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BREEDING AND REARING THE HUMBOLDT PENGUIN *Spheniscus humboldti* AT COTSWOLD WILDLIFE PARK, BURFORD, OXON. THE DEVELOPMENT OF A SUCCESSFUL HAND-REARING TECHNIQUE

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Introduction

The penguin enclosure is located within an old walled garden area of the Park and is roughly triangular in shape. It occupies a total area of approximately 300 m², some 75 m² of which are taken up by a pool. The maximum depth of the pool is one metre. The enclosure is bounded on the south and west sides by the original 4 m high boundary walls of the garden. Thus the enclosure faces generally north-east and is viewed from along the north-east perimeter by visitors. Visitors are separated from the enclosure by a 0.8 m high wall. The penguins have access to the pool by means of a gently sloping concrete ramp. This ramp also forms the route by which water flows into the pool from an adjacent waterfall. During daylight hours the water is circulated by means of a pump which takes water from the bottom of the pool and then discharges it at the top of the waterfall. Once a week the pool is emptied and scrubbed with dairy hypochlorite.

Located along the base of the high south and west walls of the enclosure are 12 nest-boxes. These are approximately 1.2 m x 0.8 m x 0.6 m high and have an entrance situated at one end, i.e., in one of the shorter sides. Each entrance faces onto the main enclosure. A wooden panel occupying half the width of the nest-box is situated 0.27 m inside the entrance to each box to act as a windbreak. The nest-box lids consist of removable wooden panels which are covered externally with waterproof sheeting. The nest-box floors also consist of wood. During the summer months areas of shade within the enclosure are provided by a tree, shrubs and vines. An artificial rock cave provides shelter throughout the year. The enclosure provides accommodation for Humboldt Penguins *Spheniscus humboldti*

and Rockhopper Penguins *Eudyptes crestatus*. At the time of writing (August 1983*) the colony consists of 5.5 breeding adult Humboldt Penguins, 16 young park-bred Humboldt Penguins and 2.2 breeding adult Rockhopper Penguins. Of the 5.5 breeding adult Humboldt Penguins, 2.4 are from the original stock purchased in November 1969 and October 1970.

The remainder of this paper refers to Humboldt Penguins only.

Diet

All our penguins are fed on sprats *Sprattus sprattus*. Frozen sprats are acquired from a fish supplier at regular intervals and stored at the park. As satisfactory air thawing facilities are not available, the frozen sprats are thawed by being placed in a container under running tap water. Although the method of thawing is always similar, it has been noticed that the quality of the thawed fish varies and presumably this is related to the method of freezing and duration of storage. Fish that are not firm to the touch when thawed are discarded as they are usually rejected by the birds in any case. The penguins are given a morning feed and an afternoon feed every day, except on Fridays when the enclosure and pool are cleaned. Apart from any very young birds recently introduced into the enclosure, the penguins are encouraged to take fish thrown into the pool.

During the afternoon feed only, one 300 mg NaCl tablet and one Mazuri Fish Eaters' tablet are together inserted into the body cavity of each of approximately 35 fish. The supplemented fish are tossed into the pool although any young birds present are first given one fish each directly by hand. It is therefore possible to ensure that on most days each penguin receives a supplemented fish. On occasions some birds take two or more supplemented fish but no ill effects have been observed as a result of this. When all of the supplemented fish have been consumed, the non-supplemented fish are thrown into the pool.

Each penguin consumes approximately 0.5 kg of fish daily. This amount varies, however, according to the time of year. During July the penguins consume larger quantities of fish than at other times and considerably increase their weight in preparation for the fast during the annual moult in July/August. During the moult the penguins consume scarcely any fish. Light feeding recommences towards the end of the moult and the normal food intake is resumed gradually over the following week or so.

Courtship

Once established, pair bondings have remained stable. This applies to birds of the original stock and birds bred subsequently within the colony. The breeding sites chosen by each pair, however, have not always remained constant from one breeding season to another. With the exception of the moult period and a period of approximately six weeks prior to it, our Humboldt Penguins have bred throughout the remainder of the year. However, the main breeding period here is between February and May. During the courtship period the penguins exhibit a marked heightening of territoriality and calling becomes more frequent. The territory of each pair appears to consist of a nest-box and an area of approximately one square meter immediately outside the nest-box entrance. Should a penguin stray unintentionally within the territory of another, the possessors of that territory initiate an exchange of loud calling (braying) with the intruder. In some cases this is followed by fighting. Such an exchange usually results in much braying within the colony as a whole. On entering its own territory or meeting its mate in a neutral area, each penguin sounds a recognition call. Courtship itself also involves loud braying as well as much neck and beak touching between paired birds. During periods of breeding activity the fleshy area at the base of the beak becomes swollen and reddish in colour. In the males, which are larger than the females, this change is more noticeable.

Nesting

Both adults incubate the eggs and share this duty on an approximately equal basis, changeovers occurring several times throughout the day and night. During the set feeding times the adult incubating at that time usually remains in the nest-box while its mate feeds.

Observations here indicate that the incubation period for the Humboldt Penguin is approximately 39 days and that incubation commences immediately after the first egg is laid. The second egg is laid between two and five days after the first.

Handrearing

After communicating with a number of other zoological establishments and generally reappraising our approach, from mid-1980 we adopted a policy of removing chicks from the parents immediately after hatching. A rearing room was set up in the basement of one of the animal kitchens, chosen because of its relatively cool and constant temperature. An extractor fan was fitted to provide improved ventilation. A Curfew still-air incubator was installed for rearing purposes and suf-

ficient working surface was made available for the handling of the chicks.

In the light of experience since that time, the following procedures are followed:

Nest-boxes in the main enclosure that are known to contain eggs due to hatch are inspected at each feeding time. The newly-hatched chick is removed from the nest-box immediately it is observed. Great care is taken while removing the chick as the parents are extremely protective at this time. However, within a few minutes after the removal of the chick the parents exhibit no signs of distress or abnormal behaviour. In cases where a second egg is being incubated at the time of the removal of a chick, the adult birds continue to incubate normally. As each chick is removed from its nest-box it is marked on either a leg or flipper for identification purposes by means of a harmless dye. It is then taken to the rearing room and placed in the rearing incubator which is set at a temperature of 32°C. The temperature is reduced gradually by around 0.5°C daily until a temperature of 22°C is reached. The rate of temperature reduction may vary slightly depending on the age of any other chicks in the incubator.

A healthy, newly-hatched chick has a dry, downy appearance and the yolk sac scar is dry and appears healthy. An egg tooth is visible on the upper mandible. In many cases, swelling of the neck immediately behind the head is observed. The extent of the swelling varies and appears to be more pronounced in a chick that has had a difficult hatch. However, some swelling is often seen in a chick that appears to have had a normal hatch. This swelling of the neck has been described by Dr. A.E. Anderson Brown (pers. comm.) as oedema of the neck muscles and overlying tissues, resulting from excessive use of those neck muscles during a prolonged or difficult hatch. The swelling disappears on the first or second day after hatching in all cases.

As the still-air incubator is used for the rearing of chicks (as opposed to the incubation of eggs) it is important to place simple barriers within the chamber of the incubator in order to prevent the chick from becoming too close to a heat source or becoming trapped in an awkward space around the thermostat equipment. It is unnecessary to make any special effort to control the relative humidity within the incubator. Each day the chick is removed from the incubator for a brief period during which time the incubator is cleaned thoroughly using hot soapy water and a hand-brush. While in the incubator, the chick rests on the standard wire mesh egg tray through which its droppings pass on to a removable sheet of paper below.

During the first 24 hours (day 1) it is unnecessary to feed the chick

as it has sufficient residual yolk to nourish it. Attempts to feed the chick are made on day 2. Liquidised food is made up once a day. Approximately 300 g of whole sprats, a 5 ml measure of Vionate powder and a pinch of calcium lactate powder are placed in a food liquidiser and 120 ml of 1% saline solution are added, the mixture being blended to a smooth consistency. Some of this mixture is placed in a 60 ml bladder syringe. The syringe is placed in a beaker of hot water until the temperature of the food is about 38°C, the approximate temperature of the regurgitated food that the chick would receive from its parents. The food is then fed immediately to the chick. The remaining liquidised food is placed in a refrigerator until required for the following feed, any unused food being discarded at the end of each day.

The chick is removed from the incubator for feeding and is held in an upright position in one hand. The forefinger of the same hand is used to raise the chick's head and open the bill. Great care is used at all times. The syringe containing liquidised food is held in the other hand and the syringe nozzle, which in the bladder syringe is around 35 mm long, is inserted gently into the chick's mouth, over the glottis and into the back of the throat. A small quantity of food, perhaps 1-3 ml, is then expelled gently from the syringe. This action initiates the chick's swallowing reflex and the nozzle is withdrawn from the mouth until the food has been swallowed. This process is repeated until approximately 5 ml of food have been consumed. The chick gradually becomes accustomed to the feeding routine and by day 3 it begins to accept food from the syringe voluntarily, increasing quantities being consumed from that time. During the first 48 hours the chick loses from around 5-10 g in weight. The first weight gain occurs around day 4 (see graph).

By the second week the chick is entirely accustomed to the feeding routine and the presence of one of the handlers is sufficient to cause it to vocalise and the raise its head, indicating its readiness to take food. The young chick rests on the tarsometatarsus at this stage.

During the first four weeks or so the chick is fed three times per day using the above mixture and procedure. The feeding times are approximately 0800, 1200 and 1700 hours. Care is taken not to over-feed the chick at any one feed as over-distention of the gut at this stage can give rise to vomiting and other complications.

Chicks showing weight gains that are significantly higher or lower than the mean during the first few weeks are often associated with intestinal infections, vomiting and a general failure to thrive or, in a few cases, to survive. Certain precautions are thus taken with all chicks to ensure acceptable weight gains during this period. The abdomen is manipulated gently with the fingertips before and during feeds so that

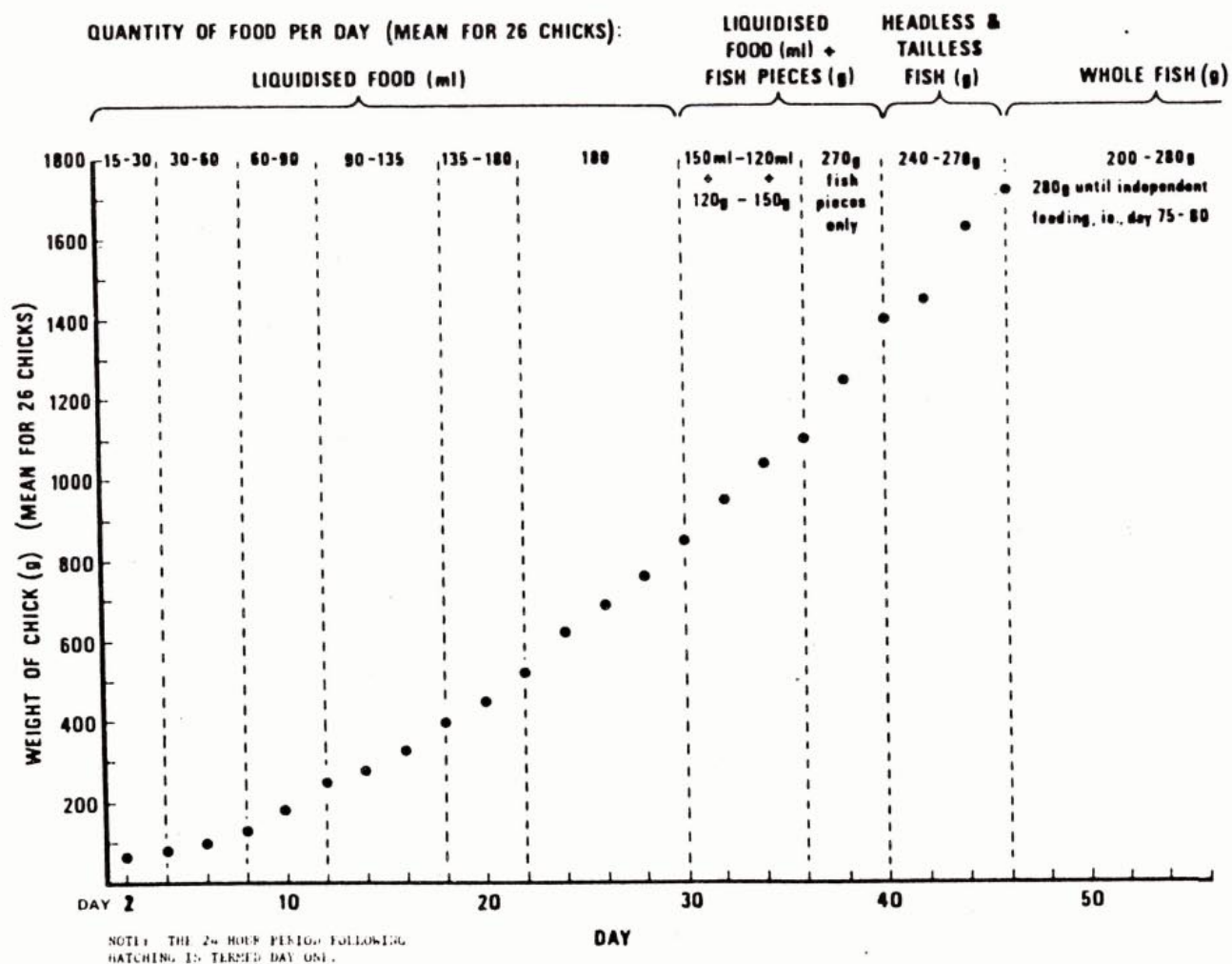


FIG. 1. CO-RELATION OF FOOD INTAKE AND DEVELOPMENT OF HAND-REARED HUMBOLDT'S PENGUIN CHICKS

the handler can gain some impression of the volume of food in the gut and can thus avoid overfeeding. It is preferable to underfeed slightly than to overfeed. A chick exhibiting weight gains that are below average may benefit from an additional feed per day for a few days.

A chick that is weak or unwell may refuse food and its mouth is examined for any signs of infection as is also the cloacal vent to confirm that excreta are being passed freely. A weak chick may also be unable to assume the correct posture in which to defaecate and excreta may then accumulate and solidify around the cloacal vent. Close observation of the faeces is maintained constantly as the presence of blood in the faeces usually indicates an infection requiring veterinary treatment. During the first seven to ten days a yolk sac infection may develop. However, it is not usually possible to confirm such an infection until after the death of the chick.

To a certain extent it is possible to maintain chicks of various ages at the same temperature in the same incubator. However, it is not recommended that a newly-hatched chick be placed in the same incubator with older chicks when the temperature in the incubator is less than 32°C. It is also undesirable to maintain a chick of three weeks old or more at a temperature of over 29°C. Thus we eventually found it necessary to purchase a second still-air incubator for use as a brooder. The chick is removed from the incubator when around 26 days old as at this age it becomes too large for the incubator chamber. The chick is then placed in a circular, open-topped container approximately one metre across, the sides consisting of a length of rolled hardboard. The base of the container consists of a fine wire mesh which is raised slightly above removable sheets of paper. The container is heated by means of an overhead heat lamp and, by positioning the lamp correctly, a temperature gradient is initially maintained of from 21°C down to 16°C throughout the day and night. When around 850 g in weight (day 30) the chick no longer requires a heat lamp and subsequently the lamp is used only if the temperature drops below 10°C.

Once the chick weighs about 950 g (day 30) it is weaned on to sprat pieces taken from filleted sprats with the head and tail also removed. Thus at this time the chick consumes around 50 ml of liquidised food plus around 40 g of sprat pieces at each of its three feeds per day. The sprat pieces are moistened with 1% saline solution or water to facilitate swallowing. It may be necessary to coax the chick into accepting these fish pieces by stroking its throat while it is being fed. However, the chick soon becomes accustomed to this addition to its diet and during the next few days the sprat pieces are increased and the liquidised food decreased.

By around 1.1 kg in weight (day 36) the chick is fed entirely on sprat pieces moistened with saline solution or water. The approximate intake is 80-90 g per feed. As at this stage the chick no longer receives the vitamin and mineral supplement previously included with the liquidised food, a dusting of calcium lactate and Vionate powders on the moistened fish pieces providing the necessary dietary supplements.

When the chick weighs around 1.4 kg (day 40), headless and tailless non-filleted sprats are introduced and increased gradually to replace a roughly equivalent quantity of sprat pieces. Whole sprats, i.e., including the head and tail, are introduced at around day 43.. At around this time the chick ceases to stand on the tarsometatarsus and extends the lower limb to stand on its phalanges.

By around 1.7 kg in weight (day 46) the chick's food consists entirely of whole sprats and the number of feeds is decreased to two per day, one at 0800 and one at 1700 hours. Approximately 100 g of sprats are consumed during each feed, the total daily consumption thus showing a small temporary decrease. One half of a Mazuri Fish Eaters tablet and one half of a salt tablet are inserted into the body cavity of one of the sprats given to each chick per day.

At this age the chick, together with any others of similar age, is placed in a separate pen within the main penguin enclosure during the day, provided that the weather is not too cold or wet. This pen has wire mesh sides that protect the chick from minor bullying by the more inquisitive members of the colony. A piece of roofing sheet or similar material is placed over part of the pen in order to give protection from the sun or rain. The pen has an open base so that the chick's feet rest directly on the grass or small pebbles of the enclosure. The chick and its pen are moved to a covered area of the enclosure at night for additional protection from adverse weather.

Assimilation into the colony

The initial introduction to the main enclosure of the penguin chick inside its pen results in one of two general reactions from members of the colony. As already noted, the colony at the Cotswold Wildlife Park is composed of both Humboldt and Rockhopper Penguins and while most hand-reared individuals of both species exhibit some interest in the new chick, most wild-caught individuals ignore it.

At around day 55 the juvenile plumage begins to replace the down feathers, always commencing on the flippers. Once around half the juvenile plumage has appeared, i.e. at around day 70, the chick is removed from its pen by day and is allowed to move freely within the colony. However, for the first few days it is caught up and placed back

in the pen at night. The newly-released chick is usually ignored by the paired adults. The sub-adult Humboldt Penguins, however, may bully the chick somewhat for a few days. This reaction may be due to the need to establish a pecking order. However, within a week of its introduction the chick appears to attract no further attention and is no longer placed inside the protective pen at night.

The newly-released chick has free access to the pool and while some chicks enter the water almost immediately, others take a day or so longer. The chick's ability to swim appears to be instinctive although during the first few days its movements are somewhat unco-ordinated. However, its swimming ability improves rapidly. Any down remaining at this time is quickly lost during swimming and subsequent preening. Within a week of entering water for the first time, the chick is encouraged by the handler to accept food from the hand while in the water. Thus the chick gradually learns to feed while swimming and eventually dives and competes for fish with the adults.

Abandoned eggs

There have been occasions when eggs were abandoned by the adult birds during incubation. On one occasion a clutch of two eggs was parent-incubated beyond the 30th day, i.e., the eggs were both within seven to ten days of hatching. As soon as the abandonment was observed the eggs were removed from the nest-box and placed in an incubator. Enquiries were made concerning penguin incubation temperatures and one experienced source advised that the eggs be incubated at a temperature of between 35.5°C and 35.8°C at 60% humidity. This advice was followed and both chicks began to pip normally. However, on the second day in each case it appeared that the shell membranes were drying out and that the chick was adhering to them. Warm water was then sprayed regularly from a fine spray onto the egg, internal membranes and the emerging chick. Both chicks were still unable to complete the hatching process and thus a pair of blunt forceps was used gradually to remove pieces of shell until the chicks were free. The chicks were subsequently hand-reared and reunited with the main colony as described above.

Subsequently, another clutch of two eggs was abandoned within a day of the second egg being laid. These eggs were placed in an incubator and were successfully hatched and the chicks reared, this time without any hatching difficulties.

Conclusion

Prior to mid-1980 only one chick was reared to independence by its

parents out of approximately 40 eggs that hatched. From the start of the hand-rearing programme to August 1983, 26 chicks were reared to independence from a total of 32 that were removed from their parents at hatching for attempted hand-rearing. The success rate is thus approximately 81%.

Products mentioned in text

Dairy Hypochlorite. Manufactured by F.B.C. Ltd., Hauxton Cambridge, England.

Mazuri Fish Eaters Tablet. Manufactured by Special Diets Services Ltd., 1 Stepfield, Witham, Essex, England.

Curfew Still-Air Incubator. Manufactured by Curfew Incubators, South Minster Road, Althorne, Essex, England.

Vionate Powder. Manufactured by Squibb and Sons Ltd., Hounslow, Middlesex, England.

Bladder Syringe. Manufactured by Monoject, Ballymoney, County Antrim, Northern Ireland.

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