

## 14. INTENSIVE CULTIVATION OF A CALANOID COPEPOD

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A calanoid copepod, *Gladioferens imparipes*, from estuaries of south-west Western Australia, has been kept in intensive cultivation and used experimentally in the diet of larval fish. An intensive cultivation was developed as a part of FRDC Project 96/398. This system is described.

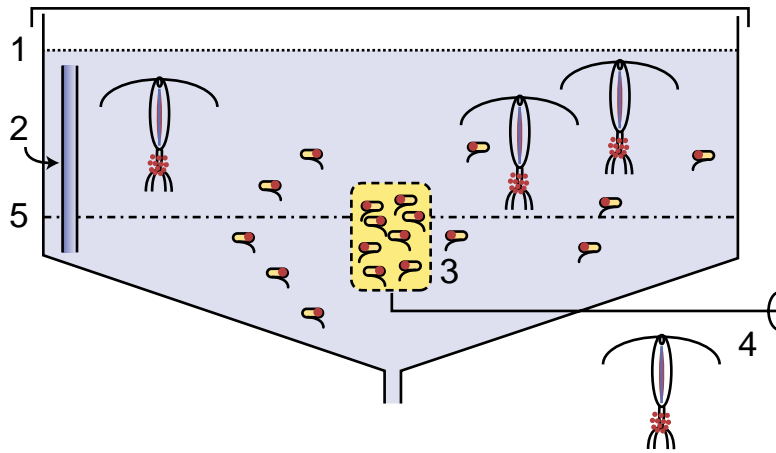
Nauplii of the same age are introduced to one of two 500-L culture vessels with an initial density of one nauplius per litre. Unicellular algae, usually *Isochrysis galbana*, is added daily to provide food. When mature females are present, usually after 14–21 days at 23°C, a daily regime of nauplius collection is initiated. One cohort of nauplii is used to inoculate the second tank. After about three weeks of daily nauplius collections from the broodstock tank it is cleaned and stocked with a new cohort of nauplii. Mature animals in the second tank now become the broodstock.

The culture system is closed (Figure 14.1). Provision for the management of water quality is linked with procedures for nauplius collection under PLC control. Nauplius collection involves daily removal of about 200 L of water from the broodstock tank (Figure 14.2). Nauplii are concentrated into a few litres and most of the 200 L is treated with biological filtration and protein skimming for 24 hours before being returned to the broodstock tank during the next cycle of nauplius collection.

The culture system is designed around particular aspects of the biology of *G. imparipes*. In at least some natural habitats, *G. imparipes* is a pioneer grazer in the ecological succession of seasonal estuaries. After the cessation of winter flow, this copepod exploits the new growth of microalgae. Adults feed only on small particles and various species of algae provide adequate food. Nauplii are not predated and can co-exist safely with the adults. In common

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The main culture vessel, 500L capacity, filled to the line 1, covered to exclude light.

- Six stand pipes (2), with air injected, provide oxygenation and water movement. Air is turned off prior to nauplius collection allowing debris to sink.
- A light within a 140 $\mu$ m mesh cage (3) is activated by PLC when water movement has stopped. Nauplii are attracted to the light and accumulate within the mesh cage.
- When nauplii have accumulated in the cage a tap (4) opens to drain water containing nauplii into the nauplius holding tank. Water drains to the level 5.
- Reconditioned water is then pumped to the culture vessel, restoring the level to 1.

**Figure 14.1.** *Gladioferens imparipes* culture system.

with some other genera of estuarine copepods, *Gladioferens* adult females hold clutches of embryos until the nauplii hatch and swim freely. Healthy nauplii have a strong photopositive response to directional light but late copepodids and adults do not.

The late-stage copepodid and adult copepods attach to firm underwater surfaces for extended periods of time using fine hair sensillae on the dorsal prosome. Surfaces of firm, 3-mm mesh are provided in the culture tanks. Animals attach to these and to the internal surfaces of the tank. Movement of water by continual airlift results in gentle currents moving past the stationary animals. The broodstock culture is kept in darkness until a PLC switches off the aeration, allowing the water to become still. The PLC then activates a light within a 150- $\mu$ m screen, attracting nauplii to a point from which adults are excluded. Nauplii are then flushed from the culture vessel

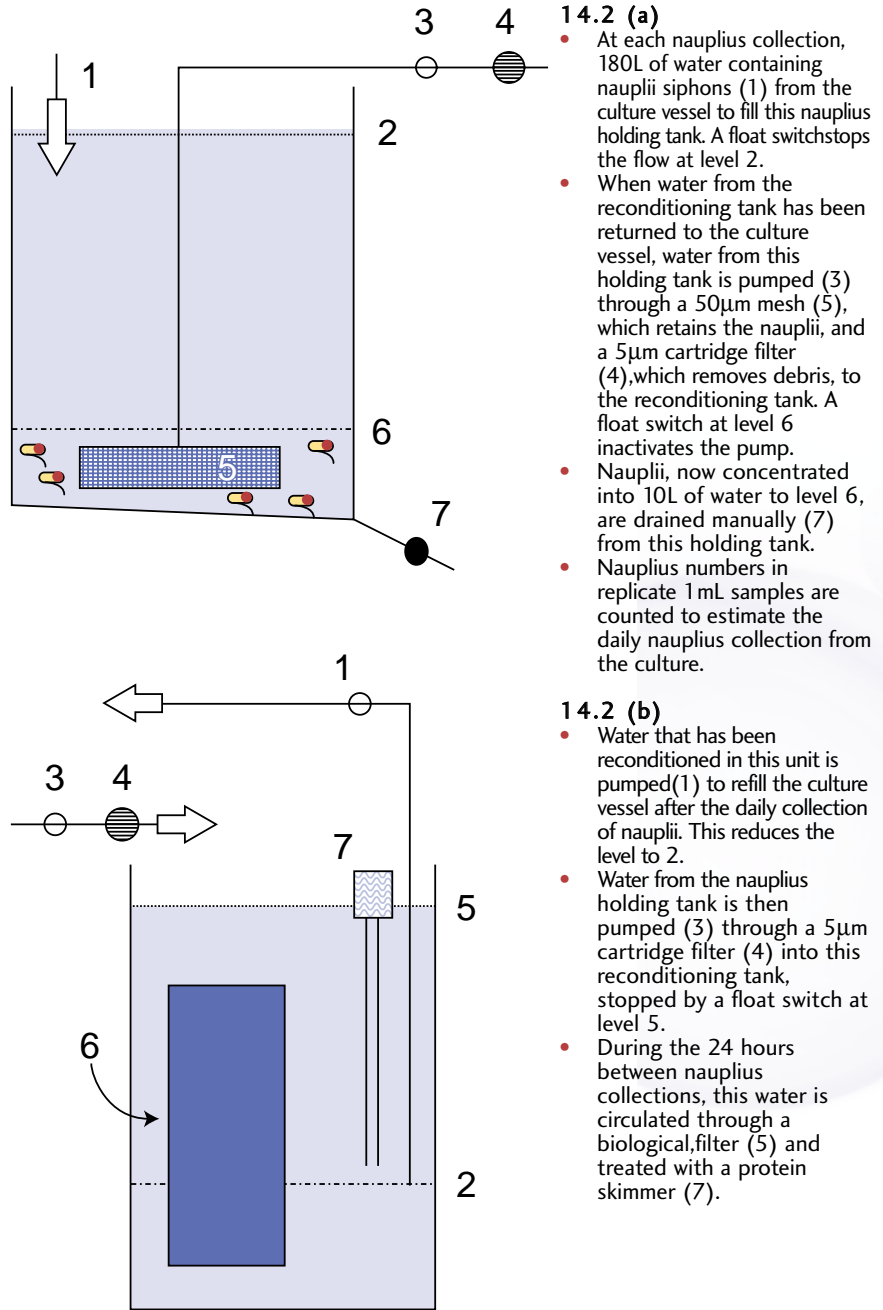
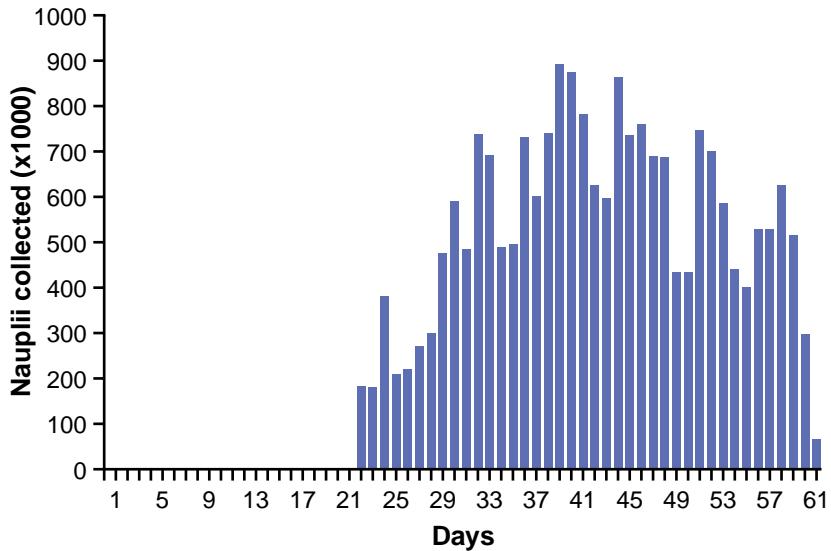


Figure 14.2. Sequence of operation of the culture system.



**Figure 14.3.** Daily nauplius production from a 500L copepod culture; mean production of 540,000 nauplii per day for 40 consecutive days.

and concentrated in approximately 10 L of water. A sub-sample of the nauplii is counted to assess production. The removal of water associated with nauplius collection involves about 40% of the volume of the broodstock tank. This water is replaced by water which was previously cleaned by mechanical filtration, biological filtration and protein skimming.

Daily collection of about 500 000 nauplii can be sustained from the system (Figure 14.3).

The closed system with recycled water allows for copepod production in a locality without a ready supply of clean seawater. Where seawater is readily available the system can be simplified and scaled up to larger tanks.

The reliability of cultures of *G. imparipes*, and the readiness with which all life history stages are taken as food by some juvenile fish, suggest that with further development of culture systems they may become important as a live food in particular aquaculture niches.

Development of the copepod culture and evaluation of *G. imparipes* as food for larval fish is described in the report for FRDC Project 96/398 titled *Intensive Cultivation of a Calanoid Copepod for Live Food in Fish Culture*. Procedures for maintaining cultures of the copepod are described in a manual produced by FRDC titled *Intensive cultivation of a calanoid copepod Gladioferens imparipes. A guide to procedures*.