Class Polyplacophora
The chitons are one of the more primitive molluscan groups. They are characterized by a shell composed of eight plates. Worldwide, there are around 800 living species. Locally, chitons are represented by one order (Neoloricata), three suborders (Lepidopleurina, Chitonia, and Acanthochitonina), and around 42 species (Table 1). Chitons are a common component of rocky intertidal and subtidal communities.

Chitons are dioecious. Nearly all of the local species are broadcast spawners. Brooding species tend to be found in the high latitudes in Arctic and Antarctic waters (Pearse, 1979). Locally, most species spawn in the late winter and spring (Strathmann, 1987). Some chiton species spawn repeatedly, with spawning events associated with the spring/neap tidal cycle. Experiments suggest that the local species, Katharina tunicata, is induced to spawn by substances in the waters associated with the spring phytoplankton bloom (reviewed in

Fig. 1. Dorsal side of larvae and juveniles of several chiton species, left to right: Lepidopleurus asellus, Mopalia lignosa, Lepidochitona cinereus, Chaetopleura opiculata, Cryptochiton stelleri. Upper row: Newly hatched larvae. Middle row: Larvae competent to settle. Bottom row: Juveniles shortly after settlement. Scales = 100 μm. Note that Mopalia lignosa and Cryptochiton stelleri are local species and Lepidochitona is a local genus. (From Pearse, 1979, Fig. 16)
Table 1. Species in the class Polyplacophora from the Pacific Northwest (from Kozloff, 1996)

<table>
<thead>
<tr>
<th>Suborder Lepidopleurina</th>
<th>Family Chaetopleuridae</th>
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<tbody>
<tr>
<td>Family Leptochitonidae</td>
<td>Chaetopleura gemma</td>
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<tr>
<td>Leptochiton nexus</td>
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<td>Leptochiton rugatus</td>
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<th>Suborder Chitonina</th>
<th>Family Lepidochitonidae</th>
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<tr>
<td>Family Ischnochitonidae</td>
<td>Dendrochiton flectens</td>
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<td>Ischnochiton abyssicola</td>
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<td>Ischnochiton interstrictus</td>
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<td>Ischnochiton trifidus</td>
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<td>Stenoplax faialz</td>
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<td>Stenoplax heathiana</td>
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<td>Lepidozona cooperid</td>
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<td>Lepidozona mertensii</td>
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<td>Lepidozona retiporosa</td>
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<td>Lepidozona scabricostata</td>
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<td>Lepidozona willetti</td>
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<tr>
<th>Family Callistochitonidae</th>
<th>Family Chaetopleuridae</th>
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<tr>
<td>Callistochiton crassicostatus</td>
<td>Chaetopleura gemma</td>
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<tr>
<th>Suborder Acanthochitonina</th>
<th>Family Acanthochitonidae</th>
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<tr>
<td>Family Acanthochitonidae</td>
<td>Cryptochiton steller</td>
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Pearse, 1979). Several researches have reported spawning to occur during periods of calm water.

Chiton larvae are non-feeding and have relatively short pelagic durations; most are in the plankton for one to two weeks (0.5 to 19 days, Pearse, 1979; Strathmann, 1987). If an appropriate settlement surface is not available, however, larvae can delay metamorphosis for up to a month (Pearse, 1979). The larvae of most free-spawning chiton species hatch as trochophores (Fig. 1). Chiton trochophores appear to be typical trochophores with no unique characteristics that would allow one to differentiate them easily from trochophores of other mollusks. Later in larval development, however, chiton larvae do develop unique characteristics that allow easy recognition (Fig. 2). Prior to settlement they first develop indentations on their dorsal side that separate the future shell valves. Seven calcified shell valves subsequently develop (the eighth valve

![Image](image-url)
forms after settlement and metamorphosis). On the side of the larvae opposite the developing shell valves (the ventral surface), a well-developed foot forms. The distinctive shell valves of these larvae should allow one to identify a larva as that of a chiton. Few local chiton larvae have been described, however, so it is not possible at this time to develop a key to their identification.

Class Scaphopoda

Scaphopoda (tusk snails) are benthic, subtidal burrowing mollusks with tusk-shaped shells. Locally, we have seven species grouped into three families and two orders (Table 2). This group has received little attention, and most of that occurred in the nineteen century. Anatomical and reproductive studies have concentrated on species in the genus Dentalium, in which there are three local species. The following description is from the review by McFadien-Carter (1979).

Tusk snails are broadcast spawners. A trochophore develops between 3 and 36 hours after the beginning of cleavage. The early trochophore in Dentalium is characterized by four bands of cilia encircling the middle of the larvae, an apical tuff, and the rudiments of the mantle (Fig. 3A). A disk-shaped ciliated velum at the center of which is an apical tuff characterizes the veliger stage. By this stage in development a shell has developed that envelops the larvae like a blanket (Fig. 3B). The shell has anterior and posterior apertures. Later in the veliger stage, a trilobed foot develops and the posterior shell aperture shrinks (Fig. 3C). At the prodissoconch stage, the posterior shell aperture closes so that the shell takes on the shape of a cylinder or goblet (Fig. 3D). The apical tuff is reduced, the foot increases in size, and the tentacular apparatus forms. Prior to settlement most of the velar lobe is lost, but enough remains that, on settlement, the newly settled larva crawls across the bottom by means of its foot and velum. The free-swimming stage of development lasts from two to six days. The larvae of no local tusk snails appear to have been described.

Class Cephalopoda, Order Octopoda

Three species of octopus are found in the Pacific Northwest (Table 3). Sexes are separate and dimorphic, with males possessing arms modified for the transfer of spermatophores during mating. Female octopuses deposit eggs in stalked chorions and then care for the brood during the several months needed for the maturation of the larvae. Octopus species that produce relatively small eggs generally have hatchlings that
spend time in the plankton prior to settling. Species producing large eggs tend to have hatchlings that settle to the bottom immediately (Wells and Wells, 1977). Octopus dofleini and O. rubescens produce pelagic juveniles; O. leioderma apparently produces benthic juveniles (Strathmann, 1987). The young of the former two species have been described, but those of O. leioderma have not. Figure 4 provides a general idea of the appearance of the pelagic juvenile stage of an octopus.

Key to the pelagic juvenile stage of local octopus (adapted from Green, 1973)

1a. Juvenile possess 10 arms ............ Orders Sepioidea or Teuthoidea
1b. Juvenile possess 8 arms ................................................................. 2

2a. Juveniles with jellylike consistency; length of longest arm less than one-third dorsal mantle length; some lateral teeth in radula with many cusps (Fig. 4C) .......................................... Bolitocaena diaphana

Fig. 3. Larval stages of Dentalium. (A) Early trochophore. (B) Veliger showing mantle development. (C) Later veliger; note the shrinking of the posterior shell aperture and the development of the trilobed foot. (D) Prodissoconch stage; note the cylindrical or goblet-shaped shell. (From McFadjen-Carter, 1979)
Fig. 4. Pelagic juveniles of
(A) Octopus dofleini, (B) Octopus rubescens, and
(C) Bolitanea diaphana.
Ventral views to the right of
the scale bar; dorsal views to the left. (From
Green, 1973, Figs. 2, 8, 12).

2b. Juveniles without jellylike consistency; length of longest arm
more than one-third dorsal mantle length; lateral teeth in radula
not with many cusps ................................................................. 3

3a. 2 rows of large chromatophores on each arm; generally only 4
chromatophores on funnel, ventral mantle completely covered
with even pattern of chromatophores; juvenile may be 2 mm
long and have 4 suckers arranged in single row. When
preserved, arms likely straight (Fig. 4B) ............ Octopus rubescens

3b. 1 row of large chromatophores on each arm; generally 7 or
more chromatophores on funnel; anterior part of ventral
mantle bare of chromatophores; larvae >2 mm and always with
>4 suckers in double row. When preserved, arms likely curled
(Fig. 4A) ................................................................. Octopus dofleini

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