

 <p>Agreement on the Conservation of Albatrosses and Petrels</p>	<p><b>First Meeting of the Population and Conservation Status Working Group</b> <i>La Rochelle, France, 29 – 30 April 2013</i></p> <p><b>Guidelines for translocations of surface- nesting albatrosses and petrels</b></p> <p><b><i>Judy Jacobs, Tomohiro Deguchi, Lyndon Perriman, and Elizabeth Flint</i></b></p>
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### SUMMARY

Translocation of albatross chicks or other surface nesting Procellariiforms and rearing them at a new location is a means of facilitating formation of new breeding colonies for restoration of extirpated colonies, enhancing total population size and distribution area, and preventing extirpation where threats exist at the original colony site. A translocation of the Short-tailed Albatross (*Phoebastria albatrus*) in Japan (Deguchi *et al* 2012, *In Press*) provides some guidance for future projects of this nature. This undertaking requires a long-term effort due to the extended fledging period of these birds and their protracted subadult period. Techniques that take advantage of strong philopatry in this Order of birds make this kind of conservation action feasible for restoration and assisted colonization.

### Directrices para el traslado de albatros y petreles que anidan en la superficie

El traslado de los pichones de albatros u otros procellariiformes para criarlos en un nuevo lugar es una manera de facilitar la formación de nuevas colonias reproductoras para restaurar las colonias extirpadas, mejorar el tamaño de la población total y el área de distribución, y prevenir la extirpación donde existen amenazas en el sitio original de la colonia. Un traslado del albatros de cola corta (*Phoebastria albatrus*) en Japón (Deguchi *et al* 2012, *In Press*) brinda algo de orientación para futuros proyectos de estas características. Este emprendimiento requiere de una iniciativa a largo plazo debido a que estas aves tienen un período extendido de abandono del nido y un período subadulto prolongado. Las técnicas que aprovechan la fuerte filopatría en este tipo de aves hacen que este tipo de acción de conservación sea factible para la restauración y colonización asistida.

## **Lignes directrices en matière de translocation d'albatros et de pétrels nichant en surface**

La translocation de poussins d'albatros ou d'autres Procellariiformes nichant en surface et leur élevage sur de nouveaux sites facilitent la formation de nouvelles colonies de reproduction, ce qui permet de recréer des colonies disparues, de renforcer la taille des populations ainsi que les zones de répartition et d'éviter que des espèces ne disparaissent lorsqu'elles sont menacées sur leur site d'origine. Le translocation de l'albatros à queue courte (*Phoebastria albatrus*) au Japon (Deguchi *et al* 2012, *In Press*) offre des pistes pour de futurs projets de transfert. Ces déplacements nécessitent des efforts à long terme étant donné la longue période d'acquisition du plumage et la période subadulte prolongée de ces oiseaux. Les techniques qui tirent parti de la forte tendance philopatrye des oiseaux de cet Ordre rendent les mesures de conservation efficaces pour restaurer et aider les colonies.

### **1. BACKGROUND**

#### **1.1. Translocation as a tool for conservation of albatrosses and other surface nesting petrels**

Birds in the Order Procellariiformes exhibit strong natal philopatry and high nest-site fidelity. These behavioural traits along with a protracted incubation and fledging period and ground nesting habit result in great vulnerability to predation by introduced mammals and commercial exploitation by humans at the breeding colonies. This has led to extirpation of many island populations of petrels around the world and made the consequences of stochastic events such as hurricanes, volcanic eruptions, epizootics, or fires at the remaining safe breeding sites much more important. As the rate and magnitude of landscape alteration due to anthropogenic climate change continue to exceed predictions, the necessity to protect existing populations nesting on low islands has also become compelling (U.S. Fish and Wildlife Service 2012 <http://www.fws.gov/home/climatechange/pdf/CCStrategicPlan.pdf>). Translocation of birds to re-introduce them to former breeding sites or to move them to new sites outside their historic breeding range (assisted colonization) are options considered increasingly more often by conservation practitioners, especially in situations where social attraction techniques are not adequate on their own. Guidelines for evaluating the appropriateness of such actions, planning, implementing, and monitoring them were adopted by the IUCN Species Survival Commission in 2012 (<http://www.issg.org/pdf/publications/Translocation-Guidelines-2012.pdf>) Gummer (2003) reviewed the use of chick translocation as a method for establishing surface-nesting colonies of seabirds and highlights some of the differences between establishing colonies by moving surface nesting species and the more commonly translocated burrow-nesting seabirds.

At least 2 ACAP species, Black Petrel (McHalick 1999, cited in Gummer 2003) and Short-tailed Albatross (Deguchi *et al.* *In Press*) have been translocated as chicks to re-introduce or initiate new breeding colonies. Another 3 have been involved in some aspect of

translocation procedures or artificial rearing for technique development (Laysan Albatross and Black-footed Albatross) or to enhance an existing colony (Royal Albatross). Several others have been identified in conservation planning documents as candidates for future re-introductions or assisted colonization including Northern Giant Petrel (Taylor 2000, cited in Gummer 2003), Black-footed Albatross, and Laysan Albatross (U.S. Fish and Wildlife Service 2011) and on the ACAP website suggesting that it might be appropriate to introduce the Spectacled Petrel to Amsterdam Island and re-introduce the Tristan Albatross to Tristan da Cunha ( <http://www.acap.aq/national-contacts/view-document-details/225-inf-04>).

## **1.2 Colony Establishment in Surface-nesting Procellariiforms**

While some of the conservative behavioural traits of the surface-nesting tube-nosed birds such as high natal philopatry and nest-site fidelity inhibit the acceptance and colonization of novel breeding sites, the strongly colonial inclinations of some of these species allow some of the standard techniques of social attraction (decoys and broadcast of acoustic stimuli) to be used either alone, in combination with each other or to reinforce active translocation of chicks to a new site. Jones and Kress (2012) reviewed 128 projects done for 47 different species of seabirds in most seabird families. They found that translocation of chicks had been most commonly employed in burrow nesting species, most of them Procellarids whereas the family with the most successful assisted colonizations and re-introductions using acoustic and visual stimuli alone were the terns.

Despite their reputation for faithfulness to the natal colony there have been a number of instances of natural recruitment to sites at which albatross nesting had never been previously recorded. Laysan Albatross (*Phoebastria immutabilis*) banded as chicks in the Northwestern Hawaiian Islands have established colonies at numerous several sites on Oahu and Kauai several hundred miles to the South in recent years. Both Laysan and Black-footed Albatross have also initiated colonies off the West coast of Mexico (Pitman 1985; Dunlap 1988) Once pioneers establish nests at a site the social attractiveness of the colony to other prospecting birds increases.

While the the challenges of ensuring site imprinting and the long prebreeding period before subsequent return to the translocated colony for surface nesting albatrosses is prohibitive, if the new colony is distant from the source colony and prospecting birds rarely pass by then the extra expense and difficulty of actual chick translocation may prove necessary to establish a new breeding site.

## **2. TRANSLOCATION OBJECTIVES AND SITE CRITERIA**

### **2.1 Translocation objectives**

Objectives of the translocation action will guide and constrain site selection and source population for the translocation. Restoration or reintroduction projects will likely have fewer unintended consequences than translocation for assisted colonization to novel sites but all efforts should be undertaken only after careful consideration of effects on native species and human activities.

### **2.2 Site Selection Criteria**

The conservation practitioners have the obligation to ensure the translocation site is safe and under a land management regime or conservation easement that provides protection in perpetuity with a management plan in place. It should be:

- A suitable geographic site with respect to topography, access to the ocean, strength and direction of prevailing winds at the site, open runway for take-off and landing, and reasonable distance to adequate foraging grounds, high enough in elevation to preclude periodic inundation from storm waves.
- free of predators and invasive species harmful to surface nesting Procellariiforms or be fenced and regularly managed to control those detrimental species
- surveyed prior to the translocation for the presence of any endemic species (e.g., plants or insects) that could potentially be disturbed by the project;
- a site not likely to be needed for translocation of another population of the same species that is genetically distinct but that may hybridize with the subject population.
- adjacent to a cliff, elevated above surroundings, or relatively free of man-made or natural obstructions to facilitate fledging and arrivals and departures of other conspecifics;
- be relatively accessible to biologists, to facilitate delivery of supplies and monitoring;
- a site for which other conflicting uses (e.g. local fishing, aircraft operations, busy roads, and antennae etc.) have been considered and conflict avoidance measures are feasible.

If other human activities occur in the vicinity of the selected site, outreach should be conducted to inform local residents about the project and get their input.

### **2.3. Regulatory Compliance**

Prior to implementation appropriate permits from all affected jurisdictions should be obtained for capturing and manipulating birds as well as modifying the site. This may include permits from Federal or State level offices. Conditions for captive care of young birds may include permits or a review of appropriate institutional authorities.

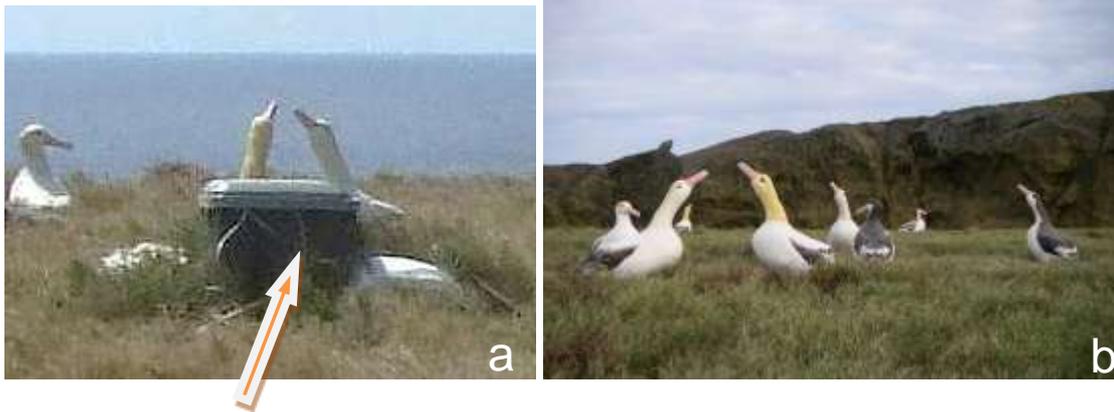
## **3. SITE PREPARATION**

### **3.1. Site preparation.**

Ideally, the site selected for the translocation should already have vegetation structure preferred by the species to be translocated. If there are species of plants that create collision hazards or block the wind and cause over-heating by preventing convective cooling they should be removed.

### **3.2. Social Attraction.**

The recipient site should be prepared with decoys resembling the target species (although perhaps not necessarily as artistic and detailed as the Japanese models (Figure 1b). It is also vitally important to have a sound system (solar-powered) continuously playing species-specific calls from existing breeding colonies.



**Figure 1** (a) Sound system (b) Decoys. Note different decoy poses & plumages

The decoys and sound system serve two purposes: (1) They provide visual and auditory stimuli to the developing chicks, which may allow them to re-locate the site when they attain breeding age; and (2) The calls and visual cues may attract others of the species to the site from a distance, and at closer range, the visual cues may encourage the birds to land. Juveniles that were not reared at the site but have not yet bred, have the potential to increase the population at the new site if they "decide" to breed there and provide additional population enhancement.

## 4. TRANSFER GROUP

### 4.1 Age at Translocation

Age of the chick at translocation is an important variable that needs to be optimized to allow chicks the longest time possible with their natural parents for species imprinting, transfer of gut flora, and expert parental care without losing the opportunity for the chicks to imprint on the translocation site and increase the probability that they will eventually recruit to the new site. Deguchi et al. (*In Press*) selected chicks that were an estimated 1 month of age (at the onset of the post-guard stage of chick development). In addition to thermoregulatory and nutritional benefits, we believe that rearing by parent birds for the first month minimizes the chance that the chicks will imprint on humans, and allows transfer of parents' stomach oil (and possibly unknown species-specific micronutrients or antibodies) to the very young chicks.

For the largest albatross species with very long pre-fledging periods, older chicks (2-3 months) could potentially be moved. The decision to move Short-tailed Albatross chicks at immediate post-guard stage was based on the results of Fisher (1971). His experiments with Laysan Albatross (*P. immutabilis*) indicated that birds moved to a new location just prior to fledging returned as breeders to the site of their hatching, whereas chicks moved (and cross-fostered) at one month of age tended to return to their translocation site for breeding. The selection of the one month age may be conservative, but the extra hand-rearing time must be weighed against the potential of all the effort being in vain if older chicks that are moved end up returning as breeders to their original hatching site.

#### **4.2 Number of chicks in each translocation cohort.**

Two factors important in choosing a cohort size for a chick translocation are genetics and rate of growth of the new colony and the practical limitations of logistical capability and labor to care for the translocated chicks. Since the translocations in this case involve only chicks of long-lived birds it is unlikely that taking any number of the chicks from the parent colony will have an effect on the viability of that source population as it might have if you were moving adult animals. In the first year of the Short-tailed Albatross translocation work (2008), ten chicks were moved. Based on the amount of time and effort required to raise these chicks, they determined that additional chicks could be reared, so 15 chicks were translocated in each subsequent year of the project (2009-2012).

#### **4.3 Number of translocation cohorts**

Translocation projects ideally should span several years to increase the genetic heterogeneity of the translocated population, to accelerate the development of a natural population age structure at the new site, to increase the size of the translocation group within the staff capabilities for chick rearing, and to “spread the risk” associated with environmental stochasticity. The Short-tailed Albatross Recovery Team decided to conduct translocations for five consecutive years, the "bare minimum" breeding age of short-tailed albatross. Full project costs and funding options should be carefully considered prior to initiating a translocation project, to avoid premature termination due to lack of funding and in some cases moving larger cohorts over a shorter duration may be preferable.

### **5. SELECTING, COLLECTING, AND TRANSFERRING CHICKS**

#### **5.1 Selection of individual chicks to be moved**

Chicks selected for translocation should of course appear healthy. However, avoid selection of only the boldest chicks, as this could bias sex ratio. The Short-tailed Albatross Team chose less fearful chicks during 2009 and 2010 because in the 2008 cohort the most timid chicks regularly regurgitated throughout the rearing period. This choice criterion resulted in a bias toward males in the sample. Efforts to maximize representation of different parents from different parts of the source colony in subsequent translocation cohorts will enhance genetic variety of the translocation group.

#### **5.2 Chick Capture and Transport**

Primary considerations for the chick capture and transport phase include reducing chance of injury, stress from unfamiliar stimuli, and overheating in the carrying containers. Chicks on Torishima were captured when their parents were not present. A soft blanket was placed around the chick and it was carried to a specially designed padded transport container (Figure 2 a,b). During pilot work with Black-footed Albatross (*P. nigripes*) chicks in 2007, a much simpler container was used, with no apparent adverse effects (Figure 2 c). However,

the sturdy, opaque padded boxes may reduce chick stress (while maintaining sufficient ventilation), especially during transport by helicopter.

Minimizing transit time seemed to produce better results during albatross translocations in Japan. In a 2007 "mini-experiment" with Black-footed Albatross, Deguchi et al. (*In Press*) found that chicks moved to their new site quickly (within 2 hours) grew a bit faster and were slightly heavier at fledging than those that were held for 24 hours prior to release. This supported their decision to adopt the more expensive option of moving Short-tailed Albatross chicks from Torishima to Mukojima by helicopter (a 2-hour trip) rather than by boat (24-hour transit time). Transport mode for other species may vary, depending of the distance from the source to the new colony. However, stress minimization during transport is a major consideration.





**Figure 2a and b** Specially designed boxes used for Short-tailed Albatross transport. **2c** Simpler container used for pilot work with black-footed albatross.

## 6. CHICK CARE AT THE NEW COLONY SITE

### 6.1 Feeding and Handling Regimen

Feeding began on the day after release, generally following the protocol outlined below. The objective was to mimic the growth trajectory of wild chicks and produce fledglings with the greatest possible probability of survival.

#### 6.1.1 Maintaining sanitary conditions

The results of pilot work with Laysan albatross in 2006 indicated that ***maintenance of sanitary conditions is of utmost importance when rearing chicks***. Mortality attributed to infection in 2 of those birds may have been the result of food handling practices. Food should be kept frozen in generator-powered ice chests. (Solar models are also available). The daily food supply is thawed in clean seawater 3–5 hours before feeding. Pet food and pureed foods (see below) should be kept on ice for transport to the hand-rearing site. At the site, the chilled containers can be warmed to slightly above ambient temperature in 50°C water prior to feeding. Separate feeding equipment should be used for each chick. The Short-tailed Albatross team used disposable gloves for preparing and administering food, and changed gloves between feeding each chick. No feeding equipment was reused without being sterilized. Equipment was sterilized in 70% ethanol and soaked overnight in soap and chlorine solutions recommended for baby bottles (Miskelly and Gummer 2004), then rinsed and soaked in clean seawater prior to use. The short-tailed albatrosses were not fed when it rained heavily because the team could not maintain sufficient hygiene conditions for food and equipment.

### 6.1.2. Capture and Handling.

To minimize stress during feeding approach chicks single-file and minimize noise, a soft fleece blanket can be used to restrain younger chicks during feeding. Weigh and measure chicks weekly prior to feeding. A platform scale is less stressful to chicks than a hanging scale. The body measurements useful for growth comparison with parent-reared chicks include lengths of wing, culmen and tarsus. Deguchi *et al.* (2012a) observed a great deal of variability between the amounts of habituation to handling among the species with which they worked.

### 6.1.3 Diet Composition

The diet fed to the hand-reared chicks should emulate the natural diet when possible and include plenty of variety to account for discrepancies in mineral balance of the diet. It should include supplements to compensate for the effects of freezing and then thawing food in running water or canning the food may have on its nutrient components such as thiamine and Vitamin E. (Chrissy, S. and P. McGill, 1994). Dr. Tomohiro Deguchi and other researchers at the Yamashina Institute for Ornithology formulated a diet for feeding of translocated Short-tailed Albatross chicks. During the first 2–5 days post translocation chicks were given 80–156 g of pureed therapeutic pet food (Prescription Diet a/d™) and 300 ml of lactic Ringer’s solution or physiological salt solution, diluted twice with spring water, daily to facilitate recovery from the stress of moving. Thereafter, chicks were fed darkedged-wing flying fish (*Cypselurus hiraii*), Japanese common squid (*Todarodes pacificus*) canned oil sardine, thawed Japanese sardine *Sardinops melanostictus* and Pacific krill (*Euphausia pacifica*) in the amounts shown in Table 1. The researchers hypothesized that wax esters in krill would increase water repellency of the chick plumage.

Table 1. Composition of diet fed to translocated short-tailed albatross

% Species fed each year	2008	2009	2010
Flying fish ( <i>C. hiraii</i> )	51%	42%	22%
Squid ( <i>T.pacificus</i> )	42%	40%	41%
Canned sardine	5%	---	---
Japanese sardine ( <i>S. melanostictus</i> )			23%
Krill ( <i>E. pacifica</i> )	2%	18%	14%

Chicks also received appropriate amounts of vitamin complex tablets (Mazuri Vita-Zu Bird Tab™, Mazuri Auklet Vitamin™) and 300–450 ml liquid containing 95% spring water and 5% clean seawater daily, for promoting development of chicks’ salt glands.

### 6.1.4 Amount of Food Administered

Chicks were given 300–900 g daily of a mixture of these foods listed in Table 1. according to their daily metabolized energy per unit body mass (840 kJ kg<sup>-1</sup>) estimated from related species (Hodum and Weathers 2003, Philips *et al.* 2003) and the energy density of each

food. For the first 2-4 weeks of feeding, we pureed the food in a food processor to facilitate digestive absorption, adding 1–4 g of Avipro™ probiotic powder to reduce intestinal disorders. Thereafter, chopped or whole food was given. This feeding regime was continued until chicks were about 100 days old (mid-April), when chick body mass was at its maximum. We then gradually reduced the amount of food by 50–66% to reduce chick body mass by 20–30% prior to fledging. Amounts were limited to 100–300 g food and 30–300 ml of liquid every two or three days for 2–3 weeks prior to anticipated fledging.

### 6.1.5 Feeding Method

Short-tailed Albatross chicks were always handled by two persons during feeding, one person restraining the chick, the other administering the food or liquids. The pet food and pureed foods were put into individual empty 350 ml caulking gun cartridges and fed to chicks with a caulking gun, through a silicon tube (internal diameter: 9 mm) inserted down the esophagus. (Figure 3a). We used 450 ml syringes (used for lamb nursing) fitted with a silicon tube (internal diameter: 5 mm) to provide liquid (Figure 3b). Chopped and whole foods were also administered wearing gloves (Figure 3c).



**Figure 3a.** Use of caulk gun for feeding pureed food to young chicks **3b.** Use of lamb-feeding syringe for providing liquids. **3c.** Hand-feeding squid chunks to older chick

## **6.2 Health Monitoring**

In addition to collecting body mass and morphometric data the short-tailed albatross translocation team collected blood samples to compare 9 different blood chemistry parameters with the same ones in naturally reared chicks (Deguchi *et al.* 2012a,b) and to characterize the effects of transmitter attachment and handling on hand-reared chicks. These measures provided insight into health status and body condition of the artificially reared birds indicating better nutritional status in hand-reared birds than those raised by wild parents but evidence of possible muscle damage or capture myopathy in birds handled for transmitter attachment.

## **6.3 Protection**

During a pilot study in 2006 using Laysan Albatross, a number of chicks were lost or weakened during a period of prolonged torrential rainfall shortly after translocation at a site on Kauai. In other climates, extensive heat may be a concern. Thought should be given to providing some protection from the elements (shade or shelter) especially for young chicks. In extremely hot weather, spraying the birds with a fine mist of water may provide relief and protection from heat-stress. This method has been employed at the Northern Royal Albatross colony at Taiaroa Head, NZ, although used primarily during the guard stage (i.e., adult still with the chick).

# **7. POST-TRANSLOCATION MONITORING AND MANAGEMENT**

## **7.1 Monitoring translocated chicks' survival and behavior**

Transferring the chicks of surface nesting Procellariiform birds to a new colony site is just the beginning of a long process of colony establishment that depends on survival of the translocated birds, their recruitment to the new colony site, and the social attraction of other pre-breeding individuals that will accelerate the growth of the colony into a viable population.

### **7.1.1 Satellite telemetry**

Deguchi *et al.* (2012, *In Press*), compared the movements of half the translocated fledglings each year with those of parent-reared fledglings from Torishima, using Microwave Telemetry 22 g solar powered 106 GPS/Argos PTT-100 satellite transmitters. These devices, which comprised less than 1% of the bird's body mass, acquired six global positioning system (GPS) locations per day, at 2 to 4 hr intervals, and transmitted locations via Argos every 3-days. Tracking devices were either Tesa-taped to the back-feathers (Figure 4) or attached by harness with Teflon ribbon. They recommend the use of satellite telemetry to compare the movements of translocated vs. parent-reared birds for at least the first year or two of the project. The number of subsequent years to continue telemetry depends on available project funding.



**Figure 4.** Short-tailed Albatross fledged in 2009 with satellite transmitter observed at sea, October 2009.

One important finding that has recently emerged from Short-tailed Albatross fledgling telemetry work is that all post-fledging mortalities from both Torishima and Mukojima have been females (R. Suryan pers. comm. Table 2).

**Table 2..** Female biased short-term post-fledging mortality in Short-tailed Albatross fledglings satellite-tagged over 5 year period (2008-2012 -- R. Suryan pers. comm.)

	Hand-reared (Mukojima)		Naturally-reared (Torishima)		Result
<b>Survival to sustained flight</b>	87% (27 of 31)		84% (26 of 31)		$p = 0.40 \chi^2 \text{ Test}$
	♂	♀	♂	♀	
<b>Mortality sex ratio</b> [# tagged]	0 [n=17]	4 [n=14]	0 [n=12]	5 [n=19]	$p = .0064 \chi^2 \text{ Test}$

The cause of this extreme female-biased mortality of SAT-tagged individuals is unknown. It could be that the transmitters comprise a slightly greater percentage of body weight of females at fledging. However, the 22g transmitters comprised less than 1% of the mass of any of the male or female fledglings. Other possibilities are that females have a greater stress reaction to transmitter attachment, or that female fledglings naturally suffer greater post-fledging mortality. This differential mortality that may be related to handling stress may be an argument for avoiding the use of telemetry in translocated populations of highly imperiled species.

### 7.1.2 Camera Surveillance

If the translocation site is inaccessible or cannot be manned once the operation is complete a camera system that allows remote access by satellite or collects data that can be retrieved later is extremely helpful for documenting the visits of non-SAT-tagged birds to the colony and observing their interactions with other birds. The Short-tailed Albatross project benefitted greatly from the interest of NHK TV Japan. This TV station ingeniously installed satellite-linked video cameras in the decoy area (Figure 5a) These devices have provided a wealth of information about behavior of the birds and identification of non-translocated visitors. We recommend installing some sort of camera system to capture events that may only occur when humans are not present (Figure 5b).



**Figure 5a** Satellite-linked video camera inside STAL decoy; **5b** Image captured with video camera of male from 2008 translocation copulating with unmarked female 4 years later.

### 7.2 Colony Maintenance

During the translocation operations the chicks being reared served as the strongest attractants to other prospecting birds. The presence of human caretakers interferes with this social attraction somewhat but it is still important and a good argument for engaging in

several years of chick rearing at the recipient site. After the final translocation, the decoys and sound system must be maintained and employed each year throughout the breeding season to attract both returning translocated birds and prospecting birds that fledged from other sites. Using these stimuli to attract the target species is even more important to ultimate success in the years following completion of the translocations, because: (1) the visual stimulation of the chicks will no longer be present to attract new recruits, and (2) the sounds of a breeding colony may provide essential cues to guide translocated birds back to the new colony site. Observations in the Mukojima colony confirm the intense interest that subadult birds have in the decoys and the speakers actively emitting Short-tailed Albatross vocalizations in 2013 (J. Jacobs pers. comm). Documented visits to the site increased between 2008 and 2009 after the sound system was repaired.

Monitoring for hazards such as introduced mammals and dense or deleterious vegetation or insects must be continued and if anything is detected appropriate management of the threat should be undertaken.

### 7.3 Measuring success

Establishment or restoration of colonies of surface nesting Procellariiforms is a long-term commitment and markers of success must be incremental. Milestones that can be quantified include:

- Proportion of chicks that survive capture and transfer to new site
- Proportion of chicks that fledge from the colony
- Body condition of fledged chicks
- Annual survival of translocated chicks
- Sex ratio in chick groups translocated
- Proportion of translocated chicks that return to the new colony from which they fledged
- Proportion of the translocated birds that recruit to the new site
- Number of prospecting birds fledged from other colonies that visit the site.
- Number of those birds fledged from other sites that recruit to the new colony.
- Reproductive performance (hatching success, fledging success) of birds breeding in the new colony.
- Natural recruitment of chicks raised completely in the new colony

The translocation of Short-tailed Albatross to Mukojima Island is the first such conservation action for a surface-nesting Procellariiform bird that has been monitored closely enough to measure these values. Deguchi et al. (*In Press*) reported that all 70 Short-tailed Albatrosses transported from Torishima to Mukojima over a 5 year period survived the trip and that 69 of the 70 chicks survived to fledging. Post-fledging survival of chicks carrying PTTs from colony departure until sustained flight was 85% and not significantly different between hand-reared and naturally reared chicks. Total visits to the breeding colony by translocated birds and birds fledged elsewhere have increased yearly and birds from the first cohort have exhibited reproductive behavior. Between February 2011 and April 2013, 18 of the 69 fledglings (26%)

have returned to visit Mukojima at least once. In late 2012 the first Short-tailed Albatross egg was laid by a naturally reared female paired with a hand-reared bird from the 2008 cohort. The egg did not hatch but this represented reproductive behavior occurring earlier than expected. A well-studied translocation of another surface nesting seabird, the Audouin's Gull (*Larus audouinii*), to a new colony site in order to enhance the metapopulation of that species was deemed a failure because even though survival rates of the translocated birds were comparable to wild birds in the population and there were some social attractants in place at the new site (decoys and non-flighted conspecifics), the neighboring natural colonies proved more attractive to the hand-reared birds and they did not recruit to the release site. The authors attributed this to either the strong attractiveness of adjacent established colonies or some recognition of differences in habitat quality between the new site and established colony areas (Oro, et al 2011). The prognosis for the first completed translocation of a surface nesting Procellariiform bird may be better due to different phylogenetic tendencies in colony establishment behavior between Larids and Diomedeids.

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