Popular science summary of the PhD thesis

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Title of the PhD thesis	Ontogenetic development and nutritional requirements in early life stages of the European lobster (*Homarus gammarus*, L.)
PhD school/Department	DTU Aqua

Science summary

The European lobster, *Homarus gammarus*, is an ecological and economically important species. Due to its high market value, the species have been highly explored as a fisheries resource. The intense fishing pressure, in particular during the 1960s and 1970s, led to significant declines in several wild E. lobster populations. To counteract the decreases in annual landings various re-stocking programs have been launched around Europe. The commercial culture of the species is attracting increasing attention as an additional measure to increase the market supply. Currently, the European lobster culture operates at a modest scale and can be divided into two complementary routes: as a remediation measure to support stock enhancement programs and as a subsector of commercial production. However, the economical viable production has been hampered by several bottlenecks, including low growth and survival rates, high cannibalism among specimens, and the lack of an artificial feed easier to handle, store, and with lower cost in comparison to the current used live, fresh, or frozen diets.

The main purpose of this thesis is to provide new insights into the metabolism and nutritional requirements in the early life stages of the European lobster. For that, five experimental studies were conducted in larvae (stages I to III), postlarvae (stage IV), and early juvenile lobsters (stage V onwards). The first study determined ontogenetic changes in the digestive capacity and chemical composition of body tissues in larvae and postlarvae E. lobsters. In the second study, we evaluated the effect of formulated feeds on the metabolic cost of feeding and nitrogen retention. During the third study, growth performance, nutritional condition, and digestive capacity were compared among individuals fed formulated feeds and a standard frozen diet composed of Antarctic krill. In study 4, the potential of a more sustainable alternative ingredient – shrimp waste meal – was tested in formulated feeds for juvenile E. lobsters. In the last study (study 5), we investigated the impact of dietary composition and type on the resilience of juvenile lobsters to temperature variation.

Results revealed that lipids, in particular cholesterol and phospholipids, are important compounds for larval stages. The requirement for dietary carbohydrates increases after the transition from larvae to postlarvae and protein requirement remains high during the entire early development. The digestion and assimilation of formulated feeds designed for juvenile lobsters did not induce extra metabolic costs. The most suitable formulated feed tested was composed of 50% protein, 24% carbohydrates, and 12% lipids. This macronutrient combination promoted growth and survival rates comparable to those observed in juvenile lobsters fed the standard Antarctic krill diet. The inclusion of shrimp waste meal in formulated feeds did not have any negative effect on growth and enhanced the survival of juvenile E. lobsters. The feed intake of juvenile lobsters was reduced at low temperatures (13°C) when compared to juveniles maintained at optimal rearing temperatures (19°C) regardless of the diet received. However, growth and energy reserves depletion was more severe in lobsters fed a high-carbohydrate formulated feed, than those fed a protein-rich formulated feed or Antarctic krill.

In conclusion, this thesis provides valuable insights and results that can be used as a reference for the formulation and development of future formulated feeds for juvenile European lobster.