Supporting Research with Tropical Marine Model Organisms

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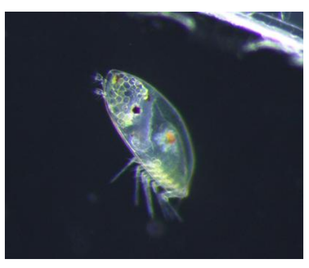
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General Background

Science research requires a reliable and sustainable supply of organisms to support experimental biology, toxicology, developmental biology, biomedical, physiology and biotechnology research. Many existing aquatic model organisms however, are temperate species, which may not be representative of the biology and ecology of tropical species in the Indo-Pacific region. In the tropics, high biodiversity is often coupled with low abundance of individual species, making repeated field collections a potential threat to natural populations. Moreover, variability among wild-collected specimens can compromise experimental accuracy and reproducibility. Mariculture of selected representative species offers a more sustainable approach for scientific research by reducing dependence on wild populations, while also ensuring high quality research organisms. Controlled breeding and standardised rearing conditions also improve suitability for laboratory experiments. The St John's Island National Marine Laboratory (SJINML), Singapore's only offshore marine station, has been developing mariculture protocols for a range tropical marine taxa to support research relevant to the region.

Examples of Resources at SJINML



Amphibalanus amphitrite **(Barnacle)**



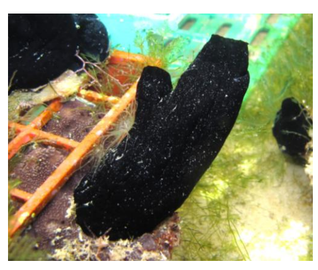
Artemia sp. **(Brine shrimp)**



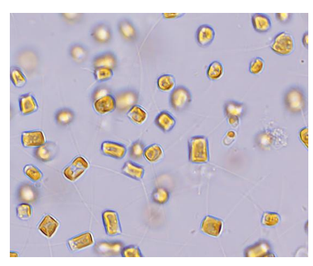
Spirobranchus bakau **(Tubeworm)**



Salmacis sphaeroides **(Sea urchin)**



Phallusia nigra **(Ascidian)**



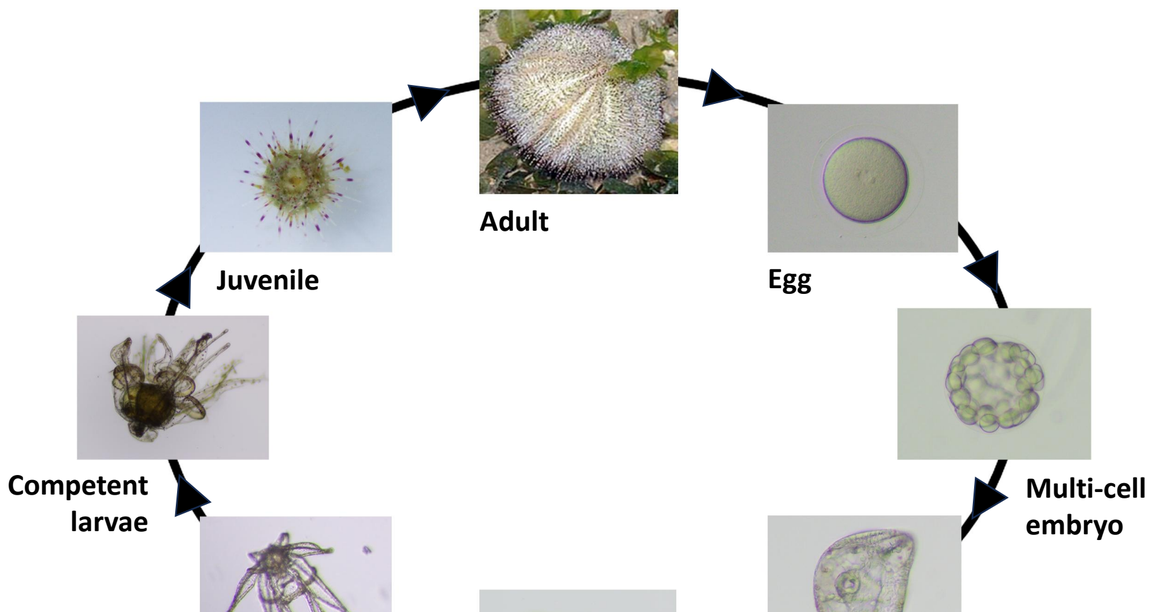
Chaetoceros mulleri **(Algae)**

White sea urchin, *Salmacis sphaeroides*

Culture Methods

- Broodstock fed on a diet of frozen prawns and corn
- Induced spawning via injection of potassium chloride into the coelomic cavity
- Larvae fed microalgae – *Tisochrysis lutea* (20,000 cells/ml)
- Metamorphosis (induced by presence of natural biofilms) and settlement to juveniles occur between 11 – 25 days
- Recommendation to induce spawning in adults >35 mm in test diameter and at least 10 months old

Fig 1. Life cycle of *S. sphaeroides.*



Examples of Applications

- Prabhakar et al., 2021: Embryos used in assays for testing toxicity of incinerated sewage sludge post-treatment for heavy metal removal.
- Spawning and fertilisation process demonstrated in educational and training workshops conducted at SJINML.

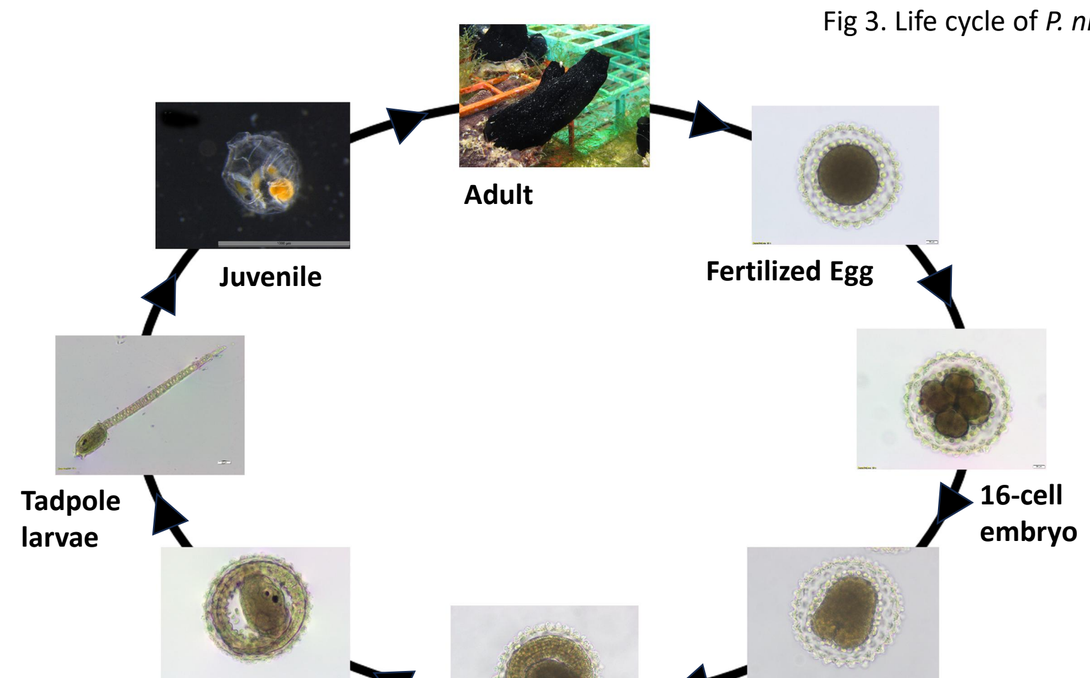
Fig 2. Abnormal development of pluteus larvae across treated sewage sludge bottom ash, at different dilution factors (Prabhakar et al., 2021).

Solitary ascidian, *Phallusia nigra*

Culture Methods

- Broodstock dissected to extract eggs and sperm
- During the settlement process, tadpole larvae were reared in the dark for 3 days, with no feed or water change
- Juveniles fed a mixture of microalgae: *Chaetoceros mulleri*, *Tisochrysis lutea*, *Tetraselmis suecica* and *Rhodomonas salina*
- Cultured juveniles able to attain sexual maturity within 4 months

Fig 3. Life cycle of *P. nigra*



Examples of Applications

- Unger et al., 2025:
  - Cultured juveniles used to compare climate change resilience in native and introduced populations, using temperature and salinity parameters.
  - Early juveniles used to measure changes in blood flow direction (in tubular heart) under temperature and salinity stress.

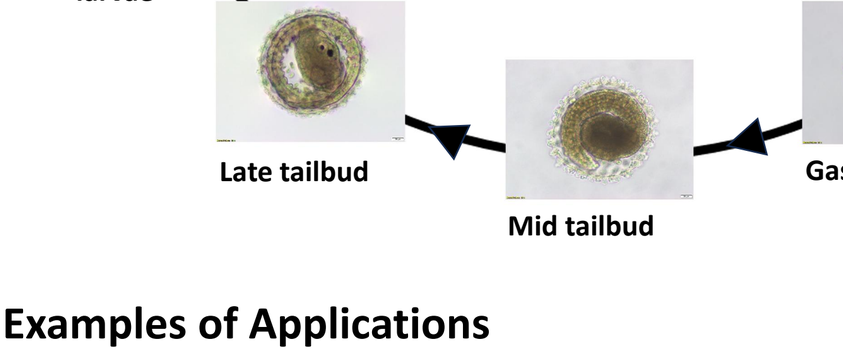


Fig 4. Survival rates under different temperature and salinity, using juveniles from different geographical regions (Unger et al., 2025).

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