

Phoronida

(Phoronids)

Phylum Phoronida
Number of families 1

Thumbnail description

Sedentary, infaunal, benthic suspension-feeders with a vermiform (worm-like) body that bears a lophophore and is enclosed in a slender tube in which the animal moves freely and is anchored by an ampulla.

Photo: A golden phoronid (*Phoronopsis californica*) in Madeira (São Pedro, southeast coast, about 100 ft [30 m] depth) showing the helicoidal shape of the lophophore. (Photo by Peter Wirtz. Reproduced by permission.)



Evolution and systematics

The phylum Phoronida is known to have existed since the Devonian, but there is a poor fossil record of burrows and borings attributed to phoronids. Many scientists now regard the Phoronida as a class within the phylum Lophophorata, along with the Brachiopoda and perhaps the Bryozoa. Phoronida consists of two genera, *Phoronis* and *Phoronopsis*, which are characterized by the presence of an epidermal collar fold at the base of the lophophore. The group takes its name from the genus name *Phoronis*, one of the numerous epithets of the Egyptian goddess Isis.

The phoronid larva, commonly called an actinotroch, retains a separate “generic” name, *Actinotrocha*, which authorities still consider different from the adult species.

There are 10 well-defined species of phoronid: *Phoronis ovalis* (creeping larva), *P. hippocrepia* (larva, *Actinotrocha vancouverensis*), *P. ijimai* (larva, *A. vancouverensis*), *P. australis* (larva, unknown), *P. muelleri* (larva, *A. branchiata*), *P. psammophila* (larva, *A. sabatieri*), *P. pallida* (larva, *A. pallida*), *Phoronopsis albomaculata* (larva, unknown), *Phoronopsis harmeri* (larva, *Actinotrocha harmeri*), and *Phoronopsis californica* (larva, unknown). There is no class or order designation in this phylum.

Physical characteristics

Body length varies from several millimeters to more than 18 in (45 cm) and corresponds to the extended size, which is generally approximately five times longer than the contracted size. Body diameter varies from 0.006 in (0.15 mm) to approximately 0.2 in (5 mm). Color is generally fleshy, sometimes brownish to black.

The other features are anatomical. Phoronids have at least two body regions in larval and adult forms, each containing

its own coelom. A lophophore, defined as a tentacular extension of the mesosome (and of its coelomic cavity, the mesocoelom) embraces the mouth but not the anus. The main functions of the lophophore are feeding, respiration, and protection. The site and shape of the lophophore are proportional to body size, ranging from oval to horseshoe to helicoidal in relation to an increase in the number of tentacles. Phoronids have a U-shaped digestive tract. A nervous center is present between the mouth and anus, as is a ring nerve at the base of the lophophore, and the animal has one or two giant nerve fibers. Phoronids have one pair of nephridia and a closed circulatory system with red blood corpuscles.

Distribution

Phoronids are found in all oceans and seas except the Antarctic Ocean. They are present in the intertidal zone to approximately 1,310 ft (400 m). All species have a wide geographical range; most are cosmopolitan.

Habitat

Phoronids secrete characteristic rigid tubes consisting of layers of chitin to which adhere particles of sediment and debris from the animal's immediate environment. Phoronids occur singly, vertically embedded in soft sediment (sand, mud, or fine gravel) or form tangled masses of many individuals buried in, or encrusting, rocks and shells. *Phoronis australis* is associated with cerianthid anemones in the tube in which it buries. In some habitats phoronids are very abundant, reaching several tens of thousand of individuals per 11 ft² (1 m²).

Predators of phoronids are not well known, but they include fishes, gastropods, and nematodes.

The larval actinotroch is a familiar component of plankton.



A phoronid worm (*Phoronopsis californica*). (Photo by Lawrence Naylor/Photo Researchers, Inc. Reproduced by permission.)

Behavior

The reaction of a phoronid to a predator is very rapid retraction of the animal down into the tube out of harm's way. Should the lophophore be taken by a predator, a phoronid can regenerate the lost parts within two or three days. Thus phoronids may provide an important food source for grazers.

Feeding ecology and diet

Phoronids are suspension feeders, capturing algae, diatoms, flagellates, peridinians, small invertebrate larvae, and detritus from the water by means of the lophophore. Phoronids orient their lophophores into the prevailing water current, and when currents change direction, phoronids can rapidly reorient to maintain the food-catching surface of the lophophore into the water flow. The cilia on the tentacles create a feeding current, which transports the food particles along the frontal surface of the animal down to the mouth at the bottom of the lophophoral cavity.

Direct uptake of amino acids through the epidermis displays seasonal variation, the maximum occurring in summer.

Several types of parasite may be present in phoronids: pro-genetic trematode metacercariae and cysts with spores in the coelomic cavities; unidentified gregarines in the digestive tract; and an ancistrocomid ciliate parasite, *Heterocineta*, in the tentacles.

The life span of phoronids is approximately one year.

Reproductive biology

Phoronids generally breed between spring and autumn over a fairly long period. These organisms are hermaphroditic or dioecious. Gametes are released through the nephridia, which serve as gonoducts. Sperm is disseminated by means of spermatophores formed in two lophophoral organs. Fertilization is internal, and cross-fertilization takes place in hermaphroditic species. Egg cleavage is total, equal, and typically radial.

Three types of developmental patterns occur. Species with small eggs undergo complete planktonic development, and species with larger eggs brood either in nidamental glands within the lophophore concavity or within the parental tube until the first larval stages and then undergo planktotrophic development. Embryonic development leads to a characteristic free-swimming larva, called the *actinotroch*, that bears an anterior preoral lobe on the top of which is located the nervous ganglion, a tentacular ridge, a pair of protonephridia, and, in the posterior, a ciliated ring around the anus. The larvae undergo planktotrophic development and settle after approximately 20 days. Metamorphosis is "catastrophic," occurring in less than 30 minutes and leading to a slender young phoronid, which burrows into the substratum.

Phoronids also reproduce asexually, usually by transverse fission around the middle of the trunk.

Conservation status

No species are listed by the IUCN.

Significance to humans

None known.



1. *Phoronopsis harmeri*; 2. *Phoronis ijimai*. (Illustration by Bruce Worden)

Species accounts

No common name

Phoronis ijimai

FAMILY

None

TAXONOMY

Phoronis ijimai Oka, 1897, Akkeshi Bay, Tokyo Bay, Japan.
Synonym: *Phoronis vancouverensis* Pixell, 1912, Vancouver Island, Canada.

OTHER COMMON NAMES

None known.

PHYSICAL CHARACTERISTICS

Extended specimens of phoronids reach a length of 5 in (120 mm) and a diameter of 0.02–0.08 in (0.5–2 mm). The color in life is fleshy to transparent. The lophophore sometimes is transparent and has white pigment spots. The lophophore is horseshoe shaped or spiral with approximately one coil and as many as 230 tentacles 0.08–0.2 in (2–5 mm) long.

DISTRIBUTION

Eastern and western Pacific Ocean, northwestern Atlantic Ocean. (Specific distribution map not available.)

HABITAT

Phoronids encrust on hard surfaces (rocks, wood) or live on soft substrate in turf-like masses with many intertwined tubes in quiet environments. Some burrow in hard substrate (calcareous rocks and algae, coral, mollusc shells) under strong water motion. The range of this species extends from the intertidal zone to a depth of approximately 33 ft (10 m).

BEHAVIOR

Reacts to predators with rapid retraction into the tube. Can regenerate lost parts within two or three days. Thus may provide an important food source for grazers.

FEEDING ECOLOGY AND DIET

Suspension feeder, capturing algae, diatoms, flagellates, peridinians, small invertebrate larvae, and detritus from the water by means of the lophophore. Orients the lophophore into the prevailing water current.

REPRODUCTIVE BIOLOGY

Hermaphroditic. The embryos are brooded in two masses by the nidamental glands of A type (on the floor of the lophophoral concavity and on the inner surface of the internal tentacles). The lophophoral organs, which produce the spermatophores, are small. Asexual reproduction is by transverse fission. The larva is called *Actinotrocha vancouverensis* Zimmer, 1964. It is approximately 0.03 (0.8 mm) long when ready to metamorphose.

CONSERVATION STATUS

Not listed by the IUCN.

SIGNIFICANCE TO HUMANS

None known. ♦

No common name

Phoronopsis harmeri

FAMILY

None

TAXONOMY

Phoronopsis harmeri Pixell, 1912, Vancouver Island, Canada.
Synonyms: *Phoronopsis striata* Hilton, 1930; *Phoronopsis viridis* Hilton, 1930; *Phoronopsis malakhovi* Temereva, 2000.

OTHER COMMON NAMES

None known.

PHYSICAL CHARACTERISTICS

Collar fold below the lophophore (genus characteristic) is well marked. Extended specimens reach a length of 9 in (220 mm) and a diameter of 0.02–0.16 in (0.6–4 mm). The body color in life is pink to greenish, the lophophore being transparent or sometimes white pigmented. The lophophore is spiral with 1–2.5 coils on each side. This animal has as many as 400 tentacles 0.08–0.2 in (2–5 mm) long.

DISTRIBUTION

Pacific Ocean, North Atlantic Ocean, and western Mediterranean Sea. (Specific distribution map not available.)

HABITAT

The tubes are embedded vertically in soft sediment from sand to muddy sand, sometimes with a coarse grain fraction. Depth ranges from the intertidal zone to approximately 328 ft (100 m) with a common range of 0–66 ft (0–20 m). Density can reach 28,000 individuals per 11 ft² (1 m²).

BEHAVIOR

Reacts to predators with rapid retraction into the tube. Can regenerate lost parts within two or three days. Thus may provide an important food source for grazers.

FEEDING ECOLOGY AND DIET

Suspension feeder, capturing algae, diatoms, flagellates, peridinians, small invertebrate larvae, and detritus from the water by means of the lophophore. Orients the lophophore into the prevailing water current.

REPRODUCTIVE BIOLOGY

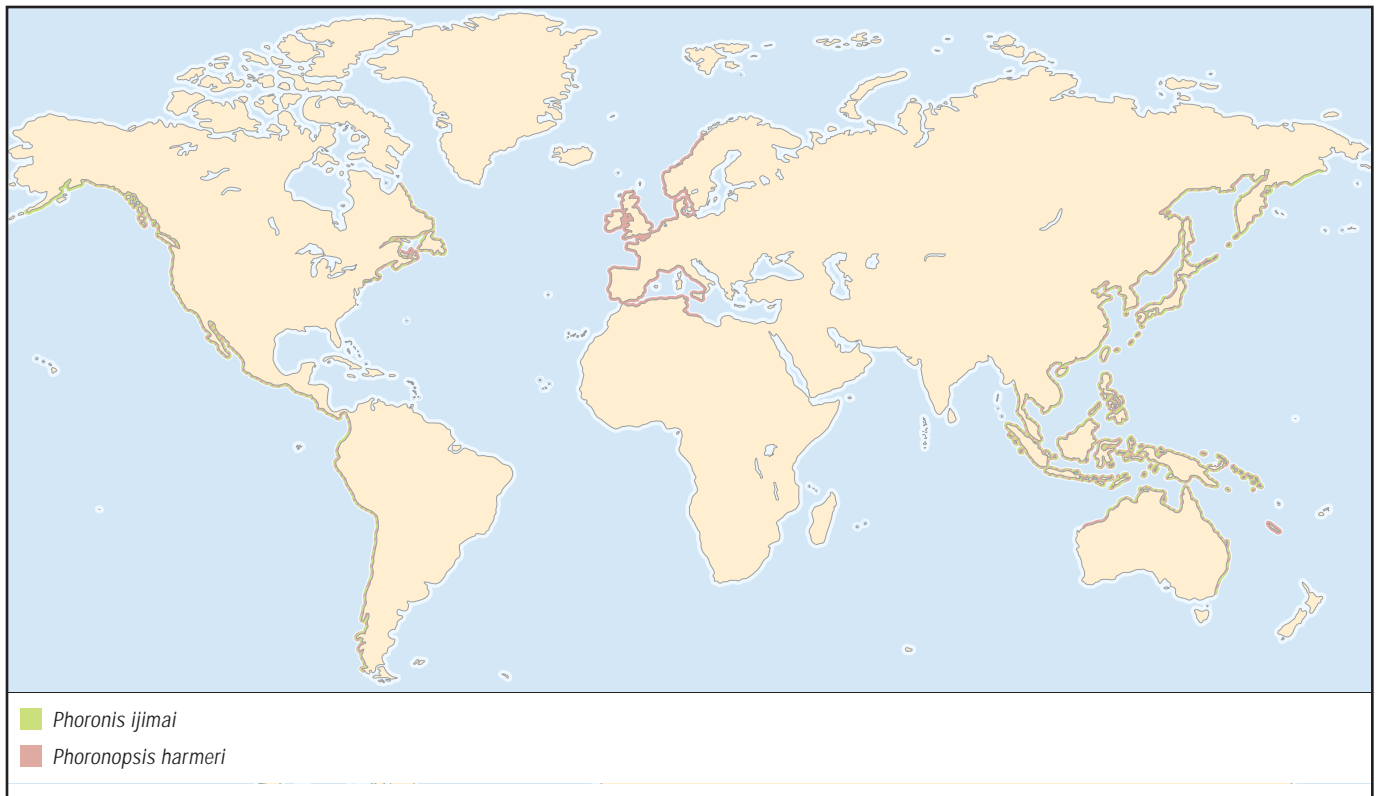
Dioecious. Females shed the ova directly into sea water. Males have large, membranous lophophoral organs. The larva is *Actinotrocha harmeri* Zimmer, 1964. Approximately 0.04 in (1 mm) long when ready to metamorphose. Asexual reproduction by transverse fission.

CONSERVATION STATUS

Not listed by the IUCN.

SIGNIFICANCE TO HUMANS

None known. ♦



Resources

Periodicals

Cohen B. L. "Monophyly of Brachiopods and Phoronids: Reconciliation of Molecular Evidence with Linnaean Classification (the Subphylum Phoroniformea nov.)." *Proceedings of the Royal Society, London Series B*, 267 (2000): 225-31.

Emig C. C. "The Biology of Phoronida." *Advances in Marine Biology* 19 (1982): 1-89.

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Riisgård H. U. "Methods of Ciliary Filter Feeding in Adult *Phoronis muelleri* (Phylum Phoronida) and in Its Free-swimming Actinotroch Larva." *Marine Biology* 141 (2002): 75-87.

Other

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