

RURAL AFFAIRS AND ENVIRONMENT COMMITTEE

WRITTEN SUBMISSION FROM MARINE SCOTLAND SCIENCE FOR EVIDENCE SESSION ON THE DECEMBER FISHERIES COUNCIL

Role of Marine Scotland Science (MSS) – Marine Laboratory

MSS Marine Laboratory provides scientific advice on fish stocks and the aquatic environments in which they live. The Marine Ecosystems Programme (MEP), comprising 87 staff, deals with marine stocks managed nationally (under Scottish and UK legislation and usually in inshore waters) and stocks which come under EU or wider international management. The principal MEP activities can be summarised as follows:

Data collection- MSS staff collect quantitative information on exploited fish species from two main sources. Fishery dependent biological data on age and size composition are collected in ports (about 2500 samples per year) and on board commercial vessels during 'observer' trips (about 150 such trips per year). Information is raised to total fleet levels. Fishery independent data is collected during about 20 fisheries directed cruises on FRVs *Scotia* and *Alba na Mara*. Survey techniques include the use of trawls, plankton samplers, acoustics (echosounders) and underwater television. Some of the surveys are internationally coordinated and the EU now contributes funds for data gathering under the Data Collection Framework (DCF). Data are worked up according to agreed protocols in preparation for stock assessments. In addition to routine activities, MEP also conducts shorter term research projects to investigate underpinning biological topics (for example on stock structure, migration or reproduction). This work may also receive some external funding and is frequently conducted in collaboration with international colleagues and draws on expertise in the universities of Scotland and the wider UK. Recent developments include particularly close associations with Aberdeen, St Andrews and Strathclyde Universities and further enhancement of marine science is expected under the MASTS programme.

Assessment - Direct counting of fish in an entire population is generally impossible so abundance estimates must be inferred using mathematical models and the data described above – in particular the number of fish of different ages, the length, weight, maturity, capture location, fishing time, and whether landed or discarded. The standard output statistics are catch by weight, fishing mortality (which is the rate of removals from the population by the fishery), spawning-stock biomass (which is the total weight of sexually-mature individuals in the population), and recruitment (the number of young fish entering the population each year). Uncertainty in the process can arise through measurement error, samples not being fully representative of the population, and incorrect assumptions about the fishery or natural processes. Even without these problems, fish stocks are naturally highly variable in space and time leading to variable estimates from stock assessments. The important issue for scientists is how to characterise this uncertainty, while managers need to be able to understand and account for the uncertainty appropriately in their management decisions.

Forecasting catches and evaluation of management measures. In addition to assessing past state of fish stocks, fisheries scientists need to forecast what is likely to

happen in the stock in the future and what catches and landings can be expected (TACs are currently a tool used to regulate landings of fish). Forecasts involve taking parameters of growth, recruitment and mortality and 'rolling' the population forwards in time. The presentation of scenarios with different rates of future mortality provides managers with an indication of the consequences for future stock condition and landings of increasing or decreasing the removal rate. Forecasts tend to be more uncertain than assessments since future growth, recruitment and industry responses are highly variable and difficult to predict. MEP is also involved in the development and evaluation of management measures. This process essentially looks forward and seeks to find solutions that fishery managers can use to meet objectives. Management measures include output control such as TACs or input controls such as effort regulation - the cod recovery plan has involved considerable work in this area. A wide variety of technical measures including fishing gear controls are utilised and MEP has a renowned research group working on novel gear designs and the measurement of net selectivity. Closed areas are sometimes employed as additional input controls and recently, information was provided on real-time closure schemes.

Advice – A key function of MEP is the provision of advice to the Marine Scotland policy divisions. This ranges from interpretation of the latest assessments, advice during the development of policy and assistance in responding to external drivers such as EU management suggestions. The work can be strategic, for example towards long term sustainable goals, or shorter term in response to rapidly changing events arising from in-year international negotiation or national management initiatives.

Scientific frameworks

ICES (International Council for the Exploration of the Sea) is a body which convenes and coordinates scientific research, monitoring and assessment mainly in the NE Atlantic. Membership cuts across regional and political organisational structures providing a forum into which data on internationally distributed and exploited stocks can be fed. A number of 'clients' (including the EU) commission work from ICES. Scientific Working Groups are convened to perform assessments of stocks in different areas and member countries nominate scientists (such as those employed at MSS) to participate. The output is a detailed Working Group report which explores available data and performs assessments. The ICES advisory committee (ACOM) delivers advice. ICES particular focus has been on stock assessment and the provision of forecasts of catching opportunities given particular stock condition and management constraints. MSS scientists participate in the work of ICES at every level.

The EC DG Mare has its own advisory body, the Scientific Technical and Economic Committee for Fisheries (STECF). This committee forms a statutory role for the EC and it is this body that the Commission is formally required to use for scientific and economic questions. This committee is appointed by the Commission and is made up of experts who provide advice in a 'non-representational' capacity on behalf of the European public. STECF focuses most on delivery of appropriate management given the stock assessment outputs that ICES provides. The inclusion of economists and technical expertise provides a more holistic view of fisheries. In recent years both scientific bodies have given advice in the context of internationally agreed sustainability objectives.

For most species, ICES provides annual advice which is reviewed by STECF in July. A few species such as mackerel are dealt with in October. A detailed synthesis of the 2010 outcomes for stocks of key interest to Scotland is provided in the submission from Tom Edwards (SPICES) who has consulted MSS in the preparation of the material. A CD containing all the ACOM advice and summaries of the main scientific issues for key stocks has been provided by MSS to the clerks of the Committee.

The remainder of this submission deals with broader fisheries management issues for which advice from MSS is increasingly sought.

Important concepts shaping current European fisheries management and scientific advice

The current objectives for fisheries management in Scotland arise from governmental commitments coming from the World Summit on Sustainable Development at Johannesburg, 2002 and the EC Common Fisheries Policy. These are intended to improve the long-term viability of the fisheries sector through sustainable exploitation of living aquatic resources, taking account of the environmental, economic and social aspects in a balanced manner. A number of basic concepts and specific management tools have developed in order to try to meet the commitments:-

Reference points provide a 'sign post' approach for judging the states of stocks. Limit reference points are provided for stock size and the fishing mortality rate and these set the safe biological limits to the stock and fishery. Precautionary approach reference points are used in practice to account for the uncertainties in measurements, the variability in the biology of the stock, and the resulting risks of depleting the stock. Management should react by reducing a fishery when it reaches precautionary reference points to ensure the stock does not decline towards the limit points. The precautionary approach, which has been in place since about 1998, provides advice for management in relation to these limits.

In addition to the precautionary approach which considers only avoidance of problems, current European fisheries management plans are being developed with specific targets. These long term objectives are to be achieved through single stock multi-annual management plans with a target fishing mortality or harvest rate that gives the maximum average yield in the long term (they are frequently termed long term management plans - LTMP). The plans can include other aspects such as limits to changes in TAC from year to year or restrictions on fishing effort. Currently such plans are in place for stocks such as North Sea haddock, saithe and herring and for west coast herring and the widely distributed mackerel. MEP staff have been heavily involved in the development of many of these plans.

One of the targets used as a basis for long term sustainability is based on considerations of maximum sustainable yield (MSY). Recently the EU Commission requested ICES to provide advice which would provide the quickest way to reach F_{msy} by 2015 (the target date set in the international agreements). Some of the management-plan targets mentioned above are generally intended to lead to MSY. There are however difficulties with the approach. The fishing-mortality rate that should lead to MSY, known as F_{msy} , can be difficult to estimate, and it can also be difficult to try to ensure that all stocks in an area are fished at F_{msy} at the same time.

Notwithstanding the technical and operational difficulties, many stocks are currently fished at rates greater than F_{msy} , and the general intention to reduce fishing mortality is likely to have benefits to the sustainability of all such stocks. It is of note that some stocks already fished at the F_{msy} level have performed well in recent years and have provided sustained fisheries – one of the most notable is North Sea haddock.

Science input to international management frameworks

Scotland participates in a number of shared international fisheries. These shared fisheries are subject to agreements and shared management of catches or regulation of fishing or management plans based on harvest rules. Managers are responsible for providing the plans' framework and work with scientists to ensure that the management plans will deliver what is expected and in line with objectives. Scientists use simulation studies as a basis for advice to managers on the likely consequences of various management actions. MEP scientists regularly support SGMD fisheries managers in a range of international forums. The timing of key negotiations on fishing opportunities is presently linked to the emergence of the scientific advice. Advice on pelagic stocks is particularly required for coastal state negotiations this is followed by EU/Norway talks which impact heavily on the TACs for a number of North Sea pelagic and demersal species. NEAFC deals with fully international fisheries. Increasingly regular negotiations between the EU and Russia regarding Rockall haddock are actively supported by MEP scientists. The year culminates with the EU Council of Ministers when stocks solely under EU control within the CFP are dealt with. The Common Fisheries Policy (CFP) of the European Union (EU) stipulates, to a large extent, how the shared resource of fish in EU waters is to be utilised by the nations participating in the fisheries. Countries can also choose to implement unilateral measures, but EU regulations are intended to be binding for all. MEP scientists have been particularly heavily engaged during 2010 in issues surrounding two key stocks, mackerel and North Sea cod.

North east Atlantic Mackerel

In 2010 MSS participated with international colleagues to survey the mackerel stock. Every three years, research vessels from several European countries survey a vast area of water to the west of the British Isles and the Bay of Biscay. They sample the water for mackerel eggs, which tells us how many eggs there are in relation to the number of parent fish: The provisional total annual egg production in 2010 was estimated at one and a half thousand trillion or 1.54×10^{15} !! These data were fed into the latest assessment along with data from the international catch at age.

On the basis of the latest assessment, both the spawning stock biomass and fishing mortality show that the stock of North East Atlantic mackerel is currently being managed sustainably. The spawning stock biomass for 2010 was estimated at approximately 3 million tonnes. This is more than the amount considered to be required to ensure the stock will continue to support sustainable fishing into the long-term. The fishing mortality rate equates to taking approximately 20% of the stock per year. This rate is almost exactly the recommended rate, estimated to provide the long term maximum sustainable yield from the stock. The sustainable management to date

has been largely brought about by a long term management plan developed by the EU, Norway and Faroes. Such arrangements have gradually brought the fishing rate on the mackerel stock down to sustainable levels and resulted in increase in stock size. The current plan was drawn up to manage the stock into the long term, by maintaining a healthy spawning stock biomass and restricting fishing to a rate that is consistent with protecting it for the future. Unfortunately, as a result of quotas being exceeded by several nations, it is estimated that in 2010, 930,000 t will be removed from the stock, compared with a recommended catch of 572,000 t. The future is now jeopardised by the excessive catches being taken.

Cod recovery, effort management and scientific support work for alternative management approaches

A revised cod recovery plan was agreed at the end of 2008. This relies on effort management in addition to quota management using a framework which seeks to reduce fishing mortality and rebuild the stock to more sustainable abundance levels.. This allocates to member states a fishing effort allowance (in KWdays) which is managed nationally. Depending on success in reducing the fishing mortality rate to a long-term target level ($F = 0.4$), the effort allowances are adjusted downwards annually. Member States may choose to employ methods other than further effort reductions provided they deliver the equivalent reduction in fishing mortality. In Scotland the pioneering Conservation Credits scheme of 2008 was further developed in 2009 as a way of providing options to fishermen to achieve these reductions.

Evaluation of the outcomes of the Scottish Conservation Credits initiative in 2009 was carried out by STECF in 2010 on the basis of material supplied by MSS. Comments from STECF were favourable and constructive and STECF acknowledged the efforts made by all involved by the co-management process. It was noted that the principle measures used (Real Time Closures (RTCs) and selective gear measures) were in the right direction, that the level of implementation had been high and that compliance had been good. STECF drew particular attention to the 144 RTCs in 2009 and the evidence of cod avoidance provided by reductions in cod catch and analysis of vessel movement and highlighted the potential for significant reductions in mortality by RTCs and gear measures. STECF pointed out that a key element in the overall evaluation of the scheme is observer data and noted the 33% reduction in discard rate in the larger mesh gears (60% discards by weight down to 40%). STECF discussed the result in the context of the ICES assessment and noted that although overall partial F had not *apparently* declined for the Scotland (or indeed any other Member State) there was a 25% reduction in Scottish discard partial F . This was an important achievement and did not occur in other countries. STECF acknowledged that the progress was partly through CC and went on to stress the need for expand the measures.

The ICES North Sea cod assessment 2010

The evaluation described above relates to Scotland's activities whereas the overall state of the stock is potentially influenced by a number of fishing nations and environmental factors. ICES is responsible for carrying out this overall assessment. The expert group which considers North Sea cod in 2010 (ICES WGNSSK) expressed several concerns about the accuracy of the [survey] data and subsequent results of their analyses. The assessment is particularly contentious because it suggests that fishing mortality (F) has increased sharply since 2007, despite various initiatives to

reduce mortality on cod in the last two years (as described above). A number of alternative assessments have since been investigated for the North Sea cod assessment by MSS and CEFAS (English) scientists. These new approaches yield similar conclusions about recent trends in fishing mortality (F), and while they suggest that further reductions in F are required to achieve management targets, they do not support the sharp increase in F during 2008 and 2009 that was suggested by the original ICES assessment. Given the concomitant changes in SSB from the different approach, and the TAC constraint built into the cod management plan, any such considerations are unlikely to change the quota advice for 2011. However, conclusions on the direction of change of fishing mortality would be different if any of the alternatives were adopted, as would perceptions of the effectiveness of recent and ongoing cod recovery efforts.

New alternative management developments in 2010

Conservation Credits has continued during 2010 with attention being paid to the requirements to deliver mortality reductions in line with the cod plan. MSS has provided new advice on the number and sizes of RTCs based on the 2009 observations and also new data from tagging studies of cod which provide information on potential residence time in RTCs of different sizes. As a consequence, RTCs are now 4 times as big as they were in 2009. Considerable further effort has been directed at joint science/industry trials of alternative fishing gears offering improved selectivity and reduced cod catches.

During 2010 there has also been development and trialling of the concept of catch quotas using remote electronic monitoring to ensure fully documented catches. European fisheries are currently managed with a combination of effort rules, gear regulations and limitations on fish landings. The latter are achieved through a set of single-species landings quotas, determined following scientific advice on the state of stocks. However, most vessels fish for several species at once. When a vessel has exhausted its quota for a particular species, there is nothing to stop it continuing to fish for other species and discarding any fish caught for which it does not have quota. Along with Denmark, Scotland has been leading the way in Europe in the development of proposals for catch quotas. Many versions of catch-quota schemes exist, from simple increases in single-species quotas to full multispecies quotas, but all rely on discard bans with the intention to “catch less and land more”. Pilot projects have been underway since 2009 to determine whether onboard CCTV equipment and other sensors (remote electronic monitoring) can be used to ensure that a discard ban is effective. MSS has conducted a range of analyses to support these projects, including comparisons between onboard and CCTV observers and determination of the CCTV sampling rate required for effective coverage. Fishery simulations are also in development that will enable catch-quota management schemes to be tested before full implementation at sea.

West coast stocks and management issues

The Council agreement at the end of 2008 included stringent measures intended to protect and recover west coast cod, haddock and whiting (gadoid) stocks in 2009. These measures were rolled forward in 2010. MSS has been involved in several

initiatives to improve understanding of the west coast gadoid situation and inform efforts to improve the current management measures.

In 2010 Marine Scotland Science conducted an additional survey of the gadoid species on the west coast (ICES Division VIa) as part of the West Coast Industry Science Forum. The aim of the survey was to produce a map of the distribution of the gadoid species and to produce an absolute estimate of abundance as opposed to an index of relative abundance which is normally produced from surveys. The planning and execution of the survey involved the explicit participation of the fishing industry using two chartered trawlers to conduct the survey. The estimates of abundance from these surveys are sensitive to assumptions made about fish behaviour in and around the trawl, but minimum estimates from this survey suggests that: cod abundance is very low (lower in fact than suggested by the scientific assessment); haddock is estimated to be of a similar order to that of the current assessment; and whiting is also low (although there is no accepted assessment to compare it with). The general distribution and age composition of all species as indicated from this survey was very similar to that from the regular surveys carried out by MSS.

Several science institutes have been working on a desk study drawing together available information from a number of sources and a report is being prepared. ICES assessments for 2010 continue to indicate difficulties particularly for cod and whiting. The haddock stock is also declining and an option to develop a formal management plan along the lines of the successful North Sea haddock plan is being pursued by MEP staff.

The numerous elements of the EU emergency measures (including gear regulations and bycatch limits) have presented industry with practical difficulties without necessarily improving the stock situation. Marine Scotland has been active in proposing modifications to the measures which are tailored to Scottish operations and are believed to offer more hope for stock improvement. The EU Commission have requested STECF for an evaluation of the proposals. Where possible, supporting information has been prepared and submitted by MEP and MS to STECF. Recent results from joint industry science surveys for anglerfish and megrim are also being worked up in time for autumn negotiations.

Interaction with stakeholders

Conservation Credits and the West Coast joint survey work exemplify the continuing engagement of MEP with stakeholders at all stages of the scientific and management process. Formal briefings to fishermen, shore based industries, NGOs etc take place each year after the ICES advice is issued. In many cases input to the process prior to scientific discussions takes place to gain insight on perceptions of stocks and fisheries from fishermen. Ad hoc meetings take place through the year with various industry bodies (for example the SFF demersal and Nephrops focus groups) and MEP also participates in an advisory capacity in RAC Working Groups when required (for example the North West waters and North Sea RACs). An especially important interaction arises through cooperative work. MSS generally enjoys good cooperation in relation to onboard sampling, joint surveys for anglerfish and chartering vessels for gear work.. MSS produces a range of published material widely available in paper form and through its website.

[Hard copies of the 2009 submission will be available at the meeting and are also available upon request from the Clerks.]