

The Influence of Early Life Phases on Community Structure and Sustainability

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Introduction

The organisms that we recognise as part of the normal rocky shore community - seaweed, limpets, paua and the like - represent the adult phase of an often complex life history.

Juvenile phases are generally microscopic - invisible to the naked eye. These microscopic stages comprise of spores or larvae.

Dispersal of juveniles is carried out by ocean currents over distances ranging from centimetres to hundreds of kilometres.

All stages of the life cycle are influenced by external factors, determining their survival and ability to contribute to the maintenance of a healthy population.



Figure 1. Common seaweed species around the Kaikoura Peninsula include *Hormosira banksii* (Neptune's necklace) and *Durvillaea antarctica* (Bull Kelp). Invertebrates, such as *Cellana denticulata* (large limpet) and *Haliotis iris* (Paua), are also found in other regions of the shore.

Affecting factors

Factors affecting the various stages of development include:

Larvae/ spores

- adult abundance and fecundity
- spawning success
- hydrodynamics
- predation within the water column

Juveniles

- larval/spore survival
- predation, when settled
- substrate availability
- competition

Adults

- recruitment of juveniles
- physiological stress
- competition
- predation

Molluscs

- The majority of life phases develop within the water column.
- Shellfish such as Paua spawn unfertilised eggs and sperm into the water column, potentially increasing the dispersal distance of the species.
- Spawning is absent in some limpets, such as *Benhamina* spp, shown below. Larvae are the only means of dispersal in this instance.

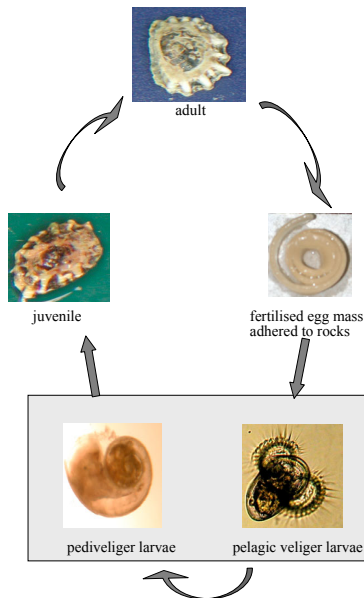


Figure 2. Grazing molluscs such as *Benhamina obliquata* often have several larval stages, with dispersal by way of a pelagic veliger larvae. The shaded area shows the microscopic stages in the cycle.

Molluscs (shellfish) are collected from the shore for food and bait, but also play an important role in intertidal community structure.

Measuring the supply of larvae to the shore helps us understand the 'supply side' effecting the distributions and abundance of adult populations.



Figure 3. Larval collectors placed around shore measure larval supply to adult habitats.



Figure 4. Growth and development is observed by culturing larvae in the laboratory. Veliger larvae of *Siphonaria zelandica* (pictured) are approximately 0.1mm in size.

Human Impact

Harvesting organisms such as seaweed and shellfish from rocky shores has long been practised.

Populations, however, may come to a point where they are over-exploited and unable to support harvesting and maintain community structure.

By linking larval sources to exploited habitats, we are able to assess the extent to which neighbouring habitats are influenced by the removal of adults from a given population.



Figure 8. Paua (*Haliotis iris*) is a commercially important shellfish that is abundant around the Kaikoura coast.

Research

Understanding the processes that influence community structure enable us to identify source and sink populations. These processes include dispersal, settlement, recruitment and mortality. This information is necessary to ensure a healthy community is sustained during harvesting.

It is not an easy task to assess whether a population is reproductively self-sustaining. Studies carried out within the Marine Ecology Research Group are aimed at identifying early life stages and the relationship between dispersal and community sustainability. We are currently working with red algae, brown algae and grazing molluscs.

Algae

- Algal life cycles vary considerably between species, often consisting of three distinct phases, as outlined in the cycle below.

- Variation between species is an important factor influencing the structure and maintenance of algal communities.

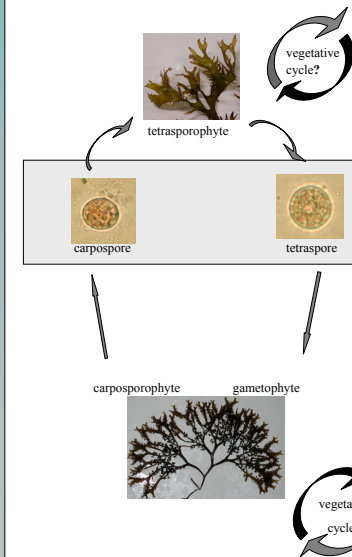


Figure 5. *Gigartina decipiens*, an important low shore species in exposed areas (pictured), undergoes sexual (gametophyte), asexual (carposporophyte and tetrasporophyte) and vegetative reproduction. Two life stages are also found on the same plant (gametophyte and carposporophyte). The shaded area shows the microscopic stages of the cycle.

Red algae are important sources of food in many Asian countries and are readily harvested from the shores around Kaikoura.

Field observations and laboratory culture are being done on several species found around the Kaikoura coastline.

These include: *Gigartina circumcincta*, *Gigartina decipiens*, *Hymenena variolosa*, *Laurencia thyrsoifera*, *Polysiphonia* spp, *Epymenia* sp, and *Pleonosporium hirtum*.



Figure 6. Exposing the plant attachment region by cutting away the main body of the plant, allows direct observation of vegetative reproduction as it occurs in the species *Gigartina decipiens*.

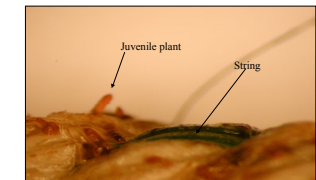


Figure 7. When string is placed in a tub with adult plants of *Gigartina circumcincta* spores settle and grow on the string. Adult plants are cultured in this way.