International Council for
the Exploration of the Sea

C.M. 1981/F:14
Mariculture Commitee.

AN ATTEMPT TO START FEED COD LARVAE WITH ARTIFICAL DIETS

BY

Ingvar Huse
Institute of Marine Research
Austevoll Marine Aquaculture Station
N-5392 Storebø, Norway.

ABSTRACT

Larval cod were fed 8 different diets based on zooplancton and hen's eggs. All but one diets were ingested, but no growth was observed. The failure of the diets to promote growth is thought to be related to the low digestive potential of the larval gut.

INTRODUCTION

Start feeding of marine fish larvae in culture is mainly carried out with live feed like rotifers, Artemia or wild plancton. The present procedures of producing rotifers and Artemia on artificial feeds certainly have enhanced these methods in terms of simplicity and general applicability. However, the advantages of an artificial start feed are quite obvious, and a successful product would certainly represent a major breakthrough in the cultivation of marine fishes.

May (1971) rewiewed attempts to rear marine larvae in the laboratory during the period from 1878 to 1969. No successful rearings with artifical diets were mentioned. Aldron et. al. (1974), however, managed to rear plaice larvae beyond metamorphosis using an artificial diet. Gabaudan et. al.(1980) evaluated different processing procedures and also mentioned successful rearing of flatfish larvae on artificial feed. Chow (1978 and pers. comm.) reported positive results with tropical marine larvae fed a microencapsulated egg diet.

Cod larvae are very small (4mm) and the life span from functional jaw to point of no return is only 6 days. The development of the gut is dependent on growth which means that the first feed must promote growth. The problems most marine larvae encounter in the first feeding stage with artificial diets might be due to a low or lacking production of digestive enzymes. This might explain the dependancy on live prey, autolysing and thus freeing its nutritional content in the larval gut. Preliminary experiments carried out by L. Klungsøyr (pers. comm.) showed a very low activity of pepsin-like enzyms in fed and unfed cod larvae.

The present study is also preliminary and will be followed up in years to come.

MATERIAL AND METHODS.

Five day old cod larvae were placed in 30 l polyethylene cylynders with plancton gauze bottoms submerged in water baths, about 500 larvae in each cylynder. The water was filtered both mechanically and with UV, and was not recirculated. The temperature varied between 3° and 6°C, while the salinity ranged from 29 to 33 ‰. Light intensity was not measured in the cylynders, but was estimated to be between 1 and 20 lux. All feeding experiments included a control group of starving larvae. Larvae were fed 4-6 times every day. Feed was dispersed at the surface with a spoon.

Altogether 8 diets were tested, 4 based on frozen wild zooplancton and 4 on hen's eggs. Three of the zooplancton feeds were based on copepods while the fourth was made from euphausides. The zooplancton was ground, hydrolysed, fractioned, and stabilized with gelatine. The gel was stored in a refrigerator and pressed through and scraped off a screen into a water container to obtain suitable particles. The variations in the 3 copepod diets were with regard to enzymes applied, pH and salt content.

The egg diets were prepared by coagulating eggs in a water bath at 70 C. Feed 1 contained only egg; feed 2 had an addition of vitamins and minerals; feed 3 was based on feed 2 but with an exstra addition of 10% cod liver oil and 1% glucose; feed 4 was based on feed 3 , but with a 15% content of proteose peptone. Suitable particles were prepared in the same way as for zooplancton diets. Feeding experiments continued until all larvae were dead.

Growth was monitored by measuring length and myotome height in samples from both starving and fed larvae.

RESULTS AND DISCUSSION

All diets except one were accepted by the larvae. Feeding incidence was close to 100% the day after first feeding except in the group fed zooplancton hydrolysate with pP 3. No larvae ingested this feed. Tere was, however, no survival to methamorphosis on any of the diets. Significant differences in growth parameters between starving and fed larvae were not observed. The life length from hatching to starvation was, however, increased by between 25 and 29%for larvae fed egg based diets, while the larvae fed zooplancton based diets died with the starvation groups. This life prolongation was most likely due to the content of lipids and glucose in the egg diets.

Five larvae with a substantial stomach content of egg diet were isolated in a chamber without feed. After 24 hours there was hardly any change to be observed by looking at the larvae under a microscope. After 48 hours the stomach content had become somewhat more transparent, and after 72 hours there was hardly anything left in the gut. From this study it is not, however, possible to decide whether the feed was assimilated or just dissolved and released. The digestion rate is extremely low compered to what is to be expected in cod larvae (Snorre Tilseth, pers. comm.). This altogether amounts to the conclusion that the tested diets were not able to promote growth in cod larvae, and as growth is a prerequisite of life at this stage, neither could the diets support life any length of time.

As the ingredients in the feed should contain all the necessary raw materials for growth the limiting factor seems to be digestion.

LITERATURE CITED

Adron, J.W., Blair, A., and Cowey, C.B. 1974. Rearing of plaice (Pleuronectes platessa) larvae to metamorphosis using an artificial diet. Fishery Bulletin: Vol. 72, 1974: 353-357

Chow, K.W. 1978. Microenchapsulated egg diets for fish larvae. In Fish feed technology. FAO/UNDP, ADCP/REP/80/11 :355-366

Gabaudan, J., Pigott, G.M. and Halver, J.E. 1980. The effect of processing on protein ingredients for larval diets: Biological evaluation. Prod. World Maricul. Soc. 11: 424-432.

May, R.C. 1971. An annotated bibliography of Attempts to rear the larvae of marine fishes in the laboratory. Spec. Sci. Rep. US Fish. 1971 no. 632: 1-24.