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Report of the Workshop on salmon tagging archive (WKSTAR)

19-21 June 2012

ICES Headquarters, Copenhagen, Denmark



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Executive summary

The Workshop on Salmon Tagging Archive (WKSTAR), chaired by Lars Petter Hansen, worked by correspondence in 2010/2011 and met at ICES Headquarters, Copenhagen, Denmark, on the 19–21 June 2012. The purpose of the Workshop was to ensure that the data compiled by the previous Workshops (WKDUHSTI, WKSHINI and WKLUSTRE) are fully archived and documented before they are lost. It was expected to result in the preparation of a Cooperative Research Report and peer-reviewed publications. The Workshop developed an outline for a Cooperative Research Report. In addition, one paper based on the data were presented at the at the NASCO/ICES Salmon Symposium held in La Rochelle, France in October 2011, and a range of analyses have subsequently been incorporated into two papers published in ICES Journal of Marine Science in November 2012.

The Workshop undertook further checking and tidying of the tag recovery databases for Faroes and Greenland to identify, correct and resolve various anomalies in the datasets. Both Greenland and Faroes databases were updated, but there is still lack of some information. It was agreed that key scientists should be asked to consult with the “data owners” in the countries that have provided records of tag recoveries to obtain permission to include the data in the ICES database. This was organized by the chair, and all data holders granted permission to develop the database.

1 Introduction and background

Most countries in the North Atlantic have tagged a large number of salmon at different life stages over the past 50 years, but many of the tag recoveries in distant waters have not been properly analysed and published. Previous workshops (WKDUHSTI (ICES 2007), WKSHINI (ICES 2008) and WKLUSTRE (ICES 2009)) have reviewed published information including the grey literature, presented and evaluated data (quantity and quality) available from different countries, compiled an inventory of available databases and evaluated metadata for georeferencing. These workshops have also made significant progress with preparing historical tag recovery data in a standardized format and modelling the results using a GIS approach. The purpose of this final Workshop was to ensure that the data compiled by the previous groups are fully archived and documented before they are lost. It was expected to result in the preparation of a CRR and peer-reviewed publications.

WKSTAR brought together the work of the previous workshops:

- REPORT OF THE WORKSHOP ON THE DEVELOPMENT AND USE OF HISTORICAL SALMON TAGGING INFORMATION FROM OCEANIC AREAS (WKDUHSTI; ICES 2007).
- REPORT OF THE WORKSHOP ON SALMON HISTORICAL INFORMATION – NEW INVESTIGATIONS FROM OLD TAGGING DATA (WKSHINI) (ICES 2008).
- REPORT OF THE WORKSHOP ON LEARNING FROM SALMON TAGGING RECORDS (WKLUSTRE) (ICES 2009).

Additional information was provided from the ICES-NASCO symposium: Salmon at Sea: Scientific advances and their implications for management held in La Rochelle, France in October 2011. In the proceedings from the symposium (see Hutchinson 2012 ed), two publications based on data from the three workshops were published (Jacobsen *et. al.* 2012; Reddin *et. al.* 2012).

2 Development of database structure

The Workshop undertook further checking and tidying of the tag recovery databases for Faroes and Greenland to identify, correct, and resolve various anomalies in the datasets. Further corrections (e.g. interpreting codes in the Canadian data) will be resolved by correspondence before the datasets are all combined. It was proposed that the datasets should be stored as an Excel workbook as well as a single Access database.

The structure and contents of the databases was discussed. Important issues were access and use of data. Consultations were made with the ICES Data Centre.

It was agreed that key scientists should be asked to consult with the “data owners” in the actual countries to give permission to include the data in the ICES database.

Initial consultations were held with the ICES Data Centre (Neil Holdsworth) to determine the procedure for submitting data to the Data Centre and for accessing it. At present the Data Centre does not hold any tagging data, and the current structure does not provide any logical ‘home’ for it. The submission of the salmon tag recovery data may be treated as a test case for expansion of the Data Centre in this area.

Permission to include the actual data in the database was granted from the data holders.

3 Database updates

3.1 Update on Faroese salmon tag database

The database of tag recoveries derived from fish recaptured in the Faroese fishery was compiled at the three historical salmon tagging Workshops (WKDUHSTI, WKSHINI and WKLUSTRE) (ICES, 2007, 2008, 2009.) by the various Workshop participants. Some further tag records and checking of entries was completed during the present Workshop (WKSTAR).

During the period 1968–2000, 2645 tags were recovered from the salmon fishery: 2258 individually numbered Carlin tags (Carlin, 1955), 383 batch-numbered coded wire tags and 4 T-bar external. These tags had been applied to salmon in 13 countries or jurisdictions (hereinafter countries): Canada, Denmark, Iceland, Ireland, Faroes, France, Norway, Spain, Sweden, the United States, and the UK (England and Wales, Northern Ireland and Scotland). No tag-recovery data were available for Russia.

The recovery data obtained from the fishery included tag number, recovery position, origin (country), date of tag recovery, and size of tagged salmon. Of the 2646 tags, the tag-recovery location was known for 2504 salmon. However, in some cases the location was coded to be inside the Faroese EEZ (north of the Faroes), and not the precise recovery location.

Sea age of the salmon was calculated from the release date to the date of tag recovery. Salmon recaptured during their first winter at sea were termed 1SW salmon, irrespective of whether they were recovered during autumn or the following winter. The same rule was applied for salmon in their second (2SW), third (3SW), etc., winter at sea. The 2+SW fish were collectively termed MSW salmon. The implications of the sea-winter definition are that the sea age was considered to change by the end of October and not at the beginning of the year. Hence, salmon were assumed to have the same sea age throughout autumn and following winter fishing seasons, i.e. from November in the year i to October in the year $i + 1$.

The Faroes tag database is compiled into one file with recoveries from countries/jurisdictions containing latitude and longitude values for locations at Faroes.

The text table below (Table 1) summarizes the content of the Faroes tagging database (ordered by number of tags recovered):

Table 1 Content of the Faroes tagging database (ordered by number of tags recovered):

COUNTRY	NO. TAG RECOVERIES	ORIGIN OF TAGGED FISH
Norway	1760	external tagging of smolts.
Sweden	367	external tagging of smolts on the west coast of Sweden
Ireland	158	CWT tagging of smolts.
Scotland	135	mainly from external tagging of smolts.
Faroes	99	external tagging of salmon smolts released in the Faroes used in ocean ranching in the 1980s and early 1990s; the smolts were originally introduced from Norway (Sundalsøra, northwestern Norway) for salmon farming.
England and Wales	69	mainly CTW tagging of smolts.
Iceland	27	mainly from CWT tagging of smolts.
N. Ireland	8	CWT tagging of smolts on the River Bush.
Canada	6	5 external and one CWT tagged smolts in Maritime Canada.
Denmark	3	Carlin tagged smolts in west and north Jutland in the mid 70s.
USA	2	one external and one CWT tagged smolts from Penobscot River
Spain	1	CWT tagged smolt in Eo River in 1993.
France	1	CWT tagged smolt in a Bretagne river.

3.1.1 Recent analyses

The information contained in the Faroes database was examined to describe the distribution of salmon of different origins and sea ages in the sea around the Faroe Islands. The results were incorporated into a presentation made at the NASCO/ICES Salmon Symposium held in La Rochelle, France in October 2011, and a range of analyses have subsequently been incorporated into a paper (Jacobsen *et. al.*, 2012).

3.2 Update on West Greenland tag database

The database of tag recoveries derived from fish recaptured in the Greenland fishery was largely compiled at the first two historical salmon tagging Workshops (WKDUHSTI and WKSHINI) by the various Workshop participants. Some further tag records and checking of entries was completed during the subsequent WKLUSTRE Workshop, and limited validation of country datasets has continued since this time. The relatively small numbers of tag recoveries arising from the biological sampling programme in the West Greenland fishery in recent years have also been added to the database (N.B. data for 2010 and 2011 sampling programmes not yet included). In addition, a worksheet within the database, which provided a collation of all the coded wire microtags (CWTs) recovered at Greenland (from 1985 to present) for all tagging countries, was split between the various appropriate tagging agencies, and the previous separate CWT sheet was removed (to avoid possible duplicate entries).

The West Greenland tag database now comprises 13 separate country/jurisdiction worksheets of tag recovery data, together with three information worksheets (a sheet containing latitude and longitude values for locations at Greenland, a sheet providing descriptors of all the fields in the database and a 'read me' sheet). The text table below summarizes the data in the 13 tag data sheets:

Table 2. West Greenland tag data

COUNTRY	NO. TAGS RECOVERED	ORIGIN OF TAGGED FISH	COMMENTS
USA	2,522	mainly external tags resulting from smolt tagging programmes).	These data have been subject to recent extensive validation by US scientists (Tim Sheehan and Alicia Miller) and are understood to be as complete as possible. A small number of US origin tags caught at West Greenland but recovered from fish imported into Ireland were added to the database during the validation exercise.
Canada – Sand Hill River.	86	all derived from external tagging of smolts in the late 1960s /early 1970s.	The worksheet contains a separate tabulated output from a separate Canadian tagging database; this has been pasted below the standardised data. These data were subject to earlier validation by Canadian scientists and are understood to be as complete as possible.
Canada – Maritimes	1,643	largely derived from external tagging of smolts.	These data were subject to earlier validation by Canadian scientists and are understood to be as complete as possible. However, some anomalous entries remain in columns U (Life history Stage) and V (River Age). For archiving purposes, it would likely also be helpful to have a separate 'read me' file in respect of the tagging location (Column L) which is currently provided as a two letter code.
Canada – CWT and	118	mainly derived from CWT programmes in	These data were subject to earlier validation by Canadian scientists and are

recent external		the 1980s/90s and external tags recovered since 2003.	understood to be as complete as possible. Tagging details (date and for some records location) are not currently provided in respect of the CWT recoveries. A small number of Canadian origin tags caught at West Greenland but recovered from fish imported into Ireland were added to the database during the validation exercise.
Norway	148	external tagging of smolts	These data were subject to earlier validation by Norwegian scientists and are understood to be as complete as possible. Three recent recoveries from East and West Greenland in 2009 have been included.
Iceland	24	mainly from external and CWT tagging of smolts	These data were subject to earlier validation by Icelandic scientists and are understood to be as complete as possible.
Ireland	146	mainly from CWT tagging of smolts	These data have been subject to recent validation by Irish scientists (Anne Cullen and Niall O' Maoiléidigh) and are understood to be as complete as possible. A small number of Irish origin tags caught at West Greenland but recovered from fish imported into Ireland were added to the database during the validation exercise.
N. Ireland	3	CWT tagging of smolts on the River Bush.	These data have been subject to recent validation by N. Irish scientists and are understood to be as complete as possible. The data include a single tag caught at West Greenland but recovered from fish imported into Ireland.
Scotland	403	both external and CWT tagging of smolts.	These data have been subject to recent validation by Scottish scientists (Gordon Smith) and are understood to be as complete as possible.
England and Wales	393	largely from external and CWT tagging of smolts.	These data have been subject to recent validation by English scientists (Ian Russell) and are understood to be as complete as possible. A small number of EandW origin tags caught at West Greenland but recovered from fish imported into Ireland were added to the database during the validation exercise
Spain	3	recent CWT tagging of smolts	
Faroes	1	from CWT tagging	The fish was caught at West Greenland but recovered from fish imported into Ireland.
International Tagging Experiment at West Greenland.	236	adult fish caught and tagged in the West Greenland as part of a collaborative international ICES/ICNAF tagging	The majority of tag recovery data derive from a single year (1972), the main tagging year. Full tagging and recovery details for the other earlier years could not be uncovered and only a few records based on fish tagged by Canadian

investigation in the late 1960s / early 1970s.	scientists were included. The whereabouts of the other data are unclear, despite efforts to locate this.
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3.2.1 Recent analyses

The information contained in the West Greenland database was examined to describe the distribution and growth of salmon of different origins. The results were incorporated into a presentation made at the NASCO/ICES Salmon Symposium held in La Rochelle, France in October 2011, and a range of analyses have subsequently been incorporated into a paper (Reddin *et. al.*, 2012).

4 Next Steps

The data in the separate worksheets are available in a consistent data entry format so could readily be combined into a single NW Atlantic data sheet if this was felt to be most suitable format for archiving (but note the additional information pasted into the bottom of the Canada- Sand Hill sheet, which is probably surplus to requirements).

It would be useful to resolve the minor data entry anomalies in the Canada-Maritimes sheet. If nothing else, the current incorrect values in columns U and V should be deleted and replaced with blanks before the data are archived.

A few tags recovered at West Greenland in 2010 and 2011 could be added.

The Databases are enclosed (EXCEL files)

1) Complete the preparation of a draft report

The development of the draft Cooperative Research Report was a major issue of the Workshop. The Workshop provided a draft outline of the CRR with initials of the key drafting person which can be seen in appendix 2.

2) Recommendations:

The Workshop recommended that:

ACTION	WHO	WHEN
The outline CRR report structure agreed during the Copenhagen meeting should be circulated to WK members for final adoption	Lars Peter Hansen	Done
Members of the WK should complete drafting sections of the CRR and liaise by correspondence	WK Members	In progress
A proposal for publication of the CRR should be submitted to ICES	Niall O'Maoileidigh	Done at ICES ASC
Discussions should be continued with the ICES Data Centre concerning storage of the databases	Ted Potter	For publication of CRR
Owners/originators of the data should be contacted to seek agreement for storage of data in ICES Data Centre		Done
First draft of the CRR to be circulated to national data contacts for approval	Lars Peter Hansen	The outline circulated and adopted

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Appendix 1 List of Participants

Name and contact details of participants of WKSTAR

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Appendix 2. CRR Report draft outline

- 1) Background (all WK reports)
- 2) Introduction (Literature review) (WKs and papers)
- 3) Tagging programmes – by country (WKDUHSTI)
 - a. Structure
 - i) Objectives
 - ii) Time period
 - iii) Numbers tagged
 - iv) Hatchery v wild
 - v) Specific issues about data use
- 4) Tag Recovery Databases
 - a. Describe structure and format etc. (WKDUHSTI)
 - b. Access procedures from ICES data Centre
 - c. Permissions and restrictions on data use
- 5) Faroes tag recovery database (include Faroes adult tags)
 - a. Summary descriptions of data
 - b. Maps and summary figures
 - Table Summary of databases metafile
 - Figure Number of tags by year country (Stacked bar)
 - Map of recovery information using lines by country colour code by sea age
- 6) West Greenland tag recovery database
 - a. Summary descriptions of data
 - b. Maps and summary figures
 - Table Summary of databases metafile
 - Figure Number of tags by year country (Stacked bar)
 - Map of recovery information using lines by country colour code by sea age
- 7) Other marine tag recoveries
 - a. Norway – longline data
 - b. Ireland coastal
 - c. UK coastal
 - d. North America????

8) Analyses of recoveries

- a. Summary of analyses in summit papers (see intro)
- b. Distribution by country of origin, time and space
 - Differences in sea age distribution and season distribution
 - Migration timing?
 - Growth over time SST (e.g. with IFF for Faroes)
 - Influence of currents

- c. Additional material not included in papers:

New stuff referred to by DR which was removed from JMS because it was too long

Hatcheries/Wild?

PCA output

Kernal plots and strength of associations

Relate Greenland and Faroes relative proportions (maybe relative production in PFA from each country as a scalar)

Putative migration routes and timing from recaptures – links with KAJ migration model

What about returning migration? Can we describe this better?

Importance of E. Greenland in the migration route (note larger proportion of USA and Norway fish in E. Greenland relative to others?)

Missing link between sub adult and adult stages at sea

Proportions by country contributing to Greenland and Faroes fisheries based on tag recoveries – from WGNAS or new analysis.

9) Conclusions

10) Appendices:

participants in WK meetings

participants in all tagging studies Acknowledgements

contacts for further information on tagging studies (see 4c)

11) References

Appendix 3. Follow up on recommendations and progress from the WKLUSTRE Workshop:

All the tag data used by the Workshops should be compiled into a single database and made available to all Workshop members. Done

Arrangements should be made for the long-term storage of the tag database so that the data are not lost. Permission should be sought from the owners of the tag data to store the data centrally, and the ICES Data Centre should be asked whether they would be willing to act as the central repository. In progress. Support received from the ICES data Centre

Access to the tag database should be restricted two years after a final approved version is available to those involved in the three Workshops to fulfil the analyses initiated by the Workshop members. After that time the data should be made freely available, where this is acceptable to the owners. In progress.

The reports of the three Workshops on salmon tagging data, WKDHUSTI, WKSHINI, WKLUSTRE, should be combined into a single Co-operative Research Report which should be designed to provide a permanent record of the background to the tagging studies and the data in the tag database. In progress

The analyses initiated by the Workshops should be written up in peer-reviewed papers; provisional topics

- Tag recoveries and adult salmon tagging at Greenland. Done
- Adult salmon tagging in the Norwegian Sea. In progress
- Tag recoveries at Faroes – Jan Arge Jacobsen.

Additional papers could address recoveries in coastal waters although these tag recoveries are not included in the database.

Appendix 4. CRR Databases: contact persons identified at the Workshop

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