

Northwest Atlantic



Fisheries Organization

Serial No. N355

NAFO SCS Doc. 81/VI/14

SCIENTIFIC COUNCIL MEETING - JUNE 1981

Summary Report of Shrimp (*Pandalus borealis*) Ageing Workshop,  
Quebec, City, Quebec, Canada, 11-14 May 1981

Convener: J. Frechette

At the November 1980 Meeting of the Scientific Council of NAFO, the Standing Committee on Fishery Science recommended that an ageing workshop on shrimp be held, with Mr J. Frechette as convener (possibly in Quebec City, Canada, during early May 1981), to conduct an in-depth analysis of shrimp samples with a view to developing criteria for the ageing of shrimp. NAFO Circular Letter 81/13 (issued 13 February 1981) contained information on the time and place of this meeting and a tentative agenda. Consequently, the workshop was held during 11-14 May 1981 at Direction de la Recherche Scientifique et Technique, Complexe Scientifique, Ste. Foy, Quebec, Canada. Mr Don Parsons agreed to act as Chairman for the meeting. Participants were as follows:

- J.C.E. Cardoso - Executive Secretary  
Northwest Atlantic Fisheries Organization  
B. I. O. Dartmouth, Nova Scotia, Canada
- Dan M. Carlsson - Greenland Fisheries Investigations  
Jaegersborg Alle IB, 2920 Charlottenlund  
(EEC Representative) Denmark
- Stephen H. Clark - National Marine Fisheries Service  
Northeast Fisheries Center  
Woods Hole, Mass. USA 02543
- Roland J. Cormier - Fisheries & Oceans, Canada  
Univ. of Moncton  
Moncton, N.B., Canada
- Hervé Dupouy - I.S.T.P.M.  
Centre de Recherches  
B.P. 1240 - F-97500  
Saint-Pierre et Miquelon (France)
- Jacques Fréchette - Direction de la recherche  
Direction des Pêches Maritimes  
Ministère de l'Agriculture, des Pêcheries  
et de l'Alimentation  
2700, rue Einstein  
Ste-Foy (Québec) G1P 3W8
- Vince Hodder - Assistant Executive Secretary  
Northwest Atlantic Fisheries Organization  
B. I. O., Dartmouth, Nova Scotia, Canada
- Peter Jackson - Alaska Department of Fish & Game  
Kodiak, Alaska, U.S.A.
- Ambrose Jearld Jr. - National Marine Fisheries Service  
Northeast Fisheries Center  
Woods Hole, Mass. USA 02543
- Klaus Lehmann - Greenland Fisheries Investigation  
Fiskeribiolog. Lab. Box 81  
3900 NUUK Greenland

- Don Parsons, chairman - Fisheries and Oceans, Canada  
St. John's, Newfoundland, Canada
- David Sampson - Maine Dept. Marine Resources  
W. Boothbay Harbor, Maine, USA
- Unnur Skuladottir - Marine Research Institute  
Reykjavik, Iceland

### Objectives

The general objective of the meeting was to discuss about available ageing methods and eventually conclude which were the most suitable. These methods require the interpretation of biological parameters as indicators of age and the use of statistical methods to separate age groups from polymodal length frequency distribution.

Such a meeting was determined necessary because, as for other species, ageing is the keypoint of further analysis (year-class strength, mortality, growth). Interpretation of shrimp age groups and consequently the parameters used for management (e.g. mortality) also differed considerably.

### Methodology

To reach these objectives, participants were asked to work together on shrimp samples provided and present their independent research results under the appropriate topic of the agenda. A terminal connected to the IBM 370 of Laval University was available during the meeting to refine or complete as necessary the analysis of a particular set of data and to produce for a chosen shrimp sample all the figures required for ageing, from size distribution to the application of a sophisticated statistical method (NORMSEP program).

### Results

For shrimp and generally all crustaceans, there is no biological feature permitting direct interpretation of age. Observation and interpretation of obvious modes on size distribution and informations on sex and maturity are the only tools available for ageing.

#### 1) Sampling procedure

Sampling strategy is very important when breaking down length frequency distributions by age groups. Selectivity of gears has to be taken into account for younger age groups, that are males (it is well documented that a sex inversion from male to female takes place during the life cycle); it is also not known to what extent these age groups

of males are available to the trawl. Diel variation and more generally vertical distribution also influence the representation of each age group in length frequency distribution; availability of each age group may vary greatly depending on time of the day and trawl type. Location and time of sampling could also affect the age groups represented; values of modes and relative strength of modal classes vary according to depth.

Because of the problem of overlap between modal classes in commercial size distribution due to location, time and depth of fishing activity a loss of information results when pooling samples.

It was generally agreed that before pooling samples, size distribution has to be weighed by catch in numbers, especially if year-class strength has to be estimated.

It was noted that on large boats where discards of small shrimp take place, sampling of these discards should be done; a more realistic figure for younger age groups was observed using shrimp discards.

There is no definite rule for sample size but the consensus was that 500 shrimps is a minimum requirement. It was also recognised that measuring the cephalothorax to 0.1 mm is advisable to allow thereafter multiple recombination at need (0.3 mm, 0.5, moving average etc...); consideration should be given to the development of an electronic recording equipment (an electronic caliper is up to now available) permitting eventually to feed a micro-computer with the measurement data on a real time basis.

## 2) Interpretation of length frequency distribution

Reproductive characteristics and statistical methods could be used to split size compositions into different age components.

In some cases, sex and maturity (males, transitionals, females with sternal spines, females without sternal spines) seem to give an accurate separation of modal classes interpreted as age groups. However, several data for other stocks indicated that sex inversion can take place at different ages; this fact complicated the analysis of length frequency distribution.

The consensus was that, before splitting age groups in length frequency distribution by any methods, sexing and maturity determination should be done. Weight frequency distributions provide very useful additional information when interpretation of length distribution is difficult due to overlapping, esp-

pecially for females age groups. For convenience wet weight is used but the use of dry weight should be investigated.

Statistical age group separation methods were reviewed with special emphasis on those actually used by participants. The statistical methods used are designed to fit normal curves on the length frequency distribution and minimize the maximum likelihood value (NORMSEP program, McDonald and Pitcher's program). A deviation method presented by the Icelandic participant differs considerably from others; this method based on the observation of deviations of size distribution from the mean size distribution over several years permits the observation of dominant year-classes over the life cycle. This method has to be tried on other stocks where comparisons with other methods are possible.

The statistical methods used in relation to sex and maturity are very helpful to estimate mean length and proportion of each age group. Statistics provided by the program concerning the goodness of the fit are valid if data are not smoothed; however, smoothing procedure is generally convenient to make a first interpretation of age groups composition.

### 3) Utilisation of age groups separation

The separation of age groups on length frequency distribution can theoretically be used to estimate year-class strength, mortality, growth and recruitment. However selectivity and availability problems for younger male age-groups excludes any accurate prediction of recruitment to the fishery.

Mortality estimates were produced for the species in the Gulf of St. Lawrence where natural mortality was estimated to be 0.5 - 0.8 for fully recruited age groups using annual assessment surveys data. For Icelandic stocks it was estimated at 0,5 from the catch curve technique; another independent estimation using Virtual Population Analysis was 0,24. For the Davis Strait stock, total mortality (Z) was estimated to 0.6 from single survey data assuming a constant recruitment. The key point of mortality estimation is how many year-classes are presented in the last mode of females; age class accumulation in this last peak is consistent with the fact that growth decreases during the female phase due to the egg-bearing period. Other methods such as weight distribution or tagging experiments were recommended to help solve this problem of age class accumulation. More experimentation was proposed for shrimp tagging with special reference to the technique used in a large scale for penaeid shrimp in the Gulf of Mexico. A tagging experiment is presently conducted in Iceland for Pandalus borealis.

Natural mortality was related to predation by finfishes, especially cod and Greenland halibut. Preliminary work by Canadian participants indicated that abundance of shrimp may be related to abundance of Greenland halibut.

Growth curves may also be produced from age group separation.

Advice of caution was given to pool data from several generations to produce a growth curve; growth of one generation to the other could vary possibly due to different exploitation rates. Participants disagreed to fix the birthday to January 1st, as in fishes; some preferred the hatching period (occurring in April and May for several stocks).

### Conclusions

Although all participants realized that this workshop did not solve the ageing problem for P. borealis, it was the feeling of all that this type of meeting is very useful considering the amount of information presented and the opportunity for each participant to discuss and compare their individual interpretation.

Several points in the agenda were not discussed due to lack of time, the more important being management implication of shrimp ageing. Although not discussed per se much of the discussions at various points in the agenda evolve around this general theme especially when considering the discrepancies which exist between natural mortality estimated or used for shrimp management. A more comprehensive report is planned for November 1981 which will be presented to STACFIS at which time some of the points not considered during the workshop will be eventually discussed.

