



**Protecting Wild Atlantic Salmon  
from Impacts  
of Salmon Aquaculture:  
*A Country-by-Country Progress Report***

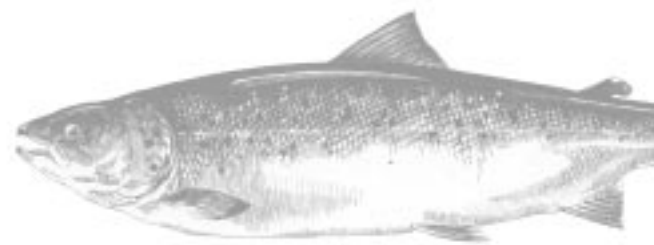
**2nd Report  
2005**

**Gareth Porter**

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Gareth Porter**

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# I. PREFACE

In June 2003, WWF and ASF contracted Dr. Gareth Porter to conduct an independent assessment of how seven member countries of the North Atlantic Salmon Conservation Organization (NASCO) had progressed in protecting wild Atlantic salmon from the impacts of salmon aquaculture as they had agreed in 1994 in the Oslo Resolution. At that time, our intention was to conduct another progress report two years later to document further actions by NASCO nations in regulating their aquaculture industries.

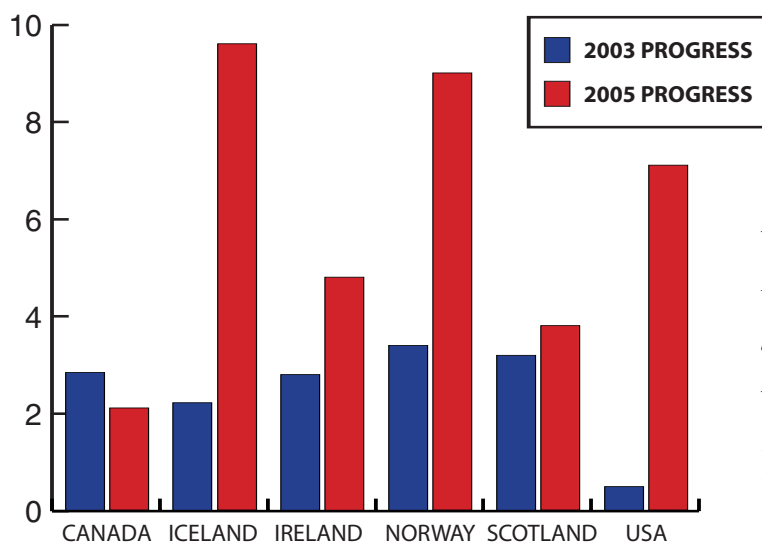
In the meantime, in 2003, NASCO combined all aquaculture measures, including the Oslo Resolution, under one agreement called the Williamsburg Resolution. Recently, WWF and ASF contracted Dr. Gareth Porter to conduct an assessment of the progress by nations since our 2003 report and base it on the Williamsburg Resolution. While NASCO's Oslo Resolution, and later the Williamsburg Resolution, obliged signatories to provide annual reports to NASCO on the measures they had adopted to comply with the terms of the resolution, NASCO has never set a formal process to evaluate the progress of this compliance.

Dr. Gareth Porter had devised a formal process to evaluate progress for the Oslo Resolution and revised it for the Williamsburg Resolution and this report.

Since 2003, NASCO has taken an important and most welcome step. The organization undertook in June 2004, a review of all the challenges that NASCO faces in the management and conservation of wild Atlantic salmon and ways in which these challenges may be met in the coming decade. The review, called "Next Steps for NASCO", entailed consultation with stakeholders and non government organizations. As part of our submission to this review process, WWF and ASF are recommending that NASCO develop a protocol on Reporting of Implementation of NASCO Agreements. What is needed is a system of reporting in which: (1) reporting requirements are clearly understood to be formal commitments under the treaty; (2) reporting requirements are adequate in scope and clearly defined as to the types of measures to be reported (legislation, regulatory requirements, monitoring and enforcement activities); and (3) the data from the reporting can be readily converted into a clear, concise and visual presentation of the progress made and remaining to be achieved.

ASF and WWF respectfully submit this progress report to NASCO as one such system of presenting data on progress in implementing the NASCO agreement on aquaculture management for the protection of wild salmon. We recognize that there are other ways to organize and present the data, but we strongly recommend that NASCO adopt, not only a format for reporting specific to each agreement, but a format for presenting the data that will be clear, concise and informative, and that the assessment be readily made available to the public.

This report documents a good deal of progress by most nations since our 2003 report, especially Iceland, Norway and the United States. All countries, except Canada, improved their scores.



*Fig 1. Progress in Protecting Wild Atlantic Salmon from Impacts of Salmon Aquaculture by six North Atlantic salmon aquaculture nations.*

*Iceland, Norway and USA have made significant strides in implementing measures to protect wild Atlantic salmon.*

The new scores reflect new initiatives that have been taken by NASCO signatory nations and the availability of new, more in-depth data on measures taken in individual countries that gave clearer insight into the situation on certain issues. Getting accurate data is very dependent on officials in the various nations who gave deeper context and detailed explanation. This is particularly true of Norway and Iceland, where English language documentation is very limited. The significant changes in scores are also the result of changes to the scoring system in part as a result of less stringent requirements in the Williamsburg Resolution, which superceded the Oslo Resolution. This second iteration of this report that builds on the 2003 evaluation provides an insight into the methodology that should be used by NASCO to report meaningfully on the actual progress of nations in implementing the Williamsburg Resolution. It certainly points out the present inadequacy of the reporting requirement by NASCO that accepts brief reports, which fail to convey the substance or real progress of the measures taken by each nation.

Lastly, this report provides three recommendations for strengthening and implementing the Williamsburg Resolution.

Bill Taylor  
President  
ATLANTIC SALMON FEDERATION

Scott Burns  
Director, Marine Conservation Fund  
WORLD WILDLIFE FUND

## II. JOINT WWF-ASF RECOMMENDATIONS FOR STRENGTHENING AND IMPLEMENTING THE WILLIAMSBURG RESOLUTION

**1. Develop a new system of reporting on actions to implement the Williamsburg Resolution that goes into greater depth on key issues of aquaculture management**

It has been widely recognized that the present system of reporting on the Williamsburg Resolution does not help to illuminate the real situation regarding progress in managing aquaculture to protect wild salmon. The experimentation by ASF and WWF in seeking to document the actual state of implementation of the Oslo and Williamsburg resolutions over the past two years has demonstrated the need for a reporting process that goes well beyond the one sentence — or even one phrase — responses that have been submitted to NASCO in past years.

The only way that reporting on progress in the key management issues of aquaculture siting, fish husbandry and health and containment of escapes can be meaningful is through an in-depth discussion of the approach being taken by each NASCO signatory nation in its aquaculture management policies. NASCO needs to discuss and adopt a system that will provide in-depth narrative reports that accurately deal with the substantial issues surrounding topics covered in the Williamsburg Resolution. To accomplish this, a mechanism with a multi-stakeholder membership should be established to work with each NASCO country on a more substantive narrative report. A major benefit of this approach will be the rapid exchange of new, cost effective innovations among member countries. This will help with Nos. 2 and 3 below.

**2. Initiate negotiations toward an international regime on managing aquaculture to protect wild salmon**

The international market pressures on salmon aquaculture industries in the NASCO countries have become increasingly intense in recent years. One result of those pressures has been the concentration of the industry in the hands of fewer and fewer companies, as smaller companies are unable to compete in the market. The remaining companies are forced to achieve greater efficiency in production. The companies that remain must strike a compromise between a sound precautionary approach to stocking densities against the need for squeezing the maximum out of each site. Under these circumstances, the only way to ease these pressures is for the relevant NASCO member governments to sponsor negotiations for an international agreement on managing salmon aquaculture to ensure the protection of wild Atlantic salmon. Such negotiations should include Chile, whose production competes with NASCO salmon aquaculture production on the world market.

**3. Review and amend the Williamsburg Resolution as needed to clarify and strengthen its provisions on major issues**

Although the Williamsburg Resolution provides a useful framework for discussion of the major issues of managing salmon aquaculture to protect wild Atlantic salmon, it contains some unfortunate ambiguities that should be rectified in order to avoid different interpretations of its provisions, as discussed in the introduction to this report. The clarification and strengthening of the language of the Resolution would be an important step to prepare for the eventual negotiation of an international regime for salmon aquaculture management.

# III. INTRODUCTION:

## THE WILLIAMSBURG RESOLUTION AND A REVISED SET OF CRITERIA

**A**s a first effort at evaluating compliance with the 1994 NASCO\* Oslo Resolution (the "Convention for the Conservation of Salmon in the North Atlantic Ocean to Minimize Impacts from Salmon Aquaculture on the Wild Salmon Stocks"), in 2003, WWF and ASF published a country-by-country progress report on the implementation of that agreement. The mechanism for evaluating that progress in a systematic way was a set of 10 criteria, based on the Oslo Resolution, each of which had a set of indicators of different degrees of compliance. Each of the indicators was assigned different numerical values.

The report was based on information supplied by the seven NASCO governments with salmon aquaculture industries to NASCO on their compliance with different parts of the agreement, government documents and documents from other sources, and personal communications from officials responsible for implementing various elements of the resolution.

The report, which took into account measures adopted officially through mid-February 2003, revealed a wide chasm between the obligations of these NASCO signatory nations and the actual measures they had taken to implement them. Although the results varied from nation to nation, all of the results were extremely low, averaging mostly between 2 and 3 out of a total of 10. In some cases, a state was in the process of developing new initiatives for regulating aquaculture, which would significantly increase the results for one or more of the criteria. But, because those developments had not yet been adopted officially, they could not be taken into account in measuring their progress.

This follow-up report, two years later, has been undertaken with the intention of accurately reflecting any further progress that has been made since the initial report. In planning this report, however, we have not simply repeated the previous exercise but have revised the system of criteria and indicators used for the evaluation in an effort to make it more accurate and more useful.

We have adapted the system of criteria and indicators to conform to the Williamsburg Resolution. The main change between the Williamsburg Resolution and the Oslo Resolution is the introduction of new language on containment. We have reflected that change in the revised system of criteria by replacing the final three criteria in the 2003 system with three

*\*The North Atlantic Salmon Conservation Organization (NASCO) was established to promote the conservation, restoration, enhancement and rational management of salmon stocks in the North Atlantic Ocean through international co-operation.*

new criteria which are based on the language of the new resolution.

We wanted to get feedback from governments and aquaculture industry representatives about the 2003 report and the structure of criteria and indicators, in particular, in order to improve the follow-up report. We contacted government officials and industry representatives in all seven NASCO signatory nations, whose measures were reviewed in the 2003 report and asked for their comments. We were unable to get any comments on the 2003 report or the framework for evaluating it used from Ireland, Scotland, Norway and the Faroe Islands. Most of those who did respond said they were too busy to provide such input. Because of our inability to get input from government or aquaculture industry representatives in regard to the Faroe Islands, we decided to exclude the Faroe Islands from its coverage, because of the lack of documentation.

Nevertheless, we did get some critical comments from Canada, Iceland and the United States (the State of Maine) on the 2003 framework and scoring. One of the criticisms of that system of criteria and indicators was that the first two criteria were too similar, because both essentially measured government initiatives to keep aquaculture away from salmon rivers and migratory routes. We agreed that it might strike a better balance in the system if the first two criteria of minimum distance from salmon rivers and exclusion zones were combined in a single criterion. Therefore, the first criterion in the new system now includes both of the previous ones, and allows the signatory nation to protect wild salmon through one or the other of the two rather than having to do both.

Another criticism was that there was a substantial overlap between the two criteria on standards for benthic ecosystem quality and on standards for fish husbandry. Indeed, the benthic ecosystem quality criterion was intended to provide a second, more indirect way of gauging progress in fish husbandry standards. In retrospect, it is now clearer that benthic ecosystem quality is not an indicator of the adequacy of industry performance in regard to stocking density or fallowing. Therefore, we have omitted the benthic ecosystem quality standards criterion, along with the monitoring and enforcement criterion for benthic quality, from the 2005 system.

Finally, we added one additional criterion which we recognize is so important that it should not have been omitted from the 2003 set of criteria: practices and procedures for detecting and responding to an outbreak of fish disease or sea lice. The addition of that criterion, along with the elimination of three of the ten criteria in the 2003 framework, meant that there are eight criteria in the 2005 framework. We decided not to attempt to match the number in the original 2003 framework artificially, and that the only important indicator is average result across all the criteria.

In reviewing the framework for evaluation of progress and the results recorded in the 2003 report, especially in light of comments from the State of Maine and from Iceland, it became clearer that the wording of some of the provisions of the Oslo and Williamsburg resolutions is ambigu-

ous enough to leave open the question of what kinds of measures the drafter had in mind. Those ambiguities meant that any scheme for evaluating progress had to make certain assumptions about the practical requirements for making these international norms meaningful.

Both the 2003 framework and the new 2005 framework have been based on two assumptions. The first is that the standards to be achieved are those necessary to ensure the protection of wild Atlantic salmon from salmon aquaculture given the physical circumstances of the aquaculture industry in question. The second is that a government role in monitoring and enforcing standards is necessary to ensure that those standards are being achieved.

Statements by some signatory states indicate, however, that they have interpreted these provisions as allowing self-policing by the industry on one of the relevant issues or the use of informal means to prompt the industry to comply, rather than formal enforcement of regulations. Certain signatory states have also interpreted the Oslo and Williamsburg resolutions to mean that no government role in monitoring and/or enforcement of fish husbandry standards in regard to fish health is necessary.

We recognize that the Williamsburg Resolution clearly states that action plans for containment of farmed salmon may be either "existing or new voluntary codes of practice, regulations or a combination of both." Therefore, we have revised the criteria and indicators for Criteria 6 and 7 to reflect the fact that relevant standards and other elements of such a plan may be generated by the industry itself as code of practice.

However, we note that the language of Section 7.2 of the Williamsburg Resolution's Annex 2 calls for "a mechanism for reporting and monitoring in order to assess compliance and to verify the plans' efficacy." That language strongly implies the need for a government role in monitoring the elements included in Criteria 6 and 7, and we have structured the indicators and evaluated progress on that basis.

Although we recognize that states will interpret the language of agreements in ways that suit their interests, we believe that such minimalist interpretations of these provisions do not advance the cause of saving threatened wild salmon populations.

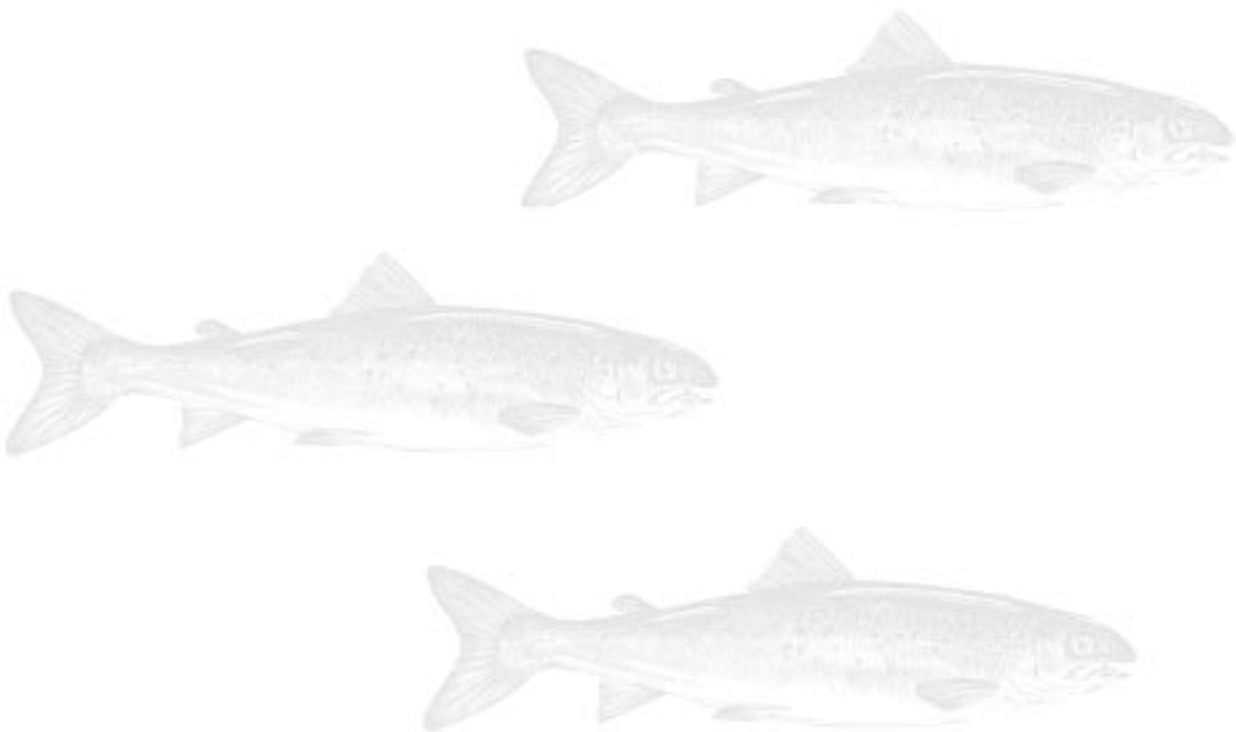
Another ambiguity in the Williamsburg Resolution has to do with the practices and procedures for detecting and minimizing the effects of outbreaks of disease and sea lice in farmed salmon. The language of paragraph 2.5, on "Unknown diseases and parasites" is much more detailed in calling for establishment "procedures...for the early identification and detection of, and rapid response to, an outbreak of any disease or parasitic infection likely to affect Atlantic salmon." However, the paragraph dealing more generally with "appropriate fish health practices" does not use similar language. It refers to "frequent inspection of fish" but otherwise does not refer to establishment of "procedures." Nevertheless, we assume that these same procedures were intended by the drafters to apply to existing "known" diseases and parasites as well.

This ambiguity about paragraph 2.5 could be removed by adding additional language to clarify the presumed intention of the drafters. For the purpose of this evaluative report, however, it makes sense to interpret that paragraph as applying to both new and existing fish diseases and parasites.

A final criticism of the 2003 progress report from both American and Canadian officials is that quantitative judgments based on legal/regulatory criteria do not accurately represent the actual progress being made in the aquaculture industry. They argued for more attention to the actual results achieved.

Although we believe that formal regulations and rigorous monitoring and enforcement are needed to ensure consistent implementation of practices that will help protect wild fish from aquaculture operations, we acknowledge that the physical and geographical context of each country's salmon aquaculture industry and wild salmon populations influences the actual results achieved. Therefore, we have added a brief overview to each country report, which attempts to convey the broader context in which the norms of the Williamsburg Resolution are applied, along with the trends in regard to major issues and status of actual results achieved, insofar as they can be quantified.

As a final form of consultation with signatory states of NASCO, we sent drafts of each of the sections to the relevant government officials with whom contact had been established during the research and writing to solicit comments on the draft. We got back specific comments from the United States, New Brunswick (a Province of Canada) and Ireland, and in each case their comments were carefully considered and generally used to revise the text.



# IV. THE REVISED SCORING SYSTEM

(PARAGRAPHS IN THE WILLIAMSBURG RESOLUTION ON WHICH THE CRITERION IS BASED ARE INDICATED IN BRACKETS)

<b>CRITERION 1</b>	
Adoption of a siting policy aimed at keeping aquaculture at a safe distance from salmon rivers [Annex 2, paragraph 1.1 and 1.2; Article 8; Annex 6]	
<b>Indicators</b>	<b>Results</b>
An adequate minimum distance or exclusion zone is adopted which will help protect more than one salmon river	10
A minimum distance or exclusion zone is adopted which with help protect one salmon river	5
A minimum distance or exclusion zone is adopted which may help reduce the risk to salmon in more than one salmon river	3
A minimum distance or exclusion zone is adopted which may help reduce risk to salmon in one salmon river	2
No minimum distance or exclusion zone has been adopted	0

<b>CRITERION 2:</b>	
Degree to which cumulative environmental impacts of salmon farming on an entire bay or other ecosystem are considered in siting decisions [Annex 2, paragraph 1.4]	
<b>Indicators</b>	<b>Results</b>
Siting approval regulations require that cumulative impacts of aquaculture operations on the entire ecosystem are taken into account, or policy decisions have been taken to limit or exclude aquaculture operations from a given area, based on scientific study of carrying capacity	10
Siting approval regulations require that cumulative impacts of aquaculture operations on the entire ecosystem are taken into account, but not based on scientific study of carrying capacity	5
Siting approval regulations provide for studies of cumulative impacts in the entire ecosystem under some circumstances, but do not require them	3
No consideration has been given to cumulative impacts on aquaculture operations on the entire ecosystem in siting approval	0

<b>CRITERION 3:</b>	
Adequacy of standards for fish husbandry, including best industry practices in regard to year-class separation, fallowing of sites and maximum stocking densities [Annex 2, paragraph 1.4 and 2.1]	
<b>Indicators</b>	<b>Results</b>
Regulations or industry codes of practice require best husbandry practices on class separation, fallowing of sites and stocking densities	10
Regulations or industry codes of practice do not require best husbandry practices on one of the three issues	7
Regulations or industry codes of practice do not require best husbandry practices on two of the three issues	4
Regulations or codes of practice do not require best husbandry practices on any of the three issues	0

<b>CRITERION 4:</b>	
Adequacy of monitoring and enforcement of best practices in fish husbandry [Annex 2, paragraph 1.4 and 2.1]	
<b>Indicators</b>	<b>Results</b>
Authorities carry out on-site monitoring of compliance with requirements or industry codes of practice for fish husbandry and have appropriate and transparent penalties for non-compliance	10
Authorities do not carry out on-site monitoring of compliance with requirements or industry codes of practice for fish husbandry, but do require industry reporting on compliance and have appropriate and transparent penalties for non-compliance	5
Authorities carry out on-site monitoring or require industry reporting on compliance with requirements or industry codes of practice, but do not have appropriate and transparent penalties for non-compliance	3
No system exists for regularly monitoring or industry reporting on fish husbandry	0

<b>CRITERION 5:</b>	
Adequacy of practices and procedures for early detection of an outbreak of any disease or parasitic infection likely to affect Atlantic salmon and rapid response to such an outbreak [Annex 2, paragraphs 2.1-2.5]	
<b>Indicators</b>	<b>Results</b>
Regulations include mandatory frequent testing/counting for ISA virus and sea-lice by appropriate authorities using specified procedures, and mandatory, automatic disease or sea-lice control actions upon detection of the ISA virus or of sea-lice numbers exceeding the maximum	10
Regulations include mandatory frequent testing for both the ISA virus and parasites but not automatic, mandatory actions triggered by detection of ISA or sea-lice counts above a specified level, or vice versa, or both mandatory testing and mandatory actions for ISA but not for sea-lice	5
Regulations include only one of the two elements for either ISA or sea-lice and neither for the other	2.5
There are no mandatory requirements for detection or actions upon detection for either ISA virus or sea-lice	0

<b>CRITERION 6:</b>	
Adequacy of national plan for minimizing escapes in regard to equipment and structures [Annex 3, sections 3 and 4, and 7]	
<b>Indicators</b>	<b>Results</b>
Plans include technical standards for aquaculture systems regarding stock containment reflecting industry best practices, as outlined in Annex 3, section 4	10
Plans provide standards for aquaculture systems regarding stock containment, but the standards do not reflect best industry practices	3
Plan does not provide for any technical standards for aquaculture systems	0

<b>CRITERION 7:</b>	
Adequacy of national plan for minimizing escapes in regard to management operations, site-specific contingency plans and notification of escapes [Annex 3, Sections 5 and 6 and 7]	
<b>Indicators</b>	<b>Results</b>
Plans include standards for management systems and site-specific escape prevention plans reflecting best industry practices, site-specific escaped fish recovery plans and mandatory notification and complete details of escapes	10
Plans include two of the three elements above	7
Plans include one of the three elements above	3
Plans do not include any of the three elements	0

<b>CRITERION 8:</b>	
Adequacy of monitoring in order to assess compliance with the national plan and to verify the plan's efficacy [From Williamsburg Annex 3, subparagraphs 7.2.3]	
<b>Indicators</b>	<b>Results</b>
Authorities carry out on-site monitoring to verify compliance with all the containment measures in Criteria 6 and 7	10
Authorities carry out on-site monitoring of most but not all containment measures in Criteria 6 and 7	7
Authorities carry out on-site monitoring for only one or two of the containment measures in Criteria 6 and 7	3
Authorities do no on-site monitoring of any of the containment measures in Criteria 6 and 7	0

**NOTE:** The average scores of each country are expressed as a number out of TEN

# V. COUNTRY-BY-COUNTRY PROGRESS

## CANADA

TABLE 1 CANADA'S OVERALL PROGRESS	
Criterion	
1. Minimum distance or exclusion zone	0
2. Cumulative impacts and siting decisions	0
3. Fish husbandry year-class separation, fallowing, density	4
4. Fish husbandry monitoring and enforcement	0
5. Standards for disease and parasite detection and response	10
6. National plan for containment re equipment & structures	1
7. National plan for containment re management, contingency and notification	1
8. National plan for containment re compliance & efficacy	1
<b>Average</b>	<b>2.1</b>

### OVERVIEW OF TRENDS AND STATUS OF PROGRESS

The vast bulk of Canada's East Coast Atlantic salmon aquaculture operations is located in the Bay of Fundy, which accounts for 95 percent of the sites in New Brunswick and nearly 90 percent of Atlantic Canada's sites (Intrafish 2001). The L'Etang Inlet is considered to have the world's highest concentration of salmon farms. After the spectacular growth of aquaculture in the Bay during the 1980s and early 1990s, the industry has had to compete over the past decade with long established marine fisheries for the limited space remaining along the coast. That conflict is particularly acute because the best areas for aquaculture, the sheltered bays, are the very ones that fishermen prize for their abundant and accessible wild stocks (Percy, 1996).

The continuing conflict between aquaculture operators and fishermen over coastal zones has limited the number of new sites available, and influenced the fish husbandry practices of New

Brunswick's salmon farmers. According to the New Brunswick Department of Fisheries, Agriculture and Aquaculture (McGeachy, pers. comm.), a majority of New Brunswick salmon farmers practiced single year-class farming even in the 1990s. Many operators knew that they needed to reduce their stocking densities and separate year-classes to minimize the risk to fish health. They could not do so, without either obtaining additional sites to implement crop rotation and lower stocking densities or reducing the size of their operations. The Department of Fisheries, Agriculture and Aquaculture (DAFA) has turned down most of the applications for additional sites (Coombs, 2002).

Like other aquaculture industries, the Canadian industry has also been under pressure from a market flooded with farmed salmon. By the late 1990s, according to industry analysts, a salmon farm needed to produce at least 200,000 fish to be profitable — much larger than the average in the Bay of Fundy (Harvey, 1998). That economic incentive has further increased the tendency to overstock.

The Auditor General of New Brunswick (2004) confirmed the belief of both the New Brunswick DAFA and the Department of Environment and Local Government (DELG) that "overstocking" — stocking levels ranging up to twice the level approved by the government — is common at Bay of Fundy salmon farms. That translates into much higher stocking densities per cage than is desirable to minimize risks to fish health.

Many of the sheltered bays available to salmon farmers also have very poor flushing action from weak tidal currents, which ensured that fish and food wastes would accumulate under the net cages (Percy, 1996). That in turn posed additional risks to the ecosystem as a whole, as was acknowledged several years ago by the New Brunswick Department of Fisheries and Aquaculture (1997).

This overstocking, and the absence of fallowing and multiple year-classes on some sites, may be reduced significantly, if not eliminated in the future, because of the major consolidation of the Canadian industry which is now underway. As smaller producers drop out, and their sites are taken over by larger producers, more salmon farms should be able to reduce stocking densities, undertake fallowing and move to single class sites.

The center of New Brunswick's salmon farming industry is also very close to Canada's troubled Atlantic salmon rivers, notably the Saint John, the Magaguadavic and the St. Croix. That makes escapes from salmon aquaculture sites particularly threatening to stocks in those rivers.

Canada's system for detection and response to fish disease and parasites has evolved significantly from the period before the first outbreak of Infectious Salmon Anemia in the Bay of Fundy in 1997. At first, judgments about testing for disease and withdrawal and slaughter of fish were made on the basis of a provincial Fish Health Technical Committee. Testing procedures were codified in 1999, but decisions to depopulate cages or an entire site were left up to the Provincial minister on the Committee's advice. In 2002, a new system was adopted, which provided for formal rules governing testing, withdrawal and slaughter of fish on a cage-by-cage basis, as well as for mandatory testing and treatment for sea lice. The level of ISA has been reduced from 16 sites in 2002 to just one farm in the 2004 year-class of salmon (McGeachy, pers. comm.).

New Brunswick's government and industry have also avoided the adoption of either regulatory requirements or a Code of Practice for containment of farmed salmon. Neither the provincial government nor the federal government release totals of incidents or numbers of fish involved in fish escapes. Data on escapes released by the North American Commission of NASCO in 2004 (see Table 1) show that the total numbers of escaped fish found in the samples of salmon from the Magaguadavic and St. Croix rivers have declined in the past two years compared with the highs of 1998 and 2001. There is a trend toward decline in the number of escaped fish found in samples of salmon from Canada's rivers, but they still represent roughly the same percentage of the salmon sampled as they did several years ago. The data for St. Croix reflects the degree of progress on both sides of the U.S.– Canadian bound-

ary, because escaped fish in the river may come from either U.S. or Canadian salmon farms, and it is impossible to identify which is which. These data suggest that progress has been made in reducing the total number of escapes, but given the declines in wild salmon runs to the region, the serious impact on wild salmon remains fundamentally unchanged.

River	1998	1999	2000	2001	2002	2003
Magaguadavic	223 (8)	79 (77)	30 (68)	132 (94)	35 (83)	22 (81)
St. Croix	25 (38)	23 (64)	30 (60)	58 (75)	5 (20)	9 (38)

*Table 2: Number of farmed salmon found in samples of New Brunswick rivers (percentage of total salmon)*

## REPORT ON PROGRESS AS OF 2005

### CRITERION 1: ADOPTION OF A SITING POLICY AIMED AT KEEPING AQUACULTURE AT A SAFE DISTANCE FROM SALMON RIVERS

In the 2003 report, Canada received a score of zero for both criteria relating to siting policy. No evidence of any change since that report was completed was found in regard to either requirements for minimum distance to salmon rivers or salmon exclusion zones to protect wild salmon. The Commissioner of the Environment and Sustainable Development (2004) found that New Brunswick still had "no guidelines about locating salmon aquaculture sites at a specific distance from rivers frequented by wild salmon." The report of the Commissioner concluded that Canada "is not living up to its commitments" under the NASCO agreement on this point. The Auditor General of New Brunswick (2004) also noted that Canada was not in full compliance with this element of the Williamsburg Resolution.

Canada does not qualify for a minimum score for this criterion.

### RESULTS FOR CRITERION ONE: 0

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### CRITERION 2: DEGREE TO WHICH CUMULATIVE ENVIRONMENTAL IMPACTS OF SALMON FARMING ON AN ENTIRE BAY OR OTHER ECOSYSTEM ARE CONSIDERED IN SITING DECISIONS

Canada has legislation (The Canadian Environmental Assessment Act of 1992), which requires the assessment, in advance of approval of any project, of the "cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out." However, the government has been reluctant to apply that act by using techniques to define the maximum level of cumulative impacts that was acceptable for a given bay or other ecosystem. The reason given by the DFO in 2001 was that the "cumulative impacts" were "not as well known as near-field impacts" and would require "improved models" (Canadian Parliament, Senate, 2001).

The Commissioner of the Environment and Sustainable Development (2004) recalls that he had recommended in a 2000 report that the Department of Fisheries and Oceans (DFO) "identify areas of needed research to understand the potential effects of an expanded salmon aquaculture industry and assign priorities to ensure that the most effective use of the limited resources before new site proposals are reviewed." Four years later, however, the Commission found that there are still "significant gaps...with respect to the needed research on the potential effects of salmon aquaculture on aquatic ecosystems...."

Canada has not taken any new actions indicating that it is applying the legislation. Although the 2003 report assumed that the law was being applied at least in some places, that optimistic assessment appears in retrospect to have been unwarranted. Canada is still in the preliminary research stage rather than the implementation stage in regard to cumulative effects of aquaculture operations on an ecosystem. Therefore, it does not qualify for a minimum score for this criterion.

## RESULTS FOR CRITERION TWO: 0

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### **CRITERION 3: ADEQUACY OF STANDARDS FOR FISH HUSBANDRY, INCLUDING BEST INDUSTRY PRACTICES IN REGARD TO YEAR-CLASS SEPARATION, FALLOWING OF SITES AND MAXIMUM STOCKING DENSITIES**

Canada has claimed in past reports to NASCO that it had adopted regulations and implementation guidelines in line with "appropriate husbandry technique" or "good husbandry practices." As noted in the 2003 report, New Brunswick, which represents nearly 90 percent of the production of farmed salmon in eastern Canada, has a standard for maximum stocking density in its guidelines of 18 kg per cubic meter of cage space, but not for fallowing or separation of year-classes, nor have the "Bay Area Management Agreements" established any standards for the fallowing or year-class separation. The New Brunswick Site Allocation Policy for the Bay of Fundy required a limited move toward single-year-class production at finfish aquaculture sites in the Bay, but it still allowed a carryover of 20 percent of the previous year-class to the following production year.

Since the 2003 report, no changes have been made in New Brunswick's regulations or guidelines on these issues. The "Codes of Practice" produced by the New Brunswick Salmon Growers Association (2004) do not provide any new standards or best practices for fish husbandry issues, except for the maximum stocking density in the New Brunswick "Environmental Management Guidelines" (New Brunswick Department of Environment and Local Government, 2001), which is simply incorporated into the NBSGA Codes of Practice.

The 2003 report awarded Canada 6 points, based on the assumption that the Marine Site Allocation Policy for the Bay of Fundy was a first step toward requiring single-year-class production. However, no requirement for a transition to full single-year-class sites has been adopted. Therefore, Canada is only credited with one out of the three fish husbandry issues — New Brunswick's standard for maximum stocking density — and qualifies for only the minimum score for this criterion.

## RESULTS FOR CRITERION THREE: 4

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### **CRITERION 4: ADEQUACY OF MONITORING AND ENFORCEMENT OF BEST PRACTICES IN FISH HUSBANDRY**

In the 2003 report, Canada was awarded a score of 2, on the ground that it was monitoring and

enforcing single-year-class production, but not the other two fish husbandry issues, and was not reporting publicly even on that one issue. According to the Auditor General of New Brunswick (2004), however, the monitoring and enforcement by the DELG, which began in 2003, has been focused entirely on reconciling fish reported as shipped to cage sites and transport mortalities with approved production levels. The report indicates that, as of 2004, the maximum stocking density still was not being monitored or enforced.

There is no evidence from the Auditor General's report or any other source of any monitoring of compliance with the (limited) year-class separation norm found in the Bay of Fundy Site Allocation Policy. The New Brunswick DAFA acknowledges that it is not mandatory (McGeachy, pers. comm.). Therefore, Canada does not qualify for the minimum score for this criterion.

## **RESULTS FOR CRITERION FOUR: 0**

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### **CRITERION 5: ADEQUACY OF PRACTICES AND PROCEDURES FOR EARLY DETECTION OF AN OUTBREAK OF ANY DISEASE OR PARASITIC INFECTION LIKELY TO AFFECT ATLANTIC SALMON AND RAPID RESPONSE TO SUCH AN OUTBREAK**

Canada began reporting to NASCO in 1999 that "federal and provincial regulations and implementation guidelines are in place and enforced," and that in New Brunswick an "ISA Virus Fish Health Surveillance Program" had been adopted (NASCO 1999). It did not report any measures during the next three years (NASCO, 2000, NASCO 2001, NASCO 2002).

However, the system for detection and response has evolved gradually from the time that ISA first hit the Bay of Fundy in 1996 and 2001 (MacPhee and Hawkins, 2001). At first, the procedures were not codified. Judgments about testing for disease and withdrawal and slaughter of fish depended on a provincial Fish Health Technical Committee formed in April 1998, with three members representing the industry, two from the province and one from the federal government, which made recommendations to the New Brunswick Minister of Agriculture, Fisheries and Aquaculture (New Brunswick DAFA, 1999; New Brunswick, Office of the Commissioner for Aquatic Development, 2002; New Brunswick Salmon Growers, 2001).

In September 1999, the rules for surveillance of farms for the ISA virus were formalized, but decisions on depopulation of cages or entire sites still lay with the Minister, based on the Fish Health Committee's advice (New Brunswick DAFA, 1999). In late 2002, the New Brunswick DAFA and the New Brunswick Salmon Growers reached a new agreement on ISA surveillance, which established a new system governing the testing for ISA and responses to an ISA outbreak. The agreement, revised in 2003, provides for mandatory monthly testing by veterinarians at each site, and withdrawal and slaughter of all the fish in any cage in which 2 fish test positive according to two different tests for ISA. These procedures also apply mandatory counting of sea lice and mandatory treatment when the count goes above a certain level (Beattie, pers. comm.).

Based on this agreement, Canada fulfills the requirements for the highest score for this criterion.

## **RESULTS FOR CRITERION FIVE: 10**

**CRITERION 6: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO EQUIPMENT AND STRUCTURES**

Canada has promised "Containment Codes of Practice" that would provide "area-specific standards required by provincial licensing authorities as the basis for regulation" since 1998. As of the completion of the 2003 report, Newfoundland had adopted such a code of practice for containment which requires cages to be appropriate to prevailing weather conditions on the site, but New Brunswick, representing 90 percent of Eastern Canada's salmon aquaculture production, had only a draft Code of Containment that had not yet been officially adopted. Canada received only the minimum of one point on this criterion.

Two years later, the New Brunswick Salmon Growers Association still had not adopted a Code of Containment. According to the Research and Environmental Coordinator for NBSGA, the Code of Containment under development is still only in draft form and not available for distribution (Smith, pers. comm.).

Therefore, Canada still qualifies for just one-tenth of the highest score for this criterion.

**RESULTS FOR CRITERION SIX: 1**

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**CRITERION 7: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO MANAGEMENT OPERATIONS, SITE-SPECIFIC CONTINGENCY PLANS AND NOTIFICATION OF ESCAPES**

As of the completion of the 2003 report, New Brunswick had not adopted any standards for management operations aimed at minimizing escapes or for site-specific escape contingency plans, nor had it established a requirement for the reporting of escapes, despite having issued "Environmental Management Guidelines for the Marine Finfish Aquaculture Industry" in 2001. As of 2004, there was still no such requirement for either best industry practices in management operations or any requirement to report escapes (Commissioner on the Environment and Sustainable Development, 2004).

Newfoundland had already established all of the elements for the criterion as of 2003, but because it represents only one-tenth of Canada's production, those standards fulfill only one-tenth of the requirement for the highest score.

**RESULTS FOR CRITERION SEVEN: 1**

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**CRITERION 8: ADEQUACY OF MONITORING IN ORDER TO ASSESS COMPLIANCE WITH THE NATIONAL PLAN AND VERIFY THE PLAN'S EFFICACY**

New Brunswick does not monitor escapes of farmed salmon from aquaculture operations (Commissioner of the Environment and Sustainable Development, 2004). And since the Code of Practice on containment has not yet been adopted, there is still no evidence of monitoring by the New Brunswick DAFA of the standards for equipment, management systems, or contingency plans. Newfoundland does monitor compliance with its standards for equipment as well as requirements for site-specific contingency plans.

Therefore, Canada qualifies for one-tenth of the highest score for this criterion.

**RESULTS FOR CRITERION EIGHT: 1**

# ICELAND

TABLE 3 ICELAND'S OVERALL PROGRESS	
Criterion	
1. Minimum distance or exclusion zone	10
2. Cumulative impacts and siting decisions	10
3. Fish husbandry year-class separation, fallowing, density	10
4. Fish husbandry monitoring and enforcement	10
5. Standards for disease and parasite detection and response	10
6. National plan for containment re equipment & structures	10
7. National plan for containment re management, contingency and notification	7
8. National plan for containment re compliance & efficacy	10
<b>Average</b>	<b>9.6</b>

## OVERVIEW OF TRENDS AND STATUS OF PROGRESS

Iceland is unique among the NASCO countries with salmon aquaculture industries for having no salmon stocks that are even believed to be vulnerable, let alone endangered or in critical condition (WWF 2001). Iceland also has the smallest salmon aquaculture industry among those seven NASCO countries. For many years, only a single salmon farm based on sea-cages was operating in the country. Although a new period of growth began in 2003, it still has only a few cage operators, and even now that one farm represents most of the production.

The task of managing the impacts of aquaculture has, therefore, been relatively light for the Icelandic government. Blessed with relative geographic isolation and strong tidal currents, as well as an effective system for monitoring the health of fish and controlling fish diseases, Iceland has been able to keep the menace of fish diseases and sea lice at bay.

Iceland has helped to ensure that its stocks remain healthy by putting seven wild salmon bays and their associated fjords off limits to aquaculture in 2001, leaving only two wild salmon rivers and one salmon bay that could be affected by aquaculture in the future (Isaksson, 2001; Isaksson, n.d.).

The one issue, which remained to be resolved in Iceland's management of aquaculture as of the 2003 report, was preventing escapes of farmed salmon. It had not adopted regulations to ensure that

sea cages and their associated equipment would hold up to storms and stress, and that fish farmers were doing everything possible in their operations to avert escapes. That problem was addressed, in 2003, with new legislation that required that aquaculture structures and equipment meet the best industry standards. Although it is possible that Iceland will have to make further adjustments in its policy and regulations with regard to fish husbandry in response to major growth in the industry, its management of aquaculture today is adequate to protect its abundant populations of healthy wild salmon stocks.

## REPORT ON PROGRESS AS OF 2005

### CRITERION 1: ADOPTION OF A SITING POLICY AIMED AT KEEPING AQUACULTURE AT A SAFE DISTANCE FROM SALMON RIVERS

The 2003 report recognized Iceland's regulations creating minimum distances between sea cages and salmon rivers, and creating Wild Salmon Coastal Protection Areas in specific bays and fjords where salmon aquaculture with fertile salmon was prohibited. In both cases, Iceland was considered to be worthy of the highest score except for the fact that it permitted exceptions in the case of sterile salmon. Because of that exception, Iceland was assigned a score of 3.3 and 5, respectively for the two related criteria that have been combined in this report.

However, the Icelandic Directorate of Freshwater Fisheries (Isaksson 2005a) has clarified that exception, pointing out that it was originally written in 1988, when there was some expectation that sterile salmon might be raised in the future. The experience eventually demonstrated that it would not work, and there has been no interest in the use of sterile salmon since then. In light of these facts, it is recognized that Iceland's regulations would qualify for the highest score for both of those criteria, as well as for the first criterion in this report.

### RESULTS FOR CRITERION ONE: 10

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### CRITERION 2: DEGREE TO WHICH CUMULATIVE ENVIRONMENTAL IMPACTS OF SALMON FARMING ON AN ENTIRE BAY OR OTHER ECOSYSTEM ARE CONSIDERED IN SITING DECISIONS

The 2003 assessment of Iceland's implementation of the Williamsburg Resolution in regard to this criterion was based on the assumption that Iceland, until 2001, had only a small aquaculture industry, in which the cumulative impacts of a large number of operations in the same fjord or bay was not a realistic concern, but that it had just approved two salmon farming operations that could raise total production to as much as 16,000 tons a year or even higher within a short time. It was thought that such a spurt in production could pose questions of potential cumulative impacts on a particular fjord.

However, that take-off in production has apparently not occurred. In 2003, the total production was still only 3,710 metric tons — a substantial increase compared with Iceland's low production up to 2002 but still extremely small by NASCO standards.

Under these circumstances, and especially given the fact that scientists had not detected any residues on the seabed from salmon farming up to that point, because of the swiftness of the current, Iceland's assertion that the norm from the Oslo and Williamsburg resolutions on separation of aquaculture facilities based on a general assessment of local conditions, is "not applicable" in the country's circumstances was valid and remains so.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
<b>Reared Atlantic Salmon</b>	2,588	2,591	2,832	2,554	2,742	2,900	2,593	2,645	1,471	3,710

*Table 4: Icelandic fish farming production 1994 – 2003 (metric tonnes). Source: FAO, 2004*

Therefore, Iceland is considered to fulfill in practical effect its obligations under the Williamsburg Resolution regarding this criterion and qualifies for the highest score.

## RESULTS FOR CRITERION TWO: 10

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### **CRITERION 3: ADEQUACY OF STANDARDS FOR FISH HUSBANDRY, INCLUDING BEST INDUSTRY PRACTICES IN REGARD TO YEAR-CLASS SEPARATION, FALLOWING OF SITES AND MAXIMUM STOCKING DENSITIES**

On this criterion, as on others, Iceland has in the past said that fallowing was "not applicable in the Icelandic situation," but in 2001, its submission to NASCO said that year-class separation was "consistent with Icelandic policy." However, Icelandic officials could provide no information on any standards for fish husbandry that the industry is expected to follow.

However, the Environment and Food Agency of Iceland (2005) asserts that all measurements have "confirmed that there are no sediments under the aquaculture cages," because of the very strong currents in the country's deepsea water fjords. It might well be argued, therefore, that Iceland is in a situation similar to that of a country with a fishery that is still in a very early stage of development, in which the catch is far short of a level that would reduce total biomass. Considering the country's favorable physical endowment for aquaculture, the fact that its industry is still very small, and the almost complete absence of threats to fish health in the past, it is reasonable to consider this criterion inapplicable to Iceland. Therefore, Iceland is deemed to qualify for the highest score for this criterion.

## RESULTS FOR CRITERION THREE: 10

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### **CRITERION 4: ADEQUACY OF MONITORING AND ENFORCEMENT OF BEST PRACTICES IN FISH HUSBANDRY**

Because of the judgment that criterion 3 is not applicable to Iceland, criterion 4 must also be considered inapplicable, and, again, Iceland must be awarded the highest score for this criterion.

## RESULTS FOR CRITERION FOUR: 10

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**CRITERION 5: ADEQUACY OF PRACTICES AND PROCEDURES FOR EARLY DETECTION OF AN OUTBREAK OF ANY DISEASE OR PARASITIC INFECTION LIKELY TO AFFECT ATLANTIC SALMON AND RAPID RESPONSE TO SUCH AN OUTBREAK**

Icelandic fish farms are subject to mandatory fish health surveillance, including twice-yearly inspections by the office of the Fish Disease Veterinarian based on a 1986 law on prevention and control of fish diseases. Iceland applies disease control measures in line with the European Community Council Directive 93/53/EEC, which calls for placing any farm suspected of being infected with a disease on a common list under official investigation to confirm or rule out the presence of the disease and control over all entry and exit of fish and other materials or people. It also calls for contingency plans for carrying out these disease control measures (Isaksson, 2001).

The combination of fortunate geographical and physical conditions and these disease control regulations have been highly successful in eliminating serious fish diseases from the country's aquaculture sites. Between 1996 and 2000, only one case of any of the four major fish diseases occurred on a marine aquaculture site in Iceland (Isaksson, 2001).

Sea lice has not been treated as a separate fish health problem in Iceland, because it has never become a fish health problem. So it is not considered as applicable to Iceland.

Iceland, therefore, qualifies for the highest score for this criterion.

**RESULTS FOR CRITERION FIVE: 10**

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**CRITERION 6: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO EQUIPMENT AND STRUCTURES**

At the beginning of 2003, Iceland did not have any standards in place for design and deployment of aquaculture equipment and structures to minimize the risk of escapes. However, in December 2003, the Ministry of Agriculture adopted a regulatory measure on the integrity of rearing cages, with which all salmonid farmers in Iceland were expected to comply by June 1, 2004 (NASCO, 2004). Iceland (Isaksson, 2003) asserts that the standard for strength and preventing maintenance of sea-cages was "more rigorous than the guidelines set forward by the NASCO liaison group."

Although no English translation of Iceland's legislation was available for this evaluation, it is assumed to conform to the standards outlined in Section 4 of Annex 3. Therefore, it qualifies for the highest score for this criterion.

**RESULTS FOR CRITERION SIX: 10**

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**CRITERION 7: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO MANAGEMENT OPERATIONS, SITE-SPECIFIC CONTINGENCY PLANS AND NOTIFICATION OF ESCAPES**

Iceland's Director of Freshwater Fisheries says that the regulation adopted in December 2003 has standards for escape prevention in management operations (Isaksson, 2005). Although that document is not available in English, it is considered for the purpose of this evaluation to fulfill the requirement of that element of the criterion. In addition, Icelandic salmon farmers are required to report on any accidental releases using a special reporting form (Isaksson, pers. comm.). However, Iceland has not

reported any requirement for site-specific escape contingency plans.

Iceland has requirements in place for two of the three elements of this criterion. Therefore, it qualifies for the second highest score.

#### **RESULTS FOR CRITERION SEVEN: 7**

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#### **CRITERION 8: ADEQUACY OF MONITORING IN ORDER TO ASSESS COMPLIANCE WITH THE NATIONAL PLAN AND VERIFY THE PLAN'S EFFICACY**

The Director of Freshwater Fisheries carries out inspections of aquaculture facilities to verify compliance with the requirements of the 2003 regulation (NASCO 2004).

Iceland, therefore, qualifies for the highest score for this criterion.

#### **RESULTS FOR CRITERION EIGHT: 10**

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# IRELAND

**TABLE 5**  
**IRELAND'S OVERALL PROGRESS**

<b>Criterion</b>	
1. Minimum distance or exclusion zone	0
2. Cumulative impacts and siting decisions	0
3. Fish husbandry year-class separation, fallowing, density	4
4. Fish husbandry monitoring and enforcement	0
5. Standards for disease and parasite detection and response	10
6. National plan for containment re equipment & structures	10
7. National plan for containment re management, contingency and notification	10
8. National plan for containment re compliance & efficacy	4
<b>Average</b>	<b>4.8</b>

*Ireland*

## OVERVIEW OF TRENDS AND STATUS OF PROGRESS

Ireland has one of the smallest salmon aquaculture industries in NASCO, with 17,000 tons of production in 2003 (Parsons et al, 2004), which has helped limit the impacts of its salmon farms on wild salmon populations. On the other hand, the physical conditions at its sites create problems for managing aquaculture in a way that minimizes those impacts.

All of Ireland's aquaculture sites are concentrated in distinct zones along the southwest, west and northwest of the country, where the temperature is warmer than in waters normally used for aquaculture (Whelan, pers. comm.). At times during mid-summer, the temperatures cause greater stress on the fish than is normally the case in the water used by aquaculture operations in more northerly countries. That in turn increases the risk of fish diseases. In mid-2003, a major fish mortality involving about one million fish in Donegal Bay appears to have been affected by the high temperatures, which stressed the fish and made them susceptible to infection (Parsons et al, 2004).

Ireland's adoption of international regulatory standards for fish health surveillance and responses to outbreak in regard to both ISA and sea lice, and the encouragement of Single Bay Management agreements have helped avoid a serious outbreak of ISA and improved the control of sea lice. However, the Irish salmon industry has been plagued by a host of minor fish diseases, and the ISA virus has been found on an Irish rainbow trout farm, although no clinical evidence of the disease was found

(Intrafish, 2002).

Given the additional stress on Irish farmed salmon, good fish husbandry is particularly important to disease prevention in Ireland. As in other countries, fallowing and separation of year-classes requires adequate space for sites with which to undertake crop rotation. But the lack of physical expansion of the industry, due to physical constraints and more rigorous regulatory requirements on siting, limited that possibility. In the absence of any regulatory standards, fish husbandry practices depend on economics as well as calculations about disease. Despite the 30-day fallowing standard, for the past few years, separation of year-classes has proven difficult to achieve in recent years, because of the lack of sites needed for rotation (Whelan, pers. comm.).

The future strategy of the state agency Bord Iascaigh Mhara (BIM) aims at increasing the industry by opening up many more so-called "high energy" sites farther offshore, where waves and currents would be much stronger (Marine Working Group Ireland, 2003a). The extremely rough weather likely to be faced by Irish salmon farms highlights the importance of regulating the design of sea cages and other equipment used in Ireland to minimize the risk of escapes. The Irish government has chosen a policy of industry self-regulation in regard to the issue of containment, resisting suggestions that it provide regulatory incentives for adopting more rigorous technical standards in salmon aquaculture. However, the Irish industry is said to have adopted the most modern cage technology available (Whelan, pers. comm.).

The available figures on escapes suggest an improvement in the containment system in recent years. From 1996 to 2000, thirteen escape incidents were reported, involving a total of 189,000 adults and 120,000 smolts — an average of roughly 40,000 adults and 25,000 smolts annually. In 2003, only one incident was reported, and it involved 2,800 rainbow trout (Parson et al, 2004). However, there is evidence from the south west coast suggesting that many smaller escapes are never reported (Marine Working Group, 2003b).

The proportion of escaped salmon to commercial salmon harvested, estimated by the Marine Institute Staff, is about one-tenth of one percent on a national basis, but that is probably an underestimate, and there is no systematic reporting of fish farm escapees in riverine salmon catches (Parson et al, 2004). The percentage is certainly small as a percentage of total wild salmon populations. The small size of the Irish salmon aquaculture industry, combined with the relative health of Ireland's salmon populations (WWF, 2001), has thus limited the damage from fish escapes, and the containment system is getting much better.

## REPORT ON PROGRESS AS OF 2005

### CRITERION 1: ADOPTION OF A SITING POLICY AIMED AT KEEPING AQUACULTURE AT A SAFE DISTANCE FROM SALMON RIVERS

As the 2003 report documented, Ireland has neither adopted any minimum distance between salmon aquaculture sites and salmon rivers nor designated areas for limitations on or prohibition of salmon farms in order to protect wild salmon. In fact, Ireland rejected the designation of salmon rivers as "Special Areas of Conservation" (SAC) under an European Commission program in 2000, arguing that the salmon species was widespread in Ireland and that SACs would not add anything to conservation mechanisms. Although it finally designated some rivers as SACs for salmon, it refused to rule out development of aquaculture on those rivers (Cleary, 2001).

Since early 2003, Ireland has made no changes in its siting policy to protect wild salmon and migration routes. Therefore, its policy does not qualify for a minimum score for this criterion.

## RESULTS FOR CRITERION ONE: 0

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### CRITERION 2: DEGREE TO WHICH CUMULATIVE ENVIRONMENTAL IMPACTS OF SALMON FARMING ON AN ENTIRE BAY OR OTHER ECOSYSTEM ARE CONSIDERED IN SITING DECISIONS

As noted in the 2003 report, Ireland's regulations on licensing and siting decisions do not refer to the problem of the cumulative impacts of all the aquaculture operations in a particular bay or other ecosystem as a factor to be taken into account. In fact, Ireland has not taken the "carrying capacity" approach into consideration in its policy toward siting of aquaculture, no doubt in large part because its sites are so geographically clustered that the alternatives to the present sites are almost nonexistent. The most careful independent analysis of this issue concluded, "The EIA process does not adequately consider cumulative impacts caused by several projects...." It called for a Strategic Environmental Assessment (SEA) for the aquaculture sector (Marine Working Group Ireland, 2003). According to the Director of Ireland's Marine Institute (Whelan, pers. comm.), officials are now looking for experts who might help provide ways of measuring the carrying capacity of the areas occupied by Irish salmon farms.

Ireland, therefore, fails to qualify for a minimum score for this criterion.

## RESULTS FOR CRITERION TWO: 0

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### CRITERION 3: ADEQUACY OF STANDARDS FOR FISH HUSBANDRY, INCLUDING BEST INDUSTRY PRACTICES IN REGARD TO YEAR-CLASS SEPARATION, FALLOWING OF SITES AND MAXIMUM STOCKING DENSITIES

Ireland has legislation requiring that all finfish farms "undertake appropriate fallowing," but the only standard for fallowing is found in the "Protocol for Fallowing at Offshore Finfish Farms" (Department of the Marine and Natural Resources, 2000b). It suggests that the current "best practices" are that all productions are "fallowed annually for a minimum of 30 continuous days...". But that standard, which is included in Co-ordinated by Local Aquaculture Management Systems (CLAMS) agreements among aquaculture sites in a given bay, is much lower than what is required or recommended in other countries. Some local Aquaculture License Appeals Board, representing all the interests at stake in aquaculture production, have found the 30-day fallowing standard to be too short to ensure that some sites are free of all disease pathogens and egg-bearing sea lice (Whelan, pers. comm.).

The fallowing protocol also calls for adjacent sites to be fallowed synchronously, which has been practiced through the CLAMS agreements among local salmon farm operators. Although no protocol or other official standard exists for year-class separation, that practice is also written into codes of practice that are part of the CLAMS agreements, as illustrated by the code of practice of the Cuan Chill Chiarain CLAMS.

Ireland claimed in its 2001 submission to NASCO, "Appropriate stocking densities are maintained through the observation by the industry of a voluntary Code of Practice." However, the only Code of Practice that had been adopted by the Irish Salmon Growers Association in the previous

decade was the "Prevention of introduction of Infectious Salmon Anemia" of 1999. That document has not been provided to NASCO, nor has it been posted on the internet. In the absence of such documentation, it cannot be assumed that it establishes any specific maximum for stocking densities.

Thus, Ireland has standards for year-class separation and for fallowing, but they are considered too low for local conditions at some sites and it fulfills the requirements for the minimum score for this criterion.

#### **RESULTS FOR CRITERION THREE: 4**

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##### **CRITERION 4: ADEQUACY OF MONITORING AND ENFORCEMENT OF BEST PRACTICES IN FISH HUSBANDRY**

No government or industry system exists for monitoring compliance with the norms for fish husbandry that do exist. Fish farms are visited 14 times a year by State officials to assess sea lice levels and by fish health personnel on fish health in general, but the purpose is not to check on the fish husbandry practices of the operator.

The protocols and CLAMS are entirely voluntary. Those aquaculture operators who have failed to observe even that minimum standard have apparently suffered no legal or administrative consequences.

Therefore, Ireland does not qualify for a minimum score for this criterion.

#### **RESULTS FOR CRITERION FOUR: 0**

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##### **CRITERION 5: ADEQUACY OF PRACTICES AND PROCEDURES FOR EARLY DETECTION OF AN OUTBREAK OF ANY DISEASE OR PARASITIC INFECTION LIKELY TO AFFECT ATLANTIC SALMON AND RAPID RESPONSE TO SUCH AN OUTBREAK**

In line with Directive 91/67, the Fish Health Unit of the Department of Marine and Natural Resources inspects the health of all farmed fish on site for each sea farm once a year and tests for diseases listed in Annex A of the Directive. Detection of any of the diseases triggers actions, which may range from treatment of fish to slaughter of the salmon farm stock (McMahon, 2000).

Under Monitoring Protocol No. 3, adopted in 1999, all finfish farms are monitored for sea lice levels using sampling based on a standard protocol 14 times each year, and a level of sea lice incidence above a range of .3 to .5 egg bearing females per fish during the spring or 2.0 during the rest of the year triggers mandatory treatment of the fish (Department of the Marine and Natural Resources, Ireland, 2000a).

Ireland's regulations qualify for the highest score for this criterion.

#### **RESULTS FOR CRITERION FIVE: 10**

**CRITERION 6: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO EQUIPMENT AND STRUCTURES**

In 2002, the Irish Salmon Growers Association adopted a Code of Practice for the Prevention of Stock Escapes of Irish Farmed Salmon (Irish Salmon Growers' Association, 2002), which deals with site selection and location, technical requirements for pen structures, tank systems and pen nets, and maintenance and inspection programs and procedures for escape prevention.

Therefore, Ireland fulfills the requirements for the highest score for this criterion.

**RESULTS FOR CRITERION SIX: 10**

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**CRITERION 7: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO MANAGEMENT OPERATIONS, SITE-SPECIFIC CONTINGENCY PLANS AND NOTIFICATION OF ESCAPES**

Irish salmon farmers are required as a condition of their license to have management systems for escape prevention and contingency plans for escape response (Government of Ireland, 1997; NASCO, 2001). They are also required to report escapes under the terms of those licenses (NASCO, 2004). The Irish Salmon Growers' Association's Code of Practice (NASCO, 2003) includes measures to prevent escapes and "a procedure detailing actions to be taken to ensure the site is prepared in the event of adverse weather."

The regulatory system of Ireland, therefore, fulfills the requirements for the highest score for this criterion.

**RESULTS OF CRITERION SEVEN: 10**

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**CRITERION 8: ADEQUACY OF MONITORING IN ORDER TO ASSESS COMPLIANCE WITH THE NATIONAL PLAN AND VERIFY THE PLAN'S EFFICACY**

The Department of the Marine and Natural Resources does carry out on-site audits of wear and fatigue on aquaculture equipment. It does not monitor compliance with the industry code of practice for containment, either on technical requirements for aquaculture equipment or on management systems. Nor does it monitor the operations of the individual salmon farms for compliance with the requirement to report escapes. However, the Department samples 30 to 60 percent of the Irish commercial wild salmon every year to identify escaped fish. That very large sample provides an estimate of the percentage of total salmon in the rivers that are escaped, although it does not indicate from which farms they escaped (Whelan, pers. comm.). The sampling procedure does provide a kind of verification of the compliance with that part of the National Plan for containment.

Ireland has monitored one element of the National Plan and part of another and is, therefore, considered to fulfill only part of the requirements for the indicator for the minimum score for this criterion.

**RESULTS FOR CRITERION EIGHT: 4**

# NORWAY

TABLE 6 NORWAY'S OVERALL PROGRESS	
Criterion	
1. Minimum distance or exclusion zone	10
2. Cumulative impacts and siting decisions	5
3. Fish husbandry year-class separation, fallowing, density	7
4. Fish husbandry monitoring and enforcement	10
5. Standards for disease and parasite detection and response	10
6. National plan for containment re equipment & structures	10
7. National plan for containment re management, contingency and notification	10
8. National plan for containment re compliance & efficacy	10
<b>Average</b>	<b>9.0</b>

## OVERVIEW OF TRENDS AND STATUS OF PROGRESS

Norway has by far the largest Atlantic salmon aquaculture industry among the NASCO signature nations, with 415,000 tons of salmon in 1999 and 500,000 tons in 2003 (Statistics Norway, 2003). The vast quantities of farmed fish that flow through this production system every year have represented a potential threat to the country's wild salmon stocks, because of the massive numbers of fish that escape each year. The Norwegian Ministry of Environment estimated that an average of 1.6 million farmed fish escaped annually from 1988 to 1999 period. However, these figures undoubtedly underestimated the problem. In 1999, the salmon farmers could not account for 5,700,000 missing farmed salmon. Farmed fish represented between 15 and 34 percent of all salmon in Norwegian rivers during that same period 1989–1999. In some rivers, however, it was as high as 70 – 90 percent (World Wildlife Fund, 2001).

The rate of escapes has slowed in more recent years in comparison with the 1990s, but still remains extremely high. In 2001 the number of escaped fish officially reported was 350,000, but the following year it increased to 630,000, and in 2003 and 2004, the figures were significantly higher than they had been in 2001 (Directorate of Fisheries, 2005).

The problem in the early years was that salmon cages were such primitive devices that they were easily broken. An enterprising owner actually built his net pens out of wood and was soon advising others on how to build them cheaply (Milstein, 2003). The technology was improved greatly, but as

the industry has expanded, more of the sites have moved out farther from the shore, where they have been exposed to strong waves, winds and currents (Lader et al, 2003). From 1993 through 1999, weather conditions were responsible for an estimated 31 percent of the fish involved in all escapes (Directorate of Fisheries, n.d.).

These data underline the importance of a rigorous regulatory regime for containment. After a long period of hesitation, Norway adopted a new regulation in 2003 aimed at seriously reducing the high levels of fish escapes. It requires that all equipment used in salmon farms conform to the highest industry standard. Unfortunately, it will not become applicable to the more than 800 existing sites until, at the earliest, 2006, and in many, if not most, cases, early 2008.

Norway has been much more responsive in the past on protecting selected salmon rivers from aquaculture operations by creating "protection zones". In 1989, Norway designated temporary "protection zones" for wild salmon, where the establishment of new salmonid aquaculture was prohibited. More fjords and rivers with wild salmon populations are to be protected under a proposal, scheduled to be voted on in parliament this spring. Norway's willingness to restrain salmon farming by keeping it away from some areas to protect wild salmon populations is due in part to the large number of salmon rivers in Norway. Fifty salmon populations had already become extinct and another 135 more were threatened or vulnerable, but that still left some 270 populations in healthy condition.

Norway was the first salmon aquaculture country to introduce some fish health procedures, because it was the first to experience an occurrence of ISA in 1984. It established regulations on transport in areas of an ISA outbreak in 1991, zones to combat outbreaks in 1993, general guidelines for dealing with outbreaks in 1996, and mandatory procedures for sea lice detection and treatment in 1998. However, it didn't establish a full contingency plan for ISA outbreaks until 2002, around the same time as did the United States and Canada.

Norway has long had a standard for maximum stocking densities of 25 kg per cubic meter, as well as a standard for fallowing set by its veterinary services. In 2004, it adopted a new standard requiring year-class separation at all sites. In the absence of data on the trends on stocking densities, it is not possible to assess what actual results have been achieved.

## REPORT ON PROGRESS AS OF 2005

### CRITERION 1: ADOPTION OF A SITING POLICY AIMED AT KEEPING AQUACULTURE AT A SAFE DISTANCE FROM SALMON RIVERS

In 2001, after several years of debate, the Norwegian government proposed a new program to make 22 fjords and 39 rivers with wild salmon populations "national salmon fjords" and "national salmon rivers", from which salmon farming would be prohibited or restricted. Two years later, a system of 21 national salmon fjords and 37 national salmon rivers was approved by parliament, with 13 of the fjords to be entirely free from salmon farming and no new salmon farms to be allowed in the remaining ones. In the other national salmon fjords, fish farms were subject to new, tighter regulations on security against escapes and health controls. In the national salmon rivers, projects or activities that might harm the wild salmon were to be prohibited (Norwegian Department of the Environment, n.d.) The Government of Norway (2003) claims that the system will protect "about 2/3 of the total Norwegian wild salmon production."

Regardless of how significant the new regulations and the limitations on new projects turn out to be, the creation of 13 fjords from which salmon farming is excluded fulfills the requirement for the highest score for this criterion.

## RESULTS FOR CRITERION ONE: 10

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### **CRITERION 2: DEGREE TO WHICH CUMULATIVE ENVIRONMENTAL IMPACTS OF SALMON FARMING ON AN ENTIRE BAY OR OTHER ECOSYSTEM ARE CONSIDERED IN SITING DECISIONS**

The 2003 report assigned a score for this criterion of zero, on the grounds that there was no requirement for the Norwegian Environment Ministry to consider the cumulative impacts of all fish farms in a given ecosystem when it approved aquaculture licenses. This was based on the fact that the technical standard for monitoring cumulative environment impacts in a particular fjord was seldom used.

According to a Ministry of Fisheries and Coastal Affairs (Enger, pers. comm.), a new regulation adopted in late 2004 provides that, if initial required tests of seabed environmental quality by an applicant for a new site show unacceptable results, the Directorate of Fisheries, in cooperation with the Environment Ministry, may require an environmental study of the entire fjord system in which the site is located in regard to sources of pollution. This regulation suggests that a study of the cumulative environmental impacts of the aquaculture industry in the entire fjord is needed under certain circumstances, although the decision to require such a study remains a matter of discretion rather than being required.

Therefore, Norway's practice corresponds to the second highest score for this criterion.

## RESULTS FOR CRITERION TWO: 5

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### **CRITERION 3: ADEQUACY OF STANDARDS FOR FISH HUSBANDRY, INCLUDING BEST INDUSTRY PRACTICES IN REGARD TO YEAR-CLASS SEPARATION, FALLOWING OF SITES AND MAXIMUM STOCKING DENSITIES**

Norway's basic law on aquaculture (Government of Norway, 1998) established a maximum stocking density of 25 kg per cubic meter for all fish farms. That standard has been carried over into the new regulations, adopted in December 2004. Veterinarians may require a lower fish density if this is needed to protect the fish health, but such a decision normally would only follow the outbreak of disease (Enger, pers. comm.).

The regulation on fallowing depends on "relevant guidelines in force at all times issued by the Norwegian Animal Health Authority Central Administration." As of January 2003, the guideline was two months of fallowing every year (Lyngstad, pers. comm.). This standard appears weak considering the incidence of furunculosis in Norway (Stephen and Iwama, 1997), and the fact that furunculosis pathogens have been shown to require far more than two months of fallowing to dissipate from Norwegian fish farms (Husevag and Lunestad, 1995).

The new requirement adopted in 2005 requires year-class separation on all sites (Enger, pers. comm.).

Norway's regulations thus cover all three fish husbandry issues. However, the fallowing standard appears to fall short of industry best practices. These regulations are considered to fulfill the requirements for the next highest score for this criterion.

## RESULTS FOR CRITERION THREE: 7

#### **CRITERION 4: ADEQUACY OF MONITORING AND ENFORCEMENT OF BEST PRACTICES IN FISH HUSBANDRY**

Norway's basic regulation requires that all fish farms keep records on a number of fish health and husbandry issues, including stocking densities. It also requires that fish farmers report every month on biomass and production volume at the site. Stocking densities are the responsibility of fisheries authorities. Stocking density data recorded at the farm are checked regularly (Enger, pers. comm.).

Management plans specifying which sites will be fallowed and for how long are also required for each site. These management plans must be approved by the government for a two-year period and thus constitute a form of monitoring through industry reporting (Enger, pers. comm.).

The animal health authorities are responsible for ensuring that fish farmers are following up to the minimum level required. Fish farms are visited 4 to 12 times a year by a fish biologist, depending on production volume, and can thus verify fallowing practices. They also have the power to levy fines for non-compliance (Enger, pers. comm.).

Norwegian authorities can issue compulsory fines if action is not taken to deal with a violation within a certain date. In extreme cases licenses can be revoked, although that has never happened (Enger, pers. comm.).

Thus, in Norway each fish farm must report on its fish husbandry practices, there are penalties for non-compliance, and it appears that on-site monitoring of fish husbandry practices is carried out. Norway's monitoring and enforcement of standards for fish husbandry, therefore, meet the requirements for the highest score for this criterion.

#### **RESULTS FOR CRITERION FOUR: 10**

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#### **CRITERION 5: ADEQUACY OF PRACTICES AND PROCEDURES FOR EARLY DETECTION OF AN OUTBREAK OF ANY DISEASE OR PARASITIC INFECTION LIKELY TO AFFECT ATLANTIC SALMON AND RAPID RESPONSE TO SUCH AN OUTBREAK**

Norway has long had a regulation providing for the introduction of zones to combat outbreaks of fish diseases, and for compulsory slaughter of fish within a 3 – 5 km zone around a "hot spot" if mortalities reach .05 percent per cage per day (Intrafish, 1999). In 2002, it adopted an ISA contingency plan involving internationally harmonized surveillance and diagnostic procedures, general measures to prevent the spread of the virus, movement restrictions and zonal eradication of outbreaks (Norwegian Department of Environment, 2004).

Norway has had regulations on control of sea lice since 1998, including mandatory counting, recording and reporting on the incidence of sea lice once a month, mandatory treatment when lice counts rise above a trigger level and fines for violations of these procedures (Eithun, 2001).

Given these regulations on both ISA and sea lice, Norway qualifies for the highest score for this criterion.

#### **RESULTS FOR CRITERION FIVE: 10**

**CRITERION 6: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO EQUIPMENT AND STRUCTURES**

The issue of mandatory technical standards for equipment used in aquaculture has been discussed in Norway since the early 1990s, and a government working group on such standards began working in 1996. Norway promised that a new system of such technical standards would be forthcoming beginning in 1998. However, no such standards had been promulgated as of early 2003, when the previous report was completed.

Norsk Standard, the Norwegian Standardizing Body, published a comprehensive set of technical standards in August 2003, which reflected the need for the Norwegian aquaculture industry to install equipment better adapted to the increasingly harsh nature conditions to which it was being subjected as more and more of its sites moved farther away from the shore (Norsk Standard 2003; Lader et al, 2003). In December 2003, the Norwegian Fisheries Department adopted a new regulation reflecting the standards being developed. The new regulation came into force January 1, 2004, for new fish farms. However, existing fish farms were not obliged to comply with the stricter standards until January 2008 (FIS Europe, 2002).

Norway's new regulation fulfills the requirements for the highest score for this criterion.

**RESULTS FOR CRITERION SIX: 10**

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**CRITERION 7: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO MANAGEMENT OPERATIONS, SITE-SPECIFIC CONTINGENCY PLANS AND NOTIFICATION OF ESCAPES**

The Government of Norway (1998) adopted a regulation requiring that salmon aquaculture operators have up-to-date "specific contingency plans" for limiting the size of escapes and recovering escaped fish, and that they report any escapes immediately by fax or phone. It also requires that the plan include "safety precautions for the towing of sea cages and the handling of fish loading and unloading." The 1998 regulation was revised and strengthened in January 2005 to require that all aquaculture sites train their staff in escape prevention. The new technical standards promulgated in 2003 appear to cover most of the management system operations identified in the Williamsburg Resolution's Annex 3, section 5.

The combination of the two regulations qualifies Norway for the highest score for this criterion.

**RESULTS FOR CRITERION SEVEN: 10**

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**CRITERION 8: ADEQUACY OF MONITORING IN ORDER TO ASSESS COMPLIANCE WITH THE NATIONAL PLAN AND TO VERIFY THE PLAN'S EFFICACY**

The new Norwegian regulation governing technical requirements for aquaculture systems took effect in late 2003, but only for new licensees. Existing license holders are required to obtain a certificate that they have equipment meeting the new standard by January 2006, but they can obtain a postponement until January 2008. Monitoring of the equipment on site is done by independent private inspection organizations that have been accredited for that purpose, thus serving as a proxy for government monitoring.

The Norwegian Government was already examining the escape contingency plans of lease holders and — less frequently — record keeping related to routine operations (Anfinsen, pers. comm.). Aquaculture operators are required to report any escapes or suspected escapes immediately to the government (Enger, pers. comm.).

Norway's regulations governing monitoring of the containment systems and other aspects of containment plans fulfill the requirements for the highest score for this criterion.

#### RESULTS FOR CRITERION EIGHT: 10

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*Norway*

# SCOTLAND

TABLE 7 SCOTLAND'S OVERALL PROGRESS	
Criterion	
1. Minimum distance or exclusion zone	3
2. Cumulative impacts and siting decisions	10
3. Fish husbandry year-class separation, fallowing, density	0
4. Fish husbandry monitoring and enforcement	1
5. Standards for disease and parasite detection and response	2.5
6. National plan for containment re equipment & structures	3.5
7. National plan for containment re management, contingency and notification	10
8. National plan for containment re compliance & efficacy	0
<b>Average</b>	<b>3.8</b>

## OVERVIEW OF TRENDS AND STATUS OF PROGRESS

Scotland has adopted an overall strategy for managing aquaculture based on voluntary industry codes and informal self-regulation rather than formal regulatory mechanisms. As a consequence of that orientation, it has moved relatively slowly in responding to the major challenges of minimizing the threat of salmon aquaculture to wild salmon.

The Scottish Executive has made only minimal changes in policy and law over the past few years to strengthen the protection of wild salmon from aquaculture's impacts. Only one new legal requirement has been instituted since the beginning of the new century — mandatory and prompt notification of the government of any fish escapes. Further development of legislation governing aquaculture has been mentioned in the past, but has not been forthcoming. Similarly, the improvement of existing industry codes of practice was originally to have been completed last year but is still in process.

At the same time, the Executive has tried to show it is responsive to pressures for change, particularly in regard to the issues of location of aquacultures sites in relation to salmon rivers and migration routes and the carrying capacity of bays in regard to the cumulative load of discharges by aquaculture. Revision of law and/or policy should be forthcoming on these issues, but in the case of site

relocation, the approach is likely to remain highly controversial, because of the implicit veto given to aquaculture operators.

The Executive has relied on voluntary norms in regard to the adoption by the industry of best practices in stocking, year-class separation and fallowing. The data collected by the Scottish Executive on compliance with the Code of Practice on ISA is the only statistical evidence available on fish husbandry practices. They indicate that in 2001 – 2002, 5 percent of nearly 260 sites continued to grow fish without separating year-classes and without using any fallowing at all, and another 8 percent fallowed for less than six weeks (Fisheries Research Services, 2002).

Two years later (2003 – 2004), the figures were almost identical: 4 percent of 226 sites surveyed were still not fallowing at all, and 8 percent were fallowing for less than six weeks (Fisheries Research Services, 2004). In statistical terms this represents only very slight improvement in the fallowing situation.

These figures undoubtedly represent a significant improvement over the situation that existed only a few years earlier, but the change can be attributed in large part to the impact of the ISA outbreak in the late 1990s. In the aftermath of that outbreak, some of the Area Management Agreements entered into voluntarily by fish farm operators have accomplished the important objective of getting all or almost all of the operations in a single loch to fallow simultaneously (Intrafish, 2003b). However, based on research done in Norway, the fallowing times applied under these agreements are not necessarily sufficient to ensure that all disease pathogens are eliminated.

Meanwhile, stocking densities are not the subject of either law or Codes of Practice, or even monitored. The successful control of disease makes the cooperation of all producers very important, and that is not happening in regard to fish husbandry issues in Scotland.

The Scottish approach to disease identification and control of the ISA threat in the aquaculture industry is partly in line with the Williamsburg Resolution, but on sea-lice, it has again depended on the voluntary efforts by the industry rather than regulation in regard to sea-lice. No data is available on what is actually being done, but the present situation of entirely voluntary private monitoring is unfortunate, because high levels of sea lice on escaped farmed fish have apparently been responsible for killing very high proportions of wild post-smolts migrating out of Scottish fjords. Furthermore, as the Scottish Association for Marine Science (2002) has observed, fish farmers are likely to allow higher levels of lice on fish than are acceptable for minimizing the risk to wild fish.

Scotland's performance in regard to containment of farmed fish again reflects its emphasis on letting the industry police itself. The results of that approach can be documented in the data on escapes from Scottish salmon farms, gathered originally from the Scottish Executive, since 1997. In 1998 the estimate of escaped fish was 95,000 in 6 separate incidents; in 1999, it was 295,000 in 15 separate incidents and in 2000, it was 440,000 in 16 separate incidents (Friends of the Earth Scotland, 2001). No data on escapes are available for the years 2001 to 2004, but it is known that in 2002 an estimated 20,000 escaped from a salmon farm in the Orkney Islands and another 180,000 fish died when their cages collapsed (Maxwell, 2002). And in January 2005 alone, as many as 700,000 fish escaped during a severe storm in the Western Isles that allowed salmon to break out of their cages (Crawford, 2005). In short, the trend line for escapes has been going up over the past eight years.

## REPORT ON PROGRESS AS OF 2005

### CRITERION 1: ADOPTION OF A SITING POLICY AIMED AT KEEPING AQUACULTURE AT A SAFE DISTANCE FROM SALMON RIVERS

Scotland's results for the first two criteria in the 2003 report requirements for adequate distance from salmon rivers and degree of restrictions on aquaculture in certain sensitive areas to protect wild salmon were quite low, because no regulation or guidelines required a minimum distance, and because its policy restricted the growth of, but did not prohibit, salmon farms in the vicinity of a few salmon rivers.

Since 2003, the Scottish executive has been developing a new policy of relocation of aquaculture sites in order to reduce impacts on wild salmon. It was announced in its Aquaculture Strategy (Scottish Executive, 2003), which pledged to produce a "policy on the location/re-location of fish farms" and "local guidance zoning the development of aquaculture in coastal areas." The Scottish Executive has been working on a pilot study on relocation of aquaculture sites, in which the benefits to wild salmon are a central consideration. The study has identified new sites that both aquaculture operators and local officials concerned with wild salmon have approved. A draft plan for relocation has now been prepared (Gilmour, Pers. Comm.).

This effort to address the issue of siting salmon aquaculture operations in relation to wild salmon rivers and migration routes has not yet resulted in any new policy or regulations, however. Nor has Scotland taken any new initiative to create exclusion zones to protect wild salmon since the 2003 report.

Therefore, Scotland has not yet fulfilled the requirements of the indicator for the next to lowest score on this criterion.

### RESULTS FOR CRITERION ONE: 3

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### CRITERION 2: DEGREE TO WHICH CUMULATIVE ENVIRONMENTAL IMPACTS OF SALMON FARMING ON AN ENTIRE BAY OR OTHER ECOSYSTEM ARE CONSIDERED IN SITING DECISIONS

Scotland has continued to develop its policy in regard to cumulative impacts of salmon farming on ecosystems since the 2003 report was completed. It has convened an Assimilative Capacity Experts Working Group, which has identified research priorities to enhance understanding of assimilative capacity issues, and its recommendations are now being applied in the sea lochs (Rosie, pers. comm.).

In the 2003 report, Scotland's score was reduced to half the highest score because, according to the Royal Society of Edinburgh, the locational guidelines taking into account cumulative effects were not applied to freshwater lochs. According to the Scottish Environmental Protection Agency, however, a different environmental carrying capacity approach is applied to salmon smolt farms in freshwater lochs through a Scottish Environmental Protection Agency discharge consent mechanism. The main concern in most freshwater lochs is phosphorus, and the objective is to prevent the nutrient status of the loch from crossing a trophic threshold (Rosie, pers. comm.).

Therefore, Scotland qualifies for the highest score for this criterion.

### RESULTS FOR CRITERION TWO: 10

**CRITERION 3: ADEQUACY OF STANDARDS FOR FISH HUSBANDRY, INCLUDING BEST INDUSTRY PRACTICES IN REGARD TO YEAR-CLASS SEPARATION, FALLOWING OF SITES AND MAXIMUM STOCKING DENSITIES**

As was the case when the 2003 report was prepared, the Scottish Executive does not have any specific regulatory requirements for fish husbandry for fish health management. The Scottish finfish aquaculture industry resisted the introduction of statutory regulation over fish husbandry issues, insisting that any such legislation be delayed until 2005. The Scottish Executive has left fish husbandry practices to voluntary controls through industry codes of practice (NASCO, 1998; NASCO, 1999; Gilmour, pers.comm.).

As of the completion of the 2003 report, Scottish Quality Salmon, the industry organization for the mainland, had adopted a "Code of Practice to Avoid and Minimise the Impact of Infectious Salmon Anemia (ISA)". That document did not specify any minimum fallowing period or address stocking densities as an issue (Scottish Quality Salmon, 2000). As the 2003 report was being completed, the Scottish Executive's "Strategic Framework for Scottish Aquaculture" was issued, which called for the Scottish aquaculture industry to develop a "Code of Best Practice" that would deal with such issues as fish husbandry and fish health. According to the timetable appended to the document, the new Code was to be produced for public consultation by the end of 2003 and would go into effect by mid-2004, with third party auditing of compliance to begin thereafter and be published in the summer of 2005.

The Scottish industry is still working on a new code of practice, but has thus far produced only a first draft (Gilmour, pers. Comm.).

The Scottish Executive also counted on Area Management Agreements, negotiated among neighboring fish farm operators in a given area to achieve a breakthrough on fish husbandry practices, including fallowing, stocking densities and year-class separation (Scottish Executive, 1999). By 2005, 11 Bay Area Agreements had been signed and two more were ready to be signed. These agreements are aimed primarily at minimizing the threat to farmed salmon from sea lice (Currie, pers. Comm.).

Area Management Agreements provide for synchronized fallowing and call for a six-week fallowing period, which is based on the life cycle of sea-lice. They do not consider the longer periods of fallowing necessary to eliminate other disease pathogens. Nor do they deal with the issue of stocking densities, which are believed to be covered by existing regulations on the maximum biomass allowed at each site (Currie, pers. comm.). However, maximum allowable biomass is calculated on the basis of a quantitative assessment of the total effects arising from all the fish farms and other pollution sources in the system (Scottish Executive, 2003). It was never intended to take into account the impact of stocking density on fish health.

Although there is movement toward a Code of Best Practice for fish husbandry, which in theory could provide accountability on issues of fish husbandry, there are still no enforceable standards for those issues as of now. Scotland, therefore, does not qualify for the minimum score for this criterion.

**RESULTS FOR CRITERION THREE: 0**

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**CRITERION 4: ADEQUACY OF MONITORING AND ENFORCEMENT OF BEST PRACTICES IN FISH HUSBANDRY**

As of 2003, the Scottish executive did not undertake any on-site monitoring of fish husbandry practices. Nor, in the absence of any enforceable standards for fish husbandry, is there any enforcement of best practices.

The Scottish Executive Environment and Rural Affairs Department (SEERAD) Fisheries Research Services sends a questionnaire to aquaculture operators once a year with questions about compliance with the "Code of Practice to Avoid and Minimise the Impact of Infectious Salmon Anemia (ISA)." The questions include one regarding fallowing times, but nothing is asked about stocking densities. In the first iteration of the questionnaire, operators were asked, "Are there multiple generations of fish on site?" In subsequent years, however, the question was the more ambiguous, "Is the site stocked in accordance with acceptable fallowing strategies specified in the COP?" (Fisheries Research Services, n.d.)

The Scottish Executive thus requires industry reporting on one of the three fish husbandry issues, but does not monitor on site and does no enforcement. Therefore, it qualifies for one third of the minimum score for this criterion.

## RESULTS FOR CRITERION FOUR: 1

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### **CRITERION 5: ADEQUACY OF PRACTICES AND PROCEDURES FOR EARLY DETECTION OF AN OUTBREAK OF ANY DISEASE OR PARASITIC INFECTION LIKELY TO AFFECT ATLANTIC SALMON AND RAPID RESPONSE TO SUCH AN OUTBREAK**

The Fish Health Inspectorate of the Fisheries Research Services has responsibility for testing for ISA, but there is no continuing general surveillance for the disease. Until 2004, the FHI tested two or three times a year unless a site had a suspected fish disease, but since then the visits have been reduced to once a year unless targeted on a site that is under suspicion (Morris, pers. comm.).

Under the Diseases of Fish Acts of 1937 and 1983, suspicion of a "notifiable disease" triggers a 30-day notice, which prohibits the movement of live fish or eggs into or out of the fish farm. If the notifiable disease is confirmed, additional control measures are applied, including the slaughter of all fish on the farm.

Following the outbreak of ISA in Scottish aquaculture net cages in 1998 – 1999, the European Commission recommended that Scottish authorities change the decision process used for confirmation of infection by the ISA virus from one based on clinical severity of disease at the farm to virus isolation in cell culture. The EC accepted a Scottish plan for withdrawal of fish in cases of ISA that accepted the EU recommendation (Royal Society of Edinburgh, 2002).

On the detection and control of sea-lice, the system has been under the control of the salmon aquaculture industry from the beginning. The Scottish Salmon Growers Association (SSGA) developed its own strategy for dealing with lice, consisting of formation of local area management groups consisting of all fish farm operators in an area to agree on coordinated monitoring and treatment. The strategy became the "National Treatment Strategy for the Control of Sea Lice" and was adopted by the industry as a Code of Practice (Rae, 1999).

The Scottish Executive has continued to make programs of testing, detection and control entirely voluntary. In 2002, the Scottish Parliament's Transport and Environment Committee called for the SEERAD Fisheries Research Services Marine Laboratory to be given a statutory role in monitoring sea-lice numbers on fish, and in setting a maximum sea-lice level that would trigger control actions. Nevertheless, the Executive indicated in 2002 that it would continue to give control over sea-lice management to the aquaculture industry, operating through Area Management Agreements (Scottish Parliament, 2002).

In its aquaculture strategy document in 2003, the Executive discussed "sea-lice management" in terms of "voluntary initiatives" and indicated that fish farms would be "encouraged" to adopt integrated sea louse management strategies, including "regular and accurate sea-louse counts" and effective treatment (Scottish Executive, 2003a). However, the frequency of and methods used to test for sea-lice are entirely up to the operators individually or in common in a particular area. The Executive has no real information on what is being done, although it is now planning a questionnaire to get more information on the situation in an effort to determine whether the voluntary program is adequate (Morris, pers. Comm.). Thus, there is no maximum sea-lice count that would trigger treatment.

Scotland has fulfilled half the requirements of Criterion 5 with regard to ISA, but none with regard to sea-lice, and qualifies for a score of 2.5 on this criterion.

## RESULTS FOR CRITERION FIVE: 2.5

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### CRITERION 6: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO EQUIPMENT AND STRUCTURES

The Scottish Executive has rejected a regulatory role in matters of containment, as noted in the 2003 report. The "Code of Practice on the Containment of Farmed Fish" adopted by the aquaculture industry (Scottish Quality Salmon and the Shetland Salmon Farmers' Association, 1999) calls for cages to be constructed "so as to be capable of dealing with the weather and other environmental conditions." It offers more concrete standards in regard to design and construction of cage nets, and advises that they should be tested at least twice a year.

The Strategic Framework for Scottish Aquaculture (Scottish Executive, 2003a) conceded the need to revise the industry Code of Practice for containment. "Ways of implementing improved standards of construction and maintenance of aquaculture structure (cages, moorings, etc.) will be explored to minimize the future risk of system failure and stock escape," the paper said. Thus far, however, no revision of the code has been made public.

The guidelines for siting of aquaculture operations in Scotland (Scottish Executive, 1999) do not refer to the issue of extreme weather as a risk factor that should be used in screening applications.

Although the Code of Practice provides some technical standards for nets, it falls short of doing so for cages, and it does not include any provision for site selection criteria to minimize escapes. Therefore, it falls between the indicator for 5 points and the indicator for 2 points.

## RESULTS FOR CRITERION SIX: 3.5

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### CRITERION 7: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO MANAGEMENT OPERATIONS, SITE-SPECIFIC CONTINGENCY PLANS AND NOTIFICATION OF ESCAPES

The industry Code of Practice on containment includes very general language regarding the planning of all procedures involving fish transfers and handling as well as record keeping, although it lacks details on these issues of management operations that minimize the risk of escapes. The Code of Practices also calls for site-specific contingency plans to respond to any escape, and such contingency plans are required by the Scottish Executive as part of the EIA process (Scottish Parliament, 2002).

SEERAD issued a requirement in May 2002 that fish farmers notify Scottish Ministers of any escapes.

The "National Plan" of Scotland regarding escapes, therefore, includes all three of the elements of Criterion 7, although one is not as well articulated as it should be. Scotland fulfills the requirement for the full score for the criterion.

## **RESULTS FOR CRITERION SEVEN: 10**

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### **CRITERION 8: ADEQUACY OF MONITORING IN ORDER TO ASSESS COMPLIANCE WITH THE NATIONAL PLAN AND VERIFY THE PLAN'S EFFICACY**

The industry Code of Practice on containment includes no provisions for monitoring compliance. However, the Aquaculture Strategy said that the Fisheries Research Services "will monitor compliance with the Containment Code of Practice and will investigate any failures of cage structures and equipment which result in escapes."

However, there is no evidence that any monitoring of compliance or effectiveness has actually taken place. The website of Fisheries Research Services has a section on "Escaped Farmed Fish," which presents a brief history of the development of "Codes [sic] of Practice for Containment of Farmed Fish," gives no indication that the FRS has any responsibility for monitoring compliance. In contrast to the annual report compiled by FRS on compliance with the "Code of Practice to Avoid and Minimise the Impact of Infectious Salmon Anaemia (ISA)," there has never been any public information issued on compliance with the Code of Practice on containment.

Scotland's performance, therefore, does not qualify for the minimum score for this criterion.

## **RESULTS FOR CRITERION EIGHT: 0**

# UNITED STATES

**TABLE 8**  
**UNITED STATES OF AMERICA'S OVERALL PROGRESS**

<b>Criterion</b>	
1. Minimum distance or exclusion zone	0
2. Cumulative impacts and siting decisions	10
3. Fish husbandry year-class separation, fallowing, density	4
4. Fish husbandry monitoring and enforcement	3
5. Standards for disease and parasite detection and response	10
6. National plan for containment re equipment & structures	10
7. National plan for containment re management, contingency and notification	10
8. National plan for containment re compliance & efficacy	10
<b>Average</b>	<b>7.1</b>

*United States*

## OVERVIEW OF TRENDS AND STATUS OF PROGRESS

**M**aine's aquaculture industry is centered on Cobscook Bay, where strong currents and high tides provide a strong flushing action that generally sweeps feed and fish wastes from the sites (Conkling and Hayden, 1997; Sowles, 2003). That has reduced one of the main environmental problems facing the industry to manageable proportions.

However, another geographical fact has created a problem for the remaining wild salmon populations in Maine: the most desirable locations for salmon farms are located close to the mouths of Maine's salmon rivers. Four salmon farms are between 5 and 8 miles from four of the remaining salmon rivers in the United States (Sowles, pers. comm.). These sites were already in place before the Oslo Resolution was adopted. So Maine has not made any changes in response to the Oslo Resolution's call for separating aquaculture sites from wild salmon rivers and migration routes.

The other major factor facing the aquaculture industry in Maine is that the wild Atlantic salmon populations in the United States have long been in a critical state. By 2000, the entire adult salmon population in the Gulf of Maine was estimated by the US Fish and Wildlife Service to number in the

low hundreds (WWF, 2001). Given these extremely low numbers; the overwhelming numbers of farmed salmon compared to the numbers of wild salmon have made any escape of farmed fish from Maine's aquaculture cages a threat to the wild populations. An escape from a salmon farm in Maine in December 2000 involved more than 170,000 farmed salmon — roughly 1,000 times greater than the number of documented wild adult Atlantic salmon in Maine's rivers (Atlantic Salmon Federation, 2001).

Both Maine and the federal government were slow to adopt regulations to deal with that threat. As of the 2003 progress report, neither Maine nor the federal government had adopted regulatory requirements for design standards or for escape prevention and response plans, and aquaculture operators were not required to report on escapes. Even the catastrophic December 2000 escape was not reported to federal authorities until February 2001.

To make matters worse, the aquaculture industry in Maine was using a hybrid of North American and European stock, importing male salmon sperm, or milt, from Europe, because European strains of Atlantic salmon were believed to grow faster and better than North American stock. The U.S. Fish and Wildlife Service and NOAA Fisheries believed that disease and genetic threats from escaped farm salmon represented a severe threat with the potential to overwhelm the small remaining wild populations. The federal government put Atlantic salmon on the endangered species list in 1999, but the State of Maine challenged the listing in court, arguing that the original Atlantic salmon species had been overtaken by many decades of genetic and other assaults.

Before a major outbreak of both Infectious Salmon Anemia (ISA) and sea lice occurred in 2001, the state had not taken adequate actions to minimize the risk of disease and had no mandatory procedures for responding to such eventualities. Maine had not set standards for fish husbandry or established procedures for testing for ISA. Nor had it adopted regulations for withdrawal and slaughter of fish or whether producers would be indemnified for such slaughter. The state had preferred to let the aquaculture industry take the responsibility on all three major issues. At least one salmon farm was caught trying to cover up positive test results for ISA (Edgecomb, 2003).

In the end salmon farmers were forced to destroy 2.6 million fish — much of the 2001 harvest (Kuehn, 2002). That opened the way for new regulations for both containment and disease control, under pressures from the federal government and conservationists. The state then established clear procedures of identifying the existence of the disease and for the mandatory actions to be taken after that. But the severity of the outbreak reduced the total production of the U.S. industry by 50 percent. A second outbreak of ISA at a site in Cobscook Bay in June 2003, involving Heritage Salmon Inc., which was one of those sites that had experienced an outbreak in 2003 (Edgecomb, 2003), suggests a continuing need to minimize risk by requiring the best practices in fish husbandry.

Fish husbandry has been the single biggest weakness of Maine's *laissez faire* approach. The absence of rigorous standards or monitoring and enforcement has allowed the U.S. industry to make decisions on year-class separation, fallowing and stocking densities reflecting financial considerations on one hand and the degree of fear of disease, on the other. When farmers believed the risk of an ISA outbreak was low, they practiced higher stocking densities and mixed year-classes. After the outbreak of the disease in New Brunswick brought home the danger of ISA, they tended to reduce densities and began moving toward stocking a single year-class (Sackton, 2000).

The General Permit for Finfish Aquaculture, which went into force in 2003, represented a step forward from the previous policy in regard to fish husbandry, requiring salmon farms to stock only a single year-class of fish. However, it did not impose particular fallowing or stocking density requirements on the industry.

Substantial progress has been made since 2001 on the problems of using non-American strains in Maine's industry and in tightening containment practices. After negotiations with conservation organizations and the federal government, the state of Maine drafted new legal requirements in 2003 on the use of North American fish in aquaculture and for plans for the prevention of escapes. These new regulatory requirements, which went into effect in 2003, represent a step forward for the United States in regard to reducing escapes and genetic impacts on wild Atlantic salmon compared with the situation existing before 2003.

The magnitude of escapes in terms of numbers of farmed salmon appearing in salmon rivers appears to have been reduced since 1997, but the new containment system has not yet solved the escape problem. Data published by the North American Commission of NASCO (See Table 9) show that the bulk of the fish escaping from Maine's salmon farms find their way into the Dennys and

River	1998	1999	2000	2001	2002	2003
Dennys	1 (100)	?	29 (94)	65 (79)	4 (67)	2 (18)
Narraguagus	0	3 (9)	0	0	0	0
Union	?	63 (90)	6 (75)	2 (100)	6 (55)	0
Other	*	*	*	*	*	

*Table 9: Number of farmed salmon found in annual samples of Maine rivers (percentage of total salmon)  
 \* unofficial reports of escapees in various eastern coastal rivers especially Cobscook Bay area*



*Fig 8 – The Dennys River in easternmost Maine, USA, has a wild Atlantic salmon population that has been given endangered status by the U.S. Federal Government. It is also a stream near aquaculture sites. Wild salmon leaving or entering this river must pass aquaculture sites in both U.S. and Canadian waters. Escaped aquaculture salmon also attempt to enter this river.*

Union rivers, and that they constituted from 55 to 94 percent of the total salmon found in the samples taken between 1999 and 2002. The percentages were lower in 2002 but still well over half the total sample of salmon. In 2003, the percentage of farmed salmon in the total sample in those two rivers did shrink dramatically to 28 percent in one case and to zero in the other case. The much smaller numbers could also reflect the fact that the number of cages in Cobscook Bay has been reduced by as much as three-fourths by a massive exodus of salmon farm operators, including at least two of the major companies, from the state (Sochasky, pers. comm.). It should also be noted that these data do not cover other rivers where escapes have been reported unofficially but where no samples were taken.

Although no definitive figures are available for 2004, one escape due to damage to a cage in a storm was voluntarily reported (Bean, pers. comm.). It appears that more will need to be done to end the threat from escaped farm salmon.

## REPORT ON PROGRESS AS OF 2005

### CRITERION 1: ADOPTION OF A SITING POLICY AIMED AT KEEPING AQUACULTURE AT A SAFE DISTANCE FROM SALMON RIVERS

The United States and the State of Maine have made no changes in their policies and regulations regarding minimum distances between aquaculture sites and the salmon rivers and regarding exclusion zones for protection of wild salmon. Therefore, the United States does not meet the requirement for a minimum score.

### RESULTS FOR CRITERION ONE: 0

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### CRITERION 2: DEGREE TO WHICH CUMULATIVE ENVIRONMENTAL IMPACTS OF SALMON FARMING ON AN ENTIRE BAY OR OTHER ECOSYSTEMS ARE CONSIDERED IN SITING DECISIONS

In the 2003 report, the United States was assigned a score of 2 for this criterion, on the ground that the United States had not taken any measures regarding this issue. However, an amendment to Maine statute 12 MRSA 6072, which became effective July 30, 2004, requires that the Commissioner "shall take into consideration the number and density of aquaculture leases in an area when making a lease decision."

In addition, the State of Maine has carried out studies of the carrying capacity of Cobscook Bay as well as other bays in the state. The Governor's Task Force on Aquaculture (2004) referred to "limited work... conducted in Maine to assess the biological carrying capacity of the bays." The results of these studies, however, were somewhat ambiguous. The Governor's Task Force on Aquaculture (2004) found that nutrient enrichment was "not currently causing ecological harm" in Cobscook Bay but noted that the data were "insufficient to determine whether nutrient enrichment may be causing effects such as shifts in phytoplankton community composition, increases in benthic algal production, and exacerbating harmful algal blooms (HABs)." A study by Sowles and Churchill (2003) concluded, "Conclusions regarding nutrient loading effects on intertidal microalgae remain ambiguous....". These conclusions about the carrying capacity of Cobscook Bay suggest that there may already be too many salmon aquaculture sites in the Bay.

The cumulative impacts of aquaculture have already been taken into account in regard to Blue Hill Bay, where scientists have found that flushing times are on the order of months, rather than a matter of days as they are in Cobscook Bay (Pettigrew, 1999; Brooks et al, 1999). Sowles (2003b),

recalled that DMR delayed the hearing on a lease for Blue Hill Bay until an assessment could be made of the projected nutrient discharge, and that monitoring of the Bay conducted in 2000 concluded that one additional farm could be added. Sowles and Churchill (2003) also noted the concern that the Inner Bay "might be more vulnerable to nutrient enrichment than the Middle and Outer Bays led to a prohibition on new discharges in Inner Cobscook in 1989...effectively excluding finfish aquaculture from that portion of Cobscook Bay."

Taking into account both the new regulatory requirement, the studies of carrying capacity on both Cobscook Bay and Blue Hill Bay, and the policy decision to prohibit aquaculture development in the latter, the United States fulfills the requirement for the highest score for this criterion.

## RESULTS FOR CRITERION TWO: 10

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### CRITERION 3: ADEQUACY OF STANDARDS FOR FISH HUSBANDRY, INCLUDING BEST INDUSTRY PRACTICES IN REGARD TO YEAR-CLASS SEPARATION, FALLOWING OF SITES AND MAXIMUM STOCKING DENSITIES

In 2003, the State of Maine adopted a "general permit" for salmon aquaculture that included a section on "Husbandry Practices." That section required that each facility covered by the permit "shall stock only a single year-class from one year-class to the next." But it allowed the facility to "maintain fish used for broodstock purposes during the period, not to exceed 10 percent of the total number of fish in the year-class during the last production cycle."

The new "general permit" also requires that operators "fallow the site for a sufficient time to avoid the harboring or spread of diseases from one year-class to the next." But in the absence of more concrete standards this requirement is inherently unenforceable. The decision not to impose a minimum fallowing requirement on fish farmers was influenced by the fact that many companies lacked alternate sites to which they could rotate, because the state was unwilling to approve additional leases.

The General Permit does not contain any standard for stocking density of sea cages. The permit refers to the issue under "General Conditions":

*The rearing density shall be low enough to avoid degradation to water quality and benthic conditions described in State water quality standards and limits contained in this General Permit. Also the rearing density shall reflect good preventive husbandry practices designed to avoid chronic conditions in the net pens that are likely to stress fish so as to elevate the risk from exposure to infectious diseases.*

As this paragraph acknowledges, a rearing density needed to avoid degradation of water quality and benthic conditions may be different from a rearing density that avoids stress on fish. Because Cobscook Bay has such strong currents and high waves, they can undoubtedly have a relatively high stocking density without causing serious harm to the benthic environment. But such a higher density could adversely affect fish health by causing too much stress on the fish and damaging their immune systems.

The difference in wording between the sentence relating to benthic conditions and the wording of the sentence relating to fish stress is of obvious significance. The sentence relating to benthic conditions is written so as to be enforceable, based on the water quality standards to which it refers. The other sentence, however, is constructed in such a way that no one can be held accountable. It refers not to any standards that can be enforced but to "practices *designed* to avoid chronic conditions...likely to stress fish...[emphasis added]." Because this "general condition" depends on the intention of the

operator, and has no benchmark for judging performance, it provides no meaningful standard for stocking density.

The Maine Aquaculture Association adopted a Code of Practice in its 2002 Finfish Bay Management Agreement, which does not go quite as far as the new state general permit. It makes the establishment of single-year-class sites a "long term target" and also does not specify any minimum fallowing time (Maine Aquaculture Association, 2002).

The director of the USDA APHIS Veterinary Services ISA Control Program in Maine (Ellis, pers. Comm.) recalls that he imposed an emergency 100-day fallow, based on the life cycle of sea lice. He says that he would have preferred as a scientist to impose a longer fallowing period than the 30 days called for in the program, but that he "didn't enjoy the flexibility of a longer-term approach."

The state's main technical expert on conditions under net pens recommended that specific fallowing periods be made a condition of the leases (Heinig, 2002). Nevertheless, the Department Marine Resources (DMR) lease decisions and the contracts based on them do not deal with that or any other fish husbandry issue (Heinig, 2002). A review of the first 40 lease decisions on the DMR website confirms that no conditions pertaining to fish husbandry have been attached to the leases (State of Maine Department of Marine Resources, 2005).

Giving the benefit of the doubt to Maine's norm for single-year-class, the new permit covers one of the three best practices for fish husbandry, and, thus, the United States qualifies for a score of 4.

## RESULTS FOR CRITERION THREE: 4

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### CRITERION 4: ADEQUACY OF MONITORING AND ENFORCEMENT OF BEST PRACTICES IN FISH HUSBANDRY

Under the General Permit for salmon farms, each facility is required to maintain records on the number and type, size and configuration of net pens in use, the age, weight and number of fish in each net pen and to report that information monthly to the DMR. Those reports effectively convey the data on stocking densities at each site. However, this data is not used by the DMR for the purpose of checking on whether stocking densities are causing stress to fish. Fallowing practices and stocking densities are evaluated only in relation to the need to adjust them in order to bring performance of the site into line with standards for benthic environmental quality. The DRM argues that this constitutes monitoring and effective enforcement of fish husbandry practices (Sowles, pers. comm.). However, the focus of this monitoring and enforcement is still benthic environmental quality and water quality, not fish health. Stocking densities that may be acceptable for assuring benthic environmental quality may not be sufficient to assure against stresses that can make fish more vulnerable to disease.

The monitoring of aquaculture operations under the Finfish Aquaculture Monitoring Program (FAMP) in Maine involves a semi-annual diver survey to assess environmental conditions under and adjacent to the sea cages, monitoring of benthic infauna to determine attainment of Maine's marine and estuarine life and habitat suitability and sampling of water at three stations near the site for dissolved oxygen (Maine Department of Marine Resources, n.d.). However, the FAMP does not provide any additional monitoring relevant to fish husbandry standards.

Therefore, the United States fulfills the requirement for a minimum score for this criterion.

## RESULTS FOR CRITERION FOUR: 3

**CRITERION 5: ADEQUACY OF PRACTICES AND PROCEDURES FOR EARLY DETECTION OF AN OUTBREAK OF ANY DISEASE OR PARASITIC INFECTION LIKELY TO AFFECT ATLANTIC SALMON AND RAPID RESPONSE TO SUCH AN OUTBREAK**

After a serious outbreak of ISA in Cobscook Bay in early 2001, the Maine Department of Marine Resources promulgated emergency regulations governing fish disease control, which were then incorporated into the Department's rules on the import of live marine organisms (13–188, Chapter 24) in September 2001. The new regulations provided for mandatory monthly fish ISA virus surveillance, specified the sampling procedures and methods for confirming ISA virus, stipulated chain of custody requirements, and specified actions to be taken upon detection of the virus.

However, the emergency regulations did not cover the problem of sea-lice, which also infested Cobscook Bay in 2001. The State did not promulgate emergency rules for mandatory surveillance and treatment of sea-lice. The "Integrated Pest Management Guidelines" established by the USDA for Maine called for Bay Management Area plans to include in their IPM Plans routine monitoring of sea-lice populations at least bi-weekly and called a maximum threshold for sea-lice counts that would trigger mandatory treatment of the fish for sea lice (USDA APHIS Veterinary Services, 2002). These guidelines were never translated into regulatory law. However, the federal government has leverage over their implementation insofar as compliance with the guidelines is required for indemnification of an operator for fish lost because of ISA. This represents an effective means of enforcing the guidelines for sea lice monitoring and treatment.

Therefore, the United States fulfills the requirements for the highest score for procedures regarding fish diseases and sea lice.

**RESULTS FOR CRITERION FIVE: 10**

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**CRITERION 6: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO, EQUIPMENT AND STRUCTURES**

In 2002, the State of Maine and the federal government agreed on the adoption of a "Containment Management System" as the basis for site-specific CMS plans to be formulated by each aquaculture operator with the aim of preventing escapes of fish into open water (Ostergaard, 2002). The CMS plan was based on the "critical control points" approach, meaning that critical limits would be defined for each structure in the production system. It required the minimum standards provided in the most current Code of Containment for each piece of equipment in the netpen aquaculture system. Such a code of containment was adopted by the Maine Aquaculture Association and its member salmon farms on October 18, 2002. The CMS provided standards for mooring, net and cage systems and the site plan as a whole. A requirement for such a CMS system was included in the "general permit" adopted by the State in 2003.

Therefore, the United States is considered to qualify for the highest score for this criterion.

**RESULTS OF CRITERION SIX: 10**

**CRITERION 7: ADEQUACY OF NATIONAL PLAN FOR MINIMIZING ESCAPES IN REGARD TO MANAGEMENT OPERATIONS, SITE-SPECIFIC CONTINGENCY PLANS AND NOTIFICATION OF ESCAPES**

The Containment Management System, adopted as part of the new State of Maine general permit in 2003, provides for inventory control procedures, predator control procedures, escape response procedures, unusual event management, severe weather procedures and training, along with a specified system of record keeping.

The new CMS qualifies the United States for the highest score for this criterion.

**RESULTS FOR CRITERION SEVEN: 10**

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**CRITERION 8: ADEQUACY OF MONITORING IN ORDER TO ASSESS COMPLIANCE WITH THE NATIONAL PLAN AND TO VERIFY THE PLAN'S EFFICACY**

The CMS adopted by the State of Maine in 2003 provides for third party auditing of the compliance with the CMS by the operator at each site at least once a year, with the auditor to be approved by the Department of Marine Resources. The auditor's written report is provided to both the facility and to the Department within 30 days, along with a corrective action plan and timetable for implementation and re-auditing to verify that any deficiencies have been corrected.

The new permit requires that each facility submit its standing inventory, including all transfer of fish in and out of the site, and other changes at the pen level, on a monthly basis. It also requires a report to the DMR in writing of any known or suspected escapes of more than 50 fish with an average weight of 2kg each or more within 24 hours. Any report of known escape of above a certain level would trigger additional audits of the site.

All salmon aquaculture facilities in Maine were audited for their Containment Management System plans in 2003 and again in 2004, and all were found to be in compliance except for some small paperwork violations in regard to their monitoring and reporting (Bean, pers. comm.). Furthermore, the CMS plan may have expedited the corrective action needed to stabilize quickly the one escape incident that occurred in 2004.

This regulation qualifies the United States for the highest score for this criterion.

**RESULTS FOR CRITERION EIGHT: 10**

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