NORTH ATLANTIC SALMON CONSERVATION ORGANIZATION

ORGANISATION POUR LA CONSERVATION DU SAUMON DE L'ATLANTIQUE NORD



Council

CNL(00)45

Review of Salmon and Freshwater Fisheries in England and Wales

(Tabled by the European Union)

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Review of Salmon and Freshwater Fisheries in England and Wales

In 1998 the UK Government appointed an independent group to review salmon and freshwater fisheries policy and legislation in England and Wales. The Review report was published in March this year and interested individuals and organizations have until 31 July to comment on its conclusions and recommendations; the Government then aims to publish a response to the Review, taking account of all comments that are received before the end of the year.

The Review is a comprehensive examination of all factors that affect the conservation of freshwater and diadromous fish and the management of freshwater and relevant coastal fisheries. It thus discusses issues such as habitat degradation and predation as well as the regulation and management of fisheries.

For the information of NASCO delegates and observers the executive summary and the section of the report dealing with the regulation of salmon and of sea trout fisheries are attached. Copies of the full report can be obtained from Will Hellon, Fisheries Division 2, Ministry of Aquaculture, Fisheries and Food, 17 Smith Square, London SW1P 3JR, e-mail w.hellon@fish.maff.gsi.gov.uk.

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Executive summary

Scope of the review

- 1. We were asked by Ministers to review policy and legislation applying or relevant to salmon and freshwater fisheries and to make recommendations. We have interpreted our terms of reference (which are set out in Chapter 2) as requiring us to consider the conservation both of all fish that spend all or part of their lives in freshwater (we refer throughout to these as salmon and freshwater fish) and of the ecosystems in which they live: our report therefore considers not just the management of fisheries but the various factors that may affect fish and their environment. We also consider the economic and social aspects of fisheries. We conclude that it is important that fisheries are not treated in isolation from their environmental context and that fisheries management should be integrated with general catchment management.
- 2. We consider that Government involvement in the conservation of salmon and freshwater fish and the management of salmon and freshwater fisheries should have the following objectives:
 - to ensure the conservation and maintain the diversity of freshwater fish, salmon, sea trout and eels and to conserve their aquatic environment;
 - to enhance the contribution salmon and freshwater fisheries make to the economy, particularly in remote rural areas and in areas with low levels of income;
 - to enhance the social value of fishing as a widely available and healthy form of recreation.
- 3. New legislation on salmon and freshwater fisheries should focus on achieving these objectives. Problems that affect the freshwater environment as a whole should be dealt with through environmental legislation, which should recognise the importance of fish in the aquatic ecosystem. New legislation on fisheries should treat all fish occurring in freshwater on an equal basis.
- 4. The Environment Agency should retain responsibility for regulating salmon and freshwater fisheries in England and Wales. Its statutory duty to maintain, improve and develop, salmon and freshwater fisheries should be interpreted as a duty on the Agency to meet the objectives set out in paragraph 2 above.

Fish and their environment

5. In spite of recent general improvements in river and inshore water quality the evidence we have received indicates a serious decline in the quality of the freshwater environment caused by water pollution, water abstraction and the impact of agriculture, land drainage and development. We conclude that modern farming practices, in particular, cause substantial damage to freshwater habitats. We would like to see: fundamental changes to the Common Agricultural Policy to encourage less intensive farming methods; tighter rules on agricultural pollution and, in particular, on the use of sheep dips, with the use of synthetic pyrethroid dips eventually phased out; the introduction of specific agrienvironment schemes to reduce the impact of farming on the freshwater environment and on fisheries. We are also concerned at the loss of wetland and river habitat by land drainage

and flood defence works and recommend that the Environment Agency should draw up a co-ordinated programme of river and river corridor habitat restoration. Other changes that we would like to see include tighter controls on water abstraction, on artificial transfers of water and on development in flood plains which adversely affect watercourses.

- 6. Commissioned Government research on piscivorous birds, published in September 1999, demonstrated the complexity of the inter-relationship between such birds and their prey species. Unfortunately, the research did not lead to firm practical management recommendations. In the circumstances we think that the present legal regime should be retained but believe that clear guidance should be given on the evidence required to demonstrate serious damage to fisheries and conclude that further research should be undertaken into alternatives to shooting.
- 7. The need for more information is not restricted to piscivorous birds. It is essential that policies on the conservation of salmon and freshwater fish and the management of salmon and freshwater fisheries should continue to be based on the best available scientific evidence. The government, the Environment Agency, NERC and other funding bodies should give high priority and long term commitment to R&D on the freshwater environment and fisheries and should ensure better co-ordination of their research and monitoring programmes in this area. We would also like to see improvements in the monitoring of fish stocks and the state of the environment and additional research in a number of areas, with more emphasis on research on coarse fish.

Social, economic and recreational importance

- 8. A substantial number of jobs are angling-related and depend on the good management of fisheries throughout England and Wales. In both rural and urban areas angling can make a substantial contribution to the local economy. This is particularly valuable in remote rural areas with few other sources of employment. It is thus important that the economic value of salmon and freshwater fisheries in rural areas is recognised in the development of Government policies on the countryside and the rural economy.
- 9. Angling as a recreation has social as well as economic benefits. To achieve this the promotion of angling should be an integral part of the Environment Agency's function in relation to salmon and freshwater fisheries and should be funded accordingly. In particular, we would like to see the Agency expand its efforts to promote angling in urban areas, to improve access to angling for disabled people and to promote angling among young people.

Fisheries regulations

10. We received a wide range of evidence on close seasons, in particular in relation to coarse fish. We conclude that the power to impose a close season should be retained in future legislation, but that this should be exercised only where a close season is needed for fish conservation purposes. If there is a need to restrict access to freshwater habitats on wider environmental grounds, these restrictions should be made under general environment legislation and should not be applied to anglers alone. We believe that this approach will lead to the retention of the close season for salmon, sea trout and wild brown trout, but not generally for stocked trout or coarse fish. We would like to see the coarse fish close season removed on all waters, including rivers, except where it is necessary to avert serious risk of damage to fish stocks. For canals this should be done as soon as possible.

- 11. Coarse fish are almost invariably returned to the water alive, so rules on angling for coarse fish are not intended to limit exploitation, unlike those for such species as salmon and eels. Nevertheless, we believe that there is a continuing need for rules on angling for coarse fish. The same applies also to trout, although special consideration should be given to wild brown trout.
- 12. Eels appear to be in serious decline. As all eels in Europe form part of a single stock, we urge the development of a Europe-wide stock recovery plan involving measures to reduce exploitation of eels at all stages of their life cycle as soon as possible. We would also like to see the introduction of a ban on fishing for elvers other than in rivers in estuaries where it is currently practised and a number of other changes made to current legislation to improve information on catches of eels and controls on exploitation.
- 13. For salmon we conclude that conservation limits (spawning targets) represent the best practicable way of using scientific principles to ensure that exploitation of salmon stocks in individual rivers does not exceed acceptable levels. However, the credibility of conservation limits is entirely dependent upon the reliability of the data used to establish them and the rigour of the supporting analysis. For this reason conservation limits need to be subject to continued review and development and be updated as necessary. There needs to be close consultation of local interests in the development and in the implementation of conservation limits.
- 14. We endorse the Government's policy of phasing out mixed stock fisheries in home waters. We believe, however, that if possible this should be accelerated and that the Government should contribute substantial funding towards the cost of compensation arrangements intended to encourage netsmen to leave these fisheries on a voluntary basis. The Government should also do all it can to reduce the impact of Irish and distant water mixed stock fisheries on English and Welsh salmon stocks.
- 15. We believe that effort controls should remain the principal method of controlling the exploitation of salmon and would like to see powers to limit effort in both rod and net fisheries retained in future legislation; we make a number of recommendations for improvements to the current rules. We advocate the introduction of a carcase tagging scheme for rod and net caught salmon, together with a general bag limit for rod caught fish and parallel restrictions on numbers that can be taken in nets. Pending the introduction of such a scheme, we believe that there should be a ban on the sale of rod caught salmon.
- 16. We consider how the salmon resource should be allocated between rods and nets. We conclude that there is no justification for a blanket ban on all commercial netting for salmon where conservation limits are being met, but that there is a need for additional powers to regulate exploitation in order to allocate the catch between interest groups. However, under such a reallocation netsmen giving up licences should be entitled to compensation and no netsman solely or mainly dependent on fishing for his livelihood should be deprived of a licence without his consent.
- 17. We consider that the approach we recommend for the management of salmon should be applied, with minor modifications, to sea trout. Conservation limits should be developed ' and set for sea trout and Salmon Action Plans extended to include them. However, given the generally healthy state of most sea trout stocks, we do not think that at present there is a need for measures such as carcase tagging, a general bag limit or a ban on the sale of rod caught fish to be introduced for them.

- 18. There was unanimity among those giving evidence that it was necessary to retain controls over movements of fish, and we agree that such controls are fully justified. They should cover both movements for the purpose of stocking and movements for fish farming purposes.
- 19. We conclude that stocking should be permitted only where it can be justified, taking into account the benefits and the disadvantages. We propose a number of guiding principles which should be used to decide whether stocking should or should not be allowed in particular circumstances. Where stocking is permitted its effectiveness and environmental impact should be monitored. We believe that there is case for taking a particularly cautious approach to salmon stocking programmes and any proposals to stock salmon need to be evaluated against alternative management options.
- 20. Currently there are no adequate mechanisms for regulating fish farming activities. To remedy this, we propose that legislation be introduced requiring all fish farms, including fish dealers premises, to be licensed. A licensing authority should have the power to impose conditions of approval and to refuse licences for inappropriate sites. Details of licences and of the conditions attached to them together with other relevant information, should be included on a public register. We do not consider that the automatic exemption of fish farms from the requirement to seek approval from the Environment Agency for introductions should be retained and we consider that marine cage salmon and trout farms should not be permitted in estuaries of rivers containing migratory salmonids or in nearby coastal waters.
- 21. Existing rules regulating fish movements have proved difficult to enforce. We conclude that enforcement would be more effective if there were a legal requirement for all fish movements to be recorded and for all such movements to be accompanied by the correct documents.
- 22. We believe that the Environment Agency's proposed byelaw, making it an offence to take fish for use as livebait unless the fish are retained at and used only in the water from which they are taken, should prevent the transfer of livebait from one-water to another. If, however, this should prove to be ineffective, we believe that livebaiting should be banned on all unenclosed waters. We also suggest that livebaiting should be banned altogether on waters where the release or escape of livebait could have an adverse impact on a valuable freshwater ecosystem or a rare fish population.
- 23. The passage of fish can be hindered by obstructions such as dams and weirs, and we suggest a number of improvements to the current legislation. We also think that there should be a presumption against the construction of estuary barrages affecting any river containing anadromous fish. Special rules on the use of fixed engines to catch fish should be repealed and all remaining fixed engines and fishing weirs regulated in the same way as fishing nets.
- 24. We make a number of recommendations for improving the enforcement of salmon and freshwater fisheries legislation. These include strengthening the powers of water bailiffs, requiring anglers to display rod licences on their person and introducing a fixed penalty scheme for minor fisheries offences.
- 25. Penalties imposed for fishing offences do not always reflect the seriousness of the offence. We conclude that efforts should be made to persuade the judiciary of the potential seriousness of fisheries offences and suggest that a special environmental court might provide a more suitable regime for trying fisheries offences.

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Institutional and financial arrangements

- 26. We conclude that there should be no change in the current institutional arrangements for regulating salmon and freshwater fisheries, with the Ministry of Agriculture, Fisheries and Food and the National Assembly for Wales retaining overall policy responsibility and the Environment Agency remaining responsible for regulation on a day to day basis. The evidence we received, however, revealed considerable dissatisfaction with the way the Environment Agency exercises its responsibilities, and we recommend a number of changes which we hope will address this.
- 27. We conclude, in particular, that the Environment Agency's current advisory committee system is not working well. We consider that the Environment Agency needs to consult its Regional Fisheries Ecology and Recreation Advisory Committees (RFERACs) more fully in the process of policy formulation, so that all those involved feel their views are being taken into account and that they are working in partnership with the Environment Agency towards shared goals. We think that more far reaching changes are needed at the local level, and recommend that the Agency restores a two tier advisory structure, with a formal local committee system. This should involve at least one local committee in each Environment Agency Area, with a legal requirement for the Agency to consult local committees, and take their advice into account, on a range of issues. We also consider that the Environment Agency should work more in partnership with local interests, such as river trusts.
- 28. The Environment Agency's responsibilities in coastal waters overlap with those of Sea Fisheries Committees (SFCs). We conclude that closer co-operation is needed between the Environment Agency and SFCs in coastal waters, and suggest that there should be a full review of the role and powers of SFCs and of their relationship with the Environment Agency. We also consider that the Environment Agency should be required by law to develop Fisheries Action Plans for all catchments. Where appropriate, Salmon Action Plans should be incorporated into these Plans, which should be reviewed regularly.
- 29. We were specifically asked by Ministers to consider what the rationale is for public expenditure for salmon and freshwater fisheries and whether existing levels of public expenditure are adequate. We conclude that there is a convincing rationale for Government intervention to achieve the objectives detailed in paragraph 2 above for policies on the conservation of salmon and freshwater fish and the management of salmon and freshwater fisheries and for that intervention to be publicly funded.
- 30. As far as the level of public spending is concerned, we note that in real terms there has been a considerable reduction in spending on salmon and freshwater fisheries since the early 1990s; in particular, there has been a very substantial reduction in Government Grant-in-Aid to the Environment Agency to fund its spending on fisheries. There appears to be no justification in fisheries terms for these cuts, or for the current situation whereby all Grantin-Aid is spent on salmon and sea trout fisheries; a significant proportion of the Environment Agency's spending on coarse and trout fisheries benefits the general public, not only anglers, and should be publicly funded. We conclude that current levels of public expenditure on salmon and freshwater fisheries are not adequate and should be increased, and that the additional work on coarse fisheries that we recommend in this report should be publicly funded. We therefore conclude that in the forthcoming public expenditure round the Government should provide a substantial increase in Grant-in-Aid. We also suggest that, in the longer term, the Government should develop ways of raising money to fund some of the Environment Agency's spending on fisheries through a levy on charges for abstraction licences and discharge consents.

- 31. We were also asked by Ministers whether it was possible to secure a greater contribution towards the costs of the public sector involvement from those directly involved with salmon and freshwater fisheries. We conclude that there is a good case for retaining rod licences, and that rod licence duties should continue to contribute to the funding of the Environment Agency's fisheries activities. We consider, however, that there is only limited scope to increase rod and salmon net licence duties, although we would like to see increases in licence duties on instruments used in eel and elver fisheries. We do not support other suggested ways of raising funds from fisheries interests, including charges on fisheries' owners. In our view it must be for the Government to meet the cost of additional spending that we believe to be essential to the conservation of salmon and freshwater fish. In particular, if salmon and sea trout are to continue to survive in reasonable numbers the Government will have to meet most of the cost.
- 32. It is important that the amount of money that the Government is being asked to find is put in perspective. In 1998/99 the Government provided Grant-in-Aid of £32 million to four opera and ballet companies and £7.4m to the Environment Agency for fisheries work in England and Wales; in 2001 it plans to provide only £3.2m for England. Even if fisheries Grant-in-Aid is substantially increased, the Government will be paying comparatively little to conserve salmon and freshwater fish and their habitats and to encourage a recreation enjoyed by over two million anglers.

7 Salmon: the key issues

- 7.1 The objective of regulating the exploitation of salmon is to ensure that sufficient numbers survive to spawn; if exploitation is permitted to increase too much, stocks will collapse. We agreed that there were four key issues to be decided on regulating exploitation:
 - how to determine an acceptable level of exploitation;
 - how to deal with mixed stock fisheries;
 - how to control exploitation to ensure that the agreed level is not exceeded;
 - how to allocate the salmon resource between different interests.

8 Determining an acceptable level of exploitation for salmon

Conservation Limits

8.1 For a salmon population to remain stable, the number of offspring that survive to spawn as adults must, averaged over a number of years, equate to the spawning stock which produced them. In practice, the number of fish that return to the river in any one year will normally be much greater than this, and the surplus can therefore be exploited without reducing the population. A hypothetical example is shown in Box 6. Thus if the population is exploited at a steady rate it will reach an equilibrium size, although there may be considerable variation from year to year. If the exploitation rate is very low, the equilibrium stock size should be close to that dictated by the maximum number of juveniles that the river can support (its natural carrying capacity). If the exploitation is maintained at a higher rate the stock will reach equilibrium at a smaller size; in such circumstances the stock size will be limited by the number of spawners and not by the available space in the river for juveniles. If the exploitation rate is increased still further it will eventually reach a critical level which cannot be sustained, and the stock will collapse. If other factors do not change, it is therefore the level of exploitation which determines the average size of the stock over a period of years. Thus, in order to determine the acceptable level of exploitation, managers must first define the spawning stock size that they wish to maintain for conservation or other management purposes.

Box 6

Hypothetical example of the numbers of individuals in a salmon population at different stages in the life-cycle; the survival rates given will not be typical of all populations



8.2 ICES and NASCO have proposed that a minimum spawning stock size should be defined for each river in order to ensure the conservation of salmon stocks. These 'conservation limits' are therefore threshold levels below which the spawning stock should not be permitted to fall. Salmon runs can be very variable and so it is not possible to guarantee that stocks will always remain above their conservation limits. Failure to exceed conservation limits in a single year may not mean that there is a problem. Similarly, exceeding conservation limits does not mean that there is not a problem, but if conservation limits are to be effective there must be a high probability of their being exceeded. Exploitation should therefore be controlled to ensure that there is a high probability that the spawning escapement exceeds the conservation limit each year. The principles of this management approach are summarised in Box 7 and explained in more detail in Appendix 1 to this chapter.

Part IV - Fisheries regulations



- 8.3 This ICES/NASCO approach has been endorsed by Ministers in a formal Direction to the Environment Agency. The Environment Agency is therefore setting conservation limits for all the main salmon rivers in England and Wales. We note that some confusion has been caused by the fact that the Environment Agency refers to these conservation limits as 'spawning targets', giving the impression that this was the stock size that they were aiming 'at' rather than a level that they wished to exceed. However, this is clearly not the case because their compliance procedures for meeting conservation limits are designed to ensure that the spawning escapement for any stock will be above the conservation limit in at least four years out of five.
- 8.4 We have heard concerns about the principles adopted by the Environment Agency for establishing conservation limits. The Environment Agency has followed the advice of ICES and NASCO in setting the conservation limit at the stock size known as the "maximum gain point". This is the stock size at which the catch can be maximised – provided that the stock is maintained at this size. If, however, the stock falls below the maximum gain point, the number of returning fish and catches will decline rapidly. For this reason, and given the variability in salmon runs, the use of a maximum gain point as a target level for a stock is not the optimal strategy. However, as we point out above, the conservation limits recommended by ICES, and adopted by the Environment Agency, are not target levels. A

conservation limit is the minimum threshold level below which a stock should not be permitted to fall. In practice, if conservation limits are to be met, stocks will need to be maintained at a level higher than the maximum gain point, closer to the level which gives maximum smolt production.

8.5 Some of the criticism we received of the Environment Agency's approach seems to be based on the misapprehension that setting conservation limits at the maximum gain point implies that the stock will be managed to maximise catches, which would tend to favour net fisheries; rod fisheries would be better served by a lower exploitation rate at a large stock size. But as we point out above, this is not the case and it is Government and Environment Agency policy to seek to maintain salmon stocks at a level above the maximum gain point. In addition, the stock level at which a conservation limit is set does not in itself have any implications for the allocation of the resource between rods and nets; this will be determined by the regulatory measures imposed on these fisheries. (Allocation of the resource is discussed in Section 11 below).

8.6 We have also received evidence suggesting that the Environment Agency's conservation limits are currently too uncertain to be used in the management of salmon fisheries. We recognise the difficulties in setting conservation limits for individual rivers and determining whether they are met. The relationship between the number of spawning fish in one generation and the number of adults produced in the next generation is complex. Fisheries scientists have well-established mathematical methods for describing this relationship for any particular stock, but the procedure depends upon collecting data over many generations of the fish. For example, it has been necessary to operate trapping facilities on the River Bush (Northern Ireland) for more than 20 years to begin to understand the relationship for that particular river stock. It is clearly not practicable to collect such data for many stocks, and managers must therefore rely upon the best available information.

- 8.7 The Environment Agency has developed methods to adjust the estimated conservation limit for the River Bush to other rivers by taking account of some of the differences between the rivers (for example, river size and altitude), but further work is required to take account of other factors. For example, if there is also a stock of sea trout in the river, the juvenile trout may compete with the young salmon for food and space and thus reduce the potential size of the salmon stock. The presence of sea trout could therefore lead to unrealistically high conservation limits for salmon if this is not taken into account in the assessment.
- 8.8 We conclude, therefore, that the credibility of conservation limits is highly dependent upon the reliability of the data and the rigour of the supporting analysis. Accordingly, the process of setting and using conservation limits needs to take account of the deficiencies in the data and must be subject to continuing review. We agree that for practical purposes conservation limits need to be set on a river catchment basis; however, tributaries in large catchments may have their own distinct sub-stocks, and the Environment Agency needs to be aware that catchment conservation limits could disguise problems with particular sub-stocks and should be ready to take remedial action.
- 8.9 Despite all the difficulties and reservations we outline above, we conclude that conservation limits represent the best practicable way of using scientific principles to ensure that exploitation of salmon stocks in individual rivers does not exceed acceptable levels. However, we believe that it would assist in the implementation of this approach if the Environment Agency also provided estimates of the higher 'target' stock size that it considers it necessary to aim at in order to achieve their objective of exceeding the conservation limit in four years out of five. We also note that since exploitation may be

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permitted to continue even when the stock size falls below the conservation limit, consideration should be given to setting a further lower limit below which no exploitation would be permitted.

Conservation limits for salmon should continue to be used to define thresholds below which the number of spawning salmon in each river should not be permitted to fall. To be acceptable, conservation limits must be realistic and credible and should be subject to continued review and development and be updated as necessary. The Environment Agency should provide estimates of the higher target stock sizes it will aim to achieve in order to ensure that conservation limits are met four years out of five, and should consider developing further lower limits below which no exploitation would be permitted. (Recommendation 34)

- 8.10 Salmon stocks in rivers usually comprise both grilse (one-sea-winter salmon) and multisea-winter salmon, and the age at which fish return is partly under genetic control. Overexploitation of one stock component, particularly if other factors are also depressing it, could result in the permanent loss of some genetic characteristics. For example, excessive exploitation of multi-sea-winter fish could result in stocks becoming permanently dominated by grilse.
- 8.11 We noted that in England and Wales, as elsewhere in the North Atlantic, multi-sea-winter salmon are at historically low levels, and ICES is recommending that extreme caution should be exercised in the management of these stocks. In our view there can be little doubt that multi-sea-winter salmon stocks, and particularly stocks of spring salmon (those multi-sea-winter salmon that return early in the year), in England and Wales are below safe threshold limits in all rivers. It is against this background that the Environment Agency introduced measures, which have been approved by the Government, to halt all exploitation of salmon in England and Wales before 1 June each year. These measures are discussed further in paragraphs10.13 and10.14. We support these measures which we believe to be justified.
- 8.12 Since grilse and multi-sea winter stocks are often exploited in different fisheries for example, the West Greenland fishery exploits only potential multi-sea-winter salmon, NASCO has requested that separate conservation limits be set for these stock components on individual rivers. This is not something that the Environment Agency has generally yet attempted to do in England and Wales, partly because of the difficulties of deciding upon the appropriate proportions of these stock components to set as a baseline. We agree that it is essential to try to maintain maximum genetic diversity within salmon populations, taking into account sea age, run timing and the structure of particular populations; we also agree that the best way of doing this is through scientifically based conservation limits.

When and where appropriate, the Environment Agency should develop and apply separate conservation limits for one-sea-winter (grilse) and multi-sea-winter salmon. (Recommendation 35)

8.13 Given the difficulties of devising such limits, we accept that at present measures need to be taken on a pragmatic basis to ensure that one-sea-winter and multi-sea-winter salmon stocks are protected. Currently the focus is on conserving multi-sea-winter salmon, but the situation might change; we note that in the first half of this century multi-sea-winter salmon were much more prevalent than they are now and that, in many parts of England and Wales in 1999 there has been a marked decline in grilse catches.

Implementation

8.14 In England and Wales, conservation limits are being implemented through Salmon Action Plans which are being developed by the Environment Agency for all main salmon rivers; 68 Salmon Action Plans are due to be finalised by 2002. For each river these set out the measures needed to maintain stocks above the conservation limit or to restore them to the level needed to achieve this objective. Local interests are consulted over Salmon Action Plans before these are finalised. We regard this as an essential feature of the plans, and we emphasise that such consultations must be genuine and that full account must be taken of the views of those consulted; the plans and the conservation limits they contain should have the support of local anglers, netsmen, fisheries owners and other interest groups. It is also important that Salmon Action Plans remain living documents, subject to continuing review and development, and that limits and targets are updated as necessary to take account of environmental changes and other factors.

When the Environment Agency publishes the conservation limits for each river it should explain the sources of data and the calculation of those limits to encourage local ownership of resulting management strategies. (Recommendation 36)

8.15 We believe that Salmon Action Plans should set out the procedures that will be followed if it becomes apparent that conservation limits are not being exceeded. We note in this connection that the precautionary approach to salmon management adopted by NASCO recommends that the management procedures to be taken in the event of a failure to meet conservation limits should be agreed beforehand. We fully endorse this approach. The key feature of such procedures is the identification of the reasons why stocks are below the conservation limit, followed by implementation of appropriate remedies. Reduced exploitation is not the only possible response: if, for example, habitat degradation is the principle culprit, habitat improvements as part of a stock rebuilding programme are likely to be needed.

Salmon Action Plans should set out the procedures to be followed if stocks in a particular river do not exceed their conservation limits. Local interests should be fully consulted and their views taken into account before the procedures are finally established. (Recommendation 37)

8.16 We have referred elsewhere in the Report to the importance of monitoring. The difficulties we have noted with the implementation of conservation limits emphasises the importance of carrying out adequate long-term monitoring.

Data requirements

- 8.17 Given the importance of adequate data for the calculation and implementation of conservation limits, and more generally for the management of the salmon stocks, we considered how data collection might be improved. In doing so, we recognised the importance of reliable, consistent and compatible data and the need to collect and apply such data carefully. We agreed that continuity of data, and particularly long term data sets, and monitoring were essential in view of the complex life-cycle of salmon. Monitoring and a data collection need to be at levels sufficient to enable conservation and management objectives to be met. Box 8 below sets out some of the current programmes being undertaken in the UK and Ireland.
- 8.18 We consider that more fish counters, to count numbers of returning adults, are desirable, but we note that it is essential that all counters are frequently validated and properly maintained and operated and that data from them are made quickly available to managers.

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This all has resource implications, which need to be taken into account at the outset; it is not enough simply to install counters without ensuring adequate provision to run them effectively. We also conclude that additional facilities for estimating the numbers of both emigrating smolts and returning adults on selected rivers (sometimes called index rivers) would be desirable combined with properly targeted juvenile surveys.

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Steps should be taken to improve the quality and reliability of data collected for salmon management. (Recommendation 38)

Box 8 Monitored salmon populations

There are a number of rivers around the North Atlantic that are intensively monitored to provide detailed information on the dynamics of their salmon populations and, in some cases, to act as an indicator of the status of stocks within a region. These rivers include the Bushan Northern Ireland, the North Esk in Scotland and Burrishoole system in Ireland. The monitoring programmes on these rivers include the use of: smolts traps to allow emigrating fish to be sampled and marked; adult traps and counters to allow returning fish to be assessed and examined; and additional sampling to monitor the production in freshwater. There are currently no rivers in England and Wales on which such comprehensive monitoring is conducted. Data have been collected for more than 20 years on the River Bush, and this has permitted scientists to describe the effects that changes in the spawning stock can have on the recruitment in the next generation. This information is being used to assist in setting conservation limits for rivers in England and Wales, and in Ireland.

In addition to improving our understanding of the population dynamics and natural fluctuations of stocks, these studies can provide information on the impacts on stocks of natural factors, such as short-term droughts and longer-term climatic change, and human activities such as abstractions and discharges. This in turn will provide a more robust scientific framework within which management decisions can be taken.

9 Mixed stock fisheries

Home waters

- 9.1 Mixed stock fisheries net fisheries which exploit salmon from a number of different river stocks make it very difficult to determine the level of exploitation of each of the individual stocks involved. Even if the overall level of exploitation in the fishery appears to be satisfactory, exploitation of one particular river stock could be too high. For this reason, it is widely accepted that mixed stock fisheries are undesirable, and in England and Wales it is Government policy to phase these out. We endorse this approach.
- 9.2 We note that this policy is not applied to estuary net fisheries exploiting fish from a small number of rivers, which technically are mixed stock fisheries; an example is the fisheries in the common estuary of the Tamar, Tavy and Lynher rivers. We agree that this is a reasonable approach as in such cases it is possible to assess levels of exploitation of the different river stocks and to ensure that all are maintained at satisfactory levels. Where the conservation limit for one river stock was not being exceeded, however, application of the precautionary approach would require the imposition of the necessary management measures to all the net fisheries in the common estuary.

The largest mixed stock fishery in England and Wales is the North East coast salmon drift 9.3 net fishery. This currently takes about 50 per cent of the total catch of salmon in England and Wales. It also takes nearly 20 per cent of the catch of salmon of English and Welsh origin since 80 per cent of the salmon caught in this fishery have been estimated to be of Scottish origin.¹⁷ This fishery, together with net fisheries in Eastern and North Eastern Scotland, was the subject of a detailed review following the passage of the Salmon Act 1986. In 1991 the report of the review¹⁸ was presented to Parliament by the then Minister of Agriculture, Fisheries and Food and the Secretary of State for Scotland. The report concluded that the review had not produced evidence of an immediate threat to stocks and thus any justification for depriving existing licensees of their licences at a stroke. It also concluded, however, that it would aid and improve the management of individual east coast salmon and sea trout stocks if the North East coast drift net fishery were to come to an end and that it would be desirable to phase it out. It proposed that this should be done gradually so as not to cause unnecessary hardship. The phase out of the fishery started in 1992, since when the number of licences has fallen from 142 to 72 in 1999, a reduction of 49 per cent; it is probable, however, that the level of exploitation of the stocks affected by the fishery will have fallen by somewhat less. We received conflicting evidence about this fishery, with the netsmen's representatives arguing that the phase out was unjustified, and many angling interests arguing for it to be closed immediately. We do not consider that a case has been made for either of these extreme options. We conclude, however, that it would be desirable to accelerate the phase out and we recommend compensation be offered to netsmen to encourage them to leave the fishery on a voluntary basis as soon as possible. We also recommend that a similar approach should be adopted to other mixed stock fisheries being phased out in England and Wales.

The phase out of mixed stock salmon net fisheries in England and Wales should be accelerated, and to achieve this compensation should be offered to netsmen to encourage them to leave these fisheries on a voluntary basis as soon as possible. (Recommendation 39)

9.4 A number of those giving evidence argued that the Government should provide the bulk of any compensation. We concluded, however, that accelerating the phase out of the fishery would have substantial economic benefits for rod fisheries and that those who benefited, in particular riparian owners and anglers in both England and Scotland, should contribute a major share of the cost. The Government should, however, provide substantial funds on a pump-priming basis and should be ready to take the lead in setting up the necessary arrangements for collecting funds and compensating netsmen.

The Government should provide substantial pump-priming funds to launch compensation arrangements designed to accelerate the phase out of mixed stock salmon net fisheries on a voluntary basis, and should take the lead in setting up these arrangements. (Recommendation 40)

Salmon and Freshwater Fisheries Review

¹⁷ 17 Returns of salmon to rivers in North-East England have increased rapidly following the improvements in water quality in some of the estuaries, particularly the Rivers Tyne, Wear and Tees. Tagging of adult salmon in the coastal fishery in the 1970s suggested that 94 per cent of the fish at that time were returning to Scottish rivers. Tagging of smolts and parr in the English rivers in the 1980s suggested that their contribution to the coastal fishery had increased to about 20 per cent. This contribution may have increased further in the 1990s but no more recent estimate is available

Salmon Net Fisheries: Report of a review of salmon net fishing in the areas of the Yorkshire and Northumbria regions of the National Rivers Authority and the salmon fishery districts from the River Tweed to the River Ugie – 17 October 1991

Part IV - Fisheries regulations

Distant waters

- 9.5 English and Welsh salmon stocks are also exploited by mixed stock fisheries within the jurisdiction of other countries. Of these the Irish drift net fishery and the fishery off West Greenland have the greatest impact; English and Welsh stocks are also subject to limited exploitation in the Faroe Islands long line fishery and in Scottish and Northern Irish waters.
- 9.6 Discussions are currently underway between scientists from CEFAS, the Environment Agency and the Irish Marine Institute to agree estimates of exploitation in the Irish drift net fishery for selected English and Welsh stocks based upon tagging studies conducted in recent years. Provisional estimates of the levels of exploitation prior to 1997 vary substantially between stocks in different areas and from year to year. However, estimates are generally low (~1 per cent) for stocks in the North East of England, higher (at around 5 to 15 per cent) for rivers on the west coast of England and in Wales, and highest (perhaps 10 to 20 per cent) for stocks from English south coast rivers.
- 9.7 In 1997 the Irish Government introduced a number of restrictions on the Irish drift net fishery. It has not yet been possible to assess the effects of these measures on the exploitation of English and Welsh stocks. While we welcome these restrictions, we believe that this mixed stock fishery should be phased out, as is being done for similar fisheries in England and Wales. We note that the Government has urged the Irish government to adopt such a phase-out, and we strongly support the Government's efforts.

The Government should continue to press the Irish government, by all available means, to take all practicable measures to reduce the impact of the Irish drift net fishery on English and Welsh salmon stocks. (Recommendation 41)

- 9.8 NASCO sets quotas for both the West Greenland and Faroe Islands fisheries. For West Greenland, the quota is calculated according to an agreed methodology which links it to the state of North American multi-sea winter stocks; as the current advice from ICES is that these stocks are below their conservation limit and should not be exploited, the quota for 1999 permits only catches in the local subsistence fishery, which is estimated to take around 20 tonnes. No commercial exports of salmon from Greenland are currently permitted. For the Faroe Islands the quota is set at a much higher level (300 tonnes in 1999), but from 1991-1998 the quota has been bought out. Licences for a commercial salmon fishery have not been issued and only a small research fishery operates, taking less than 10 tonnes per year. No buy-out has been arranged for the 1999/2000 fishing season, and it is unclear whether, if licences were issued, there would still be a demand for them, given the present low level of salmon stocks.
- 9.9 While we would also like to see these mixed stock fisheries phased out, we recognise that both fisheries are expressly permitted under the NASCO Convention, and that both Greenland and the Faroe Islands are heavily dependent on fishery resources. We consider it important, however, that the Government should continue its efforts, through the EU, to ensure that quotas for both fisheries are set at the lowest achievable levels.

The Government should continue to do its best to ensure that NASCO sets quotas for the West Greenland and Faroe Islands salmon fisheries at the lowest achievable level. (Recommendation 42)

9.10 We noted that in some years the quotas for the West Greenland and Faroese fisheries have been bought out by a private organisation, the North Atlantic Salmon Fund. The Government has so far taken the view that the cost of such compensation arrangements should be met by private interests. While we accept that in some circumstances a public contribution to compensation arrangements could be useful, we consider that public money is better spent closer to home – for example by helping to accelerate the phase-out of our own mixed stock fisheries.

10 Regulating exploitation of salmon

Quotas and effort control

- 10.1 The two basic methods of limiting exploitation in legal fisheries are quotas and effort control. Quotas limit catches to a fixed quantity. They therefore provide a clear quantitative limitation on the size of the catch. Quotas have the disadvantage, however, that because salmon abundance varies from year to year, and variations are not easy to forecast in advance, in years when stocks are low catching a fixed quantity of fish may result in the level of exploitation being too high. Thus with a quota exploitation tends to be high when stocks are low and vice-versa. This disadvantage can, however, be reduced by adjusting quotas in-year providing technical means are available to enable numbers of returning adults to be estimated during the season. Effort controls, on the other hand, attempt to control exploitation by limiting the time that fishermen can operate and the efficiency of their gear. This tends to stabilise the level of exploitation so that catches increase with stock abundance. Although effort controls still tend to result in over-exploitation when stocks are low, the effects are not as great as with quotas.
- 10.2 There is no provision in existing salmon fisheries legislation for quotas, and there was little support for quotas from those who gave evidence to us. During our visit to Ireland the Irish Government's plans to introduce quotas were explained to us; the objective is primarily to allocate the resource rather than to restrict exploitation. Overall, we can see few advantages in moving to a quota based system for controlling exploitation in England and Wales (particularly bearing in mind our recommendation for speeding up the phase out of mixed stock net fisheries). However, we recommend below that limits on catches, by both rods and nets, should be included in the carcase tagging scheme we wish to see introduced.
- 10.3 We believe that effort controls should remain the principal method of controlling legal exploitation of salmon. For nets there are currently two legal routes for the introduction of such controls. Numbers of licensed nets can be restricted using Net Limitation Orders made under Section 26 of the Salmon and Freshwater Fisheries Act 1975, and restrictions on the design and use of nets can be introduced by byelaw.
- 10.4 It was pointed out to us that Net Limitation Orders have a number of weaknesses. On their own they are of limited effectiveness in reducing levels of exploitation quickly, since they cannot be used to remove licences from licence holders who are dependent on fishing for their livelihood, even if stocks are threatened by over-exploitation. The situation is exacerbated by the fact that the Courts have given a very broad interpretation to the phrase 'dependent on fishing for their livelihood'.¹⁹ In addition, a single objection from an existing licence holder, even if the licence holder fishes only on a part time and occasional basis, triggers an automatic public inquiry. These defects could best be overcome by removing the power to introduce Net Limitation Orders and, instead, regulating licence numbers by 'byelaw. The byelaw-making powers should include specific provisions for reducing numbers of licence holders where this is necessary for conservation reasons.

¹⁹ Regina v South West Water Authority, ex parte Cox and Others (Queen's Bench Division, 10 December 1981)

Powers to introduce Net Limitation Orders should be removed; in their place the Environment Agency should have the power to limit net licence numbers through byelaws. These powers should specifically provide for licence numbers in a net fishery to be reduced immediately where this is necessary for conservation purposes. Byelaws limiting numbers of net licences should remain in force for not more than ten years, with the exception of those relating to the phase-out of mixed stock fisheries. (Recommendation 105)

10.5 The current legislation on Net Limitation Orders provides for the selection of applicants for licences when the number of applicants exceeds the number of licences available. This provision is made use of in some fisheries to ensure that full-time fishermen are given priority. The criteria used to select licence holders will become increasingly important if, as we recommend, it becomes possible to reduce licence numbers in a net fishery with immediate effect for conservation purposes. It is, however, essential that criteria are transparent and that local interests are involved in drawing them up.

Powers should be retained to select applicants to whom salmon net licences will be issued when numbers of applicants exceed the number of net licences available. Local interests should be fully involved in establishing the selection criteria, which should be transparent. Where appropriate full-time fishermen should be given priority. (Recommendation 106)

10.6 Close seasons and close times are important ways of restricting exploitation by nets. During the course of this Review exploitation of spring salmon by nets in England and Wales was banned by extending the close season until 1 June. Close times substantially reduce the time during the netting season when net fisheries can operate: for example, the North East coast drift net fishery is closed each weekend from 18.00h on Friday evening to 06.00h on Monday morning and each night from 20.00h to 04.00h.

The powers to introduce close seasons and close times for salmon net fisheries should be retained and these powers should continue to be used to control levels of exploitation. (Recommendation 107)

10.7 Another way of controlling exploitation by nets is to impose restrictions on the design and use of nets. In all net fisheries there are rules on the mesh size and design of the nets used. There are also rules on how nets should be used. For example, Section 3 of the 1975 Act makes it an offence to work any seine or drift net across more than three quarters of the width of a river or estuary, while local byelaws contain other provisions on the use of such nets. Netsmen are normally required to ensure that their nets are kept moving at all times and do not remain stationary. In our view these powers remain necessary. However, it would simplify future legislation if all provisions on the use and design of nets were dealt with through secondary legislation, with only the necessary enabling powers contained in primary legislation.

Powers should be available to the Environment Agency to impose restrictions on the design and use of nets, with the details left to the relevant byelaws. (Recommendation 108)

10.8 We have recommended in Section 3 above that close seasons for salmon rod fisheries should be retained. Existing legislation also provides powers to introduce a wide range of restrictions on angling methods. Restricting angling to fly fishing only and banning the use of natural and artificial prawns and of worms have all been used to reduce the efficiency of angling and hence levels of exploitation. It is also possible to ban angling in certain locations, such as below weirs. While the exercise of these powers is sometimes controversial, no one suggested to us that they should be removed. We believe that restrictions of this kind can play a useful role.

Powers to introduce restrictions on angling methods and areas where angling is permitted should be retained in future legislation. (Recommendation 109)

- 10.9 Under existing legislation (Section 212 of the Water Resources Act 1991) the owner or occupier of a fishery who believes that his interests have been adversely affected by a byelaw restricting the use or design of any instrument for taking fish may claim compensation from the Environment Agency. We are concerned that this provision may on occasion discourage the Environment Agency from proposing byelaws needed to conserve fish. Wild fish are not private property, and we do not think that compensation should be payable when action is taken in order to conserve a natural resource. This principle should apply equally to any reductions in net licence numbers made for conservation purposes in accordance with our recommendation in paragraph 10.4.
 - No compensation should be paid to oconers or occupiers of fisheries, or other interested parties, for the effects of measures adopted for conservation purposes. Section 212 of the Water Resources Act 1991 should be repealed. (Recommendation 110)

Illegal fishing

- 10.10 It is also, of course, important to keep illegal exploitation of salmon under control. We were told that illegal fishing for salmon remains a problem. Recent estimates, made by the Environment Agency for ICES, of illegal catches expressed as a percentage of the declared catch, range from 5 per cent to 18 per cent for different regions in England and Wales. Moreover, illegal fishing does not simply have an effect on stocks: it reduces catch opportunities in, and hence the value of, legal fisheries.
- 10.11 The Salmon Act 1986 contains a number of measures intended to curb illegal fishing for salmon. In particular, it created an offence in England and Wales of handling salmon in suspicious circumstances where the possessor knows, or where it would be reasonable for him to suspect, that the fish had been taken unlawfully and it gave Sea Fisheries Committees the power to make byelaws within their districts to ban the illegal netting of salmon under the guise of fishing for sea fish. In 1996 the Salmon Advisory Committee published a report into the effectiveness of these measures:²⁰ it concluded that the measures have on the whole proved to be very effective. It noted, however, that salmon poaching remained a serious problem in some areas. The evidence that we received confirms that this is indeed the case, and we also received a number of proposals, in particular from the Environment Agency, for improvements to existing legislation. These proposals are considered in Chapter 13.

Catch and release

10.12 In recent years it has been increasingly common for anglers to release salmon that they catch: in 1998 catch returns to the Environment Agency indicated that around 30 per cent of salmon caught in England and Wales were released although this includes kelts and unclean fish. It is plain from the evidence we have received that catch and release, even on, a voluntary basis, is an issue that arouses strong feelings among anglers. On the one hand there are those who can see no justification for ever killing a wild salmon, while on the other there are those who take the view that salmon angling is a form of hunting and that it

²⁰ The anti-poaching measures contained in the Salmon Act 1986 (published July 1996. Ref No. PB 2515)

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is wrong to subject a wild creature to the stress of capture unless one intends to eat it. Our view as a Group fell between these viewpoints. We noted that where salmon stocks are above their conservation limit, releasing all salmon would not serve a useful conservation purpose. In these circumstances, the decision on whether to release or kill salmon caught is one that is best left to individuals. On the other hand, there is little doubt that the increased prevalence of catch and release is of benefit to salmon stocks on many rivers.

- 10.13 The compulsory release of all salmon caught raises rather different issues. During the course of our Review the Environment Agency published its proposed byelaws for the compulsory release of spring salmon caught before 16 June and these have now been confirmed by Ministers. While we did not seek evidence on these proposals, a large number of people submitting evidence to us commented on the issues they raised. These views varied considerably. While the majority supported the need for measures to reduce exploitation there was significant disagreement as to which sector (nets or rods) should be targeted. We received evidence from many anglers suggesting that there was a need to close net fisheries whereas netsmen took a contrary view.
- 10.14 Given the very serious decline in spring salmon stocks in England and Wales, we agree that action was needed to reduce substantially exploitation by rods as well as by nets. In these circumstances, compulsory release of all salmon caught was an alternative to closure; those opposed in principle to catch and release had the option of not fishing. (They would not, in any case, have been able to fish if rod fisheries had been closed). We noted, however, that catch and release was not fully equivalent to closure, since some fish that are caught will die before they can spawn, although the scientific evidence we have seen suggests that, with proper handling, survival rates of at least 80 per cent of fish caught and released are attainable. Nevertheless, there may be circumstances in which even this level of mortality is not acceptable; in such cases there will be no alternative but to close the fishery concerned.

Sale of rod caught salmon

We received a considerable number of representations advocating a ban on the sale of rod 10.15 caught salmon; this is a policy supported by both the Atlantic Salmon Trust and the Salmon & Trout Association, as well as by the Environment Agency. We concluded there are three principal justifications for such a ban. In the first place, it would reduce opportunities for the disposal of illegally caught salmon. At present a poacher who wishes to persuade a potential purchaser of a salmon that he is a bona fide angler has only to purchase a salmon rod licence. Secondly, it would discourage anglers from killing large numbers of salmon for sale. We were told that a small minority of anglers account for a high proportion of the overall rod catch - Environment Agency data show that during the period 1995 to 1997 some 5 per cent of anglers accounted for about 45 per cent of the reported catch - and some of these undoubtedly fish on a semi-commercial basis, selling their catch. Finally, there is question of philosophy; we do not think that killing and selling large numbers of salmon is compatible with the recreational nature of salmon angling, although we see nothing wrong in anglers retaining limited numbers of salmon for personal consumption. For these reasons, we favour the introduction of a ban on the sale of rod caught salmon. Some of the advantages of such a ban will be overtaken if, as we recommend below, a carcase tagging scheme is introduced but this will inevitably take time.

A ban on the sale of rod caught salmon should be introduced as soon as possible; the position should be reviewed if and when a carcase tagging scheme comes into force. (Recommendation 43)

Carcase tagging

- 10.16 We also received numerous representations in favour of the introduction of a carcase tagging scheme. Under such a scheme a unique, identifiable and tamper-proof tag would be attached immediately to all salmon caught and killed in the wild. Such schemes already exist in Canada and France, and one is about to be introduced in Ireland.
- 10.17 This is not the first time that salmon tagging has been suggested in England and Wales. In the early 1980s a Salmon Sales Group was established by the Water Authorities Association to investigate various means of controlling the disposal of illegally caught salmon. The report recommended, among other things, that a tagging scheme should be introduced in Great Britain. However, the then Government concluded, after consideration of the proposal, that a salmon tagging scheme could not be made to work; the principal reason for this conclusion was the perceived problem of dealing with farmed salmon.
- 10.18 A carcase tagging scheme in England and Wales would have two principal objectives: to control poaching and to improve the standard of catch returns. So far as the first of these is concerned, the Environment Agency estimates that currently around 70 per cent of anglers submit catch declarations; a tagging scheme would be likely to improve both the quantity and the quality of the information obtained. Almost all licensed netsmen make catch returns, but these are not always accurate: both under- and, in some cases, over-declaration, of catches takes place. A carcase tagging scheme would thus help improve the quality of data from net fisheries.
- 10.19 Carcase tags would also help control poaching. Anyone caught in possession of an untagged fish would be committing an offence, so poached fish would become easier to identify. Moreover, as it would be an offence to sell an untagged fish, poached fish would be difficult to dispose of through legal outlets.
- **10.20** A carcase tagging scheme would also help enforce a national bag limit. This is considered in more detail below.
- 10.21 We are, however, concerned that if a carcase tagging scheme covered only England and Wales its effectiveness in combating poaching would be much reduced since it would be possible to claim that untagged wild salmon had been caught in Scotland. For this reason, we hope that it will be possible to introduce a scheme throughout Great Britain.
- 10.22 The exclusion of farmed salmon from a tagging scheme will also create problems, in that it would make it possible to pass off untagged wild salmon as farmed fish: it will be difficult to prove that the seller should have known to the contrary. The Environment Agency told us for that reason that it would be desirable for a scheme to cover both farmed and wild fish. However, the proposed Irish scheme will not cover farmed salmon, and in Canada farmed fish have recently been exempted from tagging. Moreover, in 1998 the total catch of wild salmon in the UK was equivalent to only 0.14 per cent of total UK farmed salmon production and represented an even smaller proportion of the total UK trade in salmon (including imports from abroad). In these circumstances we doubt that the potential benefits, in terms of better control of illegal fishing for wild salmon, would justify the additional costs to the farmed sector. On balance, we do not think that the exclusion of farmed fish from a tagging scheme would render such a scheme unworkable. We also noted that it would not be possible to sell illegally caught salmon at a premium as wild fish, and that this would act as a disincentive to passing them off as farmed salmon.

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10.23 Overall, we believe that a carcase tagging scheme, for both rods and nets, would make a useful contribution to salmon conservation, and we would like to see such a scheme introduced, preferably throughout Great Britain.

Legal powers to introduce carcase tagging should be contained in new salmon fisheries legislation; in the meantime, the Environment Agency and Government should develop detailed proposals for such a scheme. (Recommendation 111)

Bag limits

10.24 One way of reducing levels of exploitation in rod fisheries is through the introduction of bag limits. Under these, a limit is set on the number of salmon that an angler may retain. Once the limit is attained, the angler concerned either has to cease fishing or must release all subsequent fish caught. Bag limits can be set for any period; they are usually on a daily, monthly or annual basis. Bag limits are already used by the Environment Agency to limit salmon exploitation on some rivers: for example, on the River Torridge anglers may retain only two salmon over a period of seven days and seven salmon for the season as a whole. An analysis of catch returns by seasonal licence holders on different rivers shows that bag limits could lead to substantial reductions in numbers of salmon retained. This is illustrated in the Table 3 below, which shows the number of salmon that would have been retained if annual bag limits of between 1 and 5 fish had applied on the Rivers Esk, Tamar and Tyne in 1998 and throughout England and Wales in 1997; the table also shows the reduction, in percentage terms, that this would have been retained).

Table 3	Estimated number of, and percentage reduction in, salmon retained								
	Esk		Tamar		Tyne		England and Wales		
Annual Bag Limit	Estimated number of salmon retained	Percentage reduction in catch	Estimated number of salmon retained	Percentage reduction in catch	Estimated number of salmon retained	Percentage reduction in catch	Estimated number of salmon retained	Percentage reduction in catch	
1	7	(90%)	70	(83%)	243	(82%)	2,187	^د (81%)	
2	29	(60%)	124	(69%)	435	(68%)	4,053	(64%)	
3	40	(43%)	151	(63%)	627	(54%)	5.577	(51%)	
4	44	(38%)	171	(58%)	771	(43%)	6,845	(40%)	
5	49	(31%)	191	(53%)	896	(34%)	7,745	(32%)	

- 10.25 We conclude that where there is a need locally to reduce exploitation on a river by rods, bag limits, in the form of a requirement to release all salmon caught once the bag limit is reached, can make a valuable contribution, although they may well be difficult to enforce, particularly when they apply over long periods. However, on individual rivers enforcement officers will often be able to make use of local knowledge, given that only a small minority of anglers are likely to exceed most bag limits. We would, in any case, expect the great majority of anglers to respect bag limits.
- 10.26 We also considered whether there was scope for a general bag limit, restricting the total number of salmon that any angler could retain in any season. For example, as only about 5 per cent of anglers catch more than five salmon a year, a general bag limit set at five fish would affect few anglers; on the other hand, it would lead to a considerable reduction in

the number of salmon caught and retained because 30 per cent of the annual rod catch of salmon is caught by anglers who have already caught five salmon. We conclude that, for the reasons that have led us to recommend a ban on the sale of rod caught fish, we would like to see an overall limit on the number of salmon that could be caught and retained in England and Wales by an individual angler in any one year. Having a general bag limit would be very difficult to enforce without a carcase tagging scheme.

Once a salmon carcase tagging scheme is in place, a general bag limit should be introduced. (Recommendation 112)

10.27 It would be anomalous to introduce a general bag limit for anglers while issuing unlimited numbers of carcase tags to netsmen.

If and when a general bag limit is set for salmon caught by anglers the carcase tagging scheme should include a ceiling on the number of tags that can be issued to individual salmon netsmen in any year. (Recommendation 113)

Dealer licensing

- 10.28 In the evidence we received there was a good deal of support for a dealer licensing scheme for salmon. The Salmon Act 1986 contains powers for the introduction of dealer licensing; after the passing of the Act the then Government issued a consultation paper setting out ideas for introducing such a scheme. This consultation showed that there would be considerable difficulties in operating dealer licensing (it was, in particular, strongly opposed by many fish farmers and traders), and it was decided not to go ahead.
- 10.29 Over the past decade these potential difficulties have increased. Sales of farmed salmon and the proportion of total salmon sales accounted for by farmed salmon have both risen steadily; as is pointed out above in paragraph 10.22, sales of wild salmon account for a very small proportion of total salmon sales. As with carcase tagging of farmed salmon it is highly doubtful that the potential benefits of dealer licensing would outweigh the additional costs to the fish farming industry and, in this case, the wholesale and retail sector. We concluded that dealer licensing was no longer a practicable option.

11 Allocation of the salmon resource

- 11.1 Wild salmon are a scarce resource: inevitably, decisions have to be taken on how this resource is allocated between different interest groups. In England and Wales the key question we have been faced with is how any exploitable surplus should be shared between rods and nets.
- 11.2 Provided that conservation limits are met, it makes no difference in conservation terms whether salmon are caught by rods or nets. For this reason, the decision on how exploitable surpluses should be shared is primarily a management one and will be influenced by social and economic factors and historical precedent as well as by the differing characteristics of rod and net fisheries. Box 9 below provides estimates of the economic value of salmon net fisheries in England, Wales and Scotland.

Box 9 Salmon net fisheries

The Environment Agency lists some 60 separate salmon and sea trout net fisheries; in 1998 there were 547 licensed netsmen. Average catches per licence in individual net fisheries vary from less than 5 fish a year to over 150.

"你们是我的你的?"

In 1991 the Centre for Marine Resource Economics (CEMARE) at Portsmouth Polytechnic (now Portsmouth University) carried out an economic evaluation for MAFF of salmon (including sea trout) fisheries in England and Wales, and Scotland²¹. This was based on data from 1988. The study attempted to assess the economic value of these fisheries. For net fisheries, the approach was to estimate the annual gross income minus purchased inputs (fuel, harbour dues, etc.) and overheads (licence duties, repairs and maintenance etc.). On this basis, CEMARE estimated the annual economic value of salmon net fisheries in England and Wales to be around £390,000 in 1988. It should be stressed that this estimate is approximate and is based on a number of assumptions.

To provide the Review Group with a more recent estimate, MAFF economists, in consultation with the Environment Agency, updated the CEMARE estimate using the same methodology. Again, the results are subject to considerable uncertainties. However, this exercise indicated that the annual economic value of salmon net fisheries in 1996 had fallen to around £250,000. This decline in total value was caused by a number of factors: the price fetched and quantities landed of wild fish declined considerably over the period, and variable and fixed costs rose with inflation and higher licence duties.

- 11.3 Netting for salmon can be highly efficient, and all net fisheries in this country are subject to effort controls to restrict exploitation. Without such controls, exploitation rates in some fisheries, such as coastal drift net fisheries, could be very high. However, in many net fisheries effort is limited by the availability of fishing stations; the level of exploitation could not increase indefinitely because a larger number of netsmen would simply have to take it in turns to fish. Exploitation rates in some net fisheries may also decrease as the stock declines, because netsmen may not be able to operate profitably when catches are very low. Elsewhere, however, netsmen may fish more as the stock declines, and thus increase their exploitation rate, in order to maintain a satisfactory income.
- 11.4 On an individual basis, angling is usually much less efficient than netting. But, because there are many more anglers than netsmen, the total exploitation rate by rods can sometimes be greater than by nets. In addition, while most salmon are vulnerable to net fisheries for a relatively short time, they may be available to rod fisheries for many months. This is particularly true for early running salmon, which may be vulnerable to angling for the whole season. Thus, it has been estimated that rod fisheries may have taken most of the stock of large multi-sea-winter salmon (over 9.1 kg) on the River Wye since the 1950s. Exploitation rates in rod fisheries have also been known to increase at low stock levels.
- 11.5 A point to bear in mind is that net fisheries operate in estuaries or at sea, and thus exploit salmon before anglers can. It would therefore be theoretically possible for nets to take the whole exploitable surplus. For this reason controls on net fisheries are essential to allow rod

²¹ An Economic Evaluation of Salmon Fisheries in Great Britain: CEMARE 1991

fisheries to operate; the converse, however, is not true, and controls on rod fisheries are required only to ensure the survival of adequate numbers of spawners.

- 11.6 There is a further important point, which was emphasised to us in the evidence we received. Because angling is not usually an efficient method of catching fish, in order to provide good fishing the number of fish available to anglers needs to be substantially larger than the number of fish they are likely to catch. This is a factor that managers need to bear in mind in any allocation between rods and nets.
- 11.7 A number of those giving evidence to us proposed that all commercial netting for salmon should be ended. While it was usually claimed that there were conservation reasons for such a measure, the supporting arguments put to us were almost invariably social and economic. We considered these various arguments, but concluded that there was no justification for a blanket ban on all commercial net fisheries. We reached this view for the following reasons.
- 11.8 In the first place, as pointed out above, provided that conservation limits are met there is no reason in conservation terms for discriminating against any particular method of exploitation. Banning netting would increase the number of salmon entering rivers and, because exploitation rates by rods are usually low (and tend to fall as stock levels increase), there would also be an increase in the number of salmon that survived to spawn. This would simply give a larger buffer over the conservation limit.

Box 10 Value of salmon rod fisheries

The 1991 CEMARE study (see Box 10) also estimated the economic value of salmon rod fisheries, based on the estimated capital value of fishing rights. In 1988 the capital value of rod fisheries in England and Wales was estimated on this basis at £72 million. Again, MAFE, in Itaison with the Environment Agency, updated this estimate by adjusting the 1988 capital value to take account of inflation: on this basis the capital value of salmon rod fisheries in 1996 was estimated at broadly £108 million.

To enable comparison of the above values of net and rod fisheries the estimates are presented below as both capitalised and annual values. The values shown are highly dependent on the discount rate and appraisal period used. The following figures are consistent with an 8 per cent discount rate and a 25 year appraisal period.

1996	Annual Value	1200 1	Capital Value
Rod Fishery	£10m		£108m
Net Fishery	£0.25m		£2.5m

While all these estimates have large margins of uncertainty, they are thought to provide a reasonable indication of the relative total values of salmon rod and net fisheries.

11.9 Increasing the number of salmon in rivers would, of course, increase the number caught by anglers and the value of the fishery. It was put to us that, because there are many more anglers than netsmen and because rod fisheries have a much higher economic value per salmon caught than net fisheries (Box 10 above provides estimates of the value of salmon rod fisheries), the economic and social benefits of better angling and higher value rod fisheries would outweigh the losses to netsmen. We concluded, however, that in reality the

position is more complicated. The CEMARE report (see Boxes 9 and 10) explicitly warns that while its estimates for the value of salmon rod and net fisheries are of interest as a description of the economic value of salmon fisheries in England and Wales, they cannot be used for predicting the likely economic consequences of policy decisions that might affect salmon catches in rod and net fisheries. To calculate these, marginal values are needed. Reliable values are not available, and will vary, perhaps substantially, between rivers and between fisheries. It is, nevertheless, evident that the marginal value of additional fish to a rod fishery will tend to fall as stock numbers increase, and that this tendency will be accelerated by the fact that rates of exploitation also fall as numbers increase. In simple terms, if the number of salmon increases, anglers will catch a diminishing proportion of the total and the additional value to the rod fishery of the extra fish available will progressively fall. There must then become a point when the value of additional fish to rods falls below their value to nets.

- 11.10 A further point that needs to be taken into account is that the difference in value between net and rod fisheries may be less marked in some parts of the country than in others. While the economic return from net fisheries may not be significant nationally, it may well make a substantial contribution to small fishing communities dependent on a range of different fishing activities. Similarly, some rod fisheries may make a disproportionate contribution to the economy of remote rural areas.
- 11.11 While we did not feel that a general ban on commercial netting could be justified, we did conclude that there was a case for taking greater account of the economic and social values of different fisheries in sharing salmon between them. Currently, there are large variations in rates of exploitation (and hence in the share of the resource) in different net fisheries. For example, whereas in those rivers in England and Wales without net fisheries the total legal catch is taken by rods, there are nine in which estuary nets have taken more than twice the catch by rods in the past five years. These allocations have no objective justification.
- 11.12 To some extent, economic and social factors can already be taken into account under existing salmon fisheries legislation. At present, if restrictions on exploitation are introduced for conservation reasons, Section 7 of the Environment Agency Act 1995 requires Government and the Environment Agency to take into account the social and economic interests of rural areas. However, it is currently not possible to restrict ' exploitation solely for social and economic reasons. Restrictions cannot, therefore, be imposed on net fisheries with the sole purpose of increasing the number of fish available to anglers.
- 11.13 If economic, social and recreational benefits derived from salmon fisheries are to be maximised, there is a need for additional powers to regulate exploitation in order to allocate the catch between interest groups. Such a power should, however, be used only on a local basis, and in our view no netsmen solely or mainly dependent on fishing for his livelihood should be deprived of a licence for such purposes without his consent. The Environment Agency should make use of this power only if there are reasonable grounds for concluding that a reallocation of the catch between the net and rod fisheries concerned will increase the economic and social benefits derived from these fisheries, and netsmen giving up licences under such a reallocation should be entitled to compensation.
- 11.14 In most cases we would expect compensation to be privately funded by those who would benefit from a reallocation, although if publicly funded bodies, including the Environment Agency, conclude that a reallocation of the catch would promote their objectives they should not be precluded from contributing towards the costs of compensation. If a netsman who is not solely or mainly dependent on fishing is deprived of his licence without his

consent, and agreement cannot be reached on the appropriate level of compensation, this should be determined by an independent arbitrator appointed by the Minister or the National Assembly for Wales, as appropriate.

A power should be introduced to restrict salmon net licence numbers by byelaw for economic and social reasons. No netsman solely or mainly dependent on fishing for his livelihood should be deprived of his licence without his consent under this provision. Any netsmen deprived of their licences under this provision should be entitled to compensation. If agreement cannot be reached on the level of compensation, this should be determined by an independent arbitrator. (Recommendation 114)

- 11.15 We have recommended in paragraph 10.4 above that no byelaw limiting licence numbers in a net fishery should remain in force for more than 10 years. This will provide an opportunity for the Environment Agency to review the allocation of the catch on a regular basis. If, for example, there was a substantial increase in salmon stocks in a river, it might be possible to increase the number of licences in a net fishery without detriment to the rod fishery. Where a net fishery is closed for economic and social reasons this closure should also be reviewed regularly.
- 11.16 It was suggested to us that, in reaching decisions on allocation of the resource, a distinction should be made between commercial and recreational net fisheries. The safeguards that we are recommending be afforded to net licence holders who are solely or mainly dependent on fishing for their livelihood will in practice tend to distinguish between those for whom netting for salmon is a commercial activity and those for whom it is a recreation.
- 11.17 Once the carcase tagging scheme that we are recommending is introduced, it would be possible to issue separate recreational netting licences with a substantially lower catch limit than in normal or commercial net fisheries. It would be for the licence holder to decide which type of licence he or she applied for: the lower cost of a recreational net licence would be balanced by a smaller catch limit. Such a system would not be appropriate in all net fisheries the haaf net fishery in the Solway, for example, is already essentially a recreational fishery. There are, however, some in which we believe that recreational netting licences would introduce a welcome element of flexibility. If it became necessary to reduce exploitation in a net fishery with both recreational and commercial netting licences, we believe that priority should be given to the latter in order to preserve the livelihood of the netsmen involved.

Once carcase tagging is in place consideration should be given to introducing recreational salmon netting licences, with lower licence duties and catch limits than ordinary netting licences. (Recommendation 115)

1.18 It was also suggested to us that special consideration should be given to those net fisheries which could be regarded as forming part of the country's heritage. On this point, we noted that the Secretary of State for Wales decided, exceptionally, to allow Welsh coracle fisheries to remain open to fish for sea trout early in the season (despite the fishing methods used, which make it difficult to release any salmon caught unharmed) because of their unique cultural and historical significance in Wales. We concluded, however, that it would be difficult to define a separate category of 'heritage' net fisheries. Many net fisheries are traditional in the sense that they have operated on the same site for hundreds of years, and over those years they have evolved distinctive methods, influenced by custom and the fishing conditions they face. In recent years these traditional methods have often been modified by the introduction of modern materials, but there is room for debate about the extent to which these alter the traditional nature of the fisheries concerned. In some cases

they clearly have: the introduction of monofilament nets and the use of powered boats with net haulers have fundamentally altered the nature of the North East coast drift net fishery; before the introduction of synthetic yarns, this fishery operated largely at night because drift nets made of natural fibres were clearly visible to fish during the day. On the other hand, as was pointed out to us by a netsman from the River Dee, the introduction of synthetic fibres does not necessarily alter fishing methods; in the case of the Dee draft nets, the nylon used is tarred and monofilament nets are banned. It was suggested to us that the use of fibre glass coracles had altered the nature of coracle net fisheries; the coracle netsmen themselves, on the other hand, claimed that the design of the nets and the methods that they used remained largely unchanged, as did the traditional skills involved.

11.19 In these circumstances we concluded that, rather than attempt to define 'heritage' net fisheries, it would make more sense to suggest that the traditional nature of a fishery should be regarded as one of the social factors that must be taken into account in reaching decisions on resource allocation.

The traditional nature of a salmon net fishery, both in terms of the time it has existed and the methods it employs, should be taken into account by the Environment Agency and Government in reaching decisions on the allocation of catches between rod and net fisheries. However, the wish to retain the economic viability of a traditional net fishery should not be used as a pretext for over-riding conservation considerations. (Recommendation 116)

12 Sea trout (sewin)

Sea trout fisheries

- 12.1 Sea trout fisheries are highly valued in many parts of England and Wales. Many of the anglers who buy salmon and sea trout rod licences do so principally in order to fish for sea trout: in 1997 some 30,000 sea trout were declared caught on rod and line in England and Wales (nearly half of them in Wales), against some 13,000 salmon. Sea trout, or sewin, are particularly prized in Wales, where they form the mainstay of rod fisheries on such well-known rivers as the Tywi, the Teifi and the Dyfi. Sea trout net fisheries are also of importance in a number of estuaries, and in North East England.
- 12.2 It was put to us that the economic and social value of sea trout fisheries is often underestimated. We agree. Sea trout should not be regarded as a poor man's salmon, and fisheries regulators and managers should ensure that equal attention is paid to their conservation and to the management of sea trout fisheries. Care should be taken not to favour salmon at the expense of sea trout by, for example, carrying out habitat improvements which increase salmon numbers but have an adverse impact on sea trout. Some rivers appear, for reasons that are not clear, to be better suited to sea trout than to salmon, and on such rivers it would be appropriate to give priority to the conservation and management of sea trout.

Regulation of sea trout fisheries

12.3 The principles we recommend be applied to the regulation and management of salmon fisheries can be applied with a few modifications to sea trout. Sea trout are generally caught in the same river and estuary fisheries as salmon, although slightly different methods may be used when one or other species predominates. Salmon, net and rod licences also cover sea trout, and the methods currently used to regulate exploitation of the two species are identical.

12.4 There are, however, differences between salmon and sea trout which need to be taken into account in managing sea trout fisheries. In principle conservation limits could be set for sea trout stocks, and the Environment Agency has indicated that this is their ultimate aim. In practice this would be much more difficult than for salmon because of the more complex life history of sea trout: it is a multiple spawner and in many rivers migratory and non-migratory trout form a single stock. Despite these difficulties, we believe that the Environment Agency should set conservation limits for sea trout in order to provide arc. benchmark against which to regulate exploitation, particularly in net fisheries.

The Environment Agency should set conservation limits for sea trout. (Recommendation 44)

- 12.5 The exploitation of immature and small sea trout in net fisheries is best controlled by method restrictions. The current statutory minimum mesh size (2 inches knot-to-knot) results in whitling and one-sea-winter sea trout rarely being caught by nets. However, byelaws permit smaller mesh sizes to be used in some fisheries in South West England which enables one-sea-winter sea trout to be caught. It is important that any changes to minimum mesh sizes introduced in the future take into account the effect of the change on sea trout.
- 12.6 All sizes of sea trout are caught in rod fisheries. The methods used by specialist trout and salmon anglers are quite different and include fishing at different times of the day and night; nevertheless, sea trout will often be caught by salmon anglers and vice versa. In many rivers the whitling are the staple catch of the rod fishery for migratory salmonids, particularly for less skilled anglers although increasing numbers of sea trout anglers are releasing all or part of their catch.
- 12.7 As we point out in Section 8, the presence of sea trout complicates the calculation of salmon conservation limits. This fact emphasises the need to manage salmon and sea trout stocks on individual rivers in an integrated way. This does not only apply to the setting of conservation limits and to the management of exploitation; it is equally necessary to be aware of the different habitat requirements of the two species when undertaking habitat improvements. We would like to see Salmon Action Plans extended as soon as possible to include sea trout, and where appropriate brown trout, pending the development of the comprehensive Fisheries Action Plans which we recommend in Chapter 14.
- Salmon Action Plans should be extended as soon as possible to include sea trout, and where appropriate brown trout, pending development of comprehensive Fisheries Action Plans. (Recommendation 45)
- 12.8 In other respects, the principles we recommend should be applied to the regulation of salmon fisheries, including those concerning net fisheries and the allocation of the resource, should be applied also to sea trout fisheries.
- 12.9 Given the current healthy state of most sea trout stocks in England and Wales, we conclude that there is no need for additional general restrictions on angling for sea trout. We conclude, therefore, that there is no need for measures such as carcase tagging, a general bag limit or a ban on the sale of rod caught fish to be introduced for sea trout although the power to introduce such measures should cover sea trout and so make it possible to introduce them in the future if circumstances change.

Appendix 1

Salmon stock dynamics

In order to obtain an objective measure of the numbers of spawning fish required to adequately stock a river, we need to understand the relationship between the number of adult salmon that spawn and the number that survive to the next generation. Such relationships have been established for a number of salmon populations by monitoring the stock size (the numbers of spawners) and the recruitment (the numbers of smolts or adults produced) usually for at least 15 years. Figure 1 shows an example of such data, each diamond showing the spawning escapement in a single year and the number of offspring that survived. Unfortunately stocks are affected by a wide range of factors, and the relationship in the raw data is not always easy to see. Mathematical methods are therefore used to define the stock-recruitment curve that best fits the data; in Figure 1, a dome-shaped curve gives the best fit.

The stock-recruitment curve in Figure 1 shows that the number of smolts produced does not change in proportion to the number of parent spawners, but increases steeply at first before levelling out, and, at high stock levels, declining again. This means that stocks tend to be most productive (i.e. a high proportion of the offspring of each adult pair survive) when numbers are low, but that a smaller proportion of the offspring survive as numbers increase. This occurs because the juvenile fish compete for space and food in the river, and this tends to limit the population size in freshwater to a level known as the carrying capacity for the stream. There does not appear to be a carrying-capacity for salmon in the sea (at normal stock densities), and so the proportion of salmon smolts that survive to return as adults is not affected by the numbers of emigrating, although it will vary between rivers and with marine conditions. In Figure 1, the straight line at 45° from the origin is known as the replacement line. At any point on this line, the number of surviving adults equals the number of spawners in the previous generation. The stock-recruitment curve lies above the replacement line at low stock levels, and the distance between the replacement line and the stock-recruitment curve is the number of fish that may be caught without reducing the population; this is sometimes referred to as the exploitable surplus (Figure 2). Because the stock-recruitment curve levels out, it must also cross the replacement line, and this occurs at the replacement point (Figure 3). This is the stock size at which the population will tend to stabilise if it is not exploited. If the population is exploited, it will still tend to come to an equilibrium state, but this will be at a smaller size. The higher the level of exploitation, the smaller will be the equilibrium stock size (the stock will stabilise at the point where the exploitable surplace divided by the total (adult) recruitment equals the exploitation rate). However, if the exploitation rate exceeds a critical level, the stock will be unable to replace itself and will be forced to extinction.

Looking at the stock-recruitment curve, it might appear the 'optimum' status of the stock is at the point of maximum recruitment, where the number of smolts or adults produced is at its greatest (Figure 3). However, this is not the point where **exploitable surplus** is at its maximum; this always occurs at the lower stock size. If the management objective was to maximise the catch in a sustainable way, then this might be a preferable equilibrium position. In the case of salmon, the choice may not be so simple because there may be a desire to allocate more fish for the rod fisheries than they will be able to catch, in order to improve the quality of the fishing. The equilibrium state of the stock would therefore depend upon what management objectives were selected and the resulting level of exploitation.

The three points marked on the stock-recruitment curve in Figure 3 can all be defined mathematically (although the maximum recruitment point cannot be defined for all types of curve). They can therefore be objectively set for any stock for which a stock-recruitment curve can be established or approximated, and provide a sensible basis for setting reference levels for management. ICES has selected the lowest of these as an appropriate level for a conservation limit, and the objective should be to ensure that the spawning stock in each river is above this level in the majority of years. One way to achieve this is to set a management target, a point at which managers might aim, at a higher stock level. The difference between the conservation limit and the management target would depend upon the degree of uncertainty in both the stock assessments and the ability to manage the fisheries (Figure 4).

Salmon Stock Dynamics

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Figure 1. Relationship between numbers of adult spawners (stock) and production of adults in the next generation (recruitment).



Figure 2. Exploitable surplus calculated from stock-recruitment curve.



Figure 3. Stock-recruitment curve showing biological reference points.

Figure 4. Stock-recruitment curve showing conservation limit and management target.