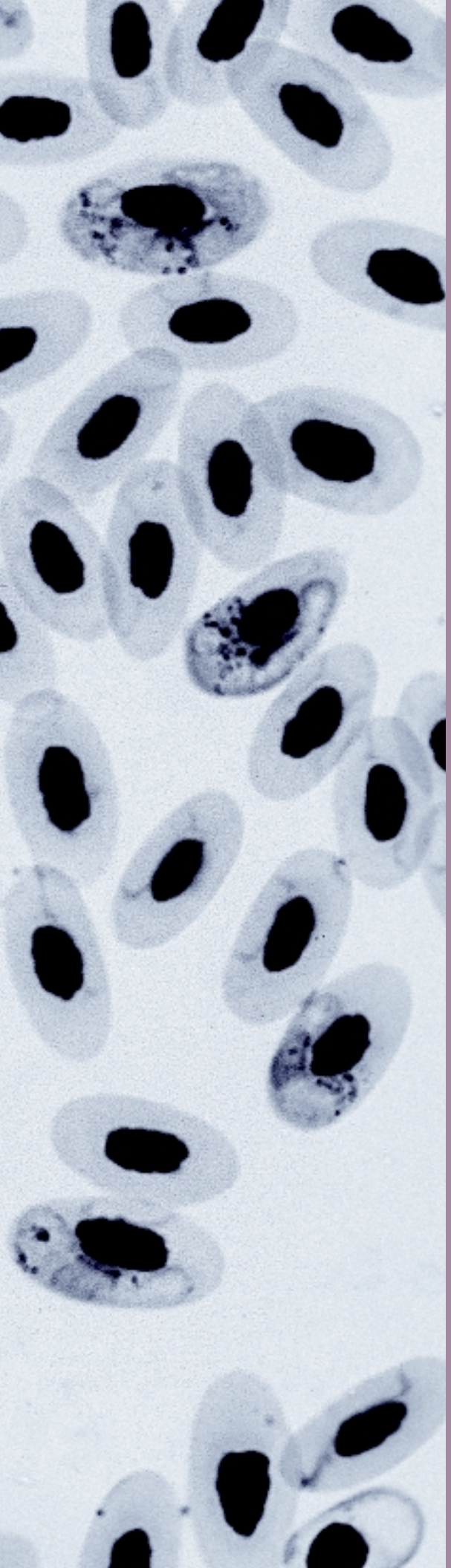


Section 5

Parasites and Parasitic Diseases

Hemosporidiosis

Trichomoniasis

Intestinal Coccidiosis

Renal Coccidiosis

Sarcocystis

Eustrongylidosis

Tracheal Worms

Heartworm of Swans and Geese

Gizzard Worms

Acanthocephaliasis

Nasal Leeches

Miscellaneous Parasitic Diseases

*Stained blood smear from a turkey infected with the parasite **Haemoproteus meleagridis***

Photo by Carter Atkinson

Introduction to Parasitic Diseases

"Parasites form a large proportion of the diversity of life on earth."
(Price)

Parasitism is an intimate relationship between two different species in which one (parasite) uses the other (host) as its environment from which it derives nourishment. Parasites are a highly diverse group of organisms that have evolved different strategies for infecting their hosts. Some, such as lice and ticks, are found on the external parts of the body (ectoparasites), but most are found internally (endoparasites). Some are microscopic, such as the blood protozoans that cause avian malaria; however, many are macroscopic. Life cycles differ greatly between major types of parasites and are generally classified as direct or indirect (Table 1). Direct life cycles do not require an intermediate host (Fig. 1A). For direct life cycles, only a definitive host is required: the species in which the parasite reaches sexual maturity and produces progeny. Indirect life cycles may involve one or more intermediate hosts (Fig. 1B and C). Intermediate hosts are required by the parasite for completion of its life cycle because of the morphological and physiological changes that usually take place in the parasite within those hosts. Wild birds can serve as the definitive hosts for most of the parasites that are discussed in the following chapters. In addition, paratenic or transport hosts are present in some parasite life cycles. The parasites generally do not undergo development in paratenic hosts. Instead, paratenic hosts provide both an ecological and temporal (time) bridge for the parasite to move through the environment and infect the definitive host. Typically, in these situations one or more intermediate hosts are required for development of the parasite but they are not fed upon by the bird. Instead, the bird feeds on the paratenic hosts, which in turn have fed on the intermediate host(s), thereby, "transporting" the parasite to the bird (Fig. 2).

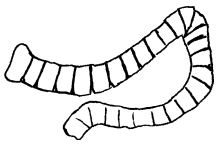
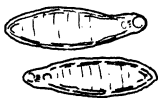
The presence of parasites in birds and other animals is the rule, rather than the exception. Hundreds of parasite species have been identified from free-ranging wild birds; however, the presence of parasites does not necessarily equate with disease. Most of the parasites identified from wild birds cause no clinical disease. Others cause varying levels of disease, including death in the most severe cases. The pathogenicity or the ability to cause disease, of different species of parasites varies with 1) the species of host invaded (infected or infested), 2) the number or burden of parasites in or on the host, and 3) internal factors impacting host response. For example, when birds are in poor nutritional condition, have concurrent infections from other disease agents (including other species of parasites), or are subject to other types of stress, some parasites that do not normally cause disease do cause disease. Lethal infections may result from parasites that generally only cause mild disease.

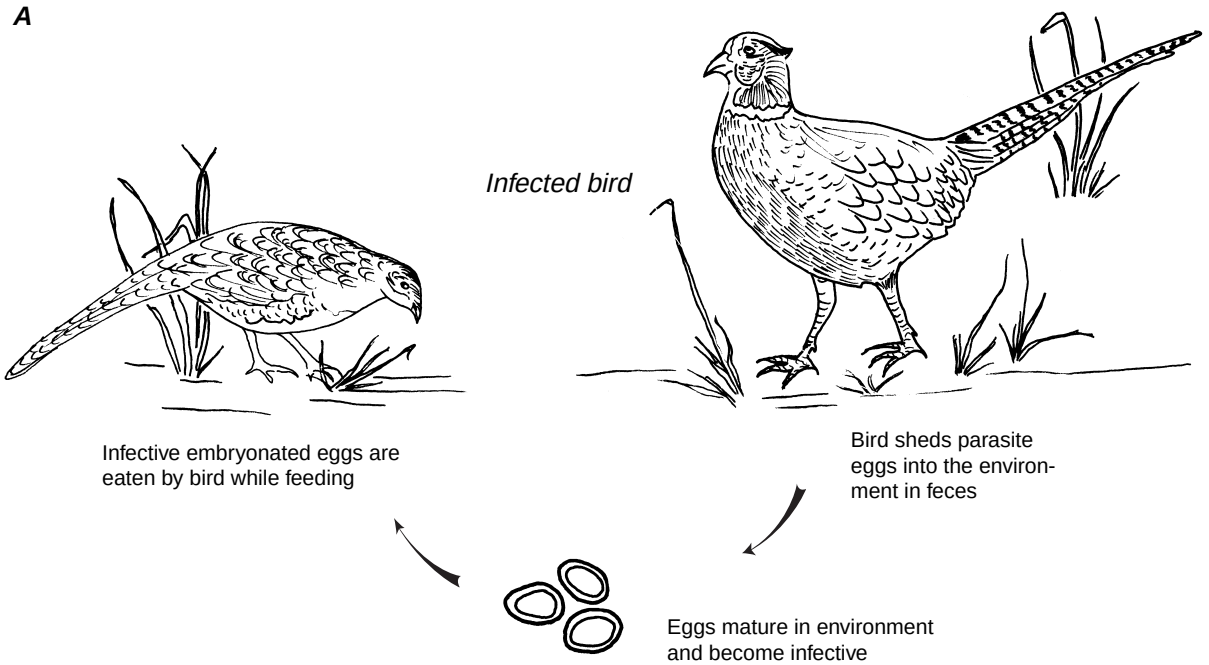
This section highlights some of the parasitic diseases such as trichomoniasis that are associated with major mortality events in free-ranging wild birds and those that because of the gross lesions they cause (*Sarcocystis* sp.), their visibility (nasal leeches), or general interest (heartworm) are often the subject of questions asked of wildlife disease specialists.

Quote from:

Price, P.W., 1980, Evolutionary biology of parasites: Princeton University Press, Princeton, NJ, p. 3.

Table 1 *General characteristics of major groups of internal parasites (endoparasites) of free-ranging birds.*

Type of parasite	Common name	Type of life cycle	Characteristics
Nematodes	Roundworms 	Indirect and direct	Most significant group relative to number of species infecting birds and to severity of infections. Unsegmented cylindrical worms. Found throughout the body. Generally four larval stages. Sexes are separate. Most are large in size (macroscopic).
Cestodes	Tapeworms 	Indirect	Flattened, usually segmented worms with a distinct head, neck and body. Found primarily in the lumen of the intestines. Lack a mouth or an alimentary canal; feed by absorbing nutrients from the host's intestinal tract. Most are hermaphroditic (self-fertilization; have both male and female reproductive tissues). Attachment is by suckers, hooks. Large size (macroscopic).
Trematodes	Flukes 	Indirect	Flatworms, generally leaf-shaped (some almost cylindrical). Generally found in the lower alimentary tract, respiratory tract, liver, and kidneys. Complex life cycles; usually require two intermediate hosts, one of which is usually a snail. Hermaphroditic except for blood flukes, which have separate sexes. Attachment is usually by suckers.
Acanthocephalans	Thorny-headed worms 	Indirect	Cylindrical, unsegmented worms. Found in the digestive tract. No intestinal tract; nutrients absorbed through the tegument (similar to tapeworms). Sexes are separate. Attachment by means of a retractable proboscis that has sharp recurved hooks or spines.
Protozoans	Coccidians, malarias, trichomonads, others 	Direct and indirect	Microscopic. Different types are found in different parts of the body. Asexual and sexual multiplication.



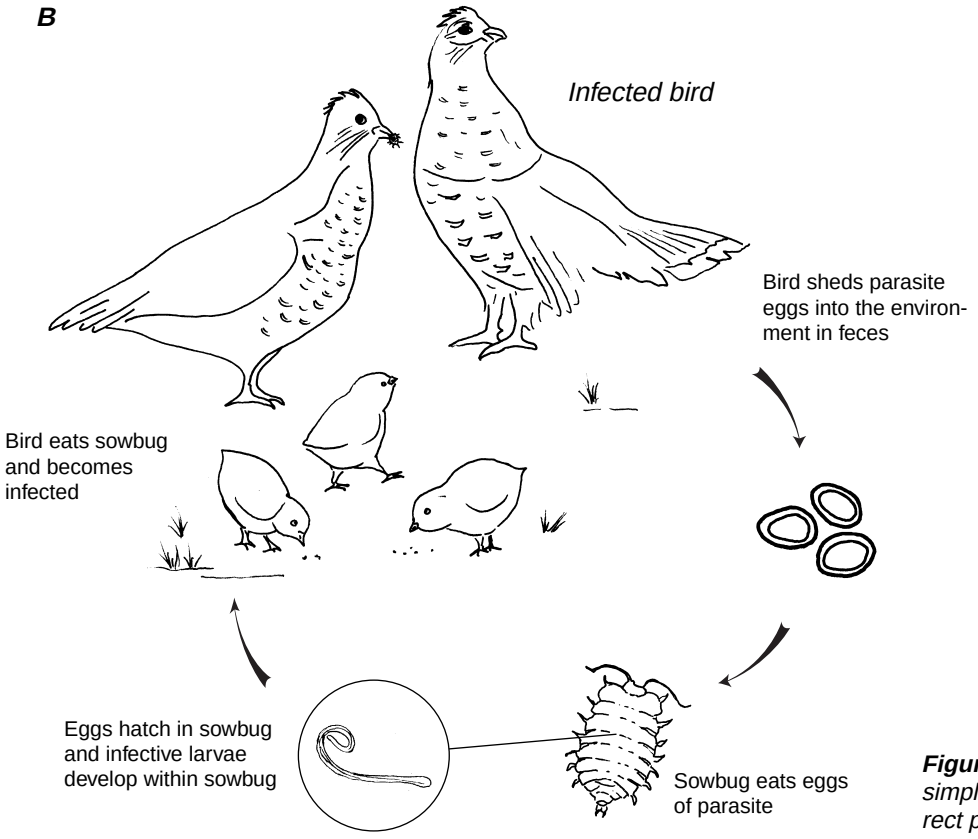
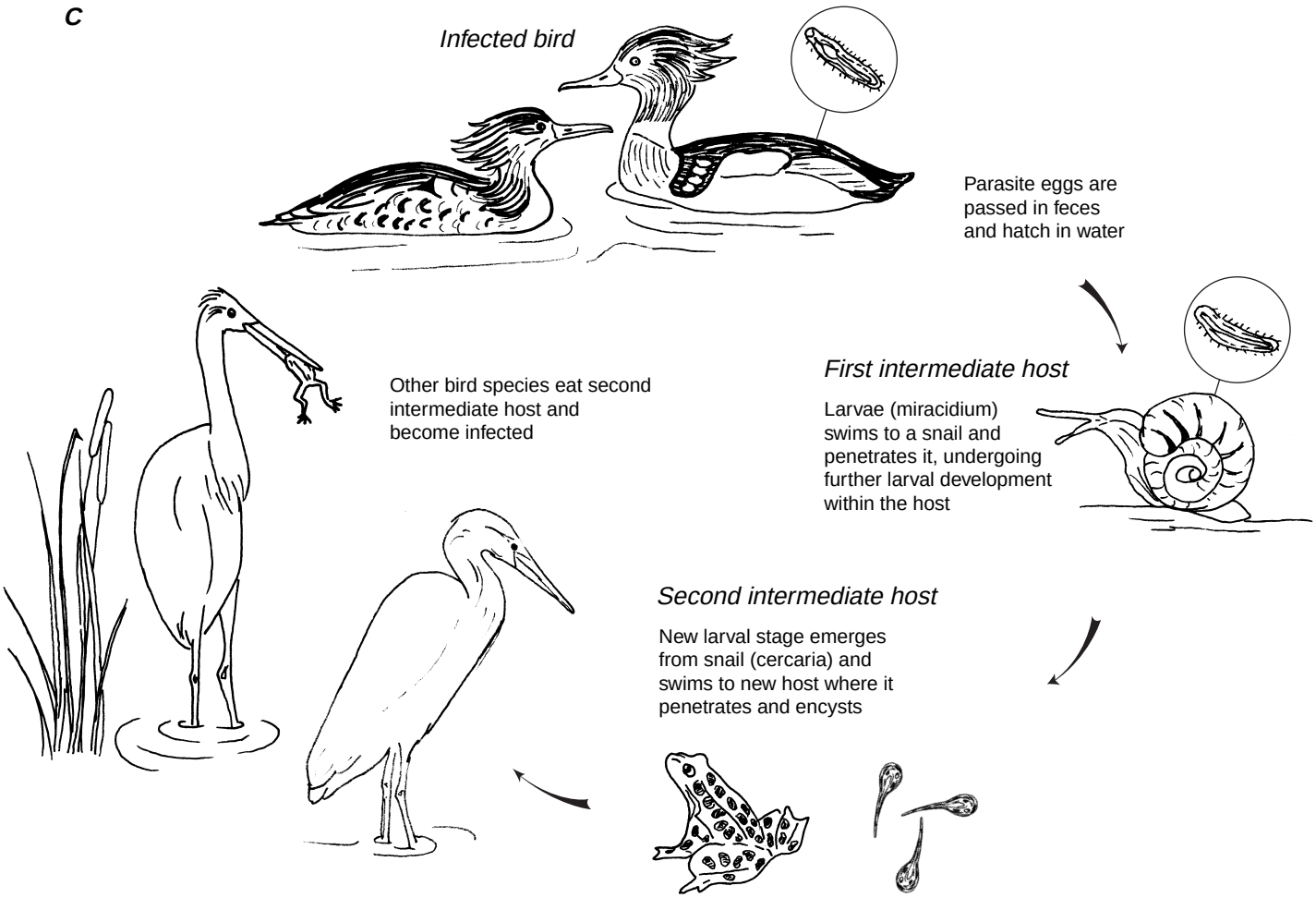


Figure 1 *Examples of* ***(A)*** *direct,* ***(B)*** *simple indirect, and* ***(C)*** *complex indirect parasite life cycles.*

C


Infected bird
Parasite eggs are passed in feces and hatch in water
First intermediate host
Larvae (miracidium) swims to a snail and penetrates it, undergoing further larval development within the host
Second intermediate host
New larval stage emerges from snail (cercaria) and swims to new host where it penetrates and encysts
Other bird species eat second intermediate host and become infected

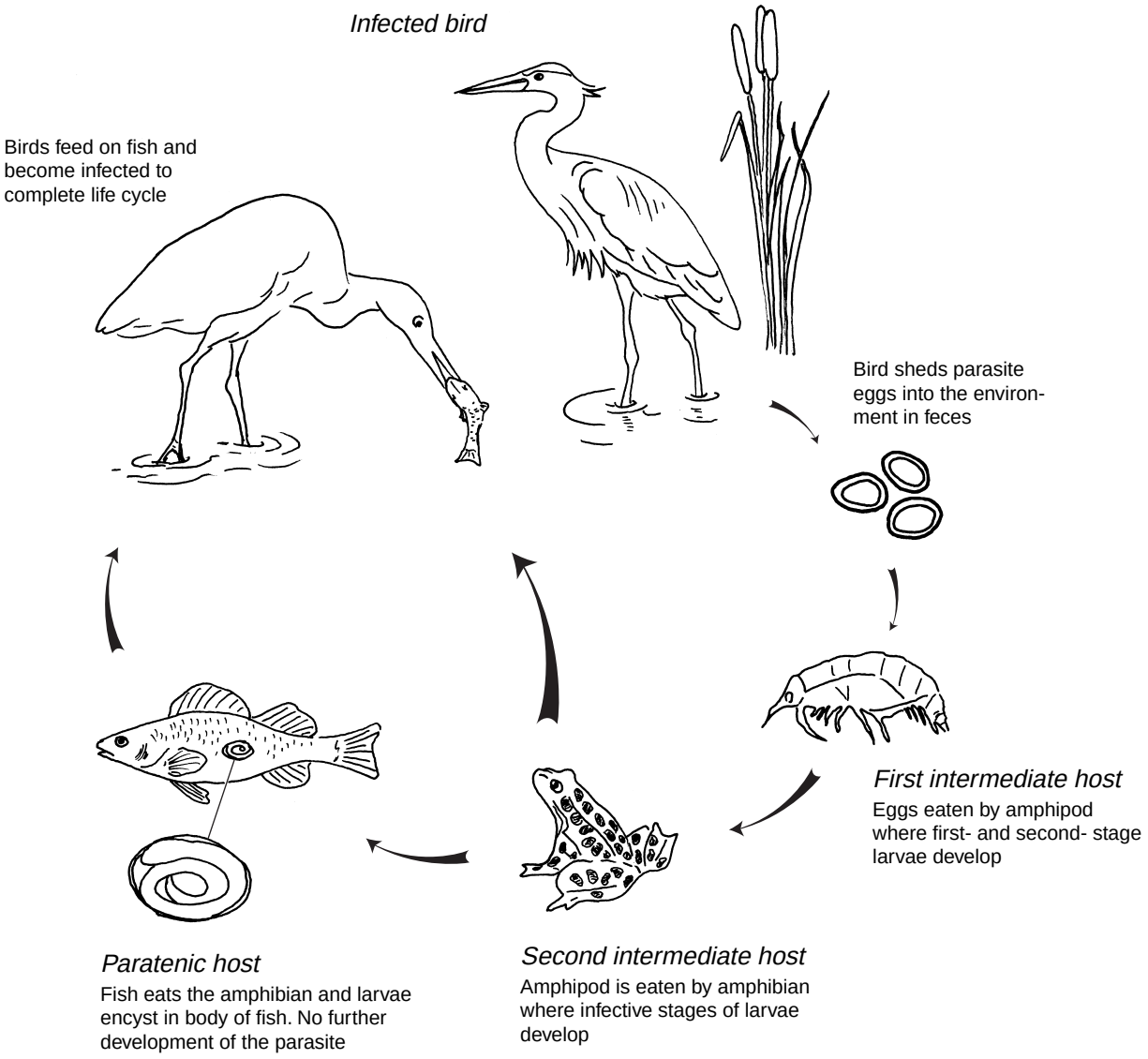


Figure 2 *Hypothetical parasite life cycle illustrating the role of paratenic (transport) hosts.*