3.2.15 Branchiuran Fish Louse Disease

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A. Name of Disease and Etiological Agent

1. Name of Disease
Fish louse or fish lice.

2. Etiological Agent
Argulus. Over 120 species reported from freshwater and marine fishes. The genus is in poor taxonomic condition. Many species presently documented are based on inadequate original descriptions and are probably synonomous with the more common and established species.

3. List of Common or Economically Important Species of Argulus

a. North America
Argulus americanus, Argulus alosae, Argulus appendiculosus, Argulus borealis, Argulus catastomi, Argulus coregoni, Argulus flavescens, Argulus funduli, Argulus japonicus, Argulus laticauda, Argulus megalops, Argulus maculosus, Argulus pugattensis, Argulus stizostethii, and Argulus versicolor.

b. Eurasia
Argulus coregoni, Argulus indicus, Argulus japonicus, Argulus foliaceus, Argulus scutiformis, and Argulus viridis.

c. Africa
Argulus africanus, Argulus amblopites, Argulus brachypeltis, Argulus exiguus, Argulus jollymanni, Argulus rhipidophorus, and Argulus striatus.

d. South America
Argulus chromidis, Argulus juparensis, Argulus nattereri, Argulus pestifer, and Argulus violaceus.

B. Known Geographical Range and Host Species of the Disease

1. Geographical Range

The majority of species are pan-continental in North and South America, Africa, and Eurasia; a few species are circumglobal. All species are found in freshwater or marine environments (16 species have been described and no localities given). Many species reported as being "restricted" to fresh or marine waters often occur on anadromous hosts in estuarine habitats. Some species are restricted to Atlantic or Pacific coasts of continents or restricted to freshwater lakes and rivers.

2. Host Species

Majority of *Argulus* species show extremely low host-specificity (e.g. *Argulus flavescens* has been reported from 18 species of freshwater fishes in North America). A single species may infect fishes from several different orders and families. The argulids can be considered opportunistic parasites in most reported cases, particularly on cultured fishes.

C. Epizootiology

The fertilized female leaves the host skin or gills and lays several hundred eggs on submerged objects. A free-swimming second copepodid larva hatches after 48 to 72 hours, and must find a host within 48 to 98 hours or die.

Larvae are positively phototaxic, and development occurs more rapidly in bright illumination. Several molts of copepodid and sub-adult stages occur on the host. The adult stage is reached in approximately 15 to 40 days, depending on water temperature. Both males and females are parasitic on the host.

Egg laying begins at water temperatures between 14 and 16°C, egg development ceases below 12°C. At temperatures less than 8°C, the parasites cease growth, encase themselves in mucus, and remain on the host until the advent of warmer water temperatures (Bauer et al. 1973). Optimal temperature for adults is 23 to 28°C. Adults may live free from a host for up to 15 days. *Argulus* infects all age classes of the hosts on which they occur, being particularly infective to and occasionally causing sever mortalities of juvenile fishes.

Mortalities of both cultured and wild fish have been attributed to *Argulus* infections, although those involving wild hosts are rare (or at least rarely reported). In particular, cultured fishes of several species and age classes have suffered mass mortalities due to *Argulus* infections in North and South America, Africa, and Eurasia. The pattern of mortality is generally simple. Optimal water temperatures induce a relatively low number of parasites to breed successfully and realize a high biotic potential. Mortality of individual hosts and progress of the disease is proportional to intensity of infection. Heavily infected fish die more quickly, and transmission and production of the parasites enhanced. Initial infection of cultured fishes is usually caused by introduction of parasitized hosts. Crowding of fishes, low dissolved oxygen levels, and slow current conditions enhance the spread and patholgenicity of the disease.

D. Disease Signs

1. Behavioral Changes Associated with the Disease

Light to moderate infections of *Argulus* caused cultured fishes to rub against the sides of the enclosure in an attempt to rid themselves of the parasite (i.e. flashing). Heavy infections cause the fish to dart about until exhausted or alternatively, to become lethargic and seek the sides and bottoms of tanks. Equilibrium loss has been reported as a consequence of heavy infections.

2. External Gross Signs

The argulids are large parasites (when adult, 5 to 20 mm), and are usually visible on the host's skin or gill surface. Older wounds are occasionally observable after becoming necrotic or ulcerated or when affected by secondary bacterial and fungal infections. The skin, gills, and fins secrete excess mucus in response to the feeding of recently attached copepodids.

3. Internal Gross Signs

Internal effects of argulid infections have not been reported.

4. Histopathological Changes Associated with the Disease

The parasites pierce the host tissue with the pre-oral stylet, inject a cytolytic toxin, and feed on the blood released by the resultant wound. The surface of the host at the point of stylet entry can become erythemic and hemorrhagic. A hemorrhagic factor is produced by some species. Several parasites feeding in close proximity may cause edema and localized swelling of tissues. Proliferation surrounding the stylet entry wound has been observed.

E. Disease Diagnostic Procedures

1. Presumptive Diagnosis

a. Isolation and Detection of Pathogen

Isolation of the parasite is not necessary to determine the cause of the disease. The relatively large size and characteristic external morphology of the adults allows quick detection and identification. Recently attached juveniles are small (1 to 3 mm) and are not easily seen with the unaided eye. The larval stages of most species are unknown.

b. Clinical Signs

Presence of the parasites occurs on the host skin, fins, or gills. Recognition of external tissue pathology is associated with feeding behavior of *Argulus* sp.

c. Histopathological Examination

Not necessary for diagnosis of *Argulus.*

2. Confirmatory Diagnosis

All species of *Argulus* are relatively large external parasites and are usually easily seen. All exhibit an external morphology that is characteristic and not easily confused with any other parasitic crustacean. The large dorsal shield and maxillary suckers are distinguishing features (Figure 1).

Identification to species is based on the structure and position of the respiratory area, the number and shape of the sclerites of the supporting rods of the maxillary suckers, and the armature of the

basal plate of the second maxillae (Kabata 1988). These morphological characters serve only to differentiate the adults and subadults of species and are not adequate or applicable for larvae. There are presently no methods for differentiating species using the larval (copepodid) stage.

Microscopic examination of adults and subadults is best accomplished by clearing the whole fixed specimen in 85% lactic acid. If necessary, small appendages or parts may be dissected from the parasite and examined separately, for species determination. Staining the parasite or any of its parts with lignin pink (while in lactic acid) is helpful in differentiating fine structure.

F. Procedure for Detecting Subclinical Infections

Periodic examination of fish will reveal the parasites.

G. Procedures for Determining Prior Exposure to the Etiological Agent

No methods are presently known for determining prior exposure to *Argulus*.

H. Procedures for Transportation and Storage of Samples to Ensure Maximum Viability and Survival of the Etiological Agent

Specimens of *Argulus* are best fixed in 10% neutral buffered formalin for two or three days, then transferred to 70% ethanol for preservation. If formalin is unavailable, 50% isopropyl alcohol is a suitable fixative and preservative.

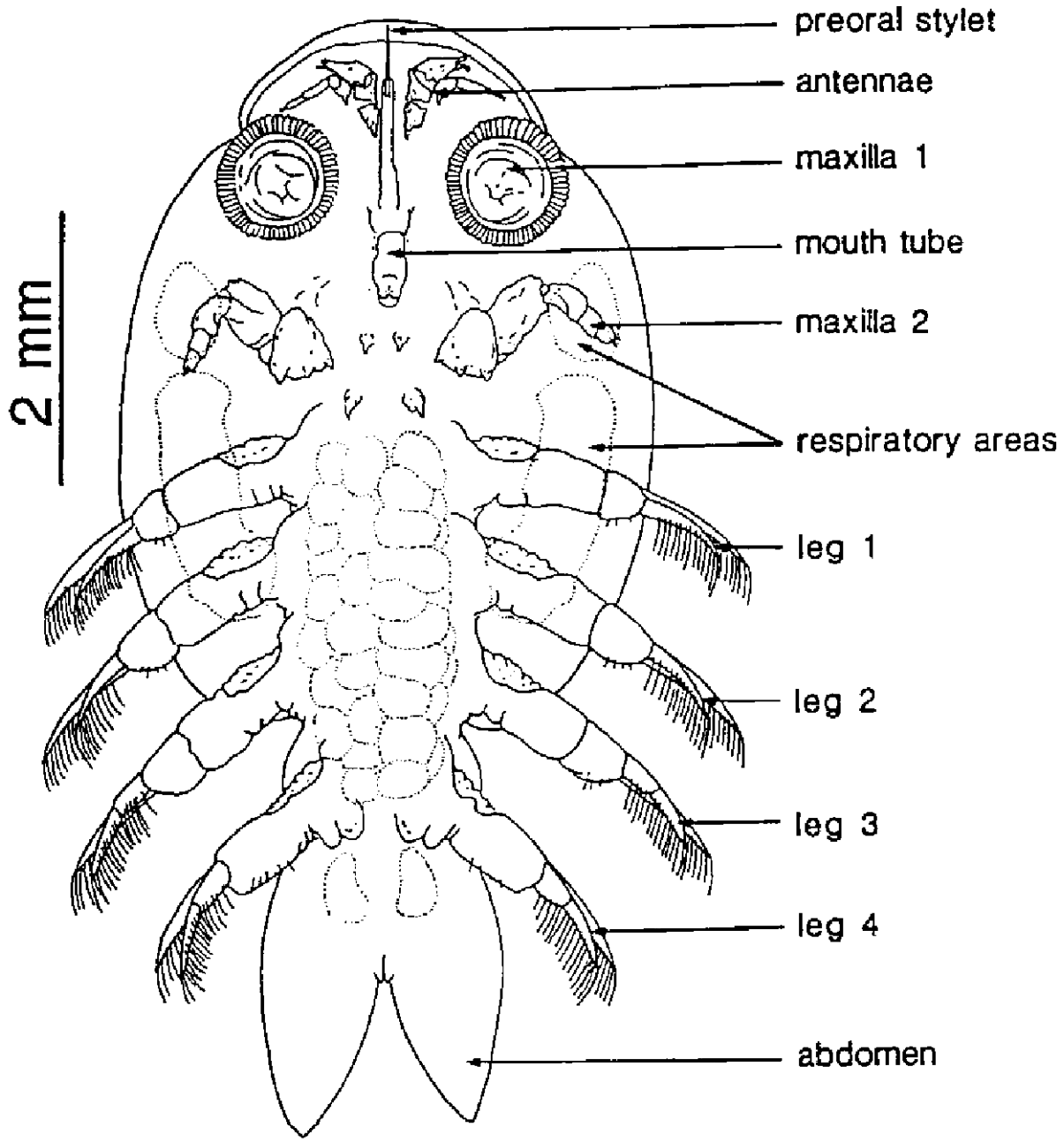

Figure 1. Ventral view of *Argulus alosae* showing pertinent diagnostic features (redrawn from Kabata 1988).

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