



White-browed wood swallows are a very gregarious species and are often seen travelling with the masked wood swallow *Artamus personatus*.

White-browed wood swallows commonly inhabit inland eucalypt forests and woodlands and can be found in spinifex and dry heaths. This species also inhabits farmlands, orchards and residential areas, Where food is plentiful.

3.3 Conservation Status

According to the IUCN red-list this species is of least concern and can be Found in flocks of over 100 birds

(IUCN Red List- <http://www.iucnredlist.org/search/details.php/51228/all>)

3.4 Longevity

3.4.1 In the Wild

The lifespan of the white-browed wood swallow in the wild is unknown, but the lifespan of a wild bird would be less than that of a captive bird because the captive bird has a stable and nutritional diet as well as veterinary care and is free from predators and disease.

3.4.2 In Captivity

The maximum lifespan of *A.superciliosus* in captivity is 17years. (V.Wilson, pers con)

3.4.3 Techniques Used to Determine Age in Adults

As mentioned in 2.1.2 (sexual dimorphism) juvenile birds have a similar appearance to other wood swallow species because they are brown and mottled this colouration is present until about two years of age. After this they have their adult colouration making it very hard to determine age unless adequate records have been kept in a captive situation.

(M.Randy, pers con)

4 Housing Requirements

When it comes to housing requirements it is essential to follow rules and regulations of the industry and government laws. For animals in general see http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0019/121564/general-animal-exhibirtion-standards.pdf this outlines the rules and regulations to follow on exhibiting animals in New South Wales from the department of primary industries. It covers points from safety, standards, housing, record management plus all other areas in animal husbandry.

4.1 Exhibit/Enclosure Design

Exhibits and enclosures must follow industry regulations and guidelines. Such as ARAZPA and the New South Wales Department of primary industries. Exhibits must be of appropriate size for the species being held and be fitted with appropriate furnishings. White-browed wood swallows are acrobatic flyers and therefore require a substantial amount of space is required so that the animals can move freely and be unrestricted, because these birds are such swift flyers an airlock mechanism should be fitted to help reduce the risk of escape. They are also a colony bird so there should be space for several birds. See spatial requirements below. (See Fig 9)

Wood swallows are a passerine which means they are a perching bird. Exhibits must have a suitable number of perches and of varying sizes so as not to lead to feet/claw conditions. Perches which are too large can stretch bird's feet and they become flat. Too small and feet become curled.

Wood swallows do not require a heavily planted exhibit. Some small shrubs such as lamandras are good for exhibits because they are ascetically pleasing. Browse should be provided for shelter and also nesting. Browse species can include various tea tree species as well as eucalypt branches.

Feed stations can be simply raised trays or swivel feeders. Numerous feed stations should be fitted especially when housing 5 or more birds. Water can be provided by a small dish or tray or be a more complex water feature made of mock-rock.

These birds as mentioned previously are very gregarious so can be housed in a mixed species exhibit. At Symbio our wood swallows are housed with numerous finches, quails and purple crowned lorikeets. Bird species that are larger than the wood swallows should not be housed together. The only issues with other bird species that have been noted are with robins, these two species are not compatible and often compete for nesting sites. Whenever housing different species always monitor for stress, dominance etc. to ensure that the two species are compatible.

4.2 Holding Area Design

Holding areas are for temporary housing so only basics are necessary. Such as an appropriate size perch, access to fresh clean food, water and shelter such as a branch. The bird should still be able to move freely and be of adequate height, length and width. See below for spatial requirements

4.3 Spatial Requirements

As stated in the New South Wales department of primary industries animal welfare code of practice No. 4 – Keeping and trading of birds.

5.1 Each species should be accommodated according to its need, including:

- (a) Protection from the extremes of climate
- (b) Safety from predators
- (c) Ability to escape from, or to avoid distress caused by other birds, animals and humans
- (d) Protection of food and water containers from contamination or from rain or direct sunlight
- (e) Sufficient space, perches, nesting areas and/or feed and water stations to meet the needs of all the birds in the cage or aviary
- (f) Nesting sites and materials appropriate for the species for breeding purposes where intended.

5.2 Cages and aviaries should be sited and constructed to minimise risks from flood or fire. Exits should allow for emergency evacuation.

5.3 In cold climates some insulation or heating may be needed for some species. Where birds are likely to be distressed by heat some cooling mechanism should be provided. Birds in small cages should not be left exposed in the hot sun without shelter.

5.4 Cages and aviaries should be designed and constructed so as to minimise the threat posed to birds by predators. Many species of birds, animals and reptiles are predators of or cause distress to aviary birds by day or by night. These include cats, dogs, foxes, birds of prey including owls, butcherbirds and currawongs, snakes and even children

5.5 Vermin and other pests should be rigidly controlled to prevent their entry to cages, aviaries or food storage areas. If vermin are observed, control measures should be taken promptly.

5.6 Bird enclosures or cages should be fitted with openings or doorways designed so as to avoid the risk of injury or escape.

5.7 Roosting sites, perches or hiding areas should be provided in the manner and positions most appropriate for the species, e.g. many aviary species require high perches in protected areas for roosting, and some ground dwelling species remain distressed if unable to use areas in which to hide. Perches should be of varied size and shape. Metal or plastic perches are not suitable. Natural branches are preferable.

5.8 Water birds given free range or swimming/wading areas require protection from predators.

5.9 Unless compatible, different species should be confined separately.

5.10 Care should be taken with new equipment. New galvanised wire may be toxic, especially for parrots. The risk of "New Wire" disease can be reduced by allowing the wire to be weathered for 4-8 weeks or by washing with a mild acidic solution, e.g., vinegar, and rinsed.

<http://www.dpi.nsw.gov.au/agriculture/livestock/animal-welfare/codes/general/aw-code-4#5--Accommodation> – originally published in, 1996, by NSW agriculture)

4.4 Position of Enclosures

There is no specific position of enclosure for *A.superciliosus*. But as mentioned above enclosures should not have direct sunlight all day it must be shaded for part of the day or have adequate shaded provided

4.5 Weather Protection

All aviaries should have an area which provides shelter, shade and keeps the animals dry and warm in adverse weather conditions. For wood swallows this can be provided by a solid roof in one section of the aviary as well as plenty of browse for them to rest and hide in.

4.6 Temperature Requirements

There are no temperature requirements for this species. But these birds may thrive in some areas better than others. For example white-browed wood swallows prefer warm climates found in NSW rather than the cooler climates of Tasmania.

4.7 Substrate

The most common substrate used in display aviaries is dirt, mulch or Nepean river sand, all of these are easy to maintain and look good.

Also the white-browed wood swallow feeds on insects so live food such as mealworms can be spread around exhibit as a form of enrichment, mulch is best for this. At Symbio Wildlife Park the substrate we use in our aviaries is mulch, this substrate is easy to maintain and works well with a variety of species.

For temporary housing substrate like newspaper or butchers paper is suitable if only housing one or two birds in a small cage temporarily.

4.8 Nestboxes and/or Bedding Material

White-browed wood swallows spend the night perched on a branch huddled up to other wood swallows; therefore a suitable size perch in a sheltered position is adequate bedding for *A.superciliosus*. For nesting white-browed wood swallows build their nest in small grass tussocks so in the breeding season suitable grasses should be planted for nesting in and suitable nesting materials such as grasses, twigs, plant stems, tea tree, and Eucalyptus

browse should be provided during the breeding season to allow for optimum conditions. (See Fig 2) (Wolstenholme 1929; D’Ombrain 1934; Frith 1969 – HANZAB – volume 7 part A – p 433)

4.9 Enclosure Furnishings

Suitable enclosure furnishings for *Artamus superciliosus* include branches for perching and plenty of browse from eucalyptus and tea tree.

Perches need to be the correct size for the species and a variety of grass species such as lamandras can be provided for shelter as well as visual effect.

A pond may be installed in the enclosure but is not necessary provided there is alternate access to water. If installing a pond or stream adequate areas for a bird to safely climb out of the pond must be provided to help reduce the risk of drowning. Caution must also be taken when installing water bowls as not to make them too big, a brick or rock can be placed in the bowl to assist birds when drinking. See Appendix III for a white-brow wood swallow exhibit design.

5 General Husbandry

5.1 Hygiene and Cleaning

Cleaning regimes for aviaries are very basic and simple to do. Here are a few steps to follow:

- Water bowls should be emptied, scrubbed and refilled daily.
- Food bowls from the previous feed should be removed every day and washed in disinfectant such as eucalyptus disinfectant, and rinsed thoroughly.
- Mess around feed areas should be swept up or wiped away.
- Perches should be scrubbed daily to remove faeces.
- Faeces should also be removed from the aviary wire and walls.
- If substrate in base of enclosure is mulch it should be scarified daily. Sand should be raked and hosed daily. If another substrate is used such as newspaper in a temporary housing situation it must be changed each day.
- Browse (branches) and nesting materials should be changed as necessary and browse pots should be filled with fresh water each day to extend the life of the plant.
- Safe cleaning products to use in an aviary include eucalyptus disinfectant and also F10 disinfectant, products such as bleach should be avoided because if not used correctly may cause harm to the animal.

5.2 Record Keeping

Record keeping plays an integral part in the animal care industry, without it we would not be able to determine which individuals are related, which could result in inbreeding. When animals are born, age, or simply what animal should be fed what and how much.

For *A. superciliosus* records need to be kept in accordance to a businesses policies and procedures. Each animal housed in the establishment should have its own individual record which is updated regularly and stored in accordance to policies and procedures. Records on individual animals should be easily accessible to appropriate staff members and should be easy to read and understand. Information that needs to be recorded includes:

- Animals ARKS number
- Any other form of identification e.g. leg band, microchip
- A brief description of the individual
- House name
- Date of birth
- Enclosure number/name
- Internal or external movements for example if in changes enclosure or zoo.
- Any information in regards to vet visits or illnesses and results.
- Any medication the animal requires
- What and how much the animal should be fed.
- Behaviors normal and abnormal
- The animals sire and dam (parents)

- Any breeding behaviors such as observation of mating ;with who and when, nest building, any offspring produced and their ID
- Date of death

Please note that anything out of the ordinary should be recorded with any species no matter how unimportant it may seem. So that if it occurs continually something can be done about it.

5.3 Methods of Identification

For *A. superciliosus* individuals can be identified in a number of ways. All methods have their own advantages and disadvantages which suggest that several methods of identification should be used to reduce to risk of misidentification. These methods include:

- Leg bands – each band has its own ID number or color which is easily identified but these bands may fall off or if not fitted correctly may inflict injury to the bird. Also in order to identify a specific individual several individuals may have to be captured which may cause stress.
- Colors and markings – male and female white-browed wood swallows are easily identified by the color of their feathers as mentioned in 2.1.2 sexual dimorphism. While both sexes share the same unique colorings and markings the female are a lot duller in color. Also individual colors and markings may vary for example the shape or size of the brow may be different amongst certain individuals. This is a good method of identification because individuals can be identified by visual inspection but can also be easily misidentified.
- Scars/ deformities – most animals have scars from all sorts of things. Some scars are more noticeable than others and these are the ones that can be used in identification. For example missing limbs, feathers, eyes. Scratches or scars from veterinary procedures and birth defects.
- Cage cards – this method of identification has the advantage of being able to display a lot of information at once and can be moved with the animal within or outside its current institution. But these cards may become lost, damaged or mixed up if not cared for correctly.
- Microchip – this method allows individuals to be identified with minimal risk of misidentification, but to find a specific individual several birds may need to be captured in order to do so, which may cause some stress to the animals. Therefore micro-chipping is best used with another form of identification.

At Symbio Wildlife Park we house a pair of white-browed wood swallows, the female is identified by a leg band and our male has a microchip.

5.4 Routine Data Collection

On a routine basis information must be collected and recorded about a species or individual to assist with general husbandry this information includes:

- Dietary changes or needs e.g. increased feed size because is rearing young or if supplements such as calcium need to be added to food.
- Internal movements - this is any change in the animals location within the institution for example individual 466 moved from off exhibit cage number 21 to on exhibit display number 974.
- External movements – this is any movement outside the current institution e.g. individual 45 from Symbio Wildlife Park, Helensburgh to Taronga zoo, Sydney. Addresses should also be recorded.
- Medical needs.
- Breeding behaviors with other individuals. Or nesting behaviors
- Unusual behaviors for example a bird that is usually very active is not.

6 Feeding Requirements

6.1 Diet in the Wild

A. superciliosus's natural diet is primarily invertebrates from the following orders. Hemiptera: cicadas, Orthoptera: grasshoppers, Acrididae: locusts, Diptera: flies and mosquitoes, Coleoptera: beetles and weevils and occasionally spiders. Their diet also contains nectar, sap and fruit from species such as Cupressaceae: *Callitris* (Pines), Xanthorrhoeaceae: *Xanthorrhoea* (grass trees), Caesalpiniaceae: *Bauhinia*, Chenopodiaceae: *Enchylaena tomentosa* (Ruby saltbush), *Leptosema daviesioides* , Myrtaceae: *Eucalyptus grandis* (Rose gum), Proteaceae: *Grevillea* (grevilleas) and Rutaceae: *citrus* (citrus fruits).

White-browed wood swallows forage in the air, among trees, shrubs, open paddocks and along edges of roads. They have also been known to feed on insects fleeing from fires. They occasionally forage on the ground. (See Fig 5)

When foraging they do so in small to large flocks consisting of 3 to over a thousand birds, these flocks have been known to occasionally be of mixed species with masked and dusky wood swallows and sometimes even forage on flowering plants with Rainbow bee-eaters and honeyeaters including yellow-throated miners, noisy friarbirds and white-winged trillers.

Foraging methods include: screening, hawking, striking from vegetation, pouncing from a low perch. (See Fig 12-14)

Smaller food items can be consumed without the need to perch.

(HANZAB – Volume 7 – Part A – page 429.)

6.2 Captive Diet

A suitable captive diet for white-browed wood swallows includes most invertebrates such as

- mealworms,
- maggots,
- fly pupae,
- cockroaches
- crickets

As well as a meat mix consisting of mince, crushed dog kibble, shell grit, and calcium carbonate (see appendix VII for recipe). *A. superciliosus* is an omnivorous species so small amount of fruit such as apples, oranges and melons should also be provided. To supplement nectar a dry lorikeet nectar mix could be added to the meat mix. When housed in aviaries captive white-browed wood swallows will also feed on wild insects.

During the breeding season august to January feeding amount will need to be increased and also more variety given where possible. Food intake should be increased by 50%.

At Symbio Wildlife Park our wood swallows are housed in a mixed species aviary with purple-crowned lorikeets, red-faced parrot finches, gouldian finches and quails. We provide our two birds with 20ml of meat mix (described above) and 5g mealworms. We also provide them with fruit which the lorikeets also feed on and supplement them with dry

nectar mix and egg and biscuit occasionally. The aviary in which the birds are housed is planted with a native mulch substrate so this attracts a lot of wild insects in which the birds can also feed upon. During the breeding season we bulk up their food with extra insects and add egg and biscuit mix to their diet.

At Healsville Sanctuary their wood swallow diet in the non-breeding season consists of 20g meat mix, 5g mealworms and 5g of diced fruit. During the breeding season they up this to 20g meat mix, 5ml of nectar mix, 10g egg and biscuit mix, 10g diced fruit, 5g mealworms, 5g maggots and 5g fly pupae (*Healsville Sanctuary wood swallow diet sheet, 2007.*). The reason for the difference in diets is that at Symbio we don't have access to invertebrates such as maggots and fly pupae. At Symbio we received one of our wood swallows from Healsville sanctuary and we also received a copy of their diet sheet to help us out. Therefore the amounts are similar. I have also observed the birds on several occasions feeding on a variety of fruit. Apple and orange seem to be the preferred fruit.

6.3 Supplements

Supplements which can be added to the captive diet of white-browed wood swallows includes, calcium carbonate in the meat mix, wet or dry lorikeet mix provided in the meat mix. Invertebrates can be coated in calcium and other supplements such as vitamin E to provide the birds with additional vitamins and minerals. The amount of supplement will depend on the number of birds housed. (See appendix VII for recipes including supplement amounts)

6.4 Presentation of Food

Meat mix and live insects can be fed in a swivel feeder or similar dish, preferably something shallow. Feed bowls and stations should blend in with the surrounds so as not to draw attention to it.

For behavioral enrichment insects can be fed out live and instead of being placed in a dish can be thrown in the air inside the aviary for the birds to catch, insects can also be thrown on the roof of the aviary so that they fall through for the birds to catch or even held through the wire of the wall in the aviary for the birds to retrieve it from your hand. This not only provides the birds with enrichment but also conditions them to be around people and they start to see people as a positive experience. This is how we enrich our wood swallows at Symbio. These activities also provide the public with a great viewing experience which allows them to see the birds up close.

- Check that all vents (nasal and cloacal) are clean and there is no discharge or dirt in them.
 - Examine the eyes for discharge or cloudiness.
 - Ensure the bird is free of lice.
 - Check that claws grasp correctly and are not too out stretched or curled in.
 - Check that inside of beak is clean.
 - Make sure that the keel (sternum) is not overly exposed. The keel can indicate that the bird is either under weight or over weight.
 - Ensure plumage is in good condition.
- Any abnormalities should be reported to management and a vet if necessary

8.3 Routine Treatments

As with most bird species woodswallows should be wormed annually using panacur 25. Or similar product to help prevent against worms in the gut. This treatment can also take place as necessary but it is advised to administer annually. Worming products should be mixed with food where possible this will ensure that the dosage is administered; meat mix is best for administering treatments.

8.4 Known Health Problems

White-browed woodswallows are a very hardy species. There is little evidence of known health problems with this species. Here is a list of common health problems in captive birds.

Name: Psittacosis

Cause: one bird is a carrier of the disease and is spread by droppings, feather dust and also hen to egg.

Sign/ symptoms: a zoonotic disease – symptoms includes eye discharge, labored breathing, diarrhea, poor appetite, lethargy, ruffled feathers, and weakness

Treatment: It can be diagnosed by pathology testing and treated by the antibiotic doxycycline which can be administered by injection or in drinking water.

Prevention: Prevention can be achieved by good aviary practices and reducing stress on birds. (Mike Owen – <http://www.birdsnways.com/article/psittico.htm>)

Name: endoparasites (tapeworms, roundworms)

Cause: poor hygiene, transmitted from another bird.

Signs/ Symptoms: ruffled feathers, weight loss, abnormal or slimy droppings.

Treatment: A bird wormer such as panacur 25.

Prevention; prevented by preventative medicines see routine treatments above and good aviary practices (*The new parrot handbook. By Werner Lantermann, Matthew M. Vriends*)

Name: Salmonellosis

Cause: food or water contaminated with salmonellae. It can be transmitted from rodents wild birds, and flies

Signs/ Symptoms: no symptoms characteristic to salmonellosis. Analysis of fecal matter will determine if it is present.

Treatment: under veterinary consultation a broad-spectrum anti-biotic can be administered.

Prevention: good aviary practices.

(The new parrot handbook. By Werner Lantermann, Matthew M. Vriends)

8.5 Quarantine Requirements

Any bird going in and out of an establishment should be quarantined. All animals require a minimum of 30 days in quarantine to ensure they are free from disease especially diseases which may affect other populations. They may only be released from quarantine when they have passed numerous health assessments including blood and fecal examinations. Animals must be housed away from animals which are not in quarantine and all equipment must be disinfected to stop the spread of potential diseases. Staff must use foot baths and wash hands with diluted F10 (veterinary disinfectant). In some cases jump suits may need to be worn and access to quarantine area should be restricted. Waste must be kept separate and disposed of correctly. Here is a list of necessary equipment:

- "Quarantine – no unauthorized entry" sign
- Insect/rodent traps/screens/baits
- Diagnostic sample collection, storage and transport equipment
- Lock for facility
- Protective clothing
- Feeding, watering and cleaning utensils
- Animal capture /restraint equipment
- Quarantine register
- Cage furniture as appropriate for the species
- Animal record forms, pens
- Bags for waste disposal
- Animal caregiver health check
- Footbath/boot changes

9 Behaviour

9.1 Activity

White-browed wood swallows live in large flocks and are gregarious bird species. They spend their days in the flock swiftly catching insects while in flight. At night they roost in a flock clustered together inside tree hollows or tree trunks, birds may also roost together during the day if the weather is poor. (HANZAB p430)

9.2 Social Behaviour

As mentioned above *A. superciliosus* is a very gregarious and socially active bird species. Wood swallows are often found in large flocks of over one hundred individuals. These flocks will sometimes not only consist of white-browed wood swallows but also masked wood swallows. Birds will call and twitter amongst themselves when flying or feeding. Often the wood swallows will feed in these large flocks catching insects at high altitudes or around low lying shrubs. (HANZAB p431)

9.3 Reproductive Behaviour

White-browed wood swallows are monogamous and nest in pairs. After the birds arrive at the breeding area nesting starts immediately. Pairs will often preen each other to maintain or strengthen bonds. Females will display when perched by lowering and fanning their tail while wagging it from side to side this entices the male to copulate. Copulation usually is done near or at the nest while it is being constructed. Brooding and feeding of nestlings and fledglings are carried out by both sexes. (HANZAB p431)

9.4 Bathing

There are no reports on *A. superciliosus* bathing. This species is often found in arid or semi-arid areas where water is scarce, although in time of extreme heat it is likely that they would bath to cool themselves. In my observations at Symbio Wildlife Park I have not observed bathing behaviour but in the summer months the birds do not seem to mind a water misting.

9.5 Behavioural Problems

I have not found any evidence of behavioral problems within this species.

9.6 Signs of Stress

Signs of stress in wood swallows are similar to that of other bird species.

- Heat stress – panting (beak open) and wing spreading.
- Depression
- Moodiness or irritability
- Excessive activity
- Feather picking
- Increased pecking
- Increased elimination
- Inactivity or sluggishness
- Lack of desire to socialize
- Abnormal vocalization
- Ruffled feathers
- Sitting at the bottom of the cage, listlessness

(<http://www.censhare.umn.edu/care06.html#Birds>)

9.7 Behavioural Enrichment

Here is a list of enrichment activities that could be offered to the white-browed wood swallow in a captive situation:

- Have a live insect feed, if this is in their daily diet the type of insect being fed can be rotated on a day to day basis because each type of insect will propose a different challenge to the bird.
- Food items can be dropped from the aviary roof or thrown into the air by keepers to stimulate a natural feeding behavior of catching their food in flight.
- Different branches can be placed in the exhibit.
- Housed in a mixed species exhibit.
- Have a small log, PVC pipe or ball with holes in it, fill with meal worms so that they crawl out of the holes at random.

9.8 Introductions and Removals

White-browed wood swallows are a highly gregarious and social bird, although pairs are monogamous. Individuals are easily introduced and removed from groups. While pairs must bond in order to breed. If a member of a pair passes away the remaining bird may bond with another and form another pair. The best way to achieve this is to house the new bird in a smaller cage within the other bird's exhibit so that they can bond and to avoid problems if they are not compatible. Pairs can be removed from a group but should be kept together. When introducing new animals positive signs may include grooming, calling, and sharing food stations. If the animals are restless and bitter over food, then an individual may need to be removed and introduced somewhere else.

9.9 *Intraspecific Compatibility*

Compatibility amongst the species is good because the species naturally lives in large flocks. As long as there is enough space for the number of birds housed so there is no competition for food or nesting areas.

9.10 *Suitability to Captivity*

As a keeper at Symbio Wildlife Park I have found that this particular species is quiet suited to captivity. The two birds housed at Symbio were both bred in captivity therefore they are used to the lifestyle, I have also observed other white-browed wood swallows in other institutions including Melbourne zoo, Taronga zoo and Featherdale wildlife park, all birds appeared happy in their surrounds. This species also breeds very well in captivity which is a good indicator of suitability.

10 Breeding

10.1 Mating System

White-browed wood swallows are a nomadic species which migrate from non-breeding areas to breeding areas. As spring arrives the wood swallows migrate south east to breeding areas where nesting will take place immediately upon arrival. Wood swallows are monogamous so pairs are generally established. Female shows her readiness to mate by wagging her tail from side to side. After copulation 2-3 eggs are laid and incubated by both parents for 14 days. See growth and development below for further information. (see Fig 1)

10.2 Ease of Breeding

A. superciliosus breeds relatively easy in captivity. Many zoos and wildlife parks successfully breed white browed wood swallows as well as other wood swallow species. It has been found that breeding is more successful when the birds are housed in colonies. (M.Randy, pers con)

10.3 Reproductive Condition

It is ideal that wood swallows are in peak condition to breed. This can be achieved by an increase in the amount of food that they receive. Just before the breeding season commences larger or extra feeders can be placed in the exhibit but with the regular amount of food. This will allow the birds to become familiar with the feeders. As the breeding season commences extra food items such as extra insects and meat mix can be fed out. Food intake should be monitored and if they are leaving feed then the amount maybe decreased and if they are consuming it all then extra feed should be added. By doing so this will ensure birds are in peak condition to reproduce. (M.Randy, pers con)

10.4 Techniques Used to Control Breeding

The best way to control breeding in white browed wood swallows is to separate males from females.

10.5 Occurrence of Hybrids

Wood swallows will sometimes nest in mixed species colonies' consisting of white-browed, masked and black faced wood swallows. And it is possible for hybridization to occasionally occur with masked wood swallows (HANZAB, p 432). Featherdale wildlife park houses wood swallows in mixed species exhibits and has had no occurrence of hybrids. (M.Randy, pers con)

10.6 Timing of Breeding

The breeding season for white-browed wood swallows is August through until December. Desired breeding pairs should be housed together prior to the breeding to allow time to bond because they are a monogamous bird species.

10.7 Age at First Breeding and Last Breeding

It is possible for white-browed wood swallows to breed at one year of age but at this age they still generally display their juvenile markings and this may be an indication that they are not ready to breed. The most common age for the wood swallows to first breed is two. (*M.Randy, pers con*) Captive wood swallows have a lifespan of seventeen years and it is possible for them to be capable of breeding until approximately 15 or 16 years of age.

10.8 Ability to Breed Every Year

White-browed wood swallows are very successful breeders and once pairs have been established it is possible for them to breed annually provided there are no other factors preventing breeding such as bad weather, infertility etc.

10.9 Ability to Breed More than Once Per Year

As mentioned above wood swallows are successful breeders and often breed more than once per year, usually averaging about 2-3 times a year and possibly up to 4 times per year. (*M.Randy, pers con*)

10.10 Nesting, Hollow or Other Requirements

In the wild wood swallows nest in any suitable site around the colony, usually in a low spot such as a fork of a tree branch or trunk, a low lying shrub or bush, even fence posts or the scaffolding of a building. They will nest in a variety of native and introduced trees and shrubs but favour natives including eucalypts, casuarinas, banksias and tea trees. (See fig 1) (*HANZAB*). In captivity tea tree browse can be placed in the back of an exhibit this will provide a suitable nesting site. Tea tree browse is the only browse necessary for nesting but other types of browse can also be placed in the exhibit so the birds can use them as nesting material, native plants are recommended. (See Fig 2)

10.11 Breeding Diet

The breeding diet for wood swallows is just an increase in the amount. Extra mealworms or maggots are the favoured food items to increase in captivity because these items are favored by the birds and they are more likely to eat more.

10.12 Incubation Period

Incubation is done by both sexes duties are shared equally. Adults will sit on nest from the time the first egg is laid but won't start proper incubation until second egg is laid. (See Fig 4) The total incubation period is 14 days from completion of the clutch

10.13 Clutch Size

The average clutch size for *A. superciliosus* is two but may lay up to three.

10.14 Age at Fledging

Fledging occurs at around two weeks. (*Aviculture in Australia, p241*)

10.15 Age of Removal from Parents

Wood swallow chicks maybe removed at any stage from their parents, fledglings will need to be hand reared. Once the chicks can feed and care for themselves they may be removed and placed in another enclosure

10.16 Growth and Development

Once the chicks have hatched, they are cared for by both parents. Fledging takes place at around two weeks of age and continue to be cared for by both parents, during this period chicks weights can range from 1.5g to 3.5g. At 18- 20 days of age they are able to fly short distances. Juvenile white-browed wood swallows are mottled they are grey brown in colour with specks of cream and white (see Fig 4). At around one year of age they lose their juvenile speckles and start to develop the adult markings of upperparts bluish- grey; under parts dark chestnut; prominent white brow; throat blue-grey and tail tipped in white. (*Aviculture Australia p242*)

11 Artificial Rearing

11.1 Incubator Type

The below information regarding incubation/hatching temperatures and humidity are from a still air incubator. One type of incubator that would be suited to incubate white-browed wood swallow eggs is the Brinsea octagon 20 or 40 digital high performance egg incubator. There are many different types of incubators out there and depending on the institution will depend on the availability of some types. As long as the correct temperature and humidity can be met and monitored and the egg is able to be turned it should be ok.

11.2 Incubation Temperatures and Humidity

In a captive situation often the eggs are left with the parents for incubation and rearing. There are not many recordings of incubation temperatures and humidity specific to *A. superciliosus* the following information is based on eggs of a similar size. Incubation temperature with a wet bulb should be 38.1 degrees Celsius, with a dry bulb no higher than 31.1 degrees Celsius. The relative humidity for the incubation period should be around 58%

(Artificial incubation of bird eggs at the zoological society of San Diego)

Eggs will need to be constantly monitored. Each egg is different and therefore has different requirements. Some eggs will require a higher or lower humidity depending on their thickness. *(Daniel Gowland, pers con)*

11.3 Desired % Egg Mass Loss

Throughout the incubation period factors such as shell thickness, porosity and water vapor concentration in the atmosphere around the egg will affect the gas/water exchange between avian embryo and the environment.

It is important to weigh eggs throughout the incubation process this will give an indication of water loss. Excessive humidity may increase the mortality rate to little and dwarfing or a decreased calcium metabolism may occur. *(Artificial incubation of bird eggs at the zoological society of San Diego)*

Eggs should have an egg incubation record sheet and all observations and measurements recorded. From this information we can measure the % of egg mass loss with the formula:
fresh weight – actual weight ÷ day × days to pip ÷ fresh weight × 100
(see appendix V for more formulas and record sheet layout) *(Daniel Gowland, pers con)*

11.4 Hatching Temperature and Humidity

As with incubation temperatures and humidity the hatching temperature and humidity is based on eggs of a similar size.

Dry bulb = 38.1 degrees Celsius, Wet bulb = 32.2 degrees Celsius, Relative Humidity = 64% *(Artificial incubation of bird eggs at the zoological society of San Diego)*

Just like incubation the temperature and humidity should be monitored and can vary between individual eggs.

11.5 Normal Pip to Hatch Interval

The average pip to hatch interval is 2 days.

11.6 Brooder Types/Design

A small bucket with saw dust or breeders choice cat litter as a medium is sufficient. Paper towel can be placed on the inside of the bucket to absorb any mess as well as making it easier to clean. This will also provide the birds with a little more comfort. (*M.Randy, pers con*). in my experience hand raising birds at Symbio Wildlife Park I used a small cage with a pillow case lining the floor and placed the chicks inside a knitted pouch. The cage was also covered with towels to help keep warmth in. the cage was placed away from drafts and in a nice warm room where the temperature did not change dramatically. When I raised the birds it was November through till February so room temperature was warm enough so that artificial heating was not needed.

11.7 Brooder Temperatures

For one to three day olds - 34 degrees Celsius. (*M.Randy, pers con*)
Older birds should be housed between 25 – 30 degrees Celsius.

11.8 Diet and Feeding Routine

Hatchlings can be fed on a variety of food including mealworms, pet mince, pinkies, and small crickets. All food items should be cut into appropriate size pieces about 1-2mm and all insects should be culled prior to feeding. Supplements such as insectivore can also be added to the diet.

When first feeding the chicks offer food approximately every three hours, if the chick refuses food try again in an hour or so. Try not to force feed the animal, let them become hungry.

To feed place food item on the end of a tooth pick and offer it to the animal from above just like a hen.

In the early stages of development the chick may need to be fed 6-7 times and at each interval will only take a couple of pieces of food this is normal. As the chick grows and develops increase the amount of food it gets but reduce the number of feeds to 2-3.

(*M.Randy, pers con*)

11.9 Specific Requirements

There are no specific requirements for this species

11.10 Pinioning Requirements

As the pin feathers start to develop at around two to three weeks of age the temperature can be reduced about ½ - 1 degree a day until room temperature is reached 25 degrees. At this stage the chick should have fully formed feathers

11.11 Data Recording

On a daily basis the following information should be recorded:

- Date
- Time when information is recorded
- Body weight
- General activity and demeanor
- Characteristics
- Frequency of defecation
- Food consumption at each feed
- Any veterinary examinations and results
- Developmental stages

11.12 Identification Methods

Young birds can be identified by markings, feeding habits, difference in characteristics or deformities.

11.13 Hygiene

Hygiene plays a very important part in the raising of any animal here are a few points to follow:

- Ensure bedding and substrate is clean
- Wash hands before handling the animal
- Wash hands between individual animals
- Used boiled water to make up formulas
- Clean up any spilt formula on animal immediately so that it doesn't dry in feathers
- Wash all feeding utensils in hot soapy water or with another suitable disinfectant

Discard any unused formula

11.14 Behavioural Considerations

White browed wood swallows are an insect eater so it is important when weaning them to feed them insects. Also they are also a social species so when raising it is helpful to raise more than one so that they can become familiar with their own species. Young white-browed woodswallows should also be provided with lots of space for flight when they are fledging.

11.15 Use of Foster Species

In a captive situation if an adult wood swallow is unable to incubate its eggs and rear its young. Eggs may be placed under another pair of white-browed wood swallows which are also incubating eggs. It may be possible to place eggs under another wood swallow species such as *A. personatus*. The success of this is not known as it is uncommon.

11.16 Weaning

A juvenile's diet is very similar to a parents and weaning only consists of getting the animal used to feeding from a bowl. Once feathers have formed when ever feeding offer the bird food in a bowl and encourage the animal to come to the bowl. Eventually it should pick items up from the bowl on its own and you will only have to feed it once a day.

11.17 Rehabilitation Procedures

If being released into an aviary young birds which are ready to be released can be placed in a smaller cage inside the aviary. This will allow them to become familiar with their surrounds and the other birds in the aviary. The door for the smaller cage can then be opened and the birds should be left to exit on their own. This is called a soft release.

12 Acknowledgements

- Photographs taken by author
- Mathew Radnidge, Park Manger, Symbio Wildlife Park – for assistance with exhibit design, handling and transport, diets.
- Michael Randy, Feed Shed supervisor, Featherdale Wildlife Park – for detailed knowledge of housing, rearing and breeding the woodswallows.
- Daniel Gowland, Priam Psittaculture – for information regarding egg incubation.
- Vaughn Wilson – white browed woodswallow stud book keeper – for age determination, longevity and species management program.

13 References

- <http://www.birdsinbackyards.net/finder/display.cfm?id=131>
- <http://www.iucnredlist.org/search/details.php/51228/all>
- The great Australian bird finder – Michael Morcombe – p405
- <http://z.about.com/d/geography/1/0/f/K/australia.jpg>
- IATA live animal regulations for transporting birds.
- Healsville sanctuary woodswallow diet sheet, 2007.
- <http://www.answers.com/topic/white-browed-woodswallow-1>
- <http://www.censhare.umn.edu/care06.html#Birds>
- aviculture in Australia – p 241 – 242
- HANZAB (Handbook of Australian and New Zealand Birds) – Volume 7 – Part A – pages 396-399 and 424-438.
- The Clarmont field guide to the birds of Australia – Simpson and Day – 2000 7th edition.
- Steve parish kids – fact file birds – Kylie Curry – pages 2 and 14
- The encyclopedia of birds – Peerage Books 1982 – Dr Christopher Perrins – page 404
- <http://www.dpi.nsw.gov.au/agriculture/livestock/animal-welfare/codes/general/aw-code-4#5--Accommodation> – originally published in, 1996, by NSW agriculture
- Greg Lees – Moss Vale TAFE – learning guide assist with general animal care RUV2103A page 14.
- Mike Owen – <http://www.birdsnways.com/article/psittico.htm>
- www.censhare.umn.edu/care06.html#birds
- Article from new developments in the zoo world p 118-136 – “ Artificial incubation of bird eggs at zoological society of San Diego – Cynthia Kuehler and Jackie Good 1990
- (*The new parrot handbook. By Werner Lantermann, Matthew M. Vriends*)

14 Bibliography

- <http://www.birdsinbackyards.net/finder/display.cfm?id=131>
- <http://www.iucnredlist.org/search/details.php/51228/all>
- <http://www.reptilepark.com.au/animals.asp?catID=1&ID=46>
- The great Australian bird finder – Michael Morcombe – p405
- <http://z.about.com/d/geography/1/0/f/K/australia.jpg>
- <http://www.dpi.nsw.gov.au/agriculture/livestock/animal-welfare/codes/general/aw-code-4#10--Transport>
- What bird is that? – Neville W. Calyley – p214
- Healsville sanctuary woodswallow diet sheet, 2007.
- <http://www.answers.com/topic/white-browed-woodswallow-1>

- <http://www.publish.csiro.au/paper/MU9930251.htm>

- <http://www.censhare.umn.edu/care06.html#Birds>

- <http://www.linkroll.com/pet-birds/stress---the-silent-killer.php>

- aviculture in Australia – p 241 – 242

- HANZAB (Handbook of Australian and New Zealand Birds) – Volume 7 – Part A – pages 396-399 and 424-438.
- The Clarmont field guide to the birds of Australia – Simpson and Day – 2000 7th edition.

- Steve parish kids – fact file birds – Kylie Curry – pages 2 and 14

- The encyclopedia of birds – Peerage Books 1982 – Dr Christopher Perrins – page 404

- <http://www.dpi.nsw.gov.au/agriculture/livestock/animal-welfare/codes/general/aw-code-4#5--Accommodation> – originally published in, 1996, by NSW agriculture

- Greg Lees – Moss Vale TAFE – learning guide assist with general animal care RUV2103A page 14.
- Mike Owen – <http://www.birdsnways.com/article/psittico.htm>

- www.censhare.umn.edu/care06.html#birds
- Article from new developments in the zoo world p 118-136 – “ Artificial incubation of bird eggs at zoological society of San Diego – Cynthia Kuehler and Jackie Good 1990

- The new parrot handbook. By Werner Lantermann, Matthew M. Vriends

15 Glossary

- Dimorphism – occurring in two distinct form
- Gregarious – sociable
- Hybrid- the offspring of two animals of different species or variety.
- Monogamous – having only one mate at a time
- Nomenclature – systematic naming
- Passeriformes – perching bird, having feet with three toes pointing forward and one pointing backwards
- Prominent – jutting out; projecting

16 Appendix I - images



Fig 1



Fig 2



Fig 3



Fig 4



Fig 5



Fig 6



Fig 7



Fig 8



Fig 9



Fig 10



Fig 11



Fig 12



Fig 13





Fig 14


Appendix II – Annual Cycle of Maintenance

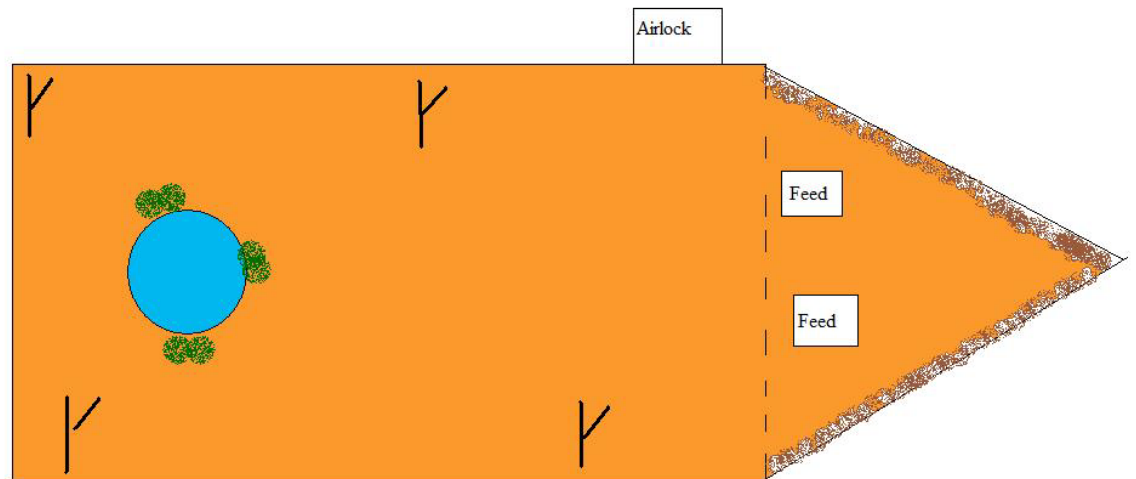
<p>January</p> <ul style="list-style-type: none"> • End of breeding season 	<p>February</p> <ul style="list-style-type: none"> • Exhibit maintenance can take place until July 	<p>March</p> <ul style="list-style-type: none"> • Annual worming 	<p>April</p>
<p>May</p> <ul style="list-style-type: none"> • New pairs should be introduced. So have time to bond before breeding season 	<p>June</p> <ul style="list-style-type: none"> • Install fresh tea tree browse for nesting. 	<p>July</p> <ul style="list-style-type: none"> • Exhibit maintenance to stop until February 	<p>August</p> <ul style="list-style-type: none"> • Breeding season starts • Increase feed amounts. See diets.
<p>September</p>	<p>August</p>	<p>November</p>	<p>December</p>

Appendix III – Diagrams for exhibit design

 = Tea Tree Browse

 = Lamandra shrubs

 = perch



Appendix IV – Material Safety Data Sheets for Disinfectants

Material Safety Data Sheet – eucalyptus disinfectant

Issue Date : October 2002 ISSUED by PEERJAL

Product Name : ACCENT EUCALYPTUS DISINFECTANT

Not classified as hazardous according to criteria of NOHSC

COMPANY DETAILS

Company Name Peerless Jal Pty Ltd (ABN 53 006 489 345)

Address 10-12 Raglan Street Preston

Victoria 3072 Australia

Tel/Fax Tel: (03) 9416 6700 Fax: (03) 9416 8516

Other Information The information in this MSDS was obtained from sources which we believe are reliable. However, the information is provided without warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use or disposal of the material are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising from or in any way connected with the handling, storage, use or disposal of the material.

IDENTIFICATION

Product Code DI36

Product Name ACCENT EUCALYPTUS DISINFECTANT

Proper Shipping

Name

None Allocated

UN Number None Allocated

DG Class None Allocated

Packing Group None Allocated

Hazchem Code None Allocated

Poisons Schedule Not Scheduled

Product Use Dilute with water for use as a Commercial Grade disinfectant or light duty cleaner.

Physical Data

Appearance Clear green liquid with eucalyptus odour.

Boiling Point Approx 100°C (@ 760mm Hg)

Vapour Pressure Not known

Specific Gravity 1.023 ± 0.005

Flash Point Non Flammable

Flamm. Limit LEL Not known

Flamm. Limit UEL Not known

Solubility in Water Infinite

Other Properties

Volatile Component 93.0 - 94.0%

pH Value 8.5 - 9.5

Ingredients: Name CAS Proportion

Non - Ionic Surfactant N/A 0-10 %
Perfumes & Dyes N/A 0-10 %
Builders & Chelates N/A 0-10 %
Water N/A To 100%
Quaternary Ammonium 68424-85-1 1.2%
compound.

HEALTH HAZARD INFORMATION**Health Effects**

Infosafe No. YSY10 Issue Date : October 2002 ISSUED by PEERJAL
Product Name : ACCENT EUCALYPTUS DISINFECTANT
Not classified as hazardous according to criteria of NOHSC
Acute - Swallowed Possible irritation of mouth, throat and stomach.
Acute - Eye May cause eye irritation.
Acute - Skin Possible irritant on repeated or prolonged contact.
Acute - Inhaled Inhalation of mist may cause irritation to the mucous membranes.

First Aid

Swallowed Do NOT induce vomiting. Give a glass of water and contact a doctor or the Poisons Information Centre. Phone 13 11 26.
Eye Hold eyelids open and irrigate with water for at least 15 minutes. See a Doctor if affects persist.
Skin Remove contaminated clothing, wash affected area with soap & water.
Inhaled Remove to fresh air.

Advice to Doctor

Advice to Doctor Treat symptomatically.

Other Health Hazard Information**PRECAUTIONS FOR USE**

Exposure Limits Not determined for this product.
Eng. Controls Ventilation: Not applicable when used in accordance with label directions.

Personal Protection

Protective Equip. Avoid contact with skin and eyes.
Wear rubber gloves if using manually.

Flammability

Fire Hazards Non - flammable.

SAFE HANDLING INFORMATION**Storage and Transport**

Storage and
Transport

No special requirements.

When storing, do not allow to freeze & store below 35°C. ie. Store between 5°C and 35°C.

Proper Shipping

Name

None Allocated

Spills and Disposal

Pick up excess with mop or wet vacuum to containers for disposal & rinse

residues with water.

Consult local authorities for disposal.

Fire/Explosion Hazard

Fire/Explos. Hazard No known harmful decomposition products formed.

Treat fire for materials actually involved in the fire.

Hazchem Code None Allocated

OTHER INFORMATION

Other Information ID No.: DI36 - 07

Passes T.G.A. test for disinfectants, Commercial Grade, at a dilution rate of 20: 1

...End Of MSDS...

Material Safety Data sheet – F10

Benzalkonium chloride

Section 1: Chemical Product and Company Identification

Product Name: Benzalkonium chloride

Synonym: Zephiral, Zephiran chloride, Osvan, Paralkan, Germitol, Germicin, Enuclen, Drapolex, Drapolene, Cequartyl, Benzalkonium A, Benirol, Bayclean, Ammonyx; Alkyl dimethylbenzyl ammonium chloride; Ammonium, Alkyldimethyl(phenylmethyl) Chloride; Alkylbenzyldimethylammonium Chloride; Alkyldimethyl(phenylmethyl)quaternary ammonium chlorides; Quaternary ammonium compounds, alkylbenzyldimethyl, chlorides

Chemical Name: Ammonium, alkyldimethylbenzyl-, chloride

Chemical Formula: Not available.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name CAS # % by Weight

Benzalkonium chloride 8001-54-5 100

Toxicological Data on Ingredients: Benzalkonium chloride: ORAL (LD50): Acute: 240 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive), of eye contact (corrosive). The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [POSSIBLE].

The substance may be toxic to kidneys, liver, heart, gastrointestinal tract, cardiovascular system, central nervous system (CNS).

Repeated or prolonged exposure to the substance can produce target organs damage.

Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: OPEN CUP: 250°C (482°F).

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: As with most organic solids, fire is possible at elevated temperatures

Special Remarks on Explosion Hazards:

Fine dust dispersed in air in sufficient concentrations, and in the presences of an ignition source is a potential dust explosion hazard.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Corrosive solid.

Stop leak if without risk. Do not get water inside container. Do not touch spilled material.

Use water spray to

reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, moisture.

Storage:

Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Amorphous solid powder or lumps.)

Odor: Aromatic.

Taste: Bitter. (Strong.)

Molecular Weight: Not available.

Color: White to yellowish.

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposition temperature: >140°C (284°F)

Critical Temperature: Not available.

Specific Gravity: 0.98 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, acetone.

Solubility:

Easily soluble in cold water, hot water.

Soluble in acetone.

Very slightly soluble in diethyl ether.

Very soluble in alcohol.

Soluble in benzene. Solubility in Benzene: 1 g dissolves in 6 ml of benzene.

Solubility in Ether: 1 g dissolves in 100 ml of Ether

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, dust generation, moisture, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Hygroscopic. Also incompatible with nitrates, anion detergents

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 240 mg/kg [Rat].

Chronic Effects on Humans:

MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [POSSIBLE].

May cause damage to the following organs: kidneys, liver, heart, gastrointestinal tract, cardiovascular system, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant), of ingestion, .

Hazardous in case of skin contact (corrosive), of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagen) and cause adverse reproductive effects (fetotoxicity, fertility (female))

based on laboratory experiments on animals.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: Causes severe skin irritation and burns.

Eyes: Causes severe eye irritation and burns.

Ingestion: Harmful if swallowed. May cause severe and permanent damage to the digestive tract. Causes

gastrointestinal (digestive) tract burns. May affect behavior (central nervous system depression, depression) and

metabolism. May produce burning pains in the mouth, throat, and abdomen, profuse salivation, muscle

weakness. May also affect the respiratory system and cardiovascular system, liver and kidneys.

Inhalation: May cause severe irritation of the respiratory tract with sore throat, coughing, shortness of breath, and

delayed lung edema. Causes chemical burns to the respiratory tract. Causes irritation of the mucous

membranes.

Chronic Potential Health Effects: May affect material (mutagenic) and may cause adverse reproductive effects.

Prolonged or repeated skin contact may cause dermatitis.

Repeated or prolonged exposure may cause allergic reactions in sensitive individuals. May cause cyanosis of the

skin and lips caused by lack of oxygen.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Corrosive Solid, Acid, Organic, n.o.s. (Benzalkonium Chloride) UNNA: 3261 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations: No products were found.

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).

CLASS D-2B: Material causing other toxic effects (TOXIC).

CLASS E: Corrosive solid.

DSCL (EEC):

R21/22- Harmful in contact with skin and if swallowed.

R34- Causes burns.

R50- Very toxic to aquatic organisms.

S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S28- After contact with skin, wash immediately with plenty of water.

S36/37/39- Wear suitable protective clothing, gloves and eye/face protection.

S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Synthetic apron.

Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 04:19 PM

Last Updated: 10/09/2005 04:19 PM

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Appendix V – egg incubation formulas and record sheets

Below are the formulas required to calculate information in regards to egg incubation.

Volume = Length x breadth x breadth x 0.51

Fresh weight = length x breadth x breadth x 0.548

Density = fresh weight ÷ egg volume

Day = min ÷ 60 + hour ÷ 24 + days – start day + initial start day correction time fraction decimal

% weight loss = fresh weight – actual weight ÷ day x day to pip ÷ fresh weight x 100

Weight loss once bird externally pipped = fresh weight – actual weight ÷ fresh weight x 100

When incubating egg data should be recorded daily to measure the growth and development of the egg as well as what temperature and humidity is required below is the record sheet used at Priam Psittaculture.

Egg incubation record sheet.

Species: _____	Length (cm): _____
Flight: _____	Breadth (cm): _____
Egg Number: _____	Lay Date: _____
Fresh weight (g): _____	Collection date: _____
Egg Volume (cm3): _____	Egg condition at collect: _____

Incubator Model: Serial Number:

Incubation Parameters: Dry Bulb Temp: Relative Humidity: Turning Regime:

Notes:

Initial start day correction time fraction decimal:

Day #	Notes	Actual weight (g)	Density (cm3)	Vein Growth (%)	Date:	Time:

Expected Incubation Period:

Expected Days to Pip:

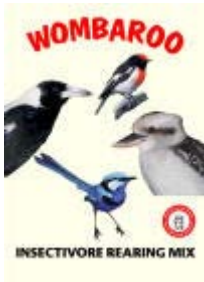
Appendix VI – addresses of suppliers and product ingredients

- Wombaroo products can be found at www.wombaroo.com.au

Wombaroo Food Products

PO Box 151
Glen Osmond
South Australia 5064

ph / fax: (08) 8391 1713
email: wombaroo@adelaide.on.net
web: www.wombaroo.com.au



INSECTIVORE REARING MIX

Complete food for rearing or supplementing insectivorous or carnivorous birds. Includes raptors, sea birds, waders, cardinals, chats, fly catchers, kingfishers, magpies, tanagers, wrens, whistlers, woodpeckers and woodswallows.

Available in 250g, 1kg and 5kg packs

Analysis

Min Crude Protein	52%
Min Crude Fat	12%
Max Fibre	5%
Max Salt	0.8%

Ingredients

Whey protein, soy protein, meat meal, fish meal, blood meal, cereal bran, lysine, methionine, vegetable oils, omega-3 and omega-6 fatty acids, vitamins A, B₁, B₂, B₆, B₁₂, C, D₃, E, K, nicotinamide, pantothenic acid, biotin, folic acid, choline, inositol, calcium, phosphorus, potassium, sodium, magnesium, zinc, iron, manganese, copper, iodine, selenium.

Pisces Enterprises Pty Ltd – insect supplier



P O Box 200
Kenmore
QLD
AUSTRALIA
4069



info@piscesenterprises.com



1800 351 839



(07) 3374-2393

Appendix VII – meat mix recipe

500g Mince (kangaroo or beef)
1 cup insectivore
2 teaspoon of shell grit
2 teaspoon calcium
1 cup crushed dog kibble.

Mix all ingredients well until for a crumbly mixture forms. If mixture does not crumble then add insectivore until this is achieved.