Abstract
Managing and hand-rearing Hyacinth Macaws has been an interesting challenge for AWWP’s Bird and Veterinary staff. Breeding the birds has not been a problem but a number of behavioral and physiological abnormalities have forced us to be innovative in our approach to overcome these challenges. A combination of experimental treatments, practicality and sensitivity has seen us successfully manage chronic self-mutilation of feathers and skin, a beak abnormality and feet abnormalities. Our problems with Hyacinth Macaws involved three birds: a breeding male who self mutilates and two of his hand-reared offspring which hatched with abnormalities—one with scissor beak and the other with structural problems of the feet.

To overcome the breeding male’s self destructive behavior, we first had to put a stop to the damage, which in June 2005 had manifested into severe mutilation of the skin covering the right side on his lower breast and thigh. He was successfully treated with an injection of a tranquilizer known as perphenazine, which is still an experimental treatment for birds. Although this was a good short-term solution, it did not address the root primary cause of the problem. Identifying and addressing the source of his distress was going to be essential to support the successful treatment applied so far, and to prevent any future self-mutilation. The staff of AWWP gained a lot from this experience and hope that our work can benefit other breeders and their problem parrots in the future.

Introduction
Working with Hyacinth Macaws Anodorhynchus hyacinthinus has been an interesting experience for the bird and veterinary staff of the Al Wabra Wildlife Preservation (AWWP). Currently AWWP house seven Hyacinth Macaws, including one breeding pair and five of their offspring. Two (one male, one female) of these offspring are parent reared from separate clutches and the other three (two males, one female) are hand-reared and come from two separate clutches. The breeding pair has been at AWWP since 1998.

The breeding pair
The interesting times began in August 2003 when the breeding pair started to pluck feathers from the nape, mantle and back of their six week old chick. The pair had successfully reared their first offspring the year before without engaging in such aberrant behavior, or, if they had then it was mild by comparison because it was never observed by any of the bird department staff. Coinciding with the time the plucking started some major construction work began in a location nearby where the pair was housed. The work was very loud and is considered the likely catalyst that triggered a negative response from one or possibly both parent Hyacinths. Exactly why such a disturbance can cause this particular reaction is hard to determine. However, it is not uncommon for one bird to take out their frustration in a destructive fashion, on another bird or even a human they share a strong bond with. Known in the behavioral sciences world as “Displaced Aggression”, it can be a very serious problem, particularly in highly intelligent parrot species such
as Hyacinth Macaws, Moluccan and Sulphur-crested Cockatoos. Displaced aggression often occurs when a third party invades the sacred space around the offending bird and its mate—be it human or bird. The offending bird gets so frustrated by what it believes to be competition, that it takes out its frustration by lashing out at the one it is bonded too most. The forces that drive this behavior are likely to be very similar to the ones that drove our offending bird(s) to pluck the chick.

Self-mutilation by breeding male
The chick successfully fledged in late October 2003 and the breeding male was observed continuing to pluck his fledgling offspring and began to pluck himself on the breast, abdomen, thighs and underside of his wings. In mid January 2004, the decision was made to remove the young fledgling, which had just reached independence, to an aviary that housed their offspring from the season before. This move occurred earlier than AWWP staff would have liked but they felt it was in the best interest of the chick and breeding male. The hope was that the breeding male would stop plucking himself now that he no longer had to deal with the stress of protecting his fledged offspring. Other attempts were made to stop his plucking by providing more enrichment items such as fresh branches for chewing, and favored foods such as nuts were spread throughout the aviary for them to spend time searching. Unfortunately there was no improvement and he continued to pluck himself until his entire breast and abdominal feathers were removed. Occasionally he would bite the odd feather on the wing coverts but other than that the destructive behavior was restricted to the breast and abdomen.

During the 2004 breeding season the male once again became very stressed and aggressive, and began to bite his own skin. The affected area was quite raw but not openly bleeding. In July, two eggs were pulled for hatching and hand-rearing but only one of the chicks hatched. The other showed no signs of development and was removed from the nest. The eggs were removed from the parents because AWWP staff did not want a reoccurrence of the problems that transpired the year before. The pair was left to incubate dummy eggs until they finished sitting. The condition of the male remained stable but he was not allowing new feather growth on the breast and abdominal region. The assumed “displaced aggression” which we believe initiated the behavior had become habitual. Projected on specific areas and stereotypical, this behavior can be very difficult to break free from. It is possible that the routine checking of new growing feathers and their removal stimulates the continued release of endorphins in the bird’s brain, therefore functioning as a natural relaxant.

The chick hatched but required assistance as it positioned itself to hatch at the small end of the egg instead of in the air space. After a poor start in life, things continued to digress and the chick died four days later. The chick’s crop appeared to be dilated and twisted and it had great difficulty swallowing even very small amounts of food. Post mortem findings supported this observation and histopathology confirmed that the chick had serious congenial defects.

“Particularly, the epithelial changes of the crop and the lesions of the koilin layer could have been a cause of the clinical symptoms. There might also have been an oxygen deficiency because of the high percentage of early polychromatic erythrocytes in the peripheral blood.”
Prof. Dr. Helga Gerlach
The pair did not attempt to lay again during the
2004 breeding season.
In April 2005 the pair recommenced breeding activity, becoming very busy in their nesting box and aggressive towards their keeper. A lengthy preamble period followed without the laying of any eggs and in June, the problems with the male became serious. He recommenced biting his skin, this time over a larger area and much more severe then before. He now had open wounds that dripped with blood, so measures had to be undertaken to deal with the problem. On the 15th of June, he was caught up for a veterinary examination, to have his wounds treated and to be given a 5mg/kg subcutaneous injection of perphenazine (available as a 100 mg/ml solution, trade name DECENTAN®). Though used with success on birds before to stop self-destructive behavior the application of this drug was new in avian medicine and there were still risks involved, especially in regards to finding the right dose.

When the male was returned to his enclosure, there was an obvious change in his behavior. The perphenazine left him very subdued for the next two days but fortunately this did not affect his appetite, which remained strong. He stopped biting his skin and on the 23 of the same month, the female laid her first of a three-egg clutch. After closely scrutinizing the housing arrangement of the pair it was felt that, although the pair was comfortable enough to breed, it was still not an ideal set up and there was a high risk of the male becoming self-destructive again. The inside section of their enclosure where their nesting box was located was very exposed to the inside sections of all the other enclosures in that bank of aviaries and their nesting box was possibly too shallow. The flooring on the inside sections were concrete and were water-hosed clean everyday, exposing the pair to even more disturbance. It was felt that the combination of disturbance and exposure created a stressful environment for the male and that the level of frustration would increase substantially when a chick(s) was in the nest. A decision was made to remove the eggs for incubation and eventual hand-rearing, replace them with dummy eggs and let the pair sit out the incubation period as though the eggs were infertile. When the pair finished incubating, the plan was to move them to a new enclosure where disturbance was minimal and the inside section was enclosed and private. The nesting box that they had successfully bred in before was to be modified to make it one foot deeper and installed in the aviary before the bird were transferred.

On the 16 July 2005 the three eggs were removed from the nest and candling revealed the first and third eggs were fertile and the second egg infertile. This was a very pleasing result especially considering that the male had been medicated (as mentioned above) only eight days before the first egg was laid. The female continued to incubate the dummy eggs for another three weeks before abandoning the nesting attempt.

Due to a hectic work schedule we weren’t prepared as planned to transfer the pair to their new enclosure and much to our surprise the pair very quickly laid a second clutch. This was the first time the pair had double clutched and it was very late in the season, hence our surprise. The female only laid two eggs this time—the first of which was laid approximately on the 27th August 2005 and the second on the 1st September, 2005. The laying of the second clutch interfered with our plan to move the pair and meant that certain staff was going to be busy with more hand-rearing.

A nest inspection on the 8 September 2005
revealed that one of the eggs had been damaged, with approximately 25% of the shell missing. Miraculously, the inner membrane was still perfectly intact. The decision was made to remove the eggs to protect them against any further damage and to replace them with dummy eggs. Closer inspection with the candling torch showed that the first egg was fertile and developing well, however the second egg which had part of its outer shell removed was either infertile or never developed enough to be visible. The female stopped incubating on the 5 October 2005 and this time we were ready to relocate them to their new enclosure. Their new enclosure was similar in dimensions to their old enclosure; however at 8 meters tall it was nearly twice as high as their previous aviary and furnished with an artificial rock wall, trees and a pond. Most importantly however, is that the inside section where their nests are located offers a high level of privacy and quiet that they had never had before. The pair settled in very well and appears to be more relaxed than in the past. Despite having access to their modified old nest the pair has chosen a new nesting site, which is made of concrete and built into the enclosure. Both birds started working their new nest in December and were observed mating in January. This behavior is normal for this pair at that time of year, however; they never actually go on to lay eggs until the summer months of May, June and July.

The male has ceased plucking feathers that grow on the breast, abdominal and thigh area but most importantly has stopped biting his skin. Sometimes his skin is observed to be quite red and spotty which clearly irritates him and causes him to scratch the effected areas with his beak. It is likely that the spots result from mosquito or other insect bites, as the condition is always observed to be more obvious in the morning.

Hand-rearing the offspring of 2005

The second aspect of this case study on Hyacinth Macaws at AWWP revolves around the hand-rearing of two chicks which were parented by the pair whose story was discussed above.

On the 21 July 2005, the first of the pair’s three fertile eggs for the season required assistance to hatch after failing to do so over a marathon 74-hour external pip-to-assist-hatch period. We were unsure exactly why the chick failed to hatch on his own. We did notice however that its toes appeared to be rather weak and slightly curved but weather or not this was enough to compromise hatchability is uncertain. The chick also had a quite large edema swelling on the back of the neck, which probably resulted from a combination of prolonged hatch period and insufficient weight loss during incubation. During the first feeding we became concerned that the chick may have more problems. Its feeding response was poor and it had great difficulty swallowing. After each beak-full of formula the chick would violently throw its head back to a point where it would rest in a backwards horizontal position. In hindsight this was most probably due to the edema swelling. Given that the pair had in the previous year produced a chick with congenial defects, we had good reason to worry that this chick may also have serious problems. The chick also had a small crop which would only fit 0.4g of fluid for the first three feeding, which equated to only 2% of the chicks hatch weight of 19g, (Generally a newly hatched chick’s crop will accommodate approximately 5% of their body weight in fluids.) Despite feeding difficulties the chick rapidly gained weight and was otherwise in perfect health. By the morning of the third day the chick had ceased throwing
its head back during feeding and was responding like a normal chick.

**Chick No.1 – Correcting mal-positioned toes**
Initially we thought that taping the toes would easily correct them into the right position but as the chick developed the problem did not improve. Although digits 1 and 4 do not oppose digits 2 and 3 when parrots chicks are really young, they do at least stick out to the side, but in the case of this young Hyacinth chick, digits 1 and 4 on both feet pointed directly forward as digits 2 and 3 should. Additionally, the chick’s entire left foot curved inwards, presenting yet another challenge for bird and vet department staff.

We started by simply taping digits 1 and 4 in the correct position and this was done approximately every three days for a period of one month, starting from when the chick was twelve days old. At this point extra calcium, in the form of Calcium Sandoz®, was added to the diet. After three weeks of no success, we informed AWWP’s veterinary staff as it was clear that the problem was quite serious. It is worth noting that despite the feet problems, the chick was otherwise in great health and was above average weight for its age. A close examination revealed that the problem was more serious than first thought as not only was there a strength issue with all four hind toes, there was also a skeletal structural issue with the right foot which was going to be difficult to correct. When digit 4 was flexed into the correct position one could see that the joint from which the toe is attached to the base of the foot, was pointing forward instead of to the rear, which meant that simple taping of the toe to the tarsometatarsus was not going to be enough to correct the problem.

The solution came in the form of a rigid cast that was fashioned from cutting a small syringe into a U-pipe. The cast was then layered with bandaging tape for cushioning and to take away any sharp edges. The cast was then fitting along the outside of digits 3 and 4, with digit four positioned along side and taped to the tarsometatarsus. Digit 1 was also positioned and taped to the tarsometatarsus. Considerable pressure was to be required when applying the cast to force a gradual position change of the mal-positioned joint. This meant that a very close eye had to be kept on the toes to ensure that blood flow was not being restricted or any swelling occurring. Because of the rapid growth rate of the chick, the cast needed to be replaced and enlarged on a regular basis for the next two weeks. The chick was also treated with a single 2ml subcutaneous injection of the homeopathic drug ZEEL®(Heel, Germany), which was also added to the hand rearing diet once per day, dose rate 1ml for the next 12 days. The problems with the left foot were not as serious as the right, and only taping of the toes into the correct position was required. The inward curving of the left foot corrected itself over time and by fledging age it was not obvious that there had a problem.

**Chick No.2 – Correcting a mal-aligned beak**
On the 6th of August, sixteen days following the hatching of the first chick, a second chick emerged unaided from egg number three. Unlike the first chick, this chick hatched in textbook fashion following a problem-free incubation period of 28 days. The chick looked almost perfect, save for a slight mal-alignment of the beak. The problem appeared so slight that it was felt that with mild physiotherapy and favoring of feeding from one side of the beak that the problem would soon be corrected. Despite our best efforts the beak did not correctly align and progressively got worse as the chick rapidly grew. There was not a lot else
we could do before the beak started to harden up because they are extremely sensitive when still soft and what was required by us to do in order to correct the problem was going to be quite invasive, somewhat painful and stressful.

When the chick was twenty-nine days old we used a chainsaw-blade file to file both the maxilla and mandible. The maxilla was skewed to the bird’s right side, which led to unrestricted growth of the left side of the mandible. Growth to the right side of the maxilla was also unrestricted and exceeded that of the left side. The aim of using the file was to correct the asymmetric growth, which was perpetuating the severity of the mal-alignment. This procedure, which was clearly stressful and probably painful, was kept to a minimum, with the intention that only a little work would be done at any one time and only once per day. The following day we added a prosthesis to the right side of the mandible, in the form of a fast setting putty called TECNOVIT® (Kulzer, Germany). The purpose of the TECNOVIT® prosthesis was to apply constant force on the maxilla to shift towards a central position. To aid this process the right side of the maxilla and the left side of the mandible were filed again the following day and then once more approximately five weeks later. The TECNOVIT® prosthesis remained in place for ten days before being dislodged, by which time it had done the job successfully. The maxilla is still not perfectly aligned but importantly it is aligned symmetrically at the point where the mandible makes contact with the maxilla when the beak is closed. It is only the tip of the beak that curves to the bird’s right and it is only mild. It is likely that within a few years the beak will grow perfectly aligned, a scenario that is not uncommon with Hyacinth Macaws.

**General Rearing Techniques.**

Until the age of nine days, the chicks were fed via a small 3ml transfer pipette with the tip cut on a 45-degree angle. From day nine onwards the chicks were fed directly to the crop via silicon tubing to speed up the feeding process. The hand-rearing formula we use for baby Hyacinth Macaws is based on a similar recipe that was kindly shared to us by the well-known American aviculturist Rick Jordan. The formula recipe is as follows;

- 175g Kaytee Exact Macaw Large Macaw Hand-rearing Formula®
- 75g fresh pear or apple (no seeds)
- 75g fresh broccoli tops
- 75g Brazil nuts
- 600g Water

All these ingredients are added to a blender and blended until smooth. The formula is then poured into ice trays to be frozen and then used as required. The solid content of the formula works out to approximately 25%. We start the chicks on 10% solids by adding water to the formula and by day five they are fed only the formula. Following is a guide for diluting the formula during the first four days of rearing as well as a general rearing guide. (continues on page 106)
### Table 1. Food preparation guide

<table>
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<th>components</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<td>Read mixture to feed</td>
<td>10% solids</td>
<td>12% solids</td>
<td>15% solids</td>
<td>20% solids</td>
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<td>mix the below combination of formula and water</td>
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<tr>
<td>Hyacinth formula (frozen)</td>
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<td>10g</td>
<td>10g</td>
<td>10g</td>
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<tr>
<td>Water</td>
<td>15g</td>
<td>10.75g</td>
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### Table 2. General Rearing Guide

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<tr>
<th>age in days</th>
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<th>number feeds per day</th>
<th>brooding temp Celsius</th>
<th>amount fed per/feeding</th>
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<tbody>
<tr>
<td>1-2</td>
<td>18-22</td>
<td>10</td>
<td>36.7-36</td>
<td>0.4-1.3</td>
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<tr>
<td>3</td>
<td>22-25</td>
<td>8</td>
<td>36-35.8</td>
<td>1.3-2.2</td>
</tr>
<tr>
<td>4-5</td>
<td>25-35</td>
<td>6</td>
<td>34.8-35.2</td>
<td>2.2-3.6</td>
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<td>6-7</td>
<td>35-50</td>
<td>5</td>
<td>35.2-34.8</td>
<td>3.7-5.4</td>
</tr>
<tr>
<td>8-16</td>
<td>50-184</td>
<td>4</td>
<td>34.8-31</td>
<td>5.4-20</td>
</tr>
<tr>
<td>17-75</td>
<td>184-1330</td>
<td>3</td>
<td>31-26</td>
<td>20-100</td>
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<td>76-100</td>
<td>1330-1220</td>
<td>2</td>
<td>26-24</td>
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<td>101-130</td>
<td>1220-1100</td>
<td>2</td>
<td>-</td>
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<tr>
<td>131-140</td>
<td>1100-1150</td>
<td>1</td>
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<tr>
<td>135-150</td>
<td>1150-1200</td>
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<td>151-200</td>
<td>1200-1300</td>
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The chicks were weaned onto the following food items; banana, pear, grapes, mango, sweet-corn, chili’s, bell peppers (capsicum), almonds, Brazil nuts, walnuts, macadamia nuts and various parrot pellets. Little interest was shown to dry seeds or boiled seeds.

Conclusion
It could be considered that the treatment of the male bird with perphenazine was a success as we achieved our primary goal of stopping the bird from further mutilating his skin. Further success came in the form of two fertile eggs being laid by his mate shortly after he had his treatment. We had hoped that the perphenazine might also stop him from plucking his feather but initially he did not stop. However, considering that he had been doing it for two years it was always going to be difficult to extinguish this aberrant behavior. It is also likely that permanent feather follicle damage has occurred, as although he has now stopped plucking his feathers, re-growth is patchy.

Our successful treatment of the physical problems encountered with our chicks and the substantial improvement in the breeding males condition, gave us rewarding learning experience that forced us to make difficult decisions and to think practically.

Acknowledgments
Our thanks go to HE Sheikh Saoud Bin Mohammad Bin Ali Al-Thani the owner of Al Wabra Wildlife Preservation for making captive breeding and scientific work for the Hyacinth Macaw possible.

References

Explanation of proprietary nutritional products mentioned in text:
KAYTEE®
Kaytee Macaw Exact Macaw Hand-rearing Formula
521 Clay Street, P.O. Box 230
Chilton, Wisconsin