RURAL AFFAIRS COMMITTEE

AGENDA

26th Meeting, 2000 (Session 1)

Tuesday 26 September 2000

The Committee will meet at 2 pm in The Hub, Castlehill, Edinburgh

1. **Stage 2 of the Budget 2001/2002**: The Committee will consider an Executive response to its report on the first stage, and a SPICe note on spending proposals.

2. **Proposed Salmon Conservation (Scotland) Bill**: The Committee will consider further details of the Executive’s consultations and a proposed programme for a stage 1 inquiry.

3. **Petitions**: The Committee will consider PE63: on increased resources for agri-environment schemes, and PE96: on sea cage fish farming.

4. **Subordinate Legislation**: The Committee will consider the following instruments under the negative procedure—

   - The Prohibition of Fishing with Multiple Trawls (Scotland) Order 2000 SSI 2000/226
   - The Farm Woodland Premium Scheme Amendment (Scotland) Regulations 2000 (SSI 2000/290)
   - The Beet Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/246)
   - The Fodder Plant Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/247)
   - The Cereal Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/248)
   - The Oil and Fibre Plant Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/249)
   - The Vegetable Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/250)

Richard Davies
Clerk to the Committee
The following papers are relevant to this meeting:

**Agenda item 1**
A paper by the Clerk to the Committee is attached, together with the Committee’s previous report and an Executive response. RA/00/26/1

A research note by SPICe will be sent separately to members

**Agenda item 2**
A paper by the Senior Assistant Clerk is attached, together with papers from the Scottish Executive RA/00/26/2

**Agenda item 3**
PE63 is attached with copies of a cover note by the Assistant Clerk, a briefing paper by SPICe and a letter from the Executive. RA/00/26/3

PE96 is attached with copies of a cover note by the Assistant Clerk, and a briefing paper from the Executive.

**Agenda item 5**
SSI’s 2000/226, 2000/290 and 2000/246-250 are attached together with appropriate explanatory notes from the Scottish Executive. Notes by the Senior Assistant Clerk together with relevant parts of the Subordinate Legislation Committees Report are also attached. RA/00/26/4
1. Subject Committees have been asked to consider relevant parts of departmental reports, to examine the spending priorities for the following year, and to examine the aims and objectives of the department. This was intended to be achieved by looking at the current year’s expenditure as an indicator for the future.

2. Because the budget papers were not made available until the beginning of April, the Rural Affairs Committee has been unable to devote sufficient time to this matter due to the unexpected pressure of legislation. Much of this report therefore suggests how the process might be improved in future years.

3. Concern was expressed about the clarity of both text and tables in the budget report. The Committee questioned the Secretary and other officials of the Scottish Executive Rural Affairs Department at its meeting on 9 May and this was followed up with a more detailed but informal discussion on 25 May. The explanations received were very much clearer than were the papers. If in future years the committee is to undertake consultation on this early stage in the budget process, the papers which are made available will need to be much clearer. This need for clarity should not just mean avoiding jargon, it should also show more clearly how European funds are applied and which parts of the budget are under the direct control of the Parliament and its Executive, without constraint from the European Union or reserved to the UK Government.

4. Officials have explained to the Committee that over 70% of the expenditure outlined in the departmental report sits outside the assigned budget over which the Executive has discretion. Even the balance of spending that could be termed “domestic”, about a quarter of the total, is dictated to some extent by European policy requirements. A large part of this domestic balance is spent on research and other scientific work. The Committee’s conclusion is that the standard questions that are generally guiding subject committees’ examination of the budget may be less relevant to the task of making meaningful comment on this particular budget. Our comments relate as far as possible to those questions as follows.

5. The Committee was asked to consider the aims of the Department as set out in its report and whether these were sufficiently clear and unambiguous. The Rural Affairs Department’s primary aim is “To help the people of Scotland to secure a life of quality and prosperity through sensitive stewardship and sustainable development of the natural resources of Scotland”.

Rural Affairs Committee

Report to the Finance Committee on the 2000/ 2001 budget consultation
The Committee agreed that these were clear and unambiguous, though of a non-specific nature. Some of the other related targets of the department relate largely to internal management arrangements which, although enabling scrutiny of administrative efficiency, do not show the impact of domestic policy.

6. It was suggested that the Committee might examine whether the objectives and targets were designed in such a way that one might tell whether they have been achieved. In questioning executive officials, the committee sought to discover to what extent the cross-cutting intentions of the Executive’s approach to Rural Development was reflected in the spending in Rural Areas of all departments. The Secretary of the Department, Mr John Graham explained that “The manifestation of the existence of the Rural Affairs Department is probably coming through elsewhere in the work of the Executive; it is not coming through in a huge new spend from the department.” Official Report, 9 May 2000, col 726. Provisional figures of total spend in rural areas by all departments were subsequently made available for members,

7. The Committee feels that, as well as scrutinising the departmental budget, it would also be useful in future years to undertake a wider scrutiny of the way in which the Executive spends across all budgets in rural areas. A constraint at present is the lack of an agreed definition of rural areas because of the differing ways in which services are delivered. But even if a single definition cannot be agreed, a reasonable approximation would allow comparison of performance over time. Evidence has been submitted by the Executive to the Committee’s current inquiry into the impact of changing employment patterns on Rural Scotland which makes a start at examining this cross-cutting approach.

8. Subject Committees were also asked to consider whether the planned expenditure in future years would adequately support the Departmental objectives. The Committee found that the objectives do not relate to any specific level of spending in the bulk of the budget. Executive Officials explained that much of the spending is demand led, so that substantial changes may occur from one year to the next, and cannot be readily used to demonstrate policies or objectives.

9. Turning to the expected out-turn of actual expenditure last year, subject committees were encouraged to examine the breakdown of spending, the effect of inflation, and efficiency savings. The Committee concluded that European funded programmes are already closely monitored and it was questionable whether the committee’s time would be well spent trying to provide another level of scrutiny. Instead the Committee would prefer to examine the effect that present spending programmes have on the rural economy and how this expenditure works to encourage people to remain in rural areas. The outcome of any such examination might then be used to inform discussions on future European negotiations.
In conclusion

Because of the nature of the Rural Affairs budget, the Committee agreed that it was difficult this year to undertake a meaningful scrutiny of spending and that future scrutiny should extend to include the impact of the Rural Affairs Department and other Executive expenditure on the economy, environment and lifestyle in rural areas including the impact of the cross cutting Ministerial group in its integrated approach to rural development.

Rural Affairs Committee
May 2000
1. Rule 5.8 of Standing Orders provides that time should be set aside during October and November for consideration by Committees of documents laid before the Parliament setting out preliminary draft budgets of public expenditure in the forthcoming year.

2. Members may recall that, for stage 1 of this process, the Executive’s spending strategy was considered during May of this year and a report was made to the Finance Committee at the beginning of June. Stage 2 consists of an examination of the Executive’s spending proposals, which were presented in broad terms to the Parliament on 20 September 2000. More detailed figures for each department are expected to follow in the next few weeks. Subject Committees are expected to consider whether the proposals take account of views expressed during stage 1 of the budget process and, if required, call the Minister to give evidence prior to reporting to the Finance Committee on whether it is content with the proposals. The Finance Committee will subsequently report to the Parliament on whether the Budget Bill generally reflects the views expressed in consultations. The Finance Committee could, if it considered it justified, place an alternative budget before the Parliament for debate at the conclusion of stage 2.

3. Subject Committees are advised to start the stage 2 process by examining Departmental responses to their stage 1 reports. A copy of that report is attached to this note, together with the Minister’s response. A paper giving a broad overview of the latest spending proposals for the Scottish Executive Rural Affairs Department is being prepared by the Information Centre and will be sent separately to members. Two further pieces of information are expected in due course:
   - The Executive’s expenditure plans, which will break down the overall rural affairs budget to a more detailed level, and
   - the work described in the last paragraph of the Minister’s letter, demonstrating the impact on rural areas of the expenditure across all Executive policies and programmes.

4. The Budget process has been delayed slightly, and the Committee is now expected to agree a report to the Finance Committee by the second week in November. Although it would be possible for the Minister to attend the Committee on 3 October, Members may wish to wait until they have had a chance to digest all of the information available (and expected), and discuss the budget with the Minister on 31 October.

5. Meanwhile, the Committee is asked to consider the attached response to its earlier report and decide if there are any issues which should be addressed.

Richard Davies
Clerk to the Committee
1. On 19 September the Committee considered a pre-legislative memorandum on this proposed Bill, and heard evidence from the Scottish Executive Rural Affairs Department (SERAD). The Committee agreed to consider this Bill as a matter of urgency. The Committee requested that SERAD provide further information regarding detailed responses to their consultation, and this information is attached to this note. The list of consultees on this legislative proposal was also emailed to members on 19 September. It is likely that the Bill will be Introduced early next week and it is anticipated that a SPICe note will also be available shortly, detailing issues raised in consultation.

2. It is suggested that this Item be brought back onto the agenda on 3 October, in order for members to approve a call for evidence. Members are requested to consider what form a request for further evidence on this Bill might take. Members should therefore consider which groups they wish to seek written submissions from. It is suggested that this call request only evidence which is supplementary to the evidence already given to SERAD during their consultation. The written evidence requested should relate to the Bill as Introduced, and explore to what extent the Bill meets the issues raised during the previous consultation process. Such a request would also identify the date set for oral submissions (31 October) and ask organisations to inform us of their availability.

3. It is suggested that the deadline for these supplementary responses be set for 20 October. Whilst this is a short timescale, it should be sufficient for supplementary submissions. This material would be circulated to members immediately after the closing date for submissions. The Committee would then be given an opportunity to decide which organisations or individuals they wish to seek oral evidence from. It is suggested that such oral evidence sessions be held on 31 October. Again, while this is calling witnesses at relatively short notice, the earlier written consultation will have flagged up this date to prospective witnesses. Members should note that this draft timescale allows for only one oral evidence session.

4. Following the hearing of oral evidence, the Committee would be required to consider privately their draft conclusions, in order for a draft report on the general principles of the Bill to be brought forward to the next meeting of the Committee on 7 November. This timetable would allow Stage 1 of the Bill to be completed by mid November.

5. Members are requested to consider whether they are content with the proposed timetable, and to give consideration to which groups they wish to receive written or oral evidence from.

Tracey Hawe
Senior Assistant Clerk
Rural Affairs Committee
Dear Tracey

SALMON CONSERVATION (SCOTLAND) BILL

Further to the meeting of the Rural Affairs Committee on 19 September and our subsequent discussions, I attach a copy of the summary of responses to the consultation paper ‘Conservation of Salmon and Sea Trout’.

In providing an anonymised version we were following a previous model used in relation to the National Parks Bill but, given the views of the Committee, we are happy to provide a more detailed version. However, you should note that we received one confidential response and, as requested by the respondent, the details of this have been excluded from the summary.

Yours sincerely

MISS JOY DUNN
Conservation of Salmon and Sea Trout – A Consultation Document

Summary of Responses for the Rural Affairs Committee

Please see the attached table summarising the response to this consultation. A total of 86 responses were received, and of these only one was confidential and has been excluded from this summary. The responses were as follows:

The Association of Salmon Fishery Boards

23 District Salmon Fishery Boards/Trusts:

Luce Ythan Awe
Deveron Conon Tay
Dee Nairn Forth
Naver & Borgie Esk Don
North & West Cree Broom
Kyle of Sutherland Halladale Beauly
Tweed Commissioners Ness
Forth Fisheries Foundation Wester Ross Fisheries Trust
River Clyde Fisheries Management Trust

6 Local Angling Associations/Clubs:

United Clyde Elgin & District Aberdeen & District
Dee Anglers & Ghillies Pitlochry Dee SFIA

24 National/Regional Bodies:

SEPA SLF sportscotland RSPB Scotland
Scottish Canoe Assoc. SLF Scottish Canoe Assoc.
Crofters Commission SANA
WWF Scotland SNH Environment Agency
Fishmongers’ Co. RICSS Royal Society of Edinburgh
Salmon & Trout Assoc. SNFAS North of Scotland Water
NASCO English Nature Forestry Commission
Assoc. for Protection of Rural Scotland
Scottish Outdoor Recreation Network

11 Councils:

West Lothian Orkney North Lanarkshire
South Ayrshire Angus Perth & Kinross
Dumfries & Galloway Highland Moray
North Ayrshire Aberdeenshire

12 proprietors

9 anglersangling interests

1 confidential response
## CONSERVATION OF SALMON AND SEA TROUT – A CONSULTATION DOCUMENT

### 1. SUMMARY OF THE 86 RESPONSES

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>In whom should powers be vested?</th>
<th>What would be the nature of the measures proposed?</th>
<th>What would be the geographic cover of the powers, conservation measures?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Association of Salmon Fishery Boards</td>
<td>DSFBs. Would wish to discuss further with SE the issue of powers for groups of proprietors. Suggest retaining existing powers for DSFBs and amending Salmon Act to extend them further. Ministers to have emergency powers only. Encourage SE to undertake more research into issue of marine mortality and address problem of predator control. <strong>Other legislative changes:</strong> Proprietors required by law to submit catch returns. Formal right of access to water for those conducting research. Allow DSFBs to apply variable assessment rate throughout district to provide for varying financial circumstances and management needs. Ban on sale of rod caught fish either nationally or by district.</td>
<td>Would like clarification of ‘enabling powers’. ASFB suggest the following measures: Catch &amp; release Daily/weekly or seasonal bag limits Size/gender limit Changes to daily/weekly close times Ban on certain baits/lures Changes to specs for net fishing tackle Closure of all or part of fishery. Measures to be either with or without time limit depending on circumstances and type of measure.</td>
<td>District or part thereof</td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
<td>What would be geographic coverage of the powers, conservation measures?</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>West Lothian Council</td>
<td>DSFBs and Scottish Ministers.</td>
<td></td>
<td>District or part thereof.</td>
</tr>
<tr>
<td>Orkney Islands Council</td>
<td>Need to form a DSFB in Orkney, at present none exists.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr Jean Balfour, North and West District</td>
<td>DSFBs, but representation on each Board should be wider.</td>
<td>To restrict angling and netting effort.</td>
<td>District/catchments or parts thereof.</td>
</tr>
<tr>
<td>Lord Burton, Ness DSFB</td>
<td>No additional burden on DSFBs. The Executive should invest money in research and dealing with the problems of seals, drift netting and fish farms.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Clyde Angling Protective Association Ltd</td>
<td>DSFBs and, where none exists, an body such as UCAPA.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jenners, Edinburgh (Andrew Douglas Miller, Kyle of Sutherland proprietor)</td>
<td>Approve of all proposals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>William Lindsay, proprietor on Tay DSFB</td>
<td>Approve of all proposals, but feels the Executive should also address issues of drift nets, seals and hydro electric schemes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEPA</td>
<td>DSFBs and Scottish Ministers.</td>
<td>To restrict angling and netting. Not in favour of wider powers.</td>
<td></td>
</tr>
<tr>
<td>Peter H R Graham, Bidwells, Inverness</td>
<td>DSFBs only.</td>
<td>Should be flexible enough to address changing situations.</td>
<td>District or part thereof.</td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
<td>What would be the geographic coverage of the powers, conservation measures?</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Scottish Landowners’ Federation</td>
<td>DSFBs or, where none exists, proprietors. Ministers should only invoke powers in extreme circumstances.</td>
<td>Wide range of conservation measures. Possibility of temporary measures where emergency provision is needed.</td>
<td>District/catchment part thereof.</td>
</tr>
<tr>
<td>James Graham, angler on River Leven (Clyde District)</td>
<td>Approves of proposals in general but feels that use of powers should be monitored.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>River Luce DSFB</td>
<td>Welcomes proposals and endorses the ASFB’s views on the consultation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSPB Scotland</td>
<td>Support proposals but with appropriate monitoring.</td>
<td>Any measures should taken into account other environmental issues, e.g. WFD, BAPs.</td>
<td>Catchment basis.</td>
</tr>
<tr>
<td>River Deveron DSFB</td>
<td>Support the proposals and the views of ASFB.</td>
<td>Wide ranging conservation measures.</td>
<td>District or part thereof.</td>
</tr>
<tr>
<td>Ally Gowans, fly angler and fishing instructor</td>
<td>Fully supports proposals for Ministers to have powers.</td>
<td>Wide ranging, including predator control and improvement of water quality.</td>
<td>District by district basis.</td>
</tr>
<tr>
<td>North Lanarkshire Council</td>
<td>DSFBs or other appropriate organisation, e.g. River Clyde Management Trust.</td>
<td>Wide ranging but should take account of Local BAP and other environmental factors.</td>
<td>District or part thereof.</td>
</tr>
<tr>
<td>Dee DSFB</td>
<td>Supports proposals for DSFBs and Scottish Ministers. Also endorses views of ASFB.</td>
<td>In addition to existing powers, catch &amp; release, size, bag and gender limits and closure of the fishery for all or part of season. Time limited if required.</td>
<td>District or part thereof.</td>
</tr>
<tr>
<td>Elgin &amp; District Angling Assoc.</td>
<td></td>
<td>Ban on sale of rod caught fish, net caught fish to be tagged. Minimum size for sea trout. Bailiffs to have more powers.</td>
<td></td>
</tr>
</tbody>
</table>

**ORGANISATION**

<table>
<thead>
<tr>
<th>In whom should powers be vested?</th>
<th>What would be the nature of the measures proposed?</th>
<th>What would be the geographic coverage of the powers, conservation measures?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Measures Proposed</td>
<td>Proposed Measures</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Scottish Canoe Association</td>
<td>Support proposals in principal but would request that measures take account of other water users.</td>
<td></td>
</tr>
<tr>
<td>Naver &amp; Borgie DSFB</td>
<td>DSFBs and Scottish Ministers.</td>
<td>Should include measures for habitat protection and improvement. Address problem of pollution by fish farms. Boards should also have power to vary the rate of assessment throughout their district, e.g. where boards of different sizes have amalgamated.</td>
</tr>
<tr>
<td>Mrs A J Angus, Dee District</td>
<td>Against the proposals. Money should be spent on restocking instead.</td>
<td></td>
</tr>
<tr>
<td>South Ayrshire Council</td>
<td>Supports proposals.</td>
<td>Measures should take account of local biodiversity needs.</td>
</tr>
<tr>
<td>North &amp; West DSFB</td>
<td>Support proposals and endorse the views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>Charles C Wood, angler in Kyle of Sutherland District</td>
<td>Supports proposals.</td>
<td>In addition, incentives should be offered to Boards to set up hatcheries.</td>
</tr>
<tr>
<td>Atlantic Salmon Trust</td>
<td>Welcome the proposals and endorse the views of ASFB. However, would not approve Ministers imposing ‘blanket’ restrictions.</td>
<td>Emergency provisions should also be available to DSFBs (with approval of Ministers).</td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>Kyle of Sutherland DSFB</td>
<td>DSFBs and Ministers (in extreme circumstances).</td>
<td>Catch &amp; release, size/gender limit, close times and baits &amp; lures. Also closure of all or part of fishery. Measures should be time-limited.</td>
</tr>
<tr>
<td>Joseph Lynch, netsman on River Forth</td>
<td>Ministers (DSFBs not always fair to netsmen).</td>
<td>Should not include measures for further restrictions on netsmen.</td>
</tr>
<tr>
<td>Philip Gwyn, co-proprietor of the River Naver</td>
<td>Welcomes proposals for greater powers for DSFBs but should coupled with increased efforts to determine causes of marine mortality.</td>
<td></td>
</tr>
<tr>
<td>Aberdeen &amp; District Angling Association</td>
<td>Feel the present system works well but if there are to be more powers, measures should have the approval of at least two thirds of proprietors in an area.</td>
<td></td>
</tr>
<tr>
<td>Ythan DSFB</td>
<td>Support the proposals and endorse the views of ASFB.</td>
<td>Measures should be specific, e.g. c&amp;r, bag/size limits, closure of whole or part of river.</td>
</tr>
<tr>
<td>sportscotland</td>
<td>Supports proposals for DSFBs and Ministers.</td>
<td>Conservation measures.</td>
</tr>
<tr>
<td>North of Scotland Water</td>
<td>Supports proposals for DSFBs and Ministers.</td>
<td></td>
</tr>
<tr>
<td>The Association for the Protection of Rural Scotland</td>
<td>DSFBs or proprietors, and Scottish Ministers.</td>
<td>Conservation measures linked to overall catchment management.</td>
</tr>
<tr>
<td>The Crofters Commission</td>
<td>Support proposals for DSFBs.</td>
<td>As per recommendation 12 of Nickson Report.</td>
</tr>
</tbody>
</table>

**ORGANISATION**

In whom should powers be vested?  What would be the nature of the measures proposed?  What would be the geographic cover of the powers, conservation measures?
<table>
<thead>
<tr>
<th>Organization</th>
<th>Position/Response</th>
<th>Conservation measures?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conon DSFB</td>
<td>Endorse the response by ASFB.</td>
<td></td>
</tr>
<tr>
<td>Nairn DSFB</td>
<td>Endorse the response by ASFB.</td>
<td></td>
</tr>
<tr>
<td>Forth Fisheries Foundation</td>
<td>Support proposals for DSFBs and Ministers (on a national basis).</td>
<td>Wide ranging and including measures for improvement of habitats. Ministerial powers to include ban on sale of wild fish.</td>
</tr>
<tr>
<td>Paul van Vlissingen, proprietor on the Little Gruinard river</td>
<td>Do not support proposals. Fish farming is the biggest problem and should be addressed by SE.</td>
<td></td>
</tr>
<tr>
<td>Esk DSFB</td>
<td>Support proposals in conjunction with research on marine mortality.</td>
<td>Conservation and should include emergency powers for Boards. SE should address issues of drift nets and seals.</td>
</tr>
<tr>
<td>River Cree DSFB</td>
<td>Support proposals and endorse views of ASFB. In addition DSFBs should be made statutory consultees in matters relating to water quality or river habitat/species.</td>
<td></td>
</tr>
<tr>
<td>Angus Council</td>
<td>Support proposals, especially if there is LA representation on the DSFBs.</td>
<td>Flexible enough to meet local needs.</td>
</tr>
<tr>
<td>Perth &amp; Kinross Council</td>
<td>Support proposals as laid out.</td>
<td></td>
</tr>
<tr>
<td>Dumfries &amp; Galloway Council</td>
<td>Support proposals for DSFBs and Ministers.</td>
<td>Should be responsive to needs of each area.</td>
</tr>
<tr>
<td>Halladale DSFB</td>
<td>Support response of ASFB.</td>
<td></td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Awe DSFB</td>
<td>Endorse the ASFB response. SE also needs to address issues of predator control, fish farms &amp; uniformity of close times for different fish species.</td>
<td></td>
</tr>
<tr>
<td>John D Pirie, proprietor in Ythan District</td>
<td>Mainly Scottish Ministers but also DSFBs or proprietors.</td>
<td>Wide ranging – to meet local needs.</td>
</tr>
<tr>
<td>Fish Conservation Centre</td>
<td>Supports that proposals in principle but only in conjunction with further reform as a result of P&amp;P consultation.</td>
<td></td>
</tr>
<tr>
<td>SANA</td>
<td>Support proposals for DSFBs and Ministers.</td>
<td>As laid down in the ASFB response. With the proviso that measures can be revoked as well as invoked should need arise.</td>
</tr>
<tr>
<td>Wester Ross Fisheries Trust</td>
<td>Generally supportive of proposals for Ministers and DSFBs. Should be coupled with research on marine mortality and action on drift netting.</td>
<td>Range of conservation measures to be determined locally.</td>
</tr>
<tr>
<td>WWF Scotland</td>
<td>Support proposals in principle.</td>
<td>Catch &amp; release, bag limits, etc. Measures based on sound scientific data.</td>
</tr>
<tr>
<td>Tay DSFB</td>
<td>Support proposals and endorse the views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>Scottish Natural Heritage</td>
<td>Support proposals together with any statutory changes resulting from P&amp;P consultation.</td>
<td></td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Trevor Tyler, angler from Northumberland</td>
<td>Does not support proposals. Feels SE should look at marine issues and invest in hatchery management.</td>
<td>SE should introduce ban on sale &amp; netting of wild salmon, fishing of salmon prey species and import of ocean caught wild salmon.</td>
</tr>
<tr>
<td>Forth DSFB</td>
<td>Support proposals and endorse views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>Pitlochry Angling Club</td>
<td>Support proposals but are concerned about costs for anglers. Should be a change is the way Board assessments are made.</td>
<td></td>
</tr>
<tr>
<td>Don DSFB</td>
<td>Support proposals but any application by a Board should have a two-thirds majority behind it.</td>
<td></td>
</tr>
<tr>
<td>Highland Council</td>
<td>Support proposals in principle but SE should continue research into marine mortality.</td>
<td>Application should be based on sound scientific advice.</td>
</tr>
<tr>
<td>Environment Agency</td>
<td>Support the proposals for DSFBs and Ministers.</td>
<td></td>
</tr>
<tr>
<td>The River Clyde Fisheries Management Trust Ltd</td>
<td>Would support proposals if, in the absence of a Board, associations such as RCFMT were given powers.</td>
<td></td>
</tr>
<tr>
<td>Dee Salmon Fishing Improvement Association</td>
<td>Support the proposals and the views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>Broom DSFB</td>
<td>Support proposals and views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
</tr>
<tr>
<td>Organization</td>
<td>Position and Supporting Details</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Beauly DSFB</td>
<td>Supports the views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>Joe McGame, netting proprietor and fisherman on River Forth</td>
<td>Supports further restrictions on anglers but not netsmen.</td>
<td></td>
</tr>
<tr>
<td>Moray Council</td>
<td>Support proposals and the need for research on marine mortality.</td>
<td></td>
</tr>
<tr>
<td>Edward Mountain, proprietor in Spey and Beauly Districts</td>
<td>Supports powers for DSFBs and Ministers (emergency only). Method of catch, bag limits, close times &amp; catch &amp; release. Measures in place for a year. Catchment or thereof.</td>
<td></td>
</tr>
<tr>
<td>Fishmongers’ Company</td>
<td>Support views of ASFB.</td>
<td></td>
</tr>
<tr>
<td>RICSS</td>
<td>Support powers for DSFBs or proprietors, and Ministers in extreme cases. Flexible, meet needs of different districts.</td>
<td></td>
</tr>
<tr>
<td>Royal Society of Edinburgh</td>
<td>Support powers for DSFBs, but they need wide membership. SE should encourage creation of Boards where currently there are none. Variable measures to restrict angling or netting effort.</td>
<td></td>
</tr>
<tr>
<td>Salmon &amp; Trout Association Scotland</td>
<td>Support proposals for DSFBs and Ministers. Varied but Ministers should not impose ‘blanket’ restrictions, e.g. catch &amp; release. Anglers and netmen treated equally.</td>
<td></td>
</tr>
<tr>
<td>Mansfield Estates, Perth (proprietors, Tay District)</td>
<td>Ministers should not impose ‘blanket’ restrictions as in England and should consider problems for salmon at sea.</td>
<td></td>
</tr>
<tr>
<td>Dee Anglers &amp; Ghillies Group</td>
<td>Support proposals but applications must be based on scientific data. Would not support ‘fly only’ regime for anglers.</td>
<td></td>
</tr>
<tr>
<td>Scottish Outdoor Recreation Network</td>
<td>Support proposals.</td>
<td></td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Salmon Net Fishing Association of Scotland</td>
<td>Emphasise that netting rights are private heritable rights. Agree with additional powers for DSFBs on the condition that they are based on accurate, unbiased scientific data. Groups of proprietors requesting powers should be representative of all interests, and Ministers should have emergency powers.</td>
<td>Varied, not just restrictions on netting. Consider measures to reduce predation.</td>
</tr>
<tr>
<td>North Ayrshire Council</td>
<td>Support the proposals but in conjunction with actions to address problems of commercial exploitation at sea and fish farming. Would like clarification of how regulations would be imposed in areas without DSFBs, the Council is a major proprietor in this area.</td>
<td></td>
</tr>
<tr>
<td>Ness DSFB</td>
<td>Proposals do not address the real problem – marine mortality. SE are trying to pass the buck to DSFBs.</td>
<td></td>
</tr>
<tr>
<td>Aberdeenshire Council</td>
<td>Support proposals together with action on marine issues affecting salmon.</td>
<td>Catch &amp; release, bag/size limits, changes to close times, controls on tackle, closure of whole or part of fishery.</td>
</tr>
<tr>
<td>River Tweed Commissioners</td>
<td>Support proposals and endorse ASFB response.</td>
<td>Also, mandatory catch returns access to water for monitoring.</td>
</tr>
<tr>
<td>ORGANISATION</td>
<td>In whom should powers be vested?</td>
<td>What would be the nature of the measures proposed?</td>
</tr>
<tr>
<td>Name</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>NASCO</td>
<td>Did not comment on the proposals directly but included a copy of the Decision Structure for Implementing the Precautionary Approach.</td>
<td></td>
</tr>
<tr>
<td>Michael C Smith, Tay District</td>
<td>Proposals are cosmetic. SE should concentrate on NE drift nets, aquaculture and reducing predators.</td>
<td></td>
</tr>
<tr>
<td>Andrew T Wood, Bidwells Property Consultants, Perth</td>
<td>DSFBs but with additional funding from SE. Not in favour of mandatory catch &amp; release.</td>
<td></td>
</tr>
<tr>
<td>English Nature</td>
<td>Proposals do not affect England, therefore no comments.</td>
<td></td>
</tr>
<tr>
<td>Forestry Commission</td>
<td>No comments.</td>
<td></td>
</tr>
<tr>
<td>The Rt. Hon Lord Jauncey of Tullichettle, (angler)</td>
<td>If DSFBs should have the backing of the majority of proprietors before making an application to SE. Otherwise, the affect on private, heritable rights constitutes an infringement of ECHR and calls for compensation.</td>
<td></td>
</tr>
<tr>
<td>Hon. Lord Morison, proprietor on the river Deveron.</td>
<td>Does not feel that DSFBs are sufficiently representative or proprietors interests. Additional powers imposed without the approval of proprietors may create calls for compensation under ECHR.</td>
<td></td>
</tr>
</tbody>
</table>
PETITION PE 63: National Farmers Union of Scotland

Date Received: 11 January 2000
Date Referred: 18 January 2000
Subject: Increased resources for agri-environment schemes.

1. Petition PE 63 calls upon the Scottish Parliament to determine the resources required to meet the objectives of the schemes in Scotland, and to oblige the application of additional funds from UK resources to these measures. The petitioners view the current resources as being inadequate for the purposes of the measures, which recognise public benefits from good land management practices. A copy of the Petition is attached.

Background

2. This petition has been referred to this Committee, with the Transport and Environment Committee asked to provide comment. The Committee previously considered this petition on 29 February 2000 and agreed to defer a decision until the views of the Transport and Environment Committee were obtained, and until Scottish Executive Modulation consultations were complete.

3. The Transport and Environment Committee considered this petition, and wrote to the Scottish Executive requesting further information. A copy of the Executive response is attached. The Transport and Environment Committee noted the petition and further noted a proposed Organic Targets Bill being sponsored by Robin Harper MSP. The Committee agreed to monitor this issue during the upcoming Budget process.

Options

4. The Committee may consider that the issues raised by this petition have been overtaken by events, principally the recent decision of the Scottish Executive regarding modulation. The Committee may wish to note this petition and continue consideration of the issues raised when assessing the response of the Committee to the current Scottish Executive budget proposals.

Tracey Hawe
Assistant Clerk
Agri-environment measures: SPICe briefing

PE 63:

Petition calling on the Scottish Parliament to increase resources for agri-environment measures.

General

Agri-environment schemes offer payments to farmers for carrying out farming practices that enhance and protect the environment. All EU Member States have been required to operate an agri-environment programme since 1992. As reforms to the Common Agriculture Policy (CAP) increasingly require links between agricultural production and support to be removed it seems likely that agri-environment schemes will become increasingly important as a means of supporting farmers.

Agri-environment schemes are different in each of the UK countries and their design and funding is devolved. There are currently 3 agri-environment schemes operating in Scotland:

- Environmentally Sensitive Areas (ESAs): offer payments to farmers in 10 designated ESAs for practising conservation on their farms. All eligible farmers who meet the scheme requirements are accepted into the ESA.
- Countryside Premium Scheme (CPS): offers all farmers outside ESAs the opportunity to apply for payments to practice conservation. Farmers across Scotland are required to compete against each other to qualify for this scheme.
- Organic Aid Scheme: offers payments to help all farmers in Scotland convert from conventional to organic production methods. All eligible farmers who meet the basic requirements are accepted into the OAS.

Future plans for Scottish agri-environment schemes

The Agenda 2000 CAP reforms introduced a new Rural Development Regulation (RDR), agri-environment schemes and other measures will be brought under the RDR. The Scottish agri-environment programme will change slightly with the implementation of the RDR and will be made up two schemes: Rural Stewardship Scheme (RSS) (which will be an amalgamation of ESAs and the CPS) and Organic Aid Scheme (which will remain as before). When it is introduced later this year applicants for RSS will be required to compete for the resources that are available after the commitments made to applications for the OAS have been met.

Funding for Scottish agri-environment schemes

In 1999/00 the total budget for agri-environment schemes in Scotland was £15.5 million. Total applications for the agri-environment programme in Scotland in 1999/00 exceeded the budget available and out of the 726 applications received for the CPS
only 326 were approved. Other UK countries have larger agri-environment budgets than Scotland, in England for example, the budget was £62.9 million in 1999/00.

Funding for agri-environment schemes in Scotland has, in the past, come partly from the EU and partly from the Scottish block.

**New resources for Scottish agri-environment schemes**

The NFUS is requesting new resources for agri-environment schemes to be allocated from UK resources. There are a number of ways through which additional resources could be made available for Scottish agri-environment schemes these are outlined in the following sections.

**Modulation**

As a result of the Ministerial decision to go ahead with modulation (announced on 4 August 2000) an additional £3 to £4 million will be devoted to agri-environment schemes in Scotland each year from 2001, rising to an extra £21.6 million in 2006. Half of this additional funding has come through redirecting up to 4.5% of mainstream agricultural support payments and half has come, as match funding for these modulated resources, directly from the UK government.

**Increase spending by the Scottish Executive**

Agri-environment scheme design and funding is a devolved matter and the Scottish Executive has a free reign in this regard so long as they abide with the requirements of the EU regulations. It is therefore be a matter for the Scottish Executive to decide how to find and allocate further resources to agri-environment measures. However, this would require resources to be diverted from elsewhere in the Scottish block. Since the NFUS is requesting additional resources from the UK government this option would not exactly meet the calls of the petitioners.

**Increase spending by the UK government**

The petitioners are calling for increased resources from the UK government to be devoted to Scottish agri-environment schemes. Other than through the use of the modulated resources, which are to be supplemented by resources from the UK Treasury, it is difficult to envisage how the Scottish Parliament might encourage this.

**Notes**

1. Agri-environment schemes, by encouraging organic and environmentally friendly farming and by contributing to farmers’ incomes, are likely to make some contribution to the sustainable development of rural Scotland. They are also likely to become a more important means of supporting farmers as CAP reforms progress.
Petition by Mr Allan Berry on Sea Cage Fish Farming

PE96 by Mr Allan Berry calling for the Scottish Parliament to hold an independent and public inquiry into the adverse environmental effects of sea cage fish farming, and the regulatory failure to both recognise and prevent significant damage to our natural heritage, the environment and other interests dependent on the integrity of our Scottish coastal waters.

The petition is accompanied by a substantial volume of additional material submitted by the petitioner to support the petition. Members who would like to see a copy of this material should contact the clerk. Attached to this covering note is a list of indications of support for the petition which have been received by the Public Petitions Committee, plus a copy of a paper on the petition requested from the Scottish Executive Rural Affairs Department. A letter from Mr Frank Buckley raising similar issues is also attached for information.

Progress of Petition

This petition was considered by the Public Petitions Committee on 29 February. It was referred to the Rural Affairs Committee, with the request that members of that Committee take into account the views of the Transport and the Environment Committee. The Transport and the Environment Committee considered this petition on 13 June 2000. The Committee agreed to support in principle the petitioner’s call for an inquiry, but noted that the Committee already had a significant work load, as well as previously agreed work priorities. The Committee agreed that the Convener should consult the Convener of the Rural Affairs Committee over the possible scope and timescale of any inquiry. The Committee agreed to consider the issue again, in the context of its future work programme, when this discussion had taken place.

Petitioner’s Request for Action

In considering how to respond to the petition, members are primarily asked to address the specific request made by the petitioner - that there should be an independent public inquiry into the issue of sea cage fish farming. Members should note that the Executive is currently consulting over a proposal to transfer planning powers for marine fish farms to local authorities, as discussed in the Executive briefing note.

If the Committee agrees with the Transport and Environment Committee that such an inquiry should be supported in principle, it would be appropriate to discuss the mechanisms for such an inquiry, and the terms of reference for this inquiry with that Committee. This could best be achieved by the appointment of a reporter to consider this issue and report back.

Tracey Hawe
Assistant Clerk to the Rural Affairs Committee
1. A petition has been submitted to the Scottish Parliament by Mr A Berry seeking an independent review of fish farming in Scotland. This paper responds to the request by the Rural Affairs Committee for a note on the subject.

2. This paper does not offer a view on whether or not such a review should be carried out; that is for determination by the Committee. Nor, in the limited time available for submission, does it purport to address all of the issues which are mentioned in the documentation accompanying the petition. Rather what the Paper seeks to do is address the implicit charge that the aquaculture industry in Scotland is unregulated or under-regulated and that insufficient regard is had to the effects which the industry may be having on the wider environment. It does this by providing a description of the aquaculture industry in Scotland (particularly salmon), details the controls that apply to the industry, and comments on the issues raised in Mr Berry’s own submission, detailing the research and development effort, some of it ongoing, which surrounds aquaculture.

3. This paper is set out as follows:

   - Part I describes the aquaculture industry in Scotland and briefly explains the operational requirements;

   - Part II outlines the regulatory framework and describes measures being taken to introduce greater harmony between aquaculture and other users of the marine environment;

   - Part III addresses the issues raised by Mr Berry and details research and development work undertaken in aquaculture;

   - Conclusion

   - Annex 1 (Detailed comments on points made by Mr Berry)

   - Annex 2 (Summary of FRS related Research & Development)
Part I - The Aquaculture industry in Scotland

4. The marine aquaculture industry has two main components: marine fish farms; and shellfish farms, producing a range of marine mollusc species. In addition, freshwater salmon farms produce smolts for on-growing in seawater.

5. There are around 350 marine salmon farms and 237 shellfish farms, in addition to which there is a small (but growing) number of sites where other marine species such as halibut, sea trout, cod and turbot are farmed. The requirements of each sector of the industry in terms of water, equipment and technology may vary considerably, but there are many elements in common.

6. Currently, virtually all marine finfish production takes place in the inshore waters of the West Coast and islands, where the most favourable operational conditions for marine fish farming are to be found. Shellfish farming shows a similar distribution, though there are relatively few farms in Shetland and Orkney, where lower water temperatures result in slower growth rates. However it is worth noting that there has been a significant growth in the number of mussel farms in Shetland over recent years.

Salmon

7. The Atlantic salmon (Salmo salar) is the main finfish species farmed in Scottish waters. Nearly all UK salmon production is located in Scotland and salmon production is the most economically important sector of the marine aquaculture industry. Salmon farming has expanded rapidly over the last 10 years with production rising from some 32,000 tonnes in 1990 to approximately 127,00 tonnes in 1999. Expansion has been achieved both through the development of new sites and increased productivity.

8. Almost all Scottish farmed salmon are grown in seawater cages. A variety of sea cage systems are currently in use in Scottish coastal waters. In most designs fish are contained in net bags suspended from floating collars. Most installations consist of rafts of cages, often arranged round a framework of walkways to facilitate servicing. Larger and more robust semi-submersible cages have been developed for use in open sea conditions. A finfish farm site may contain several installations, each maintained in position by its own mooring system.

Rainbow trout

9. The other main marine finfish species farmed commercially in Scottish waters is the rainbow trout (Oncorhynchus mykiss). Most Scottish trout production takes place in freshwater and is not covered by this Paper. However 5 marine sites, which enable the trout to grow larger, are engaged in production using similar technology to that used in salmon farming. In 1999 these contributed 1,582 tonnes or 27% of total rainbow trout production in Scotland.
Shellfish

10. Shellfish farming in Scottish coastal waters is almost exclusively concerned with mollusc production. The main species are mussels (*Mytilus edulis*), native oysters (*Ostrea edulis*), Pacific oysters (*Crassostrea gigas*), and king and queen scallops (*Pecten maximus* and *Aequipecten opercularis*).

11. **Mussels** are grown on weighted ropes suspended either from buoyed lines (the longline system) or wooden rafts. **Oysters** are grown either in trestles placed in the intertidal zone, in stacks of trays located just below the low water mark, or in net bags suspended from rafts. **Scallops** may be grown in nets hung from buoyed lines or rafts, or suspended on ropes by threading a tag through a hole drilled in one of the lobes of the shell (“ear-hanging”). They can also be grown on the seabed.

12. Although there are similar numbers of finfish and shellfish sites, the scale of shellfish cultivation is still relatively small, with a value in 1999 of only about £2 million. While a few relatively large farms account for the bulk of Scottish production, most Scottish shellfish farms are small enterprises producing less than 10 tonnes per year. Shellfish farming employs about 300 people in rural areas and provides a valuable source of income in many crofting communities, much of the employment being part-time.

Other species (in development)

13. A number of companies are currently involved in the development of **halibut** farming. 1997 saw the first commercial harvest of the species, amounting to about 0.5 tonnes. Estimates suggest that this could rise to about 60 tonnes in 2000. One company in Shetland is currently producing **sea trout** which harvested 92 tonnes in 1999. **Turbot** is another species approaching commercial production. The development of **cod** farming is still in its infancy but research being conducted by the Sea Fish Industry Authority in collaboration with a number of fish farms and retailers is producing very encouraging results. The first commercial harvest of 0.1 tonnes occurred in 1999, being sold through Marks and Spencer. This year should see some 25 tonnes produced.

Operational requirements

14. The basic operational requirements of the marine aquaculture industry are high water quality, suitable depth, temperature and salinity, adequate access, infrastructure and security. Unpolluted and well-oxygenated water is normally regarded as a pre-requisite for the culture of marine fish, salmonids and shellfish. Aquatic organisms have differing water temperature requirements. Growth rates generally increase with temperature and large seasonal fluctuations can adversely affect both fin and shellfish species. Water temperatures on Scotland’s Atlantic coast are higher and more stable than at similar latitudes elsewhere because of the effect of the North Atlantic Drift. Sheltered, shallow situations, where water temperatures may become elevated during the summer months, can be particularly attractive locations for shellfish cultivation. However, sites where the tidal flushing is poor enough to permit elevated temperatures may be prone to low oxygen levels, low salinity, low
natural food levels and poor dispersion of waste.

15. In shallow inner sea lochs and inlets which receive substantial discharges of freshwater, salinities are likely to drop below the optimum for marine aquaculture. Salmon and shellfish farming both require relatively high and stable salinities. Low salinities result in reduced salmon growth rates and can induce premature maturation or "grilsing". Scallops are particularly sensitive to low salinities and many West Coast sites are unsuitable for their cultivation due to low salinities during winter.

16. Intensive fish husbandry, particularly that using an external food source has the potential to alter the water chemistry in and around production sites. The water can become enriched in nutrients. The ecological consequences of excessive nutrient enrichment can include changes in the composition of aquatic plants, animal communities and production of phytoplankton.

17. Sustainable fish farming requires that the levels of nutrient and chemical inputs are not allowed to exceed the carrying capacity of the surrounding aquatic environment. There is clearly a need to ensure that, within any enclosed body of water, the total nutrient input from fish farming and other sources does not exceed the threshold above which an unacceptable increase in phytoplankton production or undesirable changes in species composition would occur. As a result the Scottish Environment Protection Agency (SEPA) has established environmental quality standards (EQS) to ensure that concentrations of a range of potentially toxic chemicals remain well below the level at which adverse ecological effects are detectable. Under EC Directive 91/492, which lays down stringent health conditions for the production and marketing of bivalve molluscs, shellfish harvesting areas have been classified according to the level of bacterial contamination present in samples of mollusc flesh.
Part II – Regulation of the Marine Aquaculture Industry

18. Regulation of the aquaculture takes a number of forms and involves a number of authorities. Details are as follows.

19. The Scottish Executive Rural Affairs Department (SERAD) is responsible for statutory measures under the Diseases of Fish Act 1937, as amended, and related EC Fish Health legislation to prevent the introduction and spread of serious diseases of fish and shellfish which may affect farmed and wild stocks. All fish and shellfish farms must be registered with the Department for disease control purposes. Certain diseases must be notified to the Department and there are procedures laid down for the treatment and disposal of infected stock.

20. Great Britain has a very high fish health record which has enabled us to become an approved zone under EC legislation. As an approved zone we can restrict introductions of fish and shellfish from other parts of the EC to those from areas of equivalent health status. In order to maintain approved zone status GB is required to carry out regular inspections of all fish and shellfish farms holding species susceptible to certain diseases and to test samples to establish the continued absence of those diseases. The statutory inspection programme is carried out by Fish Health Inspectors from the Marine Laboratory at an annual cost of approximately £1.4 million. In addition, the Marine Laboratory carries out a wide range of basic marine fish farm research and offers advice on production methods and equipment.

21. The Crown Estate Commission (CEC) has the responsibility for authorising marine aquaculture developments in its capacity as landlord for much of the sea bed around the Scottish coast. Some time ago the CEC expressed a desire to withdraw from its implicit “planning” role in authorising marine developments and following a review it was concluded that this function should be assigned to Local Authorities. A Consultation Paper on legislation to give effect to this was issued on 25 July 2000. This includes the possibility that planning consent may be required for sites that are not already approved by local authorities when the CEC lease falls due for renewal.

22. The decision to approve or refuse the lease application will continue to rest with CEC. However pending legislation a non-statutory interim scheme was introduced in December 1998. These arrangements enhance the advisory role of SERAD (for the wider fishery interest), SEPA, SNH and Local Authorities and the CEC has indicated that it will normally be guided by the advice offered.

23. The Scottish Environment Protection Agency has a duty under the Environment Act 1995 to promote the cleanliness of Scotland’s tidal waters and to conserve so far as practicable, its water resources. SEPA is also required, to such extent as it considers desirable, generally to promote the conservation of flora and fauna dependent on the aquatic environment. These duties are reflected in the safeguarding of the water quality and condition of the seabed in the vicinity of fish farms. Under the Control of Pollution Act 1974, consent is required for the discharge of effluent from marine fish farms to coastal waters. Applications for discharge consents are advertised and SEPA will consult other regulatory authorities. Objectors may request that the Scottish Ministers call in the application.
24. Conditions designed to minimise adverse environmental effects by imposing limitations on the release of pollutants may be attached to consents. SEPA is responsible for ensuring that appropriate monitoring of the aquatic environment is undertaken and this is achieved by applying specific consent conditions and by its own audit monitoring. Consents may be subject to a review after a period of 4 years or sooner with the agreement of the fish farmer.

25. The intensity of fish farming in an area will be affected not only by the development and location of new sites but by variations in production at existing sites. Increases in production require a change to the discharge consent from SEPA. SEPA has made clear it intends to implement a consenting policy which takes account of the Locational Guidelines (see para 35-39).

26. The Transport Division of Scottish Executive Development Department is responsible for ensuring that works in tidal waters do not constitute a hazard to navigation. Under the Coast Protection Act 1949, consent for the installation of marine fish farming equipment in sea areas must be obtained from SEDD.

27. As indicated earlier Local Authorities have a key role in advising the Crown Estate on marine fish farm proposals under the interim arrangements introduced in December 1998. The interim scheme does not apply to Shetland and those parts of Orkney where the respective Councils exercise functions in their capacity as harbour authorities under powers contained in the Zetland County Council Act 1974 and the Orkney County Council Act 1974. In Shetland the Council has powers to licence works in coastal waters which it exercises in conjunction with its powers as planning authority. Under these powers, the Council has developed policies for the development and regulation of marine fish farming. Anyone wishing to develop a marine fish farm within coastal waters of Shetland must obtain a works licence from the Council. All applications for works licences must be advertised and the Council consults widely. Applicants and objectors enjoy the right of appeal to Scottish Ministers against the Council’s decision. In Orkney the Council exercises licensing powers within certain designated harbour areas (the most significant of these being Scapa Flow). In the event a works licence is granted the applicant must also apply to the Crown Estate for a lease in the usual manner.

28. Local Authorities in general also control fish farm developments above the high water mark. Such developments, which are not covered by this Paper therefore require planning consent as do any onshore developments associated with marine fish farming.

30. The Health and Safety Executive (HSE) has responsibilities to inspect and to ensure the safe operation of fish farms under the terms of the Health and Safety at Work Act 1974. HSE has issued advice on minimum health and safety standards for the construction and use of floating fish farm installations used for finfish in inshore waters.
31. **The Veterinary Medicines Directorate** (VMD) is responsible for issuing Marketing Authorisation (MA) for medicines which can only be granted following the setting of Maximum Residue Limits (MRL) by the EC. All applications for MAs are assessed against statutory criteria of safety, quality and efficacy. In this context safety includes the operator, as well as the health and welfare of the treated animal, to the consumer of any food products from the treated animal and to the environment. Although the process of setting the MRL looks at a number of these issues it sets a safe residue limit to protect the health of consumers. In order to achieve the safe limit, farmers are required to observe a withdrawal period before harvesting fish for human consumption. VMD operates a surveillance programme to monitor compliance.

### Supporting measures

32. The previous paragraphs describe the key players in the regulation of the aquaculture industry. It is also worth highlighting a number of measures that have been taken in recent years which have a bearing on how these bodies operate and generally are designed to ensure a greater harmony between the operation of the industry and other users/interests in the marine environment. Details are as follows.

33. **The Environmental Impact (Fish Farming in Marine Waters) Assessment Regulations 1999** came into effect in March 1999 implementing the EC Environmental Assessment Directive (EA Directive). These regulations replaced existing regulations which applied to salmon farming only. The EA Directive sets the scope and procedures for evaluating the environmental impacts of “significant” development projects before consent is granted. The new amending Directive extends the previous system by:

- extending its application to cover all marine fish farming;
- requiring publicity to be given to the decision on whether or not EIA is required;
- allowing the developer to ask the “competent authority” for a formal opinion, in advance of submitting an application, of whether environmental assessment is required and if so, what should be covered in a particular environmental statement;
- extending the procedures for consultation with other Member States in the case of projects likely to have significant transboundary effects; and
- requiring publicity to be given to the reasons for deciding whether to allow or refuse a development which has been subject to EIA.

34. Previously developments were subject to EIA if they were judged likely to have significant effects on the environment, in the case of marine fish farming this
judgement was made on a case-by-case basis. The new Regulations retain but refine that process by introducing “indicative” thresholds. In practical terms the thresholds mean that any development designed to produce more than 250 tonnes (dead weight) fish per year must be considered, on a case-by-case basis, for EIA purposes. Site lease renewals may also trigger an EIA requirement. In addition, Member States are required to define “sensitive areas” within which every development, regardless of size, must be considered for EIA. The definition of “sensitive areas” includes areas such as Special Sites of Scientific Interest, Special Areas of Conservation, Marine Consultation areas, etc.

35. Implementation responsibility rests with competent authorities designated as such by Member States. Pending introduction of legislation to transfer statutory planning responsibility to Local Authorities, CEC will remain competent authority for most of the coastline. However, given the statutory arrangements which already exist in Shetland and parts of Orkney whereby the respective Councils are responsible for approving fish farm developments, the new regulations designate Orkney and Shetland Island Councils competent authority for those waters where they approve developments.

36. On 29 October 1999 the Scottish Executive published “Locational Guidelines for the Authorisation of Marine Fish Farms in Scottish Waters”. This followed extensive consultations with interested parties.

37. The guidance outlines the regulatory framework; explains the operational requirements and constraints on developments; provides locational guidelines; underlines the importance of environmental assessments, and explains the issues which Local Authorities and others should take into account pending new legislation. In addition it provides advice on good practice and other relevant information on the aquaculture industry and its operational/physical requirements.

38. The key element of the two documents is the identification of “constrained areas”. This categorises inshore and loch areas into Category 1, Category 2 and Category 3 areas. Over and above we have suggested that on the east and north coasts, where only a modest level of activity has taken place, there should be a presumption against further development.

39. In Category 1 the message is strongly that further or new developments are most unlikely to be granted. There are 11 Category 1 areas identified in the guidance. Category 2 areas are less sensitive areas but where there are already recognised problems and where the applicant would have to demonstrate that the problems will be satisfactorily mitigated. There are 56 Category 2 areas identified in the guidance. Category 3 areas are those areas where there appear to be better prospects of satisfying environmental requirements, although the detailed circumstances will always need to be carefully examined.

40. The guidance has been prepared on the basis of the best information currently available and as such it is not set in tablets of stone. It will be kept under review in the light of work under way by the Joint Working Group on Infectious Salmon Anaemia and its successor the Aquaculture Health Group and the Tripartite
Industry/Wild Fish/Scottish Executive Working Group on west coast stocks and in the light of advances in scientific understanding of the coastal environment and changes in technology, husbandry practice and the pattern of site demand.

41. In the summer of 1999, the Tripartite Working Group (TWG), comprising representatives of the salmon farming industry and wild salmonid interest groups and chaired by The Scottish Executive, was established. The TWG was formed as a result of overtures made initially by wild salmonid interest groups who were concerned about salmon and more particularly sea trout stocks in North West Scotland and who felt there was a linkage to fish farming. The purpose of the Group is to address problems common to salmonid farming and wild salmonid fisheries and to seek solutions for ensuring the maintenance of a healthy stock of wild fish whilst at the same time promoting a sustainable aquaculture industry. The Group’s Report and Concordat were published on 11 July 2000 and copies placed in the SPICe library.

42. The principal conclusion of the Report is that there must be closer co-operation at a local level between the interests of wild and farmed salmonids through the development of Area Management Agreements (AMAs). The purpose of the AMA is to ensure that the potential impact of aquaculture on wild fish, is minimised to create conditions in which wild fish populations can successfully co-exist with a viable aquaculture industry. Recommended measures include synchronised stocking of single year classes along with synchronised fallowing and sea lice control strategies.

43. Two such agreements have already been signed – in Loch Laxford and West Loch Tarbert – the first of what are envisaged as a chain of such agreements. Discussions are ongoing in a number of areas.

44. An issue raised in the TWG was that of escapes from fish farms. Whilst the incidence of escapes is relatively low, it is an issue of concern for farmed and wild fish interests alike. Reflecting this, the Scottish Executive established an Escapes Working Group, membership of which includes representatives of both salmon and trout farmers as well as wild salmonid fisheries. The Report prepared by the Group stresses the importance of preventative measures, of improving reporting arrangements, and of having in place mechanisms for recapturing escaped fish where this is deemed appropriate.

45. The Report was recently subject to consultation, responses to which are currently being considered. Measures likely to be taken include developing a code of practice on containment which will be supported by site specific contingency plans to effect recapture should escapes occur and the creation of a mandatory legislative requirement to notify escapes.

46. A major concern, arguably the major concern, for the industry over the part two years has been infectious salmon anaemia. In October 1998 a Joint Working Group (JWG) of industry and Government interests was established to identify the key risk factors associated with the transmission of the disease; to identify measures to reduce risk of the disease in future and to review current industry practices from a fish health perspective. The JWG produced two interim reports in January and May 1999.
The final report was received in February this year. Its recommendations encompass practical measures to minimise the risk from ISA and contains pointers to the research needs of the industry and diagnostic services, many of which it recommended be implemented by a voluntary code of practice and others by legislation. Many of the recommendations are valid, not only for ISA, but for fish disease control generally.

47. Scottish Ministers responded to the reports recommendations in May indicating that they agreed with the view that most of the recommendations would be best implemented by means of a voluntary code of practice but made it clear close monitoring would be undertaken and legislation considered if the voluntary route proves unsatisfactory. The Executive’s response indicated that three main areas will be taken forward i.e. a code of practice would be introduced to reduce risk of outbreak and spread of ISA and generally to improve fish health control; the development of statutory arrangements for fallowing in an effort to improve disease control and environmental protection; and the development of proposals for improved welfare on farms.

48. Whilst the JWG has now completed its work, an Aquaculture Health Joint Working Group (AHJWG) has been established with a more general health remit as well as representation from all sectors of the aquaculture industry. The Group has begun work to develop the code of practice based on the JWG recommendations and to monitor their implementation. In addition it has begun a programme of work including welfare, fish health legislation, notifiable diseases and contingency planning.
Part III – Issues raised by Mr Berry, Research and Development

49. The Submission to the Parliament includes a series of seven documents. The last two are autobiographical, and we do not offer any comment on these. The fifth document is concerned with very specific circumstances surrounding Mr Berry’s experiences in Loch Sween. This is highly specific to Mr Berry, and is largely historical, in that it is primarily concerned with a period between 1985 and 1991. We do not offer any comment on this paper either.

50. There are two main strands to the remaining four papers. Firstly, it is argued that the presence of fish farms, and in particular sea lice from salmon farms, is having widespread adverse effects on wild salmonids. Secondly, a series of issues linked to the release of nutrients and organic waste from fish farms, including distortion of marine food webs and the production of biotoxins (algal toxins) are raised. The following reflects the advice given by The Scottish Executive Fisheries Research Services (FRS) on these matters. Supporting papers are provided at Annex 1.

Impacts of salmon farms on wild salmonids – the issue of sea lice

51. Salmon and sea trout stocks have declined throughout their range. Sea trout and some salmon stocks in north-west Scotland have undergone an additional reduction in spawning stock size which in some instances has led to stock collapses. The proposition advanced by Mr Berry is that a major factor in these collapses has been sea lice from fish farms.

52. There is strong circumstantial evidence that climatically driven alterations in the marine growth and survival opportunities available to immature and maturing salmon on both sides of the Atlantic underlie the reduced levels of returning fish. Data on sea trout are less reliable but such statistics that exist suggest a decline broadly comparable with that for salmon, except in north-west Scotland.

53. Sea trout populations are more complex than those of salmon. Not all of the male members of the population migrate to sea and, especially in NW Scotland, many of the sea-going fish survive spawning and return to make further growth at sea before spawning again. Few salmon survive to become repeat spawners. Since 1989 there has been a sharp reduction in the prevalence of older and larger fish in the North West. This alteration in the age structure of the population has progressed to the point at which spawning populations are largely restricted to freshwater-resident males and a few sea-winter sea trout. Reduced levels of egg deposition is now recognised as the main constraint on sea trout smolt production.

54. Sea lice are a naturally occurring parasite in the marine environment. Fish farms can become subject to infestation from these parasites and such infestations are often controlled through the use of chemical therapies under veterinary licence. In the petition it is stated that large numbers of sea lice are generated within fish farms and these cause stock decline. It is argued that trout and salmon passing near to affected fish farms will become infested with lice to an extent that may be fatal, or affected their capacity to reproduce.
55. The exact reasons for the observed decline are unclear. The scientific evidence for a causal link between the present of fish farms and the level of sea lice on wild fish in the vicinity is inconclusive, although it is now accepted that sea lice derived from fish farms may have exacerbated the problem of reduced marine survival.

56. The question whether sea lice come within the scope of the pollution controls operated by The Scottish Environment Protection Agency under the Control of Pollution Act 1974 is currently the subject of action for judicial review of a decision of the Secretary of State for Scotland pre-devolution which is being defended on the instructions of the Scottish Ministers.

57. The particular vulnerability of wild salmonids, and in particular sea trout in the North West, is recognised and lies at the very heart of the establishment of the Tripartite Working Group and the proposed development of Area Management Agreements referred to elsewhere.

Effects of waste from salmon farms on pelagic food webs

58. This section provides comments on items 2-4 in Mr Berry’s submission.

59. Item 2 of the petition argues that the mass and composition of organic waste from fish farms are such as to overload the microbial systems of sealoch waters and cause stripping of dissolved inorganic nitrogen from the seawater. It is argued that in summer this will lead to an imbalance in the nutrients available to phytoplankton and may in turn stimulate the production of toxins.

60. There is no doubt that fish farming produces waste in the form of organic material, together with dissolved ammonia and phosphates. The sea is indeed employed as a dispersal and bio-degradation system for this waste. The issue for debate is whether the magnitude and composition of these discharges may have unacceptable consequences for the quality of the marine environment and/or detrimental consequences for wildlife and other stakeholders.

61. In the past, FRS has carried out analyses to compare the impacts of ammonia discharges from salmonid production across the range of lochs where fish farming is carried out. Essentially, the lochs have been ranked according to the expected severity of impact for the consented levels of annual production. However, as the petition correctly points out, fish farm wastes are composed of a mixture of both organic and inorganic materials, all of which are potentially reactive in the natural biological and chemical cycles of the sea.

62. In order to address the issues raised in the petition, FRS has updated and extended its earlier analyses to include carbon, nitrogen and phosphorus discharges in both organic and inorganic forms. In so doing, they find that the key evidence in the petition relating to the nitrogen:phosphorus ratios and amounts of carbon in fish farm discharges, upon which the arguments are based, are not credible and cannot be substantiated.

63. FRS has compared these new analysis results with data on the background
concentrations of carbon, nitrogen and phosphorus in sea loch waters. In 95% of all farmed sealochs, they find that at present day production levels, the discharges lead to less than 9% enhancement of carbon, 24% of nitrogen and 28% of phosphorus concentrations. In the worst case loch, the enhancement was 20% for carbon, 53% for nitrogen and 58% for phosphorus.

64. Calculations have been made by FRS to compare the rate of release of nutrients from fish farms to the Minch area, with the rate of supply of nutrients to the same area arising from the general northward movement of water through the Minch. The results indicate that, on the large scale considered (i.e. the entire Minch), emissions of nutrients from fish farms contribute only a small proportion of the natural flux of nutrients, 1.26% and 1.32% for nitrogen and phosphorus respectively.

65. In order to place the enhancement of nitrogen and phosphorus concentrations in sealochs in context relative to other coastal environments, we compared our results with published data from 20 other locations around the world. We estimated the nitrogen and phosphorus enhancements in the worst case location (Tokyo Bay) to be more than 1000-times higher those in our worst-case sealoch. At the other end of the range, we estimated a site in Hawaii which has been subjected to extensive environmental restoration, to have more than 10-times the enhancements of our worst case sealoch. On this basis we suggest that, from the perspective of nitrogen and phosphorus discharges only, the current levels of salmon production in Scottish sealochs seem sustainable.

66. In Item 3, “Harmful Algal Blooms and Mariculture: Stoichiometric Perturbation and the Production of Nitrogenous Biotoxins”, the petitioner presents a theory that the production of nitrogen-rich algal toxins, which can accumulate in shellfish and cause human illness, may be stimulated by discharges of ammonia from fish farms, animal slurries, sewage and enriched sediments. It is argued that the discharges disrupt the normal proportions of inorganic nutrients in the sea.

67. The preceding comments on the document “The sea as an open state bioreactor” are also relevant in this context. The topic of the production of toxins in marine dinoflagellates has been greatly over-simplified in the petition. This is a highly complex field that has been extensively studied for many years by scientists worldwide. These investigations continue as the problems in understanding why some dinoflagellates produce toxins, the pathways and mechanisms for toxin production (and the factors that may influence these) and the ecological and/or evolutionary roles of toxins continue to perplex the scientific community. Much of the research in this area (including much of that cited in the petition) has been based on investigations in laboratory cultures of single species where environmental factors can be carefully controlled and manipulated. It is exceptionally difficult, and in many cases misleading, to apply findings from such studies to a natural field situation that is considerably more complex. To the layman, it may be surprising that so little work has been carried out in the field, but there are significant problems in studying many of these organisms in their natural environment, and many other aspects of their biology and ecology are still poorly understood.

68. In addition to over-simplifying the issues and making some radical
assumptions regarding the natural situation from data generated through laboratory experimentation, the petitioner also cites the literature extremely selectively. Whilst it is accepted that in laboratory cultures, inorganic nutrients and the nutritional status of dinoflagellates do affect phytoplankton growth and toxin production (although some of the evidence is confusing and contradictory), in the field situation there are many other critical factors (e.g. light, temperature and turbulence regimes, trace elements, grazing, interactions with other organisms) that have been ignored.

69. In Item 4, “Amnesic Shellfish Poisoning (ASP): The Link With Pollution” argues that there is a clear link between the production of domoic acid (DA), the toxin that causes amnesic shellfish poisoning (ASP), and nutrients in fish farm discharges. The petition contains many assumptions regarding phytoplankton ecology in the sea based upon experiments carried out in controlled laboratory cultures, and as detailed above, such assumptions should be made with extreme caution. A recent review of the bloom dynamics and physiology of DA producing *Pseudo-nitzschia* species of diatom reported observations by several researchers of cell deformities in *Pseudo-nitzschia* in laboratory cultures. This serves to remind us that if the shape and structure of cells can change in the artificial conditions imposed in culture, then other physiological and chemical characteristics that are measured in culture may also be aberrant.

70. No mention of other factors that are likely to be involved in *Pseudo-nitzschia* growth and toxin production are made in the petition, and the text does not take full account of the phytoplankton cell cycle. There is no reference to the effects of hydrographic and climatic factors, nor any mention of the fact that ASP monitoring in Scottish shellfish commenced less than five years ago. The paper also suggests that the diatom genus linked to ASP (*Pseudo-nitzschia*) is increasing worldwide, but cites little evidence to support a genuine increase. *Pseudo-nitzschia* is a genus that is known worldwide, although the species succession and controls over bloom dynamics in different locations are not well understood.

71. In parts, it is not exactly clear what arguments are being made by Mr Berry, and the evidence he cites does not suggest that fish farms result in an increase in the Nitrogen:Silicone ratio. Although not well studied in the field, scientific evidence suggests that ASP is influenced by a number of factors in addition to Silicone limitation. These include climatic and hydrographic factors e.g. water column stability, light, other macro and micronutrients, the species composition and species succession of *Pseudo-nitzschia* in particular locations, predation by grazers and interactions with other organisms.

72. What does cause the algal blooms which cause shellfish poisoning? The FRS view is that algae which cause ASP, PSP and DSP, and the resultant release of toxins, occur world-wide, including in Scotland in areas where there are no fish farms and where there is no potential for exposure to the chemicals which are used to control sea lice in salmon farming. Anecdotal and documented records of shellfish poisoning events extend back over several centuries, and indicate that the incidence of algal toxicity is a nature phenomenon. Sedimentary records show that the incidence of algal species has fluctuated in the recent and geological past, and climatic and oceanographic variations are significant causative factors affecting their distribution and abundance. In addition, under some circumstances, some human activities can
also affect the abundance and composition of algae. Theoretical studies of the possible relationships between phytoplankton growth, nutrients, and particular agents, such as fish farm chemicals have been carried out for Scottish sea lochs. However, there is no evidence to support the case that such emissions from fish farms have ever actually been responsible for an algal bloom or shellfish poisoning event in Scotland. The FRS view is supported by well known authorities in this field eg Dr Shumway, Long Island University, New York State.

Research and Development

73. Crucial for its development and regulation is a sound knowledge of the industry, its practices, and potential effects. Central to this has been an extensive programme of research and development carried out by the industry and Government separately and together. Annex 2 summarises research effort currently underway in universities and research laboratories in Scotland in this area. Examples of instances of FRS environmental fish farming research activity dealing with regulating and policy areas are as follows:-

- Over the years, FRS has developed mathematical models of the dispersion of dissolved substances released from fish farms. These include nutrients and some sea lice treatment chemicals. The models have subsequently been discussed with SEPA and form the basis of the models SEPA uses in its assessments of applications for discharge consents.

- Under a combination of external and internal funds, FRS has studied the ecotoxicology of some sea lice chemicals. This work has been used variously by pharmaceutical companies in applications for Marketing Authorisations for new treatments, and by SEPA in developing EQS values for the safe use of the chemicals. It is also used by FRS in replying to consultations from SEPA, and in advising on call-in requests or appeals.

- A combination of mathematical modelling of dissolved and solid waste from fish farms was used to inform the development and classification of coastal areas which was incorporated in the Locational Guidelines for marine fish farms issued to Local Authorities in 1999.

- Combinations of mathematical modelling and ecotoxicological information is used to advise RAD on the necessary scope of Environmental Impact Statements for fish farms, and in the assessment of the Statements submitted by developers.
Conclusion

74. The aquaculture industry in Scotland, particularly salmon, has made major strides over the past 20 years or so. Production in 1999 was 127,000 tonnes compared with 32,000 tonnes in 1990 and its value, including processing, is now estimated at £0.5 billion per annum. Employment, direct and indirect is estimated at about 6,300, three-quarters of whom are located in the Highlands and Islands.

75. Inevitably with any new industry a major learning experience has been required: for those engaged in the industry and those charged with its regulation. A consequence of that experience has been the major growth alluded to but also increased knowledge of the effects of the industry on the wider environment (as explained in Part III), leading to the significant adjustments in the regulations and the measures being pursued to reconcile the interests of all users of the wild environment (as explained in Part II).

76. It has to be recognised that this is an iterative process. The industry will continue to develop new and improved methods of husbandry, health controls etc and will be encouraged under the post ISA Review so to do. Regulators for their part will continue to review the control regime, updating the likes of the locational guidelines and discharge consenting policies, refining environmental impact assessments requirements, and generally seeking to encourage greater dialogue at the local level between the various interested parties.

SCOTTISH EXECUTIVE RURAL AFFAIRS DEPARTMENT
September 2000
COMMENTS BY SCOTTISH EXECUTIVE'S FISHERIES RESEARCH SERVICES (FRS) ON SUBMISSION TO THE SCOTTISH PARLIAMENT BY MR ALLAN W BERRY

Comments on Scottish Parliament petition item 2, “The sea as an open state bioreactor”.

SUMMARY

1. Item 2 of the petition argues that the mass and composition of organic waste from fish farms are such as to overload the microbial systems of sealoch waters and cause stripping of dissolved inorganic nitrogen from the seawater. It is argued that in summer this will lead to intensification of nitrogen stress on phytoplankton and the stimulation of toxicity.

2. There is no doubt that fish farming produces waste in the form of organic material, together with dissolved ammonia and phosphates. The sea is indeed employed as a dispersal and bio-degradation system for this waste. The issue for debate is whether the magnitude and composition of these discharges may have unacceptable consequences for the quality of the marine environment and/or detrimental consequences for wildlife and other stakeholders.

3. In the past, FRS has carried out analyses to compare the impacts of ammonia discharges from salmonid production across the range of lochs where fish farming is carried out. Essentially, the lochs have been ranked according to the expected severity of impact for the consented levels of annual production. However, as the petition correctly points out, fish farm wastes are composed of a mixture of both organic and inorganic materials, all of which are potentially reactive in the natural biological and chemical cycles of the sea.

4. In order to address the issues raised in the petition, we have updated and extended our earlier analyses to include carbon, nitrogen and phosphorus discharges in both organic and inorganic forms. In so doing, we find that the key evidence in the petition relating to the nitrogen:phosphorus ratios and amounts of carbon in fish farm discharges, upon which the arguments are based, are not credible and cannot be substantiated.

5. We have compared our new analysis results with data on the background concentrations of carbon, nitrogen and phosphorus in sea loch waters. In 95% of all farmed sealochs, we find that at present day production levels, the discharges lead to less than 9% enhancement of carbon, 24% of nitrogen and 28% of phosphorus concentrations. In the worst case loch, the enhancement was 20% for carbon, 53% for nitrogen and 58% for phosphorus.

6. In order to place the enhancement of nitrogen and phosphorus concentrations in sealochs in context relative to other coastal environments, we compared our results with literature data from 20 other locations around the world. We estimated the
nitrogen and phosphorus enhancements in the worst case location (Tokyo Bay) to be more than 1000-times higher those in our worst-case sealoch. At the other end of the range, we estimated a site in Hawaii which has been subjected to extensive environmental restoration, to have more than 10-times the enhancements of our worst case sealoch. On this basis we suggest that, from the perspective of nitrogen and phosphorus discharges only, the current levels of salmon production in Scottish sealochs seem sustainable.

**DETAILED COMMENTS**

**Magnitude of discharges**

7. Rates of discharge to the marine environment of 80kg nitrogen (as ammonia), 7.5kg phosphorus (as phosphate), and 1300kg particulate carbon, per tonne of salmon production are cited in the petition. The nitrogen and phosphorus values are correctly cited from research carried out in the early 1990’s, and whilst more recent data indicate that current rates are lower, the difference is not substantial. However, the quoted particulate carbon discharge rate is not credible since it would represent a greater mass of carbon than is input as food. A relatively straightforward calculation indicates that of the carbon contained in feed, around 68% is respired as carbon dioxide, 19% is discharged as organic waste in the form of uneaten food and faeces, and 13% is harvested as fish. Current feeding strategies deliver 1200kg of feed per tonne of production, containing 58% by weight of carbon. Hence, the total output of organic carbon waste is around 134 kg per tonne of production. Of this, uneaten food makes up 35kg and faecal material the remaining 99kg, not 1300kg as cited in the petition. Both uneaten food and faeces accumulate beneath fish cages, although local currents tend to disperse faecal matter further afield than feed, due primarily to differences between the settling characteristics of the two solid waste components.

8. Recent figures for the fate of carbon, nitrogen and phosphorus in salmon feed are shown in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Carbon</th>
<th>Nitrogen</th>
<th>Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg in feed per tonne production</td>
<td>694</td>
<td>86</td>
<td>18</td>
</tr>
<tr>
<td>Kg harvested per tonne production</td>
<td>88</td>
<td>33</td>
<td>6</td>
</tr>
<tr>
<td>Kg lost as uneaten feed per tonne production</td>
<td>35</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Kg lost as organic matter in faeces</td>
<td>99</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Kg lost as inorganic products</td>
<td>472 as CO₂</td>
<td>37 as NH₃</td>
<td>9 as PO₄</td>
</tr>
</tbody>
</table>

**Elemental composition of discharges**

9. The ratio of nitrogen:phosphorus in organic discharges is cited in the petition as being 1.17:1. This is incorrect. The elemental ratios in faeces should not differ markedly from those in the feed, and hence we expect weight-for-weight N:P ratios of 4.9:1, and molar ratios (mass divided by atomic weight) of 10.9:1. It is unclear whether the cited values represent weight or molar ratios, but in either case the value 1.17:1 is clearly incorrect. On this basis, the argument that bacteria with an N:P ratio
of 5:1 will need to take up inorganic N from seawater in order to decompose fish farm derived organic matter, is clearly not correct. It is also extremely misleading to present the complex nitrogen cycling in seawater in this simplistic way. The operation of industrial bioreactors is a poor analogy for the marine microbial system, since the industrial reactor is populated with specific types of microorganisms and managed to maintain a steady state. In contrast, the marine system has fluctuating activity and is populated by a range of organisms. In conclusion, there is no foundation for the argument that the discharge of organic carbon from fish farms will lower ambient dissolved N or the N:P ratio, on the grounds of either the magnitude of discharges or their composition.

Effects of discharges on phytoplankton and microzooplankton

10. Unsubstantiated evidence (presumably from laboratory cultures) in presented in the petition that microbial activity based on organic carbon can depress photosynthesis and the production of chlorophyll. The claim is that it therefore follows that discharges from salmon farms do not increase phytoplankton activity in their immediate vicinity. Unsupported claims of the existence of evidence for depression of chlorophyll levels near discharges are also made, but must be dismissed. Firstly, extrapolation from laboratory cultures to the field is a difficult step which must be done with care, and it is counterintuitive to suggest that discharges of ammonia will not enhance phytoplankton activity even in the presence of organic matter. This is certainly not the experience with other discharges, such as sewage in estuaries. Secondly, attempts at detecting links between nutrient discharge from fish farms and local activity of phytoplankton in the field have been inconclusive. No doubt some of these have found negative relationships, but these can and will occur through chance, and it is incorrect to cite these cases as general evidence of the existence of such a relationship, when other evidence points to the contrary.

Recommendations for monitoring

11. The petition supports the proposition that monitoring for the impacts of discharges should concentrate on nutrient sampling in the summer when nutrient levels are lowest and inputs from fish farms are highest. This is a reasonable suggestion, but not without problems, and it is not clear how simply measuring nutrients at any time of year will conclusively assess impacts. The particular problem with summer measurement is that the distribution of nutrients in lochs at that time of year is patchy due to biological activity, making the detection of discharge plumes much more difficult.

Extension of earlier FRS analysis

Background

12. Earlier work by FRS to assess the impact of nutrient discharges from fish farms involved ranking of the 100 or so sea-lochs where salmon farming is carried out according to a so-called Equilibrium Concentration Enhancement (ECE) for nitrogen associated with ammonia discharges. The ECE concept can be explained using the analogy of an open topped tank of water which is being continually fed by a pipe. The
tank fills up until it overflows and thereafter the volume of water remains constant with outflow over the edge at the same rate as inflow from the pipe. Now imagine that we introduce a separate supply of a dye. The concentration of dye in the tank will increase to some stable concentration at which point rate at which the dye is being washed out will equal the rate at which it is flowing in. This stable concentration which is being maintained in the tank is what we refer to as the ECE. If we increase the water inflow from the pipe, the ECE will fall, and vice versa. If we increase the rate at which dye is running in, the ECE will increase, and vice versa.

13. To translate the simple analogy above into the situation of fish farms in a sealoch, the tank represents a sealoch basin, which is being continually flushed by the tides. We can calculate what proportion of the basin is being exchanged during each tidal cycle from hydrographic data. The annual mean rate of ammonia-nitrogen discharge from the fish farms is represented by the dye inflow, and we are aiming to calculate the stable concentration of, in this case ammonia-nitrogen, in the loch as a result of the balance between discharge rate and tidal flushing.

14. The main flaw in the above model is that ammonia is highly reactive in seawater, and is taken up by biological components long before it has a chance to attain a stable equilibrium. Hence, an ECE for ammonia would not be measurable in the field as a test of the model. What it does provide is an objective index of potential loading which can be used to rank the lochs according to the likely extent of impact. Elsewhere, we have developed more sophisticated models which take account of the role of biology in the system and simulate the flows of nitrogen more realistically. However, these models are more complex, and cannot be applied so simply to the full range of lochs in which fish farms are operating.

**New work**

15. To address the issues raised by the petition, we have reviewed and augmented the earlier ECE model of ammonia-nitrogen in a number of ways:

- First, we have amended it to take account of the more up-to-date estimates of the amount of ammonia-nitrogen released per tonne of annual production (the earlier version assumed 70kg/T).
- Secondly, we have extended the model to provide ECE values for inorganic phosphorus, and suspended organic carbon, nitrogen and phosphorus in faecal material, which we assume to be fully dispersed by water currents. Uneaten food cannot be treated in this way since it rapidly settles to the seabed below the farm cages.
- Finally, we have compared ECE values with data collected during a year-long study of Loch Linnhe in 1991.

16. Because of the reactivity of ammonia and phosphate in seawater, it is not meaningful to compare, for example, the ammonia ECE with observed values of ammonia in the field. However, the combination of ammonia plus the suspended organic nitrogen discharges from fish farms is a measure of the total reactive nitrogen discharged. This can legitimately be compared with the total of ammonia, nitrate, particulate and dissolved organic nitrogen already present in the seawater, for which
we have data from Loch Linnhe. Thus, rapid transformations between different forms of nitrogen following discharge are accommodated in the comparison. The main caveats to this approach are that it does not take account of loss to the sediments or denitrification, whereby ammonia is decomposed to gaseous nitrogen by certain bacteria and vented to the atmosphere. The latter could account for a loss of up to 10% loss of the total discharged nitrogen.

17. Equivalent calculations were performed for phosphorus, and for carbon. In these cases, we do not have measurements for dissolved organic carbon or phosphorus, or particulate phosphorus in Loch Linnhe. However, we were able to derive estimates of these from the extensive measurements of particulate carbon and nitrogen and dissolved organic nitrogen by making some assumptions about carbon:nitrogen:phosphorus ratios in the various materials based on our field sampling.

Results

18. The results from this new analysis are given in the table below, and indicate that of the three elements, carbon should be of least concern since the ECE values are lowest compared to field observations. Nitrogen and phosphorus ECE values are approximately equivalent in relation to the observations. Overall, we can say that around 5% of lochs have ECE values which are more than 25% of the background levels of N and P. The worst case loch has an ECE value of half of background levels of nitrogen.

<table>
<thead>
<tr>
<th>Loch Linnhe</th>
<th>Carbon</th>
<th>Nitrogen</th>
<th>Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>annual average total reactive concentration (dissolved+particulate, inorganic+organic)</td>
<td>1.06 gC/m$^3$ (organic, dissolved+particulate)</td>
<td>14.06 mM/m$^3$ (ammonia + nitrate + nitrite + particulate and dissolved organic)</td>
<td>1.28 mM/m$^3$ (phosphate + particulate and dissolved organic)</td>
</tr>
<tr>
<td>Worst case sealoch ECE</td>
<td>0.21 gC/m$^3$ (faecal organic C)</td>
<td>7.5 mM/m$^3$ (ammonia + faecal organic N)</td>
<td>0.75 mM/m$^3$ (phosphate + faecal organic P)</td>
</tr>
<tr>
<td>95% of sealochs had an ECE of less than:</td>
<td>0.1 gC/m$^3$</td>
<td>3.4 mM/m$^3$</td>
<td>0.36 mM/m$^3$</td>
</tr>
<tr>
<td>Worst case as % of Loch Linnhe</td>
<td>20</td>
<td>53</td>
<td>58</td>
</tr>
<tr>
<td>95% of lochs as % of Loch Linnhe</td>
<td>9</td>
<td>24</td>
<td>28</td>
</tr>
</tbody>
</table>

How representative are the data from Loch Linnhe?

19. The Inner Basin of Loch Linnhe is somewhat deeper than many of the other lochs on the west coast, but has a similar flushing rate. The data were collected in 1991, when fish farm production was lower than at present, but the loch is also
affected by sewage discharges from Fort William. Estimates of the amount of nitrogen discharged from the Caol and Fort William sewage works indicate loadings (total mass discharged per year) of around 25% of the current level of fish farm activity in the loch. Overall, there is no reason to suppose that these data should be rejected as being unrepresentative of lochs in general.

What is an acceptable value of ECE compared to the natural concentrations of carbon, nitrogen and phosphorus?

20. Our new analysis places the current discharge rates from fish farms in context relative to background concentrations of the biologically and chemically active elements in sea lochs. However, it does not identify the levels of enhancement above which we should consider discharges to result in an unacceptable burden of risk on the activities of other stakeholders, or pose a risk to wildlife. Our view is that the knowledge, data and methodology to conduct such an assessment in a fully quantitative and objective manner do not yet exist. Nevertheless, some guidance is required, so we have calculated the nitrogen and phosphorus enhancements due to various discharges into 20 other coastal environments from around the world, based on literature data. Some of these locations (eg. Tokyo Bay) are acknowledged to be heavily impacted by nutrients and suffer from recurrent algal blooms. The results showed that the worst case system we examined (Tokyo Bay) had nitrogen and phosphorus ECE’s which were more than 1000-times higher than those for our worst case sealoch. Amongst the locations with the lowest nutrient enhancement values, Kaneohe Bay in Hawaii had nitrogen and phosphorus ECE’s which were 10-times higher than in our worst case sealoch. Kaneohe Bay is a site which in the past received a heavy load of nutrients from sewage discharges, but was successfully cleaned up by diversion of the outfalls. The data we refer to relate to the post-diversion situation.

21. Whilst emphasising that our comparison between sealochs and other coastal systems is only indicative, on the basis of the results we can say with some confidence that our worst-case sea loch is very far from suffering the degree of nutrient impact that is observed in, for example, Tokyo Bay. We can also say that our worst case loch is less affected than some sites elsewhere which have been subjected to extensive environmental restoration. Hence, from the perspective of nitrogen and phosphorus discharges only, current levels of salmon production in Scottish sealochs seem sustainable.
Harmful Algal Blooms and Mariculture: Stoichiometric Perturbation and the Production of Nitrogenous Biotoxins

SUMMARY

1. The purpose of this paper is to examine the theory presented in the petition that the production of nitrogen-rich algal toxins, which can accumulate in shellfish and cause human illness, may be stimulated by discharges of ammonia from fish farms, animal slurries, sewage and enriched sediments. It is argued that the discharges disrupt the normal proportions of inorganic nutrients in the sea. We refer the reader to comments on “The Sea as an Open-State Bioreactor” for further information on discharges and their effects in marine systems.

2. The topic of the production of toxins in marine dinoflagellates has been greatly over-simplified in the petition. This is a highly complex field that has been extensively studied for many years by scientists worldwide. These investigations continue as the problems in understanding why some dinoflagellates produce toxins, the pathways and mechanisms for toxin production (and the factors that may influence these) and the ecological and/or evolutionary roles of toxins continue to perplex the scientific community. Much of the research in this area (including much of that cited in the petition) has been based on investigations in laboratory cultures of single species where environmental factors can be carefully controlled and manipulated. It is exceptionally difficult, and in many cases misleading, to apply findings from such studies to a natural field situation that is considerably more complex. To the layman, it may be surprising that so little work has been carried out in the field, but there are significant problems in studying many of these organisms in their natural environment, and many other aspects of their biology and ecology are still poorly understood.

3. In addition to over-simplifying the issues and making some radical assumptions regarding the natural situation from data generated through laboratory experimentation, the literature cited to support the petition case has been used extremely selectively. Whilst it is accepted that in laboratory cultures, inorganic nutrients and the nutritional status of dinoflagellates do affect phytoplankton growth and toxin production (although some of the evidence is confusing and contradictory), in the field situation there are many other critical factors (e.g. light, temperature and turbulence regimes, trace elements, grazing, interactions with other organisms) that have been ignored.

DETAILED COMMENTS

4. It is rather difficult to provide comments in a structured fashion, as the document is neither well structured nor well organised. We have attempted, however, to address the specific points made in the order in which they occur.

5. In the abstract, it is stated that there have been few scientific studies into the effects of pollution from industrial and municipal wastes on harmful algal blooms etc. Whilst there are indeed relatively few such studies concerned with those species thought responsible for shellfish toxicity, there have been studies of the effects of
pollutants from such discharges on phytoplankton in general, particularly relating to eutrophication effects (increased algal growth as a result of anthropogenic nutrient inputs). The fact that there are few studies of the effects of pollution on toxic phytoplankton is probably related to the fact that many of these species, although well studied in laboratory culture, are very difficult to study in the field. There are many fundamental gaps in our knowledge of their life cycles and ecology, resulting not from lack of effort, but from the complexity of the problems. These organisms also rarely occur as dominant species in the natural community, making field investigations even more difficult.

6. The petition refers to there being no reports of PSP prior to 1990 in waters off the Scottish North and West Coast, nor off the Northern Isles, yet regular occurrences since that date. PSP monitoring on the scale that we are now familiar with in Scotland only commenced in 1990. The introduction of the EC Shellfish Hygiene Directive (91/492/EEC) required more comprehensive monitoring than had previously been carried out in the UK. Sampling for PSP toxins in shellfish caught in waters off the Scottish West and Northern coasts prior to 1991 was very sporadic, as the condition was more commonly associated with East coast waters (e.g. the Firth of Forth). The lack of PSP records does not necessarily mean that PSP did not occur. The situation for ASP is even more recent, as this condition was only added to the EC Directive in 1997 and regular monitoring did not commence until 1998. The lack of records of ASP prior to 1997/98 does not necessarily mean it was not present in Scottish waters – it may have been present, but undetected.

7. It is also stated that “…the most significant co-incidental factor in most of the affected area has been the increase in discharges from the Scottish sea cage salmon farming industry.” This may be the most significant factor considered by the petition, but there are other equally significant factors that should be considered, for example, climatic and hydrographic factors. It is misleading to focus only on the factors that support certain arguments, and the case presented is therefore not well balanced.

8. The first sentence in the section entitled ‘Induction of toxin production’ is inaccurate. Meteorological and hydrographic factors certainly affect phytoplankton growth and in many cases, provide certain conditions that are likely to affect the frequency and intensity of blooms of a range of phytoplankton, including toxic and non-toxic species. However, these factors have not been conclusively linked to the frequency and intensity of toxicity per se. Paradoxically, in making this statement - even erroneously - the petition does indicate that factors other than nutrient discharges may affect phytoplankton toxicity. Climate records show that temperatures of surface waters off the Scottish West Coast have increased in recent years, yet scant attention is paid to possible climatic effects on phytoplankton growth and toxicity. It is highly probable that temperature plays an important role in phytoplankton growth and toxicity, but as yet, we do not have a clear understanding of this, particularly in the field.

9. A list of conditions is cited that may favour the accumulation of PSP toxins. Most of these conditions would, in general favour, dinoflagellate growth. The class of phytoplankton known as dinoflagellates – the majority of which are non-toxic – are known to favour relatively calm conditions. Accumulation of cells and subsequent
blooms (both toxic and non-toxic) often occur at hydrographic features called ‘fronts’. Many non-toxic species also form resting cysts that may benefit from re-suspension. The conditions identified in the petition may indeed be relevant during periods of PSP toxicity, but may be equally relevant during blooms of species which are completely innocuous. Speculation is made that waste discharges into the sea may perturb stoichiometric relativity leading to phylogenetic change and effects of metabolic processes, but no evidence and no literature is provided to support this contention.

10. Much information is cited from laboratory experiments where phytoplankton are grown in cultures. While these give insights into the effects of nutrient limitation on cell physiology, direct comparisons with the natural field environment must be made with caution. Laboratory culture experiments create a strictly controlled artificial environment where the external factors are manipulated by the experimenter. These environments seldom equate to the conditions that phytoplankton experience in the sea. Experiments are performed in conditions where the levels of light and the nutrient supply are often far in excess of those experienced in the wild, and phytoplankton cell numbers can reach a much greater level than would occur naturally. The effects of turbulence in the water are often omitted, along with the influence of competition from other species and grazing pressure from zooplankton. By creating these artificial conditions, the experimenter may be better able to observe effects that are due to the experimental conditions. Applying these results, however, to a considerably more complex field environment is much less straightforward for the reasons given above.

11. The environment on which the petition is concentrated is far removed from the laboratory culture vessel. On the Scottish west coast, fish farms are generally located in sea lochs where the environment is subject to freshwater inputs that can introduce nutrients from terrestrial sources, and from offshore influences where nutrients are introduced from offshore waters. Water circulation within sealochs and flushing by offshore waters play critical roles in the dynamics of nutrients in these systems. The intensity of the light supply to seawater constantly changes as the day progresses and is also influenced by weather conditions and the amount of particulate matter suspended in the water. Turbulence in the sea can move the phytoplankton cells up and down in the water, increasing or decreasing the amount of light and nutrients to which they are exposed. Dinoflagellates in particular do not grow well in turbulent conditions, whilst extended periods of calm conditions can cause diatoms to sink in the water column. The petition has failed to take these factors into account.

12. Scientific studies have detected an anomaly between toxicity levels in cells from clonal *Alexandrium* cultures and from cells found in the wild. Whether this is due to the artificial conditions that cells in culture experience has yet to be determined. Laboratory experiments are valuable, in that they do provide insight into controls over phytoplankton physiology and toxin production in the culture environment. Broad generalisations however, and comparisons with the natural environment, paying scant attention to the hydrographic characteristics of the area, or indeed to the physiological mechanisms in phytoplankton cells can result in very misleading conclusions.

13. Throughout the petition, increases in anthropogenic inputs and changes in nutritional ratios are cited as being responsible for the increase in phytoplankton cell
number and in toxin production. However, the petition fails to mention the wealth of existing scientific information that highlights the complexity of toxin production in phytoplankton that prevent such generalisations being made. For example phosphorous limitation has been seen to increase the toxicity of *Alexandrium tamarense*, *Alexandrium fundyense* and *Pyrodinium bahamense* but not necessarily in *Alexandrium minutum* or *Gymnodinium catenatum*, all of which are PSP-producers.

14. Much of the text concerns ‘nitrogen sources for nitrogenous toxin production’. Arguments presented in this section are confusing, relating increased levels of PSP production to low N:P ratios (where levels of P are high in relation to N) in the seawater. This is in direct contrast to a large body of scientific evidence, which has identified PSP toxin production to be promoted under high N:P ratios (where levels of P are low in relation to N). Throughout the arguments presented no account of light or temperature is taken, and turbulence in the water column is only briefly alluded to. These factors have all been recognised as important influences on toxin production. To relate toxin production to nutrients without referring to any of these factors is oversimplifying the situation to the point where arguments presented are invalidated. This is further demonstrated in the figures included with this paper. Graphs showing seasonal cycles of nutrients and nutrient ratios are presented without any information on light, temperature and salinity. The data presented cannot be meaningfully interpreted without reference to other factors. Data presentation is also inconsistent - in one example, N:P ratios are provided, for others, NO₃:PO₄ ratios.

15. It is frequently cited that the re-feeding of nitrogen-stressed *Alexandrium* cells with nitrogen particularly in the form of ammonia can increase their toxicity. This has indeed been seen in laboratory culture. However the re-feeding of nitrogen-deprived *Gymnodinium catenatum* (a dinoflagellate responsible for PSP in southern parts of Europe) was only observed to result in a weak stimulation of toxin production.

16. At no point is reference made to the internal nutrient dynamics of phytoplankton. The internal nutrient quota of a phytoplankton cell is what determines its nutritional state, and cannot always be deduced from the external nutrient concentration. Phytoplankton have a number of mechanisms to avoid nutrient stresses e.g. during periods of nutrient excess some species can store nutrients within their cells, that can be metabolised when external concentration of the nutrient become limiting. The internal cell quota is a fundamental concept in phytoplankton nutrient dynamics and to talk at length about the relationship between phytoplankton and nutrients in the water without mentioning this is indeed surprising and demonstrates a lack of understanding of fundamental phytoplankton physiology. In addition, *Alexandrium* can show a number of behavioural mechanisms that can avoid N limitation. It has been shown that *Alexandrium* can migrate downwards in the water and take up N from nutrient-rich deeper waters to compensate for the lack of nutrients in the upper layers. Thus one cannot assume that cells grown in waters with a low N:P ratio at the surface do not have access to N from the deeper bottom layers.

17. Ammonia inputs from fish farms are cited as an important factor contributing to the changes in nutrient ratios in the seawater. At no point is ammonia chemistry in seawater mentioned. Bacteria in the water can rapidly break down free ammonia, so
one cannot make the assumption that all ammonia remains available for uptake by phytoplankton.

18. The relationship between nutrient dynamics and phytoplankton growth and toxin production is a huge and complex concept that requires a lot more work before it can be fully elucidated. The petition presented considerably oversimplifies the relevant literature and has failed to even consider some of the more fundamental concepts in this field. The arguments are also biased through the exclusion of basic facts, and a lack of knowledge of the subject matter in this area is evident.
Amnesic Shellfish Poisoning (ASP): The Link With Pollution

SUMMARY

1. This paper contests what is proposed in the petition as a clear link between the production of domoic acid (DA), the toxin that causes amnesic shellfish poisoning (ASP), and nutrients in fish farm discharges. The petition contains many assumptions regarding phytoplankton ecology in the sea based upon experiments carried out in controlled laboratory cultures, and as detailed elsewhere, such assumptions should be made with extreme caution. A recent review of the bloom dynamics and physiology of DA producing *Pseudo-nitzschia* species reported observations by several researchers of cell deformities in *Pseudo-nitzschia* in laboratory cultures. This serves to remind us that if the shape and structure of cells can change in the artificial conditions imposed in culture, then other physiological and chemical characteristics that are measured in culture may also be aberrant.

2. No mention of other factors that are likely to be involved in *Pseudo-nitzschia* growth and toxin production are made in the petition, and the text reveals a poorly developed understanding of the phytoplankton cell cycle. There is no reference to the effects of hydrographic and climatic factors, nor any mention of the fact that ASP monitoring in Scottish shellfish commenced less than five years ago. The paper also suggests that the diatom genus linked to ASP (*Pseudo-nitzschia*) is increasing worldwide, but cites little evidence to support a genuine increase. *Pseudo-nitzschia* is a ubiquitous genus that is known worldwide, although the species succession and controls over bloom dynamics in different locations are not well understood.

3. It is not exactly clear what arguments are being made, and the evidence cited does not suggest that fish farms result in a increase in the N:Si ratio. Although not well studied in the field, scientific evidence suggests that ASP is influenced by a number of factors in addition to Si limitation. These include climatic and hydrographic factors e.g. water column stability, light, other macro and micronutrients, the species composition and species succession of *Pseudo-nitzschia* in particular locations, predation by grazers and interactions with other organisms.

DETAILED COMMENTS

4. As was the case for paper 3, it is difficult to comment in a structured fashion, as the document is not well structured, but the following points cover our criticisms. We also include some comments on the cell cycle, in order to demonstrate how the petition text has over-simplified the role of silicon in *Pseudo-nitzschia* physiology.

5. Throughout the petition there is an association made between the production of domoic acid (DA) with silicon (Si) limitation. DA production in stationary phase of laboratory cultures has indeed been linked to Si limitation. However, before the role of Si limitation in DA production can be determined, the effects of nutrients and light supply
on the cell cycle of phytoplankton cells must first be considered. The cell division cycle is the cycle through which cells proceed from newly formed daughter cells to subsequent division and formation into new daughter cells. Much research has been carried out on the effects of light and nutrient limitation on the cell cycle. Studies have shown that when light or an essential nutrient is withdrawn, the cell cycle will halt at a particular stage. This is termed the G1 stage and is the stage of the cell cycle before DNA synthesis occurs. Cells will remain at this stage until the nutrient or light is re-supplied. If the nutrient or light is supplied at a very low level, the duration of time the cells spend in the G1 phase is increased. This is a common feature of all eukaryotic cells (cells with a distinct nucleus) and is believed to be an evolutionary advantage - if the cell cycle halted during DNA synthesis, the chances of producing a mutant cell with reduced survival possibilities would be greatly increased. Phytoplankton cells can often alter their physiology in an effort to compensate for the limitation that causes them to remain in G1 phase. Silicon is an essential nutrient in the cell cycle in diatoms (the class of phytoplankton to which *Pseudo-nitzschia* belong). Diatoms have an outer frustule (shell) which is rich in silicon. Silicon limitation has been shown to cause the cell cycle to halt in the G1 phase, and an additional stop at the end of the G2 phase (the gap phase between DNA synthesis and cell division) has also been identified. It is thought that DA production may start during G2 phase or at the end of G1, just before DNA synthesis, although there is a requirement for more research to define this more precisely.

6. An important aspect of Si metabolism, not mentioned anywhere in the petition, is the importance of light. Light energy is essential for the assimilation of Si and cells may become Si limited, not necessarily because silicon is not available, but because there is insufficient light energy present to allow the assimilation of Si. There have been relatively few laboratory studies (and even fewer field studies) on the effects of light on growth and DA production in *Pseudo-nitzschia*, but this paucity of data does not mean that light is unimportant – our understanding of the cell cycle tells us otherwise.

7. Si limitation can result in an increase in the duration of the cell cycle and thus may alter cell physiology. Light and other nutrients, however, may have a similar effect. Light limitation has been shown to increase the duration of the cell cycle and diatom cells have a number of physiological mechanisms to compensate for this. Mechanisms such as these have yet to be fully studied in relation to DA production. Other nutrients are also essential for progress through the cell cycle. Phosphorus is essential, as it is a constituent of DNA and P limitation has also been shown to increase DA production. The role of other nutrients such as trace metals and vitamins have yet to be investigated. An important factor that remains unmentioned is the role of temperature. Temperature has been seen to have a complex effect on the cell cycle and physiology of phytoplankton, and this has yet to be fully elucidated.

8. The paper states that there is both laboratory and field evidence to show that ASP toxin production is closely linked to high N:Si ratios. Reference is made to work carried out by Gowen and Ezzi (1992) on predicting the potential for hypernutrification and eutrophication from salmon farming. While their work showed that the N:Si ratio in Loch
Hourn during 1989 changed from 0.07:1 (where Si is in excess) to 1.1:1 (where N is slightly in excess) this ratio is hardly suboptimal (the optimal ratio for N:Si in diatoms is 1:1). It should also be noted that diatoms have a number of compensatory mechanisms to reduce their Si requirement if Si becomes limiting.

9. Much of the research carried out on ASP has focussed on *Pseudo-nitzschia multiseries*, the species linked to the initial Canadian outbreak of ASP in 1987. Several other species of *Pseudo-nitzschia* are known to be capable of producing DA. Very few experiments investigating the role of nutrients on DA production have been performed on any *Pseudo-nitzschia* species other than *P. multiseries*. There is also a lack of data on growth and DA production using forms of nitrogen other than nitrate and ammonium. DA, unlike some of the PSP toxins, has a low nitrogen content, and suggesting that DA is not a storage product for excess nitrogen.

10. The petition concludes by stating that animal waste discharges that do not contain silicate are frequently found in areas suffering ASP, but no evidence is provided in support of this. The penultimate sentence states that there is strong evidence linking ASP and pollution, but again no evidence is given to substantiate this. Large areas of offshore areas were affected by ASP in Scotland during 1999 (e.g. the Minch). It is highly improbable that anthropogenic nutrient discharges into coastal waters have any significant effect in the context of the Minches when compared to the natural background levels of nutrients from oceanic water.
Estimated Elevation of ‘Natural’ Nutrient Levels Due to Fish Farming in Scottish West Coast Waters

SUMMARY

1. Calculations have been made to compare the flux of nutrients from fish farms to the Minch with natural fluxes of nutrients through arising from the general northward movement of water through the Minch. The results indicate that, on the large scale considered (i.e. the entire Minch), emissions of nutrients from fish farms contribute only a small proportion of the natural flux of nutrients, 0.64% and 0.66% for total reactive nitrogen and phosphorous respectively.

Background

2. The elevation of background nitrogen and phosphorous concentrations in Scottish west coast waters due to the presence of Atlantic Salmon fish farms was estimated from data describing the monthly emission of soluble nutrients from farms and the flux of nutrients through the Minch. The former data predict monthly quantities of nitrogen (principally NH4) and phosphorous (PO4) emitted per tonne of fish production. The total production of salmon along the Scottish west coast (i.e. not including production in Shetland and Orkney) was estimated at 64000 tonnes for 1999 and this allowed the calculation of total monthly emissions of nutrients.

3. The ‘natural flux’ was based on observations of monthly nutrient levels in the Minch in the upper water column (Slesser and Turrell, 1999), and the estimated transport of water through the area of 9.0 x 10^4 m^3 s^-1 (McKay et al., 1986). By combining the nutrient levels with the transport data, the monthly ‘natural’ flux of nitrogen and phosphorous along the Scottish west coast was estimated (in cubic metres per month). The contribution to nitrogen and phosphorous levels in coastal waters due to fish farming can then be compared to the natural flux and an estimate of the ‘Equilibrium Concentration Enhancement’ made.

Results

4. The results are shown in the tables below.

<table>
<thead>
<tr>
<th>Month</th>
<th>Background (mmol/l)</th>
<th>N‘Natural’ (kg)</th>
<th>FluxFF N Flux (kg)</th>
<th>N ECE (mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>6.70</td>
<td>22611052.80</td>
<td>130304.00</td>
<td>0.04</td>
</tr>
<tr>
<td>F</td>
<td>7.45</td>
<td>22709030.40</td>
<td>116288.00</td>
<td>0.04</td>
</tr>
<tr>
<td>M</td>
<td>7.38</td>
<td>24916030.27</td>
<td>119232.00</td>
<td>0.04</td>
</tr>
<tr>
<td>A</td>
<td>5.43</td>
<td>17717616.00</td>
<td>152320.00</td>
<td>0.05</td>
</tr>
<tr>
<td>M</td>
<td>3.47</td>
<td>11700376.13</td>
<td>171328.00</td>
<td>0.05</td>
</tr>
<tr>
<td>J</td>
<td>1.60</td>
<td>5225472.00</td>
<td>226560.00</td>
<td>0.07</td>
</tr>
<tr>
<td>J</td>
<td>1.39</td>
<td>4687574.98</td>
<td>260544.00</td>
<td>0.08</td>
</tr>
<tr>
<td>A</td>
<td>2.72</td>
<td>9179412.48</td>
<td>274432.00</td>
<td>0.08</td>
</tr>
<tr>
<td>S</td>
<td>2.42</td>
<td>7910058.24</td>
<td>246464.00</td>
<td>0.08</td>
</tr>
<tr>
<td>Month</td>
<td>Background (mmol/l)</td>
<td>P ‘Natural’ P (kg)</td>
<td>FluxFF P Flux (kg)</td>
<td>P ECE (mmol/l)</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>J</td>
<td>0.58</td>
<td>4334186.88</td>
<td>27968.00</td>
<td>0.00</td>
</tr>
<tr>
<td>F</td>
<td>0.44</td>
<td>2969809.92</td>
<td>24960.00</td>
<td>0.00</td>
</tr>
<tr>
<td>M</td>
<td>0.53</td>
<td>3960550.08</td>
<td>25600.00</td>
<td>0.00</td>
</tr>
<tr>
<td>A</td>
<td>0.40</td>
<td>2892672.00</td>
<td>32640.00</td>
<td>0.00</td>
</tr>
<tr>
<td>M</td>
<td>0.32</td>
<td>2391275.52</td>
<td>36736.00</td>
<td>0.00</td>
</tr>
<tr>
<td>J</td>
<td>0.28</td>
<td>2024870.40</td>
<td>48640.00</td>
<td>0.01</td>
</tr>
<tr>
<td>J</td>
<td>0.25</td>
<td>1868184.00</td>
<td>55872.00</td>
<td>0.01</td>
</tr>
<tr>
<td>A</td>
<td>0.28</td>
<td>2092366.08</td>
<td>58880.00</td>
<td>0.01</td>
</tr>
<tr>
<td>S</td>
<td>0.37</td>
<td>2675721.60</td>
<td>52800.00</td>
<td>0.01</td>
</tr>
<tr>
<td>O</td>
<td>0.48</td>
<td>3586913.28</td>
<td>47296.00</td>
<td>0.01</td>
</tr>
<tr>
<td>N</td>
<td>0.59</td>
<td>4266691.20</td>
<td>41024.00</td>
<td>0.01</td>
</tr>
<tr>
<td>D</td>
<td>0.52</td>
<td>3885822.72</td>
<td>35712.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36949063.68</td>
<td>488128.00</td>
<td></td>
</tr>
</tbody>
</table>

5. The results indicate that, on the large scale considered (i.e. the entire Minch), emissions of nutrients from fish farms contribute only a small proportion of the natural flux of nutrients, 1.26% and 1.32% for nitrogen and phosphorous respectively.

Total Reactive Nutrients

6. The above calculations do not take into account emissions and fluxes of organic nitrogen and phosphorous, which may be in dissolved or suspended particulate form. The rapid cycling of nutrients in the water column means that a more appropriate comparison is between total reactive nitrogen discharged from fish farms (i.e. ammonia + dissolved and suspended organic nitrogen) and the ‘natural’ reactive nitrogen present in the environment (i.e. nitrate + ammonia + dissolved organic nitrogen + suspended particulate organic nitrogen). Similar arguments can be made for phosphorous.

7. In the environment, the ratio of organic to inorganic nitrogen is typically 1.6:1. Therefore, the flux of total reactive nitrogen through the Minch annually is a factor 2.6 greater than the figure given in the table above. Similarly for phosphorous, the organic:inorganic ratio is about 1.6:1.

8. Fish farms also emit organic nitrogen and phosphorous, but in smaller quantities than inorganic compounds. The organic:inorganic ratios of fish farm emissions are typically 0.33:1 and 0.29:1 for nitrogen and phosphorous respectively. The emission of total reactive nitrogen and phosphorous from farms is therefore increased from the figures given above by factors of 1.33 and 1.29 respectively. The calculations of fluxes of total reactive nitrogen and phosphorous are shown in the table below (note that fluxes and

---

32
emissions are given in tonnes).

<table>
<thead>
<tr>
<th></th>
<th>Nitrogen</th>
<th></th>
<th>Phosphorous</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>‘Natural’</td>
<td>Fish Farm</td>
<td>‘Natural’</td>
<td>Fish Farm</td>
</tr>
<tr>
<td>Annual Inorganic Flux/Emission (t)</td>
<td>181340</td>
<td>2277</td>
<td>36949</td>
<td>488</td>
</tr>
<tr>
<td>Inorganic:Organic Ratio</td>
<td>1.6:1</td>
<td>0.33:1</td>
<td>1.6:1</td>
<td>0.29:1</td>
</tr>
<tr>
<td>Annual Organic Flux/Emission (t)</td>
<td>290144</td>
<td>751</td>
<td>59118</td>
<td>142</td>
</tr>
<tr>
<td>Annual Total Reactive Flux (t)</td>
<td>471484</td>
<td>3028</td>
<td>96067</td>
<td>630</td>
</tr>
</tbody>
</table>

9. These results indicate that fish farming contributes about 0.64 % of the total reactive nitrogen and 0.66% of the total reactive phosphorous in Scottish west coast waters.

**References**


ANNEX 2

REVIEW OF CURRENT RESEARCH PROJECTS INTO THE ENVIRONMENTAL ASPECTS OF AQUACULTURE

INTRODUCTION

This document provides information on current research projects and research interests at universities and research laboratories in Scotland. Projects have been grouped into themes. Only a brief outline of each project is given, but the institutes and principal investigators involved are noted should further details of particular projects be required.

Marine Aquaculture

The debate in Scotland about the marine environmental aspects of aquaculture is dominated currently by perceived and potential effects of the Atlantic Salmon industry. One known impact on the marine environment is that of enhanced carbon deposition on the seabed beneath farms, and the extent of this impact, it’s effect on benthic processes and prediction and assessment of the impact has been researched for about two decades. Research now focuses on minimising those effects by improved husbandry.

Other potential or perceived impacts from the Atlantic Salmon industry have been broken down into the following themes: waste emissions; the effects of nutrient emissions from salmon farms on biological processes within the semi-enclosed environments of Scottish sea lochs; other sediment impacts such as trace metal concentrations; the impact of marine parasites on local populations of wild salmonids; the effects of medicines; the effects of other chemicals. Research is currently being undertaken to investigate the extent of these effects and those projects are briefly described below. Research is also undertaken to improve the assessment and prediction of the holding capacity of sites through monitoring and modelling. Finally, broader research into the oceanography of Scottish coastal waters provides the canvas on which environmental effects of aquaculture can be assessed.

The present document describes particular research projects and programmes related to environmental effects of aquaculture in Scotland. A broader review is being carried out under the auspices of an EU Concerted Action being coordinated by Napier University, Edinburgh. Under the title “Monitoring and Regulation of Marine Aquaculture (MARAQUA)”, the project aims to review existing information on the environmental effects of aquaculture and establish a set of agreed guidelines for the monitoring and regulation of marine aquaculture. The project has established a European Network to bring together scientists, producers, regulators and voluntary organisations, in an effort to co-ordinate and provide means for the efficient exchange and review of information. An important element of the programme is the preparation of paper on a series of subjects leading to a draft Best Environmental Practice document for mariculture. The subjects include several of the themes discussed in the present paper. More information can be obtained from the web site: http://www.biol.napier.ac.uk/maraqua/
Waste Discharges

(i) Emission of Soluble Nitrogenous Compounds. FRSML (Dr Ian Davies). Funded by SERAD, ongoing.

Farmed salmon excrete soluble nitrogen (in the form of ammonia) into the water column as a by-product of metabolism. The quantity emitted by each fish varies due to a number of factors, including food composition, fish age and size, water temperature. The total quantity of ammonia emitted from a fish farm then depends on the level of production and the stage of the production cycle. In order to correctly estimate the effects of nutrient emissions on the local ecosystem, it is imperative to have an accurate assessment of the quantities of nutrients being released. This project aims to provide improved estimates of the monthly releases of soluble nitrogenous compounds from salmon farms over a production cycle. These results will then provide input to computer models predicting nutrient levels in the water column.

(ii) Quantification and Characterisation of Solid Waste Emissions. IoA (Dr Malcolm Beveridge, Dr Trevor Telfer). Funded by Taiwan Government Studentship, 1996 – 2000 (Dr Y.S. Chen, completed), and various.

The impact of finfish farms on the local benthic environment and water quality depends fundamentally on the quantity of waste organic material produced by the farm. This research programme aims to improve estimates of the quantity of waste food and faeces emanating from salmon farms. The quantity of solid waste generated by farms depends on many factors, from the feeding regime to feed composition. The developed methods and results then provide a basis for quantifying the benefits of, for example, improved husbandry, the use of automated feeders etc. The data also provide input to models predicting benthic effects of salmon farms.

The effects of solid waste material on the local environment also depends on the characteristics of that waste. Work is continuing to investigate and quantify parameters such as the settling rates of feed and faecal pellets, and the leaching of nutrients from pellets into the water column during settling. Estimated values of these parameters change as feed composition changes with new brands coming on the market, and good knowledge of appropriate parameter values is essential for accurate modelling of impacts.

(iii) Environmental benefits of intelligent feeding systems in cage culture of Atlantic salmon. IoA and DML (Dr Trevor Telfer, Dr Malcolm Beveridge and Dr Kenny Black), NERC Industrial CASE studentship, 2000 – 2003 (Mr Richard Corner) with Aquasmart Systems Ltd (Dr Sunil Kadri).

The use of intelligent feeding systems are becoming more widespread in countries such as Scotland and Norway. These systems allow automated feeding of fish using a variety of timed and behavioural responses. These systems have been developed primarily to use food more efficiently for economic reasons but this will have environmental implications for input of solid wastes and, possibly, for control and more effective use of in-feed chemotherapeutants.
This project, to begin in Sept. 2000, will investigate the waste inputs from sites containing intelligent feeding systems with those of similar production biomass and conditions over three years. Sedimentation and in situ manipulation techniques will be used as well as investigating the physico-chemical and biological environments at the trial sites. Data collected may be used to improve data sued in modelling of waste material and included into the framework for fish farm regulation.

This project has links with a current EU framework 4 funded study investigating intelligent feeding systems with bass and bream culture in the Mediterranean.

**Water Quality/Eutrophication**


The objective of this work is to investigate the effects of salmonid cage-culture effluents (metabolic waste products and uneaten food) on planktonic community structure and microplankton ecosystem function in a sea loch. A programme of field observations was undertaken at Loch Fyne over a complete seasonal cycle. Salinity/temperature profiles and water samples were collected from three depths at each of four stations located at different proximity to the fish farm. The water samples are been analysed for inorganic (NH4, NO3, PO4, SiO2) and organic nutrients (nitrogen, phosphorus), chlorophyll concentrations, and the abundance and biomass of phytoplankton, bacteria, ciliates and heterotrophic nanoflagellates. These results will contribute to improved understanding of the effects of aquaculture effluents on semi-enclosed environments.

(ii) Monitoring winter nutrient levels. FRSML (Dr Ian Davies, Dr Phil Gillibrand). Funded by SERAD, ongoing.

FRSML has previously undertaken occasional research cruises to measure nutrient levels during winter in a number of Scottish sea lochs. These data provide background data for nutrient models assessing the enhancement of nutrients in these systems due to fish farming. Cruises have previously taken place in December 1992 and December 1998. These and subsequent cruises may contribute to an indication of long-term changes in background nutrient levels in sea lochs.

**Sediment Impacts**

(i) Nutrient cycling within sediments. Leeds University, FRSML (Dr Ian Davies). Funded by Leverhulme Trust, 2000-2002.

The project is led by researchers from the University of Leeds investigating novel aspects of nutrient cycling within sediments. Results from a preliminary study indicate that understanding and representation of microbial processes occurring in organic rich marine sediments has previously been oversimplified. Evidence from modern, state-of-the-art, geochemical and biochemical techniques have identified previously unknown microbial processes, resulting in rapid recycling of nutrients and trace metals within the sediment.
This project aims to characterise these processes and to determine the rate of the major recycling reactions. Results from the project may modify understanding of enriched sediment processes in both natural environments (e.g. below cage fish farms) and artificial systems such as sewage treatment ponds and aquaculture systems.

(ii) Physical and biogeochemical pathways of fish farm wastes in Scottish Sea Lochs. DML (Dr Tracy Shimmield, Dr Kenny Black), FRSML (Dr Ian Davies, Dr Phil Gillibrand), UHI studentship (Rebecca Dean), 1998-2002.

It has recently been noted that sea bed sediments at fish farms can contain high concentrations of some metals, notably copper and zinc. The sources of these metals are suspected to be antifoulants on cage nets, and galvanising on walkways respectively. The objectives of the PhD are to establish the extent of the phenomenon and to investigate the environmental significance of the relatively high concentrations that are found, particularly of copper.

(iii) Benthic Impacts of shellfish farming. FRSML (Dr Ian Davies). FRS studentship (Jon Chamberlain), 1997-2000.

The aim of the this project is to provide a detailed survey of the benthic impacts of specific mussel farms. These farms were selected such that they were in areas of low energy and the biodeposits exposed to reduced dispersive forces. This allowed us to examine the effects of the biodeposits along gradients of deposition at increasing distances from the farms. Three sites were selected for survey on the coasts of west Scotland and south west Ireland. These farms provided a range of farm sizes (25 - 150 m) and ages (3 - 14 yrs) and were representative of the types of farms found in the areas. The effects of these biodeposits on the biology and physico-chemical structure of the surficial sediment was analysed. The quantity and nature of the sedimenting material was also analysed. A model was then developed to quantify the area over which the flux of biodeposits from the farm sites would settle out onto the benthos. The model was an adaptation and development of the fish farm impact model DEPOMOD, incorporating the results of the surveys and of mussel faeces settling velocity experiments. The potential effects of the increased sedimentation, in the form of faeces and pseudofaeces, on the macrobenthic community, physical structure and biogeochemistry of the surficial sediment around the farms were identified and possible impacts predicted.

(iv) Measuring and Modelling the Resuspension of Solid Wastes Beneath Fish Cages due to Wind and Wave events. FRSML (Dr Phil Gillibrand), UWB. Funded by CEC, SSFA, 2000-2001.

This aim of this project is to measure and model the wind- and wave-driven water currents near aquaculture cages at sites where these effects may play an important role in the resuspension and redistribution of particulate wastes. The ultimate goal is to develop a predictive module that will incorporate these processes into the regulatory procedures for discharge consenting by SEPA.

The project consists of two components: a field study of wind and wave conditions and associated near-bed tidal, wind-driven and wave-orbital velocities at selected locations in Shetland; and a modelling study to predict the water currents generated by the observed
wind and wave characteristics and to predict the extent of sediment resuspension at the site. By calibrating the model using the measured data, this project should produce a generic model capable of predicting on-site current conditions from local wind data. This will allow improved estimates of holding capacities of sites and therefore help maximise the sustainable production level of the industry.

Sea Lice

(i) Responses of Sea Lice to Odour Stimuli. AU (Dr Jennifer Mordue) and others. Funded by SQS, MHM, Landcatch UK through Link Aquaculture, 1998-2001.

This project seeks to provide a scientific basis and practical knowledge for the use of semiochemicals (behaviour modifying chemicals) in sea lice control. The use of semiochemicals could, together with disease management control, the use of medicines, and other methods, form an effective, sustainable, Integrated Pest Management Strategy. The present project aims to investigate ways in which semiochemicals could practically be used to help control sea lice infestations on salmon farms. Possible uses of semiochemicals to help control sea lice are: to monitor lice numbers to predict treatment; to employ repellent/attractant strategies to move sea lice from cages to traps with host odours and pheromones outside cages; to disrupt lice mating by causing confusion in mate location. The method is intrinsically environmentally-friendly and could help reduce the environmental effects of sea lice control.

(ii) Development of Data Based Models for Effective Treatment and the Environmentally Safe Use of Veterinary Methods in the Control of Sea Lice Infestation of Farmed Salmon. STAMS (Prof. George Gettinby, Dr Crawford Revie). Funded by MAFF, SQS, MHM through Link Aquaculture, 1999-2002.

This project aims to develop mathematical models of sea lice population dynamics and to investigate the effects of control operations on those populations. Initially, industry databases of sea lice numbers will be collated, audited and analysed. Statistical analysis of the data will be carried out to identify suitable parameterisations for mathematical models. The development of sea lice population models will enable processes such as the development of resistance to treatment to be investigated, and help identify key factors in those processes. The project will also investigate how project findings and results can be implemented at policy level and on fish farms.

(iii) The Impact of Salmon Farming on Wild Fish Populations. FRSML (Dr Phil Gillibrand), FRSFL (Dr Sally Northcott). Funded by SERAD, 2000-2003.

The project aims to examine the incidence of sea lice on wild sea trout populations in Loch Torridon and two other sea lochs, and to investigate the source and transport of infective lice stages. The project will attempt to establish surface plankton tows as a reliable method of sampling for sea lice in the vicinity of river mouths, which can then be used to monitor the effectiveness of lice treatment strategies on local salmon farms for controlling escaping lice numbers. The project will monitor activities on farms and attempt to link those practices with the variable abundance of lice at nearby river mouths, with the aim of identifying solutions and preventing incidence of high lice numbers during the spring sea trout run. Three-dimensional, hydrodynamic computer modelling and
hydrographic work will investigate possible transport mechanisms of the infective lice stages between local farms and affected rivers.

Sea Lice Medicines

(i) Post Authorisation Assessment of the Ecological Effects of Sea Lice Treatments. DML (Dr Kenny Black), PML, SEAS, FRSML, SAMS. Funded by MAFF, DETR, SEPA, SERAD, SNH, SQS, 1999-2002 (possible extension to 2004).

The toxic effects of all new sea lice treatments have been examined during the product licensing and discharge consenting processes but these studies have been limited to a few sentinel species and there is currently little information on the wider ecological consequences of the use of these products. This project seeks to address the widely perceived research need in this area by conducting long term, broad scale BACI (Before After Control Impact) studies at a range of low energy fish farm sites and encompassing all the currently available or presently proposed sea lice treatment chemicals. The results of this research will answer commonly asked questions on the ecological significance of these chemicals under realistic treatment regimes with respect to macrofauna, zooplankton, meiofauna, benthic diatoms, phytoplankton and macroalgae.

Sites selected for this work are initially in Lochs Fyne, Torridon and Sunart. In the first fieldwork season only the bath treatment Cypermethrin will be studied as this is now widely available. This work will be continued in subsequent years but with the inclusion of new medicines especially Emamectin and possibly Teflubenzuron.

(ii) To develop analytical methods for sea lice medicines used in fish farming. FRSML (Dr Lynda Webster). Funded by SERAD, ongoing.

This work aims to maintain analytical capability to measure concentrations in the environment of chemotherapeutants used in the fish farming industry. Methods have been developed to analyse for levels of cypermethrin in sediment. The project will develop analytical methods for emamectin in sediment and biological tissues, cypermethrin in biological tissue and chitinase inhibitors in biological tissue.

(iii) The biological effects of fish farm chemicals used in the treatment of sea lice. FRSML (Dr Colin Moffat, Dr Ron Stagg, Dr Ian Davies). FRS Studentship (Ben Gowland), 1998-2001.

This project is an FRS research studentship to develop biomarkers of the effects of sea lice treatment chemicals on marine organisms. The aims of the study are to investigate the effect of selected medicines on particular fauna in laboratory studies, to calibrate the laboratory techniques for field conditions, to demonstrate burdens and the availability of medicines to organisms and to incorporate this knowledge into the advisory role and regulation.

(iv) In situ investigations of the fate and environmental effects of sea lice medicines. IoA (Dr Trevor Telfer and Dr Donald Baird). Various funding from industry (ongoing).
The use of chemotherapeutants to control sea lice infestation is widespread in the Scottish mariculture industry. The medicines employed are potentially toxic to not only sea lice but other crustacea in the local environment following discharge from the farms, whether application is in-feed or by bath treatment. This programme, of commercially funded research, carries out field trials for new sea lice treatment medicines under commercial use conditions, investigating the environmental fate and ecotoxicological effects of the medicine. Recent field trials have involved examining impacts on benthic macrofauna species of emamectin benzoate and teflubenzuron over long time scales (one and two years respectively). Measurements were also made of the levels of active ingredient and primary metabolites in the water column and sediments to identify temporal variations following treatment and their relationships to community composition.

Short term trials (one month) investigating the effects on sentinel species (e.g. juvenile lobsters and mussels) transplanted around treated and untreated fish cages have also been undertaken. These specifically investigate organisms which may be targeted by sealice medicines and are of commercial importance.

(v) Investigation of the environmental effects of sea lice bath treatment chemicals on zooplankton. IoA (Dr Trevor Telfer and Dr Donald Baird), Chilean Government research studentship, 1998 - 2001 (Mr Matias Medina).

A field and laboratory based investigation of the lethal and sublethal effects of sea lice bath treatments on zooplankton species. Laboratory studies on lethal and sub-lethal effects on Acartia and Tisbe are near completion. In situ mesocosms are now under development to investigate the impacts on zooplankton species assemblages. It is expected these will be deployed later this year.

(vi) Impacts of in-feed chemicals on sediment reworker species. IoA (Dr Donald Baird, Dr Malcolm Beveridge and Dr Trevor Telfer), Malaysian Government studentship, 1997 - 2000 (Mr Rosly Bin Hassan) and industrial funding.

Sediment reworkers within the vicinity of fish cages are important in bioprocessing sedimeted nutrient waste. A laboratory based PhD study to develop ecotoxicological techniques to investigate the impacts of in-feed sea lice chemicals these reworkers is complete. In addition, these techniques are being developed further through industrial funding.

The investigation concentrates particularly on the polychaete Capitella, using specimens collected from Scottish farms and standard populations. Cultures of Capitella have been set up and exposures performed as lethal and sub-lethal concentrations. The results have significant implications for the effects of in-feed chemotherapeutants on bioprocessing of wastes. In addition, the techniques may be used as a sediment assay for the development of environmental quality standards, which at present employ organisms which may not be found in the sediment near fish cages where any effects of the drugs are present.
Effects of Chemicals

(i) The effects copper on sediment reworker species. IoA (Dr Trevor Telfer and Dr Malcolm Beveridge), privately funded studentship, 1997 – 2000 (Mr Gernot Vonhoegen).

Other chemicals released in general use from fish cages may have impacts on sediment fauna. Of particular interest are sediment reworkers which help bioprocess sedimented waste. One such important reworker in the polychaete Capitella. This project investigated the effects of sediment copper, released as fish cage net anti-foulant, which may accumulate within sediments for considerable periods of time even after cessation of use.

The study developed techniques to measure various copper species and laboratory tests to look at lethal and sub-lethal impacts on Capitella. This investigation used behavioural and sublethal endpoints in ecotoxicological testing and employed histological and x-ray methods to investigate the mechanisms of copper movement throughout the body tissues.

(ii) Investigation of the effects of anti-bacterials on sediment bacteria using laboratory microcosms. IoA. (Dr Valerie Inglis, Dr Trevor Telfer and Dr Donald Baird) Korean Government Research Studentship, 1995 – 2000 (Mr Duk Hyun Yoon)

This work investigated the effects of anti-bacterials used as medicants in Scottish fish farming on bacteria contained in sediments. Laboratory microcosms were set up to simulate nutrient enriched sediments, like those found near to sea cages, and were treated with various applications of anti-bacterial agent.

An important outcome of the research was the formulation of successful microcosms and HPLC techniques for the analysis of anti-bacterials as well data to show the possible effects on bioprocessing bacteria in sediments.

Assessment and Prediction of Impacts (Modelling and Monitoring)

(i) Modelling the Benthic Impact of Marine Salmon farming - DEPOMOD. DML (Dr Kenny Black, Dr Chris Cromey). Funded by NERC, SEPA through Link Aquaculture, 1997-2000.

This project takes as a starting point a model (BenOss) developed by DML for predicting benthic community response to varying the treatment level from long sea sewage outfalls. This model, which essentially tracks particles of organic solids in a current field, follows their incorporation and degradation in sediments, and predicts indices of community response, has been validated for long sea outfalls and is now in wide use in the water industry.

A number of modifications have been made to allow this model to be used at fish farms: the level of organic loading on the sediment is approximately two orders of magnitude greater around fish farms compared with long-sea sewage outfalls, consequently the biological communities present are quite different; the gradients of organic input are extremely steep with very large changes occurring in relatively short distances making
sampling station selection critical; fish food and faeces have quite different behaviours in sea-water relative to sewage solids and are of different composition with unknown degradation rates; waste food pellets quickly break down into smaller particles of unknown size distribution which are then susceptible to resuspension at varying rates. In addition fish farm sites are generally more stratified than sites for sewage outfalls requiring a greater appreciation of vertical current shear and its effects on particle dispersion. Whereas sewage outfalls can be described in terms of mean flows and concentrations, the output from fish farms varies dramatically over the growing cycle requiring modelling of fish growth and pellet size change. Food wastage is generally believed to be at a lower level than in the past: losses were historically estimated at typically 20%, but are more commonly thought now to range from 5-15%.

The model has been developed as a Windows 95 PC version entitled DEPOMOD. The model has been made user-friendly, allowing its use directly by fish farmers on the basis of a current meter record and site specific input data. The farmer therefore has an inexpensive and rapid method for determining whether or not to proceed with an application and the level of biomass likely to be consented. Using this model as an agreed tool for determining consents, and knowing that this is also freely accessible to the industry, the regulator should have to deal with fewer applications as those likely to fail will not be submitted. The regulator will have an additional validated method for determining consents thus reducing disputes and may use the data requirements of this model as a benchmark for the integration of regulatory requirements across all Scottish regions.

(ii) Modelling the Regional Effects of Fish Farms. FRSML (Dr Phil Gillibrand). Funded by SERAD, ongoing.

The potential cumulative effects of fish farms are modelled on the spatial scales of individual sea loch systems. The cumulative effects of nutrient discharges on background nutrient levels are modelled simply, using box models, to assess the relative impacts and potential burden imposed by fish farming on loch systems around Scotland. The development of a sea loch ecosystem model offers the potential to simulate, on a basin-wide scale, the effects of nutrient discharges from salmon farms on plankton communities, rather than simply estimating the enhancement of nutrient concentrations themselves.

Soluble sea lice medicines, administered as bath treatments, disperse within the water column following release from fish cages. It is important for water environmental quality standards (EQS) that the advection and dilution of released medicines can be predicted, allowing maximum discharge quantities to be specified. Models developed at FRSML, and under continuing development, predict the dispersion of medicines from individual farms, and also collectively from a number of farms within a single semi-enclosed sea loch. Thus the models allow discharge consents for individual farms to be set, but also examine the potential cumulative effects of multiple treatments.

(iii) GIS-integrated Site Assessment Models. IoA (Dr Lindsay Ross and Dr Trevor Telfer). Various IoA funded MSc projects, 1996 – 1998, and EU Marie Curie studentship, 1999 – 2002 (Mr Oscar Perez).
Models for predicting the rate of carbon deposition beneath fish cages have been integrated into a Geographical Information System (GIS) environment as part of several MSc research projects. The GIS model builds on initial calculations made within programmed spreadsheets, and combines the spatial mathematical functions inherent to a GIS with hydrographic and bathymetric data and pertinent information about fish farm practice to produce mapped contours of predicted carbon deposition beneath cages. Validation of the GIS model against sediment carbon data from beneath cages shows improved comparisons compared to the simpler spreadsheet-based models, and the model results exhibit strong correlations with benthic diversity indices and ordination scores.

This work is being investigated further as part of a PhD which incorporates this model into a GIS programme for aquaculture site selection around Tenerife. If successful, the methods may be applicable in Scotland for use with GIS in coastal resource management.

(iv) Modelling sea lice populations and effects of medicines. See 2.1.4 above.

Generic Related Environmental Research

(i) The Restricted Exchange Environment (REEs) Programme. CCMS DML (Dr Kenny Black). Funded by NERC, ongoing.

The Restricted Exchange Environment Programme is a NERC thematic research programme, and has as one of its main themes the concept of sea loch vulnerability. In sea lochs much of the vulnerability arises from the possibility of hypoxia enhanced by nutrient and organic inputs from anthropogenic inputs such as fish farming. One focus will be to understand, on REE-wide scales, how microbial communities within representative REEs respond to nutrient and organic loading, and the influences such responses have on the residence time of inputs within the system and their ultimate fate (burial or export to the coastal zone). Of particular interest in sea-lochs will be the understanding of interactions between hydrodynamics, organic loading (due to increased inputs from e.g. aquaculture and sewage) and the development of hypoxia and its effects on mobilization of redox sensitive metals and other contaminants.

Modelling will be used to couple field and experimental studies, test process-understanding and ultimately predict the sensitivity of REEs to key variables such as increased organic, nutrient and contaminant inputs. Ecosystem models (e.g. BenOss) will be further developed and appropriate biogeochemical modules incorporated. Key physical processes affecting biological vulnerability in REEs will be investigated and quantified using high-resolution, temporal measurements from moored and bottom-mounted instrument arrays and airborne remote sensing. These processes will include cross-sill exchange and deep-water renewal in sea-lochs, and stratification, mixing and flushing in the range of REE types to be studied.

The fate of external nutrient inputs and the ensuing enhanced primary production is a key concern to the vulnerability of REEs. Coupling between nutrient inputs and ratios, surface production and transport of organic matter and nutrients will be studied seasonally. These studies will include measurements of the rates and relative importance of in-situ primary production and imported production. The fate of this production through grazing by mesozooplankton, microheterotrophs and benthic biota, and through bacterioplankton
recycling will be followed. We will investigate the development of hypoxic sediments and basin waters, mobilization of redox-sensitive metals and their effects on both the distribution and bioturbatory activity of benthic biota. Measurements of these processes will be put in a seasonal context using data collected from moored instrument arrays incorporating fluorometers, *in-situ* nutrient analyzers and ADCPs (for zooplankton migration and enumeration). High resolution, basin-scale measurements of dissolved oxygen, manganese and key physical variables will be measured in sea-lochs using AUTOSUB. Laboratory experiments in mesocosms will be used to assess the response of bioturbating biota to hypoxia under controlled conditions.


Present-day understanding of the water movements along the Scottish west coast are due only to limited *ad hoc* current meter deployments and inferred circulation patterns from temperature, salinity and radio-caesium $^{137}$Cs distributions. Although three-dimensional circulation models exist of the entire UK continental shelf, the resolution of these models does not allow for great detail of the Minch and Sea of the Hebrides. A three-dimensional circulation model is therefore being developed of the Scottish west coast continental shelf region. The model will allow an investigation into the transport of water and associated contaminants along the Scottish coast. It will also provide a capability for improved coastal management on the west coast of the country, by providing managers with more detailed information on the exchange and flushing of the coastal zone, and better predictions of transport pathways of contaminants and organisms (e.g. disease pathogens).

Associated work includes computer modelling of water circulation and exchange in sea lochs. The hydrodynamics of sea loch systems is fundamental in determining the impact of many anthropogenic activities on local ecosystems. High energy systems may have greater carrying capacities than low energy lochs. Isolated deep water may exhibit stronger indications (e.g. dissolved inorganic nutrient levels) than deep water which is regularly exchanged. The exchange of water between semi-enclosed sea lochs and the adjacent coastal zone controls the residence time of contaminants within the former. Complex water circulation models are required to accurately assess the residence time of such systems in varying conditions of tide, wind and river runoff. Circulation models have been used to investigate processes such as deep water renewal in Loch Sunart and water and contaminant exchange in Loch Fyne. Investigations into the Loch Fyne system are continuing.

(iii) The Shieldaig Sea Trout Project. FRSFL (Dr Andy Walker). Funded by SERAD, HIE, CEC, HC, ongoing.

There is a need for hard information on the performance of sea trout and some salmon populations in West Highland rivers in view of current concerns over their sustainability. Full-scale trapping and tagging of upstream and downstream migrant sea trout is being undertaken in the River Shielding, a small river typical of the region, after the construction of a permanent trap. The juvenile population is assessed annually by electro-fishing and supplementary stocking is carried out to raise potential smolt production to the carrying capacity of the system. Environmental variables in freshwater and in the local sea lochs
(Torridon) are monitored in conjunction with estuarine trapping, which allows separate estimation of annual levels of juvenile and post-smolt mortality. Factors which contribute to marine mortality, including parasites and predation, are studied in co-operative research. Currently, sea lice are a major cause of mortality of early post-smolts. The sources of the lice (fish farms or wild salmonid fish) and their means of dispersion are studied by population genetics (St Andrews University) and by association with local fish farming practices and by hydrographic modelling (FRSML). Seasonal levels of louse abundance are investigated by plankton tows. There are prospects of greater control of sea lice by the fish farmers through improved management by therapeutants and by fallowing. The Sheildaig Project will be able to assess whether these changes bring about large-scale increases in the marine survival of sea trout. It will act as a model for possible restoration efforts in other west coast rivers. Collaboration is currently with the Wester Ross Fisheries Trust, the Association of West Coast Fisheries Trusts, SEPA, SNH, FRSML, Inverness College, the Gatty Marine Laboratory and Sea Mammals Research Unit (University of St. Andrews).


Dissolved inorganic nitrogen (DIN) includes nitrate, nitrite and ammonium, all potentially enhanced in coastal waters by human activities. Enhancement can lead to eutrophication if the extra nutrient results in additional growth of phytoplankton (or benthic algae). For practical purposes the amount of phytoplankton is most easily measured as chlorophyll, and the UK water quality standard relating to eutrophic conditions is defined using chlorophyll concentration. A knowledge of the proportionality between an increase in DIN and a resulting increase in chlorophyll is thus crucial to estimating the likelihood and extent of the eutrophication resulting from given nitrogen loadings. Two week long microcosm enrichment experiments have been undertaken at DML using natural populations of microplankton (<200µM) collected from the Lynn of Lorne on the west coast of Scotland. Light quality, light quantity, daylength and temperature are the same they would be in the natural environment, changing with the season. 12µM of ammonium or nitrate is added to microcosms using continuous culture techniques, and yield of chlorophyll from DIN has been determined over different seasons. Similar experiments will be undertaken at SEPA in the year 2000 using microplankton collected from the Firth of Forth, and then comparisons of yield of chlorophyll from DIN from comparatively oligotrophic (Lynn of Lorne) sites and hypernutrified (Firth of Forth) sites during different seasons will be made.

Freshwater Aquaculture

Relatively little research is presently being conducted into the environmental effects of freshwater aquaculture. Freshwater farms tend to be of smaller production tonnage (up to about 300 tonnes) than their marine counterparts, and concerns about environmental effects are not so high on political agendas. The legislative framework for freshwater aquaculture was developed in the 1980s, when research into effects of water and sediment quality was carried out and regulatory modelling tools developed. Many farms have therefore been operating for many years with relatively little interference from government. However, concerns about potential impacts of freshwater aquaculture
remain, and these are addressed in the next section. Concerns may also increase as the number of freshwater hatcheries required to supply smolts to the expanding marine industry grows.

Many of the environmental concerns about freshwater aquaculture are similar to those in the marine sector. Release of nutrients, particularly, in the freshwater case, phosphorous, and the storage and gradual release of those nutrients in the sediments is a major concern of regulators. The use of chemicals such as anti-fungals (e.g. malachite green, and pyceze), the effects of exotic escaped farmed fish on natural populations and ecosystems, and the sediment impacts due to settling waste material are all environmental issues requiring further research.

One current on-going project is an investigation carried out between IoA, Heriot-Watt University and industrial partners into the efficiency and cost-effectiveness of waste collection and disposal technologies, funded through the LINK Aquaculture programme.
General Procedure note

1. The Rural Affairs Committee is the lead committee on this instrument, which was lodged on 6 July 2000.

2. This order came into force on 7 July and was laid under a "negative procedure" which means that the Parliament has power to annul the order by resolution within 40 days, excluding recess. In the case of this instrument therefore, the time limit for Parliamentary action expires on 2 October 2000.

3. The order deals with Regulations, extending only to Scotland, which re-enact with amendments the Norway Lobsters (Prohibition of Method of Fishing) Order 1993. The measures form part of a new package of conservation measures aimed at reducing discards of undersized fish, notably haddock and nephrops. Equivalent regulations will be laid at Westminster to cover other UK vessels and waters.

4. The Subordinate Legislation Committee considered this instrument on 12 and 19 July and determined, in its 32nd and 33rd Report, that there are a number of technical flaws it wishes to draw to the attention of the Parliament. In particular, the Committee drew the attention of the Parliament to the Order on the grounds of defective drafting. An extract from the report is attached. Also included is a letter from the Convener of the Subordinate Legislation Committee regarding this instrument. Members should note the suggestion that the Rural Affairs Committee consider asking the Executive to bring forward an amending instrument to address the shortcomings identified by the Subordinate Legislation Committee. In view of this recommendation, the Convener has called Executive officials to attend the Committee.

5. Should a motion for annulment be proposed under Rule 10.4, (the deadline for which is Monday 25 September), the Committee would have to invite Ministers to debate the issue and then report to the Parliament with its recommendation. Where no annulment is sought, the Committee is still obliged to report to the Parliament with its recommendation, taking into account any recommendations made by any other Committee.

Actions required on 26 September 2000

6. This is the last meeting at which Members may consider this instrument. Members are requested to consider, in view of the Subordinate Legislation Report, what recommendation the Committee wishes to make in its report to the Parliament.

Tracey Hawe, Senior Assistant Clerk, September 2000
EXTRACT FROM SUBORDINATE LEGISLATION COMMITTEE 32ND REPORT:

Negative Instruments

The Prohibition of Fishing with Multiple Trawls (Scotland) Order 2000, (SSI 2000/226)

1. The Committee raised a number of points on the instrument, asking the Executive for explanation.

2. The Committee noted that the title of the instrument is given in the Heading as “The Prohibition of Fishing with Multiple Trawls (Scotland) Order 2000”. Article 1, however, provides that the Order may be cited as “The Prohibition of Multiple Trawls (Scotland) Order 2000”. The Committee asked for an explanation of the discrepancy (point 1).

3. The footnote to the Scotland Act 1998 (Modification of Functions) Order 1999 in footnote (a) on page 1 appears to be incorrect. The Committee asked for confirmation that the reference should be to SI 1999/1756 not SI 1999/1750 (point 2).

4. In article 2(1), in the definition of “the Council Regulation”, Council Regulation 1259/99 did not appear to have amended Council Regulation 850/98 nor did it seem to be relevant to that Regulation. The latter Regulation did, however, appear to have been amended by other Community legislation. The Committee asked for confirmation that the references in the definition are correct and complete (point 3).

5. In article 2(1), “equivalent Order” is defined as “an Order extending to any other part of the United Kingdom”. As the Order does not itself refer to a part of the United Kingdom the Committee enquired as to what the words “other part” refer (point 4).

6. In article 3-

   (a) in paragraph (1) the word “the” in line 1 appeared to be superfluous (point 5(i));

   (b) in paragraph (2)(c)(i), the description of ICES VI is given as south of a line drawn from “the east coast of the Sound of Jura”. The Committee believed that only pieces of land have coasts and requested further details of the boundaries of this particular area (point 5(ii)).

7. The Committee noted that no plan was produced with this Order. Such a plan would have been of assistance to the Committee in understanding the effect of the Order.

8. The Committee requested confirmation that the requirements of Article 46 of Council Regulation 850/98, approval from the Commission, have been complied with in respect of this instrument.
9. In its response, reprinted at Appendix A, the Scottish Executive replied as follows—

10. The omission of the words “Fishing with” from article 1 was an oversight.

11. The Executive confirms that the reference to the Modifications Order in footnote (a) on page 1 should be to SI 1999/1756 not SI 1999/1750.

12. The reference in the definition of “the Council Regulation” to Council Regulation 1259/99 should be to Council Regulation 1459/99. It will be noted that the relevant footnote, (e) on page 1, gives the OJ reference relating to Council Regulation 1459/99. It was accepted that Council Regulation 850/98 has been amended by other Community legislation not referred to in the definition, namely Council Regulations 2723/99, 812/2000 and 1298/2000. The references in the definition are in these respects neither correct nor complete. However, the term “the Council Regulation” appears only in article 2(2) of the Order. It is used there only for the purposes of providing that expressions used in the Order which appear or are referred to in the Council Regulation and which are not defined in the Order have the same meaning in the Order as in the Regulation. In effect, this draws in the definition of “mesh size” appearing in Article 3 of the Council Regulation. The term is used in article 3(2) of the Order. Neither Council Regulation 1459/99, which is incorrectly referred, nor any of the Council Regulations which are not mentioned contain amendments to 850/98 which are relevant for the purposes of article 2(2) of the Order.

13. It is outwith legislative competence to make law for any country other than Scotland (see section 29(2)(a) of the Scotland Act). The instrument accordingly forms part of the law of Scotland only. The words "other part" therefore refer to parts of the United Kingdom other than Scotland.

14. It is accepted that the word "the" in line 1 of article 3 (1) is superfluous. The Executive accepts that the drafting of article 3(2)(c)(i) would have been improved by the omission of the words "the Sound of". Two plans showing the effect of the Order accompanied the response.

15. The Commission wrote formally on 18 August confirming for the purposes of Article 46 of Council Regulation 850/98 that they had no objection to the introduction of the measures. A copy of the letter from the Commission accompanied the response and is reprinted at Appendix B.

16. The Executive regrets the drafting and typographical errors, identified by the Committee, but does not consider that these prejudice the effect of the Order.

17. The Committee considered that Executive’s response is insufficient as, though it acknowledges the defects identified by the Committee, it has failed to indicate what if any action it proposes to take regarding them. The Committee also considers that the Executive’s view that the defects do not prejudice the effect of the Order may be misplaced, at least in part.
18. The Executive gave no support for its view in its response and, given the doubts expressed above, the Committee wishes to be assured that the Executive’s view is securely founded. The Committee has therefore requested a further written submission and has invited witnesses from the Executive to attend its meeting on 19th September to respond to questions.

19. The meeting falls on the final day available to the Committee under Parliamentary procedure to consider and report on the instrument. The Committee will therefore communicate any further points it may have to the lead Committee by letter on that day.

20. The Committee in any event draws the attention of the Parliament and lead committee to the instrument on the grounds of defective drafting as indicated above and acknowledged by the Executive.
THE PROHIBITION OF FISHING WITH MULTIPLE TRAWLS (SCOTLAND) ORDER 2000, (SSI 2000/226)

On 5 September the Committee requested an explanation of the following matters:

The Committee notes that the title of the instrument is given in the Heading as “The Prohibition of Fishing with Multiple Trawls (Scotland) Order 2000”. Article 1, however, provides that the Order may be cited as “the Prohibition of Multiple Trawls (Scotland) Order 2000”. The Committee asks for an explanation of the discrepancy.

The footnote to the Modifications Order in footnote (a) on page 1 appears to be incorrect. The Committee asks if it can be confirmed that the reference should be to SI 1999/1756 not SI 1999/1750;

In article 2(1), in the definition of “the Council Regulation”, Council Regulation 1259/99 does not appear to have amended Council Regulation 850/98 nor does it appear to be relevant to that Regulation. The latter Regulation does, however, appear to have been amended by other Community legislation. The Committee asks for confirmation that the references in this definition are correct and complete;

In article 2(1), “equivalent Order” is defined as “an Order extending to any other part of the United Kingdom. As the Order does not itself refer to a part of the United Kingdom the Committee enquires as to what the words “other part” refer.

In article 3-
(i) In paragraph (1) the word “the” in line 1 appears to be superfluous;
(ii) In paragraph (2)(c)(i), the description of ICES VI is given as south of a line drawn from “the east coast of the Sound of Jura”. The Committee believes that only pieces of land have coasts and requests further details of the boundaries of this particular area.

6. The Committee notes that no plan was produced with this Order. Such a plan would have been of assistance to the Committee in understanding the effect of the Order

7. The Committee requests confirmation that the requirements of Article 46 of Council Regulation 850/98 have been complied with in respect of this instrument

The Scottish Executive Rural Affairs Department responds as follows:

1. The omission of the words “Fishing with” from article 1 is an oversight.

2. It is confirmed that the reference to the Modifications Order in footnote (a) on page 1 should be to SI 1999/1756 not SI 1999/1750.
3. The reference in the definition of "the Council Regulation" to Council Regulation 1259/99 should be to Council Regulation 1459/99. It will be noted that the relevant footnote, (e) on page 1, gives the OJ reference relating to Council Regulation 1459/99. It is accepted that Council Regulation 850/98 has been amended by other Community legislation not referred to in the definition, namely Council Regulations 2723/99, 812/2000 and 1298/2000. The references in the definition are in these respects neither correct nor complete. However it will be noted that the term “the Council Regulation” appears only in article 2(2) of the Order. It used there only for the purposes of providing that expressions used in the Order which appear or are referred to in the Council Regulation and which are not defined in the Order have the same meaning in the Order as in the Regulation. In effect this draws in the definition of “mesh size” which appears in Article 3 of the Council Regulation. The term is used in article 3(2) of the Order. Neither Council Regulation 1459/99 which is incorrectly referred nor any of the Council Regulations which are not mentioned contain amendments to 850/98 which are relevant for the purposes of article 2(2) of the Order.

4. It is outwith legislative competence to make law for any country other than Scotland (see section 29(2)(a) of the Scotland Act). The instrument accordingly forms part of the law of Scotland only. The words "other part" therefore refer to parts of the United Kingdom other than Scotland.

5. (i) It is accepted that the word "the" in line 1 of article 3 (1) is superfluous.

(ii) It is accepted that the drafting of article 3(2)(c)(i) would have been improved by the omission of the words "the Sound of".

6. Two plans showing the effect of the Order accompany this response.

7. The Commission wrote formally on 18 August confirming for the purposes of Article 46 of Council Regulation 850/98 that they had no objection to the introduction of the measures. A copy of the letter from the Commission accompanies this response.

8. The Executive regrets the drafting and typographical errors identified by the Committee but to do not consider that these prejudice the effect of the Order.

7 September, 2000

For: Scottish Executive Rural Affairs Department
RURAL AFFAIRS COMMITTEE

Scottish Statutory Instrument 2000/290

The Farm Woodland Premium Scheme Amendment (Scotland) Regulations 2000 (SSI 2000/290)

General Procedure note

1. The Rural Affairs Committee is the lead committee on this instrument, which was lodged on 21 August 2000.

2. This order came into force on 22 and was laid under a “negative procedure” which means that the Parliament has power to annul the order by resolution within 40 days, excluding recess. In the case of this instrument therefore, the time limit for Parliamentary action expires on 27 October 2000.

3. The instrument makes a minor amendment to the principal regulations to allow a further undertaking to be required of applicants as a condition of approval being issued under the scheme. The need for this arises under Council Regulation 1257/99.

4. The Subordinate Legislation Committee considered this instrument on 12 September and noted, in its 32nd Report, that there was a technical devolution issue in that the regulations anticipate the approval of the Commission to the Rural Development Plan. An extract of the Subordinate Legislation Committees report is attached to this note.

5. Should a motion for annulment be proposed under Rule 10.4, the Committee would have to invite Ministers to debate the issue and then report to the Parliament with its recommendation. Where no annulment is sought, the Committee is still obliged to report to the Parliament with its recommendation, taking into account any recommendations made by any other Committee. The deadline for action by this Committee is 23 October 2000.

Actions required on 26 September 2000

6. Members are requested to consider whether they are content with the Order or whether they wish to hear officials or request further information at the next meeting.

Tracey Hawe
Rural Affairs Committee
Senior Assistant Clerk
September 2000
9. The Committee noted that the Regulations make amendments to the Farm Woodland Premium Scheme to reflect the coming into force of EC Regulation 1257/99. The Committee accepted the reasons, outlined in the Executive Note, for the amendments being introduced before obtaining Commission approval to the Scottish Rural Development Plan, but asked the Executive when such approval was expected.

10. The Scottish Executive Rural Affairs Department in its response, reprinted at Appendix N, stated that approval of the Scottish Rural Development Plan is expected at the next STAR\(^1\) meeting on 20-21 September 2000 and all effort is being made to achieve that. There is, however, a risk that the matter could be deferred to a later STAR meeting on 24-25 October due to factors beyond the Department’s control.

11. Following approval at STAR, a formal Commission decision will be issued. This usually follows shortly after the STAR meeting but timing is dependent on business to hand in the Commission.

12. The Committee is aware that should the anticipated approval not be forthcoming, the Regulations would contravene Community law and so raise a devolution issue. The Executive does not think that there will be any difficulty, and circumstances were such that the Executive has had no option but to proceed with the Regulations in the meantime.

13. The Committee notes the Executive’s response and the circumstances pertaining. The Committee therefore draws the attention of the Parliament and lead committee to a technical devolution issue in that the Regulations anticipate the necessary approval of the European Commission to the Scottish Rural Development Plan. Failure to obtain such approval would result in the Regulations being in breach of Community law and thus outwith devolved competence.

---

\(^1\) STAR is an EC committee (Comité des structures agricoles et du développement rural) with representatives from all Member States looking primarily at agricultural structures. The committee has a role in approving Rural Development Plans.
THE FARM WOODLAND PREMIUM SCHEME AMENDMENT (SCOTLAND) REGULATIONS 2000, (SSI 2000/290)

On 5 September the Committee requested an explanation of the following matters:

1. The Committee notes that the Executive makes amendments to the Farm Woodland Premium Scheme to reflect the coming into force of EC Regulation 1257/99. The Committee accepts the reasons, outlined in the Executive Note, for the amendments being introduced before obtaining Commission approval to the Scottish Rural Development Plan, but asks the Executive when such approval is expected.

The Scottish Executive Rural Affairs Department responds as follows:

1. Approval of the Scottish Rural Development Plan is anticipated at the next STAR\(^2\) meeting on 20-21 September 2000 and all effort is being made to achieve that. There is, however, a risk that the matter could be deferred to the next STAR meeting on 24-25 October due to factors outwith the control of the Department.

2. Following approval at STAR a formal Commission decision will be issued. This usually follows shortly after the STAR meeting but timing is dependent on business to hand in the Commission.

September, 2000

For: Scottish Executive Rural Affairs Department

\(^2\) STAR is an EC committee made up of all Member States to look primarily at agricultural structures but also has a role in approving Rural Development Plans.
The Beet Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/246)
The Fodder Plant Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/247)
The Cereal Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/248)
The Oil and Fibre Plant Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/249)
The Vegetable Seeds (Amendment) (Scotland) Regulations 2000 (SSI 2000/246)

General Procedure note

1. The Rural Affairs Committee is the lead committee on these instruments, which were lodged on 27th July 2000.

2. The orders came into force on 1 August and were laid under a "negative procedure" which means that the Parliament has power to annul the order by resolution within 40 days, excluding recess. In the case of this instrument therefore, the time limit for parliamentary action expires on 27 October 2000.

3. The Beet Seeds, the Fodder Seeds, the Cereal Seeds and the Oil Plant Seeds orders implement provisions in Council Directives 98/95/EC and 98/96/EC regarding marketing of seeds and make changes to the arrangements regarding marketing and labelling of small packages of seeds.

4. The Fodder Plant Seeds instrument also makes wording changes regarding fodder plant seed mixtures in order to reflect the requirements of the Directive. The Vegetable Seeds Order amends the definition of marketing and introduces requirements regarding genetic modification and information on imported seeds from third countries.

5. The Subordinate Legislation Committee considered these instruments on 12 September and determined, in its 32nd Report that it wished to draw to the attention of the Parliament to the instruments on the grounds of defective drafting. An extract from the report is attached as Annex A.

6. Should a motion for annulment be proposed under Rule 10.4, the Committee would have to invite Ministers to debate the issue and then report to the Parliament with its recommendation. Where no annulment is sought, the Committee is still obliged to report to the Parliament with its recommendation, taking into account any recommendations made by any other Committee. The deadline for this Committee to report to the Parliament is 23 October 2000.

Actions required on 26 September 2000

7. Members are requested to consider whether they are content with the Orders or whether they wish to receive further evidence or hear officials on the matter at the next meeting.
EXTRACT FROM SUBORDINATE LEGISLATION COMMITTEE 32ND REPORT:

The Beet Seeds (Amendment) (Scotland) Regulations 2000, (SSI 2000/246)

The Fodder Plant Seeds (Amendment) (Scotland) Regulations 2000, (SSI 2000/247)

The Cereal Seeds (Amendment) (Scotland) Regulations 2000, (SSI 2000/248)

The Oil and Fibre Plant seeds (Amendment) (Scotland) Regulations 2000, (SSI 2000/249)

The Vegetable Seeds (Amendment) (Scotland) Regulations 2000, (SSI 2000/250)

34. The Committee, in relation to Instrument 2000/246, asked the Executive to explain the discrepancy in the dating of the Explanatory Memorandum which is also inconsistent with its contents and why it was not possible to follow the timetable set out there. The Committee had the following questions on the same instrument.

35. The Committee asked why, given certain provisions in the Regulations such as regulation 6, section 16(5) was not cited as an enabling power. The Committee asked to which Department reference to the Department of Agriculture and Rural Affairs in regulation 4(1)(c) is intended to refer.

36. The Committee also asked why only some of the relevant EC legislation was produced initially and further, whether the Executive had considered submitting a table of derivations with the instrument indicating the provision of the Directive implemented by each provision of the Regulations.

37. The above points also apply to Instruments 2000/247, 248, 249 and 250, but the Committee had additional questions in relation to Instruments 2000/247 and 248.

38. The Committee asked whether, regarding the Fodder Plant Seeds Regulations [SSI2000/247] in regulation 4(1)(c), in paragraph (b) of the revised definition of “official examination”, sub paragraphs (i) and (ii) are intended to be disjunctive or conjunctive.

39. With regard to the Cereal Seeds Regulations [SSI2000/248], the Committee noted that regulation 4(1) referred to the definition of “Certified Seed” contained in “regulation 3(1)” of the principal Regulations. The Committee noted that regulation 3(1) of the principal Regulations does not appear to contain a definition of “Certified Seed”.

40. In its response, reprinted at Appendix E, the Scottish Executive Rural Affairs Department regretted the discrepancy in the dating of the Explanatory Memorandum (EM). The EM was first drafted when it was thought possible to make and lay the
regulations before the Scottish Parliament before it rose for summer recess on 7 July. In the event, that did not prove possible. Due care was not taken to amend the EM to reflect this timing change. The reason the Executive failed to adhere to the original timetable lay in the different parliamentary sessions between Westminster and Edinburgh and the perceived desirability of simultaneous implementation of regulations governing an international commodity in Scotland and England. Late changes to the draft regulations proposed by MAFF required inter-departmental agreement, which took the Executive beyond the original timetable.

41. The Executive accepted that section 16(5) should have been cited as an enabling power. The reference to the Department of Agriculture and Rural Development is a reference to the Department so named which has responsibility in Northern Ireland. In response to requests from the Parliament’s legal advisers, the missing EC legislation was submitted. The Executive expressed its regret that time and resources did not allow for the production of a table of derivations.

42. The Executive confirmed that, with regard to the Fodder Plant Seeds Regulations, sub-paragraphs (i) and (ii) of the revised definition of “official examination” are intended to be disjunctive.

43. The Executive stated that the definition of “Certified Seed” appears in regulation 3(3) of the Cereal Seeds Regulations 1993 not in regulation 3(1) of those Regulations.

44. Commission Decisions to be reached in the Seeds Standing Committee are expected within the near future to require amendment of all Seeds Regulations. The Executive has undertaken to take account at that time of the points raised by the Committee in relation to these instruments.

45. The Executive accepts all the points made by the Committee. The Committee therefore draws the attention of the Parliament and lead committee to the instruments on the grounds of defective drafting as indicated above and acknowledged by the Executive.

46. The Committee takes the opportunity to remind the Executive of the need to produce any relevant EC legislation and relevant accompanying documentation timeously. The Committee also wishes to emphasise that the submission of a table cross-referencing the provisions of EC legislation to the relevant implementing provision in the domestic legislation, particularly in the case of complex instruments such as these is of value in its scrutiny of an instrument.