Management of Waterfowl

CHAPTER 36

The order Anseriformes includes swans, ducks, geese and screamers. Numerous excellent references are available for specific medical and biological information on these birds. Some basic biological facts of which veterinarians should be aware are discussed in the following sections.

Adult male ducks, geese and swans are referred to as drakes, ganders and cobs, respectively. Adult female ducks, geese and swans are called ducks, geese and pens. Young ducks, geese and swans (older than 3 weeks) are referred to as ducklings, goslings and cygnets.

FEATHER CHARACTERISTICS

Molting

Most waterfowl go through a complete molt following breeding season. This molt may last 3 to 6 weeks. During this time, flight feathers are lost, thus the birds are flightless. Most members of the subfamily Anatinae (eg, Shelducks, dabbling ducks, perching ducks, diving ducks) molt twice yearly. Birds of the family Anhimidae (screamers) and the magpie goose (Anseranas semipalmata) molt gradually and do not pass through a flightless period.

Feather Color and Sexual Dimorphism

Birds of subfamily Anserinae, ie, whistling ducks, swans, geese, Cape Barren geese (Cereopsis novaehollandiae) and freckled ducks (Stictonetta naevosa), have plumage that is monomorphic in all species. Magellan geese (Chloephaga picta) and kelp geese (Chloephaga hybrida) are the exceptions. Greater Magellan ganders have a white head, neck and breast, while females are reddish brown. Kelp geese males are pure white, while females are striped with different hues of brown. Birds of the subfamily Anatinae frequently have dimorphic plumage. Males typically have iridescent coloration with outstanding patterns. Ducks are usually sexually dimorphic.
except for the Pekin, American black duck (Anas rubripes) and Mexican breeds. It is a hobbyist’s theory that male ducks have a curl to their tail feathers at maturity that is not present in females.

**ANATOMIC VARIATIONS**

**Trachea**

Swans have an elongated trachea. The trachea of trumpeter swans extends into the sternum, turns on itself and then re-enters the syrinx. The ruddy duck (Oxyura jamaicensis) has an inflatable tracheal sac.

**Syringeal Bulla**

Most male ducks have a left-sided enlargement that can be visualized on radiographs. This is called the syringleal bulla and should not be misinterpreted as pathologic. This structure is absent in swans and geese.

**Phallus**

Male Anseriformes have an erect phallus that is covered with papillae. By placing gentle pressure on the sides of the cloaca, the phallus can be exteriorized, thus determining the bird’s sex as male. Females lack a phallus and instead have two small labia-like structures. Because this type of sexing necessitates turning the bird upside down, geese and swans are most easily done at a young age.

**Husbandry**

**ENVIRONMENTAL/ENCLOSURE CONSIDERATIONS**

**Enclosed Versus Open Ponds**

There are numerous advantages to keeping waterfowl in enclosed areas. The greatest advantage is protection from outside predators. In addition, it is more difficult for wild birds to enter enclosed areas, and this decreases the chances of introduction of disease into the collection. Another advantage is that birds in enclosed areas do not have to be pinioned. A disadvantage of enclosed areas is that the overall area is smaller than open enclosures, and this may lead to territorial aggression, harassment and injury to smaller birds by more dominant birds. This can be avoided by providing a tiered enclosure in which smaller, less dominant birds can fly up to the second level to escape harassment. It is important to avoid overcrowding in aviaries (Figs 36.1, 36.2).

Nylon netting works well to enclose pens. In colder areas, the netting will be weighted down with snow or ice, which will cause damage to the netting. This can be corrected by having the netting attached to several wires (Fig 36.3). The wires are then connected to a hand crank. Loosening the netting with the crank alleviates tension, so that damage to the netting is less likely (Lubbock, personal communication).

Open ponds provide more space and greater opportunity for grazing. However, birds in open areas are susceptible to predation, especially if they are unable to fly. In some cases, predation can be avoided by enclosing the area with a tall fence lined with electric wire. Furthermore, larger species such as mute swans can be very aggressive and are thus less likely to be attacked.

Protection from vermin also is an important consideration. Poisonous bait for rats, mice or roaches can be placed inside long plastic or metal tubes and put outside the reach of birds. However, there have been reports of warfarin toxicity resulting from the birds’ ingestion of mouse droppings (Lubbock, personal communication).
In general, extreme care must be taken when using rodenticides or other poisons near an aviary. Other deterrents for vermin include a 2 to 3 foot (1 m) tall sheet of metal lined with electric wire at the bottom, placed around the bottom perimeter of the cage (Fig 36.4).

Smaller waterfowl can be provided with various types of houses for nesting (Figs 36.5, 36.6). These can be made from large, hollowed-out logs (Fig 36.7) or flat pieces of wood. One breeder has had success using slatted boxes (Fig 36.8) because small waterfowl normally build nests in reeds or grasses, and the staggered pieces of wood in slatted boxes simulate stalks of grasses or reeds. Apparently, this imparts a feeling of privacy and security for birds, thus facilitating nesting (Lubbock, personal communication).

Ground cover is an important aspect of enclosure design. Hard surfaces such as concrete should be avoided, as these can contribute to bumblefoot. Grass or dirt surfaces are less irritating to feet, although they are harder to keep clean. A small (20 x 20 feet or 7.5 x 7.5 m) swan enclosure requires twice monthly re-sodding to keep the environment ideal (Montgomery, personal communication).

**Water Quality**

In small enclosures, artificial ponds can be built. These are made of concrete, then painted with waterproof
epoxy pool paint (Fig 36.9). These types of pools can be drained and cleaned on a regular basis. A water depth of 2 feet is adequate for most Anseriformes. Swans and diving ducks require 3 to 4 feet of water (Fig 36.10). Water quality in larger ponds is affected by the amount of ammonia present. Ammonia forms near the bottom surface of the pond subsequent to the degradation of fecal matter, food and other organic substances. It then rises to the surface of the pond where it facilitates algae growth. Above-water aerator systems can be utilized to remove ammonia before it reaches the pond surface. A network of underwater pipes that is connected to a central fountain achieves this (Fig 36.11). The pipes carry water (and thus ammonia) from the bottom surface area to the fountain where it is discharged into the air. This eliminates ammonia and oxygenates the water, which results in cleaner, fresher water with less algae.

Filtration systems also can be utilized to maintain water quality. There are hundreds of systems available and many of these can be researched on the Internet. The majority of these are for smaller ponds, with 25,000-gallon capacities being maximum size. Submersible filters are very effective in maintaining water quality. However, care must be taken when using these, as there have been reports of birds being pulled under water and trapped in the filtration system. Reeds and water plants can act as natural water filters when placed at exit and entry points of water flow (Fig 36.12). If water quality becomes out of balance — usually too much nitrogen and phosphorous combined with warm weather and bright sunlight — algae will bloom. A dark blue coloring agent that blocks the light so algae cannot grow is available.

**Species Compatibility**

In general, the smaller the enclosure area, the more potential there is for territorial aggression. As previously mentioned, tiered cages will allow smaller species to fly away from more aggressive birds. Inbreeding can occur and should be avoided. Likewise, interspecies breeding is undesirable and can be avoided by not having many different species of geese or ducks in one pen. Table 36.1 lists waterfowl species that should not be mixed.
Table 36.1 | Waterfowl Species That Should Not Be Housed Together

<table>
<thead>
<tr>
<th>Keep Isolated as a Single Pair</th>
<th>Exceptions</th>
<th>Specific Non-mix Combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Swans, especially:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Coscoroba</td>
<td>• Two pairs of black swans may be kept together if the area is large enough, as long as they are released together.</td>
<td>• Even on large lakes, never mix two pairs of trumpeter swans.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Never release a young pair into the territory of an established pair.</td>
</tr>
<tr>
<td><strong>Ducks, especially:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screamer</td>
<td>• More than one pair of comb ducks and white-winged wood ducks can be released together if the area is large, but do not release new birds into an existing group.</td>
<td>• Avoid keeping any subspecies together.</td>
</tr>
<tr>
<td>• Bronze-winged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pink-eared</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hartlaub’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Comb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Shelducks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• White-winged wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Musk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Crested</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• New Zealand teals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(brown teals or brown ducks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geese, especially:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sheldgeese (Andean)</td>
<td>• Never release a young pair into the territory of an established pair.</td>
<td>• Hawaiian goose (Nene) and cackling Canada goose.</td>
</tr>
<tr>
<td>• Egyptian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cereopsis geese</td>
<td></td>
<td>• Avoid keeping any subspecies together.</td>
</tr>
<tr>
<td>• Spur-winged</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Species Considerations for a Collection

Choosing which waterfowl to have in a collection depends on a number of considerations. These include price and availability of birds, aggression quotient (i.e., larger birds such as swans can be quite aggressive during mating season), susceptibility to predation (smaller, pinioned birds are more likely to be attacked) and size of enclosure and water quality. Figs 36.13-36.18 show some commonly kept swans.

Banding Birds

Once birds are acquired, placing leg bands is recommended, especially if there are two or more birds. This helps identify birds for breeding and health monitoring. Bands that are placed on the upper part of the leg (on the tibiotarsus) have a lesser chance of getting caught and causing injury (Fig 36.19). In addition, bands can be placed on the left leg of females and the right leg of males for quicker sex identification. Plastic leg bands have an advantage over aluminum because they are expandable (Fig 36.20). Aluminum bands can become bent, thus placing pressure on the leg or causing constrictions. Metal leg bands increase the incidence of frostbite injury in cold climates.

Diet

There are several commercially formulated diets available for waterfowl. These simplify meeting growing, maintenance and breeding nutritional requirements. Waterfowl kept on corn and lettuce diets frequently have dietary deficiencies that manifest as joint pain/lameness and bumblefoot. Grass and plants should be available for foraging.
Fig 36.15 | Whooper swan (Cygnus cygnus).

Fig 36.16 | Black-necked swans (Cygnus melanocoryphus).

Fig 36.17 | Coscoroba swans (Coscoroba coscoroba).

Fig 36.18 | Trumpeter swan (Cygnus buccinator).

Fig 36.19 | Bands placed on the upper part of the leg have less chance of becoming entrapped.

Fig 36.20 | Plastic leg bands are suitable for identification of waterfowl.
Management of Patients

**CAPTURE AND RESTRAINT**

Capturing pinioned waterfowl for examination in an open environment can be challenging. Most are excellent swimmers but are not proficient runners; therefore, a primary goal is to manipulate the birds out of the water so they can be more easily captured on land. This can be accomplished in a number of ways.

**Capture Methods**

**Rope-across-pond Method**

This method (Figs 36.21-36.23) involves pulling a long rope across the diameter of the pond. The birds attempt to swim away from the rope and can be herded up onto shore (Fig 36.24). A 50-foot (yellow) nylon ski rope can be purchased from a hardware or boating store. This can be wound upon a reel (such as that used to wind an electrical extension cord) for easy access (see Fig 36.21).

If a longer length is needed, two cords can be spliced together. A disadvantage of this method is that birds will quickly overcome their fear of the rope and learn to swim under or over the rope to avoid capture.

**Net Restraint**

Pole nets can be used to capture waterfowl (Fig 36.25). This method actually works well for capturing swans and geese from a small boat.

**Throw Nets**

Circular nets with a weighted outer perimeter can be thrown over birds (Fig 36.26). These are best used on land or in very shallow water. Throw nets should be inspected prior to use and damaged weights removed to avoid lead weights falling off in the pond.

**Manual Capture**

Swans and geese can be grasped gently but firmly by the base of the neck, then covered with a towel to prevent injury from the wings to the handler. Both large and
small waterfowl can be restrained by holding the base of the wings (Fig 36.27). Smaller birds can be carried in this manner; however, larger birds should be carried under one arm with the head facing backward and the body and feet supported with the other hand (Fig 36.28).

**Restraint for Travel**

Birds can be wrapped in a towel or pillowcase (Fig 36.29), then encircled with cohesive flexible bandage material. Caution should be taken so that the bird is not wrapped too tightly. In addition, birds should be monitored for overheating in hot weather.

**Drug Immobilization**

Chemical immobilization has been reported for use in waterfowl; however, this has not proven to be an effective adjunct to capture for many reasons. Drugged birds may go into the water and subsequently drown. When oral agents are mixed with food, over-consumption may cause an overdose with subsequent death. In addition, recovery from such drugs may be prolonged and may take up to 8 hours.
Dangers to Handlers During Capture and Restraint of Swans and Geese

Wings
Swans and geese use wings defensively. The distal humerus and olecranon can cause contusions. It is important to avoid having the handler’s head anywhere near the wings, as serious injury can occur. This is true with any large bird, but especially dangerous when handling the spur-winged goose.

Toenails
Waterfowl have short but very sharp toenails. These can cause painful scratches.

Beak
Most waterfowl have serrations on the edges of their beaks. They are capable of causing bruises when they bite or pinch. Handlers also must beware of the potential for an eye injury from biting birds.

PHYSICAL EXAMINATION

Feather Quality
Feathers should be smooth and regular in appearance (Fig 36.30). Frayed, dirty, bent or broken feathers may indicate lack of preening or abnormal molting (Fig 36.31). Water should roll off normal feathers, and feathers should not have a wet appearance. Feather color should be consistent, i.e., white feathers should be white, not brown or dirty.

Skin and Foot Quality
The skin is best examined over the chest muscle and on the feet and legs. Skin should not be cracked or flaky. The bottoms of the feet should be examined for bumblefoot lesions (Fig 36.32). Ideally, the bottoms of the feet should have small patterns of scale with no balding areas or scabs (Fig 36.33). Limping is generally a sign of joint or foot problems.

Body Weight
General body weights for waterfowl are available in table form. Body weight should be recorded at every physical exam. Deviations from previously recorded weights may indicate disease. Many free-ranging waterfowl have palpable keel bones. A prominent keel bone indicates
excessive weight loss with probable disease. Large birds can be easily weighed using a human scale; obtain the holder’s weight and then hold the bird, subtracting the difference of the two weights. This is an ideal way to weigh larger species.

**Eyes, Nose, Mouth**

Eyes should be clear with no redness or discharge. In collections where inbreeding is allowed, ocular abnormalities may be seen (corneal or ocular opacities). The nares should have no discharge and be bilaterally symmetrical. The oral cavity should be examined and should be free of excessive redness, white plaques or brown mucous. Breathing should not be open-mouthed or labored. Auscultation of lungs and air sacs should reveal little or no sound. Wheezing or crackling may indicate respiratory illness.

**Feces**

It is not unusual for waterfowl to have some loose feces, however, feces should not have a foul odor. Fecal color should be brown but will depend on diet. Excessively green feces, urine and urates may indicate liver disease.

**Overall Behavior**

Sick birds will sequester themselves away from other birds. Often, sick birds will be at the bottom of the pecking order, so their feathers will be more dirty, plucked and ragged than those of other birds. Another indication of illness is reluctance get up and move around. Sick birds spend inordinate amounts of time lying down or sleeping. Male swans will harass female and juvenile birds in an attempt to mate. If not interrupted, some infirm birds have been drowned by aggressive males.

**TESTING RECOMMENDATIONS**

**Blood Testing**

The recommendations for blood tests in waterfowl are similar to those commonly performed in other birds and include the following: complete blood count, advanced serum chemistry panel with bile acids, serum protein electrophoresis, chlamydial PCR testing and aspergillosis serology. Chlamydiosis serology has not been rewarding in waterfowl.

**Blood Collection**

The safest place for blood collection is the medial metatarsal vein (Fig 36.34). The cutaneous ulnar vein also can be used but there are more problems associated with using this vein. For example, birds do not like having the wing restrained and tend to struggle more during wing venipuncture. This can lead to head injury to the handler. Furthermore, hematoma formation is more
likely when using the cutaneous ulnar vein. The jugular vein is not commonly used for blood collection due to difficulty in visualization of the vein, especially in long-necked birds.

**Blood Parameters**

Hematology and serum chemistry values for waterfowl are listed in [Table 36.2](#).

**Fecal Tests**

Direct fecal smears are a simple way to check for internal parasites. This is easily done by smearing a small amount of fresh feces on a microscope slide, adding a few drops of lactated Ringer’s solution, adding a cover slip and examining under a microscope. *Giardia* spp. or other protozoan organisms as well as parasite eggs can be visualized on direct fecal smears. Fecal Gram’s stains can be used to identify *Cryptosporidia* spp. and budding yeast. Gram-negative bacteria and *Clostridia* spp. are not unusual in Gram’s stains of asymptomatic waterfowl and should not necessarily be treated.

**Endoscopy**

Endoscopy is routinely performed via the left or right lateral approach as with parrots. Because swans and geese have elongated tracheas, tracheal endoscopy is difficult, since few endoscopes will reach far enough to visualize the trachea in its entirety. A flexible endoscope can be used, as the trachea of most birds over 1000 g will pass a 3-mm scope.

Other recommended diagnostic tests include radiology, histopathology, necropsy and culture and sensitivity of feces, throat or skin lesions.

**TREATMENT RECOMMENDATIONS**

**Fluid Therapy**

Intravenous catheterization can be most easily done in the medial metatarsal vein. This vein is easy to access and not highly prone to hematomas, and birds tolerate catheter placement well there. The biggest disadvantage of using the medial metatarsal vein is that some agents injected into the legs will go through the renal portal system and be excreted by kidney tubules before entering the general circulation. However, the author has experienced successful treatment results following fluid and antibiotic therapy administered via this method. Catheter placement is implemented in the same manner as with dogs and cats. A 20- to 24-gauge Teflon catheter can be used. It is recommended that catheters not be left in for more than 48 hours. If long-term catheterization is necessary, a vascular access device may be necessary. Catheterization also may be done in the cutaneous ulnar vein; however, as previously mentioned, there is a greater possibility of hematoma, and this is more dangerous to the handler in larger birds. Jugular catheterization is difficult due to visualization difficulties discussed earlier.

Intraosseous catheterization can be performed in the tibiotarsus or ulna but is more painful than intravenous catheterization. Such catheter placement often necessitates anesthesia, and some patients may not be candidates for anesthesia. Bone infection may occur if the process is not done aseptically.

If a patient is not hypoproteinemic, subcutaneous fluids with hyaluronidase have been preliminarily purposed to be as effective as intravenous fluids.

Oral fluids should also be given in tube-feedings in mildly dehydrated birds.

**Gavage-Feeding**

Soft tubes work well for gavage feeding waterfowl. Swans and geese can be gavage fed with 14-Fr (16") red rubber catheters. Smaller birds can be fed using silicone feeding tubes (Fig 36.35). There are a variety of formulas available for nutritional support in debilitated patients.

**Medications**

*Table 36.3* lists medications commonly used for waterfowl.

**SURGICAL PROCEDURES**

**Pinioning**

Pinioning, the surgical removal of the tip of the wing from the alula distally to render a bird flightless, is a common procedure in waterfowl. When done early (at 2-3 days old), this procedure is virtually bloodless and stress free (Figs 36.36-36.38). Pinioning older birds is more difficult because stress and excessive bleeding can occur. The proper technique for pinioning is to remove metacarpals III and IV and leave the alula intact to cover the amputated area. If the alula is removed, repeated trauma to the stump can occur on a regular basis.
### Table 36.3 | Medications Commonly Used for Waterfowl

<table>
<thead>
<tr>
<th>Generic</th>
<th>Trade Name(s) and Manufacturer</th>
<th>Dosage(s) and Route(s)</th>
<th>Main Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANTIBACTERIAL AGENTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>Amoxinsol 50 soluble powder (Univet)</td>
<td>1 g/3 L drinking water* Medicated drinking water should be provided on alternate days for 3 days, i.e., 2 days of medication.</td>
<td>Sensitive bacterial infections</td>
</tr>
<tr>
<td>Chlorotetracycline</td>
<td>Aureomycin soluble powder (Cyanamid)</td>
<td>1000 ppm (18.2 g/kg feed) in feed for 45 days</td>
<td>Chlamydia</td>
</tr>
<tr>
<td>Co-trimazine (trimethoprim + sulfadiazine)</td>
<td>Cosumix Plus soluble powder (Ciba); Duopharm poultry suspension (Salvay Animal Health) (Bactrin, Roche)</td>
<td>1 ml/5 L drinking water* for 5-7 days</td>
<td>Sensitive bacterial infections</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Ronaxan tablets (Rhône Mérieux) (Henry Schein, Roerig)</td>
<td>50 mg/kg PO BID for 3-5 days (45 days for chlamydiosis) or 240 ppm in feed for 45 days</td>
<td>Sensitive bacterial infections, especially chlamydiosis</td>
</tr>
<tr>
<td></td>
<td>Steriject (Pfizer)</td>
<td>75 mg/kg IM once weekly for 6 weeks</td>
<td>Chlamydia</td>
</tr>
<tr>
<td>Enrofloxacin</td>
<td>Baytril 2.5% or 5% injection 2.5% or 10% oral solution or tablets (Bayer) (Baytril 2.7%, Haver/Diamond)</td>
<td>10-15 mg/kg IM or PO BID for 5-7 days</td>
<td>Sensitive bacterial infections. Useful for bacterial hepatitis or septicemia in neonates. Used widely in growing chickens and poultry of all ages without any incidence of articular cartilage problems: at normal therapeutic levels (10-15 mg/kg BID) it is unlikely to produce joint deformity in neonatal waterfowl (or in raptors or pigeons).</td>
</tr>
<tr>
<td>Lincomycin</td>
<td>Linco-spectin powder (Upjohn)</td>
<td>3 g/4 L drinking water* for 3-7 days</td>
<td>Mycoplasma tenosynovitis</td>
</tr>
<tr>
<td>Lincomycin/spectinomycin</td>
<td>Linco-spectalin 100 soluble powder (Upjohn)</td>
<td>3 g/4 L drinking water* for 3-7 days</td>
<td>Mycoplasma tenosynovitis, sinuses</td>
</tr>
<tr>
<td>Oxytetracycline</td>
<td>Various long-acting injections.</td>
<td>200 mg/kg IM daily for 5-7 days</td>
<td>Pasteurella and other sensitive bacterial infections</td>
</tr>
<tr>
<td></td>
<td>Terramycin soluble powder (Pfizer)</td>
<td>37 g/15 L drinking water* for 5-7 days</td>
<td></td>
</tr>
<tr>
<td>Tylosin</td>
<td>Tylan 50 or 200 injection (Elanco)</td>
<td>20-30 mg/kg IM TID for 3-7 days; or 100 mg in 10 ml saline, daily nasal flush for 10 days</td>
<td>Mycoplasma</td>
</tr>
<tr>
<td></td>
<td>Tylan tablets (Elanco)</td>
<td>20 mg/kg PO TID for 3 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tylan soluble powder (Elanco)</td>
<td>2.5 g/5 L drinking water* for 3 days</td>
<td></td>
</tr>
<tr>
<td><strong>ANTIFUNGAL AGENTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Itraconazole</td>
<td>Sporanox capsules (Janssen)</td>
<td>10 mg/kg PO SID for 7-10 days for prophylaxis, or POBID for 4-6 weeks for therapy</td>
<td>Aspergillosis</td>
</tr>
<tr>
<td>Nystatin</td>
<td>Nystan oral suspension (Lagap) (Myco 20, Squibb)</td>
<td>300,000 units (3 ml)/kg PO BID for 7 days</td>
<td>Candidiasis</td>
</tr>
<tr>
<td><strong>ANTIPROTOZOAL AGENTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clazuril</td>
<td>Appertex (Harkers)</td>
<td>5-10 mg/kg PO every 3rd day on 3 occasions</td>
<td>Coccidiosis</td>
</tr>
<tr>
<td>Co-trimazine (trimethoprim + sulfadiazine)</td>
<td>Cosumix Plus soluble powder (Ciba); Duopharm poultry suspension (Salvay Animal Health) (Bactrin, Roche)</td>
<td>60 mg/kg (combined constituents) PO BID, 3 days on, 2 days off, 3 days on</td>
<td>Coccidiosis</td>
</tr>
<tr>
<td></td>
<td>Duopharm 24% injection (Salvay Duophar)</td>
<td>30 mg/kg SC, 3 days on, 2 days off, 3 days on</td>
<td>Do not use in dehydrated birds</td>
</tr>
<tr>
<td>Pyrimethamine</td>
<td>Daraprim (Glaxo-Wellcome)</td>
<td>0.25-0.5 mg/kg PO BID for 30 days</td>
<td>Sarcocystis spp., toxoplasmosis</td>
</tr>
<tr>
<td>Pyrimethamine/sulfaquinoxaline</td>
<td>Microquinox (CVet Livestock Products)</td>
<td>60 mg/L drinking water*, 3 days on, 2 days off, 3 days on</td>
<td>Coccidiosis</td>
</tr>
<tr>
<td>Toltrazuril</td>
<td>Baycox (Bayer) (Bayvet)</td>
<td>1 ml of 2.5% solution/2 L drinking water* for 48 hours</td>
<td>Coccidiosis</td>
</tr>
<tr>
<td><strong>ENDOPARASITICIDES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorsulon</td>
<td>Curatrem (MSD Agvet)</td>
<td>20 mg/kg PO 3 times at 2-week intervals</td>
<td>Control cestodes and trematodes</td>
</tr>
<tr>
<td>Fenbendazole</td>
<td>Panacur 2.5% or 10% liquid, 8-mg capsules (Hoechst)</td>
<td>20 mg/kg PO once</td>
<td>Control nematodes</td>
</tr>
<tr>
<td>Flubendazole</td>
<td>Flubenvet (Janssen)</td>
<td>240 ppm (2.4 kg/ton) in feed for 7 days</td>
<td>Control nematodes</td>
</tr>
<tr>
<td>Ivermectin</td>
<td>Ivmec 1% cattle injection (MSD Agvet)</td>
<td>200 µg/kg SC or PO once</td>
<td>Control nematodes and nasal or duck leeches</td>
</tr>
<tr>
<td>Levamisole</td>
<td>Various, eg, Levamide (Norbrook) (Ripercal-L, American Cyanamid)</td>
<td>25-50 mg/kg SC once</td>
<td>Control nematodes</td>
</tr>
</tbody>
</table>
Another advantage to pinioning birds at a young age is that birds can be easily sexed before pinioning. Subsequently, the wing pinioned can indicate the sex of the bird, i.e., females will be pinioned on the left wing and males will be pinioned on the right.

Tendonectomies of the extensor carpi radialis tendon or the insertion point of the superficial pectoralis muscle are surgeries that have been described for rendering birds flightless. These techniques are not always effective.9 Furthermore, most waterfowl owners feel that it is not cost effective to do these surgeries.

Displaced Tendon Repair (Luxation of the Achilles Tendon)

Surgery has been described for the repair of Achilles tendon luxation.13 Depending on the cause (which is often due to malnutrition), prognosis for recovery is poor, especially in heavier birds. Placement of the affected bird in a sling apparatus to take weight off the legs may improve prognosis.

Orthopedic Repairs

Leg fractures in swans and geese may carry a more guarded prognosis for healing due to large body size and short legs. Immobilization is imperative and may cause stress to the patient. Otherwise, fracture treatment and repair is identical to that done in other birds.

Reproduction

Average Biological Data

Table 36.4 lists sexual maturity, clutch size and incubation period of various waterfowl.

Generally incubation periods are: ducks, 28 to 30 days;
geese, 20 to 28 days; swans, 30 to 40 days; and Shelducks, 27 to 30 days.

**Age of Sexual Maturity**

Most ducks are sexually mature at 1 year of age. Geese usually mature in about 2 years. Swans reach sexual maturity at about 5 years.

**Artificial Incubation**

There are a variety of incubators (Fig 36.39, 36.40), brooders and hatchers (Fig 36.41) available that are suitable for waterfowl.23,33 For artificial incubation in waterfowl, incubator temperatures of 99.3°F (37.3°C) and 85% humidity are desirable.

Brooder rooms should be designed so they are easy to clean with adequate ventilation, heating and cooling capacities (Fig 36.42). A heat source (such as a 150-watt heat lamp) should be provided in one area such that the young birds can get close to or back away from the heat as needed. The temperature should be about 95 to 99°F (35-37.2°C) initially, and then gradually decreased over a 3-week period.7 Never allow chicks to become chilled.

Food and water should be placed at the end opposite from the heat source. Large colored marbles may be placed in water dishes to encourage the birds to learn how to drink. It is not advisable to use hay, shavings, straw or newspaper in the enclosure, as these may be consumed.

Young birds may be ready for outside pens at 2 to 4 weeks of age. Concrete pens with epoxy-painted pools can be constructed. Shallow pools three-fourths inch deep are recommended to acclimate the young birds to water (Fig 36.43). A heat source can be provided in the pen. The pens pictured have doors that can open to outside pens (Fig 36.44). These help acclimate birds as they are going from the controlled indoor environment to the less-controlled environment of outside pens. Once acclimatized to the outdoor pens, the birds can then be moved to larger growing pens.

**Waterfowl Diseases**

An extensive table of bacterial, fungal, viral and parasitic diseases of Anseriformes is available elsewhere.7 Listed
Different types of incubators are available for waterfowl.

Hatcher for waterfowl eggs.

Brooder room.

Shallow ponds help acclimate young birds to water.

Indoor pens that open to outdoor pens make excellent transition housing.
below are some of the most commonly observed disease syndromes.

**Malnutrition**

Dirty, broken, frayed feathers that do not repel water effectively evidence malnutrition. Frequently, affected birds have secondary bumblefoot due to dietary insufficiencies. Leg and joint lameness with a reluctance to move are other clinical signs, especially in younger birds. Hepatic lipidosis is common in malnourished birds. These birds also are frequently immunosuppressed and thus have secondary bacterial infections. The use of balanced, formulated diets appears to mitigate, if not alleviate, many of these clinical signs.

**Bumblefoot**

Many waterfowl with bumblefoot (see Fig 36.32) show no signs of lameness. In fact, many cases are not noticeable until the bird is restrained and examined. The underlying cause is usually malnutrition, although rough surfaces and excessive egg laying also can be contributing causes. Because bumblefoot is usually a chronic inflammatory condition, amyloidosis is a common sequela.

**Trauma**

Most of the larger waterfowl cannot survive if injury, such as that incurred from a dog, alligator, raccoon or turtle attack, results in the disuse of one leg. Heavy body size is not supported well by the one remaining leg. *Pasteurella multocida* is a frequent concern from scratch or bite wounds of predators.

**Amyloidosis**

Amyloidosis is a condition in which normal organ cells are replaced with a proteinaceous amorphous, eosinophilic, acellular material. Although the exact pathogenesis is unknown, amyloidosis is thought to be associated with stress of close confinement, chronic primary diseases or inflammatory conditions. Acute death frequently occurs, and liver and kidney biopsies are currently the only ante-mortem diagnostic tests. Where clinical signs occur, affected birds appear lethargic, have a lack of appetite, and are reluctant to stand. Gout is seen frequently subsequent to kidney failure associated with amyloidosis.

**Gout**

Gout (Fig 36.45) occurs secondary to renal failure. Causes of renal failure include toxicoses, chronic infection and amyloidosis.

**Angel Wing**

Angel wing (Fig 36.46) is a condition in which the distal portion of the wing appears flipped outward. Young swans and geese are most susceptible to this condition. Angel wing is caused by excessively rapid growth of feathers in relation to muscle development. As a result, growing flight feathers cause excess stress (weight) on carpal muscles, making the carpal portion of the wing hang and twist outward. Possible causes for angel wing include manganese or vitamin E deficiency, hypovitaminosis D₃, genetic factors, over-feeding and excessive dietary protein. If angel wing is noticed soon after the condition develops, it may be corrected by taping the wing in a normal position for 3 to 5 days. However, if the condition is left uncorrected until adulthood, the carpus can become traumatized, with amputation the best solution.

**Non-specific Joint Inflammation/Lameness**

Clinical signs of non-specific joint disorders include lameness or reluctance to move. This is seen frequently in young birds that are fed primarily “scratch grains”
(cracked corn, wheat, barley or oats) or large amounts of lettuce. In these cases, improvement is seen when the birds are switched to a pelleted diet. This condition also is seen in older birds (especially swans) as arthritis or septic joint infections. Depending on the cause, some decrease of pain and inflammation can be seen with flunixin-meglumine (1-10 mg/kg IM). Carprofen (5-10 mg/kg PO q 24 h) also may be effective. Frequently, bumblefoot develops or worsens as a result of excessive weight placed on the unaffected leg.

Fire Ant Stings

Fire ants are common in Florida. Stings manifest as necrosed areas on the foot web. When healed, these areas show up as defects in the foot web. In the avairy, 5% carbonate dust will help control fire ants. Improperly applied this can be toxic to birds.

Maggot Infestation

Maggot infestation occurs when old wounds (cuts or bites) go undetected or neglected. Infestation can occur in as few as 24 hours. Hydrogen peroxide helps flush out maggots, or they can be removed manually with forceps. Prognosis for tissue recovery depends on the amount of necrosis and length of time the wound has been left unattended. Carcasses that harbor maggots may be a source of botulism toxins if maggots are consumed.9

Products and Personal Communications

Mentioned in the Text

a. Toprite Netting, Lakewood, NJ, USA; jacissel@Compuserve.com; 1-800-651-2234
b. Mike Gamebird Netting and Sight Barriers, Blue Mountain, AL, USA; 1-256-257-9461
c. BF Products Inc., Harrishburg, PA, USA; 1-800-255-8589
d. Sylvan Heights Waterfowl II, M Lubbock and A Lubbock, Scotland Neck, NC, USA; 252-826-5050
e. Montgomery, R, Palm Beach, FL
f. Pinnacle filter, MacArthur Water Garders, Bethesda, MD, USA
h. Lafeber Company, Cornell, IL, USA; www.Lafeber.com; 1-314-768-4592
i. Reliable Protein Products, Palm Desert, CA, USA; www.zoofood.com;
   1-760-521-7535
j. High Potency Fine Pellets, Harrison’s Bird Foods, Brentwood, TN, USA; 1-
   800-346-0269, www.harrisonsbirdfoods.com
k. Tomahawk Mighty Net, Tomahawk Live Traps and Equipment, Tomahawk,
   WI, USA; 1-800-272-8727; www.tomahawk trapping.com
l. Tomahawk Throw Net, Tomahawk Live Traps and Equipment, Tomahawk,
   WI, USA; 1-800-272-8727, www.tomahawk trapping.com
m. 5M Vetwrap, 5M Worldwide, www.mmm.com; 1-888-364-3577
n. Wydase, www.tricarepharamacy.com
o. Feeding Tube and Urethral Catheter, Sovereign, Sherwood Medical, St
   Louis, MO, USA
p. 17 Fr, 5.5 mm disposable silicone tubes, Veterinary Specialty Products,
   Boca Raton, FL, USA; www.vet-products.com; 1-800-362-8138
q. Emeraid Products, Lafeber Company, Cornell, IL, USA; www.Lafeber.com;
   1-800-842-6445
r. Petersime Incubator Company, Gettysburg, OH, USA; 1-888-255-0067
s. Lyon Electric Company, Chula Vista, CA, USA; 1-819-216-5400
r. Tomahawk Mighty Net, Tomahawk Live Traps and Equipment, Tomahawk,
   WI, USA; 1-800-272-8727, www.tomahawk trapping.com
u. Humidaire Incubator Company, Madison, OH, USA; hatch@bright.net;
   1-800-410-6925

References and Suggested Reading

3. Carpenter JW, Mashima TY, Rupiper DJ: Exotic Animal Formulary
4. Game Bird and Conservationists’ Gazette magazine,
5. Griffin C, Snelling LR: Use of hyaluronidase in avian subcuta-
6. Jenkins J: Hospital techniques and supportive care. In Altman RB,
Chubb SL, Dorrestein GM, Quessenberry K (eds): Avian Medicine and
7. Johnson-Delaney CA. Poultry and waterfowl. In Exotic Companion
Medicine Handbook. Lake Worth, FL, Zoological Education
(eds): Avian Medicine: Principles and Application. Brentwood, TN,
HBD Intl, Inc 1999, p 539
10. McMillan MC: Imaging tech-

niques. In Ritchie BW, Harrison
GJ, Harrison LR (eds): Avian
Medicine: Principles and
Application. Brentwood, TN,
HBD Intl, Inc 1999, p 277

11. Todd F: The Natural History of
Waterfowl. Vista, CA, Ibis
Publishing Co, 1997
12. Flinkham G: Exotic pet care:
Swans. Exotic DVM 2(1):36-38,
2000
in captive swan medicine and sur-
gery. Exotic DVM 5(4): 53-58,
2003.