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International Council for the
Exploration of the Sea

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REPORT OF THE WORKING GROUP ON MASS REARING OF JUVENILE
MARINE FISH TO THE MARICULTURE COMMITTEE OF ICES

Bergen, Norway 24-26 June, 1993

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1. PARTICIPATION

The working group convened its fifth meeting in Bergen, Norway on 24 - 26 June 1993. The following representatives of ICES member countries attended the meeting (nominated members are underlined):

Belgium:	<u>P.Coutteau</u> , <u>P. Lavens</u> , <u>P. Sorgeloos</u> .
Canada:	J. Brown, <u>J. Gagné</u> , <u>R. Peterson</u> .
France:	J. Robin
Germany:	B. Ueberschär
Holland	J. Verreth
Iceland:	<u>G. Marteinsdottir</u>
Norway:	<u>Ø. Bergh</u> , N. Finn, I. Haaland, <u>I. Holmefjord</u> , <u>I. Lein</u> , <u>T. van der Meeren</u> , <u>A. Mangor-Jensen</u> , O. Nielsen, <u>V. Øiestad</u> , K.Pitman
Poland:	<u>W. Pelczarski</u>
Portugal:	L. Conceição
Spain:	<u>J. Iglesias</u> , J. Peleteiro, M. Olmedo
Sweden:	<u>J. Pickova</u>
U.K.:	M. Bruce, <u>B. Howell</u> , <u>R. Johnstone</u> , R. Shields, P. Smith

A. Tandler (Israel) also attended as an observer.

The meeting was chaired by B. Howell (U.K.) and R. Johnstone (U.K.) acted as rapporteur.

2. TERMS OF REFERENCE

The terms of reference stated in ICES Council Resolution 1992/2.48 were to:

- a) develop a protocol for standardised monitoring of egg and larval quality;
- b) plan an inter-laboratory investigation of egg and larval quality;
- c) prepare a protocol for hygienic procedures for rearing systems;
- d) prepare a protocol for standard nutrition research;
- e) prepare a report on standard inert reference diets;
- f) consider the possibility of a workshop on advances in halibut culture in 1994.

3. AGENDA

The meeting started at 1400 h on Thursday, 24 June with some general remarks from the chairman on membership and the aims of the Working Group. The need to define clear objectives which were not only appropriate but attainable was stressed. Each of the main

topics for discussion was then introduced by one of the participants followed by discussion to establish clear objectives which sub-groups would address during parallel sessions.

The following morning commenced with a presentation by P. Coutteau (Belgium) of the results of the HUFA Intercalibration Exercise. Sup-groups then spent most of the day in parallel session discussing the various topics and formulating their reports. These were then presented to and discussed by the Working Group as a whole at the end of the afternoon.

Many members were unable to attend the final session on the morning of Saturday, 26 June because of travelling commitments, but those that remained finalised the recommendations of the Working Group and completed the report.

4. EGG AND LARVAL QUALITY [Terms of reference, items a) and b)]

Although considerable variability in the performance of eggs and larvae are still observed, the present working group does not believe that standardised protocols for the monitoring of quality *per se* can be erected. This is because measures of difference may reflect variable husbandry or environmental parameters. There is, nevertheless, a need for standardised reporting procedures and assessment protocols in order to enable better comparison of results from different groups.

Those details that are deserving of description are listed in Appendix 1. Participating member countries are urged to ensure that workers in these fields make the fullest report possible of their different rearing practices.

The need for predictive measures of subsequent performance was recognised. It is recommended that the potential usefulness of one such measure, namely cell symmetry at the 8-16 cell stage, should be explored. An organising group will be established and participating members will be invited to contribute to planned inter-laboratory and inter-species studies (**see recommendation 2**).

5. HYGIENIC PROCEDURES FOR REARING SYSTEMS [Terms of reference, item c)]

Considerable progress has been made in our understanding of the importance of hygiene strategies since the fourth meeting of the Working Group in Gent. Having regard to the hygiene recommendations made at that meeting the present working group makes the following additional comments:-

1. The efficacy of egg disinfection procedures should be proven. Although appropriate methods for the detection of alterations to the extent of bacterial contamination exist, the analysis of viral decontamination is less well advanced. The efficacy of disinfection protocols against known viral pathogens should be determined in controlled seeding experiments. The possible negative as well as positive effects of disinfection treatments on subsequent developmental processes should be monitored.

2. Proper disposal systems for suspect contaminated material from hatchery systems should be erected.

The Working Group further recommends that:-

3. The use of antibiotics in mass rearing of juvenile fish is restricted to therapeutic use only via oral administration. The primary reason for this recommendation is that although we recognise that prophylactic antibiotic treatments may have beneficial effects, we believe the risks of such treatments in generating resistance are commonly ignored. When antibiotics are used, appropriate treatment of effluent material is advisable.

Additional future research.

1. There is a need for controlled pathogenicity experiments at all the young life stages of marine fish species destined for mass rearing.
2. Whilst the descriptive phase of the verification of probiotic effects has been progressed, practical studies on the use of advantageous microorganism presence in early rearing systems after egg disinfection in live food production systems are deserving of increased attention.

6. NUTRITION [Terms of reference, items d) and e)]

Whilst the Working Group continues to see a wide variation in the design and reporting of nutritional experiments involving fish larvae, it does not now believe that standardised protocols can be devised which would reduce this variability. Rather, it urges a more critical evaluation of experimental design and more complete reporting of variables, such as environmental parameters and analytical procedures, to facilitate comparison between studies. In particular, it is suggested that reports should present analytical information of the food rather than of food ingredients and/or enrichment emulsions used in live food production.

In the view of the Working Group, some of the variability in marine fish larval nutrition studies would be reduced if the following suggestions could be implemented.

Firstly, the Working Group is concerned about the high variability in the results of current enrichment procedures for live food organisms and the effect this may have on the interpretation of results from lipid research. We urge that a short communication on the subject should be published in scientific journals, using existing data from the Artemia Reference Centre, Gent Belgium and from the National Centre for Mariculture, Eilat, Israel.

Secondly, the Working Group notes that the biochemical composition of *Artemia* cysts varies from batch to batch. The availability of selected batches of cysts of known biochemical composition suitable for enrichment by the preferred procedures as mentioned above would be further expected to enable more detailed comparison of the results from

different groups. We suggest that the main suppliers of such material be approached to examine the feasibility of this proposal.

Additional future research

The Working Group recommends that:

1. Studies on the quantitative and qualitative assessment of food ingestion by fish larvae should be carried out.
2. Research on the role and requirements of non-lipidic food sources, e.g. protein, amino acids and vitamins should receive more attention.
3. Studies on the nutritional effects of the green water technique should be undertaken.
4. Comparative studies should be undertaken to test the quality as live food of natural zooplankton, e.g. copepods and enriched cultured food organisms such as *Artemia* and *Brachionus*.

With regard to its own activities, the Working Group recommends that:

1. An inter-laboratory exercise should be undertaken to investigate the requirements of DHA/EPA ratios in the food of different marine larvae. To minimize the variation and to increase the reproducibility of the results, the Working Group recommends that reference emulsions for enrichment should be used or at least incorporated in a comparative way in this study (**see recommendation 3**).
2. It should investigate the feasibility of using selected weaning diets as test diets for nutritional studies in different marine species. To facilitate their application, these diets should have an open formulation. The Working Group recommends that this study will be carried out as an inter-laboratory exercise (**see recommendation 4**).
3. More attention should be paid to the effect of environmental conditions on the results of nutritional studies. In this regard a survey of prevailing environmental conditions in commercial hatcheries could provide valuable information. To obtain this information, the Working Group recommends that the feasibility of developing a database be studied, initially using the turbot as a test species. Participating members will be invited to collect data from several commercial hatcheries for insertion into a database (**see recommendation 5**).

7. PROPOSAL FOR A HALIBUT WORKSHOP [Item f)]

The members of the Working Group consider that there has been sufficient opportunity in the recent and immediate past (this Working Group and the accompanying symposium) for those involved in halibut research to meet, exchange and discuss their information. Since most of those involved are likely to meet again in two years time, and, in the interim, will

be exchanging information regarding the recommendations of the Working Group, we do not believe there is a strong case for the holding of a separate halibut workshop in 1994.

8. HUFA INTERCALIBRATION EXERCISE

Peter Coutteau (Belgium) presented the result of this study. The initial response to the exercise was very encouraging with 19 laboratories asking to take part. These were all provided with the protocols and materials but, disappointingly, only 9 subsequently submitted data and of these only 3 had completed all the specified analyses by the submission date requested. Data from a further 2 laboratories, however, has been promised in the near future.

Despite this less than complete response, the study has proved to be extremely worthwhile revealing important inter-laboratory differences as well as intra-laboratory differences from those who compared the prescribed analytical method with their own 'in-house' method. The Working Group agreed that it was important that the results of this study should be made widely available and recommended that they be published as an ICES Cooperative Research Report with B. Howell (U.K.), P. Sorgeloos (Belgium) and Y. Olsen (Norway) acting as an editorial committee. Further data are yet to be analysed but it was agreed that a draft report would be submitted to the Chairman of the Mariculture Committee by the end of August, 1993.

9. CONCLUDING DISCUSSION

The future activities of the Working Group were discussed and it was agreed that an examination of trends in juvenile fish production and marine fish cultivation as a whole would increase awareness of current problems and prospects and assist in focussing the work of Working Group (**see recommendation 1**). This would be achieved through the submission of information from national representatives to the Chairman in advance of each meeting. The collated data would then be presented at each meeting for discussion.

The quality of reared juveniles was also identified as a subject worthy of discussion at future meetings. Techniques for the production of juvenile marine fish have been developed comparatively recently and survival during the larval stages and normality of appearance are the main criteria by which rearing operations are judged. It is known, however, that these criteria may be poor indicators of subsequent performance. There is a need, therefore, to develop criteria for assessing the quality of reared fish which would take account of the variety of situations to which the fish may be transferred (e.g. intensive and extensive) and which could be used as a basis for assessing the effectiveness of rearing procedures (**see recommendation 6**).

10. RECOMMENDATIONS

The Working Group on Mass Rearing of Juvenile Marine Fish recommends that it should work by correspondence in 1994 and meet again in Conwy, U.K. from 22-24 June, 1995 with Dr B. Howell as Chairman to:

1. Report on the current trends, problems and prospects for juvenile marine fish production in ICES countries;
2. Report on an inter-laboratory investigation of the potential use of cell symmetry as a predictive indicator of egg quality;
3. Report on an inter-laboratory evaluation of the effects of different DHA/EPA profiles in food on production success.
4. Report on an inter-laboratory investigation on the effects of selected weaning diets.
5. Report on the establishment of a data base of environmental conditions under which fish are reared.
6. Report on the potential for quality assessment criteria for juvenile animals.

Progress towards these goals will be reported in 1994.

In addition, the Working Group recommends that:

The report on the "Intercalibration Exercise for Quantitative Analysis of Fatty Acids in Marine Samples" prepared by Peter Coutteau and edited by Drs B R Howell, P. Sorgeloos and Y Olsen for the Working Group on the Mass Rearing of Juvenile Marine Fish should be published as an ICES Cooperative Research Report. The estimated number of pages is 30.

APPENDIX 1. Reporting of procedures in egg and larval rearing studies.

The subject areas below are considered to be of possible importance in enabling the proper assessment of difference between different research groups. It is recommended that, as far as is possible and appropriate, all relevant information should be listed when studies are described. It would be desirable for standardised protocols to be drawn up and circulated where these exist.

Broodstock Holding Conditions

The following should be noted:- Temperature regime, Light regime (level and photoperiod), Salinity, Origin of stock and age in captivity, Age and size at stripping, Holding facilities, Degree and frequency of disturbance, Feeding regime.

Peri - fertilisation Practices.

Fertilisation practices should be described in detail and, in particular, the method of separation and estimation of the buoyant fraction.

Percent fertilisation should be calculated at the 2-16 cell stage. They should be calculated as the proportion fertilised of the buoyant fraction and also, in manual stripping studies, of the proportion fertilised of the total initial egg number. The presentation of both figures in the latter kinds of study will facilitate comparison of manual and naturally spawned experiments. Where known, the chronological number of each spawning batch should be noted.

Egg and Larval Incubation Practices.

Details of rearing facilities, temperature, salinity, light regime, flow rate and procedures for possible pathogen control should be described. The method of estimation of number of eggs (directly or via volumetric or gravimetric estimation and sub-sampling) and of calculation of number and proportion hatched should be noted. We advise that percent hatch be expressed as the proportion of hatched larvae (back calculated by difference from start numbers minus mortalities recorded) of the number eggs in the bouyant fraction. The number of normally developing larvae expressed as a proportion of the number hatched should be monitored at species specific timings.