

Northwest Atlantic



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Report of the *Ad Hoc* Working Group on Shrimp (*Pandalus borealis*) in Division 3M

19-20 November 1996
NAFO Headquarters, 192 Wyse Road
Dartmouth, Nova Scotia, Canada

by

Convener, D. G. Parsons

1. Introduction

In accordance with the September 1996 request of the Scientific Council, an *ad hoc* working group on shrimp in Div. 3M (Flemish Cap) met at NAFO Headquarters in Dartmouth, Nova Scotia, Canada during 19-20 November 1996. The Designated Expert, D. G. Parsons (Canada), for Shrimp in Div. 3M was appointed Chairman by the Scientific Council. A. Nicolajsen (Faroe Islands) undertook the role of rapporteur. Thirteen participants discussed topics related to improving the assessment of the shrimp stock in this area.

The tentative agenda, circulated prior to the meeting, was approved and included the following:

- a) develop a format for reporting catch and effort in order to produce a standardized CPUE index which incorporates data from as many nations as possible;
- b) evaluate the results of the autumn 1996 Canadian research trawl survey as a means to track the abundance and distribution of shrimp on Flemish Cap;
- c) analyze a time series of length frequency distributions to track growth and maturity in an attempt to resolve problems in age interpretation;
- d) discuss options for current and future assessment methodologies; and
- e) other matters.

2. Agenda Items

a) Standardization of Catch/effort Data

In order to use CPUE data from different sources and countries to describe the fishery and develop models, the need for standardizing catch and effort data was recognized. Logbooks from fishing vessels and observers' records are the main source of information on the fishery. However, they are designed in different ways which makes it necessary to define a common format.

Fishing records do not always provide detailed information on the trawl size or even whether single or twin trawls were used. Suggestions addressing the quantification of trawl size have been outlined by Skúladóttir (1996), given in Appendix I. It was agreed that this document should be tabled in Scientific Council in June 1997 and subsequently dealt with in consultation with ICES. As there is currently no international agreement on a standard to describe trawl size (i.e. through NAFO or ICES), it was decided that, for the time being, the degree of detail should be at the level of recording the number of trawls towed, i.e. single or twin trawl.

The question of using distance trawled instead of time trawled was addressed, but the group considered it unlikely that distance trawled would generally be available and recommended time in hours as an appropriate measure for this dimension of ground covered by the trawl. Where days are used instead of hours, they should be converted into hours (e.g. one day equals 18 fishing hours).

It was agreed that the common data file (column format e.g. ASCII) should include the variables catch, effort and number of hauls grouped by vessel, year, month, area and gear. The following conventions apply:

- Catch: in kilograms
- Effort: hours fished (days converted to hours, if necessary)
- Number of trawl hauls
- Name of vessel
- Country of vessel
- Horse Power (HP) of vessel
- Gross Registered Tonnes (GRT) of vessel
- Year: 1993, 1994
- Month: 1, 2, 3, 4
- Area number: (Four quadrants divided at 47 deg 10 min N and 45 deg 00 min W numbered 1-4 clockwise starting in upper right quadrant.)
- Gear: 1 = single trawl, 2 = twin trawl

Below is an example of the desired format showing that a vessel might require several entries for a single month if different areas and/or gears are fished.

Catch	Effort	No. Hauls	Country	Vessel	HP	GRT	Year	Month	Area	Gear	Meshes
135666	950.75	231	FRO	Q4567	4000	1500	1993	11	3	1	-
1878	8.10	2	FRO	Q4567	4000	1500	1993	11	3	2	-
11267	85.00	20	FRO	Q4567	4000	1500	1993	11	4	1	-

It was recognized that a certain amount of "front end" data processing would be required to produce the agreed format. Also, the data must be available for each country by 1 July and transmitted electronically to the Designated Expert, D.G. Parsons, who then will compile them as one file to be distributed to all countries prior to the September Meeting of the Scientific Council. It was further recommended that countries provide data on changes in efficiency of their fleets, e.g. addition of new vessels, increased horse power, more extensive use of twin trawls, etc.

b) Research Surveys

The EU (Spain) trawl survey series is the longest available, covering not only the period where the fishery has taken place but going back to 1988. This survey was designed as a stratified random bottom trawl survey targeting demersal fish species but small amounts of shrimp were caught and recorded. The codend mesh size was 35 mm except in 1994 when 40 mm was used. As the shrimp catches were relatively small, on average 1.37-11.75 kg per nm, the amount caught was subject to high variability and did not reflect the catch rates in the fishery. The gear used light rollers that might have avoided the shrimp. It is possible that some of the shrimp in the trawl was preyed upon by fish inside the trawl, but this effect would be somewhat reduced as several fish stocks on the Cap have declined during this period. The wide distribution evident in the 1996 data reflect, to some extent, general stock conditions.

The stratified random bottom trawl survey on Flemish Cap for demersal fish species, conducted by Canada in September-October 1996, also covered most of the shrimp stock area. The survey gear was a Campelen 1800 shrimp trawl with a 40 mm codend mesh and a 13 mm liner. Two methods (SPANS and STRAP) were used for calculating biomass and abundance and results were in good agreement. The STRAP method produced 95% confidence limits of about +/- 25%. Length distributions showed age groups 1, 2 and 3 at 11 mm, 15 mm, and 20 mm, respectively, and females at 24-25 mm. Diurnal variation was not addressed directly in the survey design although time of day was recorded with each fishing set. A suggestion was made to use fixed stations rather than random stations, but no agreement was reached on this topic.

It was recognized by all participants that the Canadian survey provided valuable information on the distribution, size and demographic structure of the shrimp stock on Flemish Cap and that, if conducted annually, represents a major step forward in the assessment of the resource.

c) **Review of a Time Series of Length Frequency Distributions**

Length distribution are important in assessment of year-class strengths but, for Flemish Cap, have presented some problems regarding interpretation. Commercial length distributions from Canada, Norway, Greenland, Faroe Islands and Iceland covering the period April 1993 to October 1996 were compiled. Samples from 20 consecutive months were available from March 1995 through October 1996.

A deviation method, comparing monthly distributions with a longer term mean, was used to track strong year-classes within the period 1993 to 1996.

It was noted that the 20-month series from March 1995 to October 1996 can provide useful comparative information on the growth and maturation of the 1992 and 1993 year-classes and that such a comparison should be conducted.

Generally, both primiparous and multiparous females occurred in deeper water (>200 fm) but the former also were taken in shallow water in June, 1996. In April, 1996, the 1994 year-class first appeared in the fishery as 2 year olds but were much more evident in September, particularly in shallow water (< 140 fm). By July each year, sternal spines of the primiparous females were much reduced prior to spawning and, therefore, difficult to differentiate from the multiparous group. By August, virtually all females were egg-bearing. In October, transition of the oldest/largest males began.

Data from both research surveys and the commercial fisheries showed that age at sex reversal was variable both within and between year-classes. Sex change has been inferred between ages 2 and 3, 3 and 4 and/or 4 and 5. This complicates the modal analysis for the female age composition, particularly the multiparous group. Ages 1, 2 and 3 (mostly males) can be estimated with acceptable accuracy but, beyond that, ageing is uncertain.

It was therefore agreed that the ageing be conducted by modal analysis for males but that females be treated primarily as a composite group.

d) **Assessment Methodology**

The choice of assessment methodology for shrimp on Flemish Cap is limited by the short time series of data. The fishery only began in 1993 and, although the EU research surveys go back to 1988 and provide much useful information, the groundfish survey gear imposes a restriction on the interpretation of the results.

Currently, the assessment relies on commercial CPUE, distribution of the fishing effort, the EU survey estimates as well as size and age composition from both sources. The Canadian trawl survey, if conducted annually, will provide another useful index but there is no specific reference point or target to link with our view of stock status.

In Iceland, a production model is used which includes standardized catch rates, recruitment indices and estimates of the stock size of important predators (i.e. cod). This method, however, requires a relatively long time series which, for Flemish Cap shrimp, does not exist.

It was generally accepted that a production model designed specifically for shrimp would be a longer term goal and that, in the meantime, options for short time series analyses be investigated with statisticians.

It was proposed that a general principle would include an ecosystem approach - that shrimp is an important prey species in the Flemish Cap area and that a certain level of shrimp biomass should be maintained. This was viewed favourably but it was recognized that, lacking an absolute measure of biomass, it would not be possible to quantify.

Experience in other shrimp fisheries was discussed as a basis to assess stock status on Flemish Cap. It was noted that, in just a few years, the fishery on Flemish Cap had become a recruitment fishery. Recruitment fisheries have existed for several years in Iceland, where the shrimp stock was believed to be increasing while the cod stock declined (i.e. the fishery is incidental to natural events). The Barents Sea shrimp fishery is also heavily dependent on recruiting year-classes and a relationship with the size

of the cod stock has been observed. It is uncertain, however, if the overall situation is the same on Flemish Cap.

Olav Rune Godø (Institute of Marine Research, Norway) noted that a time series of shrimp catch and abundance estimates is available from the Barents Sea. The catch history is one of relative stability and the trawl survey series is based on data obtained by a Campelen shrimp trawl - the same trawl used by Canada in the 1996 autumn survey. **He agreed to analyze those data to determine the relationship between the survey index and catch, so that biomass estimates obtained by similar methods on Flemish Cap can be viewed in some context.** Hopefully, this can be done in time for the Scientific Council Meeting, September 1997.

Árni Nicolajsen (Fiskoránnsóknarstofan, Faroe Islands) raised the notion of hind-casting - conducting simulations based on the available data which might explain the current situation regarding shrimp on Flemish Cap. **The group endorsed this approach and agreed to supply whatever input data were needed in order to produce some preliminary results, at least, in time for the Scientific Council Meeting, September 1997.**

e) **Other Matters**

There was some discussion on how emerging problems with by-catch might be handled. It was pointed out that by-catch data from the shrimp fishery on Flemish Cap is supposed to be tabled during the June Meeting of Scientific Council. If there is a degree of urgency involved, the Chair of Scientific Council can be notified at any time and an emergency meeting can be arranged, if necessary.

The timing of the assessment for Flemish Cap shrimp by the Scientific Council was also discussed. There was agreement that the November Meeting is more appropriate than September but the group recognized the problem of possibly creating a need for a special Fisheries Commission meeting late in the year to deal with the advice from Scientific Council. The endorsement by the experts of the Canadian autumn survey for shrimp on Flemish Cap, which the much needed additional scientific data shall become available, provides a stronger scientific argument for holding the assessment later in the year. The issue will need to be raised again at the Scientific Council Meeting, September 1997.

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STACTIC Working Paper 96/1018TH ANNUAL MEETING - SEPTEMBER 1996

The Logbooks of NAFO, Size of Trawls and Codes

by

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P.O. Box 1390, 121 Reykjavík Iceland**Introduction**

In the logbooks of NAFO there are no indications of the size of trawl used. This is very unfortunate as effort could be increased substantially although the number of vessels are the same. This can be done by enlarging the trawls used or by introducing twin trawls instead of single trawls. The difficulties in calculating a comparable CPUE of various fleets is evident. Here are some suggestions as to get around this and be able to calculate a sort of standardized CPUE where CPUE is regressed on size of trawl. The standardized CPUE is then always based on the same size of trawl i.e. the CPUE is read off the regression line every year.

Size of shrimp trawl

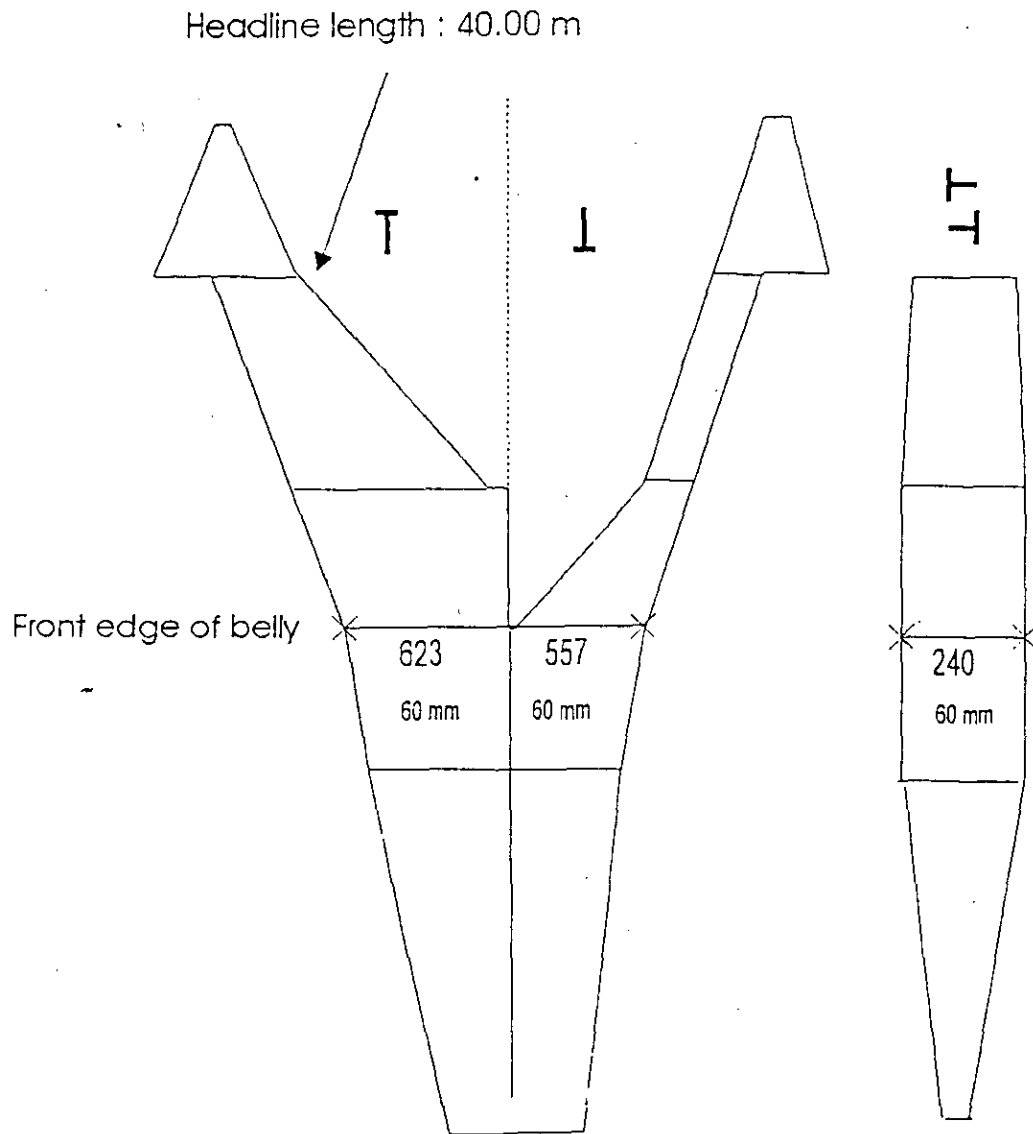
The size of the trawl is very important as the cpue is not the same in a large and a small trawl. A multiplicative model has been used to calculate CPUE for vessels of different tonnages and even horse power. As CPUE is mostly related to the sweep of the trawl it would seem most appropriate to use the wing spread or the area of the opening of the trawl.

In the Icelandic logbook there is information on the size of the trawl as well as the number of trawls operated at the same time. The measure has been the no. of meshes in the circumference of the front belly see Fig. 1. The mesh size there has to be calculated to that of a standard size, or 40 mm for shrimp trawls. As an example the mean size of the shrimp trawls of Icelandic vessels operating at the Flemish Cap was 2900 meshes in the years 1993-1996. Although Iceland has used the no. of meshes in the front belly, there are difficulties in this and mesh size 60 mm e.g. has to be calculated into that of 40 mm as shown on Fig. 1 by multiplying with a factor 60/40. It is probably easier for all nations to decide to use meters instead. Thus the circumference of the trawl on Fig. 1 where there is 60 mm mesh size in the front belly and the no. of meshes is 1660, is 99.6 m. It would also be appropriate to have headline length in meters as well.

Single or twin trawls

The fishery for northern shrimp at the Flemish Cap is carried out using a bottom trawl, the so-called shrimp trawl. The skippers are not clear on this point how to indicate that they are operating single or twin trawls. In calculating CPUE the effort of vessels operating twin trawls has to be doubled so as to be comparable to the CPUE of the vessels with one trawl. This has always been done for Iceland as Iceland uses their own logbooks as well as those specially made for NAFO. The code TBS does not say whether there is one or two trawls being operated.

Our suggestions are that in the logbook there should be included information on circumference of the front belly in meters, headline length in meters and a code or a question: one trawl, twin trawls.



Size indication:
$$\frac{-(623+557+240+240) \times 60}{40} = 2490 \rightarrow \underline{2500} \text{ messhes in 40 mm}$$

OR:

$$(623 + 557 + 240 + 240) \times 0,06 \text{ m} \\ = 1660 \times 0,06 \text{ m} = 99.60 \text{ m} \curvearrowright$$

Fig. 1 The measurements of a shrimp trawl. the position where measurement should take place is indicated by "X front edge of belly". Calculations are shown on the left side.