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International Council for the
Exploration of the Sea

C.M.1982/H.3
Pelagic Fish Committee

REPORT OF THE ICES PLANNING GROUP ON A HERRING TAGGING EXPERIMENT

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1. Terms of Reference and Participation

A resolution adopted at the 69th Statutory Meeting set terms of reference for the Herring Tagging Planning Group as:

- (i) to review the present technical problems of developing such experiments; and
- (ii) to report to the Herring Assessment Working Group for the Area South of 62°N at its meeting in 1982.

Accordingly, the Group met at the DAFS Marine Laboratory, Aberdeen, on 1-2 March 1982. Apologies of absence were received from Mr J. Molloy, Ireland, and Dr H. Dornheim, Federal Republic of Germany. The following attended the meeting:

R.S. Bailey	United Kingdom
A.C. Burd (Chairman)	United Kingdom
A. Corten	Netherlands
S. Iversen	Norway
J. Masse	France
A. Maucorps	France
J. Morrison	United Kingdom
N.A. Nielsen	Denmark
A. Saville	United Kingdom
Ø. Ulltang	Norway

2. Introduction

The ICES Planning Group reported to Delegates at the 67th Statutory Meeting on a scheme designed to attempt to answer the objectives set by an ad hoc group of the ICES Pelagic Fish Committee. These objectives were:

- (1) to estimate the strengths of the stocks in Divisions VIa and IVa;
- (2) to estimate recruitment to the stocks and to examine the inter-relation between these stocks;
- (3) to estimate natural mortality.

The Group were required to consider the area from Donegal to the northern North Sea, with tagging in May - July 1979 and recovery of tags by experimental fishing in 1980.

In its Report, the Planning Group proposed the use of micro-wire tags which had previously been used in salmonoid research. In view of the untried nature of this technique, the Delegates requested that feasibility studies should be undertaken before considering further the tagging proposal. During 1980 and 1981, Dutch and Scottish scientists have conducted a number of tests on the tagging equipment and the methods of tag detection. The results are reported below.

3. Studies in Tagging and Recovery Techniques

During 1981, the Marine Laboratory, Aberdeen, conducted two trial experiments aimed at developing a tagging method and testing an effective method of detection. In the first instance, the micro-tag size was increased from

1 mm x 0.25 mm to 1.5 mm x 0.4 mm in order to improve the detection possibilities.

It was found that the tag site in the nose, normally used in salmonoids, was not suitable for herring. Injection into the dorsal musculature was the chosen site.

Herring were caught using a pair of ring netters in June 1981 in the Clyde and in October 1981 off the Isle of Man. Releases of 4 300 and 3 000 fish were made respectively. Two tag injectors were used - one supplied by the Marine Laboratory, Aberdeen, and the other by the Netherlands Sea Fisheries Research Institute, IJmuiden.

Tagging rates of 200-350 per hour per machine were achieved. From this experience, it is considered that the maximum tagging rate possible would be no more than 500 per hour. It is clear from these experiences that the tagging rate achieved was acceptable for the objectives of the major tagging experiment previously described.

Northwest Marine Technology were invited to develop a screening system based on a 9-inch diameter tube through which tagged herring were allowed to flow. This system was temporarily set up in a processing plant for human consumption. The detection system was satisfactory, but the physical limitation of lifting boxes of fish to allow for flow of the fish through the tube is a problem which would need some attention in a full-scale experiment. Two tags were recovered from 26 tonnes screened from the Clyde taggings. In the course of tagging at the Isle of Man, about 3 000 herring were screened for tags. Four tagged fish released a few nights previously were recovered.

It was reported that a system for introducing fish to the screening device on a Dutch freezer trawler would cost about US \$10 000. Previous experience had shown that detection of tags in the environment of the processing deck was effective.

The Group considered that sufficient experience had been gained on the method of tagging and the recovery of the tags to recommend the system's adoption for the proposed tagging experiment.

4. Limitations on Tag Recovery

Under the assumptions of the initial proposal, it was supposed that in 1981 there would be no commercial fishery. All tags would have to be recaptured by charter vessels. Since that report, commercial fishing has already commenced in Divisions IVc and VIIIde and it is conceivable that more widespread fisheries might occur by 1984. If a tagging programme were agreed, it would not be possible for this to start before 1983.

The Group, therefore, discussed the possible positionings of tag detector systems. One of the requirements from the programme would be the identification of the fishing position of a recovered tagged fish. Because of the way bulk herring are handled and stored for fish meal production, it was thought unlikely that tags could be assigned to fishing location, except in exceptional circumstances.

In human consumption plants in Denmark, though tag recovery from filleting lines would be feasible, the identification of source of supply might be

difficult. In the case of the Dutch fishery, much of the catch is landed frozen or barrelled, which precludes screening ashore. This would have to take place at sea.

It was clear from the discussion that screening of commercial catches on landing would cause different problems in each country. The requirement to identify position of catch would also require different treatment in each fishery. The Group felt that these problems precluded the dependence of an experiment on the monitoring of commercial catches. For the stock estimate, reliance should be placed on charter vessel catches and inputting large number of tagged fish.

The Planning Group, therefore, proposes a limitation of the scope of a tagging experiment to an attempt to assess the size of the stock spawning in the Orkney/Shetland area in 1983/84.

5. Objectives of Proposed Programme for 1983/84

The original objectives of the herring tagging experiment were defined at the 66th Statutory Meeting (C.Res.1978/2:15) as:

- (1) to estimate the strength of the stocks in Sub-area IV and Division VIa;
- (2) to estimate recruitment to the stocks and to examine the inter-relation between these stocks;
- (3) to estimate natural mortality.

These are considered to be too ambitious with the present level of uncertainties in the herring stocks and their exploitation.

The Working Group proposes a tagging experiment in the northern North Sea (Orkney-Shetland) consisting of a release of micro-wire tags and recaptures done by chartered vessels.

The objectives of the experiment are as follows:

- (1) estimate stock size of the herring component in the northern North Sea;
- (2) a pilot experiment for a larger-scale experiment for the total North Sea and Division VIa.

5.1. Estimate stock size of the northern North Sea component

The herring spawning in the Orkney-Shetland area is a major component of the North Sea herring. The only estimates of stock size available at present are those derived from the larval surveys. The validity of these estimates is questionable because the index of larval abundance since 1978 has been above the range where the regression of VPA stock size against larval abundance is valid. Therefore, large uncertainties exist about present stock size. A stock size estimate from a tagging experiment would greatly improve the possibilities for monitoring the rebuilding of this stock component.

Acoustic surveys for herring have been carried out in this area in July each year since 1979. These have not yet given any stock size estimate. However, the surveys have given information on the distribution of the herring which can be utilized when carrying out a tagging experiment.

On the other hand, a stock size estimate from a tagging experiment would be extremely useful when evaluating the results from the acoustic surveys in the same area and in testing the validity of the stock size - larval abundance regression at higher levels of larval abundance.

The tagging must be carried out at a time when the herring in the area have separated from other components for spawning and can be found in suitable concentrations. July would probably be the best period, i.e., at about the same time as the acoustic surveys have been carried out.

The Planning Group propose that a minimum of 30 000 herring are tagged in the area shown in Figure 1 in July 1983. With the present stock size estimates, this would mean a tag density of about 1 tag per 10 tonnes of herring. Because of the uncertainties which exist as to when the fishery in this area will be re-opened and the technical difficulties which still exist in screening commercial catches, recaptures should be made in an experimental fishery with a chartered purse seiner. The experimental fishery should be carried out a year after the tag release, i.e., July 1984, to ensure that the tagged herring are properly mixed in the population. A catch of about 1 000 tonnes would be expected to give about 100 tags generating 95% confidence limits of about $\pm 20\%$ on the stock size estimate.

5.2. Problems related to a larger-scale experiment

Within a large-scale experiment, it would be preferable to be able to monitor catches from a commercial fishery. At present, some experience in screening commercial catches exists from the Norwegian tagging experiment on mackerel. However, in this experiment steel tags (20 x 7 x 1 mm) are used and the screening devices developed would have to be modified to cope with magnetic wire tags.

Therefore, the design and installation of screening devices for a commercial fishery or processing operation need to be developed.

If a fishery for herring is allowed in 1984, it would be possible to test such equipment under realistic circumstances. In this respect, the proposed tagging experiment can be regarded as a pilot experiment.

The presence of tagged fish in the sea would allow development of commercial fishery screening devices. The commercial screening equipment must be fitted to the diversity of commercial landings of herring. The landings may be grouped into the following types:

- (a) landings in bulk containers (purse seiners)
- (b) landings of boxed herring
- (c) landings in frozen blocks.

On some vessels it may be possible to screen the catch on board the vessel. The advantage of this method is an exact position of the catch. Moreover, for fish landed in frozen blocks this is the only technically feasible solution unless a system could be developed for detecting tags in blocks. For the other landings (types (a) and (b)) screening on shore might be preferable.

As has been discussed earlier, problems arise in finding suitable locations for placing tag detectors as the circumstances in factories and meal plants differ between countries and between plants within countries. It

must be left to national fisheries laboratories to investigate suitable recovery sites and to adapt systems for recovery. The Group stresses the importance of examining these problems during 1983 so that the full potential of any tagging taking place in that year could be utilized by 1984.

A common problem for the on-shore screening is the information on position of catch. A reliable system would require that individual landings (or a proportion of these) were checked and followed from landings to processing. If these problems could be solved, the screening on shore could be very efficient.

Estimated Costs of Northwestern North Sea Tagging Project

As stated above, this project has been costed on an objective of releasing 30 000 tagged herring in year n and recovering a minimum of 100 tagged herring, which will require a screened catch of 1 000 tonnes of herring, in year n + 1. Although these two aspects of the project are closely interlinked, they have been costed separately below, as the expenditure involved in each would be expected to fall in separate financial years.

The Tagging Project

A tagging experiment in the northwestern North Sea can only be carried out using a chartered purse-seine vessel. To catch sufficient herring to release 30 000 tagged fish is estimated to require 3 weeks fishing by such a vessel if the experiment is done in July, when herring are most readily available in that area. The cost of chartering such a vessel at that time of year will depend to some extent on what alternative fishing opportunities are available for the purse-seine fleet, but £25 000 per week seems a realistic estimate.

In the light of the high cost of chartering vessels, it is imperative if they are to be effectively utilized to have an adequate number of tag injection equipments on board. The Planning Group estimated that four such tag injectors would be required of which three would be supplied by participating countries. Accordingly, the estimated costs below include the cost of an additional tag injector, the associated annular magnet and field detector, and the costs of 30 000 tags. Tagging tanks, and associated piping to deliver to them a constant supply of fresh sea water, are also included at an estimated cost of £1 500. The purchase of a Tubular Tag Detector is included in order that progress may be made on the appraisal of suitable commercial recovery sites in 1983 and 1984. This will be subsequently utilized in the recovery project for 1984 when a second unit will also be required.

The estimated cost of the tagging project:

Charter of 1 purse-seine vessel for 3 weeks	£75 000
1 Tag Injector	7 400
1 Annular Magnet + 1 Field Detector	2 300
30 000 Micro-wire Tags	480
Tagging tanks, piping and accessories	1 500
1 9-inch Tubular Tag Detector	10 800
	<u>£97 480</u>

The Recovery Project

As with the tagging project, the major item of the cost in carrying out the recovery of tagged fish will be the charter costs of the fishing vessel.

This aspect of the experiment should, for a number of reasons, also be done in July of the following year. The recoveries could be made by either trawl or purse-seine but the Planning Group considered that in July in the northwestern North Sea, purse-seine was likely to be the more cost effective. As discussed above, the intention would be to recover 100 tags, which is estimated to require a catch of 1 000 tonnes of herring. It is thought that to catch this quantity would require three weeks' fishing by a purse-seiner, which is again estimated to cost £25 000 per week.

In view of the high charter costs of the catching vessel, it would, we think, be imprudent to put the vessel to sea with only one tag-detecting equipment as a malfunction of this equipment would completely negate the whole experiment. Accordingly, two 9-inch tubular detectors have been allowed for in the estimates below. These detectors also require an automatic gate to divert any tagged herring encountered to a different channel from that followed by untagged fish. The exact cost of this is not known but a figure of £6 000 should cover it. It will also be necessary to carry out some engineering work to fit the tubular detector into the purse-seiner between the separator and the storage tanks. The cost of this is impossible to estimate with any accuracy, without knowing which vessel will be chartered for this experiment, but it is considered that £1 000 should be adequate.

Accordingly, the estimated costs of the recovery project are:

Charter of 1 purse-seiner for 3 weeks	£75 000
1 9-inch Tubular Tag Detector	10 800
1 Automatic Gate	6 000
Engineering work	1 000
	<hr/>
	£92 800
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General

It should be noted that these estimates have been made at prices prevailing in 1982; that is no allowance has been made for inflation. It has also been assumed that no import duty or value added tax will be payable on items of equipment purchased from the USA. The cost of items of equipment quoted in US dollars have been converted at \$1.9 = £1.

In preparing these estimates, it has been assumed that the scientific personnel required, both for the tagging and the recovery experiments, will be supplied free of charge by the national laboratories of the participating countries. It is estimated that four scientists will be required on the tagging vessel and a minimum of two on the recovery vessel. It has also been assumed that the travel costs of these scientists to and from the home port of the chartered vessels will also be paid by their own laboratories. As estimated above, therefore, the total cost of the complete experiment is £190 300. It might be wiser to round this up to £200 000 in order to leave some margin for unforeseen contingencies.

It should also be noted that this project has been costed on the assumption that none of the costs will be offset by sale of fish surplus to scientific requirements. This was considered advisable in the light of the uncertainty about the regulations governing the herring fishery in Division IVa when the experiment will be carried out. It should be noted, however, that even at current prices for herring for reduction to fish meal, the catch

taken during the recovery side of the project would have a market value of about £70 000.

6. Future Development

The above plans are based upon one single tag release and a subsequent experimental fishery for recovering tags from that release. This will give a stock estimate for one particular year. If the tag release could be repeated in 1984 and subsequent years, the tagging data would provide updated stock estimates and estimates of mortality rates.

Since for reasons of cost it is considered unrealistic to repeat the experimental fishery for one or more years, a continuing tagging project depends on solving the major problems in screening commercial catches. If by 1984 it is clear that significant progress has been made in this respect, it should be seriously considered whether a new batch of tagged herring should be released in that year as part of the experimental fishery project. It could also then be considered whether the experience gained so far is sufficiently good to justify an area extension of the project.

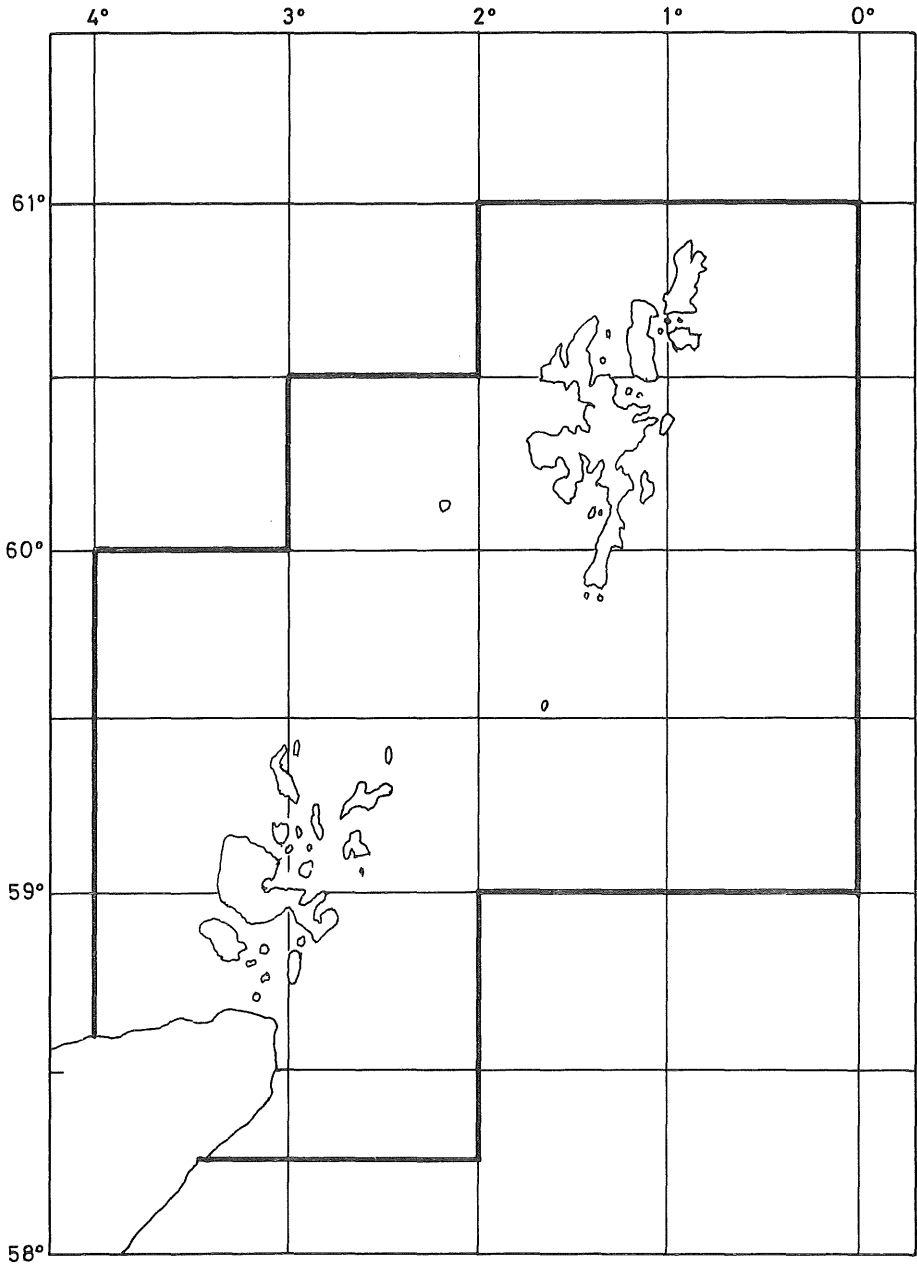


Figure 1. Area for proposed Herring Tagging Experiment in July 1983.