

## Conditioning Sedentary Captive Penguins for Increased Swimming Time

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### ABSTRACT

Penguins are seabirds that naturally spend a vast amount of their life in the ocean swimming and foraging for food. In contrast to their wild counterparts, the Cincinnati Zoo's mixed species penguin collection was comparatively sedentary and shore-bound, spending relatively little time in their pool. This study presents operant conditioning techniques that utilized feed-fish and toys to promote more swimming time in a captive penguin population. This, in turn, awakened porpoising and other naturally occurring behaviors that the penguin group never previously displayed. Additional benefits were a presumed reduction in susceptibility to bumblefoot disease and a noticeable increase in zoo visitor interest.

### INTRODUCTION

Penguins (family *Spheniscidae*) are a well studied group of flightless seabirds (Stonehouse 1975, Davis and Darby 1990, and Williams 1995) with a solely southern hemisphere range. There are 17 species varying in size from the 85 lb. (38 kg.) Emperor penguin to the 3 lb. (1.3 kg.) Little penguin. Four species breed on the continent of Antarctica, but most live in somewhat warmer climates. Characteristically, penguins have a thick layer of fat that allows them to exist without food for extended periods of time during the molting and breeding seasons. This layer also reduces heat loss while the penguins are in frigid waters. Since penguins are distinctly torpedo-shaped, with powerful wings and short stubby legs and tails, they are highly adapted for a life in the ocean. Typically they spend a considerable amount of time swimming and feeding on fish, krill (crustaceans), and squid (cephalopods).

Conversely, a multi-species group of penguins kept at the Cincinnati Zoo spent relatively little time swimming. The overall nature of our penguins was best described as sedentary. Even their swimming appeared sluggishly and solely for the purpose of cleaning their feathers. Our smaller penguin species (see 'Penguin Study Group') swam for a daily estimated average of twenty minutes. Our larger species, the King penguins, routinely swam for approximately ten minutes in the morning and would seldom venture into the pool throughout the remainder of the day. It was decided to encourage swimming for enrichment purposes and because long periods of inactivity are conducive to associated foot problems known as bumblefoot disease, *Pododermatitis* (Sawyer 1983, Ellis et al 1994).

The Cincinnati Zoo, like many institutions that house penguins normally hand fed all the food that the penguins received. During an early attempt to increase swimming time, live minnows and freshly thawed silversides (see 'Initial Feeding Regimen') were placed in the pool. When live fish were introduced into the pool most of the penguins were not interested. On several occasions silversides were thrown near the swimming birds. This also proved ineffective. Because virtually all fish in the water were ignored it appeared that our penguins did not recognize fish in their pool as food. Our two Magellanic penguins (see 'Penguin Study Group') were exceptions, because they ate from the pool and typically swam nearly two hours daily.

In September of 1997, I attended Sea World of Cleveland's two-day seminar called "Dog Days" and learned how their animal trainers use positive reinforcement to motivate captive animals for enrichment, public demonstrations and to improve animal husbandry practices. These methods seemed applicable to motivating our penguins to swim more.

The purpose of this study was to encourage swimming behavior in a mixed species group of penguins at the Cincinnati Zoo. This paper describes the operant conditioning techniques that were used with feed fish and toys to increase swimming time and activate more natural behaviors. This experiment was initiated in autumn of 1997, lasted for about a year, and has been previously summarized (Kinley 2000).

## **PENGUIN STUDY GROUP**

Our penguins were publicly displayed and maintained in the Zoo's "Wings of the World" (Bird House) sub-Antarctic coast polar exhibit. The smaller species in the study group included two African Blackfoot penguins (*Spheniscus demerus*), two Magellanic penguins (*Spheniscus magellanicus*), and ten Rockhopper penguins (*Eudyptes chrysocome*). The King penguins are the large species in this study. Initially, there were four King penguins (*Aptenodytes patagonicus*), with three more King penguins acquired later that same year.

## **Key Birds noted in this study**

- ☒ Buddy — Magellanic penguin, 10 years old
- ☒ Maggie — Magellanic penguin, 2 years old
- ☒ Bonnie — African Blackfooted penguin, 2 years old
- ☒ Squirt — Rockhopper, 1 year old
- ☒ Rockette — Rockhopper, 30+ years old, wild caught
- ☒ Blue — Rockhopper, 25+ years old, blind in one eye, vision impaired in other

## **SUB-ANTARCTIC COAST POLAR EXHIBIT**

The penguins live in a large naturalistic diorama featuring a typical penguin habitat. The exhibit is 27 ft. wide x 35 ft. tall x 16 ft. deep (8.2 x 10.6 x 4.8 m.) The exhibit pool holds 12,000 gallons (45,423 liters) of freshwater. The air and water temperatures are maintained at 50-60° F (~10-18° C.) The exhibit is illuminated by sodium vapor and metal halide lights. The day light schedule is 8 hours winter and is gradually changed to 19 hours summer following the natural sub-Antarctic cycle. In addition to penguins the exhibit also housed two Chiloe wigeons (*Anas sibilatrix*), two Imperial cormorants (*Phalacrocorax atriceps*) and a Blackfaced ibis (*Theristicus melanopsis*).

## **INITIAL FEEDING REGIMEN**

**Feed-Fish:** The following species were received boxed and frozen: silversides (*Menidia menidia*), herring (*Clupea harengus harengus*) and mackerel (*Scomber scombrus*). Live Golden Shiners (*Notemigonus crysoleucas*) and Fathead minnows (*Pimephales promelas*) were placed in the pool for enrichment, but only the Magellanic penguins would eat them.

**Smaller penguin species:** Our smaller birds were mainly fed 2-4 inch (5-10 cm) long freshly thawed silversides in three bowls distributed throughout the polar display twice a day. Their daily feeding

schedule consisted of one feeding in the morning and another in the afternoon. Five, one year old hand-reared rockhoppers would eat from the bowls but they preferred to be hand fed. Usually they initiated hand feeding by approaching the keeper who brought in the food. Rockette would not eat unless she was hand fed and, because Blue was nearly blind, he was also hand fed.

**King penguins:** Being significantly larger birds, the King penguins were hand fed mackerel and herring 6-12 inches (15-30 cm.) long. Feeding occurred once in the morning and again in the afternoon.

**Vitamins:** Additionally the penguins were given Mazuri brand® sea bird vitamins. This was administered one of two ways; by hand feeding them fish with a vitamin tablet inserted or by sprinkling a powdered form over fish in a bowl.

## **CONDITIONING METHODS**

**A variable feeding schedule:** Utilizing the information gained from the Sea World seminar, I began conditioning the penguins to eat in the water so that they could be reinforced for being in the pool. This was an important hurdle to overcome, since they rarely swam. It is well known that variable reinforcement can be used to motivate animals in training (Pryor 1984, 1999). I decided to vary their feedings by amount, time and frequency. For example, on one day they might get fed at noon, while on the next day they would be fed in the mid-afternoon. Some days the penguins were fed once, and on other days they were fed twice. I hoped that this sporadic feeding pattern would spark some mental refocusing. On my two days off each week no conditioning occurred. On those days the penguins were fed according to the Initial Feeding Regimen.

Whenever I noticed five or more penguins swimming, I would place about twenty live minnows in the water, then quickly leave the exhibit before they could scamper over expecting to be hand fed. This process was continued the length of this study. More significantly, when the penguins rushed over to be hand fed during feeding times, I would place the birds in the water. As they swam back to shore to leave the water, they were handed silversides. At first, the penguins ignored the fish while they were in the water; instead they got out and came over to be hand fed.

However, when this technique was tried again, Bonnie and Squirt each ate two fish while they swam to the pool's edge, then they quickly exited the pool following the other birds. This process was continued twice a week, and by the second week three more Rockhoppers ate this way. Bonnie was now eating fish that were tossed near her as she swam to exit the pool. After five weeks of this protocol, all of the Rockhoppers and African Blackfoot penguins were eating while in the pool.

After eight weeks of conditioning, they began jumping into the water once the first fish was thrown in. It took nine additional weeks until the King penguins began to eat in the pool. Extra patience was needed with them because they were relatively more sensitive to changes, but they too ultimately responded to these conditioning practices.

**Motivating Swimming Behavior:** Once the penguins accepted fish in the water as food, I wanted to further reinforce their active swimming behavior. To facilitate this, two to four fish were thrown in at different places in the pool. Once they were all eaten, a pause of about five seconds followed and then the process was repeated until the penguins seemed full. This method was advantageous because the

limited number of fish in the water each time caused the penguins to grab and eat competitively. This rewarded them for swimming faster.

There was a dramatic difference in penguin behavior after they started eating in the water. Not only were they spending more time swimming, but previously unseen natural behaviors were occurring as well. Almost daily they were observed enthusiastically porpoising and bursting out of the water onto the exhibit walkway. Also, they would swim very fast in figure eights and circles around the pool circumference. Even Buddy and Maggie were swimming longer and more actively. After nine months of conditioning, all of the penguins (except Rockette and Blue) would quickly jump into the pool to be fed when I entered the exhibit with food. After each feeding session, the smaller penguin species were still given access to three bowls of fish. Since the silversides and minnows were not enough to quench the king penguin's appetites, they were hand fed when they left the water.

I was initially concerned that more aggression would result from competition during the feeding sessions, but was glad to observe that aggression in the exhibit actually decreased. I believe that this was due to the increase in activity. It was extremely rewarding to have the penguins now spending approximately six hours daily swimming, versus the twenty minutes or so prior to conditioning.

**Conditioning with Toys:** The penguins were clearly receptive to the conditioning techniques used to increase swim time. Now other forms of enrichment that would encourage active swimming behaviors, yet eliminate the need to put food in the water, were considered. Ellis et al. (1994) noted that various colored rubber balls could be used as toys for penguin enrichment. To incorporate this technique, I enlisted the aid of two summer interns, Paul Evans and Micheal Kiselow.

We acquired hollow plastic balls that were red, blue and black, and varied in size from 4 to 7 inches (10-17.5 cm) in diameter. Initially, during feeding sessions and while the exhibit was cleaned, the balls were placed on the exhibit floor to desensitize the penguins to them. Strangely, the Rockhoppers seemed comfortable with the toys since three of them curiously pushed the balls around on the first day. Three days later, during a feeding session, the balls were placed in the pool and silversides were thrown near them to target the balls. After cautiously investigating the black ball, Bonnie was soon batting it around, but seemed to avoid the red and blue ones. The Rockhoppers were at first very cautious of the balls in the pool, but over the next few sessions began to show more interest.

This was encouraging, but we had hoped for a more active response. Paul proposed using a hamster ball filled with silversides to promote more interest. A yellow, 8 inches (20 cm) diameter hamster ball, with a smaller ball inserted to provide buoyancy was tried. The hamster ball was used during feeding sessions along with the other balls and was targeted by throwing fish near it. Soon the penguins were eagerly pushing the hamster ball around trying to get at the fish inside. This process seemed to encourage them to play with the other balls as well. On one occasion, Bonnie persisted until she was able to tip the hamster ball. As a result, this released all the fish, which were quickly eaten.

After a week of using the hamster ball in conjunction with the other plastic balls, Bonnie was observed exhibiting more interest in the red ball, opposed to the others. She was seen pushing the balls around with great precision, similar to the way I have seen some sea lions do in shows. The plastic balls were only used during feeding sessions so that the swimming behaviors would continue to be reinforced. After a few weeks, the penguins were avidly playing with the balls as they floated within the exhibit pool.

## **SUMMARY AND CONCLUSION**

Wild penguins acquire food only while they are in the ocean. In contrast many institutions that house penguins hand feed them, thus rewarding them while they are out of the pool. Penguins are such ocean carnivores that one may question whether or not a penguin that doesn't eat in the water or who doesn't swim much, feels much like a penguin? They are adapted for a life in the ocean. This leads to the assumption that the more closely we can mimic that situation the greater the benefits are for our penguins. In this study, conditioning techniques were instrumental in achieving the goals of increasing swimming time and promoting natural behaviors. Subsequently, our penguins are swimming more actively, more frequently and are exhibiting swimming behavior similar to penguins in the wild.

Now that the penguins *are* swimming more, the exhibit offers our visitors an enhanced experience. Now our patrons can get a closer glimpse into a more natural world of penguins.

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