

Scottish Executive Review of the Aquaculture Industry in Scotland

HIE welcomes this review of the aquaculture industry by the Scottish Executive leading to the formulation of a strategic framework for aquaculture. This is an industry which has developed over recent years to become one of the most important elements in the economy and communities of the Highlands and Islands. That said, it is one element in the social, economic and environmental context of the Highlands and Islands and as such must co-exist with an increasingly wide range of other interests.

Given the appropriate regulatory and political environment, we believe that the aquaculture industry can develop further the range of social and economic benefits it brings to the Highlands and Islands. While there is scope to improve the environmental performance of large elements of the salmon farming sector, the growth of shellfish production and the emergence of marine fin fish as commercial farming opportunities offer scope for expansion of direct aquaculture employment as well as in processing and service businesses – including environmental monitoring and management operations.

The industry is estimated to support some 7,000 jobs across Scotland, three quarters being in the Highlands and Islands. Of greatest value in economic and social terms has been the on-farm employment dispersed throughout the rural hinterland and particularly around the coastal margins of the remote mainland and islands. It is in these localities that economic development has been most difficult and in reality there are very limited economic alternatives to the employment provided by salmon farming.

Accommodating an aquaculture industry of more than 150,000 tonnes annual output around the hills, lochs and coastline of the Highlands and Islands has been no mean feat and viewed in its historical perspective, we would suggest that the businesses and agencies involved with this industry over the last 30 years have on the whole performed well. However, we would be concerned if these comments were viewed as indicating complacency on our part. Salmon farming has reached a scale in Scotland where answers must be available to those asking perfectly legitimate questions about the environmental interactions of this new industry.

We share the widely held view that scientific knowledge and understanding is deficient in this area but would emphasise that it is vital that crucial issues such as aquaculture carrying capacity are derived on objective grounds based on the highest quality science. The outcomes of this review have the potential to add significantly to the operating costs of the industry in Scotland. This is of particular concern in the case of salmon farming which faces global competition from certain producer nations where regulatory costs are arguably considerably lower than those faced by EU based producers. Where there is the risk that unsound regulatory decisions may result in significant damage to the environment or indeed to the aquaculture industry, we believe that it is essential that regulation is through objective, transparent decision making, underpinned by the highest quality of science.

Following completion of the Executive's review of the aquaculture industry, we believe that it will be possible to establish a demonstrably sustainable aquaculture industry with wide ranging social and economic benefits for Scotland as a whole and for the Highlands and Islands in particular. There is also the opportunity to set in place effective and efficient aquaculture regulatory systems which will be a model of good practice for other nations to follow.

Highlands & Islands Enterprise

Scotland has an aquaculture industry:

- what are its costs/benefits and what is their objective measure?

The benefits of the emergence of a substantial aquaculture industry are comparatively easy to measure and include direct and indirect employment, sustaining of infrastructure such as shops, schools, services, roads, ferry and air links in the remote peripheral communities of the Highlands and Islands. There is a particularly good fit of employment needs (small work teams) with small remote communities of the Highlands and Islands. There are also benefits to the diet and health of the wider population through consumption of omega 3 rich foodstuffs, salmon being a major source of such fatty acids.

While the benefits are quite readily identifiable, and have been measured in recent economic studies, including PACEC 1999, wider community impacts and economic costs are more difficult to quantify. Every action has a consequence. For example farm sites represent an opportunity cost in the broadest sense perhaps through lost fishing, yachting activity, loss of amenity through wilderness quality. On the other hand it can fairly be argued that aquaculture adds qualities to the landscape which are sought by many visitors to the Highlands and Islands - varied landscape, human activity in communities sustained by aquaculture as well as enjoying the culture of these communities.

- where does the balance of economic, social and environmental "need" lie?

The industry serves a critical economic need across the Highlands and Islands through diversification of the local economy, bringing free market forces to bear in an area where traditional primary sector businesses have had relatively weak market linkages. A salmon farm on the west coast of Lewis for example, will source raw materials (feed ingredients) and sell its products on global markets. In addition to on-farm employment, many supply and service businesses have been established to meet the needs of this new industry, introducing further diversity to local economies.

The jobs provided by such fish and shellfish farms fulfil a social need in that they sustain employment in the most remote and peripheral parts of the Highlands and Islands as well as supporting processing employment in the larger population centres and. In areas such as Ardnamurchan, Harris, north west Sutherland, the industry sustains up to 30% of the working population and is crucial in helping secure local services and infrastructure for the benefit of local communities and visitors to these areas.

The environmental need is that the industry operate in an environmentally acceptable manner, following sustainable practices and not jeopardising current or future businesses based on the marine resource of the Highlands and Islands. We believe that the current scale of the industry has been achieved in remarkably short time with surprisingly little serious adverse environmental impact. The industry is totally dependent on a high quality environment, both for rearing stocks of fish and shellfish which are themselves indicators of high environmental quality and for marketing imagery when promoting the aquaculture industry's products. With a young industry, there appears to be scope to evolve and expand the industry at a modest rate while at the same time lessening the severity of certain environmental interactions. These are positive benefits of economic activity which is dependent on high quality aquatic environments. The development of salmon farming has helped raise awareness of the role of acid rain in the decline of Salmonid populations, a decline in which sea lice from salmon farms have been implicated. There has also been crossover from R&D on salmon farming which has raised the level of knowledge and understanding of the biology of wild salmon populations.

What purpose does the Scottish aquaculture industry serve ?

- how can it help to meet growing market demand at a time when catches of other species are declining (the so-called "fish gap") ?

Long term global trends indicate that the yield from capture fisheries has levelled out. Reductions have been especially notable in landings of demersal species for direct human consumption such as cod. Demand for seafood is growing in developed nations as a premium high quality protein foodstuff and in non-developed nations as a basic protein source. Scottish aquaculture is well placed to address the demands of the former but not the needs of the latter. The Scottish aquaculture industry contributes some 150,000 tonnes of seafood raw material to markets primarily in the UK and mainland Europe. The industry cannot make a direct contribution to the protein needs of the developing nations but can provide expertise and R&D support through for example the University of Stirling's Institute of Aquaculture, to help develop indigenous aquaculture production. Purchases of primary and processed materials (fish meal, cereals) and exports of by products (e.g. fish heads and frames to Nigeria) may be viewed as Scottish aquaculture making a positive contribution to developing nations.

The growth in supply of farmed salmon has in large part countered the decline in cod supply to the UK market and in this context it is evident that aquaculture can and does offer scope to ease fishing pressure on wild fishery resources. Production of fish in an enclosed cultivation system also offers retailers full traceability not only of the food fish but also the feed fed to the food fish. In the context of wild salmon, supplies of farmed fish have progressively lowered the open market price and have in the process enormously reduced the financial incentive for salmon poaching thus providing at least one significant benefit to the wild resource.

The merits of harvesting industrial fish species to feed to farmed fish may be debated (see below) but in terms of meeting market demand, improved management of demersal fisheries may take 10 years or more to be realised whereas aquaculture has demonstrated an ability to deliver significant additional quantities of seafood for direct human consumption. Industrial fisheries appear to be managed in their own right on a sustainable basis. While that situation continues, the supply/demand of aquaculture feeds will simply follow free market forces. Aquaculture is also a minor user of fishmeal compared with livestock feed compounding. The benefits of omega 3 fatty acids are maintained to the final consumer when conveyed via salmon farming, whereas they are lost through e.g. pig or poultry rearing. Furthermore the conversion of fish meal to edible flesh is considerably more efficient in fin fish farming than is possible with warm blooded livestock.

- how can it help the diet & health of the nation ?

Salmon farming can and does help the health of the workforce supported directly and indirectly by the industry, most immediately through the employment and wage income it sustains. Also the Scottish industry is providing high quality, protein rich, low fat seafood (approximately 75,000 tonnes per annum to the UK consumer), most of which is rich in omega 3 fatty acids, vitamins and trace minerals. Clearly these foodstuffs can only provide benefits however if people chose to buy and consume them – which means that they must be competitive and desirable in the food market.

A further significant benefit which we see as being provided by salmon farming in particular is the exposure of rural entrepreneurs and communities to global market issues without the market support of systems such as the CAP and the CFP.

How is each sector of the industry placed to compete internationally both now in the longer term (5-10 years)

There is no question that salmon farming specifically has developed into a global industry which is dominated by commodity trading practices. Key advantages which remain to be exploited by the Scottish industry's international competitors relate to labour and environmental costs although there may be lesser differences in costs of sourcing raw materials and servicing markets. South America is seen as providing the most serious challenge to West European salmon and shellfish producers with growing exports of farmed salmon and scallops. Chile has relatively low labour costs, proximity to sources of fish meal and some suggest that enforcement of environmental regulations may be less rigorous. Harmonising of the environmental regulations is a highly desirable objective as this would enable fair international competition on commercial rather than political grounds.

The situation is rather different for shellfish farmers in Scotland who are developing their output and the UK market alongside existing large industries in Europe. They face the prospect at some point in the future of attracting lower cost products into the UK market they have been nurturing.

While workforce training delivery can be present logistical difficulties to trainers and trainees due to the geography of the Highlands and Islands, we believe that workforce skills must be accorded a higher priority – particularly when labour costs are comparatively high the standard of certain key competitors. The emergence of new species in marine fin fish farming, technological changes including recirculation based production and the need for greater environmental monitoring by the workforce demonstrate the importance to this industry's future of training facilities such as the North Atlantic Fisheries College in Shetland and the Seafield Centre in Wester Ross in delivering workforce training and enabling distance learning via IT systems installed on virtually every significant marine cage farm site.

In the broadest terms we see the future for aquaculture as a broadly based sector, in terms of species, company sizes, geographical production areas and end product characteristics. The global market for farmed salmon is generally accepted to have developed the characteristics a commodity market. Opportunities exist for the further development of distinctive premium quality products linked to Scottish origin branding but it is important to appreciate that while this approach may be appropriate for niche products it is unlikely to be able to deliver premium prices across the Scottish salmon farming industry.

- how can the industry diversify ?

This is principally a matter of diversifying species produced by the Scottish industry, as a means of providing a series of viable business options to operators of marine fish cage farms and, at a strategic level, reducing the vulnerability of workforce and dependent communities through the industry's excessive reliance on one farmed species. For most of the last 25 years the only commercial option to a cage farm operator was to stock salmon smolts. Now, a small number of sheltered inshore cage sites in Ardnamurchan, Lewis and South Uist are rearing halibut and project a harvest in 2002 of over 300 tonnes.

We would favour a diverse range of business size and ownership, although accepting that commercial pressures have concentrated ownership in increasingly few overseas based companies. We believe that local ownership and management of businesses in general provides operations which are more innovative and more responsible to local interests. However businesses need to be able to secure investment to diversify into new species and particularly into new production sites and therefore must be viable - or be able to demonstrate future profitability. Our wishes must therefore be tempered by commercial reality.

The high recent level of trade interest in farmed cod, and to a lesser extent halibut, has been strongly market led and retailers' interest extends also to haddock (with a multi-partner demonstration haddock farming project now underway) with farmed mussels and species from the Mediterranean such as sea bream and sea bass becoming increasingly common on the fish counter.

It is essential that aquaculture regulation recognises that these new species differ from salmon with regard to issues such as the nature of their environmental impacts, their potential for impacting on wild or other farmed fish or shellfish including the risk of transmission of disease and parasites.

- how might it otherwise increase competitiveness ?

We do not believe that the aquaculture industry in Scotland and particularly the Highlands and Islands is in a position to pursue the role of lowest cost producer of any of its aquaculture products. Clearly markets differ considerably for individual species and their different fresh, frozen and processed formats. The opportunity remains for industry to exploit the cachet of Scottishness by identifying discriminating markets and promoting and differentiating quality product ranges which can secure a price premium. Branded produce which can demonstrate enhanced standards of environmental or welfare performance will also provide niche opportunities with the Organic standard the most obvious example. Small and medium sized salmon farms in Orkney, Shetland and North Uist have attained the Organic certification and are obtaining premium prices, however the absolute price level will be linked to mainstream commodity market trends – as well as supply and demand within each market niche - but a premium will have to be maintained to cover the additional costs of operating in, for example, a more stringent environmental regulatory climate.

The aquaculture industry will continue to be subject to global free market pressures and will have to embrace efficiency and capacity investments as required by that market. Marine fin fish cultivation is a young industry which has grown rapidly in western Europe. There is considerable scope for such a young industry to evolve, improve and adapt its operations with respect to legitimate areas of concern.

A crucial element in the industry's ability to evolve and adapt in the future is its workforce. There will be a continuing requirement for training and retraining in the aquaculture workforce as one means of delivering the necessary competitiveness and high standards of business and environmental performance which will be demanded of this industry.

If the industry is to be sustainable (both in its own economic terms and environmentally):

- what factors (e.g. impact on fish stocks used for fishmeal) need to be taken into account?

The requirement for fishmeal has grown with diets for salmon farming requiring high grade fish meals. Conversion rates of industrial fish species to farmed salmon are better than those in the natural food chain and are significantly better for fin fish farming than for the rearing of livestock such as pigs and poultry which are the major users of fish meal. Feed manufacturers are however looking ahead to a time when fishmeal supplies could limit growth in the output of farmed fish (and shellfish such as tropical prawns). Trials are underway to examine the feasibility of sourcing vegetable proteins and oils for fish diets. Problems of palatability (to fish and to people) have been experienced but investigations continue, these factors being fundamental to the feasibility of such moves.

The salmon farming industry now specifies the geographical region of origin of fish meals for salmon feeds in order to minimise the levels of ubiquitous and persistent pollutants such as dioxins and PCBs. Concerns have been expressed by certain consumer sectors but retailers have been reassured of the safety of farmed fish by the measures in hand through the aquaculture industry and its feed suppliers.

Shellfish farming also has some theoretical impacts on fisheries since the process removes nutrients from the lower levels of the marine food web. There are also issues relating to predator management (e.g. eider duck). There is however the opportunity, in theory, to locate shellfish or seaweed farms in the vicinity of fin fish farms as a means of moderating the effects of nutrients introduced as a result of the fin fish operation. This will require considerable research before its feasibility can be established.

- what further growth would be compatible with our environmental aspirations?

HIE believes that the aquaculture industry can evolve its operations such that production of the current order of magnitude can be achieved well within acceptable levels of environmental impacts. Indeed we would suggest that with time, improved environmental performance of fin fish farming linked to production of farmed shellfish might enable output to approach the order of 200,000 tonnes per annum. The interpretation of “acceptable” may change over time but commercial operations can adapt to a range of regulatory or market pressures given a suitable period of time.

- what level of environmental pollution would be regarded as "acceptable" - can we devise a measure?

“Acceptable” impacts will vary with location and with time. In the 1980s there was furore over plans to site smolt cages in Loch Ness with extensive local and national media coverage before the application was approved by Highland Regional Council. A subsequent application to double the size of the cage site went through the Council unopposed and currently few if any visitors to Loch Ness are aware of the cage farm’s existence.

It is important that wherever possible, objective measures are established for acceptable environmental disturbance – such as SEPA has operated for a number of years. How aquaculture units are monitored to secure compliance with the environmental standards is something we believe is for regulators to arrive at in discussion with industry and others (e.g. local authorities and community interests).

We would suggest that with the obvious exception of wild salmon and sea trout, there is little clear evidence to date of anything other than inherently localised and short term or reversible impacts of cage fish farming. That said there is no basis for complacency and it is essential that the impacts of this industry be better understood at both local and regional levels.

- what can Scottish coastal waters (however defined) sustain?

This depends on the mix of species and technologies for fish and shellfish cultivation and the influences of a range of human activities such as fishing, farming, forestry, oil exploration and extraction, as well as short and medium term hydrographic and climatic changes affecting our marine environment. Our view, as stated above is that given the limited nature of demonstrable adverse impacts associated with the current level of industry activity, with widespread adoption by marine salmon farms in particular of the principles and practices of environmental management systems, the H&I could support an industry producing in the order of 200,000 tonnes of fish and shellfish per annum.

While industry, administrators and regulators alike have historically been involved in and condoned practices which would fall short of current best practice, it is important to recognise that hindsight is invariably perfect. Lessons need to be learned from past experience in shaping the future for this industry and its regulation. One lesson might be the need for more responsive handling of applications for the authorisation of new medications of medicine licensing. The availability of environmentally acceptable, efficacious treatments are a necessary part of any responsible farming operation.

- how might environmental impacts be reduced?

The aquaculture industry may be viewed as having a number of environmental impacts and therefore the means of their reduction are various – similarly their cost implications vary to industry and others. One consistent requirement however for achieving best environmental practice is a motivated, well trained and educated workforce and we expect to see environmental sciences assume much greater prominence in future aquaculture training qualifications.

The visual impacts of aquaculture in the landscape may be moderated by greater care and attention by the developer and regulatory bodies to the siting and design of fish farms as well as their installation/construction as well as through selection of materials and colours of shore bases, barges, roofs, parking of vehicles etc. As an example of another environmental impact, the possibility of accidental escape of farmed salmon is reduced through companies' compliance with the Executive's code of practice on prevention of fish escapes.

It has been suggested by some that a substantial proportion of marine fin fish aquaculture should be transferred from sea cages to pump ashore tanks (see comments under locational criteria below). It is possible that rearing of halibut will be economically viable in pump ashore farms but economic pressures currently appear to favour cages rearing beyond the nursery stage. Halibut and cod appear to have rather better feed conversion rates (and lower nutrient discharges) per tonne of production than salmon so if they substitute partially for salmon there will be an incremental reduction in nutrient loadings in coastal waters and in freshwaters (due to reduced salmon smolt placements).

There may be prospects of containing, and/or collecting the insoluble wastes from cage farms. Collection systems have been trialled in freshwater but with little success to date. One collection system supposedly in use in Norway uses a tarpaulin bag in place of the conventional cage net with water pumped into the cage and a piped exit flow. This would in theory permit treatment of the effluent flow which in turn raises issues about the fate of the products of the treatment process.

Nutrient budget management is an expression which has emerged in recent months. As mentioned above, units producing shellfish or seaweeds may moderate the quantity of nutrients released into coastal waters by fin fish farming and could reduce environmental impacts of the fin fish sector. The shellfish or seaweed units would of course themselves present environmental impacts of their own, particularly in terms of visual impact.

The specific impact, which is of greatest concern to us, has been that of sea lice on wild salmonids. The scientific arguments may continue but it seems clear that lice from farmed fish have had some level of negative impact on wild salmonids – amongst we believe a number of negative impacts (afforestation, legal and illegal exploitation, acid rain and climatic change – oceanic feeding areas). The essential prerequisite to a solution has been effective and environmentally acceptable treatments for sea lice on salmon cage farms. With these at last becoming available (after something like 10 years of R&D effort) there are realistic opportunities for salmon farming and fishery interests to generate constructive actions as we see in the Area Management Groups established under the Tripartite Working

Group process and their AMAs. It is essential that industry and others develop and adhere rigorously to integrated pest management disciplines within their Environmental Management Systems.

The impact of fish and shellfish of farm origin on the genetic make up of wild populations is more subtle and probably of significance only to wild salmon given its reduced numbers and the tendency for fish to home to their parental river and develop discrete populations even within different parts of the same river. Efforts must continue to reduce the numbers of farm escapees. Suggestions that farms should be stocked with sterile fish are not currently feasible. Triploid (sterile) fish underperform in terms of growth, survival, susceptibility to sea lice and consumer appeal (may be perceived as GMOs).

What should be the criteria for locating fish farms:

- should farms be sited further off-shore?

Where a farm is demonstrably giving rise to unacceptable impacts upon other interests then clearly that site should curtail those impacts or face being closed down. Moving production facilities into more exposed locations may bring some environmental benefits but will also bring additional risks as well as costs to the farm operator (equipment and site servicing, storm damage, stock escapes) – which under current trading conditions are likely to be unsustainable for most businesses – and may interfere with a different set of stakeholders such as fishing and commercial navigational interests. Equally, simply moving a perceived problem is not a responsible solution and cannot be an acceptable alternative to ensuring that aquaculture businesses operate in an environmentally responsible manner.

- should they be land-based (*anywhere* in Scotland)?

It has been suggested that fin fish farming might be moved onshore. As many as a dozen pump ashore salmon farms were running in Argyll and in the Orkney islands in the 1980s. All have halted salmon production and have closed or converted to marine species since salmon production rapidly became an uneconomic prospect for pump ashore farms other than as broodstock units. While pump ashore farms offer a piped outfall – theoretically amenable to treatment – to site the current salmon industry onshore would require perhaps 100 coastal sites each of say 10-20 acres of flat ground (not bedrock) with pumps, large tanks and good road access. This would clearly pose an enormous challenge to the planning regime and would establish a very permanent concrete “footprint” for the industry, unlike the current system of cage farms which can be taken off site in a matter of days.

There is no fundamental objection in principle to land based aquaculture units. In broad terms, they promise improved control of all aspects of the unit’s operation but at much higher capital cost and similar running cost. The refinement of recirculation technologies has seen a significant increase in the number of freshwater salmon units operating recirculation technology and it will probably feature in future production of juvenile halibut, cod and possibly haddock. New pump ashore developments may explore the opportunities offered by modern renewable energy technologies, such as water pumps, wind generators, alongside pump ashore farms to reduce energy costs but this would probably require a more favourable fiscal regime than currently applies to such installations.

The precise location of future land based units will be based on the usual commercial factors as well as national and local planning requirements. Our view is that it is unlikely that salmon will be farmed profitably in seawater pump ashore units, however there may be commercial opportunities to develop a limited proportion of farmed halibut output in pump ashore units.

- should they be otherwise re-located (and if so, when and under what conditions)?

As above, where a farm is demonstrably giving rise to unacceptable impacts upon other interests then the site should curtail those impacts or face being closed down. The precise circumstances are difficult to define and perhaps can only be defined on a case by case basis.

In the absence of commercially viable offshore technologies it has to be recognised that, in terms of current knowledge and understanding, Scottish coastal waters have little opportunity to accommodate new aquaculture sites (we would suggest particularly so with regard to fin fish sites). This makes it all the more important that decisions on closure and relocation should only be considered when other remedies have been exhausted.

Aquaculture will be bound by the terms of the new Water Framework Directive:

- what will be the Directive's impact on the industry?

The impacts of the water framework directive are not yet fully understood – by industry or by regulators. It does appear to offer a crucial opportunity for the relevant Scottish legislation to be revised to reflect the emergence of (and potential future developments in) marine and freshwater aquaculture.

One feature of the new water legislation will be the adoption of River Basin Management systems, which represents a philosophy which HIE strongly advocated in responding to the Salmon Task Force report in 1997 in the form of Integrated Catchment Management. There would appear to be analogies with the TWG approach of establishing Area Management Groups to develop Area Management Agreements.

Whatever detailed implications there are for the aquaculture industry, it appears that those who utilise and otherwise interact with water resources will have to contribute to the management and conservation of the water resource. We cannot see this as anything other than a positive move.

- on what basis will aquaculture be expected to co-exist with other water users?

We would suggest that all water users would have certain rights under law. Aquaculture businesses will continue to require high water quality standards and as such are more likely to be disadvantaged by other users' activities than the reverse. This industry can, in principle, serve as a sentinel for the aquatic environment.

What should be the role of the public sector :

- can it be both regulator and sponsor?

The public sector covers a wide range of interests and responsibilities (statutory and otherwise): local authorities, Scottish Executive, Enterprise Networks, SEPA, Food Standards Agency. In our response to the earlier SEERAD consultation on industry regulation we expressed the view that, while we sympathised with the industry's request for a single regulatory body for aquaculture, it was not really a practical option. It is clear that the range of responsibilities discharged by these bodies cannot be encompassed in a single organisation without compromising their distinct operations and would run counter to the philosophy

which led to the separation of food safety from food production responsibilities within government with establishment of the Food Standards Agency.

We believe that the public sector must carry the overall responsibility for regulation. However there may well be areas in which the private sector could play a greater role in delivery of regulatory functions (e.g. lab monitoring work on fish disease, algal toxins etc). There is a need for the relevant agencies to come closer together to improve the standard, transparency and consistency of regulatory service and the Highlands and Islands Convention Aquaculture Forum offers a valuable opportunity to explore some of these matters.

- should it continue to be investor?

The current and prospective nature of the aquaculture industry, in terms of domestic location and international competition, is such that selective support through HIE Network and FIGG can be fully justified. Indeed support will be required to help the salmon sector in particular to implement the necessary environment and competition driven investments which are in prospect. The value to the Highlands and Islands, to the UK and to developing countries of the growing base of aquaculture research expertise also deserves continued public funding (coming from various sources e.g. DTI LINK, Research Councils). Research and understanding of the environmental interactions of this industry has lagged behind commercial activity, both here and abroad, and further public support will be vital to delivering the underpinning knowledge to inform future regulation and operation of this important industry.

- what should it be?

Public funds will be required to meet at least part of the costs of the regulatory regime. It is entirely appropriate that the industry makes a reasonable contribution towards these costs although the balance of contribution by general taxation and by direct charge is a complicated matter for industry to negotiate with regulators as and when necessary.

As far as possible, public funds should serve as a catalyst to secure participation by industry and wider commercial interests (feed firms, insurers, retailers etc.) Clearly, research which is near market should secure greater levels of private funding than should research of a more strategic, pre-competitive nature.

What should local government's role be in the regulatory process:

- can/should it be more than regulator?

We would suggest that the future operation of planning legislation and national planning guidance would be the principal role of local government with regard to the industry. Shetland Islands Council have discharged control of coastal aquaculture developments and Highland Council have embraced the revision of Aquaculture Framework Plans for the larger sea lochs along their coastline. Clearly there are other local authority functions such as Environmental Health and economic development as defined by Local Economic Fora. We see a valuable role for local authorities in partnering Enterprise Network Activities where these have been agreed by the relevant Local Economic Forum.

What aspects of the industry should be supported by government research :

- what criteria should be applied in identifying research priorities?

We would suggest that limited public funding should be focused on securing through strategic research the underpinning knowledge necessary to provide the aquaculture industry with an appropriate regulatory environment in which to operate. The changes in regulatory environment which most anticipate will come about as a result of this review will generate winners and losers in the industry. Given the local and national importance of the aquaculture industry and the environments in which it operates, it is essential that regulators' decisions are based on the best available information, secured by objective well resourced scientific investigations.

At a UK level the Committee for Aquaculture Research and Development (CARD) was established in the early 1990s following a House of Commons committee investigation of aquaculture and was charged with identifying strategic research priorities and increasing the cost effectiveness of publicly funded research by avoiding duplication of effort and encouraging co-operation among institutions. There is a clear need, post devolution, for a forum to carry out the functions of CARD in identifying strategic research priorities and directions specifically for the aquaculture industry in Scotland. We would see a continuing role for CARD in view of existing trout and shellfish production in England and Wales with emerging marine fish recirculation based onshore farms. Processor, distributor, retailer and consumer interests supplied by Scottish aquaculture will continue to have their centre of gravity in the south of the UK and it is important that Scottish aquaculture retains a strong presence in CARD.

Below this level of strategic research of national and possibly international importance, we suggest the closer the research is to the "near market" category, the lesser the requirement for public funding of aquaculture research. HIE may participate as a partner in certain research and development projects, over the long term however we would expect the financial burden for anything other than strategic research moving increasingly to the private sector. The DTI LINK Aquaculture programme served to reorient many researchers' activities in the context of the medium to long term needs of the industry and it is widely regretted that it was not possible to secure a continuation of this programme.

- should there be some external scrutiny of the research proposed/undertaken?

We would argue that there is a need for expert scrutiny of all requests for public funding. Research may well require external scrutiny but it is important not to lose sight of the customer in all these processes and programmes. As noted above, the aquaculture industry greatly regret the inability to continue the DTI LINK Aquaculture but this programme had a lengthy decision making timescale and appears to have had certain inflexibilities which frustrated many involved in the programme.

- what should be the FRS role in aquaculture-related research?

There is a clear role for the Fisheries Research Services in aquaculture-related research involving both the Marine Laboratory and the Freshwater Fisheries Laboratory. In hindsight, greater integration of the working of the two laboratories might have improved the overall handling of the emerging problem of sea lice from farmed fish. While FRS has for some years been a research contractor competing with other laboratories and institutions, it has an extremely important role to fulfil through its strategic research including advice for ministers and is still widely regarded as a source of impartial information founded on sound scientific research.

The current mix of "advice to ministers" and contracted research appears to be generally satisfactory although there have on occasion been alleged conflicts of interest and Allan Berry's allegations are one such example. It is important that FRS retains its reputation for

independence and we would suggest that further consideration be given to ways in which FRS can undertake contract research through competitive tendering while at the same time maintain a reputation for independence from commercial and political considerations.

- should there be joint-funded industry/Government research projects (e.g. new technology, new species)?

Yes. There will always be areas in which commercial gain is in such doubt or is so distant in time that it proves difficult if not impossible to secure investment from commercial sources in research which would ultimately serve a common good. Environmental interactions of aquaculture is one example where clearly there has been “market failure” of the type described. Similarly, progress to species diversification in aquaculture has until recent years been an area in which investment by commercial operators has been limited and public sector intervention was necessary to stimulate activity.