting season.



Fig. 11: Cahow chick from # R816 nest on Nonsuch Island, April 2011

A total of ten nesting pairs produced eggs on Nonsuch Island during this nesting season, with seven chicks hatching (see Fig. 11) and fledging to sea, a considerable increase from the four chicks fledged at this site during the previous season.

In addition, the total number of Cahows translocated to Nonsuch Island as chicks that have returned as adults has risen to 41, representing birds from all five years that chicks were translocated to Nonsuch. Out of these, 26 have been recaptured back on Nonsuch Island itself, while the other fifteen returned birds have been recaptured in nests scattered through all four of the original nesting islets. This represents a rate of 63.4 % of all of the returned translocated birds that have been recaptured back at their original point of departure (the Nonsuch Island translocation site). It is also very noteworthy that at least three non-translocated Cahows have also been recaptured on Nonsuch Island, two of which have paired up with translocated birds.

Table 1 shows the breakdown of all translocated Cahows that have been confirmed as returning to the nesting islets as of June, 2011:

TABLE 1: Returns of Cahow Chicks Translocated to Nonsuch Island by June, 2012

YEAR Of chick cohort	Total Returns by 2011	Returns to Nonsuch	Returns to other nesting islets
2004 (14 chicks fledged)	5 (28.5%)	1 (7.1%)	4 (21.4%)
2005 (21 chicks fledged)	17 (80.9 %)	9 (43%)	8 (38.0%)
2006 (21 chicks fledged)	8 (38.1 %)	7 (33.3 %)	1 (4.7 %)
2007 (24 chicks fledged)	7 (29.1 %)	5 (20.8 %)	2 (8.3 %)
2008 (22 chicks fledged)	4 (18.2 %)	4 (18.2 %)	
Totals: 102 chicks fledged	Total = 41 (40.19 % of all translocated Cahows)	Total = 26 (25.49 %)	Total = 15 (14.7 %)

3(D): Discussion on Progress of Translocation Project:

The Translocation Program to re-establish a new breeding population of Cahows on Nonsuch Island is of particular international scientific interest. This is because it represents a management technique that could be used with other Seabirds in the same family, whether to address naturally occurring threats to a species or impacts caused by the activities of man. Naturally occurring threats include the impacts of hurricane erosion and sea-level rise, such as those impacting the Cahow, or volcanic activity threatening the breeding grounds of a species, such as the endangered Short-tailed Albatross (*Phoebastria albatrus*), which nests dangerously close to an active volcano on Torishima Island near Japan. It is worth noting that the Short-tailed Albatross is also the subject of an ongoing translocation project to establish new nesting colonies on non-volcanic islands.

It is therefore worthwhile to look at how many Cahows that were translocated as chicks to Nonsuch Island during this project have actually been confirmed as returning to the site. The percentage of birds that have returned from each year's cohort, or group of chicks that were moved, also has proved to vary considerably.

By the end of the 2012 nesting season, a total of 41 Cahows moved to Nonsuch Island as chicks had been confirmed as returning to the nesting islets (See Table 1), of which 26 had returned to the new colony site on Nonsuch Island. Of these, 5 had been translocated in the 2004 nesting season (1 returned to Nonsuch), 17 in the 2005 season (9 to Nonsuch), 8 in the 2006 season (7 to Nonsuch), 7 from the 2007 season (5 to Nonsuch) and 4 so far from the 2008 season (all returning to Nonsuch Island).

These figures show that so far, five (28.5%) of the 14 chicks moved in 2004 have returned, one (7.1%) to Nonsuch Island; by comparison, seventeen (80.9 %) of the 21 chicks moved in 2005 have returned, nine (43%) to Nonsuch. From 2006, eight (38.1 %) of the 21 chicks moved had returned, 7 of them (33.3 %) to Nonsuch, while seven (21.9 %) of the 24 chicks moved in 2007 had returned, 5 of them (20.8 %) to Nonsuch. Four chicks have already returned to Nonsuch from the 22 chicks moved in 2008, all to Nonsuch, but it is worth noting that since Cahows can take between 3 to 7 years to return for their first time to the breeding grounds, that most likely not all of the birds translocated in the 2007 and 2008 seasons have yet returned. Even so, by the end of the 2012 breeding season almost 40.19 % of all Cahows translocated over the 5-year translocation project have already returned to the nesting islands, with 25.49 % returning to Nonsuch (See Table 1 for full details).

It has been noted in last year's report for the Cahow Recovery Program that a disproportionate number of fledged chicks that survive and return to recruit into the adult breeding population seem to originate from Green Island. This season further supported this observation, with a total of 19 of the 29 returned translocated Cahows that have so far returned to Nonsuch originating from Green Island (55 % of total returned Cahows). Only 29 of the 102 fledged translocated Cahows originated from nests on Green Island (28.4% of the total number of translocated chicks), so only 28% of the returned birds would be expected to have originated from there. The reason for the high return rate of Green Island chicks is unknown, but will be investigated in upcoming nesting seasons.

Section 4: Update on Cahow Banding Program for 2012:

An important component of the Cahow Recovery Program has been a program to fit identification bands or rings to the legs of as many Cahows as possible. Banding of Cahows has been carried out since 2002, with 5.5 mm metal bands made of a strong, corrosion-resistant alloy called incoloy being fitted to the right legs of adult Cahows and the left legs of fledgling birds. These bands can last for the life of the birds and are imprinted with a unique code and a return address. The bands used for the Cahows were made especially for Bermuda by Porzana Ltd. (U.K. Wetlands Trust affiliation) in the United Kingdom.

These bands are vital for allowing easy positive identification of individual Cahows in the field, and enable researchers to follow these birds for essentially their entire breeding lifespan through recaptures over successive years.

The Cahow Banding Program has now been underway for ten years, during which a total of 445 Cahows have been fitted with identification bands as of June, 2012. This includes 115 birds banded as breeding adults, and 296 birds banded as chicks before fledging to sea. In other terms, these numbers represent almost 60% of the current adult breeding population, and about 85% of all chicks to have fledged over the last ten years. It should be noted that this does not represent the total number of living Cahows, as less than half of all fledged chicks survive their first years at sea to return to the breeding islands.

Banding of the adult Cahows gives valuable and previously unknown data on *pair faithfulness* (the tendency for a mated pair to stay together for many years) and *site faithfulness* (the tendency for a mated pair to return to the same nest site over an extended period of years).

The banding of Cahow chicks has provided information on many aspects of behavior and breeding biology, including the following:

- 1) The survival rates of chicks during the period between fledging to sea and their first return to the nesting grounds as sexually mature young adults;
- 2) The age of chicks upon their first return to the nesting grounds, and whether this differs between male and female birds;
- 3) The period of time between the first return of the young birds, to the choosing of nest sites and mates, and the first nesting attempts;
- 4) Whether young Cahows always return to their exact point of departure, or whether they can return also to other islands/nesting colonies.

Following are some of the many aspects of breeding biology and behavior that are already being revealed by banding/recapture studies:

- 1) This program has confirmed that Cahows first return to the nesting grounds between 3 and 8 years of age. Male birds return first at 3 to 4 years, although at least 2 have returned within 2 years of fledging to sea. Females average about a year longer at sea before they first return at 4 to 5 years at sea. Several Cahows, both male and female, have not been recorded back on the nesting grounds until at least 8 years after fledging.
- 2) Most returned Cahows attract a mate and choose a nest burrow during the first year after their initial return, with the first nesting attempt during the following year. However, about 25% of returning male birds either do not succeed in attracting a mate within the first year, or do not nest successfully, and switch nest sites or mates more than once before successfully nesting. At least 3 returned males have had 2-4 different mates, switching nest burrows 2-3 times, over a three-to five year period without successfully producing a chick.
- 3) Successful nesting appears to seal the pair bond, as pairs that have successfully reared fledged chicks one season will almost always return together to the same nest on the following breeding season.
- 4) The return rate of Cahow chicks, in other words what percentage of each year's output of chicks fledge to sea, and eventually return to the nesting islands to establish nest burrows and find mates, varies between 18% and 55% of the total number of fledged chicks on different years (mean average of return rate of chicks fledged 2002-2007 is 36.5%). ** One notable exception to these figures is the translocation cohort in the 2005 nesting season, from which 17 of 21 birds fledged that year have been confirmed as returning to either the Nonsuch translocation colony or the original nesting islets (80.1 % of the translocation cohort). This exceptional figure is probably at least probably due to the birds fledging to sea some 20 to 30 grams heavier than average fledging weight, due to being fed right to departure.
- 5) It was previously thought that after young Cahows fledged to sea, they always returned when mature to the same island that they had originally fledged from. The banding program has revealed that although the majority of Cahows do in fact return when mature to the island of their birth, a substantial proportion can in fact return to other nesting islands than the one they originally fledged from. As a general rule, it has been found that a higher percentage of male birds return to their natal island than do female Cahows, which seem to roam more widely among the various nesting islands on the lookout for eligible males (and available nests).

** Chicks fledged after this time period may not have all returned as of this date

Section 5: Update on Oceanic Range Study of Cahow Using Archival Geolocational Data Loggers:

The 2011-2012 nesting season marked the third and final year that archival geolocational data loggers were deployed on the legs of selected adult Cahows. During the first two seasons (2009 – 2010) that these data loggers were deployed, a total of 10 of the 12 tags deployed were recovered successfully and the data they contained downloaded. Nine of the ten loggers recovered were found to contain useful data spanning periods ranging from 1 week to over 12 months. This data could then be converted into maps on which the daily positions of individual Cahows could be illustrated. After downloading data, these loggers were reset and re-deployed on the same or different birds to gain further locational data. During this final year of deployment of the data loggers on Cahows, seven tags were recovered from birds, after having been attached for periods of up to three years. Six of these were found to contain useable and significant information.

The data from these data loggers has revolutionized the understanding of the oceanic range of the Cahow, which is much more wide-ranging than originally thought. By combining all the useable data points from all eleven of the recovered loggers, a new estimate for the overall range can now be shown, covering an area stretching from the eastern coast of North America to Western European waters. In addition, 6 of the 9 loggers recovered with up to 12 months of data showed distinct differences between the breeding and non-breeding ranges of individual Cahows (as shown in Fig. 12). The data obtained from these loggers is being summarized and will be presented by 2013, both in a specific report and through a scientific paper now in preparation.

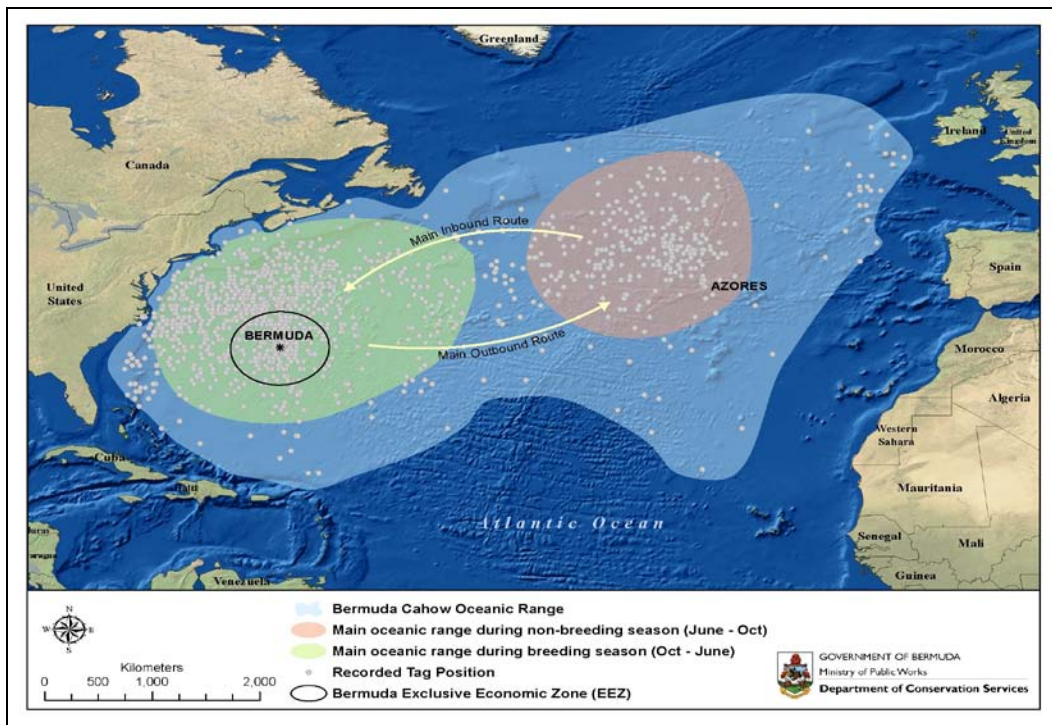


Fig. 12: Breeding and non-breeding oceanic range of 9 Cahows as shown by data loggers

Section 6: Planned Future Management Actions and Research:

A number of the projects and proposals recommended in past annual Nesting Season Reports have either been successfully completed or are well underway; following are the most important recommendations for ongoing projects which are already underway, or that are proposed for future nesting seasons:

2012 - 2013 Breeding Season:

- Start establishment efforts for second nesting colony on Nonsuch Island with planned translocation of 20 - 25 Cahow chicks from original nesting islets to “B” colony site on the South Hill of that island;
- Investigate DNA studies from blood sampling of Cahow to determine relationship with other North Atlantic Gadfly petrels, confirm that the Cahow is a distinct species, check for genetic diversity and variability within the population, check for possible inbreeding/lack of genetic variability and to confirm the sex of individual birds;
- Continue ongoing Cahow banding program;
- Continue use of sound attraction system at “A” translocation site on Nonsuch to continue attracting returning young Cahows to prospect for nests at that site;
- Continue monitoring nesting islands for presence of rats and other predators, and set out rodenticides when necessary.
- Continue installation of additional artificial nest burrows at nesting colonies

2013 – 2014 Breeding Season:

- Continue translocations of near-fledged Cahow chicks from nesting islands to “B” colony site on Nonsuch Island, moving 20 – 25 chicks annually until a target figure of 75 to 90 chicks have been moved and have fledged from Nonsuch;
- Install 2nd sound attraction system at new “B” colony site on Nonsuch Island and play disc of recorded Cahow courtship calls and cries during breeding season; also last year for using sound attraction system at original, “A” translocation site.
- Continue blood sampling of Cahows for DNA studies;
- Continue Cahow Banding program;
- Continue monitoring of nesting islands for the presence of rats; set out rodenticides when necessary;
- Continue installation of additional artificial nest burrows at nesting colonies.

Section 7: Acknowledgements:

A major species recovery project can not be successfully carried out without a large support group to provide manpower, backup and logistical support. I would like to acknowledge with thanks the following Departmental staff, volunteers, organizations, schools and members of the public for their assistance in the Cahow Recovery Project during the 2010 – 2011 breeding season:

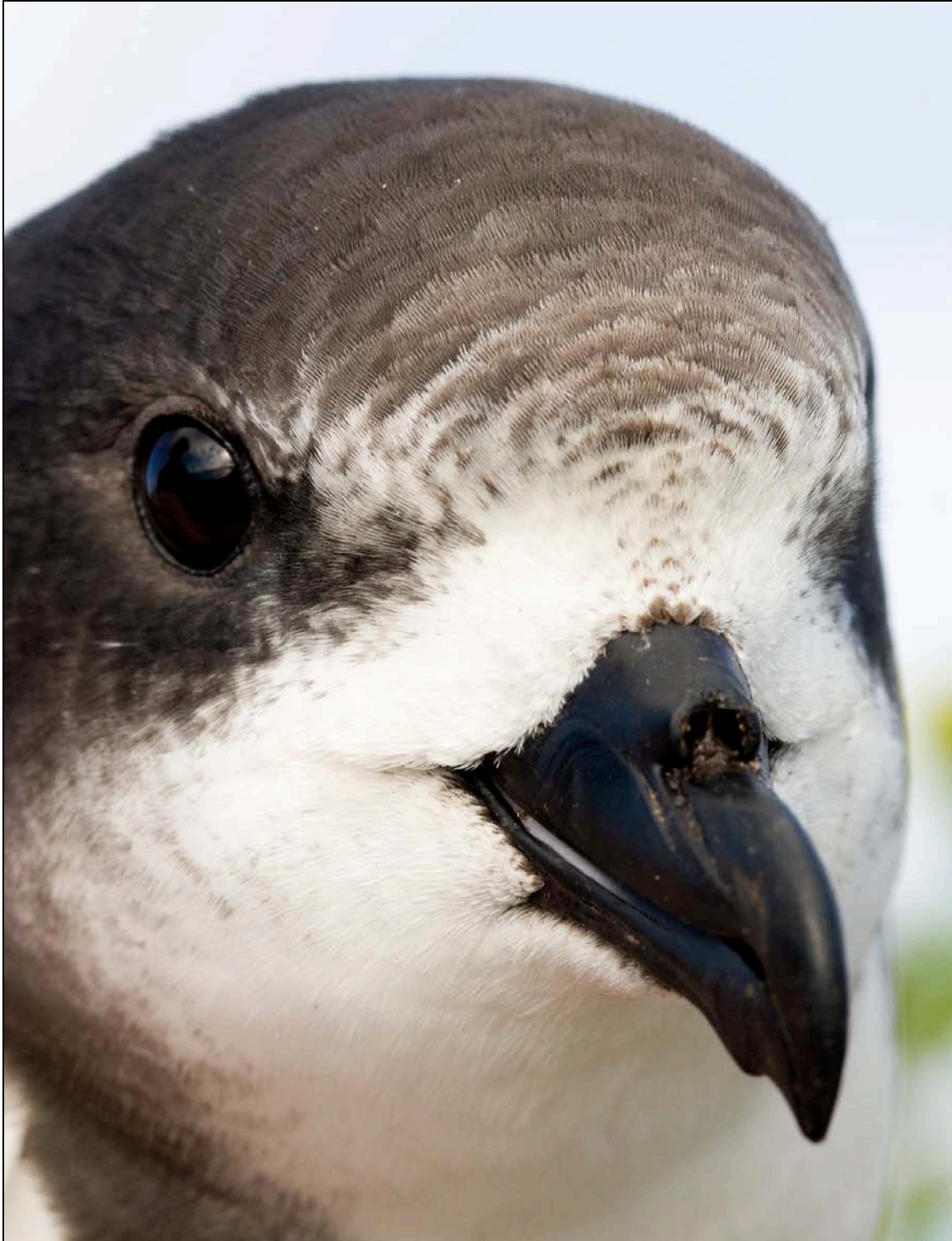
Mr. Drew Pettit, Director, Dept. of Conservation Services, Mr. Peter Drew, assistant Conservation Officer (Dept. of Conservation Services); Ms. Mandy Shailer (GPS coordinator, Dept. of Conservation Services), who for a third year has compiled locational data from the geolocational data loggers and used this to make the tracking and oceanic range maps, Nicholas Carlile and Dr. David Priddell, (New South Wales Department of the Environment and Climate Change, Australia), who have provided guidance on various aspects of the recovery program and have collaborated in the writing of two scientific papers on the breeding biology of the Cahow and the Cahow translocation project; Chris Flook, collections officer, Bermuda Aquarium, Museum and Zoo, Lynn Thorne, tour director, Bermuda Zoological Society (Nonsuch tours and “Cahow encounters” for school and BZS tour groups).

As usual, I am deeply indebted to the Terrestrial Conservation Crew for their hard work in building artificial concrete nest burrows for the Cahows on both Nonsuch Island and the original nesting islets. The Terrestrial Conservation Crew consists of Barry Smith (Foreman), Hillgrove Iris, Kiwon Furbert and Marvin Jones. In addition, volunteer workers from the Ascendant Group of Companies dug out nine new Cahow nest burrows at the new ‘B’ colony site on the south hill of Nonsuch, and have given financial and logistical support to the Nonsuch Living Museum project in a number of ways. I would like to personally thank the Ascendant Group of Companies for this essential support.

A good deal of the research work carried out by the Cahow Recovery Program has in fact been possible only because of donations by schools, businesses, organizations and members of the public. For example, the geolocational loggers which have revolutionized the understanding of the oceanic range of the Cahow were purchased entirely through public donations, notably by Saltus Cavendish School and Paget Primary School. Special thanks also go out to the Atlantic Conservation Partnership (A.C.P.) and the Ascendant Group of Companies, who have supported and coordinated donations for the Nonsuch Island Living Museum and the Cahow Recovery Project. We are deeply grateful for the interest and generosity shown by all of these and other donors.

In conclusion, I would especially like to acknowledge my wife, Leila Madeiros, and children Seth and Elizabeth, without whose support and patience I would not have been able to carry out this demanding and time – consuming project over the last 11 years.

Jeremy Madeiros,
Senior Terrestrial Conservation Officer



**Fig. 15: Adult Cahow from nest burrow on Long Rock – detail of head
(Chris Burville)**