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THE USE OF STOCK REBUILDING PROGRAMMES IN THE PRECAUTIONARY MANAGEMENT OF SALMON STOCKS

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ABSTRACT

The last two to three decades have seen serious declines in Atlantic salmon (*Salmo salar*) stocks throughout their range. In response, the North Atlantic Salmon Conservation Organization (NASCO) and its Parties have agreed to apply a Precautionary Approach to the conservation, management and exploitation of salmon. They have also proposed that Stock Rebuilding Programmes (SRPs) should be developed for all river stocks that are below their conservation limits. NASCO has therefore developed guidance on the process for establishing an SRP for a salmon stock and what such a plan might contain. The nature and extent of the programme will depend upon the status of the stock and the pressures that it is facing. While the short-term response to a stock failing to exceed its conservation limit may be to reduce or eliminate exploitation, salmon stocks frequently face a range of other pressures in both the freshwater and marine environments. SRPs will therefore be expected to include an array of measures to both evaluate and address the causes of the stock decline. In some situations, there may be a need for comprehensive programmes of research and management, which may be undertaken by, or have social and economic impacts upon, a number of user groups. While progress is being made with the development and implementation of such plans, there remains a need to ensure that a more holistic approach is taken to planning and implementing action which might be more consistent with current moves towards an Ecosystem Approach to Fisheries Management.

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INTRODUCTION

The past two to three decades have seen a major decline in the state of Atlantic salmon (*Salmo salar* L) stocks throughout much of their natural range in the North Atlantic Ocean (ICES, 2000). Despite on-going efforts to curb exploitation and improve production, there have been few signs of any reversal of these trends. This has led authorities to re-examine the principles applied in the management of salmon stocks and their fisheries. The objective of the North Atlantic Salmon Conservation Organization (NASCO), which was established in 1984, is to contribute through consultation and co-operation to the conservation, restoration, enhancement and rational management of wild Atlantic salmon stocks. In 1998, NASCO and its Parties agreed to apply a Precautionary Approach to these activities (NASCO 1998) and, further, that Stock Rebuilding Programmes (SRPs) should be developed for stocks that are below their conservation limits. An Action Plan was subsequently prepared to address all aspects of the Organisation's work on salmon conservation and management and to develop appropriate guidance (NASCO, 1999). One of the final elements of this Action Plan was the preparation of Guidelines on the Use of Stock Rebuilding Programmes in the Context of the Precautionary Management of Salmon Stocks (NASCO, 2004a), hereinafter referred to as the SRP Guidelines. The inclusion of SRPs within the NASCO Precautionary Approach Agreement reflected similar clauses in other international agreements on the Precautionary Approach (e.g. UN, 1995).

Because of their anadromous life-cycle, salmon pass through many different habitats and may be vulnerable to a range of different commercial and recreational fisheries during their lives. The SRP Guidelines provide advice on the issues to be considered in establishing a management programme for rebuilding a depleted salmon stock. They recommend that SRPs should, *inter alia*: fully evaluate the state of the stock; consider the possible effects of natural and anthropogenic influences in both the marine and freshwater environments; plan and prioritise actions to address these problems; consider the involvement of a range of different stakeholder groups; and ensure mechanisms are in place to assess the efficacy of any work undertaken.

The SRP Guidelines also provide an important link between several other guidance documents developed by NASCO in relation to the application of the Precautionary Approach; in particular:

- The Decision Structure for the management of salmon fisheries (NASCO, 2002);
- The Plan of Action for the protection and restoration of salmon habitats (NASCO, 2001);
- The Guidelines for Stocking of Atlantic Salmon (NASCO, 2004b); and
- The Guidelines for Incorporating Social and Economic Factors in Decisions under the Precautionary Approach (NASCO, 2004c).

In this way the SRP guidelines established a framework for bringing together much of NASCO's earlier work relating to the Precautionary Approach.

In this paper we present an outline of the SRP Guidelines and discuss progress made with developing and implementing specific SRPs for salmon. Finally we discuss whether lessons may be learnt for the development of rebuilding programmes for other threatened diadromous fish species such as sea trout (*Salmo trutta*) , eels (*Anguila spp.*) and shad (*Alosa spp.*).

DEFINING AN SRP FOR SALMON

NASCO has defined an SRP for salmon as an array of management measures, possibly including habitat restoration/improvement, exploitation control and stocking, which is designed to restore a depleted salmon stock above its conservation limit. In this context NASCO has adopted the definition of a 'stock' provided by ICES (1996) of "a unit of a size (encompassing one or more populations) which provides a practical basis for the fishery managers, while still helping to ensure the conservation of the contributing populations". A range of stock units have been used in the management of salmon in the North Atlantic, but the primary management unit (e.g. for reporting statistics and regulating fishing) is generally taken to be the 'river stock', comprising all fish originating from eggs laid within the river; the term stock has been used in this way throughout this paper.

As the above definition implies, many stocks will include two or more genetically distinct 'populations'. While salmon would ideally be managed at the population level, this is rarely practical both because populations are generally difficult to distinguish, and because most fisheries, even within rivers, exploit a mixture of several populations. It is therefore important to note that stock rebuilding not only refers to improving stock numbers but equally implies a need to maintain or restore the appropriate balance between all populations making up the stock so as to protect stock diversity.

ASSESSING THE STATUS OF STOCKS

Clearly the first step in stock management is to determine the stock status. The SRP Guidelines propose that this assessment should be based upon the use of conservation limits, which NASCO has previously determined should be established for all river stocks (NASCO, 1998). Conservation limits should ideally be established on the basis of stock-recruit relationships for each specific stock (ICES, 1995), and serve to indicate a level below which the reproductive capacity of the stock is impaired. This provides an objective and consistent approach to determining the need for management action, which makes the imposition of regulations easier to explain and justify to stakeholders. However, there are around 2200 salmon river stocks around the North Atlantic and so it is not possible to collect detailed information on them all or even to monitor them all closely. In many cases, information on the stock will be limited, so there may be uncertainties about both the conservation limit and the current stock abundance. In addition, the numbers of salmon returning to spawn can be highly variable from year to year, and so the stock will sometimes fall below the conservation limit simply as a result of natural variation. While these uncertainties should be taken into account in the decision-making process, they should not prevent management decisions being taken, and the Precautionary Approach requires that in such circumstances management actions should be more cautious so as to give priority to conserving the productive capacity of the resource (NASCO, 1998).

Assessing the status of the stock also requires more than simply determining whether the spawning escapement has fallen below the conservation limit, and a range of other factors will influence the type of management action that may be appropriate. Both the degree and duration of the conservation limit failure (e.g. failure by more than X% for more than Y years) are relevant to the assessment. Clearly, the further that a stock falls below its conservation limit and the more years for which it does so, the greater the probable need for management action. The nature of the stock decline (e.g. timing and severity of decline) may also be informative in determining the main causes. Ideally managers and stakeholders should agree in advance upon the failure criteria that will trigger certain management actions. This may be achieved through the development of decision structures for stock management, although it is important to ensure balance between providing clarity on the course of action that may be preferred and constraining management by being too prescriptive.

The SRP Guidelines do not specify the failure criteria that will trigger management actions nor prescribe the actions to be taken. Indeed, this is unlikely to be productive as the approach taken should be closely linked to the management options that may be adopted, and these in turn need to be appropriate to: the legislative framework within which they will operate; the nature of ownership and operation of the fisheries and the associated habitat; and even local cultural considerations. NASCO has developed a simple Decision Structure to highlight the issues that should be considered in assessing stocks (NASCO, 2002) and developing management measures in relation to exploitation control, but has recommended that its Parties develop their own more detailed management approaches. In England and Wales, an approach is being developed which uses the trend in the catches over the past 10 years to estimate the probability of the stock achieving its conservation limit by a future target date (Godfrey Williams, Environment Agency, UK, *personal communication*). The result is used to trigger different categories of response, in terms of exploitation control and habitat improvement, as part of an overall package of management measures.

IDENTIFYING THE THREATS AND PROBLEMS

The short-term response to a stock failing to exceed its conservation limit is frequently to reduce or eliminate exploitation. Such action is likely to have the most immediate effect on the spawning escapement, but exploitation is rarely the greatest threat to the stock. Indeed, such have been the reductions in exploitation of salmon in recent years, following years of decline in the status of salmon stocks throughout the North Atlantic, that many stocks are now subject to only very limited fishing. Thus there should be a more detailed investigation of the factors affecting the stock throughout its life-cycle and throughout the habitat that it occupies. In some situations, extensive research programmes may be required to elucidate the problems.

Stocks may fall below their conservation limits as a result of reduced production and/or increased mortality, and these can result from either natural or anthropogenic factors (including fishing). The exact reasons for the stock decline may be unknown, but possible causes and potential threats need to be fully evaluated to ensure that management action is appropriately targeted. The SRP Guidelines consider the following causes of stock decline:

- Natural environmental change, including rainfall and river flow patterns, river temperatures, marine temperatures and currents;
- Habitat degradation, including water quality, sub-lethal effects, water chemistry (e.g. pH), water quantity caused by man-made structures or extractions, spawning and juvenile habitat (e.g. sediments and reduced carrying capacity),

factors affecting food production, obstructions to smolt or adult migration (and entrainment), fish farming;
- Species interactions, including fish/bird/mammal predators in sea/freshwater, diseases and parasites (e.g. *Gyrodactylus salaris*, sea lice), competition with native species, competition with introduced species (e.g. stocking effects); wild/farmed fish; and
- Exploitation, including by-catches of post-smolts, marine salmon fisheries, by-catches in homewater fisheries, directed homewater net and rod fisheries, non-catch fishing mortality, exploitation of prey species.

Different stock components may be affected in different ways by different factors, and it is also important to identify those stocks components in greatest need of protection or restoration. For example, age groups may be differentially affected by fisheries which operate at different times of year or are size-selective, and tributary populations may be differentially affected by water quality problems.

Efforts should also be made to trace problems back to their root cause. The 'classic' response to depleted salmon populations has frequently been to stock hatchery-reared juveniles, often without first determining whether production has been limited by degraded habitat which may be unable to sustain the 'enhanced' stock. There is now a growing recognition that greater and longer-term benefit may be achieved from habitat restoration and improvement, and that while stocking may be used to circumvent particular bottlenecks in production (e.g. poor egg survival), it should generally only be used as an interim stock protection measure while other actions are taken to address the cause of the stock decline.

Where natural environmental changes are occurring, such as increases in sea temperature, efforts should be made to explain the effects these have had on salmon production, from which we can begin to predict the longer-term impacts taking account of forecasts of the likely duration and extent of the changes. If continuing deterioration of natural environmental conditions is predicted, this will need to be taken into account in determining the most appropriate management actions. This may become a greater problem in the future, with climate change having significant effects on patterns of river flow and temperature, as well as on the marine environment. As some stage, it may become necessary to decide when restoration and protection programmes are no longer going to be economically practical. It would be advisable for the ground-rules for such decision-making to be explored well in advance of the problems arising.

Interactions with other species often present particular problems, since they may create conflicts between different interest groups. Thus, for example, coarse fish anglers may oppose measures to control fish predators such as pike, even when these have been illegally introduced to the waters. Similarly, ornithological interests are likely to oppose controls on piscivorous birds, particularly where the status of the birds is also under pressure. This clearly calls for the participation of all interest groups at an early stage as envisaged by an Ecosystem Approach to river catchment (or watershed) management.

PLANNING AND PRIORITISING MANAGEMENT ACTIONS

Having identified possible causes of stock decline, the SRP Guidelines highlight the need to plan and, in particular, prioritise management actions, consistent with a

Precautionary Approach. Prioritisation is particularly important where a number of problems/threats have been identified, and resources are limited. Both the costs of ameliorative action and benefits likely to accrue need to be evaluated when planning an SRP. Such planning should also take account of the need for additional monitoring or research, when information is inadequate, and the evaluation of the results of any SRP put in place.

Control of legal exploitation should be seen in the context of other measures that may be taken, including reductions in unreported or illegal catches and by-catches, and may only be required while other problems/threats are remedied. In general harvest strategies for salmon are poorly defined and the operation of fisheries exploiting the same stocks in several jurisdictions further confuses attempts to identify clear and consistent objectives (Crozier, *et al.,* 2003). Both managers and stakeholders are likely to benefit from having clearer harvest strategies for all stocks, and if long-term changes in productivity are expected, this would facilitate identifying the needs for change.

Almost all management actions will have cost implications, and these will need to be considered in relation to the potentially wide-ranging and long-term benefits associated with maintaining healthy salmon stocks. These costs may range from the direct financial costs of implementing management plans, such as habitat improvement, to both social and economic effects arising from the loss of commercial and recreational fishing opportunities. Managers also need to consider incidental consequences of different management options. Thus, for example, there may be a need to ensure that the long-term future of a fishery is not prejudiced by a short-term closure, if there is a possibility that local fishing skills will be lost. This is a particular concern for some salmon fisheries, which employ highly specialised fishing methods for use in particular locations, and has led to the need to consider the possible heritage value of specific methods in some areas (EA, 2003). Furthermore, the NASCO Convention requires that, in exercising their functions, the NASCO Commissions take into account the interests of communities which are particularly dependent upon salmon fisheries (NASCO, 2000a). NASCO guidelines have also been developed to provide a framework for incorporating social and economic factors into decisions which may affect wild salmon and the environments in which it lives (NASCO, 2004c).

IDENTIFYING AND INVOLVING STAKEHOLDERS

An essential part of any SRP identified by the SRP Guidelines is the involvement of stakeholder groups who may not only be affected by specific measures taken to restore the stock but are likely to be well-placed to assist in their implementation. It is important that these groups engage with the rebuilding plans, and they should therefore be involved from the earliest stages in the development of the SRP. Benefits will be gained both from their general experience of salmon management and their specific knowledge of the stock(s) in question.

SRPs for any species may involve a range of stakeholder groups, but this is particularly likely to be true for salmon. The responsibilities of these different groups and organisations in the SRP should therefore be clearly defined. There will often also be benefits in engaging with the wider community when trying to restore a stock and this may call for a range of out-reach projects, such as the development of education material for dissemination to other groups making use of the river environment and to the wider public. Consideration also needs to be given to the potential incidental effects of an SRP on those, for example, with interests in other parts of the ecosystem that may be affected. Nevertheless, SRPs for Atlantic salmon will often benefit other diadromous fish stocks particularly where they involve habitat protection and restoration initiatives.

IDENTIFYING THE NEED FOR INTERIM MEASURES

Where stocks are seriously depleted, and full recovery is likely to take several generations, there may be a need to develop a staged approach to the recovery programme and to adopt certain interim measures. Where the prognosis for stock rebuilding is long-term, it may be appropriate to consider an intermediate 'recovery' reference point or to set a goal of an annual average percentage increase. This should not be seen as a watering-down of the management action but as a means to assist in tracking stock recovery over a longer period.

Consideration may need to be given to the need for stocking, although there is now a strong feeling that this should only be used as an interim stock protection or rebuilding measure (NASCO, 2004a). Stocking may be used to circumvent particular bottlenecks in production while other actions are taken to address the cause of the stock decline, but the action carries its own risks which should be carefully evaluated. Where stocks are very seriously depleted or in danger of extinction, consideration may also be given to the need for establishing a gene bank by cryopreservation of gametes or holding broodstock in order to preserve potentially unique genotypes.

MONITORING AND EVALUATING PROGRESS

The SRP Guidelines emphasise that monitoring to assess the outcome of the measures being taken is essential. Clearly there is no point in continuing a programme that is ineffective, and the earlier that improvements to the programme can be identified and implemented the better. Thus when measures are proposed, they should include a forecast of the expected benefits against which the stock recovery can be assessed. This should include interim targets set for the course of the project timescale which should allow progress to be followed more closely. Existing monitoring programmes should certainly be maintained and, in many circumstances, will need to be enhanced to permit appropriate evaluation of the progress of the SRP, and progress should be assessed against the forecasts of the expected benefits of the different management measures, including, where possible, trajectories for stock recovery.

SRPs should also be responsive to change. Programmes may need to be planned over one or more decades, in which time unpredicted changes may occur. For programmes operating over such time-scales there will need to be regular assessment of progress and review of planned actions by a competent authority.

IMPLEMENTING SALMON STOCK REBUILDING PROGRAMMES

Central to application of the Precautionary Approach is comprehensive reporting of the actions taken and evaluation of their effectiveness. Following adoption of the SRP Guidelines, each Party was asked to provide to NASCO, on an annual basis, a summary or list of its current SRPs and suggestions for how the SRP Guidelines might be improved. The first reports were made in 2005 and are presented in NASCO (2005a).

From these returns, it is clear that in response to the marked decline in abundance of both European and North American salmon stocks (ICES, 2005), SRPs have been initiated or are under development in most North Atlantic countries. These programmes vary considerably in their nature and extent and employ one or more of the following measures: exploitation control (including control and enforcement actions), habitat improvement, stocking, gene banking, predator control and management of aquaculture.

SRPs have been implemented on rivers with widely varying stock status, including those which have lost their stock, those in which the stock is critically endangered, and those in which there is no immediate concern about the survival of the stock but in which the stock has fallen below the conservation limit. In some of the SRPs there is one clearly identified factor limiting production, e.g. acidification or the parasite *Gyrodactylus salaris*, while in others research is being undertaken to evaluate the problem and inform management action. Some SRPs rely on the voluntary actions of stakeholders while others have a legal basis. Some SRPs involve novel partnerships, for example where wild and farmed salmon interests have pooled resources and expertise to rear critically endangered wild populations in the USA to spawning condition in commercial salmon farming facilities (David Bean, NOAA Fisheries, USA, *personal communication*). SRPs may also target an individual river or may cover a number of rivers within a geographical area or which are affected by a common problem.

The examples that follow demonstrate the nature and extent of stock rebuilding initiatives and show how the main elements of the SRP Guidelines are being applied in practice.

On a North Atlantic-wide basis, the regulatory measures agreed through the regional Commissions of NASCO, the closure of the Northern Norwegian Sea fishery, and the actions taken to eliminate fishing by vessels registered to non-NASCO countries, have created an environment in which States of Origin can implement stock rebuilding measures with some confidence that those initiatives will not be undermined by the actions of others. A consequence of the adoption by NASCO of regulatory measures for the distant-water fisheries has been a requirement for burden-sharing, and measures designed to reduce exploitation of salmon have been introduced by States of Origin throughout the North Atlantic, partly for domestic reasons and partly in fulfilment of international obligations, although a number of coastal fisheries continue to operate (ICES, 2005a) and may frequently take salmon from more than one river or jurisdiction.

Measures taken have included:

- closure of all commercial salmon fisheries in Atlantic Canada since 2000;
- banning of the drift net fishery for salmon in Norway in 1989 and a 68% reduction in the number of fixed gears between 1970 and 1999 (NASCO, 2000b);
- an 83% reduction in netting effort in Scotland between 1975 and 1999 (NASCO, 2000c);
- reductions in the commercial salmon quota in Ireland of 48% since the initial quota was set in 2002 (NASCO, 2005b);

- increasing use of catch and release in recreational salmon fisheries in six countries to the extent that more than 140,000 salmon were released following capture in these countries in 2004 (ICES, 2005a); and
- implementation of a policy in England and Wales to phase-out all salmon fisheries exploiting predominantly mixed stocks (NRA, 1996).

These and other measures to control exploitation have reduced the impact on spawning escapement of the very substantial reductions in pre-fishery abundance reported by ICES and are a significant contribution to stock rebuilding.

The parasite *Gyrodactylus salaris* was first identified in Norway in 1975 following its introduction from the Baltic with movements of infected hatchery stocks (NASCO, 2004d). It has subsequently infected 45 salmon rivers in which parr densities have declined by, on average, 86% (NASCO, 2004d). The SRP for the affected rivers involves the treatment by a combination of construction of barriers and treatment with rotenone. Twenty-five of the infected rivers have been treated and in 15 the parasite has been eradicated (Øyvind Walsø, Directorate for Nature Management, Norway, *personal communication*). During treatment, the salmon populations are maintained in a living gene bank which is used to supplement natural recovery. The cost of this SRP since its inception is approximately £20 million excluding the costs associated with the loss of income from the fisheries. Monitoring and measures to prevent the further spread of the parasite are key elements of the rebuilding programme. Not all infected rivers are amenable to treatment, and on the Drammenselva, for example, the stock is maintained through hatchery releases.

A second major SRP is being conducted in acidified rivers in the south of Norway. In 2004, 21 rivers were limed at a cost of £4 million. The largest liming projects are in three large watercourses and in two of these, fisheries have been resumed (NASCO 2005b).

In Canada, a new national policy framework for the conservation of Atlantic salmon is under development with the goal of restoration and sustainable management of diverse Atlantic salmon populations and their habitat. Thirty-two Inner Bay of Fundy rivers have been listed as ‘endangered’ under Canada’s Species at Risk Act and, under an SRP, rebuilding efforts are underway for priority rivers where live gene bank and individual fish pedigree techniques are used to maintain the genetic integrity in each river. In Quebec, mandatory catch and release angling is the first step in stock rebuilding but for some rivers a five-year stocking programme has been implemented to accelerate the recovery. In Newfoundland, community conservation initiatives have been established for seven rivers, and these rivers have recently seen increased runs. The initiatives involve stewardship and public awareness campaigns (NASCO, 2005c).

In the US, SRPs have been developed and are under evaluation for the salmon rivers in Maine listed under the Endangered Species Act and for other rivers, including the Connecticut, Merrimack and Pawcatuck. Factors contributing to depressed population levels are being evaluated and strategies to protect and restore critical habitats have been developed. Stakeholders have been identified and included in the rebuilding programme process. For one of the endangered population rivers, non-lethal methods of displacing cormorants have been evaluated. In 2004 more than 15 million juvenile salmon were released into 16 rivers in the US (NASCO, 2005c). An educational outreach programme entitled ‘Adopt a Salmon

Family' has been ongoing for 12 years and is an important element of the SRP for some rivers.

Within the European Union there is a major international SRP on the River Rhine. In Ireland, habitat improvement and exploitation control together with stocking in sixteen rivers are being used to rebuild stocks. Three rivers in Spain are subject to SRPs and, in the UK, habitat management, exploitation control and stocking are being undertaken. In England and Wales, the Environment Agency has developed Salmon Action Plans (SAPs) for all principal salmon rivers (EA, 1998). Each SAP comprises two documents: a Consultation Document reviews the stock and fishery status, identifies factors limiting performance and lists a series of costed options to address these; the Final Plan is compiled following the consultation process and contains a list of agreed of actions which the Environment Agency, in partnership with others, is committed to address in the five year lifetime of the Plan; progress against agreed actions is reviewed annually.

In Iceland there are relatively few anthropogenic habitat problems and, with the exception of three rivers, only minor stocking programmes using local stocks are undertaken by river associations, often in cooperation with angling clubs. In northern Finland no rebuilding programmes have been developed. In Russia only one comprehensive programme has been initiated, on the Umba river where poor logging practices and illegal fishing resulted in a considerable decline in the stock to well below its conservation limit. The Umba SRP includes exploitation control, stocking, habitat management, predator control, control and enforcement actions, and research and monitoring to assess the programme's effectiveness.

In the Baltic Sea, a Salmon Action Plan 1997-2010 has been adopted with the objective of achieving 50% of the best estimate of potential production in each salmon river by 2010 and re-establishing wild salmon populations in potential salmon rivers (see www.ibsfc.org).

DISCUSSION

The NASCO SRP Guidelines are designed to provide clear direction for the development of management programmes for depleted salmon stocks, without losing the flexibility needed to accommodate the varied nature of different stocks and fisheries. A more strictly formalised system may have merits, including providing greater clarity and consistency for stakeholder groups, greater ease to justify taking protective measures in the face of stakeholder resistance – sometimes through legal procedures – and clearer reporting of progress. However, if applied across large areas, this may constrain an ability to be responsive to local conditions and issues. Thus there may be advantages in using the SRP Guidelines to develop standard procedures tailored for a particular region or jurisdiction.

The success of SRPs will depend on the productive capacity of the stock under the prevailing conditions (ICES, 2003). While programmes targeted at specific threats to the resource which are amenable to management action, e.g. the liming programme in Norway, have resulted in rebuilding of stocks to the extent that resumption of exploitation has been possible, even at a time of elevated marine mortality, it may take many years to rebuild low productivity stocks which are well below their conservation limits and where there is no obvious limiting factor(s) that is(are) amenable to management intervention. For some low and moderately productive salmon populations modelled by ICES, conservation limits were not achieved within a fifty-year simulated SRP (ICES, 2003). A key challenge will therefore be to maintain strong public and political support for, and broad stakeholder involvement in, salmon SRPs. Full cost-benefit analysis, taking into account all of the social and economic values of Atlantic salmon, including the existence values, should be supportive of conservation and restoration of wild salmon stocks (NASCO, 2004c).

Salmon has both high user values, particularly as a recreational resource, and existence values commanding significant public and political interest. The same is generally not true of species such as the shad, or even sea trout and eel. This certainly limits the amount of research that is undertaken on these species and may constrain the political will to implement significant rebuilding programmes. Nevertheless, even in such circumstances, there may be particular merits in developing SRPs, since these may better publicise the need for action, ensure better co-ordination of activities and allow better use of available resources. The extent to which the approaches proposed by NASCO for salmon SRPs can be adopted for other threatened diadromous species may be limited although lessons can certainly be learnt.

An example of the problems posed for other species is evident from the seriously depleted state of the European eel stock. ICES (2005b) has estimated that recruitment to the stock has fallen to about 2% of its historic levels and has recommended urgent protective action. The European Community has developed an Action Plan for the Management of European Eel, but it is clearly very difficult to implement a common course of action, given the range of stakeholder groups and jurisdictions with interests in the eel stock. The extent of the decline is so severe that the need for exploitation controls is evident to most parties, but the greatest difficulty arises in trying to pinpoint the cause of the stock decline and thus identify more specific actions to protect and restore the stock.

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