REPORT ON FIFTH TRANSFER OF GREY- FACED PETREL (*Pterodroma macroptera gouldi*) CHICKS FROM TARANGA (HEN) ISLAND TO MATAKOHE-LIMESTONE ISLAND (DECEMBER 2008)

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ABSTRACT

Forty-one grey-faced petrels (oi) were transferred from Taranga (Hen) Island to Matakohe-Limestone Island by boat on 5 December 2008. This was the fifth of five transfers planned by the Friends of Matakohe-Limestone Island (FOMLI), in order to establish a new population of this species on the island. Suitable chicks were selected on weight and wing length criteria established over the preceding four transfers.

Once on Matakohe-Limestone Is., the chicks were fed using the same method as in the previous years, with tinned sardines in soya oil, blended with water, via crop tube. The chicks were fed small watery meals at first while they adjusted to the artificial diet. Meals of undiluted puree were then gradually increased in size to the level required for each individual to reach the normal fledge weight range. Where required the diet was supplemented with cod liver oil at a rate of 5ml oil: 50ml sardine puree. All chicks appeared to do well on the diet and fledged within the normal range, including the lower weight birds.

One chick died from acute bacterial enteritis. One chick developed a septic arthritis of the right carpus and was euthanased. One chick fledged from the site, but was found dead the next day, on a beach on Matakohe-Limestone Island. Post-mortem indicated death due to misadventure.

38 chicks (93%) were presumed to have successfully fledged from Matakohe-Limestone Is. After a mean of 24 days on the island, the chicks fledged at a mean weight of 541 gm and mean wing length of 316 mm.

A total of 152 Grey-faced Petrels have successfully fledged over the five years of the project.

INTRODUCTION / BACKGROUND (Gummer, H. & Bishop, C.; 2005)

The grey-faced petrel *Pterodroma macroptera gouldi* (oi) is a member of the Procellariidae family of seabirds; all have distinctive external nostrils encased in a tube on the top or sides of the bill. This species colonises mainland headlands, cliff tops and offshore islands from the Three Kings to Taranaki on the west coast and near Gisborne on the east coast. The main colonies occur on Taranga (Hen Is.), Mokohinau Is., the Mercury and Alderman Is., Whale Is. and White Is. This species is the most common breeding in the New Zealand region with over 1,000,000 pairs (Heather & Robertson 1996: Field guide to the birds of NZ). Their diet is mainly squid, with some fish and crustaceans.

Matakohe-Limestone Is. is a 40 ha (approx.) island located in the upper Whangarei Harbour. The island is a designated scenic reserve managed by a voluntary community incorporated society – Friends of Matakohe-Limestone Island (FOMLI) – formed in 1991. A full-time ranger is resident on the island. A large scale revegetation programme is underway with species introductions carried out (both assisted and unassisted) as habitat and food source increase. It is highly likely that petrels, shearwaters and other seabirds once bred on Matakohe-Limestone Is.

The five year project began in 2004 with the transfer of the first 40 chicks, and FOMLI plan to translocate up to fifty oi chicks annually to Matakohe-Limestone Is. Breeding seabirds excrete considerable quantities of guano which will help lift the nutrient levels on the island. Nest burrows will provide additional habitat for lizards, kiwi and invertebrates.

Man made burrows were constructed and set into the ground in a suitable location on Matakohe Is. Seabird ecologist Helen Gummer was contracted by FOMLI in 2004 for the first transfer, and supervised the feeding and welfare of the birds until the first chicks fledged. Nine chicks died during the first week after transfer and a further three were found dead at a later stage, probably due to the inability of these under-nourished birds to cope with the artificial diet. They were in poor condition when transferred and probably would not have survived naturally on Taranga Is. 28 chicks were presumed to have fledged from the Matakohe-Limestone Is. colony site from the 2004 transfer.

For the second transfer in 2005, Rose Collen (aviculturalist with experience in seabird hand-rearing and transfers) was contracted by FOMLI, and supervised the feeding and care of the chicks until 28 December 2005. At this point care of the chicks was handed over to the new resident rangers Cathy & Peter Mitchell, and Ngatiwai contractor Tanya Munro, with the last of the chicks fledging on 11 January 2006. 31 chicks were transferred, 5 died and 26 are presumed to have fledged successfully.

The three subsequent transfers were managed by Cathy and Peter Mitchell, resident rangers on Matakohe-Limestone Is. Cathy is an NZVA registered Veterinarian. In the third year (2006), the collection trip was carried out a week later than the two previous years and a good number of suitable birds were available for selection. Forty birds were transferred, 1 became lost and was not found, and 39 birds are presumed to have successfully fledged.

In the fourth year a good number of birds was once again available, however weather conditions meant that the transfer could not be carried out until December 15th. By this time many of the birds were outside the selection criteria and only 22 birds were transferred. One bird was euthanased and 21 birds are presumed to have successfully fledged.

This report details the fifth and final Grey-faced Petrel transfer to Matakohe-Limestone Island carried out in December 2008.

All transferred chicks have been banded (apart from Burrow 22 in 2007). It is expected that the first birds should begin returning to Matakohe-Limestone Is. three to five years after fledging, and start prospecting for suitable nesting burrows and partners. Breeding may not occur until the birds are seven years old.

Background information on grey-faced petrel fledging weight and wing length statistics

Grey-faced Petrel weights peak dramatically before falling to a weight at which birds are able to fly/ fledge. Parental meals may reduce in size and frequency after chick weight peaks as chicks need to lose weight while plumage development is completed. Key information below on weights, wing lengths and emergence behaviour prior to and at fledging is based on data collected by Graeme Taylor at the Bethell's Beach (west Auckland) colony:

- Peak weight for grey-faced petrel chicks occurs at around 75-80 days (approx. 175-190 mm wing length)
- Peak weights reach 800-1100 g after feeds (900 g for normal healthy chicks)

- Fledging weight range is 480-580 g (most commonly 520-550 g). *Chicks are not fed for last 3-5 days or longer before fledging; fledging weights are not post-feed weights.*
- Fledging wing length range is 305-340 mm (average around 315-320 mm)
- Wing growth accelerates with age: at >250 mm the primaries grow at 5 mm/day; at 200-250 mm the primaries grow at 4 mm/day; at <200 mm the primaries grow at <4 mm/day, etc. It would take a chick approximately 12-13 days to grow from 200 mm to 250 mm and a further 14 days to grow from 250 mm to the average fledging wing length of 320 mm. Therefore, chicks with wings measuring 200 mm could be expected to fledge approximately 27 days later.
- Chicks have not been recorded naturally as emerging from burrows with wings less than 250 mm.
- Chicks emerge from burrows each night for an average of 2 weeks before fledging.

NB From experience with other seabird chick transfers, chicks fed on the artificial sardine diet tend to fledge at heavier weights and with longer wings than naturally-reared chicks. If this is the case with Grey-faced Petrels then it could be expected that chicks in the best condition fledge at weights up to 600 g and with wing lengths closer to 340 mm. (see Discussion below).

METHODS / RESULTS

Preliminary survey on Taranga (Hen) Is., October 2008

As for the 2007 year a one day survey trip was carried out in October 2008. The purpose of the one day trip was to collect data on the chicks for this season. This data was then compared to the October data from the 4 previous translocations to confirm that the chicks were on track to fledge at a similar date. This trip also gives a preliminary indication on the number of chicks present in the current year.

On this one day trip, 15 birds were located and measured at the eastern end of the island. This was slightly fewer birds than were located in the same areas in 2007 (20). See Appendix 1 for between-year comparison of October data.

Collection trip, December 1st to December 5th

A team of 6 people arrived on Taranga Is. on 1st December with the aim of locating chicks and carrying out 2 measurements 2-3 days apart to allow selection of those suitable for translocation.

On arrival on the first day camp was set up and the remainder of that day was spent locating chicks at the eastern end; weighing, measuring and assessing the health of each chick. Each chick was examined thoroughly for any signs of injury or abnormality as part of the health check (results shown in Appendix 2). The majority of chicks which had been located during the October trip were also relocated and measured. The weather deteriorated in the late afternoon with rain, so 5 chicks were not revisited until collection day (December 4th). As these 5 chicks were only weighed once, on collection day, their weight selection criteria was increased by 100 gm to 570 gm.

On the second day (2nd Dec) searching and measurement of chicks at the western end of the island was carried out. The area above camp was also searched on the second day. A total of 89 birds were available for selection. There was a wide variation in numbers of birds found at some sites this year compared to the 2007 year. For example, only 3 birds were found in Astelia Knoll this year, compared to 9 in 2007, whereas 22 birds were found in G Block compared to 10 in 2007. Taken overall however the total number of birds found was similar, for the same areas searched.

On the third day (3rd Dec) the team had a day off to allow at least 2 days between the two weights, so that the true unfed weight was obtained. A short list of potentially suitable birds was drawn up for use the following, collection, day.

On December 4th the short listed birds were re-measured and suitable birds were placed in pairs into corflute boxes lined with shredded paper. The burrow number was recorded for each chick. In addition some nest material was collected from each burrow and the burrow number recorded, so that it could be placed into the Matakohe-Limestone Island burrow of the chick. Two boxes at a time were transported down to Wahine Bay, strapped securely onto pack frames. Once down at the landing site the chicks were placed in individual boxes which were left in a cool location under a tarpaulin, as rain was forecast that night. Fifty-six birds were checked on December 4th, 41 of these were suitable for transfer.

The birds were transferred to the boat by 8am the morning of December 5th. They were then transported directly to Matakohe-Limestone Island, arriving at approximately midday.

Arrival and installation of chicks on Matakohe-Limestone Is.

On arrival at Matakohe-Limestone Is. the chicks were carried onto the landing area for the welcome. The chicks were blessed and welcomed onto the island by Te Warahi Heteraka of Ngatiwai and Freddie Tito of Te Parawhau. Approximately 30 people were present, with representatives from Te Parawhau, Ngatiwai, FOMLI, Whangarei Boys High School and the local community.

The chicks were then driven up the hill to the artificial petrel colony site. The chicks were placed in the shade of the petrel feeding station shelter as quickly as possible, (the weather was hot out of the wind). Each chick was fed 20 ml of boiled (cooled) water via a syringe and crop tube (to rehydrate after the transfer), and placed in one of the numbered burrows with its own nest material.

The straw from the 2007 transfer had been left in the burrows, and was given a top up of clean straw just prior to the arrival of the 2008 chicks. The entrance tunnels were blocked off with fence post rounds.

The chicks were banded by Nigel Miller (DoC, Whangarei Area Office) and disease screened on December 10th. The tunnels were unblocked the same day.

Supplementary feeding

Chicks were fed the same diet as the previous years; tinned “Brunswick” sardines in soya oil (66%) blended with water (33%). Each 106-gram tin was blended with 50 ml cold (boiled > 3 mins) water to a smooth puree. All food preparation methods and equipment remained the same as for the 2004-2007 transfers (Appendices 6, 7 and 9).

A feeding regime, which would allow the chicks to make a gradual transition from natural to artificial diet, was adopted on arrival at Matakohe-Limestone Island (as was recommended by Helen Gummer and Rose Collen after the 2004-5 transfers).

The feeding process was as follows:

Transfer day: All given 20 ml water on arrival

Day 1: 50 ml runny puree (50:50 sardines: water) fed to all chicks

Day 2: 50 ml runny puree fed to all chicks

Day 3: 100 ml runny puree fed to all chicks

Day 4: None fed

Day 5: All fed 100 ml normal puree mix (66:33 sardines: water)

All chicks were fed every second day thereafter. Fluid or food supplementation was given between feeds for those which were considered to need it, for example if they had not received a full feed due to regurgitation.

Cod liver oil was once again used to supplement the diet of lighter chicks needing to gain weight. This is to avoid overfilling the crop by feeding large volumes of the sardine puree. These chicks were fed a maximum of 130 gm puree plus 10 ml cod liver oil. This regime appeared to work very well with all lighter chicks fledging within normal fledging parameters.

Chicks approaching fledging often have trouble taking food and may regurgitate feeds, and thus maintaining their weights and hydration can be difficult. These chicks were also supplemented with cod liver oil where needed, at a rate of 5 ml oil to 50 ml puree. As with the previous year, maintaining hydration was also focussed on this year and up to 35 ml electrolytes in the form of Lactated Ringers was used in many birds. They tolerated this well and often were able to hold this down where they had regurgitated their regular feed.

On arrival at Matakohe-Limestone Is. all of the chicks appeared bright and alert, though some were quiet. All chicks were measured (weight and wing length) and fed for the first 3 days, thereafter they were measured every second day before feeding.

The amount fed was adjusted for each chick on feeding days. Weight, wing length (maturity), and response to previous feed were used to decide on feeding for that day.

A total of 375 tins (106 g) of sardines were used to feed the Grey-faced Petrel chicks in 2008.

Daily chick and burrow monitoring

The process for checking, handling and feeding the chicks was the same as for previous years (Appendix 8). On 10th December, after 5 nights blocked into their burrows, the blockades were removed so chicks could emerge. Stick fences at the burrow entrances were used to monitor each chick's emergence behaviour. All burrows were checked daily (including non-feed days), fence status recorded, and the chicks sighted/checked for any signs of ill-health.

All chicks were measured daily for the first 3 days, thereafter they were weighed and wings were measured before each feed (every second day).

Disease screening

All birds were given a general health check on Taranga Is. before selection.

Ten chicks were screened on 10th December 2008 on Matakohe-Limestone Island. The chicks in burrows 31, 32, 33, 34, 35, 36, 38, 39 40 and 41 were blood sampled (wing vein) for a complete blood count (CBC). Cloacal swabs were taken from chicks from burrows 32 – 41 inclusive for Salmonella culture. Faecal samples were taken from 2, 7, 10, 11, 16, 32, 35 and 40 as the birds obliged, and were tested for internal parasites. Samples were tested at New Zealand Veterinary Pathology in Hamilton.

All results returned negative or normal.

Health problems and mortality

Three birds in total are known to have died while on site or shortly after fledging.

Burrow 20. This bird was found outside the burrow on the morning of December 20th. It was flat on the ground with spread wings and unaware of its surroundings. It was gagging severely, and could not hold its head up. It was given oral fluids but continued to deteriorate, so was euthanased later that day. On the burrow check the preceding day nothing abnormal had been observed.

The body was sent down to Massey University, Palmerston North. Post-mortem examination indicated death due to acute bacterial enteritis. No causative bacteria were isolated. The burrow was blocked to prevent entry by other birds.

Burrow 39. This bird fed, grew and emerged as normal. It was one of the birds which displayed neurological signs as it approached fledging weight (see below). It recovered from this but still did not fledge as expected. A full health check revealed an arthritis, probably chronic, of the right carpus. Due to the arthritis the bird could not fully extend its wing and would therefore be unlikely to successfully fledge. The bird was euthanased. A similar chronic arthritis had been seen in a chick (Burrow 5) in the 2007 transfer, this bird also had to be euthanased.

Burrow 24. This bird fed well, had normal weights and wing growth and emergence pattern. It fledged the site on the night of December 27th. The body of the bird was found on one of the Matakohe-Limestone Island beaches the following day. The location of the bird indicated that it had been washed ashore by the easterly wind, at mid tide at around 11am, as the tide went out. This confirmed successful fledge from the site. The body was sent to Massey University, Palmerston North for post-mortem examination. This examination revealed fresh haemorrhage in the right lung, trachea and right caudal thoracic air sac, which indicated that death was due to misadventure.

Neurological Problems. As for the 2005 and 2007 transfers, two of the 2008 chicks experienced neurological symptoms. These were the birds from Burrows 6 and 39. Both birds were treated with Vitamin B supplements (Multiject B, 0.03ml orally) and anti-inflammatory (Metacam 0.03ml orally), and extra fluids. The tunnels were blocked for the first night, due to the risk of death due to misadventure. Both recovered from their neurological symptoms within 24 hours and the chick from Burrow 6 went on to fledge successfully the following night. The second bird, Burrow 39, was found to have arthritis of a carpal joint which prevented fledging (see above).

Burrow hygiene and temperature

As for previous years burrow hygiene was closely monitored throughout the rearing period. Straw was topped up as required (rather than replaced). The burrows remained dry and ammonia/smells were minimal. Tunnels had a small amount of gravel in them so plumage would not become soiled if they were damp, however most remained dry.

The nest chambers were kept covered with two sand-filled sacks at all times to help keep the burrows cool. The sacks and tunnel entrances were kept damp to help maintain burrow humidity. The trees on the site have grown significantly over the years of the transfers and are beginning to provide shade, however manuka branches were also laid over some of the more exposed burrows and tunnel entrances.

Details of chicks sitting in tunnels:

Burrow 15 - found in tunnel once
Burrow 32 - found in tunnel once, (was also found in other burrows, see below)
Burrow 24 - found in tunnel three times

This represents a significant reduction compared to previous years, possibly due to improved burrow hygiene and humidity.

Emergence and fledging

Emergence and fledging dates are recorded for each chick in Appendix 4.

Chicks usually start emerging after their wing length has reached 250 mm. Of the 41 chicks transferred, only 3 started emerging with wings less than 250 mm. This is a reduction in the number of birds showing this behaviour over previous years, and in general the chicks seemed very settled in their burrows. Early emerging in natural colonies is often associated with sick or starving chicks. The chick from burrow 20 emerged prematurely at a wing length of 235 - 240mm, and died 4 days later. However it should be noted that other translocated chicks have emerged at similar wing lengths in the past, with no signs of ill health, and gone on to fledge successfully. The 2 other chicks showing premature emergence were of wing lengths closer to normal (243 and 245mm) and successfully fledged. Many birds were well over 250mm wing length on first emergence, with 4 chicks being above 285mm.

Any absent chicks were presumed to have fledged, as all were of fledging weight and wing length. Burrow 32 was absent one day, but appeared in burrow 25 the next. A number of chicks were found in burrows other than their own. All of these birds were close to fledging.

Details of chicks wandering and being found in burrows other than their own:

Burrow 2 - found in burrow 3 once, and burrow 1 twice
Burrow 14 - found in burrow 3 once
Burrow 23 - found in burrow 30 once
Burrow 25 - found in burrow 13 once
Burrow 30 - found in burrow 24 once
Burrow 32 - found in burrows 12, 25 and 26 once in each case

The first chick is assumed to have fledged on 19 December 2008 (burrow 10), and the last chicks left on 8 January 2007 (burrows 6 & 14). The 39 chicks which fledged spent a mean of 24 days on Matakohe-Limestone Is. The mean emergence period was 16 days.

DISCUSSION / RECOMMENDATIONS

Timing of transfer and number of birds found

The ideal time for transfer of chicks from Taranga has been well established over the 5 years of the translocation project. In the first year (2004) only 50 chicks were available for selection, which in retrospect was insufficient numbers. More chicks (72), were available in the second year (2005), however they were taken off at the beginning of December which resulted in a number of chicks being too immature. In the 2007 year due to the weather conditions, the chicks could not be taken off until the end of the second week in December, and though there were good numbers (88) to select from, many were too mature by this time. From this it recommended that any future translocations of Grey-faced Petrels from Taranga Island would ideally be carried out between December 5th to 10th, and with a pool of up to 100 birds to select from.

Over the five years of the transfers, a good number of sites with burrows were located. The number of birds in any one site appeared to vary considerably from year to year. For example, in Astelia Knoll there were 9 and 3 chicks, and in G Block there were 10 and 22 chicks in 2007 and 2008 respectively. Numbers over all the sites, however, were similar each year, with 89, 90 and 88 chicks being found in total in the 2006, 2007 and 2008 years. A good number of sites containing burrows are needed to ensure sufficient numbers of chicks are available for selection each year.

Protocols for translocation

Protocols for transfer, site management and feeding of the chicks have been well established over the five years of the translocation. No significant changes were made in this final year of the project.

Wind on the artificial colony site

It was noticeable that the numbers of chicks fledging appeared to vary with the night-time wind conditions. Very few chicks fledged on calm nights, even when there were chicks of fledge weight/ wing length present on the site. The growth of trees around the burrows provides more shade keeping the site cooler during the day, but also shelters the site from wind. Some ramps were put on the site this year in an attempt to give the chicks some elevation, and there were signs that they had been used by the few chicks remaining at that stage.

Sick/Dead chicks

Two chicks became sick and were euthanased. The chick from Burrow 20 developed an acute bacterial enteritis, the underlying cause for this was not established. The chick from Burrow 39 developed a chronic arthritis which prevented successful fledging. A similar arthritis was seen in the chick from Burrow 5 the preceding year, a final postmortem report was not received for this bird. Both these illnesses are likely to have been isolated occurrences which, while disastrous for the individual, are unlikely to have implications for the health of the colony as a whole.

Neurological Problems: As in two of the preceding years, chicks in the 2008 year experienced neurological symptoms. The cause of these symptoms has not been established, but certain features have been seen in all the cases. Symptoms seen included, arching back of the head (opisthotonus), ventroflexion of the head, inco-ordination and distress. All the chicks displaying these symptoms were of fledging weight/wing length and were among the later fledging birds (ie, had been on the site for at least 18, and up to 37, days).

All six affected chicks recovered from their neurological symptoms, and five of the six went on to successfully fledge (the sixth bird, as discussed above, had other problems preventing fledging). Treatments given were;

- 2005 – (Burrow 30) fluids and antibiotic, recovery within 24 hours
- 2007 – (Burrows 2 & 15), fluids and antibiotic, improvement noted 48 hours later, Vitamin B + anti-inflammatory given 60 hours later by which time symptoms were minimal
- 2007 – (Burrow 4), Fluids, antibiotic/Vit B/anti-inflammatory orally were given 24 hours after mild neurological signs were first noted, at this stage symptoms were marked, chick was apparently normal less than 12 hours later
- 2008 – (Burrows 6 & 39), Fluids, Vit B/ anti-inflammatory orally were given within 10 hours of signs being seen, symptoms were marked at that stage, birds both appeared normal 12 hours later

Two of the birds from 2007 (Burrows 2 & 15) and the two from 2008 developed symptoms on the same day. In all cases the symptoms coincided with a period of hot calm weather.

It is recommended that this treatment could be used by other sea-bird translocations experiencing similar symptoms - that is, oral administration of fluids, B Vitamins and anti-inflammatories.

Normal Weight and Artificial feeding

In the introduction, data gathered from the Bethell's Beach colony was used as a guide for expectations of weights and wing lengths during the emergence and fledging periods of chick development.

In the Bethell's colony, chicks reach peak weights of around 800 – 1100 gm, 900 gm for normal healthy chicks (after feeding). Such weights were rarely recorded in the Taranga colony, with no chicks having weights above 800 gm out of 71 weighed at the 'peak weight' wing length of 175 – 190 mm (though many of these will be unfed weights). Over the five years of the project only 4 chicks (of any wing length) were recorded at a weight of 800 gm and one at a weight of 860 gm.

Normal (un-fed) fledge weights recorded at the Bethell's Beach colony were 480 – 580 gm. It was noted in the introduction, that from experience with other sea-bird translocations, 'it could be expected that chicks in the best condition fledge at weights up to 600 g and with wing lengths closer to 340 mm.' Over the 5 years of this translocation four chicks fledged at 600 gm or more, and two others fledged at 580 gm. The majority fledged at 570 gm or less. The maximum fledge wing length from Matakohe-Limestone Island was 328 mm. Thus, the majority of chicks fledged at the normal weight and wing lengths as recorded at the Bethell's Beach colony.

Between-year Comparison

Adjusted data for the transfer years has been compared (see Appendix 4). Fledge dates, fledge wing lengths and number of days on Matakohe-Limestone Island (allowing for the later collection date in 2006), are all very similar. This indicates that fledging dates for the chicks from Taranga are similar between years and timing the collection trip around the 8th of December is likely to give the best results.

Returning Birds

The site was monitored over the 2008 autumn/winter for signs of returning birds. The site was visited at night, fences were erected at the external and internal tunnel entrances, and the site was checked for feathers and droppings. Call tapes were played every night throughout this period.

No returning chicks were seen or heard at the night visits. Fences were found to be down on many occasions - mostly external, but also internal ones showing that the chamber had been entered. Most of the time when fences were down, however, kiwi sign was present on the site (probes, footprints and kiwi scat) and there was no petrel sign found. It is most likely that the fence disturbances were due to kiwi - the island is a kiwi crèche with a relatively high kiwi density, and kiwi have been found during the day in the petrel burrows in the past.

Call tapes will be played again from April to November and site monitoring will continue.

ACKNOWLEDGEMENTS

This five-year project can be considered a success, and we would like to thank the following people who made it so:

- Te Parawhau have mana whenua over Matakohe-Limestone Island and Ngatiwai have mana whenua over Taranga Island. Both groups were involved in all stages of this project.
- Department of Conservation staff who gave advice (Graeme Taylor and Tony Beauchamp) and practical assistance, including Emma Craig and Paul Cornille (Taranga team 2006) and Andrea Booth (SOP, banding) and Nigel Miller (banding).
- The many dedicated volunteers who gave their time to help with the collection, transfer and feeding programme over the five years of the project. These include many members of the FOMLI Committee as well as community volunteers, who returned to help on more than one occasion, and have now become experienced 'Petrel Heads'.
- The experienced ‘core’ Taranga team of Tanya Munro, Grant Stevens and Lawrie Mead, whose assistance (and enthusiasm) was so important in the success of the collection side of the project. Tanya Munro was also a key player in the Matakohe-Limestone Island feeding team, and has seen the project through from start to finish.
- The well-documented experience of all the previous transfers has played a crucial part in refining all the protocols, so that improvements have been made each year and the process is now reliably repeatable from year to year.
- Thanks must go to our boatmen of the last five years. Peter Emerson assisted with transport of people and gear to and from Taranga on many occasions. Thank you also to Martin Hunt for volunteering his time and his launch “Manaaki” to transport people and gear, and who brought the chicks back to their new home on four occasions.
- World Wildlife Fund for Nature – New Zealand who have sponsored three of the five project years. Without this crucial funding the project could not have gone ahead.

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APPENDICES

Appendix 1: Comparison of Grey-faced petrel data between years – October survey trip

Appendix 2: Locations of grey-faced petrel burrows on Taranga (Hen) Island, 2008

Appendix 3: Weights, wing measurements and health status of chicks found on Taranga (Hen) Island, 2008

Appendix 4: Transfer, emergence and fledging data for 41 grey-faced petrel chicks transferred to Matakohe-Limestone Island in December 2008.

Appendix 5: Comparison of (adjusted) data from Grey-faced Petrel translocations over five years (2004 – 2008)

Appendix 6: Grey-faced petrel chick food preparation guide

Appendix 7: Checklist of equipment to transport to colony site on chick feeding day

Appendix 8: Grey-faced petrel chick feeding, measuring and monitoring guide

Appendix 9: Grey-faced petrel chick post-feeding clean-up guide

Appendix 1: Comparison of Grey-faced petrel data between years - October survey trip

Year	Number	Weight (gm)	Range (gm)	Wing (mm)	Range (mm)	Date
2004	50	433	170-660	92	38-148	22nd
2005	72	356	170-590	73	48-112	17th
2006	87	327	160-630	58	30-118	6th
2007	22	379	290-680	83	54-156	22nd
2008	15	369	260-440	73	44-91	19th

Appendix 2: Locations of grey-faced petrel burrows on Taranga (Hen) Island, 2008

Location	Burrow ID	Comments
A block towards TM 14, west of B block		
Round past large rock	AC1	
B block @ TM 15 (blue tags TM1 – TM10 from B Block to F Block)		
Just below TM1	BC1	
By lunch rock	BT1	
By lunch rock	BT2	
Next to lunch rock entrance	BT4	
Down & left of Main TM15	BT3	Lid
10m above TM3	BC2	
Burrow not marked	BC3	Lid, bird too light
10m up past TM3	BT5	Lid
5m up from BT5	BT6	
Under large rock, directly above BT5	BC4	Tempt out with bag
Labyrinth. "Spongy" area east of B block, below large rock, (to TM 16)		
10m below TM5	LabC1	
On track just past TM5	LabC2	Rock at entrance, roll back
C block – east of TM 16 extending to TM 17		
5m up from TM6	LabT1	Actually in C Block, lid
5-10m up from TM6	CC1	
5-10m above & right of CC1	CC2	
Approx 5m above CC2	CC3	
At TM7, (5-10m back from MainTM17)	CT1	Lid
5-10m from TM7	CT2	
D block – vicinity of TM 18		
Just above TM8	DC1	
At TM8, next to DC1	DC2	
5-10m down from TM8	DT2	Lid
Along track 5-10m from TM8	DT1	
On flat right of main track as it begins to go uphill	DC3	Lid
E block 20m east of TM 18, blue TM		
Approx 10m down from fallen log, under rock arch	ET1	Lid
F block east of E block, TM 20 approx		
Start of block, above TM9	FC1	
10m above FC2	FC3	Bird too small, burrow not marked
10-15m above newly fallen tree	FT1	
Approx 10m up & left of FT1	FT2	Lid
10-15m up & right of TM10	FT3	
10-15m above TM10, go up past FT3	FC4	Lid
5-10m up from TM10	FT4	Lid
Hanging Petrel (HP) site is located on steep, eastern track down to Dragon Mouth Cove camp site (from TM 22 at ridge)		
Only 1 bird located, not worth accessing		
Astelia Knoll (AK) from TM 22 round to south side, blue marker on main track		
Tuatara flat, before Astelia Knoll	AK1	Lid
Beginning of Astelia Knoll	AK2	Lid
Above AK2	AK3	
G block 50m west of TM 26 (Nic's knoll), right around knoll, back to track (most birds on Northern side), blue markers East – West TM1 – TM26		
5-10 m above TM1 on main track	GC1	
5-10m above TM10	GT1	
Gut above TM10	GT2	
Below TM11	GC3	
10-15m above TM18	GT4	
Below TM 18	GC5	Use bag to extract
5-10m above very large puriri, which is TM19	GT3	
Approx 10m below TM19	GT6	
Across ridge/gut from TM19	GC4	

Location	Burrow ID	Comments
Just past TM20	GC7	
10m right of TM20	GT8	
At TM 22	GC6	
5-10m up & right of TM22	GT7	
Approx 15m below TM22	GT5	
Approx 10m below TM23	GC8	
At TM24	GT9	
10-15m down from TM24	GT10	
5-10m right of GT10	GT11	
5m across from TM25	GC9	
Across from GC9	GC10	
Burrow not marked, bird too mature	GC11	
H block – before/below lunch knob (blue markers East – West TM1 to TM7 on main track)		
On main track, under lge puriri, East of lunch knob	HP1	Lid
5m across from TM1 & 5m down	HC1	
Just below main rock, between TM3 & 4	HC2	Lid
7m below TM4	HP2	
15m below TM5, orange trail from TM5	HC3	Under fallen log, lid
Beside TM6, 4m to main track	HP3	
I block - TM 47 junction & moving to north side of Knob (blue markers East – West, TM1 to TM16, leaves weeder track at TM4)		
4m above TM1	IP1	
10m above TM5	IP2	Lid
10m directly below TM5, 8m across from TM6	IP6	Lid
5m below TM6	IC2	
Between TM6 & 7	IP3	
Above & slightly right of TM7	IC1	
6m above TM12	IP4	Lid
4m above TM16	IP5	Round to right in hole
Camp – above and to right of main WB Camp (TM1 – TM11 from above camp up first ridge to TM7, then crossing to track ridge & down to main track)		
Up by bluff	CampT1	
Tree roots, just below TM2	CampC1	
Beside CampC1	CampC2/3	
2nd ridge across from TM2, orange trail	CampC4	
Under karaka, approx 5m up & right of CampC2	CampC5	Lid
Up from TM2, follow orange trail to left from above roots fallen tree	CampT2	Lid
1st ridge across & up TM3	CampC6	
Right & down from TM6	CampT3	Lid
Directly below TM6	CampT4	
Approx 10m above & right of TM6	CampT5	Lid
Below TM8, trail crossing to left, nikau valley	CampC7	
Just below TM10	CampC8	
Just below TM10	CampC9	Used bag to extract
Approx 20m above TM10, left of main ridge	CampT7	
Just other side of ridge from TM10, white flag	CampT6	
At TM11, down main ridge	CampC10	
Wahine Bay track		
Right of pohutakawa on main track, blue marker on track	WB1	Lid
Above main track just before stream crossing	WB2	

Notes

- TM 1 – 35 run from Dragon Mouth Cove to Wahine Bay Junction. Block A – F, plus Labyrinth, Hanging Petrel & Astelia Knob on/to the side of this track.
- TM 1 – 70 run from Wahine Bay to Eastern Point. WB before the junction, Block G – I and Rock Wall after the junction on this track

Appendix 3: Weights, wing measurements and health status of chicks found on Taranga (Hen) I. 2008

Selected √	Burrow	Wgt Oct 19	1st Wgt Dec	2nd Wgt Dec	Wing Oct 19	1st Wing Dec	2nd Wing Dec	Health comments	M-L burrow no.
	AC1		430			181		Too light	
√	BC1		700	800		174	201		6
√	BT1		790	635		210	214		3
	BT2		480			139		Too small	
√	BT4		620	530		196	204		30
√	BT3		630	600		205	223		35
	BC2		700	600		174	178	Too immature	
	BC3		440			224		Too light	
	BT5		560			280		Too mature	
	BT6		400			110		Too immature	
√	BC4		770	760		225	233		7
√	LabC1		610	520		219	228		5
√	LabC2		750	770		196	208		20
	LabT1		700			275		Too mature	
√	CC1		670	600		201	211		16
	CC2		490			166		Too small	
	CC3		520			165		Too immature	
√	CT1		520	560		176	191		32
	CT2		485			158		Too immature	
√	DC1		680	570		178	191		27
	DC2		550	550		258	264	Too mature	
√	DT2		700	620		224	225		17
	DT1		510	440		226	234	Too light	
	DC3		510			168		Too immature	
	ET1		415			185		Too light	
	FC1		480	400		206	212	Too light	
	FC3		440			156		Too immature	
√	FT1		570	530		190	203		22
	FT2		520	460		182	-	Too light	
	FT3		520			150		Too immature	
√	FC4		680	540		193	200		26
	FT4		590			167		Too immature	
√	AK1		650	580		209	220		37
	AK2		560			164		Too immature	
	AK3		560	680		178	178	Too immature	
√	GC1		570	540		189	201		15
	GT1		540	720		255	270	Too mature	
	GT2		420			180		Too immature	
	GC3		310			98		Too immature	
√	GT4		750	750		224	238		40
√	GC5		520	650		191	206		29
	GT3		380			162		Too immature	
√	GT6		580	520		199	218		8
√	GC4		580	590		210	219		24

Selected √	Burrow	Wgt Oct 19	1st Wgt Dec	2nd Wgt Dec	Wing Oct 19	1st Wing Dec	2nd Wing Dec	Health comments	M-L burrow no.
	GC7		680	800		251	265	Too mature	
√	GT8		595	590		226	242		10
	GC6		620	420		233	-	Too light	
	GT7		520			163		Too immature	
	GT5		450			153		Too immature	
√	GC8		600	710		202	220		41
√	GT9		620	570		234	254		1
	GT10		515	470		219	-	Too light	
√	GT11		540	510		229	241		4
	GC9		490			152		Too immature	
	GC10		400			161		Too immature	
	GC11		630			289		Too mature	
√	HP1	410	530	720	76	198	210		39
	HC1	440		460	77		-	Too light	
	HC2	370		580	54		171	Too immature	
√	HP2	420		690	88		199		33
	HC3	320		560	76		186	Too light	
√	HP3	265		640	68		184		34
√	IP1	400	630	630	78	212	225		36
√	IP2	440	500	510	91	221	230		31
	IP6	390	430		68	168		Too light	
√	IC2	410	510	590	88	227	245		11
√	IP3	380	570	560	81	229	245		23
√	IC1	420	700	760	78	230	245		9
	IP4	310	440		69	161		Too immature	
	IP5	260	570		56	173		Too immature	
	CampT1		420			193		Too light	
√	CampC1		720	650		238	242		21
	CampC2		380			143		Too immature	
√	CampC4		620	620		178	186		38
√	CampC5		550	470		174	187		25
	CampT2		490			133		Too immature	
	CampC6		560			174		Couldn't extract at collection visit	
√	CampT3		590	530		175	179		14
√	CampT4		630	590		249	252		12
	CampT5		635			162		Too immature	
√	CampC7		580	550		200	207		19
	CampC8		520			155		Too immature	
	CampC9		590	610		175	178	Too immature	
√	CampC10		650	760		195	203		2
√	CampT7		690	720		201	211		13
√	CampT6		750	660		200	206		28
	WB1	300	610		44	141		Too immature	
√	WB2		710	630		205	218		18

Appendix 4: Transfer, emergence and fledging data for 41 grey-faced petrel chicks transferred to Matakohe-Limestone Is. in December 2008.

Mat. Is. burrow no.	Band	Taranga burrow	Transfer weight (g)	Transfer wing (mm)	Fledge weight (g)	Fledge wing (mm)	First emergence date (pm)	Fledge date (pm)	Emergence period (nights)	Total no. days on Matakohe
1	E277391	GT9	570	254	550	313	10/12/08	21/12/08	12	16
2	E277390	CampC10	650	207	540	314	17/12/08	04/01/09	19	30
3	E277389	BT1	635	214	530	312	15/12/08	27/12/08	13	22
4	E277351	GT11	510	241	530	324	14/12/08	27/12/08	14	22
5	E277388	LabC1	520	228	530	316	10/12/08	27/12/08	18	22
6	E277387	BC1	700	201	560	318	18/12/08	08/01/09	22	34
7	E277386	BC4	760	233	580	321	12/12/08	24/12/08	13	19
8	E277385	GT6	520	218	540	317	16/12/08	28/12/08	13	23
9	E277384	IC1	700	245	580	322	12/12/08	24/12/08	13	19
10	E277383	GT8	590	242	520	305	10/12/08	19/12/08	10	14
11	E277382	IC2	510	245	510	318	12/12/08	22/12/08	11	17
12	E277381	CampT4	590	252	550	322	13/12/08	21/12/08	9	16
13	E277380	CampT7	690	211	550	318	14/12/08	02/01/09	20	28
14	E277379	CampT3	530	179	500	325	23/12/08	08/01/09	27	34
15	E277378	GC1	540	201	540	315	15/12/08	02/01/09	19	28
16	E277377	CC1	600	211	520	325	20/12/08	02/01/09	14	28
17	E277376	DT2	620	225	550	320	13/12/08	26/12/08	14	21
18	E277375	WB2	630	218	540	306	15/12/08	27/12/08	20	22
19	E277374	CampC7	550	207	520	316	16/12/08	02/01/09	18	28
20 #	E277373	LabC2	750	208	-	-	12/12/08	-	-	-
21	E277372	CampC1	650	242	520	318	11/12/08	22/12/08	12	17
22	E277371	FT1	530	203	550	305	13/12/08	28/12/08	16	23
23	E277370	IP3	560	245	530	312	12/12/08	22/12/08	11	17
24 #	E277369	GC4	580	219	510	310	15/12/08	27/12/08	13	22
25	E277368	CampC5	470	187	530	317	16/12/08	06/01/09	22	32
26	E277367	FC4	540	200	550	320	16/12/08	02/01/09	18	28
27	E277366	DC1	570	191	540	308	19/12/08	04/01/09	17	30
28	E277365	CampT6	660	206	550	316	17/12/08	02/01/09	17	28
29	E277364	GC5	520	206	520	313	17/12/08	28/12/08	12	23
30	E277363	BT4	530	204	550	323	15/12/08	02/01/09	19	28
31	E277362	IP2	500	230	540	310	12/12/08	25/12/08	14	20
32	E277361	CT1	520	191	540	314	17/12/08	06/01/09	21	32
33	E277360	HP2	690	199	550	332	18/12/08	06/01/09	20	32
34	E277359	HP3	640	184	550	313	19/12/08	03/01/09	16	29
35	E277358	BT3	600	223	530	313	14/12/08	28/12/08	15	23
36	E277357	IP1	630	225	550	310	12/12/08	28/12/08	17	23
37	E277356	AK1	580	220	550	318	13/12/08	27/12/08	15	22
38	E277355	CampC4	620	186	540	318	18/12/08	03/01/09	17	17
39 #	E277354	HP1	530	210	-	-	13/12/08	-	-	-
40	E277353	GT4	750	238	620	319	10/12/08	22/12/08	13	13
41	E277352	GC8	600	220	540	317	13/12/08	28/12/08	16	16
			Transfer weight (g)	**Transfer wing (mm)**	**Fledge weight (g)**	**Fledge wing (mm)**			**Emergence period (nights)**	**Total no. days on Matakohe**
		Mean	596.0	216.3	541.0	316.2			15.9	23.5
		Standard deviation	74.6	19.9	21.25	58.2			3.9	5.9
		Range	510-750	179-254	500-620	305-332			9-27	16-34
		Sample size	41	41	39	39			39	39

Notes:

- Where birds were weighed twice on the collection trip, the lighter weight was taken as the transfer weight.
- Total number of days on Matakohe-Limestone I. included transfer day.
- Where birds fledged the night after a feed, their fledge weight was taken to be the pre-fed weight on the feeding day.
- Where birds fledged the second night after a feed, their fledge weight was estimated on the basis of the previous pattern of weight loss/gain between feeds.
- 20 # - Died
- 24 # - Died after fledge
- 39 # - This bird was euthanased

Appendix 5: Comparison of (adjusted) data from Grey-faced Petrel translocations over five years (2004 – 2008)

Year	Transfer date	Number	Transfer Weight (gm)	Transfer Wing (mm)	Fledge Weight (gm)	Fledge Wing (mm)	Median Fledge Date	Days on M-L Is.
2004	Dec-01	28	488	219	531	312	Dec-26	26
2005	Dec-03	26	522	195	498	311	Dec-31	28
2006	Dec-08	39	537	224	516	314	Dec-29	21
2007	Dec-15	21	514	242	538	317	Jan-4	24
2008	Dec-05	39	517	216	541	316	Dec-28	24

Adjustments:

- Deceased/missing birds not included
- The adjusted transfer weight was taken as the lightest weight on either the collection day or the day after, as this is most likely to reflect the true unfed weight of the chick. This also allows for a more valid comparison between years as weighing was carried out at different times due to the different transfer methods.
- Where birds fledged the night after a feed, their fledge weight was taken to be the pre-fed weight on the feeding day.
- Where birds fledged the second night after a feed, their fledge weight was estimated on the basis of the previous pattern of weight loss/gain between feeds.

Appendix 6: Grey-faced petrel chick food preparation guide

Grey-faced petrel chick food preparation (Gummer & Bishop, 2004)

1. Wash hands with antibacterial soap.

2. Boil water for up to four 1 litre thermos flasks for food-warming baths.

3. Make up 8 litres of Johnson's antibacterial solution in small bucket
   (1 tablet / 2 litres cold water, so 4 tablets/ 8 litres water).

4. Clean sink/bench area and wipe over with cloth soaked in antibacterial solution.

5. Heat water for cleaning after food preparation (at least two kettles).

   Equipment for food preparation:
   Blenders / knife / spatula / cold (boiled for >3 mins) water / sardines / food containers

   Recipe:
   1 (106 g) tin sardines in soya oil (include oil contents)
   50 ml cold (boiled > 3 mins) water
   Contents of sardine cans: sardines (89%), soya oil (10%), salt (<1%)

   NB Process a mix of only 3 tins of fish (with 150 ml water) in each batch to prevent strain on blender.

6. Place 150 ml cold (boiled > 3 mins) water in blender with 1 tin of fish and liquidize. Add half of second tin (chop fish up in tin) and blend.
   Add remainder of second tin and blend. Repeat with third tin until smooth. Pour mixture into container – 2 or 3 batches (6 or 9 tins) per container.

7. Place food containers in large red chilly bin with three chilly blocks. Food must be kept cool at the colony site (to prevent contamination) and then warmed just before use.
   NB Keep one container out for first round of feeding – transport in small blue chilly bin.

8. Wash out sardine tins in hot, soapy water for disposal.

9. Wipe down blender bases with cloth soaked in antibacterial solution.

10. Remove blender blades and rinse out blender etc. before doing two thorough washes (with the petrel washing-up brush) in very hot, very soapy water to remove all oil. Rinse off detergent before placing equipment in bucket of antibacterial solution for the day (minimum soak period 2 hrs).

Appendix 7: Checklist of equipment to transport to colony site on chick feeding day

Checklist of equipment to transport to colony site on grey-faced petrel chick feeding day
(Gummer & Bishop, 2004)

- 1 container of food (not chilled) for first feeding round, in 1 small blue chilly bin (food-warming bath)
- 1 large red chilly bin containing rest of food containers + 3 chilly blocks
- 2 syringes (50 ml Bovivet plexiglass)
- 2 crop-feeding tubes (6.3 x 140 mm Teflon speed feeding tubes)
- 1 tall jar (for crop tube sterilising chlorhexidine solution)
- 2 rectangular rinse baths
- 1 large lid (for resting loaded syringes on)
- 1 spatula
- 1 container (3 litres) boiled (>3 mins) water for rinsing
- Up to 4 thermos flasks of hot water (food-warming baths)
- Waterproof notebooks (x3) and pencil
- Clean pillow cases (weigh bags)
- Any other supplies to restock e.g. tissues, rubbish bags, paper towels, hand-washing water.

Microshields chlorhexidine (5%) is a pink runny sterilising liquid made into a solution with water:
1 part chlorhexidine to 9 parts water (e.g. 10 ml chlorhexidine to 90 ml water).

At the colony site stored in a bucket should be:

- Castor oil (to lubricate syringes)
- Chlorhexidine solution
- Scales (1000 g and >1000 g Pesola scales)
- Wing rule (400 mm)
- Spare pillow cases
- Spare tissues and paper towels
- Band aids
- Hand-washing water
- Antibacterial soap
- Spare pencils
- Rubbish bags and bin
- Spare transfer boxes

Appendix 8: Grey-faced petrel chick feeding, measuring and monitoring guide

Grey-faced petrel chick feeding, measuring and monitoring (Gummer & Bishop, 2004)

A 3-person team is ideal for a full feeding day: one feeder (concentrating on feeding, food temperature, hygiene) and two handlers.

1. Wash hands (with antibacterial soap).

2. Place first food container in small chilly bin in 1 flask of hot water to warm up. Use clean spatula to stir regularly (even temperature).
   Test temperature on wrist: mixture should be *just* warm (cold mix may be rejected by chick; hot mix may damage chick's internal tissues).

3. Fill two rinse baths with boiled (>3 mins) water.
   Fill tall jar with chlorhexidine solution/water mix and stabilise with chux cloths in flask lid

4. Assemble syringes and crop tubes (hand-tight) and lubricate plunger with smear of castor oil.

5. Complete rounds of all occupied burrows to record fence status (emergence behaviour). NB Don't bother erecting fences at this stage (see 7 below).

6. Process chicks in the following order:
   - Extract chick from burrow.
   - Check nest thoroughly for signs of regurgitation and that faeces are present and normal (dark brown gritty faeces with white fluidy urates, usually seen on chamber walls).
   - Replace lid to keep chamber cool and dry.
   - Weigh (to obtain pre-feed or base weight)
   - Wing length (right wing) if wing measuring day
   - Any other handling (e.g. screening, physical examination)
   - Feed (record amount delivered)
   - Return to burrow (face chick to back of chamber opposite pipe).

7. Search all pipes for any missing chicks (two chicks can be found in one burrow) by feeling inside entire length of every pipe with fence recorded as down. Two people can feel inside pipe from each end, or use long soft stick to feel from entrance end. Fences can be restored at this stage, or at the end of all chick processing.

8. Weigh birds over a surface (to prevent injury if fall from scales). Replace weigh bags as soon as soiled. Keep birds in bags (to keep calm) for wing measuring, removing right wing to measure – gently straightened and flattened to record maximum wing cord.

9. For feeding, load syringe full to an excess of 50 ml, ensuring all air bubbles are removed. The excess allows for 7 ml to be left in the bottom of the syringe after delivery of 50 ml to the chick, important for the sterilising process. Wipe the crop tube with a clean tissue to remove residue food.

10. During feeding, the handler holds the chick firmly on a surface with crop (breast area) unrestricted while the feeder inserts the crop tube to the back and side of the throat (to keep airway clear), stretching the head and neck up at all times. Food is delivered in 50 ml batches (up to 30 seconds delivery time) which allows chick to rest in between loads. Food delivery stops at the pre-determined amount, or earlier if signs of food coming back up throat. Chick is rested briefly, then carried immediately back to the burrow (not in bag) held in an upright position to prevent any regurgitation incidences.

11. After feeding, wipe the crop tube with a tissue and place tube upright in jar of chlorhexidine for a minimum of 2 mins sterilising time. After sterilisation, remove syringe/tube and eject remaining food (<7 ml) in syringe – this is important to remove any disinfecting solution that may have soaked into the food in the tube. Rinse the outside (entire length) of tube through two rinse baths. The syringe/tube is now ready to draw up more fresh food (there should be no air bubbles present).

12. Keep monitoring food temperature regularly (before each chick) and stir with spatula before drawing up food (the thick part of the mix can settle). Remove from water bath if too warm. Towards the end of each batch, get the next batch out to warm up using a new flask of hot water. Thoroughly clean spatula before using in the next mix – rinse off with the pre-boiled water in the 1 litre red-top bottle.

13. On a full feeding day, the syringe barrels need to be rinsed out and disinfected (fill them with chlorhexidine for minimum 2 mins) and rinse baths replaced at least once during the day (twice if very hot weather). Thoroughly rinse syringes with clean (boiled) water before use again.

14. After all feeding is complete, check all fences at burrow entrances are restored. Three thin straight sticks are sufficient, lightly placed in the soil at the entrance so as not to barricade the chicks in!

Appendix 9: Grey-faced petrel chick post-feeding clean-up guide

Grey-faced petrel chick post-feeding clean-up (Gummer & Bishop, 2004)

1. Heat water for cleaning (at least two kettles).

2. Wash hands, then remove food preparation equipment (blender jugs etc.) from antibacterial solution that have been soaking over the day in the small bucket. Rinse equipment under cold tap and air dry.

3. Pour the antibacterial solution from the bucket into the large red chilly bin, ready for soaking the days equipment after washing. Add a further 2 litres of water and 1 Milton or Johnson's tablet.

4. Wipe thermos flasks with cloth soaked in Milton, take off lids and stack on shelf.

5. Discard surplus sardine mixture in the sea (to prevent oiling up drains).

6. Rinse all equipment under hot tap to remove bulk of mixture before doing two thorough washes (with petrel washing-up brush) in very hot, very soapy water to remove all oil. Pass hot, soapy water through tube and syringe, then remove tube and plunger for more thorough washing (put dish-wash liquid in syringe barrel and use petrel bottle brush to remove oil residue).

7. Rinse off detergent before placing in chilly bin of antibacterial solution (minimum soak period 2 hrs). After sterilising, rinse equipment under cold tap and air dry. Discard the antibacterial solution (recommended to change this every 24 hours); fresh solution is made on the next feeding day.

8. Shake out weigh bags and soak in Napisan overnight. Weigh bags from the previous weighing day will need to be rinsed well and hung to dry.

9. Boil water (>3 mins), enough to fill the boiled water container full ready for the next feeding day and to set aside (in a clean/sterilised food container) for use in food preparation on the next feeding day.