AN ACCIDENTAL EXPERIMENT ON NEST AND CHICK RECOGNITION IN TAVETA GOLDEN WEAVERS *Ploceus castaneiceps*

by Annie Valuska and Chelle Plassé

Taveta golden weavers *Ploceus castaneiceps* are small birds closely related to finches. They are common throughout their range in Tanzania and Kenya and are popular additions to zoo aviaries due to their bright coloration, small size, and gregarious nature. They are colony nesters and, as their name implies, will build many ornate woven nests if provided with adequate material. Despite their showy nests, very little is known about their reproductive behaviour as they have rarely been studied in the wild or in captivity. Disney's Animal Kingdom's collection offers an excellent opportunity to study this species, as we have a group of over 100 individuals housed with many other bird species in a large walk-through aviary and we also have smaller groups in the Avian Research Centre (ARC), a facility which is inaccessible to park visitors and provides a quieter, more controlled environment. In an effort to learn more about this weaver species, members of our Science Team collected data on their behaviour at the nest. This article will focus on an "accidental experiment" that occurred with one group of Taveta golden weavers housed at ARC.

The ARC group is housed in an 9m x 6m x 2.5m (approx. 29.5ft x 19.7ft x 8.2ft) enclosure along with Carmine Bee-eaters *Merops nubicus*, Bartlett's Bleeding Heart Doves *Gallicolumba criniger*, African Pygmy Geese *Nettapus auritus*, a Green-winged Dove *Chalcophaps indica*, a Hooded Pitta *Pitta sordida*, a Jambu Fruit Dove *Ptilinopus jambu*, and Stone Partridges *Ptilopachus petrosus*. The birds are offered bowls containing soaked insectivore pellets, soaked parrot pellets, and dry insectivore pellets with finch seed, shredded carrots, chopped kale and some fruit mixed in, twice a day. They also have access to other species' diets, including soaked dog food, shredded carrots, chopped pinkies and small meatballs. All of the bowls get a finishing sprinkle of a variety of insects, including waxworms, mealworms, superworms and crickets. The enclosure contains a pond for the geese and is heavily planted with a variety of species, including Areca palms *Dypsis lutescens* and Bamboo grass *Bambuseae* spp., which the weavers commonly use to build their nests. A potted fern was hung from the overhead mesh above the pond, and it became a very popular nest site. Three nests were constructed there by a single male, and all were eventually occupied by three different females. The top of each nest was marked with a red, purple, or green pipe cleaner for identification, and 20 minutes of

behavioural data was collected on each nest daily. During each observation, data collectors recorded the activity at the nest, noting the identity of any visitor, indicated by coloured leg bands, and whether it was near, perching on, or inside the nest.

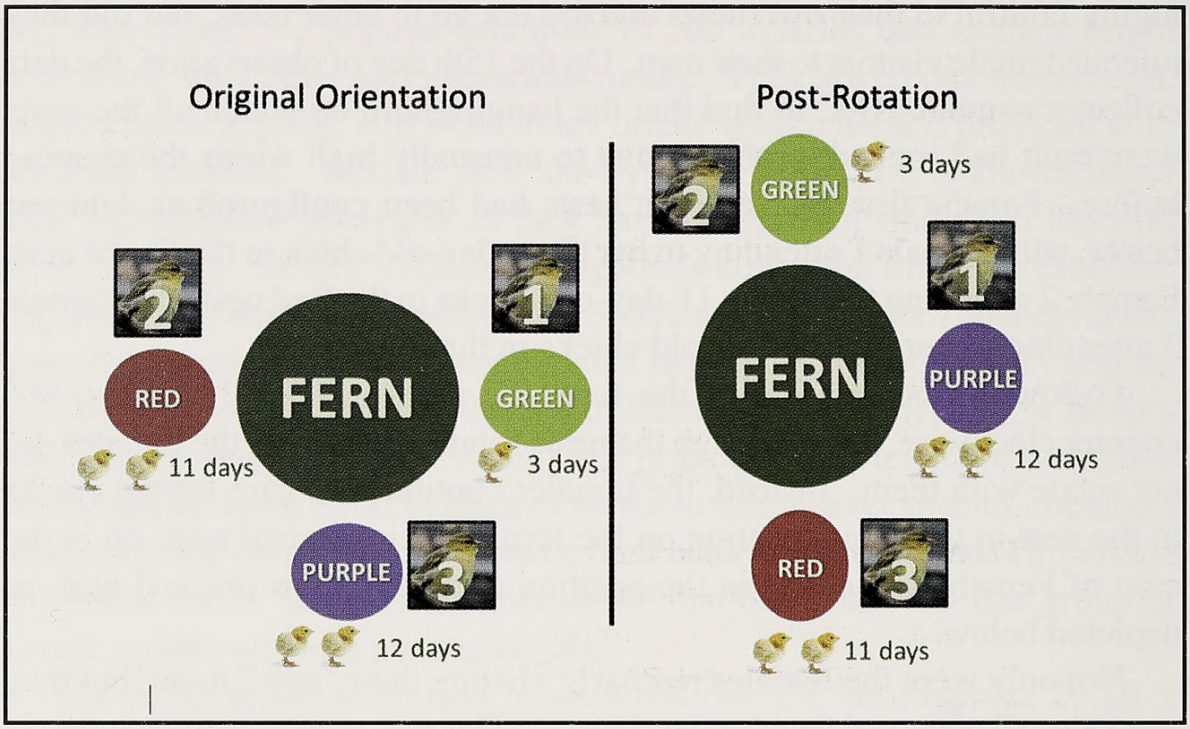
After 14 days of observation on the Red and Purple nests and 10 days of observation on the Green nest, no nest had ever been visited by a female that was not the occupant. These data were consistent with occupancy data collected in our larger, walk-through aviary. In both groups, females were highly faithful to their own nests and did not go to other nests, nor did they tolerate female visitors to their own. On the 15th day of observation, the data collector came to ARC to find that the hanging fern on which all the nests were built had rotated, probably due to unusually high winds the evening before. For the first 14 days, the nests had been configured as depicted below, with Female 1 attending to her three-day-old chick in the Green nest, Female 2 attending to her two 11-day-old chicks in the Red nest, and Female 3 attending to her two 12-day-old chicks in the Purple nest.

Following the rotation of the fern, the nests essentially shifted 90° counter clockwise. Even though the nests rotated, however, the females did not rotate with them. Instead, the females continued to care for the chicks in the nest in the same location on the fern as their original nest, or, in the case of Female 2, the nest in the position closest to their original nest, as depicted below.

Not only were the females regularly visiting their "new" nests, but they were also all observed feeding the chick(s). This was especially interesting in the case of Female 1, who switched from feeding a single three-day-old chick to feeding two 12-day-old chicks, and Female 2, who switched from feeding two 11-day-old chicks to feeding a single three-day-old chick. So as not to interfere with the ongoing study, the fern was moved back into its original position after an hour of observation. Within minutes of repositioning, all three females were observed visiting their original nests and feeding their original chick(s). They continued feeding those chicks until fledging, and were never again observed switching nests.

Although this was only a brief "accidental experiment", and thus should be interpreted with caution, it does suggest some interesting things about Taveta Golden Weaver reproductive behaviour. Firstly, these observations indicate that females may rely very heavily on location-based cues to identify their own nests. This has been commonly observed in other species (Beer, 1970; Davies and Carrick, 1962; Tinbergen, 1953), but, to our knowledge, has never been demonstrated in Taveta Golden Weavers. In the wild, Taveta weaver nests are usually woven on tree branches, which are unlikely to shift location; thus, it would be adaptive to rely on those stable locational cues

to identify a nest. However, our observations suggest that the weavers do have some flexibility: Female 2 was attending to a nest that was in a different location from her former nest. She may have been able to do this because 1) the spot her old nest had occupied was completely vacant after the shift and 2) her new nest was in a spot that had been vacant prior to the shift. This is consistent with the behaviour of some other avian species that have been studied (Nero and Emlen, 1951; Peek et al., 1972), though not all (Lashley, 1915; Nice, 1943).



These data also suggest that females may not be able to identify their own chicks, at least not before 12 days of age, which was the age of the oldest chicks at the time of the shift. It would be interesting to see if the females recognize their offspring when they get closer to fledging (18 days of age), as occurs in other species. For example, Red-winged Blackbirds, which fledge at 11-12 days of age, do not appear to recognize their own three to four-day old chicks, and if a female's chicks are replaced with unfamiliar ones at that age, she will care readily for the foster chicks. However, if the chicks are swapped at seven days of age, she will follow her own chicks to their new location, probably through the use of auditory cues (Peek et al., 1972). There are some species, however, which appear to never learn to recognize their own offspring in the nest, such as Kittiwakes (Cullen, 1957), Tricolored Blackbirds (Emlen, 1941), and Black Phoebes (Kinsey, 1935). More work is needed to learn at what point, if any, Taveta Golden Weavers are able to recognize their young. From an applied perspective, it would also be interesting to see if all three of the females would have continued to

feed their foster chicks until fledging, particularly the female who switched from 11-day-old chicks to a three-day-old chick. If so, this would suggest that we may be able to successfully cross-foster a much broader age range than has been traditionally thought. This could have important implications for captive breeding protocols for Taveta golden weavers.

Behavioural data is still being collected on the Taveta weavers at ARC and in our walk-through aviary. We are learning a lot about their reproductive behaviour and have plans to further explore some of the questions raised by this accidental experiment in the future.

Acknowledgements

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Bibliography

Beer C. G. 1970. Individual recognition of voice in the social behavior of birds. In: Lehrman DS, Hinde RA, Shaw E, editors. *Advances in the study of behavior.* New York: Academic Press. p 27-74.

Cullen E. 1957. Adaptations in the Kittiwake to cliff-nesting. *Ibis* 99:275-302.

Davies S. J., Carrick F. 1962. On the ability of Crested Terns, *Sterna bergii*, to recognize their own chicks. *Australian Journal of Zoology* 10:171-177.

Emlen J. T. 1941. An experimental analysis of the breeding cycle of the Tricolored Redwing. *Condor* 43:209-219.

Kinsey E. C. 1935. Parental instincts in Black Phoebes. *Condor* 37:277-278.

Lashley K. S. 1915. *Notes on the nesting activity of the Noddy and Sooty Terns.* Carnegie Institute Washington 211:61-83.

Nero R. W., Emlen J. T. 1951. An experimental study of territorial behavior in breeding Red-winged Blackbirds. *Condor* 53:105-116.

Nice M. M. 1943. Studies in the life history of the Song Sparrow. I. A population study of the Song Sparrow. *Transactions of the Linnaean Socity of New York* 4:1-247.

Peek F. W., Franks E., Case D. 1972. Recognition of nest, eggs, nest site, and young in female red-winged blackbirds. *The Wilson Bulletin*:243-249.

Tinbergen N. 1953. *The Herring Gull's World.* London: Collins.

AN AVICULTURAL REVIEW OF LIVING COASTS, TORQUAY, DEVON, UK.

By Simon Tonge, Clare Rugg and Jo Gregson

Introduction

Living Coasts is an exhibition of marine biodiversity located on the harbourside at Torquay, Devon, UK. It was opened to visitors in July 2003. The exhibit was developed by Paignton Zoo Environmental Park using funding from the zoo itself matched by external grants.

The site is owned by Torbay Council and is leased to the zoo for 125 years. It measures approximately 5000m^2 and is situated on a south-east facing promontory on the north side of Torquay harbour. At the commencement of construction the site largely consisted of bare reinforced concrete slabs with the remains of granite arches, which had been part of a marine spa, at the southern side.

Until 2012 Living Coasts had six major exhibits consisting of an aquarium, fur seals, penguins, auks, waders and sea ducks, but in that year the sea duck exhibit was converted to keep otters. Covering the whole thing is a polyethylene net, 19 metres high which serves to keep free flying birds within the exhibit and excludes others, such as the local population of Herring Gulls *Larus argentatus*. In total the exhibit has 650 metres of public walkway which are deliberately convoluted in order to disorientate visitors, allow good use of the available space, and maximise visitor stay on what is a relatively small site.

All five of the major external exhibits have pools up to 3 metres deep faced with acrylic windows which allow underwater viewing. All the pools except the wader exhibit are connected to a single water system using raw seawater pumped in from Tor Bay. The water is treated using a protein 'superskimmer'. Water parameters set by the zoo required 10 metres clear visibility without sterilisation of the water that would prevent colonisation of surfaces by marine animals and plants. The wader exhibit, a facsimile of a local estuary, contains fresh water on a muddy substrate with a simple cartridge filter, which increases the period between needing to dump water via the sewer when dirty.

Planting and landscaping around the exhibits were carefully considered. Individually they were too small to be convincingly themed as the habitats of the bird species therein and so a theme of British native coastal planting was chosen in order to unite them. Artificial rockwork was designed to match the natural rocks on nearby headlands.

Underwater viewing in the exhibit is mostly in an undercroft area where

the majority of the interpretive material is also concentrated. Further background information on the construction of the exhibit can be found in Tonge (2005a; 2005b).

The Mission

Living Coasts is managed as a subsidiary of Paignton Zoo Environmental Park. There were a variety of commercial reasons, beyond the brief of this paper, why the zoo chose to develop Living Coasts. From the biological perspective, the zoo had planned to redevelop its old African penguin *Spheniscus demersus* exhibit in due course but lacked the finance to construct an exhibit of suitable quality. The Living Coasts site, with its proximity to both a source of clean, cool, seawater, and fresh sea breezes to counter the threats from aspergillosis and the mosquito vectors of avian malaria, was felt to be an excellent site on which to maintain seabirds in general.

The opportunity to create a state of the art exhibit for the zoo's penguins was too good to miss. However, of much more importance was the opportunity for the zoo to fulfil its conservation and education mission in a subject area, coastal and marine conservation, in which it had never operated before.

Seabirds were chosen as the primary focus because of our belief that visiting seabird colonies is one of the most inspiring natural history experiences of all. The intention was to try to recreate the noise, vibrancy, and, maybe, the smell of such places. As many seabirds obtain most of their food under the water rather than on its surface, there were great opportunities for underwater viewing and so acrylic windows were installed in all the pools.

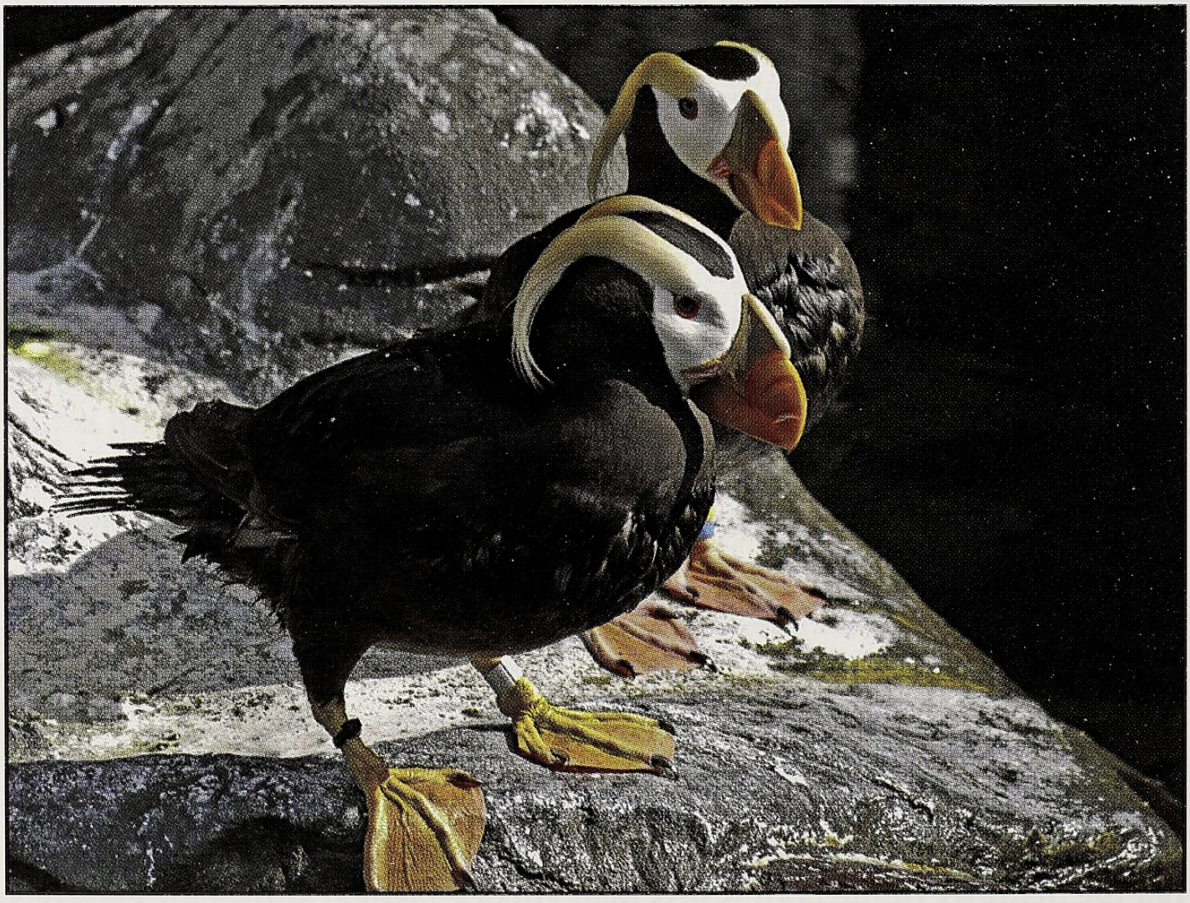
Aviculture at Living Coasts

The site has now been in operation for ten years and it was felt that that a review of its avicultural achievements would be of interest. A full list of species maintained at the site is shown on p.127. The site has been organized in a series of ecologically appropriate exhibits for maintaining different taxa and this review will discuss each exhibit in turn.

Penguin Beach

The first exhibit seen by visitors is Penguin Beach. The exhibit is designed to resemble the habitats used by nesting colonies of African Penguins *Spheniscus demersus* in southern Africa. The land area of the exhibit is 307m^2 and the pool is 143m^2. The water is shallow to the back end but the majority of the pool is less than 3m deep which allows for vigorous swimming and diving. African penguins nest in holes so 30 artificial burrows

Gull and tern aviary.



Tufted Puffin *Fratercula cirrhata.*

Living Coasts avian inventory 2003-12

English name	Scientific name
Gentoo Penguin	*Pygoscelis papua*
Macaroni Penguin	*Eudyptes chrysolophus*
African Penguin	*Spheniscus demersus*
Bank Cormorant	*Phalacrocorax neglectus*
Common Eider	*Somateria mollissima*
Spectacled Eider	*Somateria fischeri*
King Eider	*Somateria spectabilis*
Common Scoter	*Melanitta nigra*
Long-tailed Duck	*Clangula hyemalis*
Green-winged Teal	*Anas crecca crecca*
Bufflehead	*Bucephala albeola*
Barrow's Goldeneye	*Bucephala islandica*
Hooded Merganser	*Lophodytes cucullatus*
Eurasian Oystercatcher	*Haematopus ostralegus*
Black-tailed Godwit	*Limosa limosa*
Redshank	*Tringa totanus*
Ruff	*Philomachus pugnax*
Black-necked Stilt	*Himantopus mexicanus*
Pied Avocet	*Recurvirostra avosetta*
Red-legged Kittiwake	*Rissa tridactyla*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Sandwich Tern	*Thalasseus sandvicensis*
Inca Tern	*Larosterna inca*
Common Guillemot	*Uria aalge*
Pigeon Guillemot	*Cepphus columba*
Tufted Puffin	*Fratercula cirrhata*
Red-billed Chough	*Pyrrhocorax pyrrhocorax*

were created and dug into an artificial sand dune. A second, pebble beach, nesting area designed for species that do not nest in burrows has been created on the opposite side of the visitor path.

Access for the penguins onto the public walkways is unrestricted, thus allowing visitors to get a close and satisfying encounter with the penguins, but on the latters' terms. The birds seem perfectly relaxed even in noisy and crowded situations, presumably reflecting their normal behaviour in a natural colony.

African Penguins are renowned for being reluctant swimmers in zoos, very different in their behaviour from their close relative, Humboldt's Penguin *S. humboldti*. For this reason we planned to add a more pelagic species to the colony and Gentoo Penguins *Pygoscelis papua*, the best swimmers of all, were obtained from Sea World in Orlando. We were fully aware that, with the sole exception of the remarkable colony at Edinburgh Zoo (Wheater 1976; Stevenson et al. 1994), this species normally requires refrigerated accommodation in European zoos. Nevertheless we felt that the site of Living Coasts and the availability of natural seawater gave us a chance of managing this species successfully. We were wrong. The mild summers in southern England are simply too warm and the species suffered debilitating thermal stress and regular aspergillosis leading to unacceptable levels of mortality. For this reason the surviving birds were transferred to Edinburgh Zoo in 2007.

Edinburgh very kindly donated a flock of 12 Macaroni Penguins *Eudyptes chrysolophus* to Living Coasts in 2005. Whilst not being such frequent swimmers as the Gentoos, they still swim regularly and are a striking species physically, very popular with visitors. By the end of 2012 the colony had increased to 25 birds and is one of only two successful breeding flocks in European zoos. Nevertheless the genetic base of the flock is rather small and the age pyramid is too narrow so it will take careful management and close co-operation with other holders to ensure that the flock has a long term future.

S. demersus is a prolific species in captivity and it has been necessary to control reproduction in this species by the removal of eggs. Nevertheless over 100 birds have been exported to other collections to date.

As an Endangered species the African Penguin has been a key focus for Living Coasts' conservation and education efforts. Links have been developed with the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB) and Living Coasts has supplied financial and logistical support to that organisation.

The penguin exhibit is arguably the most important exhibit at Living Coasts in terms of visitor enjoyment. Diving experiences with the birds

are now regularly offered and are very popular with both the public and the birds alike. Sub-adult Macaroni penguins spend considerable periods of time in the water and will interact endlessly with divers.

Bank Cormorants

The EAZA Pelecaniform Taxon Advisory Group was approached by SANCCOB to see if European zoos could assist in the development of a captive flock of the Bank Cormorant *Phalacrocorax neglectus*. This is an Endangered seabird with a global population of about 3200 pairs, endemic to the coasts of southwest Africa. A CAMP process in 2002 had identified that the species had declined by about 60%, for unknown reasons, during three generations, and had recommended that a captive population should be established to work out husbandry methods. During restoration work on the jetty at Robben Island during the summer of 2002/3 several Bank Cormorant nests had to be removed. Eggs were taken and attempts were made to hand rear the chicks to provide the founding stock for the captive population. Ultimately only three birds were reared but they came to Living Coasts in June 2004. Two males still survive and are in excellent condition but to date it has not proved possible to obtain females to pair with them. The future for this programme is currently uncertain.

Wader Estuary

The wader exhibit at Living Coasts presented a special challenge. How could full-winged birds be encouraged to remain in one section of such a large aviary? The natural barriers for wild animals are those formed by habitat. Therefore the artificial habitat had to be planned with meticulous care to ensure that the birds would choose to dwell in their designated area. Using design concepts developed at Rheine Zoo, Germany (Salzert & Schelshorn 1979; Salzert & Johann 1994) several major habitat types were included in the design and the waders did stay in their assigned area. This is the only pool to contain fresh water and the birds chose not to settle on any of the salt water pools. A soft sand beach area was constructed which also included a wave machine set to gently move the water across the beach edge. A short grassy area and some more tufted landscaping were shaped for ruff to lek and shelter in. The addition of a secluded slow running stream from the back of the exhibit suited the Redshanks very well.

Wading birds were imported over a four year period beginning in 2001. The species were selected based on their natural habitat type and their ability to mix with other species. Pied Avocets *Recurvirostra avosetta*, Ruff *Philomachus pugnax*, Black-necked Stilts *Himantopus mexicanus*, Redshank *Tringa totanus* and Black-tailed Godwit *Limosa limosa* were all

brought into the collection.

These birds live in brackish or fresh water. They can be found on estuaries, or in smaller niches such as sewage farms, harbours or wet grassland. Most of them will move small distances throughout the day following the tide. The godwits are slightly different and will often fly a little further onto nearby farmland as the tide rises. For that reason it soon became apparent that they did not fit into our aviary mix. They were often found in other parts of the aviary, and were soon taken out of the collection plan. More recently Eurasian Oystercatchers *Haematopus ostralegus* have been added to the exhibit. Initial concerns that they may dominate or even predate smaller species have proved unfounded and they have settled well with the other species.

The waders have generally been successful at Living Coasts and in the spring the avocets and ruffs, in particular, provide a striking and memorable experience for visitors. Most species breed freely but there have been some challenges. We have learnt that the optimum number for avocets is about thirty birds; otherwise density-dependent factors lead to reduced nesting success. Redshanks are entirely self-sufficient and rear their own chicks in the denser grassy areas. Ruffs have not proved able to rear their own young in the aviary, but the females are very cryptic nesters and so it has proved difficult to find the nests to retrieve the eggs without causing unacceptable levels of disturbance to other species. Some enclosure modifications have recently been made which hopefully will allow us some greater control over the ruff flock in the future.

Over a 10 year period, wader hatchings include 167 avocets, 153 redshanks, 25 ruff and 13 black-necked stilts and 99 birds of three species have been supplied to other breeders.

Auk Cliff

Auks are traditionally thought of as difficult birds to keep in captivity but, as new husbandry techniques have developed over the last 20 years, some of the challenges have been met and a number of species are now self-sustaining in captivity (Gunther 1994; Douma & Carlso 1994). A fundamental requirement is that they must have clean, 'lively', water. In particular, the surface water must remain free of debris and grease. As the birds surface from a dive, any oil or grease on the surface is likely to collect on their plumage and compromise the waterproofing properties of their feathers. Once water finds its way into the insulating layer of feathers the bird will become chilled and other ailments will surely follow. The primary source of oil into the ponds is the birds' food and so care is taken to source good quality fish with as low oil content as possible. Sprats *Sprattus* spp.

are the main food supply supplemented with smelt Osmeridae, whitebait and squid. Stagnant or still water also attracts mosquitos which can carry malaria to the birds. The Auks' pool at Living Coasts was designed with these specifications in mind.

A powerful wave machine keeps the water moving and drives the surface water towards a horizontal slot at water level about mid-way along the back cliff. The shape of the pool is such that there are no corners where debris could be missed by the skimming action. At the other end of the pool there is a tip bucket that works on a pivot action and when the bucket is full of water it tips 900 litres into the pool. This causes turbulence both at the surface and below the water helping to keep the water active and moving towards the skim slot.

Eighteen Tufted Puffins *Fratercula cirrhata* have been hatched in this exhibit. Their nest boxes are placed behind a backdrop of artificial rockwork. Plastic drainage pipes are used to form tunnels leading from the rock face to the hidden nesting box.

Puffins, like many seabirds, are vulnerable to aspergillosis. Building a seabird colony near clean coastal air and using cold natural sea water has greatly reduced the risk of the birds contracting lung ailments. Care is also taken about the type of nesting material used in the enclosed nesting spaces. Pebbles are placed in the boxes as a non-slip base, and pine needles are offered to the birds ad libitum to carry out their own nest building. Pine needles are known to be less prone to carry fungal spores than many other plants. Other auks bred within this section include nine Pigeon Guillemot *Cepphus columba*, and twenty-three Common Guillemot *Uria aalge*. The latter species nests on rock faces in the open and has strongly precoccial chicks. The puffin and common guillemot populations are now self-sustaining in the aviary but the Pigeon Guillemot, which is a hole-nesting species, has not been able to compete with the two larger species and the population is now no longer viable.

Sea Duck Pool

Apart from Common Eiders *Somateria mollissima* marine anatids are rarely exhibited in zoos. This is because of their susceptibility to aspergillosis and to infection by parasites unless they have access to very clean water. One exhibit at Living Coasts was initially given over to sea ducks. However, because of their poor exhibition value in summer when they are in eclipse plumage, inactive and moulting, in 2012 their exhibit was converted for otters. Spectacled Eiders *Somateria fischeri* and King eiders *S. spectabilis* are still retained in the collection and now co-habit with the penguin colonies. In winter, when all the sea ducks were in their breeding

plumage and were performing their various courtship displays the sea duck pond was a wonderful and engaging sight.

The inventory (p.127) shows the variety of sea ducks that were held in the exhibit. Common and Spectacled eiders have bred regularly but the King eider pair have only once produced fertile eggs and these failed to hatch due to an incubator malfunction. Barrow's goldeneye *Bucephala islandica* bred freely but the chicks had to be hand-reared because they cannot survive on sea water. Long-tailed ducks *Clangula hyemalis* were routinely bullied by the Barrow's goldeneye males until the latter species was phased out of the collection but even then seemed to be intimidated by the larger eiders. So no reproductive activity occurred. The male Common Scoter *Melanitta nigra* regularly courted female eiders but ignored the two female scoters so the trio was sent to join the breeding programme for this species being developed by the Wildfowl & Wetlands Trust.

Gulls & terns

Probably the most successful species at Living Coasts has been the Inca tern *Larosterna inca*. The environmental conditions within the aviary appear to be perfect for this species and the terns are the only birds that make full use of the whole flying volume available. Even storm force winds and driving rain cause them no difficulty whatsoever; they never touch the net, and they never get ill. They also give great pleasure to visitors by their tameness and beauty. They breed freely in the aviary in any hole that they can find and the major challenge is actually to control their numbers. By the end of 2012, 162 birds had been sent to other collections.

Other tern species maintained in the aviary have proved much more challenging. The Common terns *Sterna hirundo* always seemed to have problems with the waterproofing of their feathers and, when flying, often scraped their primary feathers on the aviary net causing abrasion and asymmetry which affected their flight control. The Caspian terns *Sterna caspia* rarely flew in the aviary, despite its great volume, and developed a variety of ailments without a clear pattern. Our current view is that we would not try to maintain terns, other than Incas, in the future.

Six Red-legged kittiwakes *Rissa brevirostris* were obtained from the Alaska Sea Life Centre in 2003. Unfortunately all were females. Four birds still survive and are in good condition, regularly making nests. Despite repeated attempts it has not proved possible to source male birds so this species will die out. It is the intention to replace them with Black-legged Kittiwakes *Rissa tridactyla* in due course.

Conclusions

Living Coasts was developed as a zoo without cages where people could mix freely with animals and learn about them in a lively and entertaining way. The design of Living Coasts was aided by experience gained during the construction and maintenance of the Seal & Penguin Coasts exhibit at Bristol Zoo and freely shared by those involved (Dow & Bertram 2005). By carefully designing the environment, and choosing the appropriate livestock, a comfortable exhibit where the animals are relaxed, even when in close proximity to people, has been created to the benefit of both parties. The natural advantages of the site, discussed above, have allowed the maintenance and exhibition of species that will always be challenging to keep in more conventional zoo settings unless very significant resources such as refrigeration and air conditioning are supplied.

References

Douma B. and Carlson M. (1994) Breeding alcids at the Seattle Aquarium. *Int. Zoo Ybk.* 33: 142-147

Dow S. and Bertram B. (2005) Innovation and learning: how Bristol Zoo's Seal and Penguin Coasts exhibit works. Pp 99-109 in Plowman A. & Tonge S. (Eds.) *Innovation or replication? Proceedings of the 6th International Symposium on Zoo Design.* Whitley Wildlife Conservation Trust: Paignton, Devon, UK.

Gunther M.R. (1994) Alcids in North American zoos and aquaria. *Int. Zoo Ybk.* 33:136-141

Salzert W. and Johann A. (1994) The Wetland Aviary in Rheine Zoo. *Int. Zoo Ybk.* 33:119-124

Salzert W. and Schelshorn D. (1979) Maintaining and breeding avocets at Rheine Zoo. *Int. Zoo Ybk.* 19:143-145

Stevenson M.F., Dryden H., Alabaster A., and C. Wren (1994) The new penguin enclosure at Edinburgh Zoo: the palace for the 1990s. *Int. Zoo Ybk.* 33: 9-15

Tonge S. (2005a) Living Coasts – bridging the gap between zoos and aquariums. *WAZA magazine* 7: 16-18

Tonge S. (2005b) How to procure large capital projects, the example of Living Coasts, Torquay, UK. Pp 133-138 in Plowman A. & Tonge S. (Eds.) *Proceedings of the 6th International Symposium on Zoo Design.* Whitley Wildlife Conservation Trust: Paignton, Devon, UK

Wheater R (1976) The breeding of Gentoo penguins in Edinburgh Zoo. *Int. Zoo Ybk.* 16: 89-91

FEATHER DAMAGING IN AFRICAN GREYS - GROUND-BREAKING RESEARCH

by Rosemary Low

The most serious behavioural problem encountered by companion parrot keepers is feather plucking and other feather damaging behaviours. It is no coincidence that this is frequently encountered with the most intelligent species: Greys, macaws and cockatoos.

Because the problem is so common and so serious, in-depth research relating to its cause has been needed for several decades. It is fortunate for parrot keepers worldwide that Yvonne van Zeeland decided to make this topic the subject of her PhD thesis.

This has been published under the title of *The feather damaging Grey parrot: An analysis of its behaviour and needs*. Because this book is unlikely to be encountered by many parrot owners, I believe it is important that its content should be shared as widely as possible.

But first let me describe its totally unique cover. It shows a Grey Parrot, partly denuded on the underparts, plucking or preening its shoulder. The floor below its perch is littered with plucked feathers. Tilt the book forward to another angle and the picture changes (presumably laser imagery) to a perfectly feathered Grey: the plucked feathers have gone. Quite the most imaginative and appropriate book cover I have ever seen!

Its content, being a PhD thesis, is not so readily absorbed. However, its 281 text pages are quite enchantingly punctuated with the colour cartoons of Mandy Beekmans. I hesitate to call them cartoons because although they are humorous, they retain the essential characteristics of the species, and illustrate important research findings.

The author is a veterinarian and a certified parrot behaviour consultant. She is a qualified European Specialist in Zoological Medicine (Avian). She starts by explaining that an estimated 10-15% of captive parrots either chew, pluck, bite or pull their feathers. She states: "Although the consequences of this self-inflicted feather damage may be solely aesthetic, medical issues may also arise due to alterations to the birds' thermoregulatory abilities and metabolic demands, haemorrhage and/or secondary infections." Once parrots display feather damaging behaviour (FDB) it is often difficult to break the habit, with treatments generally yielding disappointing results. The outcome is often that the bird is given to a parrot sanctuary or it is euthanized.

FDB can be classified as among the abnormal repetitive behaviours which often develop in captive animals due to stress or aversive stimuli and/or the inability to perform species-specific behaviours. Parrots are particularly