

## H-B.1

### ASPERGILLOSIS



**B-1.1**

**B-2.1**

**B-3.1**

#### What is aspergillosis?

Aspergillosis is caused by a fungus belonging to the genus *Aspergillus*. The most common species of this fungus found in diseased birds is *A. fumigatus*.

*Aspergillus* is most often noticed in the lungs of infected birds and causes respiratory infection.

Aspergillosis is not contagious (not spread from bird-to-bird) but is acquired from the environment.

*A. fumigatus* is commonly found in damp locations such as on decaying vegetation or grain. Inhalation of tiny egg-like structures (fungal spores) can lead to infection of the lung by *Aspergillus*. The pneumonia that develops may be rapidly fatal or cause more of a long-term sickness (chronic).

Birds with a more chronic form of the disease may develop thick whitish areas (plaques and mats) of mould in the lungs, air sacs and other surfaces of the body cavity.

Chronically infected birds may become emaciated (see emaciated in section H-G.2), weak and have difficulty breathing.

#### Where is aspergillosis found in birds?

Aspergillosis is found in the lungs and windpipe of the bird.

In chronic infections, any surface inside the body may be involved.

## H-B.1

### What species are affected?

- ❖ Aspergillosis may occur in any species of bird. Some species, for example falcons, are more susceptible than others.
- ❖ Birds that are sick, weak, emaciated or stressed are more likely to contract the disease. Normal, healthy birds will not commonly develop the disease unless exposed to massive numbers of spores.

### Human health concerns

- ❖ It is unlikely that infected birds would cause aspergillosis in humans. However, caution is advised when handling birds suspected to be sick. Butchering the bird may release tiny, invisible fungal spores into the air. To be safe, discard infected lungs and other infected body parts.
- ❖ Cooking will kill the fungus and make it safe for human consumption. However, if the bird looks sick for other reasons, it is not recommended to eat it.

### Safety of the meat for dogs

- ❖ It is not recommended to feed any contaminated parts such as infected lungs to the dogs.

### Samples to collect

- ❖ Collect infected lungs and freeze them.



## H-B.2

### AVIAN CHOLERA



**B-1.2**



**B-2.2**



**B-3.2**

#### What is Avian Cholera?

Avian Cholera is caused by the bacterium *Pasteurella multocida*. There are many different types of this bacterium, each of which is associated with different hosts and geographic ranges.

#### Species Affected

Avian cholera has been reported in a wide range of species. It is likely that all species of birds are susceptible to infection. The most dramatic outbreaks and the greatest losses tend to occur in waterfowl. Snow geese, Ross's geese, Canada geese and Common eiders are Arctic species that have been diagnosed with avian cholera.

#### Known Occurrence in the Arctic

Large scale die-offs have occurred in Snow geese in the Arctic, in Hudson Bay and on Banks Island.

#### Ecology of the Disease

Avian cholera tends to occur as large-scale outbreaks with high death rates (mortality). Birds are most vulnerable when congregated together at high densities, and thus the disease is strongly associated with waterfowl wintering grounds. It has also been known to occur during migration and on the nesting grounds. The bacterium is likely transmitted from bird-to-bird through water and feed that is contaminated by excretions from infected birds. Direct bird-to-bird transmission is also possible, although it is likely a much less important route of transmission.

## H-B.2

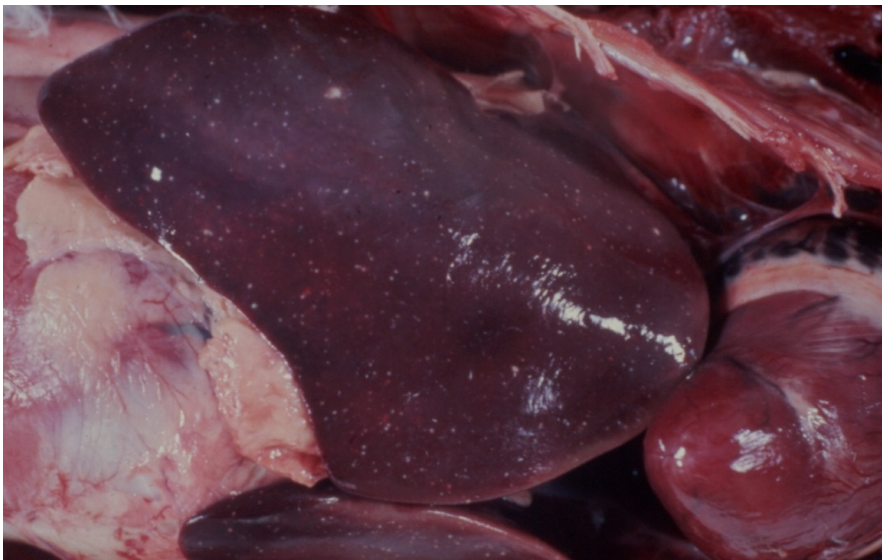
- ❖ It is not understood how the bacterium manages to survive between outbreaks and how outbreaks are started. One possibility is that some birds carry the bacterium but are unaffected by it. At one time it was thought possible that some environments, such as certain wetlands where the disease repeatedly occurred, were contaminated with the bacterium, but little evidence has been found to support this hypothesis.
- ❖ Once an outbreak has begun, transmission under conditions of high population density is rapid resulting in high levels of mortality.

### Clinical disease

- ❖ The course of disease tends to be very short, with affected birds dying quite suddenly. Clinical signs are fairly broad. Previously healthy birds may die without apparent warning, and sick birds that are captured may die during handling. Sick birds may appear weak and unable to fly.

### Pathology

- ❖ Birds dying of avian cholera are often in good to excellent body condition. Obvious abnormalities include bleeding (hemorrhages) on the surface of the heart and gizzard as well as many small white spots in the liver. The white spots represent areas of cell death (see abnormalities of the liver in section H-G.8). The liver may be enlarged and fragile when handled. There may also be large quantities of mucus in the small intestine.



White spots in the liver as the result of cell death due to avian cholera. (Photo credit: Dr. G. Wobeser)

## H-B.2

### AVIAN CHOLERA, CONT'D

#### Significance of the disease

Avian cholera is one of the most important infectious diseases of wild waterfowl and is capable of causing large population losses.

#### Human health concerns

*Pasteurella multocida* is capable of infecting a wide range of species and some precautions should be taken while handling carcasses potentially infected with this bacterium. Wear protective gloves and wash your tools, hands and outer clothing in hot soapy water to prevent infection through cuts and breaks in the skin, or by mouth.

It is not recommended to eat the bird if many white spots are seen throughout the liver.

#### Safety of the meat for dogs

It is not recommended to feed infected birds to dogs.

#### Samples to collect

Entire carcasses provide the best specimens for diagnosis. If the entire carcass can not be submitted, large or complete samples of heart and liver, placed in separate plastic bags and frozen, provide the best alternative specimen. If the carcasses are no longer freshly dead, an entire wing remains a useful specimen, as the bacterium can persist for long periods of time in the wing bones.

#### Carcass Disposal

Carcasses should be burned or buried in order to prevent environmental contamination and further transmission of the disease.



## H-B.3

### GIZZARD WORMS



**B-1.3**



**B-2.3**



**B-3.3**

#### What are Gizzard Worms?

Gizzard worms are roundworm, or nematode, parasites. The two species most commonly involved in causing infections in waterfowl are *Amidostomum* sp. and *Epomidiostomum* sp.

#### Species affected

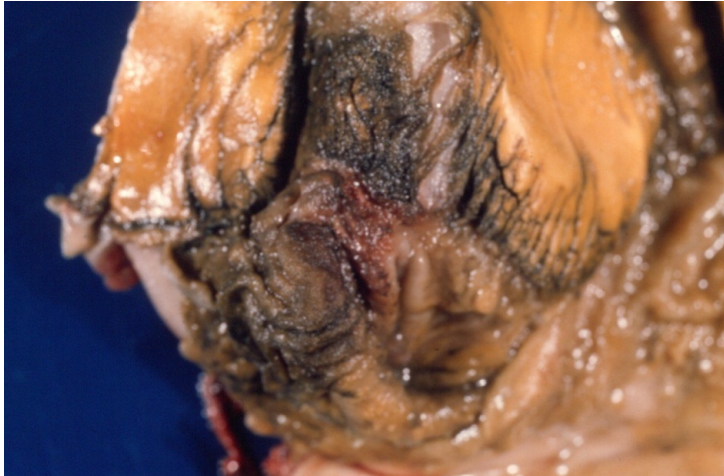
Wild geese are commonly infected by gizzard worms. Ducks are less commonly infected.

#### Life cycle of the parasite

An infected bird will shed parasite eggs through its digestive tract. The immature (larval) parasite will hatch out and further develop on the ground. Eggs and larvae may persist for some time in the environment and can survive low temperatures, although there is evidence that the extreme sub-zero temperatures of the Arctic winter will kill them. They are susceptible to drying out. Birds are infected by eating these larvae while grazing. Once ingested, the larvae burrow through the lining of the gizzard and further develop into adult worms which feed, mate and shed eggs into the bird's intestinal tract and the cycle continues.

*Amidostomum* sp. lives just beneath the lining of the gizzard while *Epomidiostomum* sp. lives within the muscle of the gizzard.

## H-B.3



Erosion of the gizzard due to *Amidostomum* sp. infection. Photo credit: Dr. G. Wobeser



Nematode – Gizzard nematodes are small, parasitic and thread-like (1-3 cm long). They are often found coiled.

### How does it affect the bird and what does it look like?

- ❖ The effect on the bird is likely in proportion to the number of worms present. Worms cause damage to the gizzard by their migration through the lining and muscle and by their feeding activities. The grinding pads that line the gizzard may become worn away (eroded) and sores (ulcers) may develop. The grinding pads may slough off if severely damaged. There may be tissue damage in the muscle due to the presence of the worms and to the redness and swelling (inflammation) reaction that they cause.

### Human health considerations

- ❖ There is no human health risk associated with handling or eating infected tissues. Nonetheless, because of concern over such things as secondary infections, it is recommended that gizzards be thoroughly cooked before eating.

### Safety of the meat for dogs

- ❖ It is not recommended to feed infected gizzards to dogs raw. The rest of the bird is safe to feed to dogs.

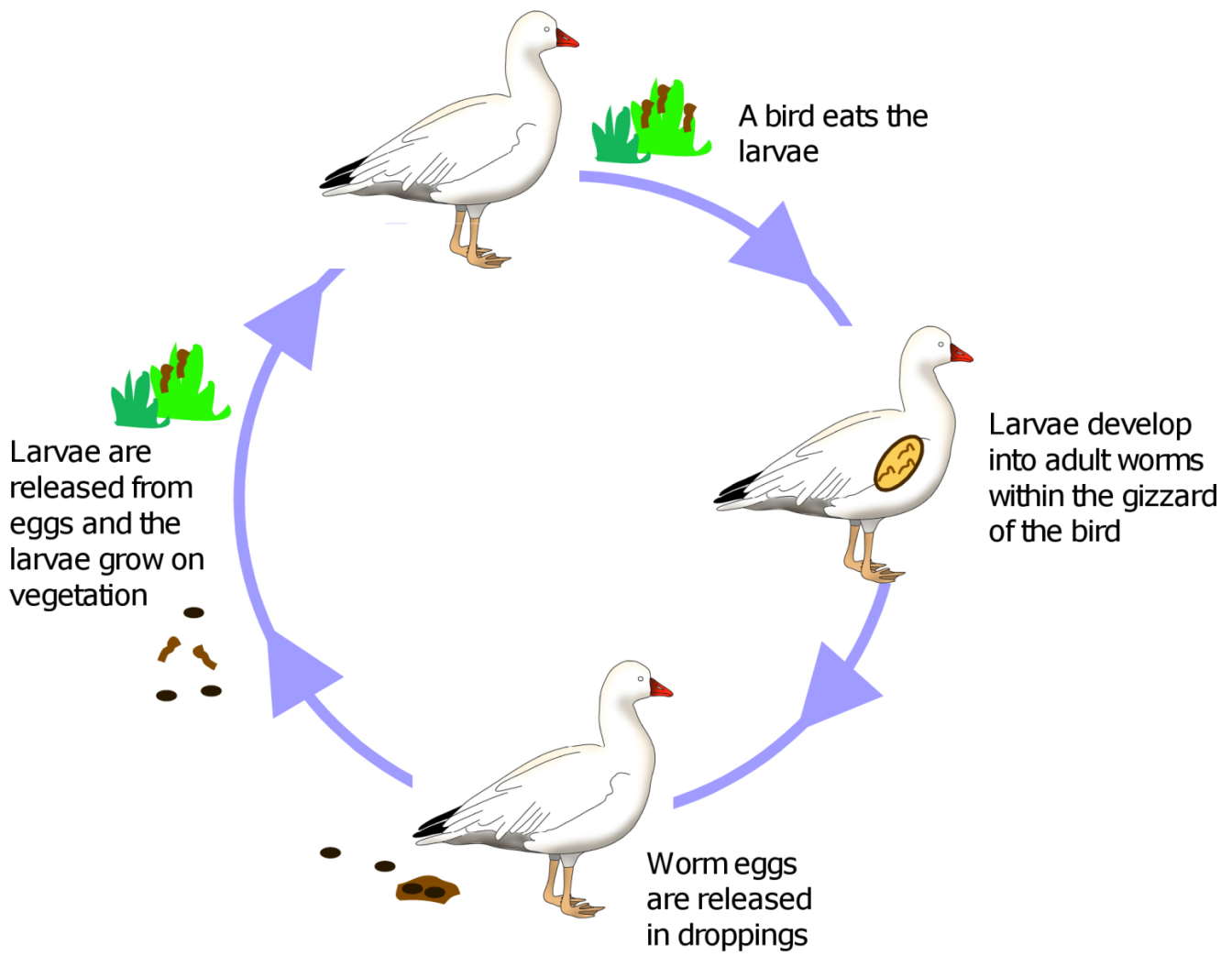
### Samples to collect

If gizzard worms are suspected to be the cause of death of a bird, the entire carcass should be submitted, in order to rule out other possible causes of death. The parasites alone may be submitted, frozen, for identification. Alternatively, the entire gizzard, frozen, could be submitted



# H-B.3

## Gizzard Worm Life Cycle





## H-B.4

### RENAL COCCIDIOSIS



**B-1.4**



**B-2.4**



**B-3.4**

#### What is Renal Coccidiosis?

Renal coccidiosis is caused by protozoa, usually of the genus *Eimeria*. These are single-celled parasites with life cycles that involve a series of developmental phases within the host.

#### Species affected

Renal coccidiosis occurs commonly in various species of waterfowl.

#### Ecology and life cycle

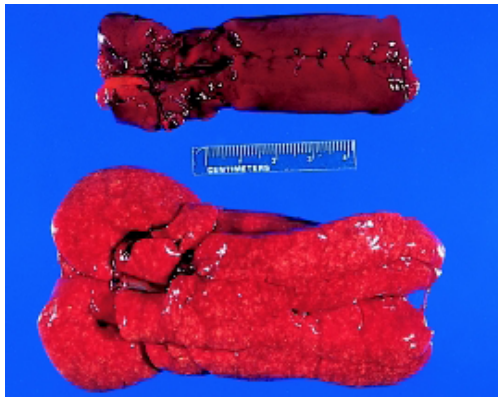
An infected bird will shed tiny, invisible egg-like pieces (oocysts) in its droppings. After oocysts have been ingested by another bird, they will undergo a developmental stage in the bird's intestine before reaching their final destination its kidneys. Here, the parasite will produce the oocysts that are passed out with the droppings, completing the life cycle.

Oocysts are quite resistant to environmental changes and can persist in the environment for long periods of time. When large numbers of birds are found together at one time, such as on nesting grounds, the environment can become heavily contaminated with oocysts, facilitating transmission of the parasite. The hardiness of the oocysts in the environment ensures that the disease will persist in these areas for some time.

#### Effects on the bird

If infection is light, there may be no detrimental effects on the bird. However, if the parasite burden is high, it may result in renal (kidney) failure and death.

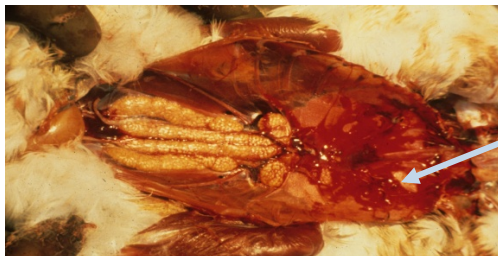
## H-B.4



Normal kidneys (top)

Infected kidneys (bottom) can become enlarged and often contain small white or yellowish spots scattered throughout.

Photo Credit: C. Franson, USGS



Enlarged kidney with many white to yellow spots.

Photo credit: WCVM

### Pathology

- ❖ Affected kidneys are pale, swollen and contain many small white spots throughout. Microscopically, these white areas are seen as areas of oocyst production accompanied by the host's inflammatory response. Failure of the bird to excrete urates may cause the build-up of chalky white material in the kidneys as well. Severely affected birds may be emaciated (see emaciation in section H-G.2).

### Human health considerations

- ❖ There is no risk of transmission of avian coccidia to people. Heavily infected birds may not be in good body condition and may not be desirable for human consumption.

### Safety of the meat for dogs

- ❖ It is safe to feed the meat to dogs. Avian coccidia is not transmissible to dogs.

### Samples for collection

The entire carcass is the best specimen, particularly in cases of birds found dead. If unusual-appearing kidneys are found in a harvested bird, the entire kidney, either frozen or divided (half fixed in formalin and half frozen), is the most useful sample

## H-B.5

### THORNY-HEADED WORMS



**B-1.5**



**B-2.5**



**B-3.5**

#### What are thorny-headed worms?

Thorny-headed worms belong to the phylum Acanthocephala (Genera *Fillicollis* and *Polymorphus*). These parasites have a retractable tubular structure (proboscis), armed with curved hooks, or spines, at the front end of the worm. Acanthocephalans do not have a digestive system so absorb nutrients directly through their body wall.

Numerous species of Acanthocephalans are found in birds. All Acanthocephala have life cycles involving at least one invertebrate that hosts the immature (larval) worm (intermediate host). Birds are infected by consuming the intermediate host containing the larval stage of the parasite.

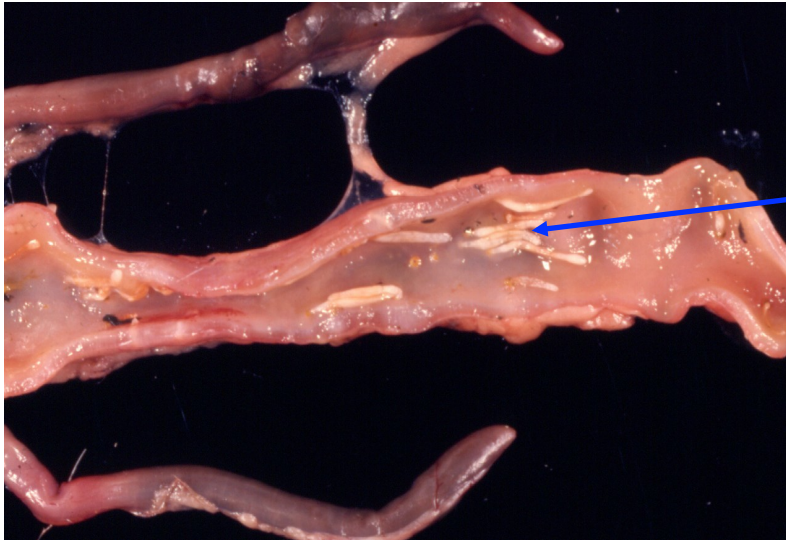
#### Where in the birds are thorny-headed worms found?

Thorny-headed worms are found within the intestine of the bird.

They use their proboscis to attach themselves firmly to the inner lining of the intestine, and may actually penetrate the intestinal wall. The worms may be visible from the outer surface of the intestine as small white nodules.

If damage to the intestinal wall is severe, leakage of intestinal fluid into the abdomen may cause redness and swelling (inflammation) within the abdominal cavity (peritonitis). Inflammation can cause loops of intestine to become stuck together.

## H-B.5



Thorny-headed worms in the intestines of a duck. Photo credit: Dr. G. Wobeser

### Effects on the bird

- ❖ The effects of Acanthocephalans on a bird are likely in proportion to their numbers and the severity of the damage that they cause. Some birds may tolerate large numbers of worms without apparent effect while others are found dead with lesser numbers of worms. Birds in poor body condition or that are stressed by other diseases are likely more vulnerable to the effects of these worms.

### What species are affected?

- ❖ Severe outbreaks of thorny-headed worms have been reported in common eiders.
- ❖ Ducks, geese and swans are all susceptible.

### Human health concerns

- ❖ Adult thorny-headed worms will not infect humans and the meat is safe for human consumption.

### Safety of the meat for dogs

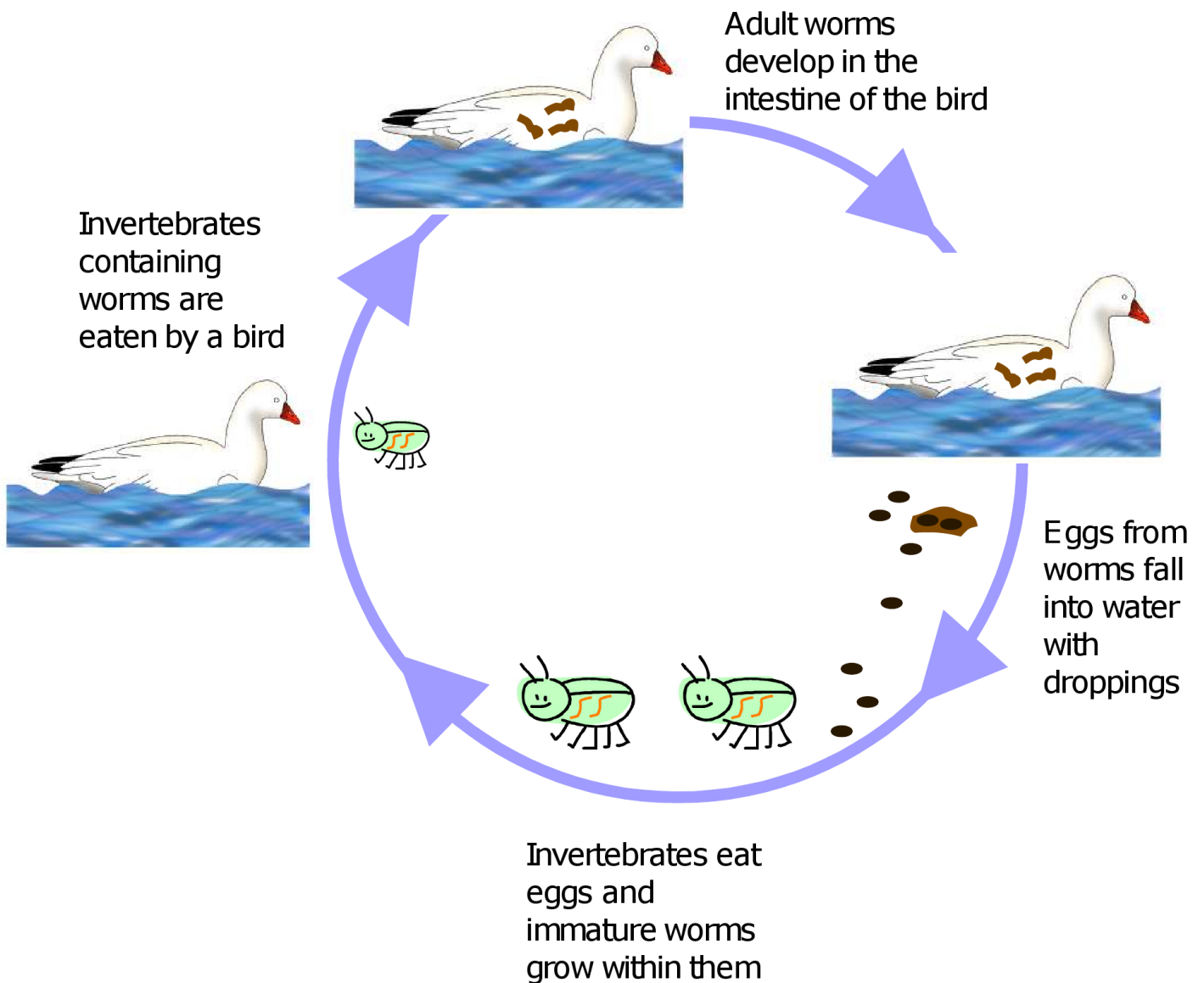
- ❖ The meat is safe to feed to dogs.

### Samples to collect

- ❖ Collect the intestine with intact thorny-headed worms preserved in alcohol.

## H-B.5

# Thorny-Headed Worm Life Cycle

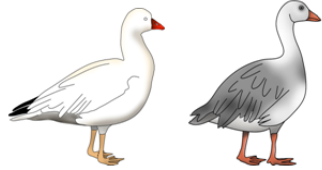






## H-B.6

### HEARTWORM



**B-2.6**

**B-3.6**

#### What is heartworm?

The roundworm (nematode) parasite *Sarconema eurycerca* is the cause of heartworm.

#### Species affected

Geese and Swans.

#### Ecology

The heartworm is a nematode parasite that lives within the heart muscle of infected birds. It sheds immature (larval) parasites, called microfilariae, into the bloodstream of the bird. Microfilariae are ingested by the biting lice, *Triniton anserinum* (intermediate host), when they feed on infected birds. The microfilariae further develop to an infectious stage within the louse. These larvae may enter a new bird when the louse feeds again. Microfilariae develop into adult worms in the bird (final host) and reside permanently in the bird's heart.

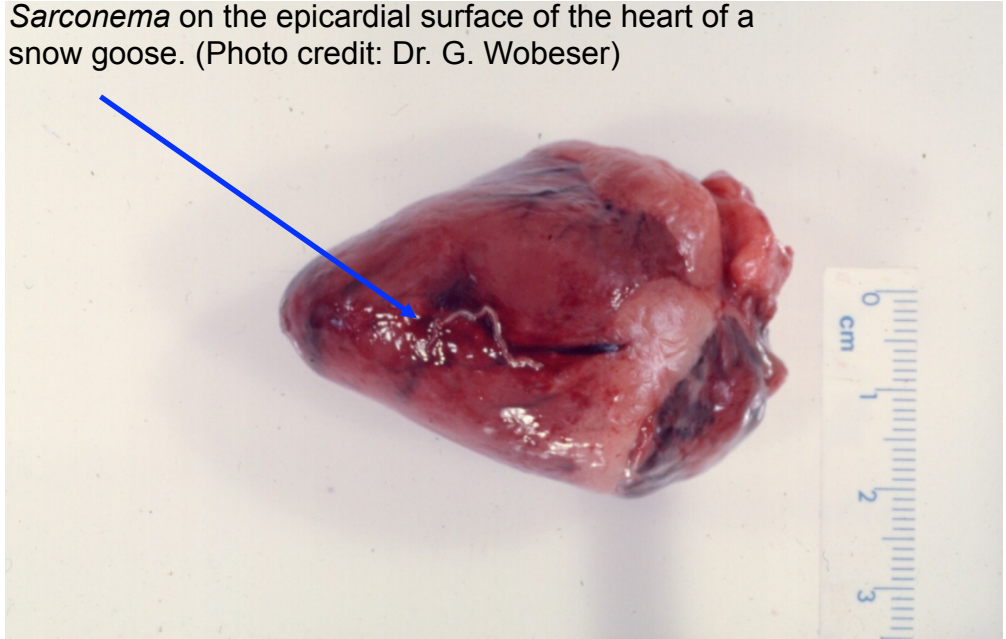
Spread of the disease requires bird-to-bird movement of lice and so tends to occur when birds are living at high densities such as on breeding grounds.

#### What does it look like?

The worms may lie just under the inner lining of the heart (epicardium) where they may be visible as long, thin, thread-like worms. If they are located deeper in the heart muscle (myocardium) they may be detected only as pale areas.

## H-B.6

*Sarconema* on the epicardial surface of the heart of a snow goose. (Photo credit: Dr. G. Wobeser)



### Pathology

- ❖ The presence of worms within the heart may lead to redness and swelling (inflammation) and areas of myocardial damage and scarring (fibrosis), which, if severe and extensive, may cause a loss of body condition in the bird. However, heartworms may be found in many healthy birds, in which they apparently cause little problem. Heartworms may be considered to be the primary cause of weakness or death in birds in which there is evidence of damage to the heart and an absence of other significant disease conditions.

### Human health considerations

- ❖ Heartworms are not transmissible to humans and the louse which transmits it can not survive on a human host.

### Safety of the meat for dogs

- ❖ The bird is safe to feed to dogs.

### Samples to collect

- ❖ An entire intact carcass is required in order to investigate the significance of heartworms to the health of a bird. A second choice is the entire heart, preferably fixed in formalin. The worm itself can be preserved in alcohol or formalin for identification.

# H-B.6

## Heartworm Life Cycle

