

Research on Kanmurijima

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About the Author:

I am Lena Wiest from Germany and am currently staying in Japan on a working holiday in order to improve my Japanese, a hobby I started during university. Besides my love for other animals and interest in mechanisms of life I was hooked with birds especially thanks to a German NGO (Nabu) concerned with wildlife protection. I started to study Biology at the University of Freiburg (Albert-Ludwigs-Universität), a city in southwestern Germany, known for its beautiful environment and for being a "green city". I graduated last year after conducting my graduation thesis in Ecuador, about the social behavior of the endemic, cooperatively breeding El Oro parakeet (*Pyrrhura orcesi*). During my time as a student I also gained some experience volunteering for a NGO in Kenya concerned with the protection of sea turtles and environmental education.

Thanks to the working abroad scheme this is my second trip to Japan which will last a year in total until I have to return in January. I am enchanted by Japanese culture, especially the art of fighting, creating gardens and of painting, fabric and paper. And of course the food is excellent - a reason why I chose Osaka for my stay. But I also prefer the friendly, open manner of the people in Kansai and its vicinity to a lot of great spots in Japan.

Since I plan to work in the biological/nature protection/wildlife management field after my year abroad I wanted to gain more insight into this field even in Japan and to broaden my knowledge on how other countries conduct research. Through Akiko Shoji and her contact to Yamashina Institute's Deguchi-san and Nakamura-san I was able to take part in some ringing with Kansai stationed bander Kozono-san. Through her kind mediation I was also able to meet Sugawa-san and partake in the swallow-banding at Ujigawa (29.7.-8.8.) and the research on Kanmuri Island (19.8.-22.8.).

The following text offers English information about the ongoing investigation on Kanmuri-Island, or Kanmurijima, city of Maizuru in Kyoto Prefecture (冠島; 舞鶴市, まいづるし). Since 1971 a long term study is conducted on this summer breeding site of Streaked shearwater (*Calonectris leucomelas*). The study is sponsored by the Board of Education of the city of Maizuru and conducted with the assistance of the Japan Maritime Self-Defense Force. The ringing survey takes place every year during spring and summer on two 3nights-4 days-investigations.

Apart from translations of existing material on the research I will also give a personal account of my experience on Kanmurijima, hopefully helping future non-japanese participants to enjoy their trip to Kanmurijima.

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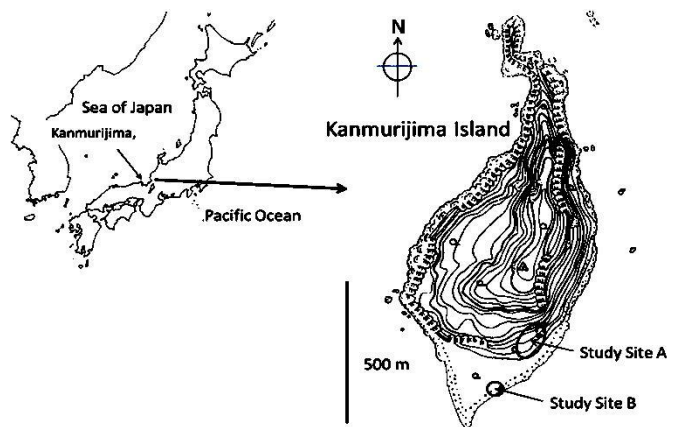
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Information about the Streaked shearwater on Kanmuriijima

(free after Sugawa 2006)

The Streaked shearwater *Calonectris leucomelas* (jap. ōmizunagidori) is a large pelagic seabird inhabiting the Pacific Ocean. Most of the breeding islands are located in the seas surrounding the Japanese Archipelago, an area of high marine productivity. One of the biggest colonies is the one on Kanmuriijima (Oka 2004). After breeding season the birds migrate southwards from their breeding habitats in the northwestern Pacific Ocean towards the equator to winter in Australia and Southeast Asia (Takahashi et al. 2008; BirdLife International 2015). With an estimated number of 3 million individuals the Streaked shearwater is classified as nearly threatened, the population size is thought to be decreasing (BirdLife International 2015).

Kanmuriijima (**Fig 1**, Maizuru city, Kyoto Prefecture) is an uninhabited island ca 23km off the coast of Japan, in the middle of Wakasa Bay between Nariu Cape and Tango peninsula. It spans approximately 1.2km from north to south and 0.5km from east to west with its highest elevation 169m and most part covered by evergreen forest (mostly *Persea thunbergii*, some *Castanopsis cuspidata* and *Ilex integra* (Maesako 1999). The rest



of the island is made of steep rocky cliffs.

Fig 1 Map of Kanmuriijima Island and the study sites (Sugawa et al. 2014)

In 1924 the island was declared as a

Natural Monument and landing is prohibited except for religious and scientific purposes. In 1964 the Streaked shearwater became the official bird of Kyoto Prefecture. A continuous banding scheme was established in 1971 and has been conducted on an area on the southeast tip of the island every year until today.

On Kutsujima, another small island ca.3km north of Kanmuriijima, there is also a small colony of Streaked shearwaters (Sato et al. 2010), as well as nesting sites of Black-tailed gull (*Larus crassirostris*; jap. umineko), Japanese murrelet (*Synthliboramphus wumizusume*; kanmuriimisuzume) (Sugawa 2006b) and Swinhoe's storm petrel (*Oceanodroma monorhis*; himekuroumitsubame) (Sato et al. 2010).

While approaching Kanmuriijima you can observe Streaked shearwater and Black-tailed gulls flying over the sea. While shearwaters fly close to the water surface (in order to calm the sea, their Japanese name translates as "birds calming the sea", nagu = to calm), gulls normally maintain some distance to the water surface and therefore can easily be told apart.

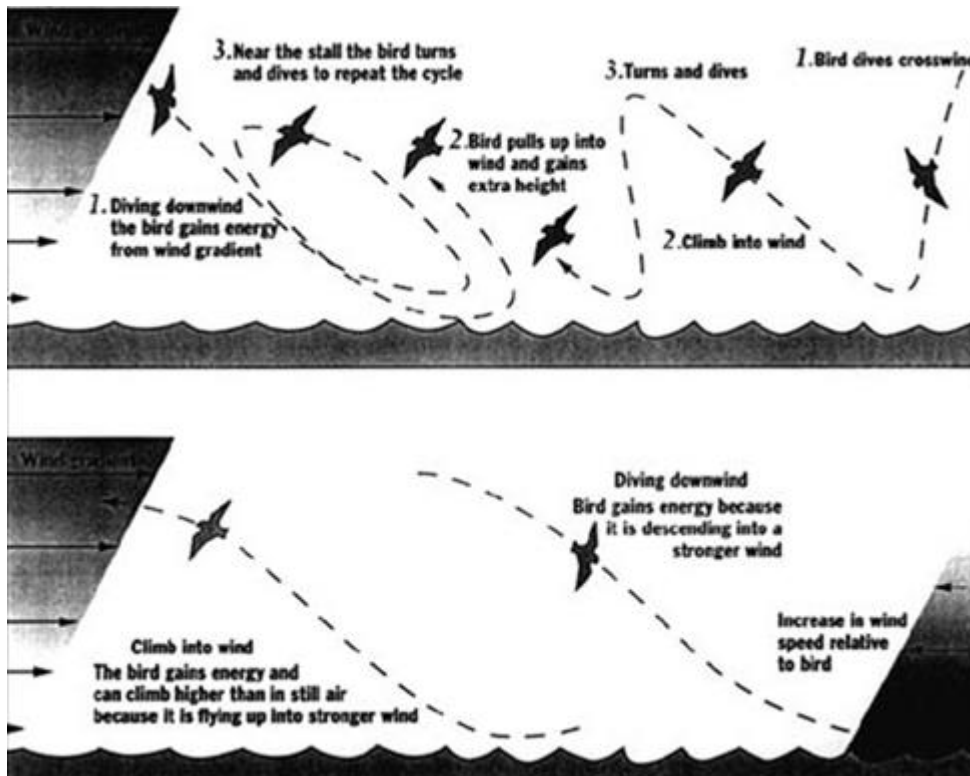


Fig 2 Dynamic soaring.
<http://www.ctie.monash.edu.au/hargrave/fogel.html>

The flight performed by shearwaters, albatrosses and large petrels is called Dynamic soaring (Fig 2). Since over open water there are no thermal upward wind drifts the birds use horizontal winds over the water surface. Because of friction the wind speed next to the water surface is reduced, in consequence creating a wind gradient with stronger velocity in higher altitudes. By turning itself against the wind the bird gains altitude, lifted up by the gradient because the air flows faster over the top of its wings than the bottom. Then it glides back down to the sea, flying with the wind to increase speed. By repeatedly crossing between the air masses of different velocities by using a semicircular flight, the bird is able to increase its speed and to move forward at a very low energy cost.

Morphology: Large bird with long, broad wings. Upper parts darker in mid-brown color, white underparts. Head and neck are flecked white to almost entirely white, extend probably age related (Brazil 2009). Like other Procellariiformes it has a tubenose that connects to a salt gland above the hollow between the eyes (Fig 3). The gland extracts surplus salt to keep the blood salt content balanced.



Fig 3 Head of the Streaked shearwater with typical tubenose

Shearwaters live in colonies and dig ca 1-2m deep horizontal burrows into the island sediment (Fig 4). The density of the holes on an area of 10mx10m about 60 on average, in Kanmuriijima there are theoretically 2000 such squares which makes approximately 120000 burrows.



Fig 4 Nesting burrows, reaching 1-2m into the ground

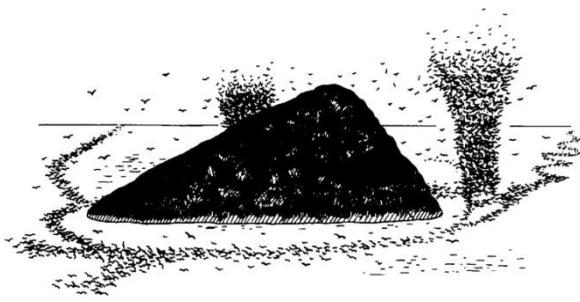


Fig 5 Evening approach to the island including the formation of "bird pillars".

Their diet mainly consists of fish and squid which are gathered on foraging trips to the ocean. In the evening the flock of shearwaters returns from feeding at the open ocean. First, they circle anti-clockwise around the island. After sunset, they form one or two circles and gain height (so-called "bird pillars"), from where they suddenly

Usually they manage to come down not far from their own hole. Despite total darkness they are able to identify their hole not visually but rather by olfactory cues.

Male and female can be identified by their different calls (Arima & Sugawa 2004). Males call with a high, pitched voice (ahah, pipoopi), females with a lower nasal voice (ooah aa, ooah aa). After their return, the island becomes quite noisy (not necessarily so, since there is variation in the number of birds returning to the island per day). The voices settle around midnight, but around 3 o'clock the birds start to scream once more. Then the movement to the jumping point commences. Because of their morphology, they can't easily take off the ground but rather start



Fig 6 Birds climbing up the bark of a tree in order to jump from it.

soaring from an elevated point. As take-off points are used: Cliffs with an opening towards the ocean, places where gaps from fallen trees open the canopy and allow to jump of the slope, as well as long strips of leveled ground where they can perform an approach run before leaping into the air. Streaked shearwaters are famous for being seabirds that are able to climb trees (Fig 6). But there are not many individuals doing so. The trees used for jumping are used every morning, easily identifiable by the scratches the claws left on their surface. Individuals who leave the island early wait for later following birds. They land on the water and assemble in a big group offshore of Kanmuriijima. This behavior is called "foot washing". When joined by the latecomers, they leave for their feeding grounds.

Breeding: The birds return from their wintering areas to the breeding site of Kanmuriijima in late February. They spent March and April to dig and repair their nesting holes. The courting and mating season lasts from early May till late June. Eggs are laid from beginning of June till the middle of the month, each female only laying one egg. After about 53days of incubation the nestlings hatch around beginning August until mid-August. The chicks leave the nest between October and end of November. Since the raising of the nestling takes around 78days, adults spend more than four months for reproduction, from egg-laying until the chicks leave the nest. Since most adult birds start migration early, before their offspring leave the nest, the juveniles head south by instinct, crossing the Kinki region, south of Kanmuriijima. Sometimes juveniles go astray and fall down. They are taken into rehabilitation before they are released back to the sea.

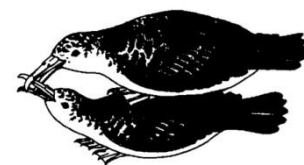


Fig 7 Courting and copulation with male on top of female

Eventually both adult and young birds reach their wintering areas in the Southern Pacific Ocean.

Mating process in more detail: The Male is courting a female while sitting on her and copulating pairs can be seen everywhere (Fig 7). Mating is conducted in the vicinity or inside of the burrow. Simultaneous calls of (fugaa fugaa) and males (piiku piiku) can be heard. Next to the take-off-areas and trees males are lying in ambush and a lot of females with copulating males riding on them can be observed.

Just before egg-laying in the beginning of June both male and female do not return to the island for several days so even during evening the island is fairly quiet. This phenomenon of prelaying exodus in the family of shearwaters is called "honeymoon" and provides time for building up energy reserves. This energy is needed by the female to lay the egg and the male to incubate it. A single egg is laid, if this egg is lost the pair won't attempt a second time that season. The egg is as big as a chicken egg (width diameter ca. 44mm, and length ca. 67mm, weight ca.70g). Since the average female weights about 540g, this one egg makes up ca. 13% of her body weight. Male and female take turns to incubate the egg for 53 days. After laying the egg and incubating it for 2-3 days, the female turns over the incubation to the male who continues for about a week, after that they take turns in a one-week interval (the details about the birds in Kanmuriijima are not yet known). During this time both male and female develop brood patches in the size of the egg. During incubation period there are also individuals without brood patches and which don't take part in building nests. Those seem to be young individuals which do not take part in breeding during this season. After approximately 53 days of incubation the chick hatches (beginning August till mid-August) with an initial weight of ca. 55g. After hatching the chick is brooded for some days until the plumage has dried and the now fluffy ashy-grey chick is able to thermoregulate by itself. Predators of eggs and small chicks on Kanmuriijima are - among others - the Japanese rat snake (*Elaphe climacophora*) and Rats (*Rattus norvegicus*). Since adults with their sharp beak and claws are able to fight off the intruders, the predators wait for their chance should the chick be on its own.

Chicks are fed with small fish, half-digested fish and stomach oil (digested food from their parents' gut). Whether they have been fed on a daily basis can be measured in changes in their body weight. Even though not given food every night, there are also nights where they are fed by both parents. In the middle of September the chick's weight is around 500g and therefore matches that of its parents (ca. 480-680g). By beginning of October its weight is 1.5times as much and sometimes twice as much as its parents. Around this time the parents hardly return to the island while the chick continues its growth with the stored energy and molts from its juvenile down feathers to adult plumage.

In the end of October it gets harder to distinguish the youngsters of the year from adult birds but there are various hints:

- 1) remaining down feathers at the abdomen
- 2) head feathers of adult birds are clearly black and white (pale and streaked) while juveniles' is darker only interrupted by some white rims
- 3) The adults' tube nose is more prominent above the beak than the juveniles'.
- 4) More than anything the bite of the juvenile isn't strong and ferocious like the adults'.

Thanks to the long-term ringing survey on Kanmuriijima and ring recovery reports, it is known that Streaked shearwaters are wintering in 3000-5000km distant southern Pacific areas like the Philippines and Papua New Guinea from December till February (for comparison see also geo logging study of Takahashi et al. 2008). Like other Procellariiformes, Streaked shearwaters also display natal philopatry, returning to and breeding at the same site in the colony for almost all their life (Sugawa et al. 2014). During their breeding season from March till October they stay

near the Japanese coast, undertaking foraging trips predominantly of around 200km (Fig 8 concerning feeding behavior see also interesting study of Ochi et al. 2010).

冠島と標識確認地点(3月~10月)の距離の分布

距離の範囲 [km]	3 ~100	100 ~200	200 ~300	300 ~400	400 ~500	500 ~600	600 ~700	700 ~800	800 ~900
回収例数	2	11	2	2	2	3	0	0	1

During the study a lot of chicks could be ringed. Since catching them in the deep burrows causes a lot of distress the majority of the chicks is ringed just before fledging. During this time the chicks often leave the burrow during night and flap their wings in order to exercise.

Re-catches of individuals ringed as chicks and therefore with known age offer some further insight into the ecology of Streaked shearwaters. As re-catch data shows, birds only return to the breeding islands from the age of 4 years onward (Fig 9). As mentioned before, there are a considerable number of individuals who do not seem to take part in breeding. Speculating, the age when they start to propagate is probably 5 years and older.

The oldest bird re-caught after being ringed 30years prior seems to be 34 years or older, since it was probably 4 years or older at the time it was first caught as an adult.

Fig 8 Number of birds recollected outside of Kanmuriijima during breeding season (March to October) and distance between point of recovery and Kanmuriijima (in km). Shorter distances probably representing foraging trips during breeding season.

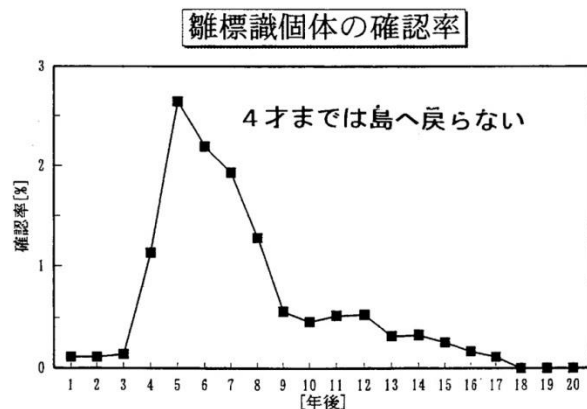


Fig 9 Percentage of re-caught individuals ringed as chicks in correlation to their age at recovery.

What to prepare for Kanmuriijima

We would like to give you some information about the research you are about to participate. The stay on Kanmuriijima will be 3 nights, 4 days.

Things you should prepare for your stay on Kanmuriijima

1. Tent, sleeping bag (if temperatures require it), mat. There will be a tarp for protection against rain but it is recommended to bring your own tarp to prevent damage of your tent because of moisture and rough underground.
2. Water tank (ウォータータンク, at least a 10L-container, can be filled at Maritime Self-Defense Port), additional drinks and food for 4 days. While dinner will be prepared in groups, you need to bring your own food for breakfast, lunch and in between (bento for the first lunch, bread, instant food (f. e. cup noodles), cookies, etc.). Bring a container or cooling box in order to keep your food fresh and save from the rats on the island.
Please prepare 3 gô rice (1 gô = 150g, http://cookpad.com/cooking_basics/5638, 3 gô are about half a kilo, rinse-free/pre-washed 無洗米)
3. Camping gas, cooking tools, mug, bowl, plate, chopsticks and other cutlery you may need, toilet paper for cleaning the dishes, garbage bags.
Food for dinner is cooked in groups. Please contact your group and discuss which items you bring for yourself (like cutlery) and which items you prepare and share in your group (like cooking utensils, camping gas or ingredients for dinner).
4. Clothing:
Raingear
Boots
Sandals
Headlamp + batteries for 3 nights (you need your hands for handling the birds)
Working gloves (ぐんて, “gunte”, made of cotton)
Long sleeved shirts and pants (because of mosquitos and for protection while handling the birds), a towel to protect your neck
5. Toiletries (towel, toothbrush, tooth paste, soap, medicine, etc.)
6. Sunscreen, mosquito repellent, band aid (shearwaters have a sharp beak and claws!)
7. Research tools (camera, binoculars, stationery, etc.)
8. (Other outdoor items you need f. e. swimming gear, sunglasses)
Notice: swimming is not recommended, only needed for bathing. A lot of people visit area near the island on boats and they are not supposed to think that we are there for pleasure.

Useful information about Kanmuriijima and past research

(reading is highly recommended beforehand)

- Homepage of **Kanmuriijima Study Group** (in Japanese)
<http://larus.c.ooco.jp/KANMURI.htm>
- **Manual about the research and handling the birds** (in Japanese, please make a print out)
<http://larus.c.ooco.jp/Sugawa2006OonagiManual.pdf>
- **Basic Explanation about Streaked shearwater on Kanmuriijima** (in Japanese)
<http://larus.c.ooco.jp/Oonagi2006.pdf>

- **Research papers** (in English or English Abstract)
 - http://www.marineornithology.org/PDF/42_1/42_1_11-15.pdf
 - https://www.jstage.jst.go.jp/article/jjo1986/53/1/53_1_40/article/-char/ja/
 - https://www.jstage.jst.go.jp/article/jyio2003/35/2/35_2_164/pdf
- About Kutsujima:
http://www.marineornithology.org/PDF/38_2/38_2_133-136.pdf

Aims of your stay

Summer is the breeding period of the Streaked shearwater. At this time the main task is to band Streaked shearwaters and small birds. Furthermore there will be a count of Streaked shearwaters during evening and early morning.

Goals of the participants:

- | | | |
|---|---|---------------------------|
| 1) Safe handling of Streaked Shearwater | } | everyone |
| 2) Proper banding and recording | | you are encouraged to try |
| 3) Measuring (body size, etc.) | | |

Schedule

Arrival day (August 19th)

8:30 Meeting at the port in Maizuru (be on time, the Navy does not wait)

Briefing

11:30 Landing on Kanmuriijima

Prepare tents

Put up mist nets for small birds

Check area for night banding in 10m-grid area

Daily tasks on the island (for 3 nights)

20:00-23:30 banding Streaked shearwaters in 10m-grid area

3:00-5:00 banding at the rock area where birds come together and fly to the sea

5:00-10:00 Open mist-nets for small birds

Departure day (August 22th)

10:00 Preparation for departure

13:00 Leave Island

15:30 Return to the port

Please keep in mind that you have to arrive early. If you do not have the possibility to travel by car we recommend booking a room in a hotel in Maizuru city and getting there the day before.

So we can all profit from your experience: Please share your survey results, inputs, photos etc. after the investigation. Please submit a report about your experience on Kanmuriijima.

Map of Marine Defense Port in Maizuru, Kyoto Prefecture



Fig 10



Fig 11

How to handle Streaked shearwater on Kanmuriijima

(see Manual about the research and handling the birds; オオミズナギドリ調査マニュアル「手の中にオオミズナギドリ！」の紹介; 須川恒 (Sugawa 2006a))

Print out the 4 pages of the japanese article on a DinA4 page, put it in a plastic bag to see study site and ring numbers according to seasonal year. Add a band to put it around your neck.

In Kanmuriijima birds are banded in an ongoing survey. Catching and ringing takes place twice during a night.

First catching takes place during counting the birds on a ground area which is divided into several squares. This investigation area of roughly 0.6 ha around the island shrine was established in 1987. Each section is numbered so that the position of each bird can be identified during the survey. During late evening the returned individuals on the ground and hidden in the burrows are captured by hand. Individual birds are equipped with serially-numbered metal rings. Still un-ringed individuals are given a new ring, the number of already ringed individuals is read and noted; afterwards the birds are set free.

Again in the early morning birds are ringed while assembling for their take off at designated areas. Here lots of birds appear in a short time and can easily be captured, their ring number confirmed or newly get ringed. They jump off from a cliff in the uppermost corner of the investigation area, starting 3 o'clock in the morning square E4N7 "岩場").

Checking ring number and ringing

Since the birds are strong, there are tricks you need to know in order to catch them and check their ring number and to attach new rings. Please be careful of the sharp beak, claws and the strong movements the birds make. Grasp the bird by its neck with one hand. The bird will start to fight. Secure the head and hold it tight like a ball against your body, immobilizing the wings. To check the ring number, the right hand is needed. Swap the bird into your left hand. Secure head, beak and feet with one hand (see picture **Pic 9**). Check both feet for rings.

The ring number consists of a 3-digit (also 2-digit) guide-number followed by a 5-digit number. The first part of the guide-number stands for the ring size (for shearwaters usually the size 9 was used, but there were also years where 10 was used). The guide-number for the Streaked shearwater on Kanmuriijima can be 100, 090, 091, 092, 9A, 9B, refer to the reference table to know in which year which ring was used (Fig 13, we are sorry that only the old list is included). Even though there are 100 and 090, 091, 092 rings, they are hardly been found and you are lucky if you find a specimen with those ring numbers. Nowadays most numbers will start with 9A or 9B.

Please tell the record keeper the number in three parts as follows: f. e. 9 A-1 23 45 becomes 9 A の 123 の 45 (の= "no"). The record keeper repeats the number.

There are specimen wearing two rings on the left and right leg. Record as double ring (D) and be careful to record right and left separately.

If the bird has no rings tell the record keeper there is a new bird and you need a ring ("atarashi ringu wo onegaishimasu"), attach the ring to the right leg of the bird. For a new ring the record keeper marks N for new bird, followed by the new ring number (last 3 digits) and hands the ring to the person holding the bird. The record keeper should pay attention to keep the numbers in a consecutive order.

Hold the bird in the left hand. While holding the pliers in the right hand, position the ring on the right leg of the bird and with the curved side of the pliers close the ring. You should be able to read the number the way you are holding the. Then by rotating the ring by 90° form the ring to a

round circle with the inner curb of the pliers. Make sure that the ring is closed and no gap is left. Afterwards repeat the ring number to the record keeper.

Beginners can ring a bird together in a team; more experienced people can ring a bird alone. You should be able to handle it after two nights of experience.

If the bird shakes off the ring during the ringing process or if you lose a ring - try to search for it. If it can't be found, note the number of the lost ring.

Apart from that report if the bird made a sound and therefore the sex could be determined. If known, the sex of the caught individual should be noted. Sex differentiation is possible by sound (Arima & Sugawa 2004) and by size (Head size >104.5mm male, >101.5 mm female). If they can be differentiated during ring survey because of their voice other measurements will be taken as well.

Sometimes old rings are damaged or loosened, or the engraved number becomes hard to read. Those rings should be exchanged. Remove the old ring with Opening pliers and get a new ring from the record keeper. Old rings will be kept safe for the record. The record keeper notes as follows: C (for change of ring) old ring number → new ring number

Because 090 and 092 rings were subsequently exchanged over the last years they became limited. 09A rings therefore also include older specimen and not only bird captured since the 1990ies.

After this procedure is over release the bird towards the opposite direction of the research staff and the ongoing investigation.

Ground census

標識 年度	成 鳥		雛	
	標識数	足環番号	標識数	足環番号
1973	4485	09006001~09014000	0	
1974	7859	09022001~09027000 10001251~10009062	0	
1975	3813	09004001~09041000	286	09040458~09041259
1976	2986	09041487~09054950	453	09051034~09054736
1977	2872	09054337~09065600	115	09064384~09066110
1978	1122	09065602~09067750	889	09066111~09067000
1979	1527	09067751~09087402	1150	09088001~09090150
1980	1469	09082001~09091200	1000	09102001~09103000
1981	1638	09087731~09201244	114	09103001~09103113
1982	735	09201251~09202002	24	09103114~09103140
1983	1190	09103131~09208450	509	09103392~09103900
1984	1045	09202501~09209000	90	09104001~09104100
1985	770	09233001~09233776	751	09103981~09105851
1986	923	09233777~09240200	12	09103982~09103993
1987	720	09208715~09253419	313	09103994~09105100
1988	958	09253501~09254574	0	
1989	943	09104293~09A00261	688	09A00262~09A00950
1990	1067	09104801~09A15831	0	
1991	432	09A15484~09A21208	0	
1992	506	09A21160~09A22451	0	
1993	439	09A21301~09A22592	0	
1994	687	09A21414~09A23000	0	
1995	421	09A22874~09A40987	0	
1996	373	09A40988~09A41575	75	09A41576~09A41650
1997	671	09A40649~09A42200	500	09A42201~09A49700
1998	269	09A49001~09A49701	0	
1999	518	09A41086~09A49916	0	
計	40438		6969	

Fig 13 Amount of caught birds and respective ring numbers per study year for a) adult birds and b) chicks

	W5	W4	W3	W2	W1	O	E1	E2	E3	E4	
N7											岩場
N6									E3N6	E4N6	
N5		Q K			W1N5	ON5	E1N5	E2N5	E3N5	E4N5	
N4			W3N4	W2N4	W1N4	ON4	E1N4	E2N4	E3N4		
N3	W5N3	W4N3	W3N3	W2N3	W1N3	ON3	E1N3	E2N3	E3N3		
N2	W5N2	W4N2	W3N2	W2N2	W1N2	神社	E1N2	E2N2			
N1					W1N1	ON1	E1N1	E2N1			
O		W4 O	W3 O	W2 O	W1 O	O O					
S1		W4S1	W3S1	W2S1	W1S1	OS1					
S2											

Fig 12 Grid for ground survey. Numbers of squares are signed on the pole in the southwestern corner, in this picture the left bottom corner.

岩場: place where birds jump off to the sea
神社: island shrine (of the old people, "Oitoshimajinja")

In order to measure the abundance of birds on the island they are counted and banded on a designated area. The area consists of 10x10m grid cells. Squares along two 50m transects are evaluated. From the two transects one heads towards north-east starting on square E1N1, the other towards north-west starting on square W2N2. All corners of the squares are marked with plastic poles, which are visible during night thanks to the attached reflectors to their tips. The number of each square is marked on its southwestern corner pole. There will be a rope helping to find the parameters during night. The survey will start on the south west corner of a square. The record keeper of each team will note the starting time and the number of birds that can be sighted inside a square. Since the research ends in the early morning, time will be counted not in 24h but in 30 hour intervals (example: research starts June 3rd evening and ends early morning the next day: 8:12pm→20:12, 3:15am →27:15). This non-intruding survey will be followed by capturing the birds in the respective rectangle, both birds outside and inside the burrows. It is noted if Individuals were caught on the ground (S, surface) or inside a burrow (B). Check the burrows visually and by inserting your hand. If there is a bird in a burrow catch its head and drag it out of the burrow. If there are two birds in the burrow (sometimes they are copulating) specify the bird lying above (“ue”) and the bird underneath (“shita”). Probably many individuals can't be caught because they cannot be reached in the deep burrows.

From late May until the beginning of June a lot of mating individuals can be found, define the bird above and underneath. They lay one egg, as big as that of a chicken. Both male and female incubate. During this time a brood patch can be found on the abdomen, about the same size as the egg. If the bird has a brood patch it should be recorded as well (see **Table 1 Brodd patch rank**).

There is no big fluctuation in the number of birds, catching on average 0-10 birds per square. But since sometimes there can be 40-50 birds the checking of one square can take time.

Table 1 Brodd patch rank

0	initial status, no brood patch developed non-breeding season or non-breeder during breeding season
10-20	developing stage of brood patch
30	brood patch well developed breeder during egg-incubation
40-50	recovering back to initial status 0

Data processing

Next morning total number of R (including re-caught C- birds) C, N will be counted separately and put into form and check if N (and newly attached rings) are in consecutive order. Old, exchanged rings will be flattened out and attached into the original form with a tape next to their entry. The numbers will be checked at daylight again. By referring to the previous data it is also important to note down after how many years the material is worn down etc. Later the data will be entered into several data files.

My impressions on Kanmuriijima

To reach the island you are able to board a ship of the Japanese navy. This is an experience of its own not to mention that the way between the ship and the island is a trip on fast motor boats. After arriving on the island and setting up your tent under the tarp the area of the ground survey is prepared for the night count. A rope is stretched between the squares on the ground to facilitate identifying the squares that are going to be checked in the dark starting 8 o'clock. The return of the birds to the island around 7 o'clock in the evening is breathtaking. A huge flock circling like a wind pipe before descending down over your head into the forest. Soon after this, the ringing survey is about to start. During ground survey the record keeper starts the observation time for each square, first looking for birds on the ground then starting to check the burrows for hiding birds using your hands and nets to catch them. While paying attention not to break through the unstable ground you'll get dirty pretty fast lying on the ground and reaching into the burrow. If you're "lucky" and a bird is hiding in the burrow you'll soon find out. Be careful of their sharp beaks and claws, even with gloves they are able to inflict some wounds. It won't take long until you'll be able to correctly hold the birds and avoid their weapons. The rings used have an additional clip to securely close them. Burrows with juveniles in it should be marked and not further disturbed. In order to determine whether you have caught a male or a female you patiently wait for them to call out. After a really short night time break, the ringing starts again at 3 o'clock around the rocky area the birds use to jump right off the slope. Suddenly you will be surrounded by a large mass of birds first seemingly fearless. They approach you quietly from behind, strolling onto the rocks and climbing up the barks of the trees around you. But as soon as you catch them at their necks they will viciously fight you off. When slowly the incoming supply of birds fades off and they flew out to the ocean joining the fisher boats catching squid with bright lights, it is time to finally get some rest. During daytime there is other research going on. Apparently rats are a problem on the island - not only for your own food but especially for the chicks in the burrows. To measure their abundance as well as to get rid of them, they are baited into traps and killed. During the first trip to the nesting grounds a dead chick could be found. Not only rats but also snakes are a threat to them. Furthermore, the depth of the burrows is being measured as well as the number of nests occupied along a transect. The inside of the burrow is checked via camera to see if adult birds or chicks are present during daytime. There is also a botanist surveying the possible effect the birds have on their surrounding vegetation. During the stay on the island mistnetting smaller birds is also carried out. There is also some research on the nearby Kutsu-Island concerning bird diseases and their vectors (ticks). During your free time there is also the chance to snorkel which I highly recommend. You will be able to see a lot of interesting fish and squid which display an interesting avoiding behavior. In case of the approach of a potential predator squid position themselves vertically to the surface which radically reduces the chance to spot them (**Fig 14**).

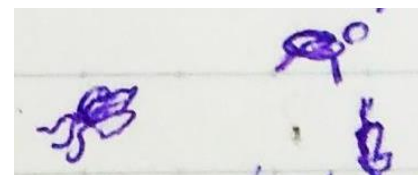


Fig 14 Squid: Normal swimming position and vertical position in presence of threat (swimmer)

So you will definitely not get bored during your stay on Kanmuriijima.

Useful words

Japanese word	Pronunciation (Hepburn)	English expression
オオミズナギドリ	ōmizunagidori	Streaked shearwater
ちょうさ	chōsa	investigation, survey
しゅ	shu	Species
オス	osu	Male
メス	mesu	Female
大人 せいちょう	otona seichō	Adult
ひな	hina	Chick
ようちょう	yochō	Juvenile
すあな	suana	burrow; nesting hole
ふかい	fukai	Deep
くちばし	kuchibashi	Beak
おぼね	obane	Tail
ほうらんはん	hōranhan	brood patch
はね	hane	Feather
つばさ	tsubasa	Wing
せみ	semi	Cicada
スズメバチ	suzumebatchi	Hornet



Pictures

Pic 1 Getting there with the Maritime Self-Defense Force



Pic 2 Kanmuriijima



Pic 3 Nesting area with burrows /preparing for nighttime investigation



Pic 4 Catching and measuring chicks



Pic 5 Investigation during daytime:

a) measuring depth and direction of all burrows in grid W4N5 and b) controlling inside of burrows and contained chicks with a tube-camera (conducted by Karino-san this season)



Pic 6 Evening count of returning birds



Pic 7 Adult bird and chick



Pic 8 Nighttime survey: catching, confirming ring number and ringing newly caught individuals



Pic 9 Correct way to hold a bird in order to read the ring number

Thumb on the back of the head, beak between index and middle finger. Feet between ring finger and little finger. Wings closed and fixed by holding the bird against your body.



Pic 10 Small birds caught with mist nets



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