

Establishing Controlled Environment Penguin Populations Via Eggs

by Frank S. Todd
Corporate Curator of Birds
Sea World — San Diego,
Ohio and Florida

Between 11/2/84 and 11/14/84 research was carried out by a Sea World field team on Isla Noir, Isla Magdalena and Isla Marta in southern Chile. In addition to the scientific commitments, the prime objective was to acquire a number of fertile penguin eggs (as well as those of several other avian species), which would be subsequently hatched in San Diego, California. Sea World has been deeply committed to polar penguin research for the past 12 years and maintains the largest colony of controlled environment subantarctic and Antarctic penguins in the world. The techniques used for egg acquisition and transport were prototyped during the 1983/84 season in the Antarctic in conjunction with the Chilean Antarctic Institute, Chilean Air Force and the University of Chile. The success of that venture formed the basis for the current project.

Isla Noir: This remote island is located some 200 miles to the northwest of Cape Horn and has been visited by very few naturalists, or anybody else for that matter. The island was extremely difficult to reach and conditions there were less than hospitable. Isla Noir (Black Island) was larger than any chart available indicated and was far more rugged than anticipated. This greatly hampered our ability to accomplish all of the scientific objectives. Several of the science projects had to be scaled down even more due to extreme climatic conditions. At times, the wind speed exceeded 90-100 mph and the sea state generally was in excess of 20 feet. As a result, landings in a small rubber zodiac were extremely difficult, not to mention hazardous. Additionally, the unbelievably dense vegetation precluded accurate census work since penetration through the thick growth was essentially impossible. For an accurate avifauna census to have been accomplished, dozens of qualified people working continuously for several weeks would have been required.

Rockhopper penguin (*Eudyptes crestatus*): This was a common nesting species on Isla Noir. However, they

were difficult to reach because the penguins tended to favor rough coasts, nested high on the steep slopes (200 meters or more), and the rookeries were usually located in dense vegetation. Rockhoppers were abundant all along the southeast coast but some were also observed on the north side of the extreme eastern coast. However, they were not nearly as numerous in this sector, undoubtedly because of the vertical cliffs.

The specific rookery we ultimately selected was somewhat difficult to reach, but it was one of the more accessible. This small rookery consisted of 300-500 pairs of rockhoppers, but many other rookeries dotted the hillside. We estimated in this area alone, at least 5,000 pairs were nesting. However, due to the visual restrictions of the thick vegetation, the number could easily have been five times that amount.

The eggs were collected without incident because the rockhopper penguins tended to be very nervous and would move off the nest when approached. This was curious, since it did not conform to the behavior of *E. crestatus* I have worked with elsewhere; i.e., Falkland Islands, MacQuarie Island, etc. Generally, these are very aggressive, territorial and defensive birds which are not hesitant to attack and bite viciously. In addition, the nesting penguins were scattered, rather than in dense concentrations as is more typical elsewhere.

Crested penguins are of great interest since they produce a clutch of two dissimilar sized eggs. The first egg laid (alpha egg) is approximately one-third smaller than the second egg (beta egg). Why the small egg is laid first when the reverse appears to be more logical is not known. We were anxious to determine the viability of the alpha egg and wanted to know if egg size is related to sex determination. To accomplish this, 50 double egg clutches were collected along with an additional 30 beta eggs.

Crested penguins, while sometimes hatching two chicks, are not capable of fledging more than one young. This fact has been documented repeatedly.

In order not to compromise reproductive potential, one egg from nests we did not collect from was placed in nests where the two-egg clutches were acquired. Despite the fact that the territories were temporarily abandoned during collecting activities, and since penguin eggs are quite tolerant of cooling, the egg switch should have been successful.

Based on the behavior of the birds, combined with the fact most eggs in the colony did not exhibit extensive nest staining, we estimated that incubation had been in progress for approximately two weeks. The eggs were transported in portable, forced air, battery-operated field incubators. The temperature was maintained at a constant 96.5°F. The transport of the eggs by boat back to the anchorage was extremely traumatic for us. The high winds and heavy seas (with 20+ foot swells), pounded the little 39-foot fishing boat to such a degree that we were doubtful the eggs could survive. During the early stages of incubation, developing embryos are particularly sensitive and any kind of shaking can cause development to terminate.

Once back in San Diego, the eggs were transferred to the stationary incubators within the USDA-approved quarantine freezer facility. We have since determined that both the alpha and beta eggs are indeed viable and while some of the alpha egg chicks were tiny (45 grams), the young were reared without major incident. It is also possible for researchers to analyze the remains in the discarded shell for hormonal traces and this data will enable us to sex each chick.

It will then be possible to answer the question of whether or not egg size is related to sex. The peak of hatching occurred on December 1 and since the incubation period is 32-34 days, we can fairly accurately determine when the Isla Noir rockhoppers commenced laying—the last week of October. A force in excess of 80 volunteers was required to assist with the hand rearing since feeding was necessary 24 hours a day, seven days a week. Ultimately 88 rockhopper penguins were fledged out of 92 hatched.

Macaroni Penguin (*E. chrysolophus*): The rookery of this species was ultimately located along the southwest coast of Isla Noir. Due to heavy weather we were able to reach it by rubber boat only once, and even then time was limited since the weather was closing down rapidly. The lack of time precluded a comprehensive census,

but a very conservative estimate would put the population at an excess of 10-12,000 pairs. Once ashore, the rookery was relatively easy to reach and was located on gently sloping terrain. The rookery area itself was completely denuded of vegetation, obviously a result of the pressure exerted on it by the nesting penguins. I would judge the colony to be in a state of expansion based on the number of birds establishing territories in the thick vegetation around the perimeter of the main rookery.

As was the case with the rockhoppers, the behavior of the macaronis did not conform to what I consider normal. Rather than being very aggressive and territorial, they tended to move off the nest when approached. Essentially all birds were incubating a single egg. This egg was quite large and was clearly the beta egg. We were extremely interested in the fate of the alpha egg: Was it kicked out of the nest deliberately? I did observe a few small alpha eggs in the mud, but not enough to suggest mass ejection. It is more likely that the small eggs were broken during territorial conflicts. Macaroni penguins (particularly the males) tend to fight viciously when defending territories and because the small egg is laid

first, it is logical to assume there are numerous opportunities for this egg to be broken. The only other possibility is that the macaronis were laying but a single egg. However, I do not believe this to be the case.

Climatic conditions and heavy seas prevented us from getting back to the rookery by zodiac to acquire the eggs. As a result, we were forced to use a Chilean Air Force helicopter. When the military helicopters arrived to take the team off the island, the pilots indicated it might be possible to hover above the ground some distance from the rookery since it was impossible to land there. (Indeed, it took us considerable time to locate an appropriate landing site for the helicopters at the anchorage). Hovering can be a risky business and several of us had to jump out of the airborne helicopter. The helo then immediately flew back to the anchorage to refuel, only to return 20-30 minutes later, which gave us very little time to acquire the eggs.

We did exceedingly well with the macaronis and fledged 129 out of 132 hatched. The hatching peak was on November 26. Taking into account an incubation period of 32-37 days (mean: 35 days) and adding three to six days which would include the laying of

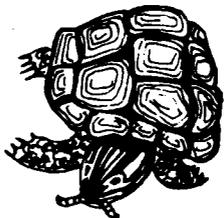
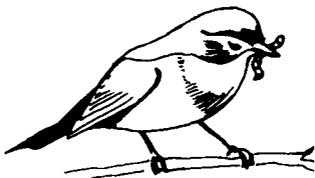
the first egg, we can conclude that egg production commenced the second week of October. This earlier laying period than the rockhoppers was not totally unexpected since when two species of crested penguins nest on the same island, the larger of the two generally commences breeding first. In the case of both rockhopper and macaroni penguins, Isla Noir constitutes one of the more northerly rookeries.

Magellanic penguin (*Spheniscus magellanicus*): This species was extremely common on Isla Noir, but they were difficult to get to due to the dense vegetation. However, we did manage to check a number of burrows and, unfortunately for us, all contained chicks which ranged from one day to two weeks of age. Therefore, it was necessary to acquire the eggs on Isla Magdalena where the population is even larger and essentially all the burrows are exposed and relatively shallow, which precluded the need to dig them out. We wished to avoid digging if possible in order not to destroy burrows. The required eggs were collected rather easily. No chicks were observed; it was clear that the reproductive cycle of the Magdalena colony was behind that of Isla Noir.

Continued on page 25

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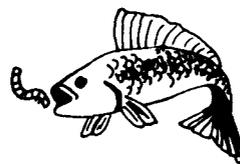
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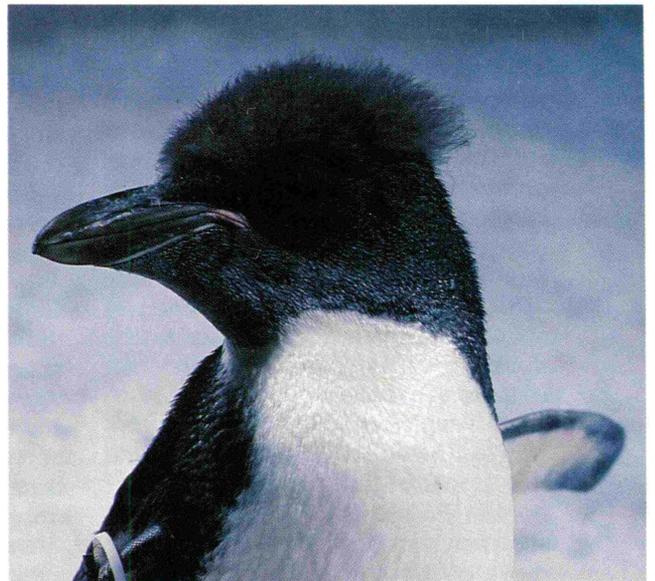
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Transferring the eggs from the field incubators to the main incubators.



Macaroni penguin, 7 weeks old.



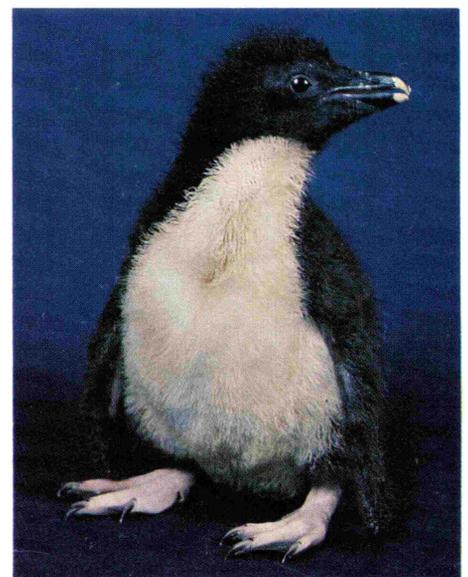
Clutch of Rockhopper eggs. The first laid egg (to the right) is often a third smaller. Note it is much more nest stained.



Magellanic oystercatcher fledging, ± 6 weeks.



Brooder boxes for older penguins.



Rockhopper penguin chick.

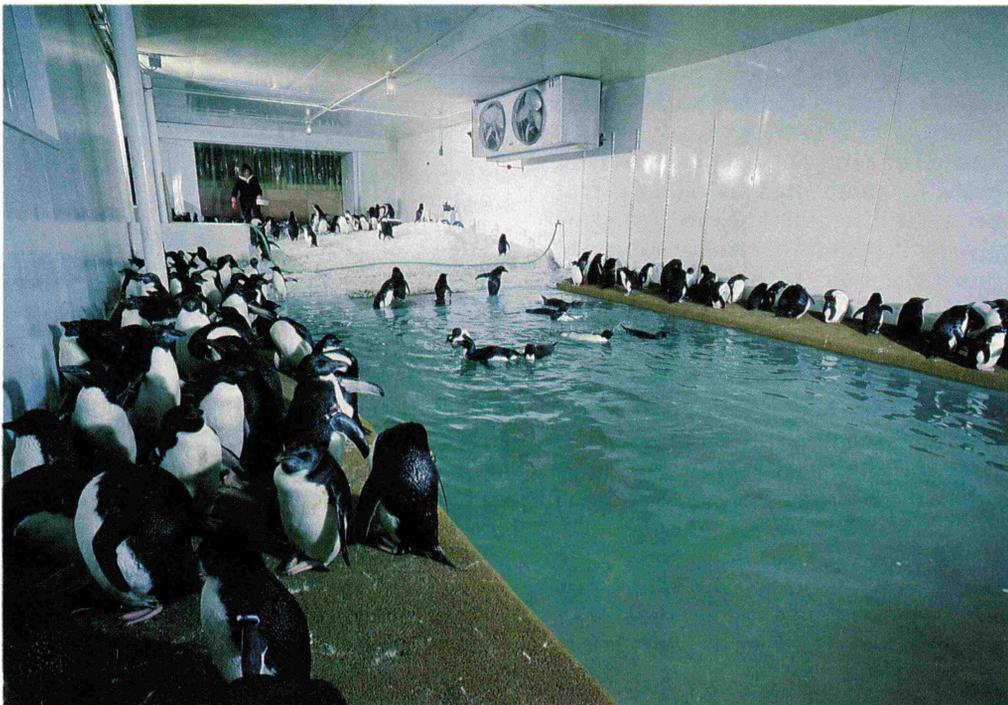


Buff-necked ibis chick, ± 10 days.



Buff-necked ibis, 6-7 weeks.

Fledged penguins in the quarantine facility.



Eighty-nine Magellanic chicks hatched and there was but a single mortality. Curiously enough, fledging occurred, within 60 days rather than the expected 90 days which is typical for the genus. The incubation period of this species averages 42 days. Since the peak hatch date was December 1, we can assume the Isla Magdalena penguins commenced laying in the middle of October. Accordingly, the Magellanic penguins on Isla Noir undoubtedly started at least two weeks earlier—the end of September or the beginning of October. The variance in egg laying dates and the extended hatch period of this species is not surprising since Magellanic penguins are more temperate in distribution and are burrow nesters. Therefore, they are not subjected to the climatic extremes of those species farther to the south. As a result, they are not forced to hatch and fledge within a specific, rather limited time span.

As was the case with all chicks reared in San Diego, daily growth rates of this species were compiled. This voluminous data is currently being computer programmed. The results will enable us to prepare accurate growth rate charts which can be used by independent field researchers. By simply weighing a chick and checking the chart, it should be possible to accurately age any chick to within several days. In addition to the penguins, eggs of several other species were acquired as well and success was achieved in rearing a number of pied oystercatchers, buff-necked ibis, kelp gulls and dolphin gulls.

The encouraging results of the past two austral seasons suggests that egg acquisition might be a more acceptable way to import some species of birds. For example, in the case of those penguin species which produce two eggs, but generally fledge a single chick, the removal of one egg does not adversely impact the reproductive potential. Since no adults are removed, the population remains intact. In addition, the disturbance factor is minimized and quarantine is much less traumatic. While importing birds via eggs is certainly not the answer for all avian species, there are a number of suitable candidates. Considering the fact that a number of animal protectionist groups are demanding a halt to avian importation because they claim collectors are "raping the environment," this is an alternative that deserves some serious consideration. ●