

Pink Pigeon Management Guidelines: A Personal View



Photo: © John Hartley

Compiled by Gillian R. Stewart



**DURRELL WILDLIFE
CONSERVATION TRUST**
SAVING SPECIES WORLDWIDE

**Durrell Wildlife Conservation Trust
1999**

INDEX

	Page
Introduction	3
1.1 The wild	4
1.2 The captive programme	4
1.3 The release programme	4
2 Accommodation	5
2.1 Breeding aviaries	6
2.2 Single aviaries	7
2.3 Communal aviaries	7
2.4 Free-flights and tropical houses	8
3. Diet	9
3.1 The diet at Jersey	9
3.2 Natural browse	10
3.3 Water	10
4 Breeding	11
4.1 Splitting up the pairs	11
4.2 Suitable breeding accommodation	11
4.3 Pairing	12
4.4 Nesting	15
4.5 Hatching	16
4.6 Teaching parenting	18
4.7 Group size	18
5 Fostering	19
5.1 Fostering facilities	19
5.2 Basic maintenance	20
5.3 The reproductive cycle	21
5.4 Setting pink pigeon eggs	22
5.5 Problems	24
5.6 Creches	26
6 Health	27
6.1 Trauma	27
6.2 Infection	28
6.3 Reproductive disorders	28
6.4 Parasites	28
6.5 Deformities	29
6.6 Lack of flying ability	29
6.7 Pre-export screening	29
6.8 Other health problems	29

7	Handling	30
7.1	Capture	30
7.2	Transportation	31
7.3	Escapes	31
8	Record keeping	31
	Postscript	33
	Products	33
	Appendix	34
	Bibliography	35

INTRODUCTION

Management guidelines for pink pigeons (*Columba mayeri*) were last produced in 1990 by Reese Lind. Since then, various aspects of our knowledge have changed, and for the past couple of years I have been aware that a new set of guidelines were long overdue. This fact was brought home to me on recent trips to Europe and the UK, where I met several pink pigeon keepers (and their birds). Several keepers mentioned that they would like to see a new set of guidelines produced. I was also struck, chatting to these keepers, as to what a personal thing zoo keeping was; most of the keepers had their own way of doing things, and many had experienced problems which I had not experienced. For this reason, I have termed this document- 'a personal view'. I have a set way of doing things, and it seems to work, but I have no doubt that other methods are also valid.

In fact, 'a personal view' is a slight misnomer, since I have had help from several people, not least David Jeggo and Reese Lind, and of course the keepers in the other EEP collections, all of whose knowledge has rubbed off over the years. Kurt Hungden in the Bronx Zoo (Wildlife Conservation Society), and Carl Jones and Kirsty Swinnerton in Mauritius (Mauritian Wildlife Appeal Fund) have also proven to be founts of knowledge. More immediately, Chris Dutton (vet), Ann Tomlinson (laboratory technician) and Candy Gonzalez (veterinary intern) at Jersey, all gave me advice on the veterinary chapter. John Hartley advised me on the original capture of wild birds, and Anna Feistner helped with the editing.

I have also become aware that we still have many gaps in our knowledge of pink pigeon husbandry. Some areas would benefit from the wider experience, and I have mentioned in the text the areas I would most like feed-back on, e.g.- cage-mates, food plants, diets.

Any information received will be incorporated into the next set of guidelines. Meanwhile, it is hoped that this current document is of some use to my fellow pigeon keepers. I have tackled most of the problems that I am frequently asked about, but, please, feel free to contact me if you have any further queries. (I am always pleased to talk about pink pigeons...)

1.1 THE WILD

The pink pigeon (*Columba mayeri*) is endemic to the island of Mauritius in the Indian Ocean. Since its official classification by Prevost in 1843, it has been variously classified in both the genus *Columba* and *Nesoenas*. The monotypic name, *Nesoenas*, is preferred by Baptista *et al.* (1997) in Volume 4 of the 'Handbook of the Birds of the World', because the pink pigeon shows behavioural affinities with *Streptopelia*.

Since its official discovery in 1843, the pink pigeon population in Mauritius has faced a series of misfortunes. Introduced predators (crab eating macaques, *Macaca fascicularis*, black rats, *Rattus rattus*, domestic cats, *Felis domestica*, and mongooses *Herpestes auropunctatus*), nest predation, cyclones, seasonal food shortages, and inbreeding depression, and, most importantly, loss and degradation of habitat, contributed to reducing the wild population to a critical level (Jones *et al.*, 1992). By the 1950s, there were only 40-60 birds left, and by 1976, the species, which once roamed over the whole island, was reduced to a small area of forest in the south-west of the island. The population was believed to number less than 25 birds.

1.2 THE CAPTIVE PROGRAMME

In 1976, a captive breeding programme was initiated for the pink pigeon at the Mauritius Government Aviaries in Black River. The Jersey Wildlife Preservation Trust, now known as the Durrell Wildlife Conservation Trust, became involved in 1977. Sixteen pigeons and several eggs were taken from the wild. Eleven of the pigeons bred and became founders of the captive population. All the pink pigeons in captivity around the world remain the property of the Government of Mauritius.

Four pigeons (three males and one female) were captured in Pigeon Wood in 1976. These four pigeons, ISBN# 1,2, 3, and 4, went to the aviaries at Black River. The female bird did not breed and was thought to be too old. Ten more pink pigeons (5 males, 4 females, and 1 unknown) were captured in Pigeon Wood in 1977 - ISBN# 5, 6, 7, 8, 9, 10, 11, 12, 13. and 14. These also went to Black River, but 3 males and 2 females were sent to Jersey one month later. These five 'Jersey' birds (ISBN# 9, 10, 11, 12, 13) were the start of the European captive programme. The capture of this second group of pink pigeons is the theme of Gerald Durrell's book, 'Golden Bats and Pink Pigeons'.

The first captive bred pink pigeon was hatched in August 1977 at Black River. The first ex-Mauritius chick hatched in Jersey later in the same month. By the end of 1990, the captive population stood at 164 birds in 20 collections. A Population Viability Assessment was held in Jersey in April 1991.

1.3 THE RELEASE PROGRAMME

A trial release took place at the Royal Botanic Gardens, Pamplemousses, between March 1984 and April 1985. Since the reasons for the low numbers of wild pink pigeons was not well understood, it was not thought wise to release birds straight back into their native forest. It was felt that a trial release would be useful in order to examine the methods involved, and that the birds could be easily monitored in the

botanic gardens. Twenty-two birds were released, and nest-building and egg laying was attempted. However, mortality proved too high and the trial was aborted (Jones *et al.*, 1992).

In July 1987, the release programme proper began, whereby pink pigeons were released into native forest (Jones *et al.*, 1992). The site chosen, at Plaine Lievre, no longer contained wild pink pigeons, but was part of their historical range. This area now forms part of the Black River National Park, which was gazetted in 1991. By 1991, the released population numbered 15 known birds, with two young successfully reared by them. By 1994, there were 77 birds in the wild. Things have continued to go from strength to strength, and latest figures indicate a very healthy wild population of c.330 birds.

The majority of the released pink pigeons were released at Pleine Lievre. Recently birds were also released at Bel Ombre, and a new site is now being used at Combo. The small relict population of wild birds at Pigeon Wood has been augmented by released birds which have flown in, although no birds were actually released to this area. Birds are now beginning to migrate between these sites, which should have important benefits to future genetics. The wild populations are still carefully monitored and receive supplemental feeding.

Pink pigeons have also been released onto a small island off Mauritius - Ile aux Aigrettes. This island lacks predators, but also lacks water, and suffers from a high density of exotic doves. As a result, whilst the breeding results are good, the incidence of disease is high.

2. ACCOMMODATION

Pink pigeons can be housed in a variety of aviaries, but three basic housing types are in use in Jersey. Firstly, breeding aviaries which conform to the requirements of a breeding pair. Secondly, small, basic aviaries which are used to isolate a single pink pigeon. Thirdly, other communal aviaries in the zoo where a single pink pigeon, resting between breeding episodes, mixes with other species.

In Jersey, where the winter weather is quite mild, pink pigeons can be housed with an open fronted shelter. However, an enclosed shelter is more useful should the bird need to be locked inside for some reason. Ideally, the shelter should also have some form of heat. Whilst quite cold hardy, pink pigeons appreciate heat if it is available during poor weather. The species does not appear to be prone to frostbite. Pink pigeons have been recorded roosting outside at Jersey in temperatures of minus seven degrees Centigrade without problems.

Pink pigeons also appreciate access to the open air. They like to bask in the sun and bathe in the rain. Pink pigeons which are kept in indoor aviaries develop very dry plumage and tatty tails. Ideally the flight should be planted. Plants are eagerly eaten by pink pigeons, and are useful both for the digestion and as a form of environmental enrichment. In addition, plants can be used as perches, as nest sites, and as a refuge from an aggressive mate.

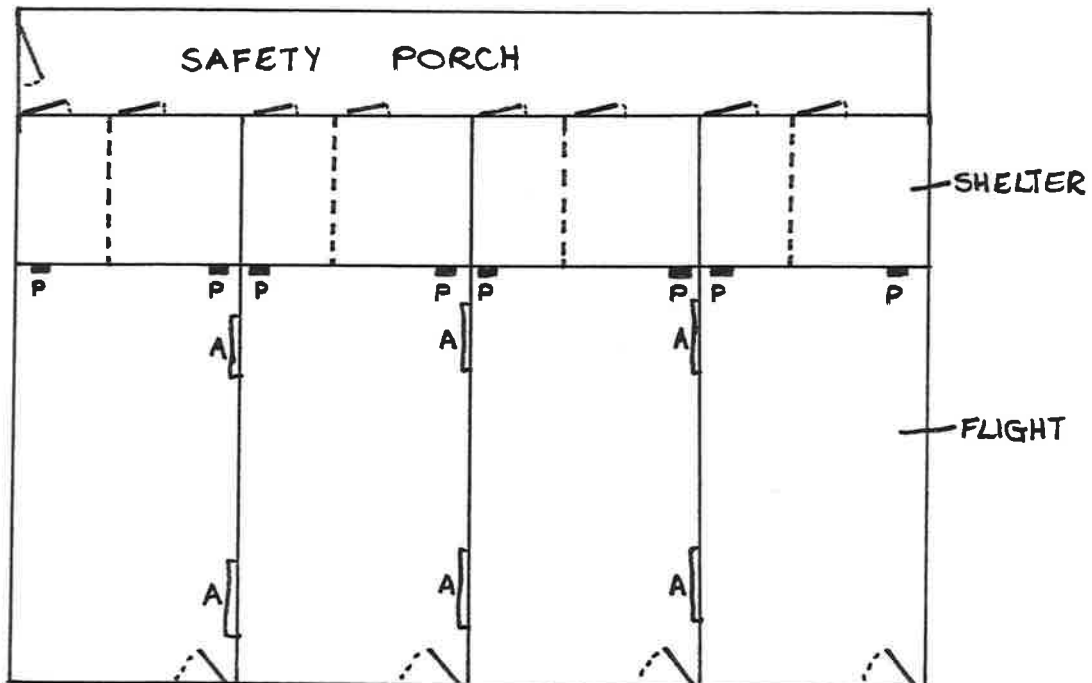
An ideal pink pigeon aviary should have some form of a safety porch. This becomes more true as the aviary size diminishes. Very small aviaries must have a safety porch; pink pigeons frequently fly out of small aviaries when they are being serviced.

2.1 BREEDING AVIARIES

A breeding aviary should be as large as possible, and preferably at least 3m x 6m, and as high as possible (ideally at least 4m high). Pink pigeons can be aggressive during pairing, and small aviaries make it more likely that one bird will kill the other. Also, pink pigeons are less likely to feel stressed in larger aviaries, and hence are more likely to breed successfully. Having said that, I have seen pink pigeons breed in quite small aviaries in some collections. Larger shelters are better than small ones where breeding is concerned. Nest sites should be provided in the shelter (see 'breeding' below). The best breeding aviaries have large well planted flights.

Breeding aviaries should be thoughtfully perched. Too many decent aviaries are ruined by having only one twig for the birds to sit on. This is especially true where breeding pink pigeons are concerned. Newly paired birds often indulge in some chasing, and several perches are needed to ensure that the birds can always fly away from each other. If some of the perches are very small, and only enable one bird to perch at a time, so much the better. Likewise, mating usually occurs on a large horizontal branch in the centre of the aviary, and it is a good idea to supply such a perch.

Figure 1: Typical breeding aviary



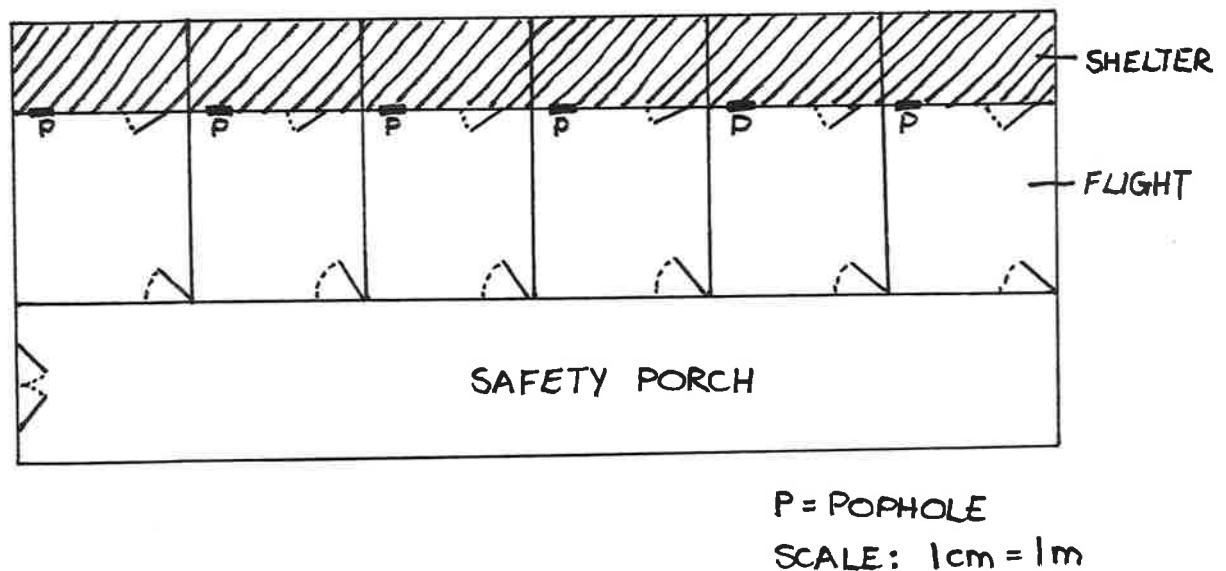
P = POPHOLE
 A = LARGE, ADJOINING PANELS TO GIVE ONE PAIR ACCESS TO TWO AVIARIES, IF DESIRED.
 - - - = TEMPORARY PANEL TO DIVIDE SHELTER.
 SCALE: 1cm = 1m

2.2 SINGLE AVIARIES

Pink pigeons are often housed alone. Pairs should be split up for several months of the year. Young birds need removing from their parents or foster parents at c.2 months of age. Sick birds should be isolated. Pre-export birds should be isolated and checked for good health. New imports should be quarantined. For this reason, it is a good idea to have a set of small basic aviaries designed to hold a single pink pigeon.

In Jersey, we have a row of six aviaries set aside for isolated pink pigeons. (And we could always use more.) Each aviary has a basic wooden enclosed shelter measuring 1.3m x 2.3m, and a small sanded flight measuring 2.3m x 2.5m x 2m high. The aviaries can be easily resanded and reperched between birds. The six aviaries are serviced via a safety area.

Figure 2: Block of six aviaries at Jersey Zoo designed to hold six single pink pigeons



2.3 COMMUNAL AVIARIES

Pink pigeons should be 'rested' between pairing episodes. In Jersey, resting pink pigeons are often housed in communal aviaries. Ideally, such aviaries should be fairly large, to give enough flight room to keep the birds fit. The style of aviary is comparatively unimportant.

The choice of cagemates can be critical. Not all pink pigeons have a placid temperament, and conversely, their confident nature can make them fall foul of the other aviary inhabitants. We have a limited number of species at Jersey, so our knowledge of safe associates is necessarily small. We have found that white eared pheasants (*Crossoptilon crossoptilon*) are not safe to mix with pink pigeons; they frequently kill them. Likewise, we prefer not to mix pink pigeons with Palawan

peacock pheasants (*Polyplectron emphanum*) because a big argumentative male pink pigeon can do them harm if he wants to. We have mixed certain known-to-be-gentle pink pigeons (usually young females) with Palawans, but we always watch them carefully.

Edwards' pheasants (*Lophura edwardsi*) should be safe to mix with pink pigeons, but individuals vary. We have had certain Edwards' pheasants attack pink pigeons, and we have had certain pink pigeons attack Edwards' pheasants. The same is true for Congo peafowl (*Afropavo congensis*). I believe that the trouble usually arises when the pigeon lands on the floor of the aviary, for example, to help itself to food from the pheasants' dish. Any pigeon that develops this habit is asking to be walloped on the back of the head. The problems are magnified if one or other species breeds. Breeding pheasants are more likely to attack passing pigeons. And newly fledged pigeons are going to flutter around on the ground once they fledge.

Other species, such as waterfowl, touracoes, starlings, etc., can also be mixed with pink pigeons. Waterfowl in aviaries tend to be fully flighted, and we do get problems with them wolfing down the pigeons' food. Also they tend to make for muddy aviaries with dirty drinking water. My preference, for ease of management, is not to mix pink pigeons with waterfowl, but there is usually little danger in doing so.

On the whole, this is one area where we could amass more information. If any pink pigeon keepers wish to send us information on both safe and unsafe mixes, we would be glad to hear from them, and will incorporate all information into the next updated version of the management guidelines.

2.4 FREE-FLIGHTS AND TROPICAL HOUSES

There is an increasing trend towards keeping birds in large freeflights, and several EEP participants wish to keep their pink pigeons so. The species certainly does look good in such surroundings, however there are a number of drawbacks. Firstly, I know of few occasions where pink pigeons have successfully bred in a free flight; I believe they have done so in Albuquerque. Usually, the pair choose to nest in some totally inaccessible site, often on a beam under the roof. The nest is invariably flimsy, and all eggs laid fall out and smash. Secondly, catching the birds is often difficult in such situations, thereby making splitting of the pair difficult. Thirdly, the pink pigeons can prove aggressive to the other inhabitants of the freeflight, especially to other pigeon species. (Chester Zoo have a pair which have claimed a whole area of their freeflight as their own territory.)

As an educational tool, pink pigeons do well in freeflights. As a breeding proposition, success is unlikely. Therefore, I suggest only keeping genetically unimportant pairs in such surroundings.

Several zoos (e.g.- Rotterdam) keep their pink pigeons in smaller aviaries within large heated tropical houses. They usually do very well, and breed in such aviaries. I am curious to know whether such accommodation is not, in fact, too hot for the species. Pink pigeons are after all very hardy, and live in cold, damp areas in Mauritius. I am also curious to know whether they are prone to aspergillosis in such hot and humid surroundings. Any feedback would be welcomed.

3. DIET

In the wild, pink pigeons feed both on the ground, and among trees and bushes. Arboreal feeding is preferred. Many species are eaten, the three main plants being *Nuxia vericillata*, *Aphloia theiformis*, and *Erythrospermum monticolum*. Leaves, young shoots, flowers, fruits, and seeds are all eaten. Foraging is most frequent in the early morning and late afternoon.

Nowadays, the wild population is carefully managed, and is offered grain from hoppers at all times. The wild birds, many of them released, appreciate the grain, and visit the feeders readily. Grain consumption decreases when wild food is most abundant, but its provision undoubtedly sees many birds over lean times, for example, after cyclones. The grain also increases the rate of fledging of chicks, so that the wild birds can rear more chicks each season than under normal conditions.

However, leaves are the natural food source, and captive diets should reflect this fact. Some collections do feed a mainly grain diet, with no apparent ill effect to the birds, but one assumes that a pink pigeon's gut is designed for green food, and therefore green food should be included.

3.1 THE DIET AT JERSEY

The pink pigeon diet at Jersey consists of approximately half grain and concentrated foods, and half vegetables and fruit. The whole lot is stirred up and divided between individual dishes, each pigeon receiving a 10cm diameter ceramic dish of food, which holds c.135g of food. Each pigeon has its own food dish, so if there are four birds in the aviary, there are four dishes. In his way, the dishes can be spread around, and one bird can not hog all the food.

I prefer to feed on an ad-lib basis. The old dish of food is not removed until the new dish is being offered. I expect there to be some left over food in the old dish. This can lead to some quite tubby pigeons, especially young, growing birds kept in small aviaries. However, we have never had any problems relating to over-weight pink pigeons. On the contrary, a pink pigeon with a bit of fat on it is more likely to survive any rough patches that it may meet. For example: bullying by a cagemate, illness, a stressful breeding season, etc. If any pink pigeons do appear to be putting on an excessive amount of weight (we had one monster of 450g!), then I move it to a larger aviary where it can take more exercise.

The following ration is enough for 40 - 50 birds. I have not included actual weights, for the simple reason that relative quantities vary with the season, keeper, etc. We use a one litre jug to measure quantities by bulk:

1 jug grain (whole wheat with some whole maize)
1 jug brown breadcrumbs
Half a jug layers pellets
Half a jug insectivorous mixture
c.1 jug apple, diced finely

c. 1 jug grated carrot
1 head celery, diced finely
1 cucumber, diced finely
1 or 2 small handfuls of grated hard boiled egg
1 or 2 jugs of finely chopped leaves - watercress, lettuce, celery leaves.

Each dish of food receives a sprinkling of Neutrabol vitamin powder.

The choices of low calorie celery, cucumber, and carrot are not coincidental, but were chosen specifically to add a non fattening vegetable component to the diet. Other chopped fruits can be added if desired, but most fruits have the effect of making the feed too moist. The pigeons at Jersey seem to prefer the resulting mixture to be of a rather crumbly, dry consistency. Moist food tends to get left.

3.2 NATURAL BROWSE

Planted aviaries are best for pink pigeons. The birds appreciate being able to nibble the leaves, and get good exercise straining to reach them. The pink pigeons at Jersey particularly enjoy Russian vine *Polygonum baldschuanicum*, Japanese cedar *Cryptomeria japonica*, Oleaster *Elaeagnus angustifolia*, and willow *Salix spp.*, and I have seen some pink pigeons in Belgium devouring elder, *Sambucus racemosa*. Curiously, they relish rather leathery, shiny leaves, which one would suppose to be rather inedible, even poisonous. Apparently wild pink pigeons also enjoy rather noxious leaves. The story has it that these leaves taint the flesh of the pink pigeon, with the result that whilst the Mauritius Blue pigeon *Alectroenas nitidissima* was hunted to extinction, the less tasty pink one was less hunted, and hence survived.

A list of plants liked or not liked by pink pigeons has not been compiled. (This is another area where we would like to hear from any pink pigeon keepers with their own experiences.) I have never heard of one being poisoned, and I suspect that their digestion can cope with most things. Usually the plants suffer before the pink pigeons. Fast growing or mature plants will survive better than a precious, young, dainty horticultural rarity.

3.3 WATER

Fresh drinking water should be on offer at all times. At Jersey, the water is offered in a ceramic bowl. The water is changed daily, even though it should still look clean. The dish is scrubbed daily, with a brush kept for the purpose. Each range of aviaries has its own water brush, to minimise cross contamination. Care must be taken that the water dish is not placed under a perch where droppings can soil it.

I like to use a dish that is large enough for the pigeons to bathe in if they wish, although I have rarely seen a pink pigeon bathe in standing water. They prefer to bathe in gentle rain, raising a wing. Young pink pigeon will sometimes jump in and out of their water bowl, but I suspect that this is just inexperience and experimentation on their part; adult pink pigeons never seem to use the water dish for any purpose other than to drink. In fact, pink pigeons that are kept inside with no access to rain develop dry, tatty tail feathers, a condition that is quickly remedied once they are given access

outside. Interestingly, the site of the relic wild population, Pigeon Wood, is the area of highest rainfall in Mauritius.

4. BREEDING

Pink pigeons do not appear to be as easy to breed as many other pigeon species. Putting a male and a female in an aviary will not guarantee success, and several collections have kept pink pigeons for many years without ever hatching a chick. However, take heart, once a few simple rules are observed, pink pigeons are actually quite easy to breed. The difficult part is in successful parent rearing rather than fostering.

4.1 SPLITTING UP THE PAIRS

It seems strange to start a chapter on breeding with a discussion on splitting up the pairs, but in fact splitting the birds is an essential part of breeding. Without it, success will not last long. Pink pigeons must be split up between pairing episodes. Pink pigeons tend to be aggressive towards each other, and are best kept singly when not breeding, however, some pairs will remain peacefully in a cage for years, neither fighting nor breeding. Do not be fooled: they are unlikely to suddenly come into breeding condition of their own accord - they must be separated first, and then re-paired. In fact, a pair of pink pigeons needs two aviaries, not one, and more if chicks are produced.

Ideally, a breeding season will be planned with the birds being paired up in spring for three or four months only, and then separated again. It is possible to pair them up again in the autumn for another couple of months, but not really necessary if the initial pairing has been successful. The birds are better off being rested again until the following spring.

If a collection has several pairs, it is useful to pair each pair a month apart, through the spring, so that eventually all are paired. This is especially so if fostering is envisaged, because it spreads the initial 'glut' of eggs, and thereby there is more likelihood of a suitable foster pair being available when needed.

In the wild, breeding starts in December, peaks in the summer months of January to June, and few or no birds breed between August and November. Breeding appears to be in response to food availability; breeding ceases after a cyclone, when the forest (i.e.- the food supply) has been damaged. In captivity, the pigeons can be bred all year round, perhaps because of the constant food supply.

4.2 SUITABLE BREEDING ACCOMMODATION

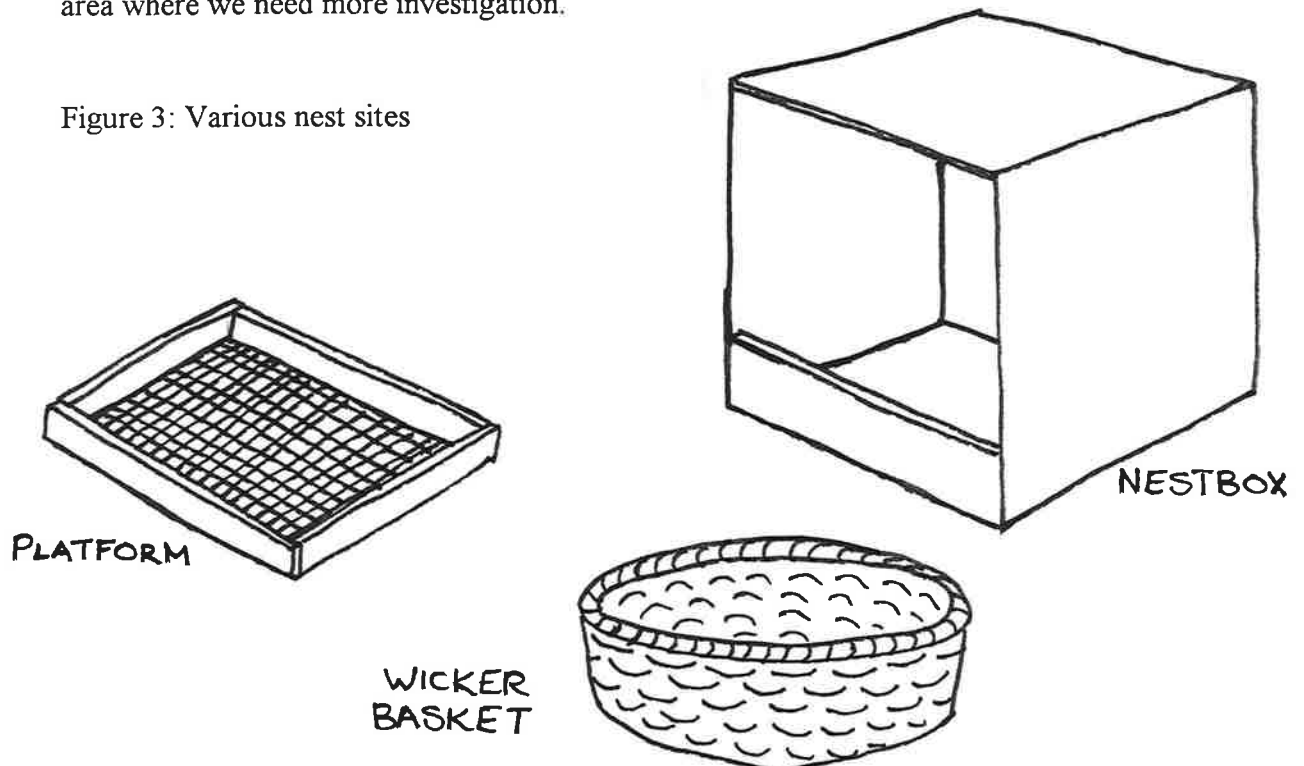
I shall not repeat the chapter on aviary design here, but I shall just recap that a breeding aviary should be as large as possible (within reason). Ideally it should be planted, and ideally the birds should have a shelter for their own use only. Even better, it should be possible to divide the shelter in half, thereby providing separation facilities if necessary.

If other species are cohabiting with the pigeons, they should be excluded from the shelter, because this is where most of the nest areas will be, and other species can easily disturb the pigeons on the nest. In Jersey, breeding pink pigeon pairs often share with Congo peafowl (*Afropavo congensis*) or with Edwards' pheasants (*Lophura edwardsi*). When they share with Congo peafowl, the two species are given a shelter each. When they share with Edwards' pheasants, the pheasants are not given access to the shelter.

The aviary needs to be thoroughly cleaned and 'redecorated' prior to pairing the pigeons. Special attention needs to be given to perching and nest sites. There must be plenty of perching, of various sizes and shapes. Small perches up high which only have room for one bird allow a harried bird to escape its mate. A large horizontal perch in the centre of the aviary is often chosen for mating.

A variety of nests should be supplied. Nests can be flat platforms, open fronted nestboxes, or woven baskets. Different collections have found success with different designs. In Jersey, for years, we have used flat, wire mesh platforms, formed 1cm welded mesh on a 4cm x 1.5cm wooden frame. Size varies from c.25cm x 25cm to c.15cm x 20cm. These, whilst liked by the birds, have a severe design fault - eggs and squabs are easily knocked off the platform. Open fronted boxes (25cm x 25cm x 26cm), are sometimes chosen by our pairs. In Rotterdam these are used almost exclusively by their birds. In Mauritius, locally made deep woven baskets are used with great success. We tried these in Jersey in 1998, but all the pairs ignored them, preferring their old flat platforms. I suspect early conditioning has a lot to do with the birds' choice. Perhaps, if no choice was offered, but only baskets, for example, all the birds would happily use the baskets. Experimentation is always useful, and this is one area where we need more investigation.

Figure 3: Various nest sites



At least three nest sites should be supplied, as the pair often begin to nest on a second nest while the first still has a chick. The birds often choose to build their own natural nest in a bush, and these flimsy affairs are usually unsuccessful.

Access to the nests is important. Suitable perching around the site will enable male and female to enter and exit the nest without mishap. This is an area that has not yet been well studied in pink pigeons. However, in crowned pigeons, *Goura sp.*, the perching around the nest has been found to have an influence on egg breakage (King *et al.*, 1995).

All nest sites should be emptied of old nesting material, cleaned, and disinfected before pairing. There is a school of thought that believes that leaving the remains of an old nest will give the new pair a head start when nesting. In fact, such old nests are possibly dirty and full of germs, resulting in a large number of dead embryos. Nest building is also an essential part of courtship.

4.3 PAIRING

It goes without saying that birds for pairing must be in good physical condition. They should be of good weight- at least 300g for males and 280g for females. Both birds must be able to fly well. In addition, both should have their toenails trimmed if necessary; over-long nails can puncture eggs.

Once the aviary is ready, the pair can be introduced to it and to each other. This is where a divided shelter comes in handy. In aviaries such as this, the usual practise is to lock one bird into each half of the shelter. The birds have good visual access to each other through the wire mesh partition. The two popholes to the flight are opened but have wire mesh on them. This allows the birds to see the flight, obtain fresh air, and to orientate themselves.

After about three days, one bird is given access to the flight. This is usually the female, because she is usually the one to be attacked. However, in pairs where the female is known to be aggressive, the male will be given access to the flight first. By giving the subordinate bird first access, it learns its way around (for quick escape), and also hopefully will have a slight territorial edge when the dominant bird is introduced.

After about a week, at a time that suits the keeper, but preferably some time in the morning, the male is also given access to the flight. The keeper should set aside some time to watch the pair at this crucial stage. Sometimes the second bird will come out immediately. Often it remains inside until the keeper has gone (they seem to know when they are being watched). If the second bird does not come out, the keeper should aim to return every half hour. If by the end of the working day, the bird is still inside, it is wiser to shut the pophole and try again tomorrow.

In any event, once the birds are finally mixed, there should be some sort of a reaction. Often one bird instantly attacks the other. Conversely, they often mate immediately. More often the pair spend about ten minutes eyeing each other up. Usually one bird starts to follow the other. As one bird flies to a new perch, so does the second. The first then flies again, followed by the second, etc. This gentle chasing needs to be

watched, because whilst chasing is an essential part of pink pigeon breeding behaviour, there is a fine line between courtship chasing and aggression. If real aggression is observed, with fast chasing, pecking, and wing hitting, the birds must be split up immediately.

Hopefully, the male will attempt to bow and coo display to the female whilst gently chasing her, and likewise, hopefully mating will follow. The female crouches down to stimulate the male to mate, a signal which he sometimes ignores. The male may gently peck the female. This appears to stimulate her and is not to be confused with aggressive pecking. Mating and chasing can continue on and off all morning, and the keeper needs to check the pair at regular intervals. Pairs which have mated and appear happy can fall out during the day. Indeed, a close eye should be kept on the pair for at least the first week after pairing.

Aggression can sometimes be detected by the sound of wing clapping from an aviary. I have often heard this noise, and rushed around to the aviary only to be confronted by two perfectly innocent, peaceful pigeons. But, do not be fooled - the aggression usually starts again as soon as one turns one's back.

In some cases a pair are mixed, no aggression occurs, but neither does any courtship. These pairs can safely be left together. They should start to show signs of reproduction within a week or two. In occasional cases, such birds do not breed at all, usually because of some external factor. For example, the birds may have been paired up too late into the autumn and winter months, or one bird may be too old and not in breeding condition. Where there is absolutely no sign of breeding after two or three weeks, the pair is best split, and an attempt made later in the season.

Once a pair are deemed safe enough to leave together, the internal partition between the two halves of the shelter should be removed, and they should be supplied with a large pile of suitable nesting sticks, scattered around the aviary (see below). This must be supplied immediately, because twig carrying and nestbuilding is an essential element of successful courtship.

Pairing can also be achieved in an aviary which does not have a shelter which can be divided. In this case, I usually shut one bird in the shelter and the other in the flight with mesh in the pophole and a convenient perch either side to enable the birds to have a good look at each other. After a week or so, the mesh is removed, and the pairing process is undertaken as above.

One sometimes encounters problem pigeons whose nature is so aggressive that they prove very difficult to pair. In this situation there are a number of tricks that can be tried. Firstly, the non-aggressive bird should always be given first access to the flight to enable it to establish a slight territorial edge. However, this is usually not enough for very aggressive birds.

The next step is to try and pair the bird to a different mate (with studbook approval). Aggressive birds do best if paired to equally aggressive, dominant birds. When no other equally aggressive bird exists, another trick is to mix the male with two females. This tends to deflect him slightly, because he can not keep up a concerted attack on

both birds. Hopefully he should pair up with one of them, in which case the second female will need removing pretty smartly or she runs the risk of being attacked by both birds.

When all else fails, radical treatment can be attempted. Both birds can be dumped together in a strange aviary with no time to get to know it. This sometimes unsettles the birds just enough to prevent them attacking each other.

4.4 NESTING

Once the birds are successfully paired, nestbuilding should start immediately. The male chooses the nest site, and displays on it to attract the female to it. Ideally, he will have chosen a safe site in the shelter. Signs of nest building may occur within a day of pairing, and the nest can be built quite rapidly. The first egg is often laid within a week of pairing. Nesting material must be continuously supplied throughout the breeding cycle, at least every few days. Even when loads of old twigs are lying around the shelter, fresh pliable ones will be preferred.

The male supplies the nesting material to the female, and the female constructs the nest. In the wild, nests are constructed quickly, often within a day. In captivity, the process often takes two or three days. The favourite twigs appear to be very fine birch twigs, under 1mm in diameter and broken into lengths of about 10 - 20cm. If a handy birch tree can be found, enough freshly fallen twigs can usually be found under the tree. Birch is not essential, however. Any fine pliable twig will do. Jones reported that the twigs of privet, *Ligustrum robustum* were the commonest nesting material in wild birds. (In fact, the privet used as a common hedging plant in Europe, *Ligustrum ovalifolium*, is a different species than the Mauritius one.) Presumably several other species could also be popular. Jones also reported that most of the nests constructed by the relic wild population in Pigeon Wood were in trees of the exotic *Cryptomeria japonica*.

The female will usually start to sit on the nest two or three days before laying. Nesting pink pigeons are incredibly easily disturbed, and all effort must be made not to disturb them. Ideally, the chosen aviary will be slightly off the beaten track as regards servicing by staff. The daily routine should be strictly adhered to. The birds are easily stressed by new keepers, or changes in routine. Servicing of the aviary should be kept to a minimum. I change the water first thing in the morning, and check that the birds are alive and well. Fresh food is delivered mid morning, and the nest is also checked at this point. Usually checking the nest is purely visual; eggs on a wire mesh platform can often be seen through the sticks, from underneath. No other servicing is done during breeding. Cleaning is kept to a minimum, and is in accordance with the pigeon's laying cycle. Excessive noise around the aviary - building work, gardening machines, etc, should be avoided whilst the birds are sitting, if at all possible.

Hopefully, the pigeon will lay her egg in the nest, and will remain incubating it. Incubation starts from the first egg. Eggs that are laid off a perch and found smashed are invariably the result of disturbance. It is also possible that many eggs which are candled and deemed infertile, were, in fact very early dead embryos caused by disturbance when the pair started to incubate. Most authors state that the male

incubates by day and the female by night. This is usually so, but I have seen variation, and often both birds sit together on the nest.

If fostering facilities are available, it may be decided to remove the egg for fostering. If this is the case, it should always be replaced by a dummy egg, even if the birds are not incubating. The second egg should be laid two days later, although females do sometimes lay one egg clutches. If this second egg is also removed for fostering, a dummy need not replace it, since the dummy from the first egg is already in the nest. Every effort should be made to encourage the birds to incubate. This involves continuing the regime of peace and quiet. Twigs should still be supplied on a regular basis. The pair will add to the nest continuously throughout incubation.

We use a plastic dummy egg designed for domestic pigeons and measuring c.40mm x 30mm. Such eggs are usually obtainable in pet shops. I have also seen wooden and porcelain dummies used.

Most pairs will incubate a dummy egg quite happily in lieu of their two real eggs. However, I have encountered at least one female which would automatically cease incubating once a dummy was introduced. Such birds should be left one egg of each clutch.

I suspect that the first two or three clutches of each pairing are crucial to the future nesting behaviour of the pair. The birds must be encouraged to incubate from the start, for they rapidly get into the habit of not incubating if the eggs are continuously pulled and no dummy substituted. In fact, when a young pair of birds is being bred from for the first time, it may be wise to leave them the first couple of clutches, even though there is a high chance of failure.

Both dummy eggs and real eggs are easily knocked out of the nest, at least when flat platforms are being used. Incubation will cease once the egg is lost. Some collections report that their pairs refuse to incubate beyond about three days, even when the egg is still in the nest. I suspect this may be due to disturbance. I also believe that continuous nest building during incubation is a stimulus, and that failure to keep up a supply of twigs may be a factor in some cases.

If the birds are incubating their own egg or eggs, they might be candled during the incubation period. This will advise you on the fertility, but the resulting stress to the incubating bird may be counter-productive in the long run. I suspect that waiting the full 14 days to see if anything hatches is a safer option. Even if the egg proves infertile, the experience of sitting on a real egg full term will be a good lesson for the pair.

4.5 HATCHING

After 14 days, if the egg is still in the nest and the pair still incubating, a hatch can be expected. Pink pigeons being what they are, this is quite a rare event.

In fact, fostering can be useful when parent rearing. I would recommend pulling both eggs for fostering, leaving the parents to incubate a dummy egg, and then returning the real egg to the nest just prior to hatching if the birds are still incubating tightly. In this

way, many fertile eggs can be saved whilst the dummy eggs are knocked out of the nest. The quandary arises when the moment comes to return a healthy, point-of-hatch egg to a nest. The temptation is to keep it in the foster room where it stands a very good chance of hatching and being reared successfully. But, really, it should be returned to the parents; pink pigeons are no longer so very rare in Europe that we can not afford the loss of one chick, and every effort must be made to parent rear.

Once the egg hatches under its natural parents, it is in great danger. Perhaps 90% of all parent hatched squabs die within the first three days. The top three causes of death are not being fed, not being brooded, and falling out of the nest. Being flattened by the parents comes a close fourth. Parenting is a skill which requires some practise, and with initial hatches, feeding and brooding the chick may not come naturally to the parents. Chicks which are found cold and lifeless under a nest may still be alive if placed back under a bird (either their parent or a foster) and warmed up. Sometimes the fall results in internal damage as well, and the chick may not survive. Some chicks found dead under a nest actually died of other causes and were knocked from the nest post mortem.

Failure to feed a squab may not be the fault of the parents. Very weak chicks are unable to beg for food. Chicks sometimes hatch with their yolk sac not fully absorbed, and these chicks are doomed.

It is worth checking the chick at an early stage. I have had parent birds brood a chick for three days before checking and discovering that the chick had actually died on the first day (but at least they proved keen to brood!). It is useful to check that the parent birds have fed the squab. The imbibed crop milk is easily visible through the skin of the crop. Pink pigeon parents have often been recorded to brood but not to feed the chick, although this may be a result of the chick being too weak to beg and feed rather than parental neglect. Great care must be taken whilst checking the nest. The adults may either leave the nest in great hurry, accidentally taking the chick with them, or they may try to beat the intruder with their wings and damage the chick instead.

If all goes well, the adult birds should brood their chick constantly for the first week. Thereafter, they leave it unattended for longer periods. At this stage, the young chick is not always able to maintain its body temperature, and some additional heat in the aviary is often beneficial. After 21 days it can be expected to leave the nest. The chick will spend much time on the floor initially, still being fed by its parents. If possible, the chick should be kept locked into the shelter at this early stage, whilst still allowing the adults access to the flight via a raised pophole.

When the chick is approximately two months old, the parents are likely to turn on it and attempt to chase it from their territory. It must, of course, be removed at this point. The adults are then likely to nest again, if they have not already done so. Frequently a pair will lay and start to incubate on a second nest before their chick has fledged. This is usually not a problem; they should still return to feed their chick.

4.6 TEACHING PARENTING

In Mauritius, where many pigeons are raised each season both naturally and by fostering, efforts are made to teach the pigeons how to parent. When a pair of pink pigeons are due to hatch their first squab, they are watched meticulously. If the squab is not fed by its parents, it is removed to the foster room where it is swapped for a pigeon squab that is about three days old and feeding well. This second squab, when presented to the pink pigeon pair, is more likely to stimulate feeding by its more vigorous calls for food. Meanwhile, the first, unfed chick is receiving some food from the fosters. Apparently, chicks up to about one week old can be substituted in this manner, but once the quill feathers start to grow it is likely to be thrown out by the adults. The real chick can be returned when the parents have learnt how to feed it. Naturally, the substituted chick may also need to be returned to the foster room if not fed, and yet another chick substituted.

This method requires a good supply of pink pigeon chicks at any given moment, and is probably unsuitable for most collections, however, it also works, apparently, if domestic pigeon chicks of the right age are substituted. There is a potential disease risk when using domestic pigeons, however. Domestic pigeons can carry certain pathogens to which they remain resistant, whereas exotic species may be susceptible to such diseases. This is especially true in the case of an isolated island species such as the pink pigeon.

Once a pink pigeon has learnt how to parent, it should be able to do so again and again. Likewise, young first time breeders are more likely to parent successfully if they are paired to an experienced breeder.

With some young birds, there appears to be no hope. From the first egg they make poor nests, and refuse to sit on egg or dummy. But all is not lost. We have had such birds which do go on to parent successfully. The main thing is to leave the dummy in the nest, even if the nest is poor, and the birds show no interest. It can be removed after about three days of total unattendance.

4.7 GROUP SIZE

Pink pigeons in the wild appear to be less aggressive to each other than they do in the confines of captivity. Roosting at night is usually at communal sites, although birds can roost singly. By day, the individuals disperse widely in search of food, often up to 6 or 8km from their roost site. The birds forage either singly, in pairs, or in family groups. Loose concentrations of pink pigeons occasionally develop at a particular food source. Breeding pairs hold a territory, and either male or female will repel all intruders. Territories are announced by both a cooing display by the male, and also by a wing-clapping flight display, similar to that seen in the woodpigeon, *Columba palumbus*. (This flight display is, naturally, not observed in the confines of an aviary.)

5. FOSTERING

Fostering has proved a vital tool in the management of the pink pigeon, both in Mauritius and in Europe and America. Even when parent rearing is the objective, fostering can prove an important tool in getting the parent birds to the hatching stage. A brief glimpse at the studbook confirms the importance of fostering, the vast majority of birds in the EEP having been fostered. In Jersey alone, c.90% of all chicks hatched were hatched under fosters; the percentage of chicks actually reared to fledging by fosters must be even greater. In fact, even when the intention is to maximise parent rearing, the breeding season at Jersey is definitely 'won or lost' in the foster room. For this reason, the fostering facilities deserve great attention to detail.

5.1 FOSTERING FACILITIES

In Jersey, we are fortunate to have a small room devoted entirely to fostering pink pigeons. Most collections do not have such a facility. Many zoos utilise a few pairs of doves behind the scenes, or a communal aviary of doves on show to the public. Some collections have no fostering facilities at all.

The foster room at Jersey was built in 1986 and has been in continuous use, unmodified ever since. In fact, if I were to rebuild the room again, I would make a couple of minor alterations, and these I shall mention as I go along. The room contains 14 small cages, in two tiers, each containing a pair of white Barbary doves, *Streptopelia 'risoria'*, (commonly known as Java doves).

Each cage measures 85cm x 60cm x 60cm. If space allowed, I would advocate a slightly larger cage size. The current size is adequate for a pair of doves, but becomes rather overcrowded when a large, fledged pink pigeon is also in residence. The cages are made of easily washed 'Darvic'. Each cage has a 20cm x 21cm x 22cm open fronted nestbox hanging in a top corner at the rear of the cage. There are two perches of 2.5cm diameter doweling, at right angles to each other, and at different heights. Both nestbox and perches can be easily removed for cleaning purposes. The door of each cage measures 38cm x 38cm, and all feeding, cleaning, etc, is via this door. This works fine at most times, but pink pigeon poults are very scatty and have a tendency to escape through the door during servicing, often with disastrous results. A smaller door, and a cleaning tray at the base would be more useful at such times.

The room itself has a sink with hot and cold water on tap, and a storage cupboard underneath. A small table serves as a worktop. The room is fitted with an extraction fan, a useful tool to keep down the copious amounts of feather dust that the birds produce. A small electric heater is kept running on a low thermostatically controlled heat throughout the year, even in hot weather. This is important, since it maintains a constant background temperature which can prevent young chicks from chilling, and promotes a good growth rate. Two fluorescent tube lights are kept on a time clock, which extends the day length to a 12 hour period throughout the year. One of the two lights is fitted with a day-glow strip light, to simulate sunlight. Large windows run along one wall. These are opened at the top, with a grille of mesh to prevent escapes. In fact, these windows can prove lethal to young pigeons which have been known to hurtle with speed out of their cages and straight into the window. (For practical

reasons, it has not proven possible to cover these windows with mesh.) The floor is smooth and slopes to a drain. It is regularly washed by pouring a bucket of hot water and disinfectant onto it, and squeegeeing excess water to the drain. This process adds a certain amount of humidity to the air, and I suspect aids hatchability especially during the hot dry summer months.

In Jersey, we usually have three or four pink pigeon pairs breeding at any one time, and with careful management, our 14 pairs of doves can just cope with this. Obviously, the more pairs of doves that one has, the more versatile one can be. However, as a minimum I would recommend three pairs of doves per breeding pair of pink pigeons.

The foster room at Jersey is a closed colony. Since the initial stock was installed in 1988, no new birds have entered the room. If a bird leaves the room, it is not allowed to return. Only pink pigeon eggs can enter. All replacement doves must be bred within the colony. This is to minimise the risk of disease transmission to the pink pigeons.

5.2 BASIC MAINTENANCE

The foster room is checked first thing in the morning. Special attention is paid to cages with pink pigeon squabs, to see that they have not fallen out of the nest and that there are no problems. The extractor fan is switched on.

Cleaning and feeding of the colony takes place later in the morning. Each cage has a layer of newspaper on the floor, and this is removed and replaced daily. Each cage gets a fresh dish of grain (wheat with some whole maize), and a clean dish of water. The water has vitamins added; we use BSP vitamin drops. In addition, each pair receives a small pinch of pigeon grit and a small scoop (11.5g) of a mixture of small seeds. We use a millet and canary seed mixture, designed for budgies. The grit and the small seed are given on the floor of the cage and act as a form of environmental enrichment - the birds wait eagerly for their seed and hop down for it before cage servicing has finished.

There are two points of note regarding this small seed daily treat. Firstly, because the birds wait eagerly for it, it is important that the cages are cleaned in the same order each day. Doves sitting on eggs often leave the nest in anticipation as the cleaner works his or her way towards their cage. By confusing the birds and starting the cleaning routine at the other end, there is a possibility that some eggs will be left uncovered for a longer period than usual.

Secondly, the quantity of our 'small scoop' appears to be rather critical. I have no evidence, but I have the impression that the seed acts rather like oats in horses, and can make the birds a bit too highly strung. Pairs which have lived amicably for months, often fall out when given an excess of small seed, the male usually beating up the female. The quantity is, however, increased once the pair have a squab. Once the egg hatches an extra half scoop is given each day, and this is gradually increased until the pigeon squab fledges, at which point the pair plus squab will be receiving two scoops of small seed a day.

The contents of each nestbox are checked as the cage is serviced, and a record maintained in a diary kept for the purpose.

The pink pigeon squabs are weighed daily at 14:00 hr, on an electronic balance. This daily weighing continues until the birds are 21 days old, at which stage it is difficult to persuade them to sit still on the scales.

The foster room is checked one more time last thing before going home and the extractor fan is switched off.

Additional cleaning consists of changing the nestbox, removing and scrubbing the perches, and washing the whole cage. All the nestboxes hang on two screws and can be easily lifted out and changed for a fresh one. This is done as a matter of routine in line with the doves laying cycle. We keep a couple of clean, extra boxes for the purpose. Perches have a habit of picking up dirt, and are also removed regularly for washing. The cage is washed down on a less regular basis, but at least after a young pink pigeon has been reared and removed from the cage; the cage is especially dirty at this point. We keep a couple of spare cages to put the doves in while their cage is washed.

It is important to remember that the foster room needs as much attention to cleanliness as does an incubator room. After all, the eggs in the foster room are just as likely to pick up germs as those in the incubator. In fact, doves can be messy birds, and I am not suggesting that it is possible to keep a foster room as sterile as an incubation room, but increased attention to basic cleanliness does improve the hatching results.

5.3 THE REPRODUCTIVE CYCLE

The Barbary dove has the same breeding cycle as the pink pigeon. i.e.- Two eggs are laid, incubation takes 14 days, and the squabs are fed crop milk (not a real milk, but a secretion from the lining of the crop (Baptista *et al.*, 1997)). The only real difference is that whereas the pink pigeons lay their two eggs on days one and three, the Barbary doves lay theirs on days one and two. This is a small point, and does not affect their potential as a foster species.

At the start of a pair of doves' breeding cycle, they are given a fresh nestbox. This box has a wire base inside, sculpted to form a dip in the middle. On top of this is put a layer of clean, dry straw. Attention must be paid that the straw has no trace of mould, as there is a potential for the birds to develop aspergillosis. (This has not happened to us yet, but the potential must be there.) In the early days at Jersey, straw was not provided, and eggs were laid onto the mesh base. Some birds tore newspaper from their floor and used it as a nesting material. This system had a few problems. Eggs were often damaged on the hard surface. Newspaper, if used by the birds, proved too slippery for the chicks, and many developed splayed legs as a result. Since adding straw to the nests, results have improved. The coarse nature of the straw approximates the sticks used by the pink pigeons, and gives the squabs something to grip. It is also easier to maintain a high standard of cleanliness with this system. One problem that can arise, however, is that if too much straw is stuffed in the box, the eggs can roll out.

The male dove should sit in the box, cooing and bowing, to attract the female's attention to it. Often he drives the female, sometimes quite aggressively, so that she is almost forced to take refuge in the nestbox. In any event, the female should start to sit in the nestbox one or two days ahead of egg laying. It is important that the nest is checked daily, and that the date of the first egg is recorded. i.e.: 'Box 1 - 1st egg'. The second egg will be laid the following day, although occasionally only one egg is produced.

Both birds will incubate the eggs, sometimes together, but usually taking turns. After 14 days, the eggs will hatch. Although laid a day apart, the two eggs usually hatch on the same day - one in the morning and one in the afternoon.

The only problem, of course, is that usually we have no desire to hatch doves. So, one week after the laying of the first egg, both eggs are removed and thrown away (or delivered to the reptile house for use as food). This event is also marked in the diary: 'box 1 - start again'. It is at this point that the doves' cycle is considered to start again. Often the doves will sit on for an extra day or two on an empty nest. Eggs are usually laid again exactly 10 days after the old clutch has been thrown away. A clean nestbox, with fresh straw, is usually given seven days after discarding the old clutch. If given much before this, the pair may have thrown out all the straw by the time they are ready to lay again.

5.4 SETTING PINK PIGEON EGGS

Once a pink pigeon egg has been laid, and the decision has been made to foster it, the foster room diary should be checked to find a suitable dove pair. It is absolutely critical that the pigeon egg is synchronised with the dove eggs that it replaces. The reason for this is that crop milk is produced after 14 days of incubation, but its production ceases in the absence of a chick. If the pigeon egg has been set too late, the doves will have no food for it when it hatches, and death is guaranteed.

Therefore, the ideal foster pair for a pigeon egg is the pair which laid their first egg on the same day. This is not always possible, and so one can also use a pair which laid their first egg one, two, or even three days previously. After this, it is too late. If no fosters are available at the correct stage of their cycle, then the pigeon egg is best left with its parents. Hand-rearing is, of course, an option, but if successful, the resulting birds are usually too imprinted to be of use for breeding. (Contact Kurt Hungden, Wildlife Conservation Society, New York, for details of hand-rearing procedures which proved successful with pink pigeons, or Mark Pilgrim, Chester, for details of other pigeon species.)

Once the pigeon egg arrives in the foster room, it is assigned a number, weighed, measured with a Vernier callipers (length and width), and then set under the doves. The doves own eggs are discarded at this point. A record card is then hung on the cage, recording parentage and all other information. Never write on the pigeon egg itself, the shell is too thin and easily damaged.

Figure 4: Example of an egg and chick record card used for pink pigeons at Jersey.

Species: Pink pigeon		Egg number:
Date Laid:		Date hatched:
Initial weight:	g.	Sire: x Dam:
Egg length:	mm.	Parent birds' location:
Egg width:	mm.	Foster location:
Egg status:		Specimen number:
		Rings:
Daily weights of chick (g.):		
Day 1:	Day 2:	Day 3:
Day 4:	Day 5:	Day 6:
Day 7:	Day 8:	Day 9:
Day 10:	Day 11:	Day 12:
Day 13:	Day 14:	Day 15:
Day 16:	Day 17:	Day 18:
Day 19:	Day 20:	Day 21:

Although both pink pigeons and Barbary doves lay two eggs in each clutch, the doves two eggs are replaced with only one pink pigeon egg. This is because pink pigeon eggs are almost twice the size of the doves' own eggs, and the squab requires at least twice as much food, to grow twice as big. (Hence, at two pairs of doves are required to foster one pink pigeon clutch.)

Three days after the pigeon egg was laid, it is candled. At this point, fertile eggs will show a distinct 'spider' of blood vessels. Candling before this point, will invariably show nothing, although very occasionally some early sign of blood vessels can be seen on day two. If the exact date of lay of the egg is not known, candling at this point can enlighten you, because the day three fertile egg is very distinctive.

If the egg is infertile, it is not discarded immediately, but rather, the doves are permitted to incubate it until their allotted seven days is up. If the egg is fertile, a note is made in the diary of the date that it is due to hatch.

Fertile eggs are candled twice more during the incubation period. Eggs which die during incubation can be identified by skilled candling, thereby freeing up the doves to lay again. A record is kept of the fate of all eggs - whether infertile, early dead embryo, late dead embryo, or dead in shell. Dead in shell usually refers to an egg that dies after the chick has entered the air space, however, for my own records, I only catalogue eggs as dead in shell once they have already chipped the shell. The exact recording method used is unimportant, so long as the same system is used throughout and the parameters are recorded. Eggs can also be recorded as broken.

Eggs which are due to hatch should be checked a day before they are due, because it is not unknown for them to hatch a day early. Also, the foster room floor should be washed the day before an egg is due to hatch, because this will increase the humidity in the room and may help the hatching process. Some doves have a habit of adding torn newspaper to their nestbox, on top of the straw. In these cases, all newspaper should

be removed just before the egg hatches, because its presence can lead to splayed legs in the chick.

Eggs usually hatch overnight, and the newly hatched chicks are seen for the first time on the early morning check of the foster room. An empty eggshell on the cage floor is often the first sign. The chick should be checked and weighed. Note should be made of whether there is food in the crop or not. If the chick has not been fed, there is no need to panic yet; it may have only just hatched.

The first weight of the chick is often quite revealing. Very small chicks, under c.10 g, usually do not survive. In fact, such small weak chicks often are never fed, not because of a lack of willingness on the foster doves' part, but because they are too weak to beg for food. A healthy chick should weigh between 13 and 18 g on its first day (this weight is for a chick which has already been fed, since the chicks have invariably been fed by the time they are discovered). Thereafter, chicks are weighed at 14:00 hr each day. A standardised time is quite important because the growth rate is rapid. (See appendix.)

Once a pink pigeon chick has hatched, I like to offer the pair of doves a dish of pink pigeon food each day. Many of them ignore it, but some appreciate it. This raises a curious point. Barbary doves are seed eaters, and pink pigeons are leaf eaters. Do the crop milks therefore vary? I do not know the answer to this.

The pigeon squabs grow at a phenomenal rate. By two weeks of age, feathers are springing through. And by three weeks, the chick is ready to fledge and leave the nest box. Often chicks will hop out prior to their 21st day. If I find a chick on the floor before this date, I return it to the nestbox, but after 21 days, I leave it. Having left the nestbox, the squab is still fed by the parents. Within two or three more weeks, the chick should be seen feeding itself - picking small seed off the floor. When the pigeon food starts to disappear in large quantities, you know that the chick is feeding well and ready to leave the foster room.

There is a tricky period when the chick has fledged but before it is old enough to be removed. Initially, it will be unable to hop up to the perches and is on the floor when one attempts to clean the cage. At this stage, I usually lift the chick out and put it in a safe dark place while I clean. In fact, I use a bucket with a lid, lined with paper. The chick should be used to being handled once a day, and this should cause it little stress.

The danger period arises when the chick has learnt how to perch. It is no longer a simple matter to catch the pigeon each day, certainly not without stressing it. Pink pigeons are far scattier than their domesticated relatives, and the young pigeon is quite likely to suddenly launch itself out through the cage door. I find that with care, talking calmly, the job can be achieved without mishap, and most young pigeons will become calmer if always treated with extreme patience and care.

5.5 PROBLEMS

Several problems seem to arise time and again when fostering, and they tend to be different problems than those that arise when parent rearing.

Not Being Fed: I do not remember a case when our foster doves did not feed a chick through a fault of their own. If the setting of the egg has not been correctly timed to the foster doves' cycle, they will be unable to feed the chick. Chicks that are too weak can not beg (see above), but this is not the fault of the fosters. Likewise, we had one chick with a deformed beak which could not be fed. Chicks which are not fed die within the first three days. If the doves do genuinely fail to feed their squab, they should be weeded out.

Splayed Legs: I believe that splayed legs are invariably a product of the environment. A nest that is too smooth will cause the legs to splay. The problem most commonly arises within the first week of the chick's life. If the legs do start to splay, and the problem is spotted quickly, it can be rectified by tying or taping the legs together. The young pigeon's growth is so rapid that the legs seem to 'grow right' within about three days. However, the tape or string does need changing every day, or it will cut into the legs. Big fat squabs with an excellent growth rate often have legs which appear to go out to the side, whereas in fact, they are purely a product of the large weight of the chick.

Rotation of the Hock: Whereas splayed legs consist of the chick doing the splits, a rotation of the hock is quite a different thing. Usually only one leg is affected, and as the squab grows the affected leg starts to rotate from the hock so that eventually it sticks out at right angles to the body. The problem usually arises later than splayed legs - usually in the second or third week. I even remember one case which only started to develop in a fully grown young bird after it had left the foster room. This problem is very serious. The cause is unknown, but I believe it may be a genetic problem. We have never found a cure; the birds are always eventually euthanased. In fact, whereas we used to leave affected chicks until they could not easily move, we now euthanase chicks as soon as the problem is definitely identified.

Weight Loss: In some years we have been plagued with large numbers of cases of chicks whose weight starts to fluctuate. Sixteen percent of all fostered chicks at Jersey, died of this complaint. Growth more or less ceases, and the chick invariably dies after one or two weeks. It is a depressing state to watch, especially as we have never identified a cause or a cure. Occasionally chicks do pull through, and then they tend to make up the weight at a later stage so that they end up the same weight as healthy pigeons; they do not remain as runts. One possible cause is a failure by the doves to feed the squab, but I do not believe this to be the case. The foster parents of such squabs have all raised chicks perfectly before and since. The cause may be genetic, although I hesitate to say so since it is too easy to blame persistent problems on inbreeding rather than trying to find the true cause.

Foster Failure: Occasionally disaster strikes whilst a pink pigeon chick is being raised, in the form of the death of one of the foster parents. We have also had an occasion where one foster parent became ill and stopped feeding the chick. If the chick is still very young, one parent should be able to supply enough food, but eventually it will not be able to keep up. In this case, it is quite possible to supply some extra hand feeding for a week or two, until the chick fledges and starts to feed itself. I have found that soaked whole grains of maize are the easiest food to stick down its beak. Soaked maple peas have also been used in the past. This would not be a recommended hand

raising diet as a rule, but as a supplementary food source, it works very well. The number of feeds needed varies - two or three per day is usually enough. The grain in the pigeon's crop can be felt, and the feeding regime should only be in response to its emptiness.

Whole Maize: Kirsty Swinnerton has informed me that in Mauritius they have had problems with young squabs dying after being fed whole grains of maize by their foster parents. The grains lodged in the young birds' throats. For this reason they withhold whole maize for the first week or so. This is not a problem that we have ever encountered in Jersey, and for this reason we do not alter the diet.

5.6 CRECHES

Once the young pigeons are feeding themselves well in the foster room, they can be removed. We usually wait until we have two or three youngsters at this stage, and then remove them together to an aviary to form a 'creche' of young birds. Pink pigeons do not normally live together peacefully outside of the breeding season, but young birds can be mixed for their first six months or so.

The removal of the young birds from the foster room is the best time to ring and sex the birds. Indeed, it is essential that they are ringed at this point before they are mixed in a group. Ring size 'K' = 9 mm. It is also the best time to pluck a few feathers for sexing purposes.

We have a room at Jersey with four large cages, (each 2m x 1m x 2.1m) which are used specially for young birds coming out of the foster room. It acts as a convenient half way house between foster room and outdoor aviary. Initially the young birds are very inexperienced, and they take some time to become confident at perching, flying, etc.

Initially a large dish of grain (wheat with some maize), and a smaller dish of small seed, is offered on the floor of the cage. This is left, but not refilled, and acts as a sort of weaning from foster dove diet to pink pigeon diet. After two or three weeks all the seed and grain will be either eaten or ignored, and at this point the dishes are removed. Meanwhile the young pigeons have been receiving their usual daily dishes of pigeon food. Initially at least one dish is placed on the floor, but as the birds become more adept at perching, they will start to prefer to feed out of the dishes on the raised food platform, and at this stage, all the dishes are placed up high. Young pigeons usually moult their 'baby feathers' at about six weeks of age, so the room where we keep our young birds is usually full of shed feathers (despite daily sweeping!)

Once a group of young birds has been formed, no new birds are added to the group. However, occasionally we have a third or fourth chick in the foster room which is a week or two behind the others in its development. In this case, it is usually possible to add the extra bird to the group a week after the others, but there is no guarantee that it will be accepted. I have been referring to foster raised chicks in this chapter, but, of course, if a parent raised chick exists at the same stage of development, it can also be added to a creche situation.

I believe that creching forms a useful role in the development of the young pigeons. Presumably they pick up some socialising skills which hopefully will prove useful to them later when they are paired up. However, there has been no research in this area, and single youngsters which do not have creche experience do not appear to suffer from any particular social problems. In any event, creches save aviary space!

Naturally, birds coming out of the foster room do not need to have a special indoor half-way house. they can be moved straight to an aviary, but in this case it is essential that they are locked in their shelter until they are confident, fully mobile, and seen to be feeding themselves well.

Before six or eight months, it is very unusual to have a youngster that bullies its cage mates. If one does arise, it must be removed from the creche. After six or eight months, the birds will start to become sexually mature and will become aggressive to each other. At this stage, the birds must be separated. If left, even if the only sign of trouble is chasing rather than actual aggression, birds will die. The bird that is at the bottom of the peck order will gradually lose condition, and will fade away. Often, mere chasing erupts into full scale violence overnight, and a dead, bloodied bird is found in the morning. There is no excuse for these deaths: once a creche starts to squabble, they must be split up.

We have had occasions in Jersey where pairs formed within creches and started to breed. This is not a good idea. Firstly, parentage of any eggs is not assured, and secondly, the birds chosen partners are unlikely to be those chosen by the studbook.

6. HEALTH

This chapter does not intend to be a definitive veterinary guide to pink pigeon diseases, but rather a brief resume of problems that have affected birds within the EEP. On the whole, pink pigeons are healthy birds. A brief glance at a list of post mortem details returned to the studbook, showed that trauma, fighting, and predators were responsible for the greatest proportion of deaths. Death due to infection - *Yersinia pseudotuberculosis*, *Pasteurella*, etc, was the next largest group. Several birds were euthanased, usually due to congenital deformities or problems due to old age.

6.1 TRAUMA

This is the most common cause of death of pink pigeons. Females are commonly killed by males, resulting in a shortage of females in the EEP population. Pink pigeon pairs must be separated once either bird shows signs of aggression. Death by cagemate can also result in a creche or fostering situation. The rule of thumb is to separate birds as soon as aggression is noted, because all out war and death can be very rapid.

Pink pigeons have a highly developed flight reaction, with the result that many birds are injured or killed in a fear situation. This is especially so in larger aviaries. The appearance of a predator, or a keeper with a net, can send a pigeon hurtling into the aviary wall resulting in a broken neck or a scalping. The aviaries at Jersey are formed

of 2cm welded mesh, a size that seems ideal for scalping scared pink pigeons. Even a relatively uneventful capture event by the keeper can result in bleeding to the cere above the beak. In worse situations, the pigeon can hit the mesh at such speed as to scalp itself, taking a flap of skin back neatly from the beak. Such severe wounds need to be stitched- an operation which appears to cause the bird little distress and usually heals without scarring.

Glass is a perennial danger to pink pigeons. They do not appear to have the capacity to learn about windows. Most of the bird species at Jersey, if introduced to an aviary with a glass window, can be taught to recognise it by temporarily painting white lines on the window. When these are washed off after a few weeks, most species will respect the window. But not, alas, pink pigeons. Whilst the white lines remain on the window, the birds will avoid it. As soon as the white paint is removed - Wham! For this reason, pink pigeons should never be kept in a large, converted greenhouse type of free-flight. Georgian wired glass is slightly safer than plain glass.

Predators can and do kill pink pigeons. The studbook has had returns reporting death by weasels and sparrowhawks. Doubtless many other species can kill pink pigeons given half a chance.

One bird in the studbook died after its oesophagus was punctured by a stick; some freak trauma deaths are hard to guard against.

6.2 INFECTION

The most commonly recorded infections to actually kill pink pigeons, appear to be *Yersinia pseudotuberculosis*, and avian tuberculosis. However, as with all infections, they seem to affect certain collections more than others. Other infections that have been reported include *Pasteurella*, *Erisipelas septicaemia*, ornithosis, bacterial hepatitis, pneumonia, and enteritis.

6.3 REPRODUCTIVE DISORDERS

Few pink pigeons are reported as having died through reproductive disorders. Cloacal collapse has been reported, as has peritonitis due to an old egg in the oviduct.

6.4 PARASITES

Faecal sampling is a useful tool to detect internal parasites. Currently the most commonly noted internal parasites at Jersey are Strongyloides and Ascarids. Both are easily treated with an injection of Ivomec. Trichomoniasis has been reported from other collections. Ivomec can also be used to treat external parasites, such as mites. Recently in Jersey, we have had problems with feather moths. These small moths are usually only seen in collections of stuffed specimens, where the small caterpillars eat the feathers. These caterpillars have a woolly covering and hide in crevices in our aviaries, particularly in our foster room. There they seem to enjoy eating the foster doves feathers, but seem to ignore the feathers of the pink pigeon chicks. Where the woolly caterpillars have been found out in the aviaries, none of the birds appear to have chewed feathers; perhaps the caterpillars feed on shed feathers there? The best

treatment appears to be washing the cage with an insecticide solution (remove the birds first), although we have only managed to keep the numbers down rather than totally eradicate the pest.

6.5 DEFORMITIES

Deformities occur relatively frequently in pink pigeons. It is tempting to suppose that such congenital deformities are due to inbreeding within the population, but this has been neither proven nor disproven. Malformed legs, twisted spine, beak deformities, or lack of an eye, have all been seen. We even had one bird whose gut emptied out its side, and not into the cloaca. Some deformities result in the death of the newly hatched chick, either because it is unable to feed properly, or because it is euthanased immediately. Other deformities are less apparent, and result in a decision to euthanase at a later stage. Birds which show deformities which may possibly be of a genetic origin should probably not be bred from, and are possibly best euthanased.

6.6 LACK OF FLYING ABILITY

Some pink pigeons appear to lose the power of flight at some stage of their life. This may be due to old age, but I suspect that most cases are due to other factors. Two birds that were euthanased because they could not fly showed symptoms of tuberculosis on autopsy. It is possible that the lack of flight was only a secondary symptom of disease. Other pigeons have gone through periods of poor flying ability, but when rested up for some months have resumed it again. These birds are probably run down for one reason or another, perhaps stress-related. If you have a pink pigeon which loses the power of good flight, I suggest checking it for some other disease, and resting it in a quiet aviary for several months before giving up and resorting to euthanasia.

6.7 PRE-EXPORT SCREENING

At Jersey, we practise both import and export screening, following E.A.Z.A. guidelines. This is regardless of whether the birds are required to undergo an official government quarantine period. All pre-export pink pigeons are isolated for at least 30 days prior to departure. During this period, a set of two cloacal swabs are taken to check for Chlamydia, and three faeces samples are taken to check for bacteria and parasites. Naturally, any birds that prove positive for any problem are treated where appropriate. In any event, each pigeon is given an injection of Ivomec against internal parasites prior to export. The object of this pre-export screening is to ascertain that the bird is in good health and that we are not exporting any disease to other collections.

Likewise, when birds are imported, they undergo a quarantine period, and are sampled in a similar manner.

6.8 OTHER HEALTH PROBLEMS

Various other ailments have been reported to the studbook, including visceral gout, tumour, hepatopathy, necrosis, death through dehydration, crop impaction, and internal bleeding.

7. HANDLING

7.1 CAPTURE

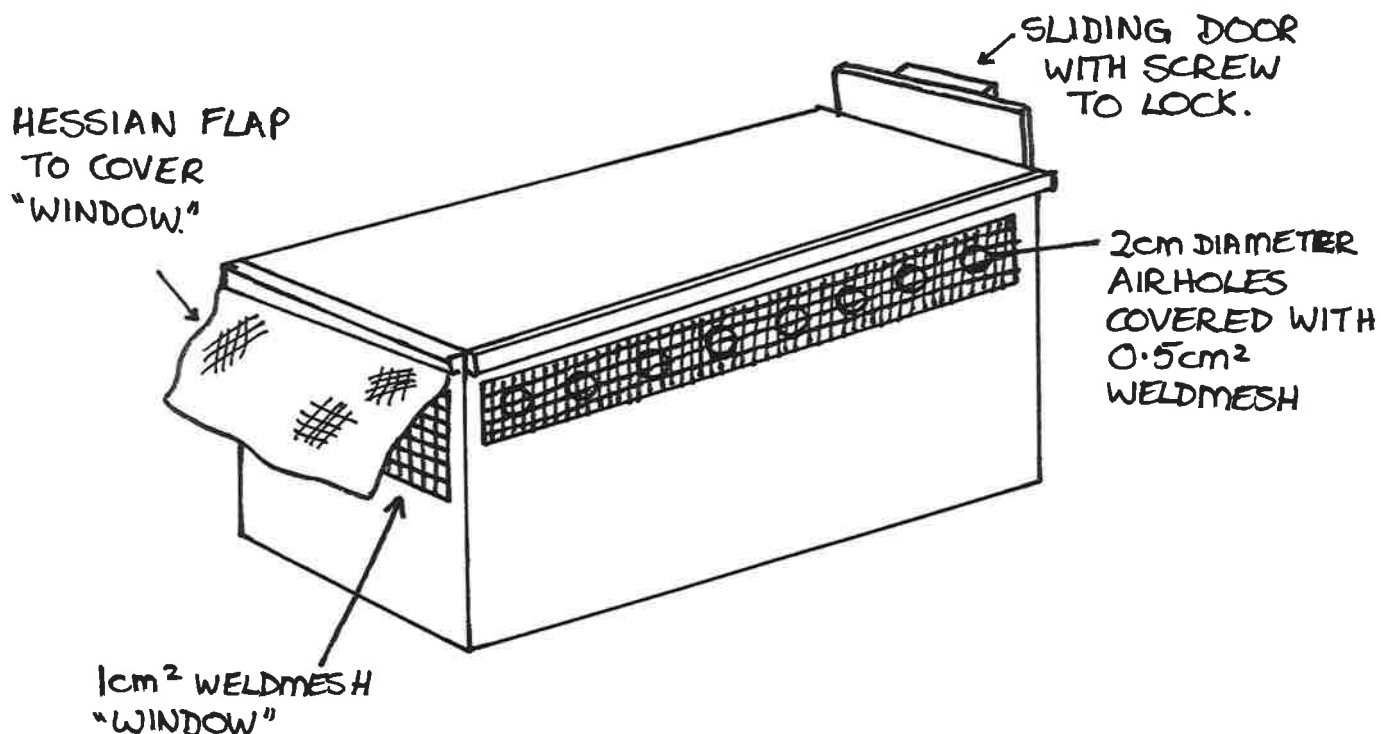
The best sort of net for catching pink pigeons has a diameter of 40cm and a soft padded edge. Ideally, the net should have a choice of handles - a short one for use in confined spaces, and a long handled one for use in the aviary flight. If the long handle can be extended, so much the better.

Pink pigeons usually fly in a circle around their aviary when disturbed. The correct way to net a pink pigeon is to observe this route and then aim to whisk the pigeon out of the air. With practise it should be possible to do this first time. The difficulty arises in heavily perched aviaries with no open areas.

The incorrect way to catch a pink pigeon is to aimlessly chase it round and round the aviary until it crashes exhausted to the ground. Equally inept is to catch the pigeon against the wire. A nasty gash to the pigeon's cere is likely to result with this method. In fact, this is the most likely problem to arise when netting a pink pigeon. Some birds panic upon seeing a net, and fly straight into the wire. This can happen no matter how careful the keeper is being.

Once the pigeon is netted, it should be removed from the net, and placed in a cloth bag or a transport crate. We use cloth bags for short moves between aviaries (in fact, we use pillowcases), and crates for transportation to another institution.

Figure 5: Travel crate suitable for transportation of pink pigeons



Every time a pink pigeon is netted it should have its rings read (to ensure that it is the bird you think it is), and it should be weighed. We use a 500g Persola spring balance, and weigh the bird once it is knotted into the cloth bag. (The weight of the bag is then subtracted.) The weight of the bird is a big indicator as to its general health and breeding fitness. When the bird is in the hand, I also like to check its general condition. (How prominent is its keel? What are its feathers like?) I also like to check the length of its toenails, and trim them if necessary, using a clippers designed for dog claws. I also check that its leg rings are not too tight.

7.2 TRANSPORTATION

Figure 5 (above) shows a crate which is recommended for the transportation of a single pink pigeon between institutions. The crate measures 45cm x 20cm x 20cm. Note that there is no perch inside; it has proven safer to omit one.

7.3 ESCAPES

Pink pigeons can and do escape, not through any cunning intention on their part, but purely because they are 'flappy' birds and have a tendency to take to the wing as a keeper enters the aviary. This is especially true in small aviaries. Many pink pigeons will lap their aviary as a keeper enters, and if the door is large they are quite likely to exit. Hence a safety door is vital, especially on a small aviary.

Once the pigeon has escaped, it will either head for the hills at a rate of knots, or it will hang around near its aviary. Once the pigeon has disappeared in a straight line, it is unlikely to be able to orientate itself and find its zoo again. In which case it is unlikely to survive.

Escaped pigeons which take a more casual attitude and stay within the vicinity of the zoo are more likely to be recaptured. These birds can be fed, and hopefully tempted back into an aviary.

8. RECORD KEEPING

It is only by keeping good records that trends can be analysed and knowledge gained. In compiling this guide, I have become aware of just how many gaps we still have in our knowledge. For example, we still have a rather incomplete list of plants that can be safely grown in pink pigeon aviaries, and of those that are eaten by the birds. Recently, I undertook a records analysis of the breeding of pink pigeons at Jersey, and it was only when I sat down to analyse the records that I realised the importance of recording each and every seemingly obscure bit of information.

As a bare minimum, I would recommend that certain recording procedures are set in place for every type of event, so that, eventually, a large number of standardised records are available for each type of event. The following are some of the basic events that I like to record daily:

a. Movements: Each move to a new aviary should be recorded. The new cohabitants of the aviary should be recorded. Any future removal of a bird from the aviary should also be noted. Every time a pink pigeon is caught, its rings should be read to verify its identity and it should be weighed, and the weight recorded. (Various other measurements can also be taken, such as wing length, tarsus length, etc., but weight should be a minimal requirement.)

b. Health: All symptoms, sampling, treatments, dosages, and results should be recorded. In fact, the recording of dosages and clinical symptoms is usually done by the vet, but it is useful for the keeper to also make a record, for future reference. This is especially so now, as more and more collections are starting to use the MedArks record system to record all veterinary procedures rather than including the data on ARKS where it can be easily accessible by the keeping staff.

c. Breeding: All details of behaviour during pairing should be recorded. Once the birds start to lay, every egg should be assigned a number (even broken eggs). The type, position, and quality of the nest should be recorded. We grade our nests on a scale of zero to five. A 0/5 nest has no nesting material, a 1/5 nest consists of only 3 or 4 twigs, a 2/5 nest is rather poor, etc. It is useful to record whether the birds are incubating the egg, whether it is removed for fostering, if so, whether a dummy was given. Egg abnormalities should be recorded, and whether the egg was damaged and needed repairing. Eggs that are removed are weighed and measured.

A typical diary entry after the laying of a pink pigeon egg at Jersey would be:

B4056(F) Pink Pigeon SF6 (cage no.) R/GS
Egg #98056 laid in a good (4/5) nest, on a platform in the NW corner of the shelter.
Female incubating. Egg removed for fostering. Dummy egg substituted.
Egg #98056: Wt = 15.7g 39.65 x 26.92 mm.

The fate of each egg is also recorded - whether broken, infertile, early dead embryo, late dead embryo, dead-in-shell, or hatched.

POSTSCRIPT

Pink pigeons are not the easiest species of pigeon to keep and breed. They often kill each other when paired; they require a slightly more troublesome diet than one of pure seeds; they have a habit of crashing into their aviary sides causing injury or death; they are rather 'flappy' to work around and have a habit of flying out opened cage doors; and to crown it all, they are hopelessly inadequate at successfully incubating their own eggs and rearing their own chicks. In fact, I know of several pink pigeon keepers that despair of the species, considering them endlessly troublesome, or worse, considering them a species which is just 'impossible' to breed.

Well, I do agree that pink pigeons do require more effort than the average species. And, yes they can be difficult to breed. However, it is precisely because of this that it is such a joy to successfully breed them. The keeper which has managed to rear surplus pink pigeons, and to see them into their export crates, can feel justifiably proud. Not only have they succeeded in a difficult area, but in doing so they have made a very real contribution to an on-going conservation programme. With less than 600 pink pigeons in the entire world, every chick reared makes a difference.

Hopefully, having read these guidelines, those amongst you that have yet to breed pink pigeons will realise that the task is not impossible. It can be done! And once you've bred one chick, all subsequent chicks will be easy...

It's up to you now!

PRODUCTS MENTIONED IN THE TEXT

Neutrabol Vitamin Powder	Vetark Animal Health, P.O.Box 60, Winchester, Hants SO23 9XN, U.K. Tel: 01962 - 880376
BSP Vitamin Drops	Vetark Animal Health, as above.
Darvic	I.C.I.
Spring balance	Pesola, Precision scales, Switzerland.
Vermier callipers	Rabone

APPENDIX: Mean weights of fostered chicks at D.W.C.T. in 1997 and 1998.

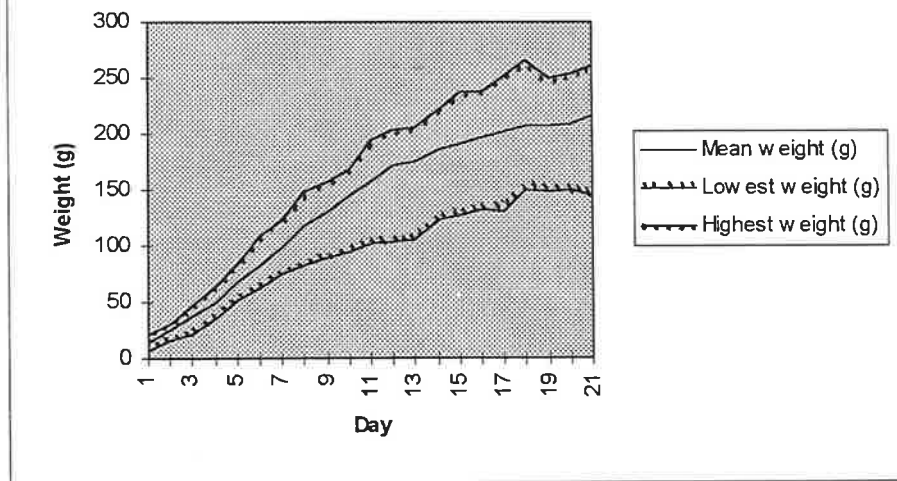
Day	Weight (g)	Range (g)
1	14.6	8.0 * - 20.8
2	24.7	16.3 - 30.6
3	36.8	22.3 - 46.3
4	50.7	36.1 - 64.7
5	67.0	51.0 - 83.5
6	81.7	62.5 - 109.2
7	98.6	74.5 - 123.0
8	117.2	82.1 - 148.1
9	129.9	89.1 - 157.0
10	143.9	95.5 - 168.6
11	157.5	101.7 - 195.5
12	171.3	104.3 - 203.2
13	174.6	104.5 - 204.8
14	185.2	123.6 - 222.1
15	190.4	127.3 - 238.2
16	196.3	131.3 - 238.3
17	201.2	131.0 - 251.5
18	206.6	149.6 - 265.8
19	206.6	148.3 - 250.8
20	209.6	149.2 - 254.2
21	215.9	144.2 - 260.3

* Note: This very small 8.0 g chick was weighed immediately after an assisted hatch.

Only chicks which survived to fledging were included. n = 39 chicks.

Most weights were taken at the same time each day (14:00 hr). However day 1 weights vary, the chicks usually being weighed as soon as they were discovered - often at 07:00 hr. Day 1 weights may or may not include a full crop, depending on whether the chick was weighed prior to its first feed, or not.

Figure 6: Daily weights of fostered pink pigeon chicks in 1997 and 1998.



BIBLIOGRAPHY

Baptista, L.F., Trail, P.W., and Horblit, H.M. (1997). Family: Columbidae (Pigeons and Doves). Pp 60-243 in: del Hoyo, J., Elliott, A., & Sargatal, J. eds. (1997) *Handbook of the Birds of the World*. Vol. 4. Sandgrouse to Cuckoos. Lynx Edicions, Barcelona.

Cooper, J.E., Needham, J.R., Applebee, K., and Jones, J.G. (1987) *Clinical and Pathological Studies on the Mauritian Pink Pigeon Columba mayeri* Ibis 130: 57-64

Durrell, G. (1979) *Golden Bats and Pigeons*. William Collins Sons & Co Ltd, Glasgow.

Flach, E.J. and Cooper, J.E. (1991) *Clinical and Pathological Findings in Two Mauritian Pink Pigeons (Columba mayeri)* Veterinary Record 129: 48-51

Hungden, K (1993) *North American Regional Studbook of the Mauritius Pink Pigeon (Columba mayeri) Volume 2* The New York Zoological Society, USA.

Jeggo, D. (1977) *Preliminary Notes on the Mauritius Pink Pigeon (Columba mayeri) at the Jersey Zoological Park* Dodo, J. Jersey Wildl. Preserv. Trust 14: 26-30

Jones, C.G., Jeggo, D.F., and Hartley, J. (1983) *The Maintenance and Captive Breeding of the Pink Pigeon Nesoenas mayeri* Dodo, J. Jersey Wildl. Preserv. Trust 20: 16-26

Jones, C.G (1985) *The Biology of Critically Endangered Birds of Mauritius* M.Sc. Thesis, North-East London Polytechnic.

Jones, C.G., Todd, D.M., and Mungroo, Y., (1989) *Mortality, Morbidity and Breeding Success of the Pink Pigeon (Columba (Nesoenas) mayeri)* ICBP Technical Publication No.10

Jones, C.G., Swinnerton, K.J., Taylor, C.J., and Mungroo, Y. (1992) *The release of captive-bred pink pigeons Columba mayeri in native forest on Mauritius. A progress report July 1987 - June 1992.* Dodo, J. Wildl. Preserv. Trust 28: 92 - 125

King, C.E., Nijboer, J., and Wiersma, T. (1995) *Observations on Nesting Failures by a Pair of Scheepmaker's Crowned Pigeons at Rotterdam Zoo.* EEP Studbook Crowned Pigeons, Number Three, Rotterdam Zoo: 139

Lind, C.R. (1994) *Mauritius Pink Pigeon (Columba (Nesoenas) mayeri) EEP Masterplan Number One* Jersey Wildlife Preservation Trust, Jersey.

McKelvey, S.D. (1976) *A Preliminary Study of the Mauritian Pink Pigeon (Nesoenas mayeri)* Mauritius Inst.Bull. 8 (2): 145-175

Spencer, S. (1993) *Clinical Investigation of the Mauritius Pink Pigeon (Nesoenas mayeri)* Animal Technology 44 (1): 59-63

Taynton, K.M. and Lind, C.R. (1991) *Pink Pigeon (Columba (Nesoenas) mayeri) International Studbook Number One* Jersey Wildlife Preservation Trust, Jersey.