

DHI SOLUTION

LIVE FEED FOR AQUACULTURE

Developing plankton production systems for optimised larval rearing

AQUACULTURE & AGRICULTURE

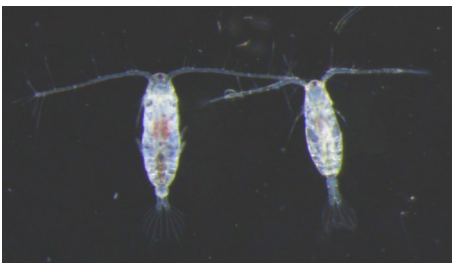
Plankton is defined as the microscopic plants and animals that inhabit the water column in salt or freshwater. They form a primary food source for many fish and their larvae as well as other organisms. Owing to the crucial role of plankton organisms, processes occurring at plankton scale are of utter importance for the functioning of the aquatic ecosystem.

The production of phytoplankton and zooplankton is essential in various industrial activities, such as:

- Aquaculture (feed for larval stages of aquatic animals)
- Food industry (feed additives and nutraceuticals)
- Energy (biofuels)
- Ecotoxicological studies (test organisms), and many more

AQUACULTURE RELIES ON PLANKTON ORGANISMS AS A FOOD SOURCE FOR LARVAL FISH

Plankton is the natural food source for the larval stages of many aquacultured species. The use of live feed in larval rearing therefore remains a necessity in most aquatic organism hatcheries. In fact, most early stages of fish larvae do not react to dry feeds and require live feeds that swims actively and stimulate their raptorial behaviour. In addition, larval fish usually do not ingest or are not able to digest formulated feeds.



*The copepod *Acartia tonsa* commonly used in fish larvae hatcheries: female (left), male (right).*

Yet, the cultivation of adequate live feeds remains to be a bottleneck to the development of larviculture. Any development in this area relies on a diverse set of research portfolios and experience, their combination is essential to determine the key aspects (e.g. optimal live prey species and development stage, optimal larval rearing conditions).

SUMMARY

CLIENT

Hatcheries, aquariums, consulting bodies, government agencies

CHALLENGE

- Adequate live feed production is a bottleneck in the development of new species for the aquaculture industry
- Live feed size, nutritional quality and behaviour need to be adapted to the target aquacultured species
- Environmental factors in the rearing tanks (turbulence, light, turbidity) should favour larval feeding

SOLUTION

- Isolation and cultivation protocols of “new” plankton species
- Use of video techniques to investigate the feeding and swimming behaviour of both prey and predator, and thus characterise the problems related to feeding success
- Developments of feeding protocols for larval stages of aquaculture species

VALUE

- Optimised plankton cultivation systems
- Reduced culture crashes
- Increased survival and quality of larvae
- Diversification of raised species
- Protection of aquatic resources (restocking programs, use of aquacultured species for the aquarium trade)
- Increased revenue, through more efficient larval rearing protocols



Small scale phytoplankton production (left) and microscope analysis of plankton (right) at the DHI laboratories in Singapore.

IMPROVEMENT OF LARVAL FISH FEEDING PROTOCOLS

Larval rearing success largely depends on fish larvae feeding. There are several factors that need to be considered: for example, while some prey items may have adequate nutritional value, they may not be easily detected and captured by fish larvae.

DHI combines unique expertise in the analysis of fish larvae-prey interactions, which will be put at work for optimising your feeding protocol. Analysed parameters include prey type, turbulence, light, and many others. Our methodology combines video techniques and feeding experiments to determine the optimal adjustment of these parameters for your needs.

IMPROVEMENT OF PLANKTON CULTIVATION SYSTEMS

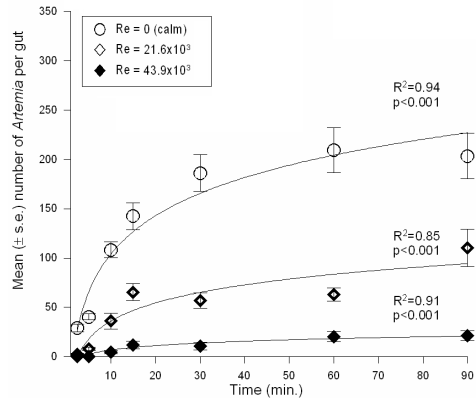
Cultivation procedures for plankton organisms - both phytoplankton and zooplankton - can be optimised in many ways. Our experts can develop personalised operating protocols for well-described organisms tailor-made for your specific needs. Applying our multiple research portfolios, we will characterise key environmental parameters that offer the optimal growth conditions for plankton organisms.

Moreover, our in-house biological services and R&D laboratories can be used to isolate, describe and study new local live prey more suitable to the aquatic species to be cultivated.

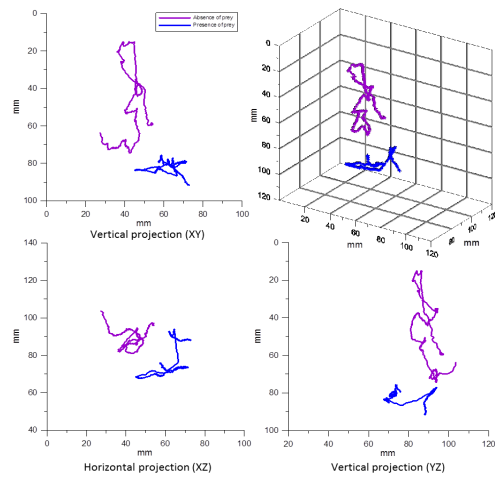
ECOLOGY OF PONDS AND TANKS—CHARACTERISE YOUR SYSTEM

Our experts in plankton ecology and water quality assessment will assist you in characterising your production system. In a closed production system, natural plankton may be considered as an additional food source or as a bioremediator (used to remove pollutants), but also as a parasite and disease vector. A thorough understanding of the key processes connecting the trophic levels can result in a significant improvement of the system's management and productivity.

Contact: info@dhiigroup.com
 For more information visit: www.dhiigroup.com



Ingestion of *Artemia nauplii* by european sea bass (*Dicentrarchus labrax*) larvae (TL=13mm) over time, exposed to different flow conditions (adapted from Mahjoub et al., 2012)



Swimming paths of grouper (*Epinephelus malabaricus*) larvae in the absence (purple) and the presence (blue) of *Artemia nauplii* (adapted)

EXAMPLE OF PROJECTS CURRENTLY RUNNING AT DHI

DEN-SELECT (2011-2013, funded by Danish ministry of research and innovation)

Density and selection effects on the copepod *Acartia tonsa* for use as live prey for larval fish rearing.

Biomass production from harpacticoid copepods (2011-2014, funded by GAIA Mariculture)

Development of an automatised culture system of harpacticoid copepods for biomass production.

IMPAQ (2012, funded by Roskilde University, Denmark)

Behavioural studies of turbot larvae (*Scophthalmus maximus*) feeding on copepods as live feed (laboratory and pond studies).