Stitchbirds:
an Avicultural Challenge

by Rose Collen, Glen Holland, Caroline Twentyman, Jerry Pauli , Betty Watt
Masterson, New Zealand

The Stitchbird *Notiomystis cincta*, a New Zealand endemic, belongs to the order Passeriformes, family Meliphagidae (honeyeaters) and are the sole member of the genus *Notiomystis*. The Meliphagidae include over 170 species of honeyeaters, miners, friarbirds, and sugarbirds. They are distributed primarily through Australia, New Guinea, Timor and the Pacific Islands. The Bellbird *Anthornis melanura* and Tui *Prosthemadera novaeseelandiae* are the only other members of the family occurring in New Zealand.

Stitchbirds, known also by the Maori name Hihi, are one of only two honeyeater species known to nest in tree cavities. The name Stitchbird originates from the contact call, which resembles the word "stitch." Both sexes also have a soft warbling song and an excited alarm call, and males have a three-note whistle as well as mimicking other species.

In pre-European times (it is believed that the Europeans introduced rodents and mustelids) Stitchbirds were distributed throughout the North Island and a number of the surrounding islands. By 1885 Stitchbirds had disappeared from the mainland, possibly as a result of ship rat predation at nest sites. Currently the only self-sustaining population resides on Little Barrier Island in the outer Hauraki Gulf. The Department of Conservation has recently re-introduced them to a further three islands where intensive management and monitoring is still underway; none of these three populations is considered to be successfully established to date.

The Mt Bruce National Wildlife Centre (NWC) is the only facility holding captive Stitchbirds. The NWC is operated by the New Zealand Department of Conservation and is dedicated to the breeding and restoration of rare and endangered New Zealand bird species. The Department of Conservation Stitchbird recovery plan uses a captive breeding program in order to (1) develop effective husbandry techniques to be used in the event of a disaster affecting the only viable wild population and (2) trial techniques that could assist in establishing new self-sustaining populations.

The plan also acknowledges the environmental education role the species can play. While Stitchbirds have been held and bred in captivity for over a 14 years, there remain several challenges to their husbandry, including further disease research, development of hand-rearing protocols and trialing new aviary designs that will reduce disease risk. In the wild, naturally bad fruiting and flowering seasons can cause low productivity. In poor years, many second and third clutches are deserted. This phenomenon could, in future provide a source of birds for hand rearing if deserted clutches could be salvaged while still viable. In addition, disease-free hand-raised birds for further research could be sourced from eggs from the captive population, which currently stands at 2:5.

There have been nine male and six female Stitchbirds brought in to Mt Bruce since 1985.

Diet

In the wild, Stitchbirds feed on a variety of nectar plants, fruit and invertebrates. The current artificial/captive diet is modeled on this variety, and is offered daily in three separate bowls, with a top up as required when rearing chicks. The diet provided consists of:

- Jam water: 250 ml of apple & raspberry jam and a tablespoon each of bee pollen and Pronutro, blended into 1 litre of water. The pollen is a valuable nutritional supplement that is now a popular supplement with nectivores and species such as lorikeets. Pronutro is a cereal-based South African product (22% protein) that GH has used to raise species ranging from estridlids to psittacines.
- Wombaroo lorikeet nectar: a milk by-product-based product with <0.5% lactose, produced in Australia
- A fruit/vegetable puree (finely blended) which includes sweetcorn, carrot, grapes, apple, pear, and orange is made in a large batch and stored frozen in the amounts required daily.

Captive Stitchbirds are also offered a variety of natural food items. In addition to the natural plantings in the aviaries, the birds receive an almost daily supply of nectar-bearing flowers or bunch of wild fruits (e.g. *Coprosma* sp.). These natural foods are placed strategically so as to enhance public viewing of foraging birds. Live food, particularly moths, is readily caught using two fan/light insect traps. Live insects are mainly provided during the breeding season, and priority is given to the females with young. Small crickets, waxmoth larvae, and mealworms have also been offered without success. In the future, we intend introducing these to hand-raised birds at an early age.

Causes of Death in Captive Stitchbirds

Aspergillosis

A fungal disease caused most frequently by *Aspergillus fumigatus* and seen most commonly in its chronic form at the NWC. This is characterized by rapid respiration, lethargy, anorexia and weight loss. *Aspergillus* is a ubiquitous fungus that grows well in soil and organic matter; transmission occurs by inhaling spores. Damp organic litter encourages production of

Reasons for fledged juvenile and adult deaths over the past 10 years.

	89	90	91	92	93	94	95	96	97	98
Aspergillosis	1	1	3		1		1	1	1	1
Coccidiosis						1				
Asphyxiation		1		1					1	
Stress							2			1
Other	2	1	3	3		2	1	1	3	2

HAGEN®

PRESENTING PARROT SPECIALTY FOODS

For Breeders & Hobbyists

APPROVED BY: HARI® HAGEN AVICULTURAL RESEARCH INSTITUTE

Genuinely Balanced Formulas of Vital & Pure Ingredients, Resulting in Foods with High Biological Value, to Help Ensure an Active, Healthy Life for your Bird.

TROPICAN™

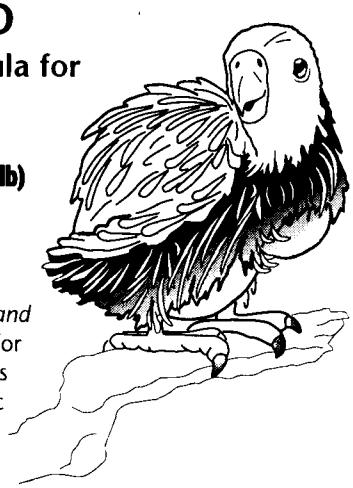
FORMULATED FOOD

Special Hand Feeding Formula for Babies

Micro-ground Extruded Formula

B-2661, 1kg (2.2 lb) B-2262, 5kg (11 lb)

Natural Extruded Granules
Comes in two granule sizes:
Cockatiel and Parrot.



Tropican contains *seven different grains and nuts* with *natural colors and fruit flavors* for maximum nutrition and palatability. Less powder waste, along with higher caloric value, making it very economical to feed.

Life-Time/Maintenance Granules

Cockatiel: **B-2527,3.6 kg (8 lb)**
B-2528, 9.1 kg (20 lb)
B-2529, 18.2 kg (40 lb)

Parrot: **B-2627, 3.6 kg (8 lb)**
B-2628, 9.1 kg (20 lb)
B-2629, 18.2 kg (40lb)

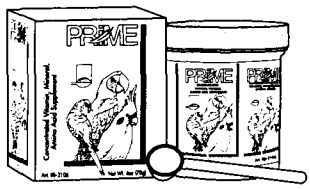
High-Performance/Breeding Granules

Cockatiel: **B-2532, 3.6 kg (8 lb)**
B-2533, 9.1 kg (20 lb)
B-2534, 18.2 kg (40 lb)

Parrot: **B-2622, 3.6 kg (8 lb)**
B-2533, 9.1 kg (20 lb)
B-2624, 18.2 kg (40 lb)

***Note New smaller bulk sizes**

PRIME



CONCENTRATED FULL SPECTRUM VITAMIN, MINERAL AND LIMITING AMINO ACID SUPPLEMENT

Sprinkle over fruit and veggies for birds on seed/legume based diets.

B-2105 - Screw top jar, 70g
B-2106 - Screw top jar, 0.45 kg (1 lb)
B-2110 - Bucket, 2.2 kg (5 lb)

Distributed by:
CANADA: **Rolf C. Hagen Inc.**, Montreal, Qc H4R 1E8
U.S.A.: **Rolf C. Hagen (U.S.A.) Corp.**, Mansfield MA 02048
In U.S.A. call: Tel.: 1-888-BY-HAGEN for local distributor

HARI'S WEB SITE:
http://www.pubnix.net/~mhagen/

NOW AVAILABLE!

TROPICAN FOOD STICKS

Same Premium Tropican Formulas

Sticks are larger and longer, designed for large parrots who like to pick up their food and hold it.

Tropican High Performance Parrot Food Sticks

B-2615, 3.6 kg (8 lb)
B-2616, 9.1 kg (20lb)
B-2617, 18.2 kg (40 lb)

Tropican Life-Time Maintenance Parrot Food Sticks

B-2611, 3.6 kg (8 lb)
B-2612, 9.1 kg (20 lb)
B-2613, 18.2 kg (40 lb)

Gourmet

SEED, FRUIT, NUT & VEGETABLE MIX *Fortified with Tropican*

Rich variety for fun, Parrot food can be soaked with warm water to rehydrate fruits and vegetables.

Cockatiel: B-2804, 5 kg (11 lb)
Parrot: B-2809, 4.5 kg (10 lb)
Parrot Gourmet is 100% edible fruits, veggies, and nuts, no messy shells

- *All foods are packed in ***Gas-Flushed Air Barrier Bags*** * with the exception of 40 lb sizes which have no fruit flavor or C02 gas.
- Protects package from environmental deterioration. Carbon dioxide gas slows oxidation of nutrients and ***prevents bug infestation.***
- ***Exceptional Quality Control.*** Each batch is ***tested for quality and guaranteed analysis.***
- Fed to **HARI's** birds before being released.
- ***Smaller Consumer Sizes Also Available.***

HAGEN®

large number of spores. Problem sites include damp nest box material, dusty environments and accumulations of moldy food scraps. Aspergillosis is acquired from environmental sources and is not an infectious disease. Factors that we decided were important in the epidemiology of the disease in the species in captivity were:

Environmental:

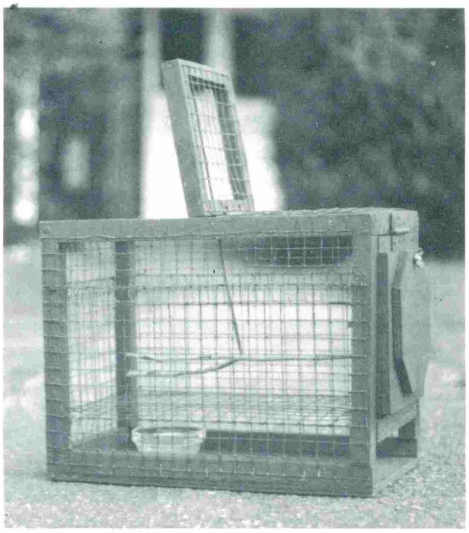
- Cage set-up
- Access to leaf litter
- Local weather effects
- Food hygiene

Bird factors:

- Species susceptibility
- Diet
- Stress

Management changes were implemented that we hoped would lessen the impact of the above factors and control this condition. When the disease is suspected, we treat affected birds with a combination of Ancotil and Diflucan.

Photo by Rose Collen



Passive capture trap used for Stitchbirds.

Atoxoplasmosis

The first diagnosed case of coccidiosis in Stitchbirds at NWC occurred in 1994. Analysis of mortalities show that it is now the most important disease problem in Stitchbirds at Mt Bruce, causing deaths of young birds. We are reasonably certain that the coccidial infections in stitchbirds at the NWC are due to Atoxoplasma organisms. These produce isospora-like oocysts that are passed in feces and are indistinguishable from other isosporan species. We have established the times when deaths from coccidiosis at Mt Bruce are most likely to occur. These are:

- In very young birds where a whole clutch has been lost. In one case the entire second brood for a pair was lost at 16 days of age. There was a concurrent severe red mite infection and capillaria was also present.
- In fledged birds separated into a flocking aviary. The stress of movement can allow a low-level coccidial infection to flourish.

We have endeavored to establish a preventative program for coccidiosis to enable successful breeding to take place. This program involves: 1) hygiene, 2) preventative treatment, and 3) fecal monitoring.

At present, treatment is based on Toltrazuril (Baycox) which unfortunately is only active against the gut forms of Atoxoplasma. We are also trialing a coccidiostat and a Primequin (malarial treatment) in combination with Baycox. We are keen to hear of any other treatments that aviculturists have used successfully in the treatment/control of atoxoplasmosis.

Stress

Stress related deaths have been attributed to aggression from a male towards females and birds recently brought into captivity from the wild. Handling for transmitter fitting prior to transfer/release is also suspected to have caused stress-related death in one bird. In the another case, two 6-month-old males died following a severe territorial dispute. Some of these birds had concurrent aspergillosis

Asphyxia

Since 1990 there have been three deaths from asphyxia, all in birds less than a year old. Two involved arthropods, and in the other case a whole kernel of corn was stuck in the pharynx.

Other

There have been a number of other causes of Stitchbird mortality at the NWC most of which have appeared as isolated cases and hopefully will not become bigger problems.

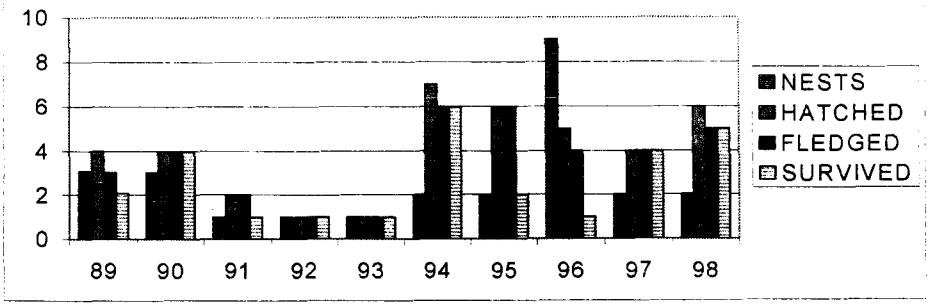
Photo by Rose Collen

Dosing and weighing chicks with coccidia.

Coccidial Research

Because of the importance of coccidiosis as a cause of death in captive juvenile Stitchbirds, a group at Massey University, Palmerston North, has been carrying out research on this disease. It is believed that the organism responsible is a type of *coccidia* known as *Atoxoplasma,* however the exact identification and the life cycle are unknown. There are many questions that need answering: How does infection occur and when? How does infection with this parasite cause disease? At

Summary of Nest Record Cards for the Past 10 Years



what age does the bird become resistant? How common is this organism in free-living Stitchbirds and does it cause disease? Is the same organism found in other species of birds or does it infect only the Stitchbird? What treatments are effective?

The research group has been provided with tissues from all the Mt Bruce Stitchbirds that have died from this disease since 1994, and has been able to examine their pathology in detail. Regular examination of Stitchbird feces from the captive population for evidence of the *coccidial* oocysts has also been undertaken. In addition, feces from other bird species and from free-living Stitchbirds have been examined. So far, it has been found that free-living Stitchbirds carry similar *coccidia* to those in captivity, but there has been no evidence of disease in wild birds.

Transmission experiments using Zebra Finches are in progress at present. In these experiments, which were unsuccessful, oocysts from Stitchbirds were inoculated via the mouth into a number of parasite-free finches and feces from these finches were then tested twice daily for evidence of *coccidia*. At pre-determined times the finches were euthanized and necropsied, and the tissues examined microscopically in order to detect any sign of *coccidia* or changes induced by them. It is necessary to sporulate the *coccidial* oocysts in the laboratory (i.e. encourage them to change their form into their infective stage) before identification can be attempted or transmission experiments undertaken. A major obstacle encountered is that the Stitchbird oocysts from Mt. Bruce appear to be unresponsive to conventional methods used to stimulate sporulation, requiring oocysts to be sourced from other Stitchbird populations. Further work is required in order to understand the mechanisms of infection and disease and minimize the effects of this parasite.

Captive Husbandry

Aviaries

Stitchbirds at Mount Bruce are held in large bush aviaries, measuring at least 10 x 10 x 4 m high [33 x 33 x 13 feet]. Each aviary has an interior divider creating two flights. The aviary floor is natural, with fresh leaf-litter added regularly to boost insect numbers. Insects, particularly winged (moths for example) are an important component of Stitchbird diet, and they spend much of their time foraging amongst the vegetation for them, especially when rearing chicks. The large size of the aviary allows the many plant species inside to grow to maturity, providing some of the fruits and flowers that the Stitchbirds would utilize in the wild. The large volume of vegetation also provides good habitat for an abundance of invertebrate life.

Aggression

Adult birds have to be held in separate flights for most of the year, as they are very aggressive and engage in competitive behavior, not only between the same sex, but also male towards female. This aggressive behavior is compounded in the captive situation, as subordinate birds in an aviary are unable to escape harassment by dominant birds. This social stress has lead to health problems (see chart). Some individuals are compatible however — usually older, experienced males with females. Any pairs held together require

careful monitoring to ensure social problems don't develop. Juveniles are housed together until they are approximately two months old, when aggression levels amongst them gradually escalate and they need to be separated. The requirement to house all birds separately has limited our ability to hold many birds and has also compromised research into captive husbandry and disease.

Breeding

The Stitchbird breeding season begins in October and final clutches can be laid as late as February. During this time, captive females can rear two to three clutches of up to four chicks per brood. They can make up to four nesting attempts depending upon circumstances.

Stitchbirds are unusual cavity nesters — usually entering a cavity and building a platform upwards. We therefore provide nestboxes that have the entrance hole at the base. The nest base consists of a tower of coarse twigs, grading into finer material such as fern rhizomes and leaf skeletons. The cup of the nest is lined thickly with tree fern scales. In the wild, some nest bases are up to 30 cm high [12 inches].

Each aviary has three nestboxes set up in the female's flight for her to choose from, and one in the male's flight close to the dividing wall. In an effort to "impress" the female, the male will begin a small nest in his box (in the wild they try to lead the female to nest sites). This behavior sometimes helps stimulate nest building in the female next door. The nestboxes we provide measure 30 x 25 x 40 cm high [12 x 10 x 16 inches].

The breeding season can be a very stressful time for Stitchbirds. The males have high testosterone levels and will pursue the female and mate with her many more times than is necessary for fertilization. When the female, with soft calls and tail up, solicits mating, the male will usually copulate with her in the normal manner. However copulation is often forced, with the male chasing the female down to the ground and mating with her in a face-to-face position (unique among birds) — claws locked and wings spread over her to prevent escape. The repeated chasing and "rape" by the male is a cause of much stress for the female. If such attacks persist for too many days the female resorts to hiding from the male. In the captive situation she may even be unable to feed sufficiently or get opportunities to build a nest.

We now hold the male and female of a pair in adjacent flights during the season, thus stimulating the female to nest-build without harassment by the male. When she has nearly finished nest building, her weight is carefully monitored with an automatic scale at the feeding station to determine when she is ready to lay. We then introduce the male to her flight. Depending on the degree of aggression shown by the male, we either separate the pair after copulation has been observed, at the end of each day, or, if little aggression is observed, the male is left in the female's flight for a week until egg laying is complete. One male was so peaceful towards his mate that we allowed him to stay with her throughout incubation and to assist with chick rearing. Females are capable of rearing chicks on their own, but if a male is present he can contribute up to one third of the feeds.

Stitchbirds at Mt. Bruce usually lay 3 - 4 eggs in a clutch. On occasions five eggs have been laid, but in these cases no more than four hatched. The small, white eggs are incubated for 15 days. At around 10 days it is possible to see the embryo developing inside the translucent shell without touching or candling the eggs so that they can be easily checked for fertility by opening the nestbox while the female is off the nest. When the eggs are due to hatch, the nest is checked twice daily to monitor the progress of the hatch, and any eggs that do not hatch within a day of the first are candled. Dead-in-shell or infertile eggs are removed immediately, as nests have been abandoned when dead-in-shell eggs were left with young chicks.

The nestling period is 28 days, during which time the chicks are checked daily. Fortunately the parents tolerate a fairly high level of disturbance at the nest. By Day 6 the chicks are passing relatively solid feces, which are collected daily for disease screening. The feces are screened for *capillaria* and *coccidia* loadings each day, so that treatment can begin immediately infection occurs. If left untreated, chicks infected with *coccidia* usually die near fledging and this disease has been the main killer of young chicks since the captive program began.

To guard against mites and fecal build-up in the nest, the nestbox is often replaced with a clean one, which also provides an opportunity to weigh and dose the chicks as required. The chicks become used to human contact and therefore are quite tame and inquisitive as adults, making management (catching and moving between aviaries) and public viewing easier.

Inside the clean nestbox, the chicks are placed in an artificial nest once the natural nest becomes soiled. The artificial nest consists of a sieve (with the handle removed) lined with polar fleece fabric and placed inside a raised wooden platform in the nestbox. The first time the natural nest is replaced,

Photo by Rob Suisted

Female Stitchbird feeding on coprosma berries.

Photo by Rose Collen

Banding a fledgling.

Photo by Rose Collen

Adult male Stitchbird—note ear-tufts raised and cocked tail as part of his display

the female typically appears confused on re-entering the nest and hesitates at the door. Eventually the calls of the hungry chicks lure her in and she readily accepts the nest changes from then on.

The chicks fledge at 28 days and are fed by their parents for a further 1-2 weeks. They learn to use the artificial feed stations after about a week and can be separated from their parents at around 40 days. Daily fecal sampling of each chick continues (where possible) until they are three months old. We assume that by this age they have acquired resistance to *coccidia,* which very rarely kills adult birds. Sampling is then conducted twice weekly until their feces are consistently clear of *coccidia*. Throughout the winter months, birds of all ages are screened monthly. The past two breeding seasons have, in terms of long term juvenile survival, been the most successful to date. Four chicks fledged in 1997/98 and five fledged in 1998/99. Of these juveniles, the females have been retained for captive breeding and four males were transferred and released onto Tiritiri Matangi Island in the Hauraki Gulf.