



Agenda Item 6.2
For Information

Council

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***Recent investigations into the stock composition of coastal fisheries
in Scotland.***

(Tabled by EU-UK (Scotland))

Recent investigations into the stock composition of coastal fisheries in Scotland

Introduction

In Scotland, it is acknowledged that coastal fisheries are highly likely to be mixed stock in nature. Further, it is recognised that in accordance with the NASCO Guidelines for the Management of Salmon Fisheries

(http://www.nasco.int/pdf/far_fisheries/Fisheries%20Guidelines%20Brochure.pdf)

“Rational management of a MSF (mixed stock fishery) requires knowledge of the stocks that contribute to the fishery and the status of each of those stocks”. This paper provides brief background information on the nature of Scottish coastal MSF fisheries and describes the recent investigations that have been undertaken to assess stock composition in these fisheries.

Background

Over the period 1952 to 2013, there has been a marked decline in the Scottish nominal catch from a peak of ca. 1500 tonnes to the current level of ca. 120 tonnes per annum. Throughout this period the percentage of the nominal catch taken by coastal fisheries has remained at ca. 40%, catches in recent years being ca. 50 tonnes per annum. There has been a substantial reduction in the scale of these fisheries since 1952 and the present effort deployed is only 5% of the highest recorded value. There are a number of types of coastal nets but all are operated close to the shore and are indeed prohibited beyond 1500 m from the shore.

In 2013, there were 34 active coastal fisheries reporting either catch or effort to the Scottish Government. However, the overall coastal catch was not apportioned equally among fisheries with a small number accounting for the majority of the catch. The largest four fisheries accounted for 79% of the total reported coastal fishery catch,. The remaining 30 fisheries accounted for just 21% of the total reported coastal fishery catch. The largest fishery, accounting for 43% of the total coastal fishery reported catch, is based on the east coast adjacent to the river South Esk. The second largest fishery, accounting for 16% of the total coastal fishery reported catch, is located on the north coast at Armadale. Investigations have begun to determine the stock composition of the catch in both of these fisheries.

Recent investigations into the stock composition of coastal fisheries

South Esk radio tracking investigation

In Scotland, the number of spring salmon (early running MSW fish) in the rod catch have generally declined since the early 1950s, although in recent years, numbers have stabilised, albeit at historically low levels. However, on the river South Esk rod catches have not stabilised but have continued to decline, despite a range of statutory and voluntary measures being introduced in both the coastal and freshwater fisheries, leading to concerns about the status of this particular sub-stock in this river. A radio tagging and tracking project was conducted using salmon caught in the South Esk coastal net fishery in the spring of 2012 and 2013 with the aims of determining (a) the spawning location of these fish (as a prerequisite of for targeted freshwater investigations) and (b) to assess the degree to which the coastal

fishery is mixed stock in nature. A number of radio receivers were deployed in the river South Esk to track the migration of salmon in the river and, in addition, individual receivers were sited on a number of other east coast rivers. The number of salmon tagged and the number subsequently detected in different locations are given in Table 1.

Table 1. The number of salmon tagged and the number and location of subsequent detections in 2012 and 2013.

Year	Number tagged	Number and location of subsequent detections						
		Spey	Don	Dee	North Esk	South Esk	Tay	Tweed
2012	153	See footnote (a)	2	7	16	18	5	See footnote (a)
2013	38	2	0	0	5	5	2	0

Footnote (a): Not monitored in 2012.

Interpretation is complicated as not all the tagged salmon were subsequently detected and tracking was only undertaken on a small number of east coast rivers. However, it is possible to derive an estimate of the contribution of the South Esk stock to the coastal fishery. This was estimated to be between 8 and 25% in 2012 and between 11 and 29% in 2013. The wide distribution of detections relative to the tagging site is similar to that observed in earlier coastal experiments, carried out at various locations around the Scottish coast, using external tags and relying on recapture reports from the fisheries active at the time (Malcolm *et al*, 2010). In conclusion the South Esk near shore coastal fishery is highly mixed stock in nature.

Genetic approaches

Genetic approaches to stock discrimination are now being explored and may allow assignment of fish caught in any fishery/location to area of origin. The potential advantages of such approaches, if they work, are that they do not rely on extensive tracking programmes, recaptures from active fisheries, which in themselves compound interpretation, and large numbers of fishery samples might be assessed relatively cheaply. Such techniques rely on identifying informative genetic variation from freshwater baseline sample sites at a level that is informative for the particular management question being addressed.

Two types of genetic marker may be used, namely microsatellites or Single Nucleotide Polymorphisms (SNPs). Microsatellites comprise short regions of DNA where sequences of genetic bases are repeated a variable number of times and hence the regions differ in length depending how many repeat units are present. SNPs are the most common type of genetic variation (every few hundred bases) where variation occurs at a single genetic base.

The approach requires that an extensive number of baseline samples are screened for either a set of microsatellite markers or a large number of SNP markers with cluster analysis then being used to select a set of markers that can provide differentiation among stocks at different geographic scales.

Application of the concept at a gross scale of definition is evidenced by a recent contract work undertaken by Scottish Government geneticists in collaboration with Environment Agency staff in England to determine the stock composition of the various coastal fisheries

operating off the North East of England (Gilbey *et.al.*, 2012). In this case, a suite of 14 microsatellite markers, as used in the EU SALSEA-Merge project (Anon, 2011), allowed the assignment of fishery samples at a regional scale but not at the smaller river scale. The derived assignments were to those previously found using external tags (Potter and Swain, 1982).

The results from the study above strongly indicated that higher genetic resolution was required before finer scale (i.e. river level) assignments of fishery samples could be achieved. Therefore, with respect to assessing stock composition in Scottish coastal fisheries, variation in SNPs have been examined. We have collected a SNP baseline comprising 147 sites and a total of 3,787 fish. The material has been screened using the 'V2-salmon SNP microarray' to provide ca. 5,000 SNPs per fish. Cluster analysis has been performed to identify hierarchical assignment units of regions with similar genetic signatures and a suite of 288 SNPs identified which best differentiate between these regions. Within regions, we are currently selecting sets of SNPs with the aim of achieving finer geographic assignment of fishery samples, for example to rivers where possible. Fishery samples have been secured for both the South Esk and Armadale coastal fisheries and will be screened once the most appropriate suite of SNPs has been finalised.

References

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