UK Aquaculture R&D Database
Strategic Summary 1999-2009

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Terminology and abbreviations

All acronyms are cited in full upon first usage in the text.

Author's address

FRM Ltd
7 Atholl Gardens
Dunkeld
Perthshire
Scotland
PH8 0AY

Tel:/Fax:+44 (0)1350 727484
Email: info@frmltd.com
Website: http://www.frmltd.com

UK Aquaculture R&D Database – Strategic Summary 1999 - 2009

Introduction

The Department for the Environment Food and Rural Affairs (Defra) sponsors FRM Ltd[1] to compile a database of UK funded aquaculture related research and development (R&D). All the major UK sponsors of R&D are asked to complete and return an Excel proforma spreadsheet annually. A list of the sponsors approached is included in Table1. The majority of significant public and private sponsors of R&D submit data. Responses from industry bodies are patchy, but much R&D is collaborative and therefore we anticipate that most significant projects are included in the database.

Although the full database contains pre 1999 records, these data tend to be less reliable and for the purposes of analysis, only records of projects with expenditure from 1999 onwards are included.

As sponsor's own data management has improved, so too has the quality and continuity of the data submitted. The R&D database has therefore gradually included an increasing number of historic as well as recently commissioned projects.

Table: 1

Sponsors approached for data
Defra (Department for the Environment Food and Rural Affairs)
The Scottish Government
Aquaculture Wales
DARDNI (Department for Agriculture and Rural Development, Northern Ireland)
NERC (Natural Environment Research Council)
BBSRC (Biotechnology and Biological Research Council)
FSA (Food Standards Agency)
ASSG (Association of Scottish Shellfish Growers)
SAGB (Shellfish Association of Great Britain)
SFIA (Seafish Industry Authority)
BMFA (British Marine Finfish Association)
SSPO (Scottish Salmon Producers Organisation)
BTA (British Trout Association)
OATA (Ornamental Aquatics Trade Association)
SARF (Scottish Aquaculture Research Forum)
HIE (Highlands and Islands Enterprise)
The Highland Council
SEPA (Scottish Environment Protection Agency)
EA (Environment Agency)
SNH (Scottish Natural Heritage)
The Crown Estate

The principal use of the R&D database is to facilitate more efficient and transparent co-ordination and management of research fund allocation. Access to project summary information can also be helpful guide to those requiring technical information on specific projects. By providing access to historic and contemporary project data, the database serves to reduce duplication of effort and helps to identify gaps in the UK's R&D portfolio. The database also facilitates the development of a strategic vision of the research being conducted to underpin the sustainable development of the aquaculture sector. Resources to support R&D are scarce and analysis of the database is providing important insights into expenditure patterns and, increasingly, the capacity to project important trends.

The database is available from both the Defra and FRM websites as an Excel spreadsheet http://www.frmltd.com/UK_Aq_Database/UK Aquaculture R&D Database 1999-2009.xls

A searchable version of the database is also available at:
http://www.frmltd.com/UK_Aq_Database/index.php

[1] Database and summary produced by Dr M. A . James – FRM Ltd – 13-8-09.

Data limitations

Some sponsors do not provide data or do not provide complete data and therefore the database does not capture all aquaculture related R&D supported in the UK. Commercially sponsored projects tend not to be reported unless conducted in collaboration with public sector sponsors. Some sponsors provide details on projects which are not relevant to aquaculture and these are excluded from the dataset based on experience. Some organisations do not include project cost in their returns. Whilst these projects are included in the database for reference, they are not taken into account in any analysis. These represent a relatively small proportion of projects and overall expenditure. Organisations such as Department for Agriculture and Rural Development, Northern Ireland (DARDNI) and the Environment Agency (EA) conduct aquaculture related R&D and have this year, for the first time, provided data. The data presented represents a snapshot and is likely to include most of the UK public expenditure contributed to aquaculture related R&D between 2000 and 2009. Summary figures provided in this report are calculated directly from the database as compiled in March 2009 and will therefore be an under estimate of project number and sponsor expenditure for 2009/10.

Only the calculated total cost of the project to a named sponsor is used for analysis as this represents a known cash contribution. Whilst sponsors may provide total project costs, these include undefined in-kind and cash contributions from project participants and co-sponsors.

Only project data with a start and end date together with a cost to sponsor are included in analyses. Historic data which is incomplete is retained within the database for information but is not used for analyses.

Annual project costs are estimated by calculating the total number of project days (1st January to 31st December) from the difference between the project Start and End dates, dividing the total cost to sponsor by the total number of project days to give a daily rate and then allocating this rate *pro rata* over the life of the project. This calculation may not reflect the true project expenditure profile or actual staff time allocations, but is likely to provide a reasonably accurate picture of expenditure over time given the number of projects used for these analyses. Calculated project costs are rounded to the nearest pound sterling which may lead to minor total summing errors which are insignificant in descriptions of overall patterns of expenditure as presented below. The duration and cost of a project does not provide any measure of productivity.

The projected trends provided are based on the database as compiled and are subject to change as a result of both the addition of new projects as well as historic project data being submitted.

Description of the Data

The database contains the following project information:
Project Code; Title; Start Date; End Date; Project Summary; Project Cost to Sponsor; Total Project Cost; Main Sponsor; Sponsor contact; Main contractor

Data is categorised as follows:

Main categories:

- **Salmonids** (salmon and trout)
- **Shellfish** (bivalves, gastropods, crustaceans and echinoderms)
- **Finfish** (marine finfish of aquaculture interest such as cod, haddock, halibut, turbot etc.)
- **Aquaculture General** (aquaculture related projects not attributable to the other categories)
- **Fish General** (non-commercial fish related projects of relevance aquaculture)
- **Fish Other** (mainly references to ornamental fish)
- **Algae**

Subcategories:

- **Nutrition**
- **Husbandry**
- **Environment – includes shellfish hygiene**
- **Disease**
- **Physiology**
- **Genetics**
- **Economics and Markets**
- **Life stages**
- **Omics**
- **Reproduction**
- **Behaviour**
- **Equipment and Systems**
- **General**

Projects are allocated to category and subcategory with reference to both title and project summary. Some projects could be allocated to two or more categories, or more refined categories. Project categorisation is based on the primary focus of the project. Where available this is based on the project summary rather than the title only.

For the first time, the database has been further categorised to identify records relating to projects that are likely to produce results of potential interest to aquaculture:

- **Directly relevant applied R&D – directly relevant to the**
- **Relevant applied R&D**
- **Relevant fundamental R&D**
- **Not relevant**
- **Not R&D**
- **Uknown**

Records categorised as “Not relevant”, “Not R&D” or “Unknown” are not included in any analysis. Relevance is determined on the basis of experience and may therefore be subjective. However, the purpose in disaggregating data records on the basis of “relevance” may exclude relatively large amounts of project expenditure that is be being quoted as related to “aquaculture” by some sponsors. This may be an artefact of the way that their data is categorised and extracted.

We are defining aquaculture as the active cultivation and husbandry of species (plant and animal) in the aquatic environment.

Some freshwater fisheries related data has been included in this year’s dataset and we hope to expand these records in the future. Some of these data are relevant to aquaculture and have been included in analyses.

Data Summary for 1999 – 2009 – Aquaculture "relevant" projects only

Total number of projects – 589 (including duplicate records for co-sponsored projects)

Total number of "relevant" records (see above) –
Directly related applied R&D - 357
Related applied R&D - 50
Related fundamental R&D - 67
Not related - 73
Not R&D - 16
Unknown - 26

Total number of "relevant" related records analysed - 431. A total of 43 "relevant" records were excluded because they ended before 1/1/99, or no date or cost data was provided.

Project commitments extend to 2014

Total calculated cumulative cost of relevant R&D to Sponsors – 1999 – 2014 = £64.95 million

See Summary Table 2.

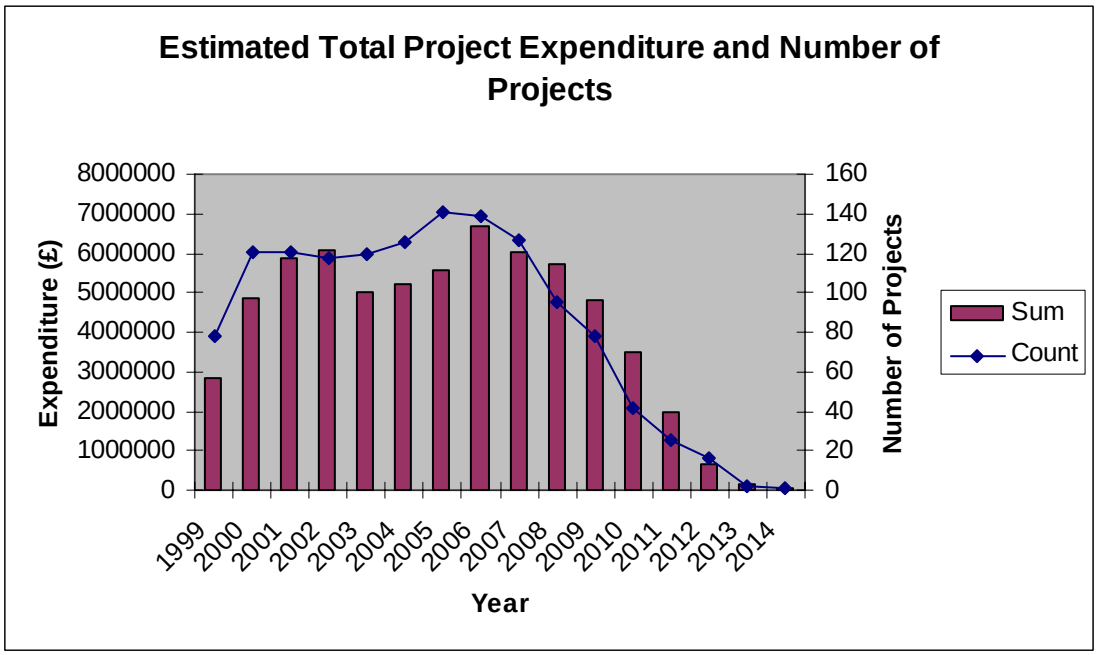

Figure 1 Total sponsor expenditure on aquaculture related R&D per year together with the total number of projects.

The histogram shows current commitments until 2014. Sums remain to be committed for 2009 onwards. The total expenditure in 2008 was approximately £5.71 million – a fall of approximately £0.3 million on the previous year. Within the context of the overall commitment to UK aquaculture R&D the reduction in expenditure in 2008 falls within the range of expenditure fluctuations seen since 2000. However, it is important to note that for the first time, figures from 2007 onwards contain new data provided by the EA and DARDNI. If these data are extracted, the underlying decrease is greater with estimated total expenditure of £4.8 million – approximately 8.6% lower that the previous year. Figure 2 suggests that there is no significant trend in estimated total expenditure between 2000 and 2008 if the EA and DARDNI are excluded from the dataset.

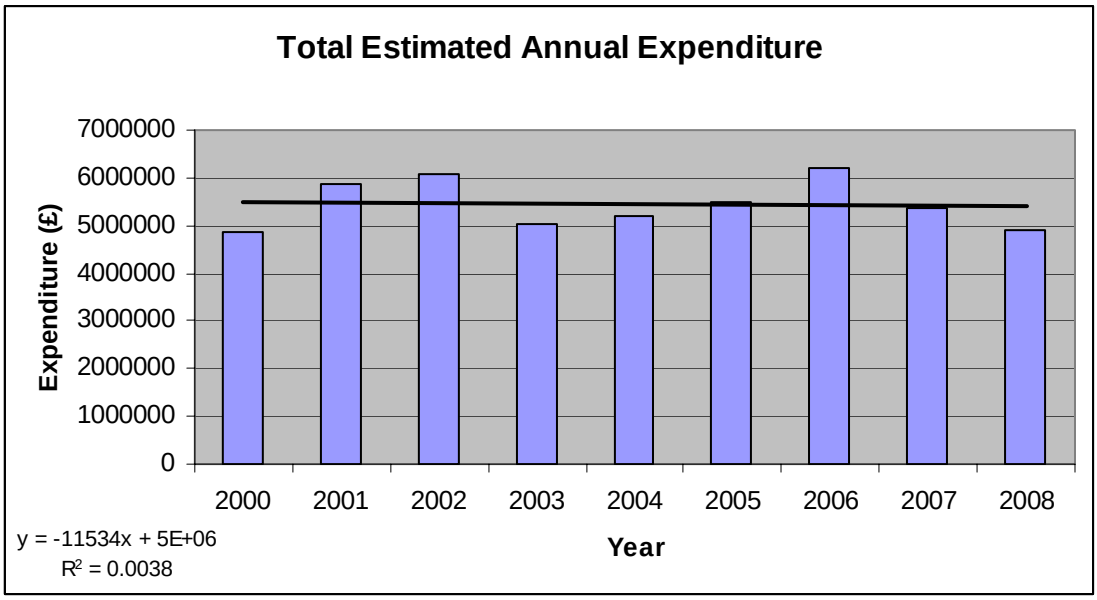

Figure 2. Total estimated annual expenditure (EA and DARNI expenditure excluded)[2]

The overall increase in levels of mean per project expenditure for the period 2000-2008 is suggests by Figure 3, with a projected annual increase of approximately 1.76%. In previous reports we have calculate the annual increase as being higher. The refinement of the dataset to focus on projects that are definable as "relevant" to aquaculture probably accounts for this difference. The underlying average inflation rate between 1997 and 2007 has been about 2.7%[3]. This being the case, we must assume that the average cost of a project has fallen behind the rate of inflation, with a cumulative difference of about 7.5% between 2000 and 2008. The mean annual cost of a project in 2008 was £58,211 (SE £8,238). However, there is significant variation in annual project costs because many of the Government funded agency projects may be categorised as broad areas of work consisting of a number of discrete project lines which are not defined within the data provided. Hence the disproportionately large sums allocated against some agency led projects.

Project Number

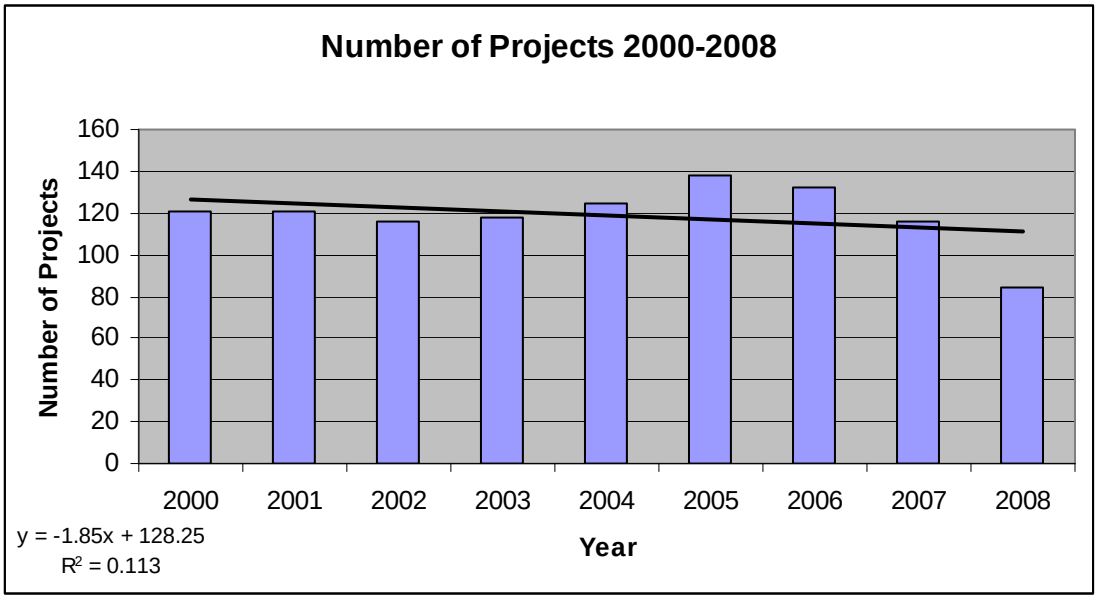

Figure 4. Number of projects supported annually between 2000 and 2008

[2] Note: For the purposes of interannual comparisons, DARDNI and EA data which pertains to 2007 onwards only, are excluded from the analysis.

[3] http://www.thisismoney.co.uk/news/article.html?in_article_id=420045&in_page_id=2 - 1997-2007 average inflation: 2.7%

Since 2000 the number of projects "relevant" to aquaculture has fluctuated around 120. However, there appears to be a significant decline in project number between 2007 and 2008 to 84. This decrease in project number appears to directly mirror the increase in mean project cost noted in Figure 2 for 2008 and is further emphasised by the overall reduction in expenditure for the same year in Figure 1. Figures for 2009 are incomplete at the time of writing, but anticipating the strong downward pressure on public expenditure that is likely to occur from 09/10 onwards, it would seem likely that this decline in funding and overall project number will continue. In previous reports we have noted a slight increase in project numbers underpinned by reduced project duration. Clearly there is a point at which reduced project duration is no longer sufficient to balance reduced funding and increasing cost.

The following analyses of expenditure by sector, subject area and sponsor include data from DARDNI and the EA which only pertains to projects post 2007. The majority of data is complete between 2000 and 2008 and this will form the main period of analysis unless stated otherwise.

Spend by Sector

See Table 3

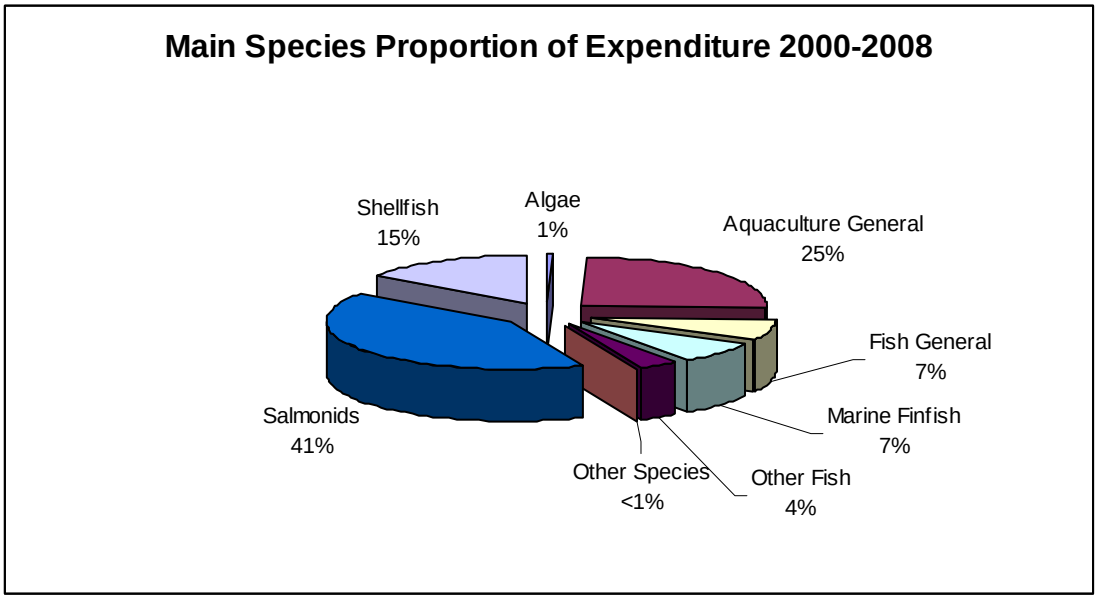

Figure 3. Percentage expenditure on aquaculture related R&D by sector 2000-2008.

Expenditure on salmonids and principally Atlantic salmon accounts for more than 40% all R&D expenditure, with R&D commitments to marine finfish such as halibut, cod accounting for 7% of total expenditure between 2000 and 2008. R&D work on marine finfish has been in decline in the UK for at least the last two years reflecting the lack of commercial success within this sector in the UK. The ability to conduct commercially relevant R&D is often predicated on the need for research providers to have access to fish and commercial facilities. Sponsors are also increasingly reluctant to commit limited resources to sectors that appear not to be "developing" or have suffered conspicuous commercial failures. In the absence of proper analysis of such failures, the move to reduce support for some related subject areas may be premature.

Shellfish R&D accounts for 15% of expenditure, with the majority of expenditure focusing on shellfish hygiene only.

A considerable amount of generic aquaculture related R&D (25%) is captured in the database which is further categorised under subject area below.

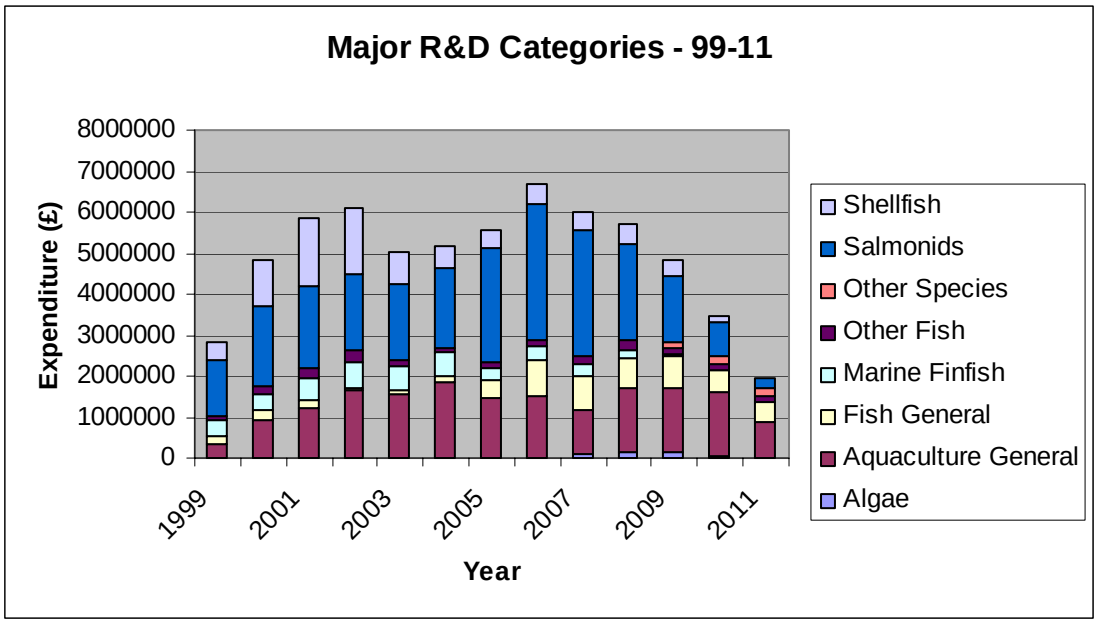

Figure 4. Annual estimated expenditure by Sponsor – 1999-2011.

Other fish, includes ornamentals which account for about 4% of R&D expenditure – much of this sum is accounted for by disease related work on Koi Herpes virus.

Over the past decade, the UK has committed very little expenditure to non-fish and shellfish aquaculture and work has focused on relatively few species including: Atlantic salmon; rainbow trout; halibut; cod; Pacific and native oysters, and blue mussels.

The development of non-food use aquaculture species, although a long term aspiration, has not been the subject of any significant research in the UK. Projected increases in population and changes in demographics and climate change, coupled to increasing pressure on a wide range of supplies of raw materials suggests that this is an area where some strategic investment is required.

Expenditure on algae and the potential use of macroalgae as a source of biofuel has increased dramatically over the last two years, but much of this expenditure is from the EU and not captured in full in the current database. With regard to biofuels, microalgal production is an increasing feature of R&D elsewhere in the world.

Spend by Subject Area

See Table 4.

R&D expenditure is increasingly dominated by disease related R&D – accounting for 59% of expenditure between 2000 and 2008. The majority of this expenditure is committed through the Government Agency laboratories of Cefas Weymouth and FRS Aberdeen (now Marine Science Scotland). In Scotland the focus remains on aquaculture related diseases. In England and Wales there has been a change in focus over the last five years towards a broader view of disease reflecting the wider range of freshwater coarse fish species and amphibians. With a much smaller aquaculture sector by value and volume than Scotland, the emphasis has shifted to protection of wild stocks.

The amount and proportion of expenditure on environmentally related R&D has been reasonably stable for the past 4-5 years and accounts for 19% of expenditure between 2000 and 2008. The main decline in environmental research was accounted for by the significant reduction in shellfish hygiene work funded by the Food Standards Agency between 2000 and 2003.

Whilst a proportion of the expenditure in both the disease and environment areas is designed to address the needs of industry the majority of expenditure is driven by policy and regulatory requirements.

Between 2000 and 2007 there has been significant investment in genetics related studies, particularly with selective breeding. There have also been major EU and international projects in this area, but expenditure now appears to be tailing off. Similarly, a raft of physiological studies has been conducted, capitalising on the use of novel molecular (omics) tools. Funding in this area is also tailing off – in the applied arena at least.

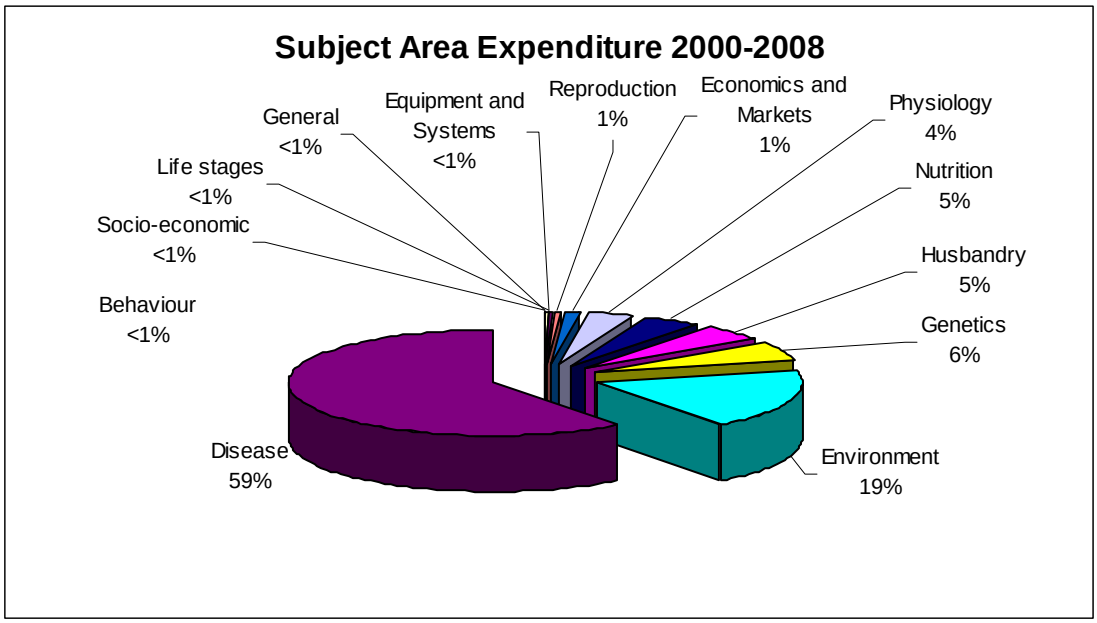

Figure 5. Percentage expenditure by subject area 2000 -2008

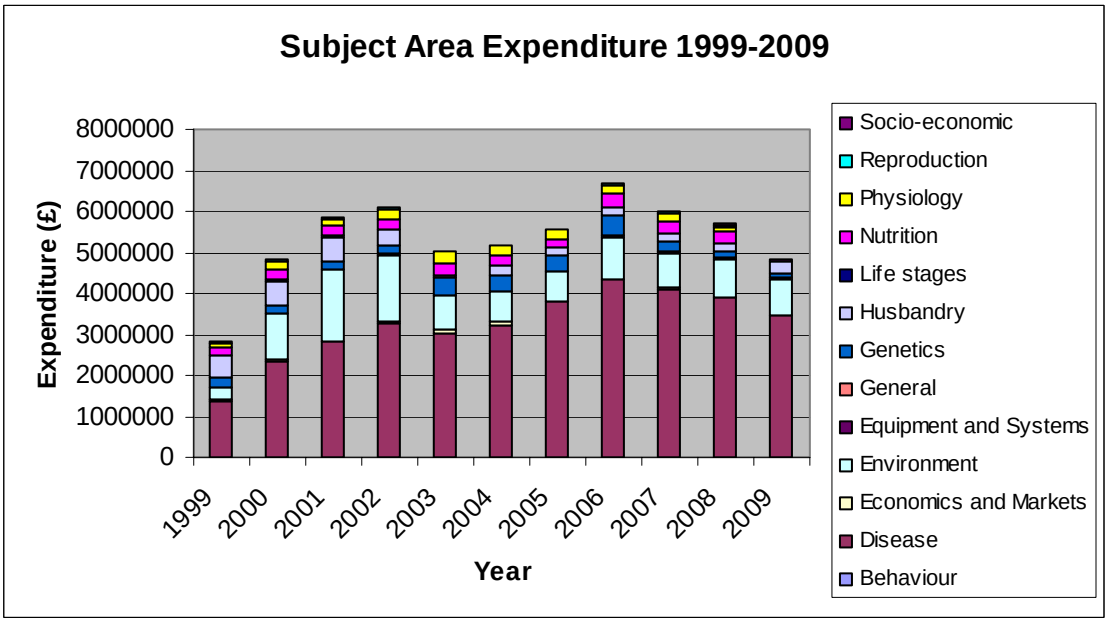

Figure 6. Annual estimated expenditure by subject area – 1999-2009.

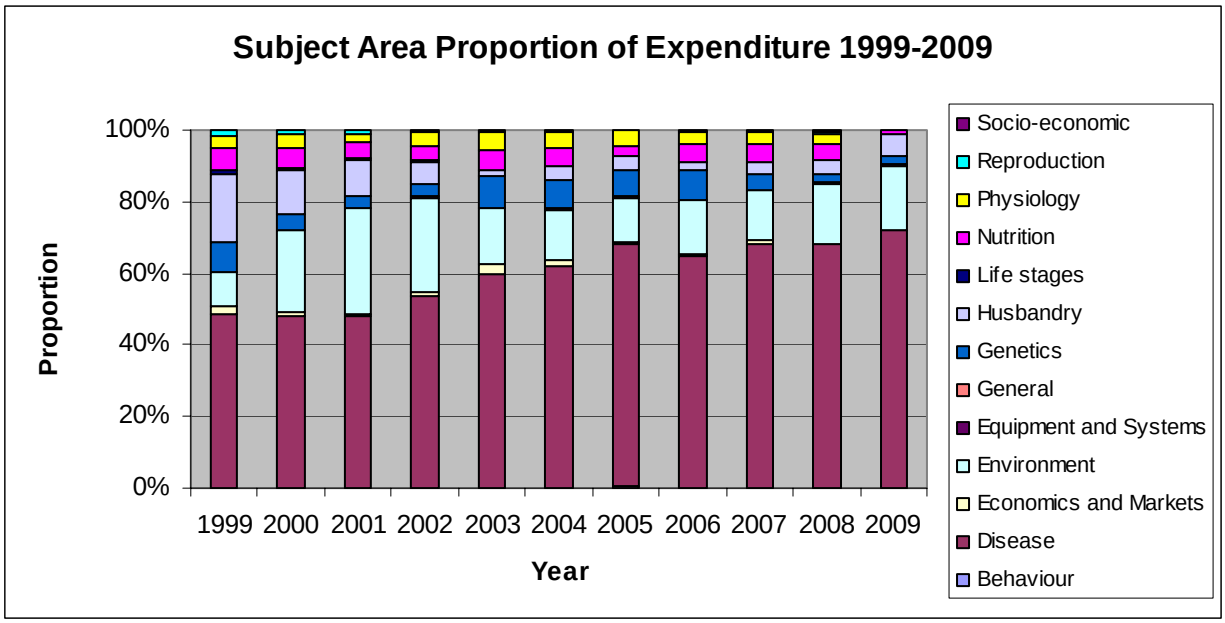

Figure 7. Annual estimated proportion of expenditure by subject area – 1999-2009.

Little has been committed to the development of equipment and systems or economics and market related studies, but this is perhaps a reflection of the fact that much of this work has been conducted by the industry as part of core commercial development. However, demands for better fish containment, more durable and flexible structures for use in more exposed locations, coupled to the need for more remote and automated husbandry, suggest that cross disciplinary research and development investment is required. There is little R&D associated with recirculating systems in the UK perhaps reflecting the challenging economics of this form of production. The "husbandry" category includes some fish welfare and more general aquaculture production related projects, but expenditure in this area also appears to be diminishing.

Expenditure by Sponsor

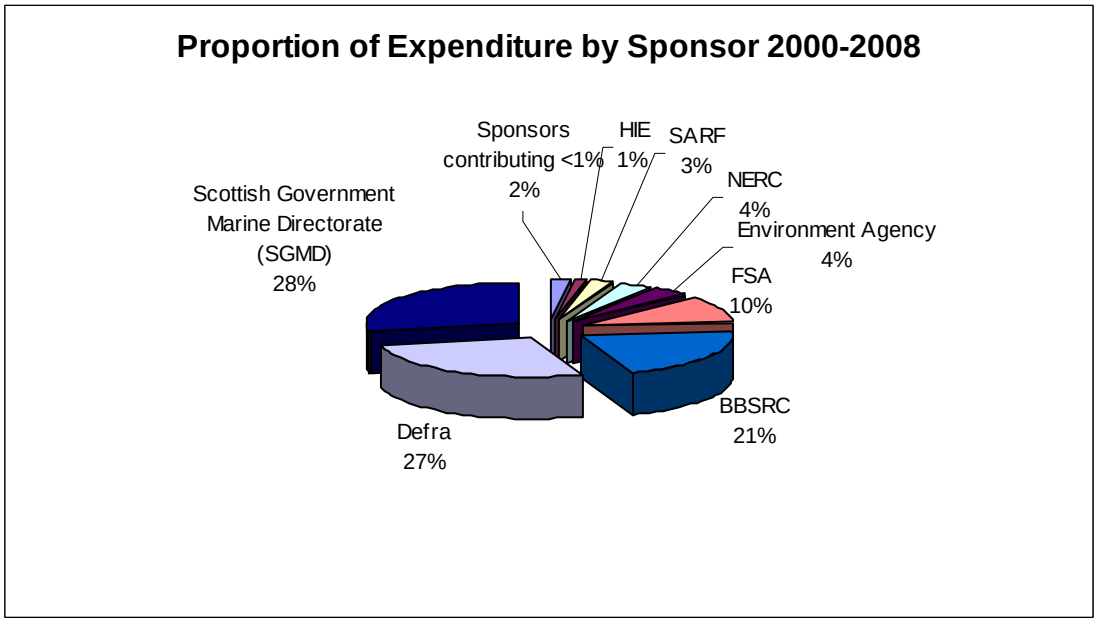

Figure 8. Percentage total contribution by sponsor 2000 -2008

The Research Councils
BBSRC is the largest single research council contributor to aquaculture related research in the period 2000-2008 more than 60% of which may be categorised as aquaculture related fundamental research. Whilst the overall level of BBSRC expenditure on aquaculture related R&D has increased, peaking in 2005/2006, the proportion of this research councils funding being allocated to directly related applied and applied aquaculture R&D has declined over the last eight years from about 65% to less than 30% - representing an overall decline in funding to applied work in this sector in real terms over the last eight years. Since 2005 NERC has largely ceased to contribute to aquaculture related research.

Government Departments and Non Departmental Bodies
Defra and SEERAD are the most significant contributors to applied policy relevant R&D, with the majority of their expenditure being devoted to fish disease related studies.

The FSA has been a significant sponsor of shellfish hygiene related work and the principal driver for their sponsorship of aquaculture R&D is from a public health perspective. Some of the FSA sponsored work related to seafood generically rather than aquaculture specifically.

HIE and THC provide discrete allocations of funding to regionally specific projects and generally only do so in partnership with other sponsors. Although not reflected in the database, we are aware of other regionally allocated funds for aquaculture R&D, but the sums involved are relatively small.

SFIA (Seafish) allocates a proportion of levy income to support aquaculture research either directly or through SARF.

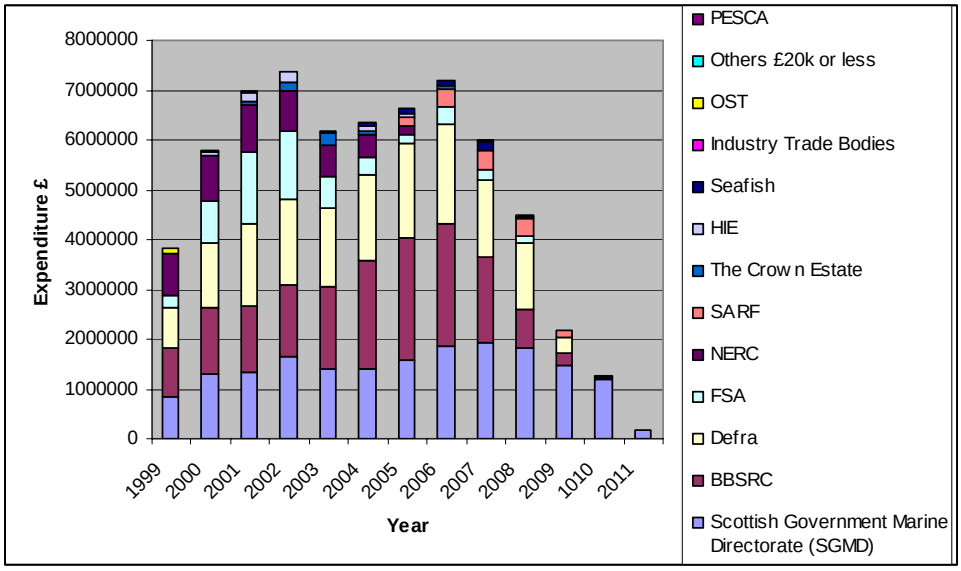

Figure 9. Annual estimated expenditure by sponsor 1999-2011

Private and Charitable Bodies
The Crown Estate contributes to R&D in this sector both independently and through SARF. SARF has been in operation since 2004, acting as an R&D co-ordinating and commissioning body on behalf of a range of sponsors including The Crown Estate, SFIA, SEPA, SNH, SEERAD, HIE, COSLA together with all the key industry and NGO stakeholders. SARF is now responsible for contributing 5% of total R&D allocation and there is every prospect that this contribution will continue to rise.

Others
There are a number of other sponsors who collectively contribute sums of less than £50k per year, usually in partnership with other larger sponsors. The industry contributes both directly in cash and in-kind towards research and through its respective trade bodies. The SSPO, BTA, BMFA and OATA have contributed modest cash contributions to projects which are not fully reflected in the database as these sums are often not recorded in the figures provided by sponsors. In addition, collective bodies such as SARF, receive

contributions from a range of organisations including Government, Regulators, industry as well as other charitable and levy bodies, which are not recorded separately within the database.

Funding allocation to "Main contractor"

It is important to track the pool of available expertise in aquaculture R&D with a view to understanding which organisations are conducting relevant R&D and, in the future perhaps ensuring, that we are supporting and fostering the scientific skills and resources that are required to underpin aquaculture. The database contains reference to the main or lead contractor for each research project. It is important to note that some projects will have multiple contractors, but the assumption in this analysis is that the lead or main contractor will be the recipient of the majority of any particular project budget.

Analysis of expenditure between 2000 and 2008 clearly shows that the majority of UK aquaculture related R&D funding is committed to CEFAS and Fisheries Research Services (FRS now Marine Science Scotland), and accounts for 54% of expenditure. The Universities of Stirling, Aberdeen and St Andrews account for 18%. The proportion of Environment Agency funding may be an under estimate of their real allocation of funds during this period because we have data relevant to 2007 onwards only. A further 7% of funds were allocated to 5 other research providers – at least two with no obvious connection with aquaculture development. The remarkable feature of this analysis is that the remaining 18% of expenditure is divided amongst 107 other "Main contractors", reflecting the large number of relatively small projects that are a feature of R&D in this sector.

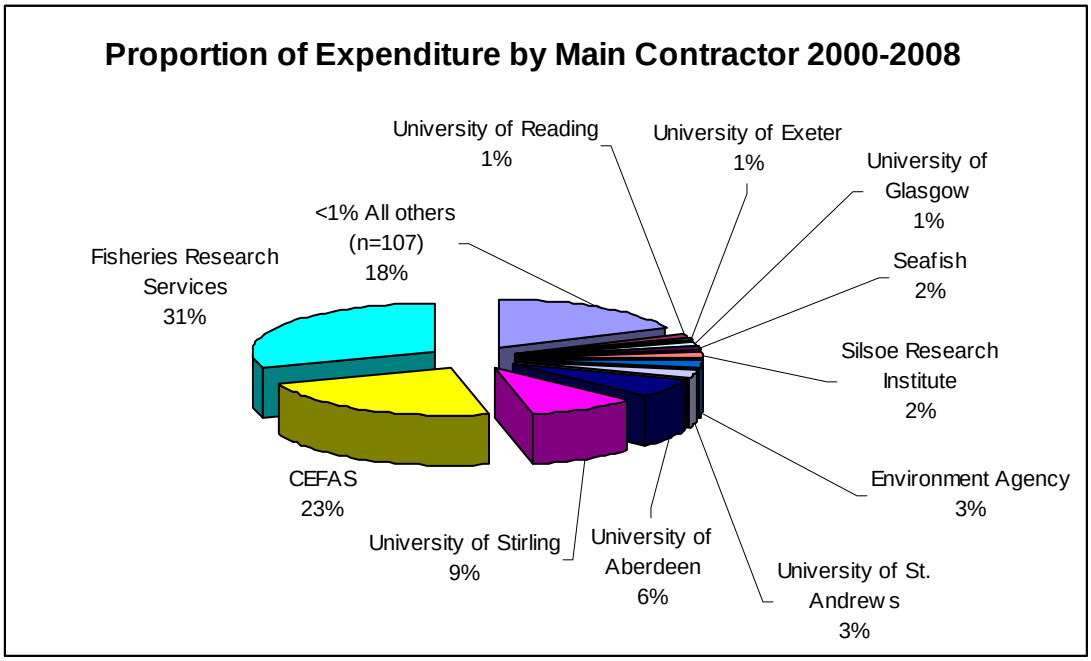

Figure 10. Analysis of the proportion of expenditure allocated to "Main Contractors" between 2000 and 2008.

If this expenditure pattern is examined as an annual breakdown it is possible to see that allocations to CEFAS and FRS have remained fairly consistent between years, although from 2006 onwards, expenditure with FRS has increased, whilst CEFAS appears to have decreased over the same period. Expenditure with the other main contractors noted above, gradually increased to a peak in 2006 with the Universities of Stirling and Aberdeen increasing their share of the available funds. Post 2006 both of these research providers appear to receive less funding from UK sources. The University of Stirling, in particular, shows a marked decline in securing UK based funding post 2006. In contrast, the proportion of R&D that is conducted by a variety of contractors who receive less than 1% of the allocated R&D budget has steadily increased throughout the period of analysis and particularly so over the last three years. This observation is important because it may reflect a change towards a more competitive and fluid environment in terms of research provision which CEFAS and FRS have, to a large extent been protected against, by the nature of their funding allocations. Of the 107 contractors receiving less than 1% of allocated budget between 2000 and 2008, approximately a third are mainstream research providers such as universities and research institutes.

The remainder are small businesses and consultancies. Growth in this area of research provision may reflect the ability of these service providers to operate more dynamically with lower fixed costs and to provide highly specialised expertise to projects of relatively short duration – particularly projects that may not require costly equipment of and facilities. Although not reflected in the database, it seems likely that mainstream research providers who have "traditionally" relied upon domestic funding sources are increasingly turning to EU for support.

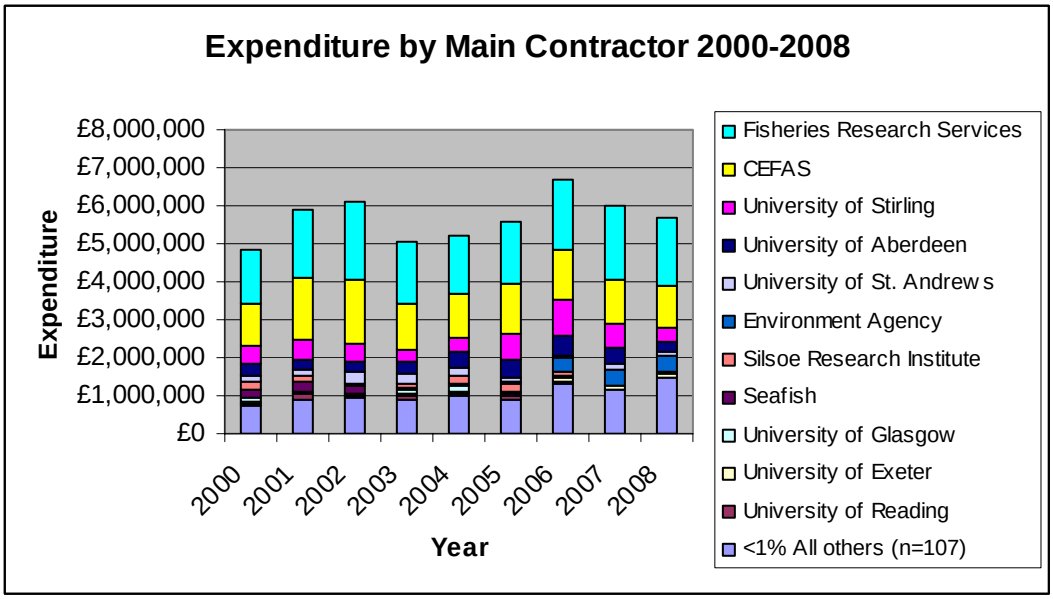

Figure 11. Annual estimated allocation of funds to the main or leading contractor for each project 2000 – 2008

Summary

The current recession and projected negative impact on levels of public expenditure over the next 5 to10 years will have significant implications for domestically funded R&D. The UK Government and the devolved administrations are the main sources of funding for applied aquaculture related R&D. The majority of their funding goes to support their respective agency laboratories in the provision of scientific policy advice. Defra and Scottish Government together with some other public bodies have also allocated budgets to support "non-agency" or "extramural" R&D projects and programmes. Government laboratories tend to represent large fixed costs with R&D being delivered through broadly defined "provision of advice" projects that are in fact programmes of work. Whilst this provides policy customers with a degree of flexibility in service provision, it is difficult to identify potential overlap that may be occurring between these and more tightly specified projects being conducted by other research providers.

Although it is difficult to place an objective measure on the direct value/benefit to the industry of much of the R&D contained with the database, experience would suggest that despite the plethora of knowledge transfer and other Small to Medium Sized Enterprise (SME) R&D schemes, there is a lack of commercial focus to much of the R&D supported over the last eight to ten years. The academic community tends to be focused on the need to publish in the scientific literature as demanded for their professional progression and at an institutional level by the Research Assessment Exercise (RAE) which affects their core public funding allocation and their ability to secure significant research funding from the research councils.

Projected changes in population, demographics, health, energy supply and climate change[4] suggest that aquaculture for food and non-food purposes will become increasingly important for the UK and Scotland in particular. Inevitably, this will require investment in R&D which, in the current economic climate and through established mechanisms, is likely to be very constrained. However, developments in some of these areas are of strategic importance and should perhaps take precedence over some existing lines of research supported by the public purse.

[4] http://www.defra.gov.uk/marine/pdf/aquaculture-report0904.pdf

Analysis of the R&D subject categories outlined above shows that there is considerable disparity in the areas in which R&D is supported and most of the expenditure relates to fish disease, shellfish hygiene, and the environmental impact of fish farming. Much of this work focuses on policy and regulatory advice. It is also important to acknowledge the potential for some of the demand for R&D in these areas to be driven by the fact that we have encouraged the development of a large body of scientific expertise in them. Whilst all of these subject areas are relevant to the industry, there has been relatively little investment over the last decade in R&D designed to develop and expand the industry in real terms. Simply relying upon existing market forces to guide R&D investment undermines the need to develop strategically important areas of research.

The database does not adequately capture industry supported R&D, but knowledge of the sector in the UK would indicate that levels of direct investment in R&D for the majority of the industry is very low. Whilst many collaborative style R&D programmes require the support and participation of industry, they are still very much driven by the interests and requirements of the research community. The structure of the industry in the UK is such that it will not, in the foreseeable future, be likely to invest on a sufficient scale to elicit the step change in development that will be required.

Analysis of the database together with experience of participating in the management and delivery of applied R&D for 15 years would suggest a pressing need to support dynamic, commercially responsive, problem solving projects that deliver meaningful results in commercially realistic timescales. Existing organisational structures, reward systems and funding regimes for R&D simply do not fit with this requirement.

Analysis of the main recipients of UK R&D funding suggests that, where funds are delivered in a flexible manner, there is the potential for significant competition. Whilst there are areas of research that need to be supported with a view to the provision of policy and regulatory advice, there are clear examples of ways in which some of this information can be generated through the flexible allocation of resources to a wide range of potential research providers.

Table 2. Project summary

	1999	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***
Mean	36135	40079	48483	52055	42314	41208	39406	48098	47282	60053	61751	82748	78705	42548	83795	40499
Standard Error	4886	4166	4523	4891	4633	4758	4646	6260	6808	8085	9480	15606	11982	8264	68190	0
Median	20991	26025	32710	33845	26113	15232	16516	18127	17568	23397	32797	52349	74863	34551	83795	40499
Mode	9646	9672	7208	8983	14374	14413	1300	1700	3567	10418	1987	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	43148	45823	49758	52908	50541	53403	55165	73805	76724	78805	83729	101139	59908	33056	96435	#DIV/0!
Sample Variance	1.86E+09	2.1E+09	2.48E+09	2.8E+09	2.55E+09	2.85E+09	3.04E+09	5.45E+09	5.89E+09	6.21E+09	7.01E+09	1.02E+10	3.59E+09	1.09E+09	9.3E+09	#DIV/0!
Kurtosis	11	19	4	3	9	8	18	20	19	5	12	8	-1	9	#DIV/0!	#DIV/0!
Skewness	3	4	2	2	3	2	3	4	4	2	3	2	0	3	#DIV/0!	#DIV/0!
Range	262463	350883	271835	271672	305419	306093	428196	569011	569395	393311	521797	522175	196374	144723	136379	0
Minimum	1428	652	343	506	100	266	664	716	332	597	1497	1118	3143	7716	15606	40499
Maximum	263891	351534	272178	272178	305519	306359	428861	569727	569727	393908	523294	523294	199517	152440	151985	40499
Sum	2818502	4849569	5866480	6090393	5035421	5192243	5556260	6685609	6004808	5705057	4816570	3475437	1967619	680769.6	167590.2	40498.9
Count	78	121	121	117	119	126	141	139	127	95	78	42	25	16	2	1
Confidence Level(95.0%)	9728	8248	8956	9688	9175	9416	9185	12378	13473	16053	18878	31517	24729	17614	866427	#NUM!

Table 3. Estimated expenditure by sector

Major Group	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Calculated Cost to Sponsor
Algae	£0	£0	£0	£0	£0	£19,175	£9,825	£0	£111,382	£150,515	£164,447	£52,665	£19,108	£14,331	£0	£0	£541,449
Aquaculture General	£350,830	£925,601	£1,238,098	£1,634,438	£1,584,125	£1,841,586	£1,460,876	£1,507,893	£1,044,258	£1,540,552	£1,560,246	£1,559,138	£856,397	£219,721	£15,606	£0	£16,988,535
Fish General	£196,471	£241,497	£156,066	£73,591	£84,607	£163,548	£423,670	£903,401	£840,876	£763,803	£778,294	£525,077	£501,886	£264,821	£151,985	£40,499	£5,913,620
Marine Finfish	£384,479	£400,728	£553,020	£655,281	£575,726	£547,255	£290,989	£305,625	£273,820	£170,227	£45,708	£28,543	£4,293	£0	£0	£0	£3,851,215
Other Fish	£86,155	£209,281	£239,468	£270,223	£169,759	£87,924	£168,155	£146,983	£240,548	£263,653	£148,763	£109,189	£109,189	£26,997	£0	£0	£2,190,133
Other Species	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£127,035	£218,762	£218,762	£91,727	£0	£0	£656,286
Salmonids	£1,396,116	£1,915,376	£1,994,154	£1,842,824	£1,850,881	£1,966,046	£2,755,665	£3,318,496	£3,039,667	£2,346,030	£1,613,278	£814,209	£246,032	£63,173	£0	£0	£23,765,832
Shellfish	£404,452	£1,157,087	£1,685,673	£1,614,036	£770,322	£566,707	£447,078	£503,211	£454,257	£470,278	£378,799	£167,853	£11,951	£0	£0	£0	£8,227,254
Grand Total	2,818,502	4,851,569	5,868,481	6,092,395	5,037,424	5,194,247	5,558,265	6,687,615	6,006,815	5,707,065	4,818,579	3,477,447	1,969,630	682,782	169,603	42,513	62,134,323

Table 4. Estimated expenditure by subject area

Subject Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Calculated Cost to Sponsor
Behaviour	£0	£0	£0	£0	£0	£3,572	£16,052	£16,052	£12,436	£0	£0	£0	£0	£0	£0	£0	£48,112
Disease	£1,375,531	£2,324,848	£2,818,944	£3,257,765	£3,016,119	£3,229,755	£3,777,623	£4,308,509	£4,095,448	£3,884,146	£3,461,526	£3,075,947	£1,763,487	£513,999	£15,606	£0	£39,543,722
Economics and Markets	£59,626	£52,163	£22,800	£82,429	£124,066	£82,946	£24,554	£30,041	£35,293	£17,223	£0	£0	£0	£0	£0	£0	£471,515
Environment	£265,537	£1,111,376	£1,747,749	£1,602,128	£793,301	£720,656	£695,213	£1,025,687	£851,998	£939,693	£883,237	£317,163	£180,730	£152,440	£151,985	£40,499	£11,213,854
Equipment and Systems	£0	£0	£3,593	£14,374	£14,374	£27,522	£5,648	£10,533	£16,123	£13,473	£1,497	£1,118	£0	£0	£0	£0	£108,254
General	£0	£0	£0	£0	£0	£0	£1,300	£1,700	£0	£8,750	£26,250	£0	£0	£0	£0	£0	£38,000
Genetics	£234,764	£228,167	£197,791	£199,541	£441,780	£396,834	£409,329	£531,302	£254,189	£150,895	£94,579	£0	£0	£0	£0	£0	£2,904,407
Husbandry	£543,673	£585,334	£576,354	£392,710	£73,088	£213,744	£209,237	£154,398	£201,388	£205,087	£304,231	£81,208	£23,402	£14,331	£0	£0	£3,034,512
Life stages	£25,690	£25,760	£25,690	£25,690	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0	£77,140
Nutrition	£173,721	£268,511	£274,259	£226,715	£281,091	£264,896	£178,379	£340,692	£313,273	£277,170	£36,335	£0	£0	£0	£0	£0	£2,461,321
Physiology	£93,565	£191,133	£148,776	£241,590	£265,426	£234,095	£232,055	£235,378	£184,808	£131,774	£0	£0	£0	£0	£0	£0	£1,865,035
Reproduction	£46,396	£62,276	£50,525	£47,451	£26,177	£18,224	£6,869	£31,317	£39,851	£29,438	£6,376	£0	£0	£0	£0	£0	£318,503
Socio-economic	£0	£0	£0	£0	£0	£0	£0	£0	£0	£47,408	£2,540	£0	£0	£0	£0	£0	£49,948
Grand Total	£2,818,502	£4,849,569	£5,866,480	£6,090,393	£5,035,421	£5,192,243	£5,556,260	£6,685,609	£6,004,808	£5,705,057	£4,816,570	£3,475,437	£1,967,619	£680,770	£167,590	£40,499	£62,134,323

Fisheries Resource Management Limited
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