

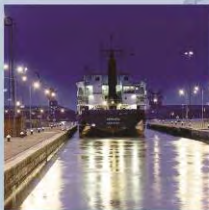
North Devon AONB

North Devon Aquaculture Centre Scoping Exercise

Report R.2357

July 2015

Creating sustainable solutions for the marine environment



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North Devon AONB

North Devon Aquaculture Centre Scoping Exercise



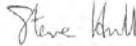
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Summary

Aquaculture is one of the UK's key food production sectors and helps to underpin sustainable economic growth, both in rural and coastal communities and in the wider economy.

In Northern Devon, aquaculture is currently an under-developed sector. However, the Northern Devon Economic Strategy has identified the growth of marine sector-related businesses, through the expansion and diversification of existing businesses, as a priority economic opportunity for Northern Devon. In addition, the Northern Devon Fisheries Local Action Group (FLAG) Development Strategy also aims to create the conditions for the sustainable development of Northern Devon's fishing communities, through encouraging innovation, new catching methods and technologies. Hence it has been proposed that aquaculture could play an important role in achieving the aims of both of these Strategies, whilst providing diversification opportunities and potential benefits to the local fishing communities.

The Northern Devon coast is recognised as having a high quality natural environment, demonstrated through multiple nature conservation and heritage designations. Any development of the aquaculture sector would therefore need to be compatible with the unique coastal and marine environment, ensuring that sustainable and acceptable practices are proposed which will not damage the environment and will be in line with local communities' aspirations.

This study was commissioned by the North Devon Coast Areas of Outstanding Natural Beauty (AONB), supported by the Northern Devon FLAG, Devon and Severn Inshore Fisheries Conservation Authority (IFCA) and Seafish to assess the feasibility of establishing an Aquaculture Centre in Northern Devon and scope the potential demand, operating model, scale and location for such a facility.

The level and nature of interest in establishing an Aquaculture Centre in Northern Devon was assessed through consultation with stakeholders and a demand analysis. A project workshop was held to discuss general opportunities and constraints to the development of sustainable aquaculture in Northern Devon, what type of services and facilities an Aquaculture Centre could provide to support such expansion of the industry (locally and nationally) and potential locations for such a Centre. A wider consultation was also undertaken to characterise current aquaculture-related research in the UK and assess whether any additional services or facilitation were required to support sustainable development of the UK industry.

The study showed that there was a high level of interest in the development of aquaculture, and an Aquaculture Centre, from stakeholders both in Northern Devon and further afield in the UK. However, the study highlighted that there are several key barriers to the development of the aquaculture industry in Northern Devon, related to:

- Water quality in the Taw Torridge Estuary (where aquaculture would be most likely to develop in the short term);
- Exposed conditions outside the Taw Torridge Estuary where the viability of aquaculture techniques suitable to the conditions would need to be established; and
- Planning and regulatory hurdles, particularly in relation to the establishment of Several Orders in Northern Devon.

Although the remit of the study was to scope the feasibility of establishing an Aquaculture Centre, based on the outcomes of the demand analysis it was concluded that at the current time the development of an Aquaculture Centre is not a desirable approach. Instead, an incremental approach to addressing the barriers to aquaculture development should be adopted and if the barriers identified can be overcome, as aquaculture businesses in the area start to reach a critical mass, an Aquaculture Centre could be reconsidered at that time.

The recommendations are split into three phases: short, medium and long term and are designed to provide an incremental step-by-step approach to providing the environment and support for aquaculture businesses to set up and establish in Northern Devon.

Short Term (Year 1):

- Establish Several Orders to support current local shellfisheries and aquaculture production businesses;
- Continue to foster stakeholder dialogue and in particular cross-fertilisation between fishery, conservation and aquaculture business interests to help define innovative approaches that will address the concerns of all groups;
- Develop a guidance sheet providing information regarding the consents and licences required for different types of aquaculture businesses (finfish, shellfish, seaweed) and relevant contact details to support current and any potentially new aquaculture developers.
- Discuss the potential for development of a local coastal/marine management plan which takes account of potential future aquaculture activity with statutory authorities (i.e. Local Authorities, Natural England, Environment Agency, Marine Management Organisation (MMO)). Any local plan produced would likely only constitute a material consideration within the South West Marine Plan if it is adopted by a relevant body; and
- To assist in the development of a local plan/strategy (if taken ahead), undertake spatial modelling to further identify areas of 'aquaculture potential' which incorporate all marine spatial planning consideration (e.g. other marine sectors activities, infrastructure, designations) as well as suitable natural resources and physical conditions. The outputs of such a model can be used as a tool by potential developers and regulators to identify and focus on areas where there may be the least marine spatial planning-related constraints to development.

Medium Term (Years 2-5):

- Ensure that investment in catchment sensitive farming methods is implemented to improve water quality. Assess whether further investment is needed by water companies to address water quality failures related to sewage discharges;
- Undertake small-scale projects to test concepts developed during the initial phase, e.g. shellfish trials to establish the most suitable species/methods for cultivation; and
- Establish a network of aquaculture businesses and other potential stakeholders and interested parties.

Long Term (Year 5+):

- Further to demonstrable long term improvements in the water quality in the Taw Torridge Estuary, establishment of viable marine culture techniques and creation of a supportive aquaculture development environment (through development of a wider coastal/marine management plan), an Aquaculture Centre could be developed. The strengths, weaknesses, opportunities and threats analysis indicated that the optimal approach for an Aquaculture Centre in Northern Devon would be a facility (for example, built using public funding, or utilising an existing building or site) with private aquaculture-related businesses as 'anchored tenants', to provide a core income for the Centre. This represents a mixed approach of public and private enterprise, which could help to generate collaboration, innovation and new development opportunities.



Acknowledgements

The project team gratefully acknowledge the information and expertise provided by numerous stakeholders, including those who attended the Project Workshop in January 2015.

The project team would also like to thank Elaine Hayes, who initiated the project and Chrissie Ingle of the North Devon Coast AONB for their input and advice throughout the project.

Abbreviations

ABPmer	ABP Marine Environmental Research Ltd
AONB	Areas of Outstanding Natural Beauty
APB	Aquaculture production business
AZA	Allocated Zones for Aquaculture
BBSRC	Biotechnology and Biological Sciences Research Council
CaBA	Catchment Based Approach
CAMS	The Centre for Applied Marine Sciences
CEFAS	The Centre for Environment, Fisheries and Aquaculture Science
CFP	Common Fisheries Policy
CIC	Community Interest Company
CSAR	Centre for Sustainable Aquatic Research
EC	European Commission
EMFF	European Maritime and Fisheries Fund
FAO	Food and Agriculture Organization
FLAG	Fisheries Local Action Group
FW	Freshwater
HLF	Heritage Lottery Fund
HMRC	Her Majesty's Revenue and Customs
IFCA	Inshore Fisheries Conservation Authority
IMTA	integrated multi-trophic aquaculture
INTERREG	Innovation & Environment Regions of Europe Sharing Solutions
IRO	Independent Research Organisation
MANP	Multiannual National Plan
MCRS	Minimum Conservation Reference Sizes
MCZ	Marine Conservation Zone
MLS	Minimum Landing Sizes
MMO	Marine Management Organisation
NERC	Natural Environmental Research Council
NGO	Non-governmental organization
PhD	Doctor of Philosophy
R&D	Research and Development
RAS	Recirculating aquaculture system
RGF	Regional Growth Fund
SAC	Special Areas of Conservation
SAIC	Scottish Aquaculture Innovation Centre
SAMS	Scottish Association for Marine Science
SIF	Strategic Investment Fund
SME	Small and medium size enterprise
SNCB	Statutory nature conservation bodies
SSSI	Site of Special Scientific Interest
SWOT	Strengths, weaknesses, opportunities and threats analysis
UNESCO	United Nations Educational, Scientific and Cultural Organization



VALMER Valuing Ecosystem Services in the Western Channel
VAT Value-added tax
ZSL Zoological Society of London

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

North Devon Aquaculture Centre Scoping Exercise

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1. Introduction

1.1 Project Overview

Aquaculture is one of the UK's key strategic food production sectors and helps to underpin sustainable economic growth, both in rural and coastal communities and in the wider economy. The industry provides community benefits in high quality, secure jobs and related social infrastructure (Defra, 2014).

In Northern Devon (comprising the districts of Torridge and North Devon; see Image 1), aquaculture is currently an under-developed sector. However, the Northern Devon Economic Strategy has identified the growth of marine sector-related businesses, through the expansion and diversification of existing businesses, as a priority economic opportunity for Northern Devon, (North Devon Council and Torridge District Council, 2014). Furthermore, the Northern Devon Fisheries Local Action Group (FLAG) Development Strategy 2011-2015 also aims to create the conditions for the sustainable development of Northern Devon's fishing communities, through encouraging innovation, new catching methods and technologies. Hence it has been proposed that aquaculture could play an important role in achieving the aims of both of these Strategies, whilst providing diversification opportunities and potential benefits to the local fishing communities.

However, the Northern Devon coast is recognised as having a high quality natural environment, through the designation of Areas of Outstanding Natural Beauty (AONB), a UNESCO Biosphere Reserve, Exmoor National Park and Heritage Coast. Furthermore nature conservation related designations include Sites of Special Scientific Interest, a designated Marine Conservation Zone (MCZ; offshore), four recommended MCZs (two of which have been put forward for consideration in Tranche 2 of the MCZ network development phase) and Special Areas of Conservation (SACs), several of which have marine components. Hence any development of the aquaculture sector would need to be compatible with the unique coastal and marine environment, ensuring that sustainable and acceptable practices are proposed which will not damage the environment and will be acceptable to the local communities involved.

The North Devon Coast Areas of Outstanding Natural Beauty (AONB), supported by the Northern Devon FLAG, Devon and Severn Inshore Fisheries Conservation Authority (IFCA) and Seafish commissioned this study to assess the feasibility of establishing an Aquaculture Centre in Northern Devon and scope the potential demand, operating model, scale and location for such a facility.

1.2 Project Aim

The aims of the project were to:

- Identify the need and potential for an Aquaculture Centre within Northern Devon and the potential stakeholders within the commercial, environmental and research sectors;
- Identify if there is a demand locally for the services;
- Identify the potential market and how existing businesses could grow;
- Identify the most appropriate size and location for the facility, based on existing centres in other regions; and
- Produce a costed Business Plan.

1.3 Report Structure

This report is structured as follows:

- Section 1: Introduction (this section);
 - Section 2: Methodology;
 - Section 3: Characterisation of Northern Devon Aquaculture and Fisheries;
 - Section 4: Characterisation of Existing Aquaculture Centres in the UK;
 - Section 5: Demand Analysis;
 - Section 6: Option Appraisal and SWOT Analysis; and
 - Section 7: Conclusions and Recommendations.
-
- Appendix A: Aquaculture Development Plan;
 - Appendix B: Example of Consultation Guidance for Aquaculture Developers in Scotland;
 - Appendix C: Stakeholder Consultation;
 - Appendix D: Existing Aquaculture Centres in the UK.

2. Methodology

2.1 Characterisation of Existing Fisheries and Aquaculture Activity in Northern Devon

In order to establish the current baseline and enable future opportunities to be investigated, current aquaculture and wild capture fishery activity within Northern Devon were described using the following information sources:

- Northern Devon FLAG (2011) – strategy docs;
- Northern Devon FLAG (2013) – FLAG study, including Marine Management Organisation (MMO) statistics on fishing activity in the region;
- Cefas, 2013 – Sanitary survey for the Taw/Torridge;
- EU Aquaculture Registration Database;
- General internet searches;
- Stakeholder consultation (see Section 2.3).

2.2 Characterisation of Existing Aquaculture Centres

For the purposes of this study, the term ‘aquaculture centre’ was considered to comprise:

- Academic institutions (i.e. universities and associated research laboratories);
- Public (non-academic) research institutions;
- Private aquaculture-related research companies; and
- Other educational and vocational training institutions.

With regard to characterising existing centres in the UK, the term aquaculture centre was not considered to include ‘production’ i.e. commercial hatcheries or aquaculture production businesses (APBs), as characterisation of all such businesses in the UK was considered outwith the scope of the study. However, it is recognised that many production businesses also conduct research and contribute significantly to aquaculture science in the UK, including through science and industry partnerships (e.g. see Defra, 2014).

Existing aquaculture centres in the UK were characterised to determine their main areas of focus and expertise through internet searches and direct consultation with the centres via questionnaires and the stakeholder workshop (if attended). (see Section 2.3.1 and 2.3.2). The following aspects were considered, where information was publically available or provided by the centre:

- Name;
- Location;
- Function and/or primary focus of research;
- Facilities;
- Vocational training or education provision;
- Funding sources.

2.3 Demand Analysis

The nature and level of interest in developing an Aquaculture Centre in Northern Devon was assessed through consultation with the following key stakeholder groups:

- Fishing and aquaculture stakeholders e.g. production businesses, fishermen, industry representatives, IFCAs, key supply chain businesses (e.g. processors);
- Government agencies and statutory nature conservation bodies (SNCBs);
- Economic Development Agencies and Local Authorities (e.g. District Councils);
- NGOs and local environmental groups;
- Other key local stakeholders (e.g. landowners including riparian owners); and
- Universities and other institutions involved in aquaculture-related research and or education/vocational training.

A list of aquaculture-related stakeholders for consultation was drawn up initially through the knowledge of the project team (ABPmer and Stirling Aquaculture) and the North Devon Coast AONB, supplemented by a brief internet search and further suggestions from stakeholders when they were contacted. The full list of stakeholders contacted is provided in Appendix C. All stakeholders were sent a Project Introduction email to explain the purpose of the study and to invite their input.

Stakeholder opinion on the need and demand for an Aquaculture Centre was achieved through the project workshop and a wider consultation process.

2.3.1 Project Workshop

Consultation with key local stakeholders was undertaken through a Project Workshop held in Northern Devon on 29 January 2015. The Workshop included local stakeholders in the fishery and aquaculture sectors, as well as national representatives from organisations linked with aquaculture, such as The Centre for Environment, Fisheries and Aquaculture (Cefas) and The Crown Estate. The stakeholders were given an overview of the background and aims of the project. The initial group discussion focussed on what the stakeholders considered to be general opportunities and constraints to the development of sustainable aquaculture in Northern Devon, what type of services and facilities an Aquaculture Centre could provide to support such expansion of the industry (locally and nationally) and potential locations for such a Centre.

A list of stakeholders represented at the workshop, the agenda and outputs from the event are provided in Appendix C.

2.3.2 Wider Consultation

Stakeholders identified as aquaculture centres were sent a brief questionnaire regarding their main aquaculture specialism and opinions on services and facilities required to enhance or compliment current aquaculture-related research in the UK and/or facilitate sustainable development of the industry. The list of stakeholders contacted is provided in Appendix C and the responses are summarised in Section 5.1.2.

2.4 Option Appraisal and Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis

Information obtained through the stakeholder consultation processes described above was collated to provide an initial list of:

- Opportunities for aquaculture development in Northern Devon;
- Constraints; and
- The viability of the opportunity (based on current knowledge of the aquaculture industry).

An initial screening exercise was then undertaken to identify the most viable options for an Aquaculture Centre, for which a more detailed assessment of the potential operational model, technical requirements, scale and location was undertaken. A SWOT analysis of the three most viable options was undertaken.

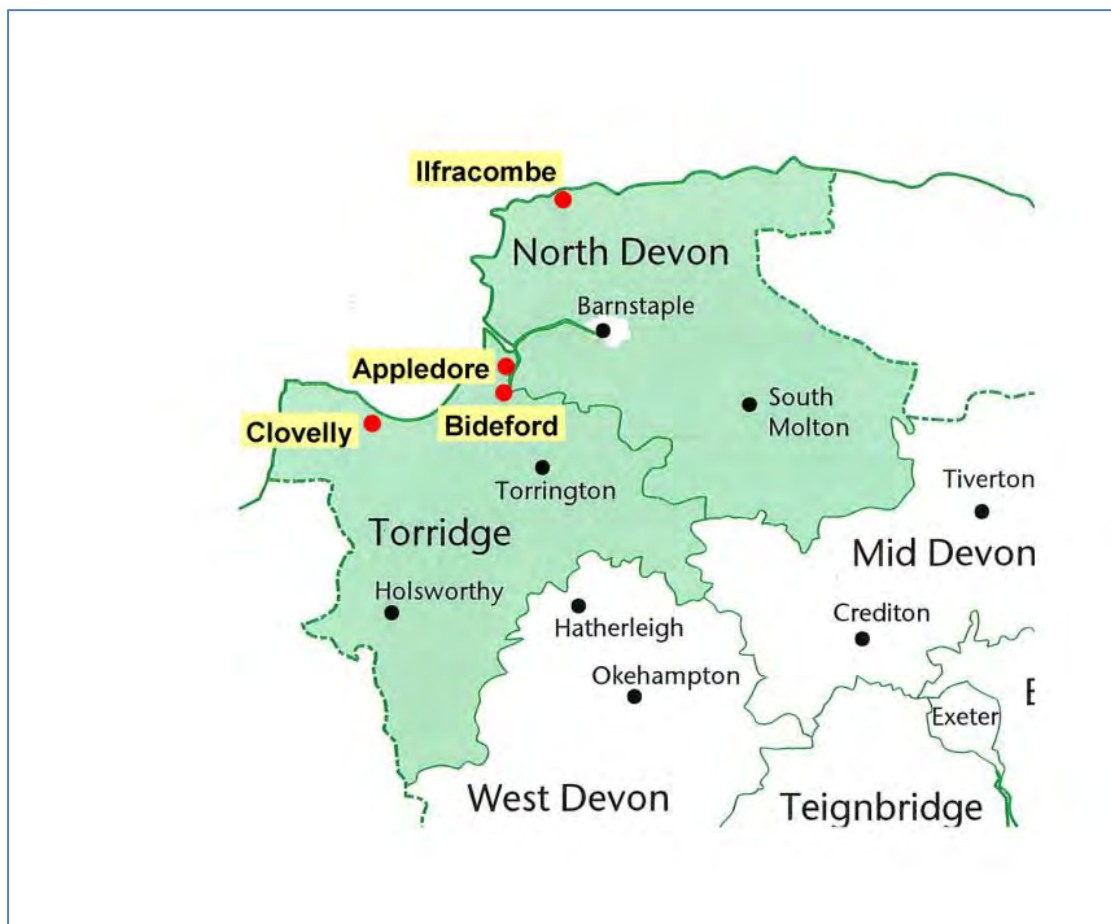
2.5 Identification of Potential Funding Sources

Potential funding sources were identified through a desk-based internet search and through consultation with stakeholders.

3. Characterisation of Northern Devon Aquaculture and Fisheries

3.1 Study Area

Northern Devon comprises the local authority districts of Torrridge and Northern Devon (see Image 1). The main fishing communities and landing ports are at Appledore, Clovelly, Bideford and Ilfracombe. The area is predominantly rural. Fishing and agriculture, whilst a small part of the economy, play an important role in the attractiveness of the area for tourism (Northern Devon FLAG, 2011). The fishing sector also plays an important role in employment in communities that are typically experiencing multiple social and economic problems. Existing aquaculture activity and wild capture fisheries undertaken in the region are described in Sections 3.3 and 3.4 respectively.



(Source: Northern Devon FLAG, 2011)

Image 1. Map of Northern Devon showing location of main fishing ports

3.2 Heritage and Nature Conservation Designations

The natural heritage and nature conservation importance of the Northern Devon coast and marine area is recognised through a number of designations which are listed below and shown in Figure 1 and Figure 2.

- Areas of Outstanding Natural Beauty (AONB) – North Devon Coast;
- National Park – Exmoor;
- UNESCO Biosphere Reserve;
- Heritage Coast;
- Marine Conservation Zone (MCZ) – Lundy;
- Recommended MCZs – Bideford to Foreland Point, North of Lundy (both put forward for consideration in Tranche 2), Morte Platform and Taw Torridge Estuary;
- Special Area of Conservation (SAC) – Braunton Burrows, Lundy (both have a marine component), Tintagel-Marsland-Clovelly Coast (no marine component); and
- Site of Special Scientific Interest (SSSI) – Mermaid’s Pool to Rowden Cut, Northam Burrows, Taw Torridge Estuary, Braunton Burrows, Saunton to Baggy Point Coast, Barricane Beach, Morte Point.

The Taw Torridge estuary is the site of the only current aquaculture activity within the study area (further described in Section 3.3.2). The Taw Torridge is a macro tidal estuary comprising the twin estuarine system of the River Taw and the River Torridge, which flows into Bideford Bay near the mouth of the Bristol Channel (see Figure 2). The estuary encompasses a rich variety of estuarine and coastal habitats with a complete sand dune sequence at Braunton Burrows, rare salt marshes, reed beds, grassland and intertidal mudflats. The estuary falls within North Devon’s UNESCO Biosphere Reserve and, as noted above, is designated as an SSSI, an AONB and a SAC owing to its complete sand dune sequence, geological features, rare species and vulnerable species such as the important overwintering and migratory bird populations that frequent the saltmarsh and mudflats. The intertidal mudflats also sustain a large variety of bivalves and marine invertebrates; a source of food for the birds that frequent the mudflats and supporting a bivalve fishery (Cefas, 2013 and references therein).

3.3 Aquaculture Activity in Northern Devon

For the purposes of the current study, aquaculture has been defined using the UN Food and Agriculture Organization’s definition (FAO, 1988):

“Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture, while aquatic organisms which are exploitable by the public as a common property resources, with or without appropriate licences, are the harvest of fisheries”.

As noted in Section 1, the aquaculture industry in Northern Devon is currently considered to be under-developed. Current finfish and shellfish aquaculture activity in the area is described below, based on the publically available information sources listed in Section 2.1. There is no crustacean aquaculture in Northern Devon, although local fishermen do work with the National Lobster Hatchery in Padstow (Northern Devon FLAG, *pers. comm.*).

3.3.1 Finfish

Finfish culture in Northern Devon is focussed on the freshwater production of trout species (rainbow and brown trout), using ponds or tanks and raceways, for put and take fisheries (both species) and human consumption (rainbow trout). Table 3.1 shows the APBs which are registered as finfish farms¹ in the study area. There is no sea-based finfish aquaculture (mariculture) in the study area.

Table 3.1 Registered Finfish Production Businesses in the Study Area

Business Name	Location	Farm Type	Farm Production	Authorised	Species
Blakewell Fisheries	Barnstaple	FW Ponds	Consumption;	Finfish farm	Rainbow and brown trout
		FW tanks/raceways	Put and take fisheries		
Bulldog Fish Farm	Barnstaple	FW Ponds	Nursery;	Finfish farm	Rainbow trout
		FW tanks/raceways	Put and take fisheries	Finfish importer	
		FW closed (recirculation)			
Exmoor Caviar	South Molton	-	-	Dealer	
Fish Network Limited	South Molton	FW tanks/raceways	-	Importer cold-water and tropical	?
Plaistow Mills	Barnstaple	FW cages/enclosures/pens	Nursery;	Finfish farm	Trout (assume rainbow)
		FW ponds	Consumption;		
		FW tanks/raceways	Put and take fisheries		
Rye Farm	Barnstaple	FW ponds	Put and take fisheries	Finfish farm	Rainbow and brown trout
Southwood Farm	Barnstaple	FW ponds	Nursery;	Finfish farm	Rainbow trout
Bulldog fish farm			Put and take fisheries		
River Torridge Fishery Association	Winkleigh	FW tanks/raceways	Put and take fisheries	Finfish farm	Brown and sea trout
		FW closed (recirculation)			

Note . The table includes all fish-related APBs including registered finfish farms; FW – freshwater.

(Source: Public Register of Aquaculture Production Businesses in England and Wales)

3.3.2 Shellfish

Shellfish aquaculture in the study area is limited to the relatively small scale culture of Pacific oysters (*Crassostrea gigas*) on the east shore of the Torridge estuary. The oysters are grown

¹ <http://www.cefas.defra.gov.uk/euregister/annex1.aspx>

from seed in suspended triangular nets and harvested by hand. The same production business also harvests mussels (*Mytilus edulis*) by hand from naturally-occurring mussel beds in the estuary (i.e. the mussels are not cultivated), which are a public resource (i.e. not located within a Several Fishery Order²) and hence are vulnerable to exploitation from vessels from outside the area.

There is an existing Several Fishery Order within the River Taw (The River Taw Mussel Fishery Order 1962) which is owned by South West Water.

3.4 Wild Capture Fisheries in Northern Devon

With regard to the wild capture fisheries sector, Northern Devon has a relatively small local fishing fleet (approximately 35 vessels in 2012) the majority of which are in the under-ten metre sector and based in Bideford (under-tens) and Ilfracombe (over-tens). Fishing activity includes trawling, potting, gill netting, hand-lining and at certain times scallop dredging. The main wild capture fishing sectors and the main species they target are shown in Table 3.2. In general, due to the small size of the vessels, the fleet has a limited operating range and fishing activity is also limited by poor weather conditions (Northern Devon FLAG, 2013).

Table 3.2 Main Wild Capture Species in Northern Devon by Local Fleets

Fishing Vessel Type	Main Target Species
Trawl	Ray, squid, Dover sole, plaice, turbot, brill, gurnard, cod, haddock, dab, whiting, sea bass
Potters	Brown crab, lobsters, spider crab, whelks
Net	Herring
Hand-line	Sea bass, mackerel, cod
Dredges	Scallops

(Source: Northern Devon FLAG, 2013)

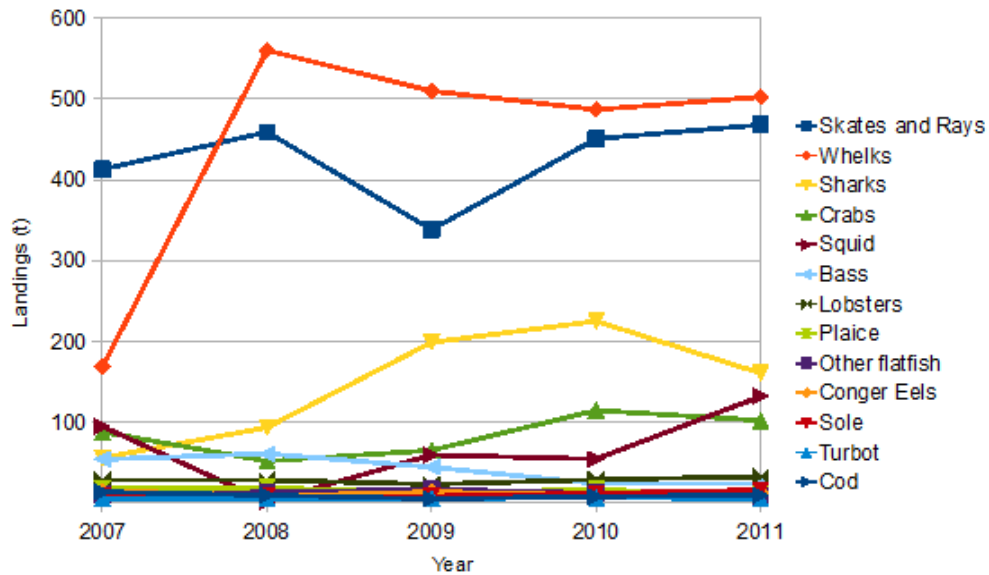
The main landing ports are Appledore/Bideford, Ilfracombe and Clovelly. The following information relating to the value, volume and composition of local catches between 2007 and 2011 has been reproduced from Northern Devon FLAG, 2013 to provide an overview of the important fisheries in Northern Devon (it was not within the scope of this study to present a more recent analysis of landings).

Between 2007 and 2011, the average tonnage of wild capture fish and shellfish landed into Northern Devon ports was 1,350 tonnes, with an estimated annual average value of £2.1 million. The most valuable component of these landings was 'skates and rays'³ (£600,000) with whelks, lobsters, squid and bass contributing between £240,000 - £295,000 each (Northern Devon FLAG, 2013). Image 2 and Image 3 show the volume and value of landings of key species into Northern Devon ports between 2007 and 2011, which shows the importance of the

² Several Fishery Orders confer legal owner of the shellfish species covered by the order within a specified area and the owners have the exclusive right to harvest the named shellfish species from the specified area, create and maintain shellfish beds and collect, move or deposit shellfish within the specified area.

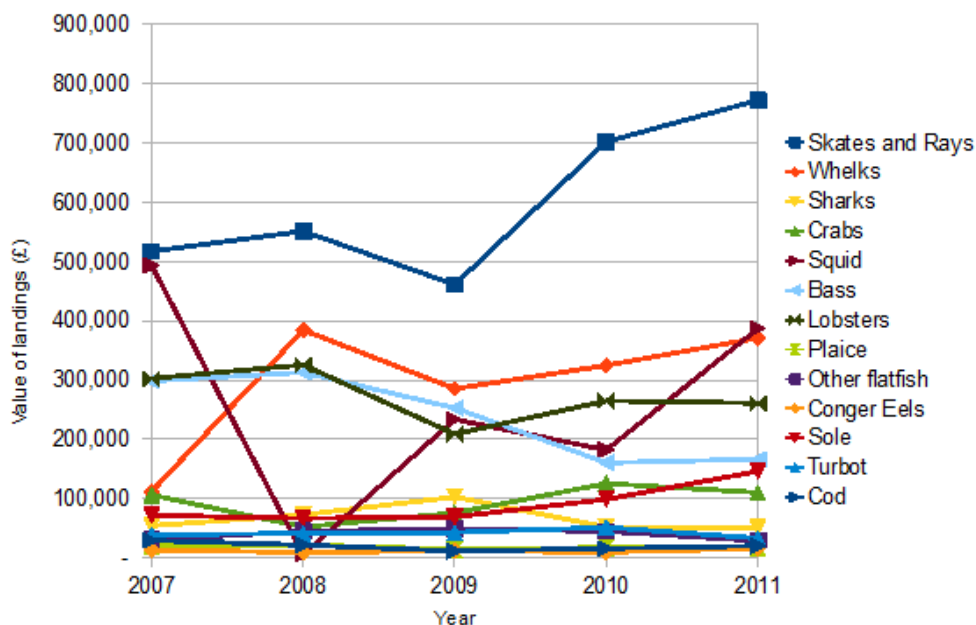
³ The MMO landings data refer to the category 'Skates and Rays'. It is noted that the Northern Devon fishery is directed at ray species, which are part of the Order Rajiformes, or 'true skates'.

ray fishery to the area. In 2014, the majority of the local trawler fleet left Northern Devon due to large cuts in ray quota for the Bristol Channel. It is not clear what the future of fisheries in the region will be.



(Source: Northern Devon FLAG, 2013)

Image 2. Volume of landings of key species into Northern Devon ports (2007-2011) (live weight, tonnes)



(Source: Northern Devon FLAG, 2013)

Image 3. Value of landings (£) of key species into Northern Devon ports (2007-2011)

4. Characterisation of Existing Aquaculture Centres in the UK

A high level review of existing aquaculture centres in the UK, summarising their main areas of focus and expertise, was undertaken to inform the demand analysis in Section 5. The outcome of the review is described briefly below and a matrix providing further detail on the areas of specialism and facilities of the centres assessed is provided in Appendix D.

The majority of aquaculture research within the UK occurs within or in association with universities. The review identified universities and colleges that offer undergraduate and postgraduate degrees and vocational qualifications in sustainable aquaculture science and systems, and which have their own research facilities that are specifically geared toward aquaculture-related research. These institutions included:

- The University of Bangor (The Centre for Applied Marine Sciences (CAMS)) - where research areas include environmental interactions of aquaculture, shellfish and finfish farming technology (including hatcheries and offshore development), feed and nutrition, species diversification, aquaculture-based fisheries stock enhancement, microbial water quality, tropical aquaculture and extraction of novel ingredients from seaweed species;
- The University of Plymouth (Marine Biology and Ecology Research Centre) – research areas include fish nutrition; aquaculture feed formulation and development, global aquaculture sustainability and biosecurity;
- The University of Stirling (The Institute of Aquaculture) - research interests span the full spectrum of aquaculture from applied production technologies through to cutting edge disease, nutrition and environmental research; and
- The University of Swansea (Centre for Sustainable Aquatic Research; CSAR)) - research areas include: aquaculture water quality management; aquaculture nutrition and feed development; marine hatchery optimisation; recirculating aquaculture system (RAS) technology development; micro / macro algae cultivation, harvesting and processing; effects of climate change on commercially important marine aquaculture species.

Numerous other universities within the UK (particularly in Scotland) offer aquaculture-related courses, or modules on sustainable aquaculture, including the University of Aberdeen, St Andrews, Edinburgh, Napier, Dundee and Strathclyde, the Highlands and Islands, Newcastle-upon-Tyne, Southampton and Portsmouth. Many of these institutions have associated marine laboratories and aquaculture-related research capacity. Other universities, including Bournemouth, Bristol and Exeter, do not provide specific courses or modules on aquaculture but do have staff who undertake aquaculture-related research.

The recent establishment of the Scottish Aquaculture Innovation Centre (SAIC) should also be noted. The SAIC is a virtual 'hub' drawing together the collective expertise and resources found across 13 research partners and its extensive aquaculture supply chain with funding from government and industry. The latter also providing the leading role in determining the research work that is funded.

Colleges which provide degrees and vocational qualifications in fisheries and aquaculture-related management and husbandry include Sparsholt College, Bridgewater College, Falmouth Marine School and South Staffordshire College (Rodbaston Aquaculture), which combine vocational training qualifications (e.g. diplomas) with research facilities and commercial production businesses or demonstration farms.

Non-academic research institutions include Cefas, which is an executive agency of Defra. Aquaculture-related research is undertaken at the Weymouth site where work includes fish and shellfish health, food safety, the efficiency of resource utilisation and environmental impact, systems performance and planning.

Marine Scotland (a government agency in Scotland), also directly conducts aquaculture research and is currently working with the Scottish salmon farming industry on a £1 million programme of sea lice research funded in equal portions by government and industry.

The Scottish Association for Marine Science (SAMS) is Scotland's largest independent marine research organisation and houses the Centre for Aquaculture which specialises in four areas of research: impacts of the environment on aquaculture (e.g. harmful algal blooms, invasive non-native species); impacts of aquaculture on the environment, diversification of aquaculture practises (including seaweed and invertebrate culture) and aquaculture-related socio-economics. As part of the University of the Highlands and Islands, the Centre offers various educational opportunities including, from 2015, a postgraduate qualification in 'Aquaculture, Environment and Society', which is an EU Erasmus funded programme in partnership with the Universities of Crete (Greece) and Nantes (France).

There are also numerous private companies which provide commercial services to the fisheries and aquaculture sectors and undertake specialist aquaculture-related research, often in collaboration with the research institutions described above. Example areas of specialism include feed trials/nutrition, culture technology, pharmaceutical and veteraceutical⁴ research, technology testing facilities and recirculation aquaculture systems. A number of these companies also offer training services.

Further research takes place in organisations funded from public sources or charities which include the National Lobster Hatchery, the National Marine Aquarium and the Zoological Society of London (ZSL). These organisations tend to focus on research and conservation as well as education and public awareness.

In summary, the review indicated that there are a large number of institutions and companies actively involved in aquaculture-related research and education. Not only are these institutions involved in active research in the UK, most are involved in wider collaborative research programmes in Europe and more globally.

⁴ The development and production of veterinary medicines and other treatment agents, for example, sea lice treatments.

Furthermore the above is not an exhaustive summary of research capacity in the UK because many aquaculture production businesses are also actively engaged in aquaculture-related research through science/industry collaborations with the above institutions. A brief comparison (i.e. gap analysis) of the expertise provided by current aquaculture centres in the UK and the Research and Development (R&D) and support requirements of the UK aquaculture industry as determined in the demand analysis is provided in Section 5.3.

5. Demand Analysis

This section summarises the level and nature of interest from stakeholders in the development of an Aquaculture Centre in Northern Devon, based on the outcomes of the stakeholder consultation. Section 5.1 provides an overview of European and national level drivers which are likely to be key influences on the development and expansion of the UK aquaculture sector in the short term future. Section 5.1 also provides a summary of the feedback from the wider stakeholder consultation exploring what services and facilities would best support sustainable aquaculture expansion in the UK. Section 5.2 summarises the output from the stakeholder workshop.

5.1 National Level Demand

5.1.1 Drivers of Aquaculture Expansion

There are a number of key European and UK policies which aim to drive the expansion of aquaculture and which therefore will influence the level and nature of demand for services and facilities to support the industry going forward. These are briefly reviewed below.

5.1.1.1 European Commission Blue Growth Strategy

Blue Growth (EC, 2012) is a European Strategy to support sustainable growth in the marine and maritime sectors. The Strategy recognises that the sea and coast are drivers of the economy and identifies five sectors, including aquaculture, for which there is an opportunity for 'blue growth' i.e. harnessing the potential of Europe's oceans, seas and coasts for jobs and growth. The growth of aquaculture will be promoted through the reformed Common Fisheries Policy (CFP) (see below).

5.1.1.2 Reformed Common Fisheries Policy and the European Maritime and Fisheries Fund

As noted above, the European Commission intends to boost aquaculture through the reformed Common Fisheries Policy (CFP) and the European Maritime and Fisheries Fund (EMFF) is the financial instrument put in place to support the implementation of the reformed policy.

EMFF funding (which covers the period 2014-2020) aims to co-finance projects, along with national level funding, to boost the sustainable growth of the aquaculture industry throughout Europe. Aquaculture comes under Union priority 2: 'fostering environmentally sustainable, resource efficient, innovative, competitive and knowledge based aquaculture by pursuing a range of specific objectives including supporting technological development, protection and restoration of aquatic biodiversity, environmental protection, and the development of professional training'.

5.1.1.3 UK Multiannual National Plan for the Development of Sustainable Aquaculture

The European Commission (EC) required all Members States to draw up multiannual plans to promote the development of aquaculture based on strategic guidelines produced under the reformed CFP.

The UK Multiannual National Plan (MANP) for aquaculture, details how the UK intends to foster growth in the aquaculture industry. The MANP describes initiatives, research bodies and partnerships which are helping to drive the development of the sector, provides examples of industry-driven innovation, industry best practise, innovative techniques and key knowledge exchange forums. Of particular relevance to the current study, the MANP highlights several areas where innovation and links between R&D and the aquaculture industry would be beneficial and which link to specific measures in the UK's EMFF Operational Programme. These are listed below (Defra, 2014):

- Innovation and research into reducing potential impacts on other sectors, e.g. sea lice and escapes with respect to wild salmonids; use of licensed therapeutants⁵; interaction with predatory species;
- Constant innovation in development of sustainable (sometimes non-traditional) raw material sources for 'fed' aquaculture species;
- Innovation and technical developments that open up commercially-viable new productive areas;
- Innovation that reduces shellfish sector reliance on variable wild seed supplies;
- Water quality improvements in all aquaculture areas, but especially shellfish;
- Partnering in (using core expertise) developments in non-food aquaculture: marine agronomy; marine bio-fuels; and
- Innovation to support aquaculture development in more exposed sites⁶.

5.1.1.4 Other Research and Development Drivers

Further research and development of sustainable aquaculture in the UK is funded by the Natural Environmental Research Council (NERC) and the Biotechnology and Biological Sciences Research Council (BBSRC) (see also Section 6.3). BBSRC investment in recent years has been around £1 million per year in research directly related to aquaculture, plus additional funding for underpinning research topics such as basic fish biology and potential novel fish feeds. BBSRC have stated that they will continue to encourage and fund research relevant to a range of types of aquaculture that are important in the UK and worldwide while encouraging engagement between researchers and relevant sectors of the industry and other users of research. BBSRC will also continue to work closely with NERC, other research councils and other funders to develop joint activities for aquaculture (BBSRC, 2014).

Additionally, The EU Horizon 2020 research and technology development programme states that aquaculture has a large potential for the development of healthy, safe and competitive food products. As a result it suggests that research effort should be focused on the domestication of some species (established and new species), on interactions with the environment, on health and nutrition of farmed aquatic organisms and on reproduction and breeding, which are among the main obstacles to the sustainable development of European aquaculture. It also states that

⁵ Therapeutants are healing or curative agents or medicines and in aquaculture include sea lice treatments and antibiotics.

⁶ Defra (2013) states that the primary route for aquaculture development in the UK relates to new production opportunities and technologies, especially [in] more exposed sites in the marine environment.

research should address the social aspects of the seafood sector, which are essential for the cohesion of the social fabric in European coastal areas (European Commission, 2015).

Recommendations that arose from the Seafish Industry Authority's review of its services to the UK aquaculture industry included the provision of technical support to the production sector mainly in the form of collaborative R&D projects using Seafish levy income to leverage public funds (see also Section 6.3). Another recommendation was the provision of information for the industry via acting as a 'one-stop-shop' for aquaculture knowledge on both a local and international level, potentially via becoming a web portal for the industry (Seafish, 2014).

5.1.2 Wider Stakeholder Consultation

Consultation with national stakeholders in the aquaculture sector provided the following information regarding the type of centre and facilities that would best enhance or compliment current aquaculture research and the sustainable expansion of the industry in the UK.

A Northern Devon Aquaculture Centre should or could:

- Promote new aquaculture developments suited to local conditions;
- Establish commercial-scale demonstration projects, which in turn can provide funding for the Centre;
- Focus on technologies with proven potential to enhance UK aquaculture, e.g. recirculating aquaculture systems (RAS) for high-value niche species and improved systems for coastal shellfish production;
- Focus on sustainable systems for example low technology, local 'backyard aquaculture';
- Provide a shellfish hatchery for production of bivalve, mollusc seed/spat (e.g. oyster, scallop);
- Carry out nutritional feed trials (for finfish cultivation);
- Provide vocational training; and
- Carry out breeding and husbandry of endangered species with the aim of restocking wild populations.

Although specific research and development opportunities were not raised by stakeholders, potential additional areas of interest to the aquaculture sector may include:

- Research and development relating to the use of cultured species (including algae) in the pharmaceutical, nutraceutical (production of nutritional food supplements) and the cosmetics industries;
- Scaling-up facilities for increased production of species for the above industries;
- Research related to improved detection of contaminants in seafood (e.g. in relation to microalgae toxins or norovirus) and other diseases affecting the industry; and
- Cultivation of aquaria species to improve sustainability of this industry.

The areas of innovation, research and development required within the UK industry as a whole described in the sections above provide opportunities for a potential Northern Devon Aquaculture Centre. For example, the potential for research into feed trials, the production of

spat and juveniles to lower reliance on wild seed supplies, water quality improvements (an issue of concern in the Taw-Torridge Estuary), and development of aquaculture in more exposed sites (which would be facilitated by the exposed conditions and large tidal range in the Bristol Channel) were highlighted as key issues requiring further research at a national level.

5.2 Local Level

Through the initial group discussion at the project workshop, stakeholders identified four main themes in relation to potential demand for an Aquaculture Centre in Northern Devon, which represent key gaps in current service provision in the region:

- Development of an information hub/aquaculture development zone;
- Conservation and restoration opportunities;
- Education and training opportunities; and
- Diversification of fisheries and aquaculture activities.

'Workgroups' in the afternoon then further explored the requirements, strengths, weaknesses and priority of each type of opportunity and the outcomes are summarised below (note more detailed outputs of the workgroup discussions are provided in Appendix C). It should be noted that the project workshop outcomes have been reported directly as proposed by the stakeholders. An initial assessment of the viability of the proposed opportunities is presented in Section 6.

5.2.1 Development of an Information Hub/Aquaculture Development Zone

Stakeholders identified that support to aquaculture businesses wishing to develop aquaculture activities in the region would be beneficial, such as through an information hub and/or aquaculture development zone. In relation to this, the following points were identified:

- The industry would benefit from a centre to facilitate and support applications to expand existing aquaculture initiatives or to set up new ones.
- The process would involve getting the 'right parties' together, creating an information network to address what permissions/consent are needed and who from. Such an information hub would need a website.
- All relevant agencies and local stakeholders would need to be involved.
- An agreed 'marine plan' is needed that identifies appropriate areas for aquaculture — where it will be positively supported — so that licensing decisions will be made in the context of the agreed plan. It should be noted that the requirement for the establishment of regional marine plans comes under the Marine and Coastal Access Act 2009. France may provide some examples, such as Ile de Ré, a site specific to aquaculture. Stakeholders questioned whether it would be possible to have 'simplified planning zones' similar to those on land.
- Additional phases of funding would be required for development of the information hub and for the operational phase, further to a more detailed assessment of the most beneficial format of such a hub (options explored further in Section 6.4) and ensuring co-ordinated development in parallel with the proposed national information hub (see Section 5.1.1.4 above).

- It was suggested that the AONB could host the development phase, and one of the local or national government agencies could host the operational phase.
- Possible sources of funding for an information hub include European funding, Local Enterprise Partnership, and funds linked to promoting business growth and marine industries.

5.2.2 Conservation and Restoration Opportunities

Stakeholders felt that Northern Devon, due to its many important conservation and landscape designations, could provide an opportunity to showcase how aquaculture can contribute to conservation and how aquaculture can provide environmental remediation and restoration opportunities. The following points emerged:

- Aquaculture contributes to food production but may also provide an opportunity to be a 'restorative' industry in Northern Devon, such as for use in a bioremediation (via shellfish or seaweed cultivation) and/or bioengineering capacity (via shellfish) to provide beneficial ecosystem services. The majority of nitrates (97%) in the estuary come from the catchment and it has been identified that an investment of approximately £15 million per annum over a five year period is required to address water quality issues related primarily to diffuse pollution sources in the Taw Torridge Estuary (Environment Agency estimate; Andrew Bell, North Devon Biosphere Reserve, *pers. comm.*). Some of this funding will be met through stewardship schemes and small grants to farmers (e.g. via the catchment sensitive farming project) and projects which will help to reduce diffuse pollution which have received funding include the Nature Improvement Area, Taw River Improvement Project and the Diffuse Pollution Pilot Project. However, additional funding will be required (for example from the European Regional development Fund) and is currently being sought. Shellfish or seaweed (macroalgae) aquaculture might provide an opportunity to help address water quality in the estuary, but there may need to be safeguards to ensure people do not harvest and eat shellfish grown for this purpose. Commercial scale macroalgal production at sea has yet to progress beyond pilot schemes and the markets for farmed seaweed in the UK are uncertain and may also be influenced by whether the seaweed was primarily farmed for bioremediation purposes. There may also be opportunities to use aquaculture as a tool to maintain and enhance conservation objectives.
- A Centre could be used for research and education in relation to the restorative function of aquaculture (see Section 5.2.3 below).
- Aquaculture restoration work could link into an overall 'Northern Devon' brand identity, emphasising restoration of the environment, not just using it.
- There may be a possibility to restock Spiny lobster (*Palinurus elephas*), an MCZ Feature of Conservation Importance, and the Aquaculture Centre could produce juveniles for restocking.

5.2.3 Education and Training Opportunities

An Aquaculture Centre could also provide education and training opportunities in the form of short courses linked with other educational establishments. The group discussion highlighted the following points:

- There is a lack of opportunities in fisheries and fisheries management (especially freshwater) and there is a need for career development through the industry.
- Raising awareness of seafood should be a high priority, for example, raising the profile of seafood, working with schools to raise awareness of seafood, its consumption and career opportunities; raising awareness of job opportunities and potential salaries in seafood sector — the Scottish Government is very proactive at this, and it is an important prerequisite to build interest in the sector, to be able to subsequently provide industry-based training courses later on.
- The Aquaculture Centre could provide short courses to train people for jobs in the aquaculture industry. This could be vocational training, as well as short courses as modules of a wider degree programme for different colleges and universities. Such training must be based on industry needs and demands, so it is not possible to specify subject matter or course content at this stage.
- A training facility would require full-time staff (in contrast to the information hub concept discussed above).
- Training should focus on short courses (for example), rather than PhDs, however, there may be an opportunity to act as a research and accommodation base for PhD students. Postgraduate students come to Northern Devon to do research, but they need accommodation; there may be potential for a hosting facility for conservation-related fieldwork. Lundy is a key area for such research. It may be possible to create larger demand for such facilities via diplomas and vocational activity.
- The group that considered conservation and restoration opportunities also highlighted the possibility to develop training courses in this area, subject to a demand analysis.
- Training will be a high priority if the aquaculture industry develops in the region. An Aquaculture Centre could be a centre of excellence, of good practice, such as Sparsholt College in Hampshire, for example. Bridgwater College provides another example of a vocational training institution which has set up an eel rearing facility and undertakes restocking and rearing to support the existing fishery. They have also run a successful small-scale oyster farm for one year. A large component of Bridgwater College's work is providing vocational training to existing fishermen and to students in sustainable fishing and also running school engagement projects. It was highlighted that many people are only interested in carp farming when they go there, but the college tries to broaden their horizons and provide work experience placements.
- An Aquaculture Centre would have the potential to include a commercial fishing aspect to training, but may come into competition with other training providers (e.g. Western Training, Seafood Cornwall, which are part-funded by Seafish to provide some fishing industry training courses) so further analysis would be required to determine if this would be viable or not. Alternatively, the centre could provide established training providers with a facility in which to provide any required certification courses.

- The Centre could provide specific industry qualifications ('tickets') that are needed for certain jobs and roles. Teaching can draw on semi-retired/ex-fishermen to provide practical experience and mentor students. Courses would also need to address Health & Safety aspects, which are important in all industries these days.
- Possible formats for teaching:
 - Weekend courses;
 - Long-distance online courses;
 - Specific modules for Plymouth University, Bridgwater College, Petroc etc.
- Requirements/facilities:
 - Rooms (teaching room);
 - Staff/expertise;
 - Links with other institutions.
- A Visitor Centre could also be included as an 'add on' to the centre, but should not be the main purpose of the Centre. This would provide opportunities to engage, educate and inform the public (local residents and tourists) about the fishing and aquaculture industries and would provide an additional source of funding.

5.2.4 Diversification of Fisheries and Aquaculture Activities

An Aquaculture Centre could support the diversification of fisheries and aquaculture activities in the region, helping to generate economic opportunities. The following points emerged from the discussion:

- Stock enhancement (e.g. via a hatchery) is a key opportunity, such as for scallop or lobster. There could also be a commercial opportunity for hatchery production of shellfish spat such as oysters (e.g. Pacific oyster triploids) or mussels.
- Care should be taken to avoid conflict with existing commercial fisheries, and there should be a focus on ensuring that the industries can cohabit. Seaweed cultivation could benefit wild fish; mussels and lobsters provide mutual benefits (mussels support juvenile lobster). There is also a need to address the public perception of aquaculture; conservation and restoration work (see Section 5.2.2) and public awareness/educational outreach (see Section 5.2.3) could contribute to this.
- The group that considered conservation and restoration opportunities highlighted that there may be potential to extend inter- and sub-tidal shellfisheries, and there should be consideration of what kind of species would be used, or not used. A Plan or Framework could be developed so that it is clear to the aquaculture industry what they can do or can't do, to avoid confusion.
- The Taw Torridge Estuary is one of the best natural mussel beds in the country. There may be an opportunity to create spat for selling, for relaying elsewhere. If the estuary itself is used to put down spat, there is a need for relaying areas where the mussels can be re-laid before harvesting for six months, based on the current water quality of the estuary.
- The potential to develop or enhance an eel fishery in Northern Devon should be investigated.
- Another opportunity is habitat enhancement – lagoon cultivation, led by a shoreline management plan, which can also provide flood attenuation.

- Constraints to aquaculture development include:
 - Transport links into the area⁷ (road improvements to strategic links was highlighted as a priority in the Northern Devon Economic Strategy 2014-2020 (North Devon Council and Torrington District Council, 2014);
 - Water quality in the Taw Torrington Estuary;
 - Food regulations;
 - Red tape, which could be addressed through identification of sites that are specific to aquaculture use. Changes to licences and policy in 2020 (under CFP reform) and other European [policy] drivers may help deal with red tape. More locally, issues may relate to planning, specifically the high cost of land and availability.
- There is a need to consider how to manage waste produced from aquaculture (e.g. use as biofuel, recycling), and funding for this is available.
- Potential production systems discussed included:
 - Marine – seaweed, bivalves – on seabed, rope grown, trestles.
 - Finfish (net pens) – aquaculture-reared finfish has the market benefit of being able to be sold at sizes smaller than the Minimum Conservation Reference Sizes (MCRS; previously Minimum Landing Sizes, MLS), allowing the possibility of ‘plate-sized’ fish for restaurants. There is potential for cultivation of bass or rainbow trout in Northern Devon, and possibly sea bream. However, juveniles would have to be imported, and the introduction of non-native species could be an issue.
 - Shore-based [Recirculation Aquaculture Systems]. Seawater pumps, oxygenation systems, temperature control. This could include crustacean (shrimp) aquaculture.
 - Freshwater – trout, salmon hatcheries.

5.3 Summary of Demand and Gap Analyses

There was a high level of interest in the project among the national and local stakeholders contacted.

The demand analysis revealed that specific areas of research have been identified as being required to support the UK industry generally and these may provide opportunities for the Northern Devon Aquaculture Centre including:

- Innovative and technical developments that open up commercially-viable new productive areas;
- Innovative and technical developments that reduce the shellfish sectors reliance on wild seed supplies (including multi-species shellfish hatcheries);

⁷ Barnstaple is the most well connected town, accessed from the M5 by the North Devon Link, although this is primarily a single carriageway link road. The journey time to Exeter by road is over an hour from most parts of the area, increasing to 1.5 to 1.75 hours from the northern coast. The journey time to Junction 27 of the M5, the nearest main transport artery, is 45 minutes from Barnstaple and 30 minutes from South Molton although is over an hour from many parts of the locality. Only the southeast corner of Torrington has easy access to the A30. Road links and access to South Devon are poor (North Devon Council and Torrington District Council, 2014).

- Improvements in water quality;
- Technology to enable aquaculture to move into more exposed sites;
- Health and nutrition of aquaculture species including novel fish feeds and nutritional feed trials;
- Reproduction and breeding;
- Interactions with the environment;
- Vocational training.
-

Other areas of interest to national stakeholders that a Centre could support include:

- R&D into high value ingredients from cultured species for use in other industries (and the potential requirement for scale-up facilities for production of the above);
- Improved detection of contaminants in seafood;
- Sustainable production of ornamental aquaria species; and
- Breeding of endangered species (for conservation purposes).

Based on the characterisation of existing aquaculture centres in Section 3 (see also Appendix D), no immediate gaps in research potential are apparent, with established research institutions, organisations and companies undertaking a diverse range of aquaculture-related research and development. Furthermore, science/industry partnerships help to target research outputs with industry requirements.

In general, many of the above areas (education and training, conservation) were also proposed as possible opportunities by stakeholders attending the project workshop. However, specific research needs, facilities and services to support existing and new start up aquaculture initiatives in Northern Devon were identified. These included:

- Research or trials to establish what types of aquaculture developments suited to local conditions;
- Information to facilitate and support local aquaculture initiatives; and
- End product testing facilities to reduce costs for existing producers.

There was also strong support for the development of aquaculture activities to provide potential diversification opportunities to the existing fishing communities and employment and education opportunities for the younger generation. Numerous potential opportunities were proposed and discussed at the Project Workshop as described in Section 5.2 above and Appendix C.

However, the demand analysis also highlighted a number of key constraints which need to be overcome to enable development of sustainable aquaculture in Northern Devon, which included:

- Water quality in the Taw Torridge Estuary;
- Physical (exposed) conditions outside of the Estuary;
- Regulatory hurdles, particularly in relation to the establishment of Fishery Several Orders;

- The high number of conservation and landscape designations (although this was also seen as an opportunity to demonstrate exemplar aquaculture developments in such areas); and
- The lack of an aquaculture strategy at both a local and national level.

An initial scoping of the feasibility of the opportunities identified by the demand analysis and of establishing an Aquaculture Centre to support such opportunities in Northern Devon is presented in Section 6.

6. Option Appraisal and SWOT Analysis

In order to identify the most viable opportunities for an Aquaculture Centre in Northern Devon, and undertake a strengths, weaknesses, opportunities and threats (SWOT) analysis of the most viable options, the following steps were undertaken:

Collation and initial screening of all stakeholder information to identify:

- The nature of the opportunity (e.g. commercial aquaculture initiative, conservation initiative, research opportunity, educational opportunity);
- General benefits and constraints;
- Lessons learned from similar initiatives; and
- Whether the opportunity was suitable for further immediate consideration in the current study or whether it was likely to be an opportunity that could be further developed at a later stage in the process.

6.1 Initial Screening of Proposed Opportunities

Table 6.1 presents the opportunities and ideas for aquaculture development and/or for the services that could be provided by the Aquaculture Centre suggested by all stakeholders. For each opportunity, an initial assessment of the main constraint(s) and hence viability of the proposed option is presented (based on stakeholder discussion and other information sourced) and opportunities to be considered further within the current study are identified. To assist in the screening process the following general points, provided through stakeholder consultation were taken into consideration:

The Aquaculture Centre:

- Must be a commercial entity;
- Must not be just a building/visitor centre;
- Should focus on the development of aquaculture suited to local conditions;
- Should provide:
 - Diversification opportunities for current fishermen and attract a new generation into fisheries and aquaculture sectors;
 - Vocational training and short courses;
 - Public awareness and link to tourism (secondary function but important);
 - Information and guidance for developers;
 - Must not replicate current locally available provision.

Aquaculture in Northern Devon – questions and constraints which would need to be addressed to enable development of the industry in Northern Devon:

- Need to establish what cultivation techniques/species possible in Northern Devon due to physical conditions;
- Does North Devon have a unique selling point?;
- Need to overcome regulatory hurdles particularly in relation to the establishment of Fishery Several Orders for mussel beds (currently public resource and vulnerable to exploitation from larger vessels from outside area) and getting historical shellfish beds

re-opened/ re-classified (to provide relay beds for depuration purposes if mussel bed classifications are downgraded);

- To help overcome red tape, is it possible to establish aquaculture 'development zones' or have a simplified planning zones?
- Water quality in the Taw Torridge Estuary is a major constraint;
- Geographical location – Northern Devon is a remote area, the existing transport links won't prevent aquaculture development but definitely a weakness; and
- General concerns regarding disease and biosecurity.

Based on the demand analysis, stakeholder consultation and characterisation of existing aquaculture centres, the following were identified as potential opportunities for the Northern Devon Aquaculture Centre:

- Information hub / one stop shop to facilitate local aquaculture development;
- Creation of a plan for aquaculture development in Northern Devon and 'aquaculture development zone(s)';
- Use aquaculture for provision of beneficial ecosystem services e.g. bioremediation;
- Hosting centre for conservation-related fieldwork;
- Hatchery production of shellfish seed/spat (proven species/ technique) — for on-growing (commercial product e.g. mussels, oysters) or restocking (e.g. scallop);
- Hatchery production of European lobster for restocking (proven species/technique);
- Research and development of breeding/hatchery production of other species e.g. eel, native oyster, spiny lobster, for potential restocking, restoration or ranching (on-growing on seabed);
- Short courses (for people working in aquaculture);
- Specific modules for universities, other vocational institutions (e.g. including long-distance on-line courses);
- Sea-based production of macroalgae;
- Sea-based production of bivalve molluscs (seabed, lantern nets, pearl nets, rope, trestle);
- Sea-based production of finfish;
- Shore-based recirculation systems for production of high value niche species of finfish and/or crustaceans;
- Nutritional feed trials for finfish cultivation (e.g. aquaculture feed formulation and development) – land-based;
- Facility that researches the culture (husbandry and breeding) of critically endangered species with the aim of potentially restocking;
- Production of organisms for the aquarium sector;
- Larger-scale production of organisms for pharmaceutical and nutraceutical industries;
- End product testing laboratory;
- Establish a demonstration hub (e.g. like those developed for renewables) to test what culture methods are viable in the physical conditions of Northern Devon; and
- Commercial-scale demonstration farm (e.g. for shellfish species such as oyster).

These are evaluated for their benefits and constraints, and whether they should be taken forward or not, in Table 6.1.

Table 6.1 Analysis of Potential Opportunities for the Northern Devon Aquaculture Centre

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
Information hub / one stop shop for aquaculture information.	Would assist existing and start-up businesses.	Service would be national; no comparative advantage to it being created in Northern Devon rather than through an existing centre	<p>Idea already being taken forward and Seafish likely to become the 'one stop shop' for aquaculture (Seafish, pers. comm.).</p> <p>However, it is important that there is sufficient support to help existing and start-up businesses at a local level – where there may be specific issues. In Northern Devon such issues particularly relate to the establishment of Several Orders. If such guidance cannot be provided through the national initiative, there may be requirement for additional support services locally.</p> <p>Consultation has shown that there are expert stakeholders who may be able to assist with such an initiative should it be taken forward. Any local initiative should involve liaison with Seafish to capture any available relevant information and link with any other information networks being established.</p>	No - there is no advantage to a national information hub being developed in Northern Devon. However, there is clearly a need for information and support for local businesses to overcome local regulatory hurdles, for example, in the format of a guidance document compiled with the input of all relevant stakeholders, regulators and statutory nature conservation bodies.
Creation of plan for aquaculture development in Northern Devon and 'aquaculture development zones'.	Such a Plan would identify areas in which applications will get favourable consideration, helping to promote development of local aquaculture	Statutory Marine Plans, based on marine sector requirements, are being developed by the MMO. However, the timescale for production of the South West	Statutory regional Marine Plans aim to raise the profile of the aquaculture sector amongst other marine sectors and provide a degree of certainty in relation to	No – further assessment of the potential for a local marine plan (for example, a Biosphere Reserve Marine Plan) to be adopted as a material consideration within the

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
		<p>Marine Plans is not currently known.</p> <p>Furthermore, there is no legislative basis by which a local marine plan can be established and considered to be a material consideration within a statutory Marine Plan.</p>	<p>potential future sites which may be suitable for development. For example, the East Coast Marine Plan (MMO, 2015) provides for the potential to establish sustainable aquaculture development sites, identified through research. Aquaculture Policy AQ1 states that within such areas proposals for other licenced activities should demonstrate that they will avoid adverse negative impacts on future aquaculture development.</p> <p>The Marine Plans will be used to inform licence applications (where required), however they are not intended to accelerate aquaculture licence applications (Stacey Clarke, MMO, pers. comm.).</p> <p>A recent study by Cefas made a recommendation for national administrators and regulators to provide strategic planning for marine aquaculture development to inform spatial planning processes and include Allocated Zones for Aquaculture (AZAs). Furthermore, they recommended that aquaculture should be integrated into River Basin Management Plans (Jefferey <i>et al.</i>, 2014).</p>	<p>statutory Marine Plan is recommended.</p>

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
Use aquaculture for provision of beneficial ecosystem services e.g. bioremediation.	<p>Species could be cultivated to help improve water quality in the Taw Torridge Estuary.</p> <p>This type of aquaculture would support the nature conservation designations in the region.</p>	The water quality of the estuary would influence the end use/market for any species cultured. Shellfish species cultured in Class B or C shellfish harvesting areas need depuration or relaying in Class A waters before they can enter the food chain and there is a lack of such areas in Northern Devon.	<p>Evidence exists for the provision of beneficial ecosystem services of certain shellfish species (e.g. reef building bivalve molluscs such as oysters) and marine algal species, including with respect to regulation of pollution.</p> <p>Case study examples of the use of shellfish for water quality improvement exist e.g. the creation of Pacific oyster reefs in America, however, the oysters cannot be harvested for human consumption.</p> <p>Bivalve molluscs and macroalgae are increasingly being used in many parts of the world in integrated multi-trophic aquaculture (IMTA) in which cultivation of species from different trophic levels are cultured in close proximity to each other, with the waste products from higher trophic species (excreted nutrients) being utilised by the lower trophic levels, resulting in the production of multiple products.</p>	Potential area for research by the Aquaculture Centre.
Hosting centre for conservation-related fieldwork.	Provision of accommodation and lab//bench space for visiting scientists.	Demand unlikely to be sufficient to sustain the centre.	Not a stand-alone viable commercial enterprise.	Lab space / research facilities could be provided to visiting researchers alongside the Aquaculture Centres own researchers.

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
	Promotion of research links with other research facilities.	Provision of accommodation would require specific facilities and staff.		Accommodation not for further consideration – given the high levels of tourism to the areas there are numerous accommodation providers in the area.
Hatchery production of shellfish seed/spat (proven species/techniques) — for on-growing (commercial product e.g. oysters) or restocking (e.g. scallop).	Commercial opportunity producing seed/spat for domestic and export market	Requires seawater abstraction – hence important that water quality is adequate. Hatchery production of mussel seed has yet to be proven as economically viable unless the product has added value such as triploidy (genetic induced sterility which results in year round high meat production as spawning does not occur) (e.g. Blue Seed, 2008).	In other parts of UK, disease issues (oyster herpes virus and <i>Bonamia</i>) have hampered initiatives.	Yes – as a potential commercial enterprise. However, it should be noted that any hatchery development would need sufficient associated farms (customers) for the operation to be viable (i.e. an assessment of current supply and demand to ensure economic viability would need to be undertaken).
Hatchery production of European lobster for restocking (proven species/technique).	Potential benefits to local catch sector and lobster populations	Adequate water quality required for abstraction and use in hatchery; Stakeholder experience of difficulty (particularly expense) of setting up hatchery in an AONB).	Exemplar case study in Padstow (National Lobster Hatchery). Northern Devon fishermen already working with this hatchery. It is important to consider the overall aim of any restocking programme. For example, if landings of lobster are not falling, it is important to consider whether the existing habitat can sustain an increased population. Also, there is a high mortality of juveniles, hence introduction of more juveniles will not necessarily translate into a larger population of adults.	Possible for future collaboration with the National Lobster Hatchery to complement or support the expansion of this work for the further benefit of lobster populations in the south west and the North Devon lobster fishery. The requirement for, and ultimate aim of such work should be further assessed.

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
			However, aquaculture can be used for general restoration of a fishery e.g. scallops.	
Research and development of breeding/hatchery production of other species e.g. eel, native oyster, spiny lobster, for potential restocking, restoration or ranching (on-growing on seabed).	Conservation and fishery benefits. Spiny lobster is a high commercial value species and a species of conservation importance in MCZs.	Adequate water quality required for abstraction and use in hatchery.	The technical obstacles to spiny lobster production are far greater than for <i>Homarus</i> species, mainly due to the very long larval stage. Research to develop culture technology for spiny lobster has been undertaken in Australia and is currently being undertaken in the UK (Wales).	Potential future consideration
Short courses (for people working in aquaculture).	Stakeholders indicated there was a demand	Ideally (especially for practical training) would be linked to an operational aquaculture site, which are currently lacking.	Will require expert staffing	Yes - potential for development of some courses in the short-term, as well as providing a venue for outside providers, and practical courses in the longer term when Centre and aquaculture activities more firmly established.
Specific modules for universities, other vocational institutions (e.g. including long-distance on-line courses.)	Vocational training. Income stream for the Centre.	Many universities have their own courses established; would require further demand and viability assessment.	Will require expert staffing and adequate/unique facilities	Yes - potential for development in the longer term when Centre established.
Sea-based production of macroalgae.	Commercial enterprise, generates revenue for the Centre.	Current market demand for product is unclear. Water quality (for estuary production) may have implications for end product use, offshore water quality likely to be better.	Need to check viability of production techniques in local coastal/offshore conditions.	Potential future consideration if viability of offshore production established and market demand is sufficient.

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
Sea-based production of bivalve molluscs (seabed, lantern nets, pearl nets, rope, trestle).	Commercial enterprise, generates revenue for the Centre.	<p>Water quality (for estuary production) means product may require relaying, depuration and/or heat treatment; offshore water quality likely to be better.</p> <p>It is currently uncertain what level of constraint, if any, may be posed by designation of recommended MCZs in the local area (e.g. Bideford to Foreland point, put forward in Tranche 2; Defra 2015) and any subsequent management measures imposed. It is noted that a number of MPAs have been designated in areas of existing shellfish aquaculture without requiring significant additional mitigation measures. It may prove more challenging for new development to obtain consent. However, the level of constraint would depend, to a considerable extent on the habitats and species for which the MCZ was being proposed.</p>	<p>Viability of production techniques in local conditions (coastal/offshore) needs to be confirmed.</p> <p>Small scale production of Pacific oysters on trestle tables recently established in Porlock, just east of FLAG area. Potentially provides evidence of viability of this technique in similar physical conditions – although it must be noted that the harvest area is Class A.</p>	Yes – potential for commercial enterprise, although risk relating to water quality in estuary and viability of any production system outside of estuary would need to be established.
Sea-based production of finfish.	Commercial enterprise, generates revenue for the Centre.	<p>Concern relating to potential environmental impacts e.g. relating to escapees, parasites.</p> <p>Market competition from wild capture fish is a constraint to economic viability.</p>	Viability of existing technology in local offshore conditions needs to be confirmed (this is a development opportunity too, however).	No - based on the strength of opposition to demonstration projects in other regions of South West, and low margins and their vulnerability to global fish prices.

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
			<p>Plans for a demonstration site off the coast of Cornwall were abandoned due to strong oppositions based on concerns over environmental impacts.</p> <p>Market competition from wild capture fishery products was the reason cod farming in Scotland was not viable (increase in wild landings reduced prices, eroding the small margins for farmed cod)⁸.</p>	<p>Furthermore, the viability of sea-cage culture in the high energy conditions off the Northern Devon coast would need to be established but would likely need substantial equipment requiring relatively large scale production to ensure economic viability. Even if technically and economically feasible (which is unlikely) Northern Devon does not have the required land-based infrastructure to deal with large scale offshore production.</p>
Shore-based recirculation systems for production of high value niche species of finfish, crustaceans.	Commercial enterprise, generates revenue for the Centre.	<p>High costs (set up, energy).</p> <p>Market demand and price (due to production costs).</p>	<p>Stakeholder feedback that this technology has good potential for high value niche species.</p> <p>Some previous land-based RAS enterprises in the UK have not been commercially successful (e.g. turbot).</p>	<p>Yes – as a potential commercial enterprise, although viability relates to production of species for which adequate market demand and prices which cover the relatively high cost of production. If such land based systems are not based close to markets/supply chain businesses high transport costs could further threaten economic viability.</p>
Nutritional feed trials for finfish cultivation (e.g. aquaculture feed formulation and development) – land-based.	Demand exists from commercial sector.	Government regulations with regard to animal trials are very restrictive.	Many forms of fish research require a Home Office licence, which require the fish to be destroyed at the end of the trial. However, there is potential for field testing phases	Yes – as a potential commercial enterprise, or as part of a research programme.

⁸ See: <http://www.heraldsotland.com/collapsed-cod-farm-was-ahead-of-its-time-1.878369>

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
		Competition with other research centres and private companies.	between strict laboratory conditions (required for valid scientific research) and larger commercial farming operations. For example, stakeholder feedback suggested that trials may be undertaken as 'part of husbandry' e.g. in an aquaculture facility.	
Facility that researches the culture (husbandry and breeding) of critically endangered species with the aim of potentially restocking.	Contribution to conservation. Potential for accessing conservation funds.	Non-commercial enterprise – requires funding. Research required into production of eggs and conditions for rearing could be extensive.	Such research activity is often taken alongside habitat enhancement activities (e.g. creation of artificial reefs in a marine context), which can often turn out to be a more cost effective strategy. ZSL suggestion that could assist other countries with less capability to undertake such activity. Work in partnership with others e.g. ZSL.	Yes - potential for development in the longer term.
Production of organisms for the aquarium sector.	Contribution to conservation (reduce depletion of wild populations). Potential for accessing conservation funds.	Research required into production of eggs and conditions for rearing could be extensive.		Yes – potential for development in the longer term.
Larger-scale production of organisms for pharmaceutical and nutraceutical industries.	Current university research facilities lack potential to scale up production. Commercial enterprise, generates revenue for the centre.	Research required into production of eggs and conditions for rearing could be extensive.	Centre would need to become established and market its services to potential clients.	Yes – potential for development in the longer term.

Potential Opportunity	Potential Benefit(s)	Potential Constraint(s)	Additional Comment	Further Consideration Within Current Study?
End product testing laboratory.	<p>Reduced costs to aquaculture production businesses.</p> <p>Demand from local aquaculture businesses.</p>	<p>Lack of producers (customers) locally, may restrict market.</p> <p>Other laboratories may provide competition.</p>	<p>Type of tests to be conducted to be established.</p> <p>Samples can be delivered by specialist courier.</p>	Yes – as a commercial service if there is sufficient demand for it to operate competitively.
Establish a demonstration hub (e.g. like those developed for renewables) to test what culture methods are viable in the physical conditions of Northern Devon.	<p>The practical viability of cultivation methods in more exposed locations will need to be established.</p> <p>Physical conditions in the Bristol Channel provide an opportunity for testing.</p>	This technology/development likely to occur in Scotland where majority of aquaculture takes place	In the mid to long term future the sector is likely to look to develop further offshore due to competition for space.	No - research in Scotland where the majority of aquaculture takes place is considered more likely.
Commercial-scale demonstration farm.	Revenue raised by sale of product will fund additional activities/research/centre	<p>Water quality, depending on species and location.</p> <p>A location in the estuary would provide easy access for educational and tourism, but water quality is currently a problem.</p>	Example case studies of commercial scale demonstration farms in USA – e.g. for Oysters in Chesapeake Bay. Used for education (schools, universities, professionals), diversification opportunities	Yes – as a not for profit enterprise/educational initiative. It is likely that such an enterprise, even with a profit made on a small-medium aquaculture operation, would still require additional funds for research and training activities.

In summary, a number of options for further consideration were identified, which can be grouped as follows:

Potential commercial opportunities (depending on viability):

- Hatchery for production of shellfish seed/spat for on-growing or restocking of target species populations;
- Sea-based production of macroalgae (viability to be assessed);
- Sea-based production of bivalve molluscs (viability to be assessed);
- Land-based production of finfish or crustacean species (economic viability to be assessed);
- Production of organisms for the aquarium sector (also a research and conservation opportunity);
- Larger-scale production of organisms for pharmaceutical and nutraceutical industries;
- End product testing ; and
- Commercial scale demonstration farm (also educational opportunity) (viability to be assessed depending on culture species and location).

Potential research opportunities:

- Use of aquaculture for the provision of beneficial ecosystem services; and
- Nutritional feed trials.

Potential conservation opportunities:

- Hatchery for production of lobster species for restocking of target species populations (also a potential educational opportunity);
- Hatchery production and restocking of other species (e.g. native oyster, eel, spiny lobster) (hatchery production proven or being researched in other UK locations – viability of restocking would need to be assessed); and
- Breeding (with aim of restocking) endangered species (requires research into breeding and husbandry).

Potential education opportunities:

- Vocational short courses for people working in aquaculture; and
- Provision of modules for universities, colleges and other vocational and training institutions;
- Location for marine field work.

These options are based on the initial scoping, screening and demand analysis conducted under this study, and should be subject to further analysis to assess their practical and commercial viability before being taken forward.

6.2 Potential Operational Models

An Aquaculture Centre could have several different operating models, which would provide the potential to access a mix of funding sources to support complimentary activities in several different spheres.

6.2.1 Limited Company

A limited company must be registered at Companies House and have its own Articles of Association. A limited company is a legal entity with its own legal rights and obligations, separate and distinct from those of its members. A company can enter into contracts, employ people, sue and be sued and can be liable if it commits criminal offences, but members' liability for debts is limited (unless they have acted wrongly in some way). Limited companies must file an Annual Return and Annual Report and Accounts at Companies House, as well as providing accounts and filing corporation tax returns to Her Majesty's Revenue and Customs (HMRC). A limited company would require a Director and Company Secretary, who are responsible for running the company and complying with the legal requirements. The members or shareholders would need to be determined for the Aquaculture Centre.

Limited company status would provide a vehicle through which the Aquaculture Centre can generate its own income from fee-paying consultancy work, and provision of goods and services, such as the production of spat or cultivation of organisms for commercial projects. It can generate profits which can be distributed to its shareholders. As a small to medium size enterprise the company would also be eligible for a range of funding support through regional development schemes linked to EU projects (see Table 6.2).

6.2.2 Independent Research Organisation

If an Aquaculture Centre can gain recognised status as an Independent Research Organisation (IRO), it would be eligible to receive Research Council funding. An IRO must:

*'possess an existing in-house capacity to carry out research that materially extends and enhances the national research base and are able to demonstrate an independent capability to undertake and lead research programmes.'*⁹

IROs must also satisfy other criteria related to their financial and legal status, including: having at least ten researchers with a significant number of publications in top quality journals and/or with key academic publishers; a track record of staff, while employed at the organisation, leading or co-leading innovative research projects in the previous five years; and research income from independent sources averaging at least £0.5 million per year over the previous three years.

⁹ <http://www.rcuk.ac.uk/RCUK-prod/assets/documents/documents/eligibilitystatement.pdf>

An Aquaculture Centre would therefore not be able to receive Research Council funding immediately, but in time as the Centre develops its research role, experience, and is able to take on more research staff, it may be possible to apply for IRO status and directly access Research Council funding.

An Aquaculture Centre would be able to work in partnership or collaboration with any institution that is eligible for Research Council funding (such as universities, the International Institute for Environment and Development, or the Zoological Society of London – Institute of Zoology) in order to access Research Council funds (subject to the conditions of specific grants), without being an IRO itself.

In exceptional circumstances Research Councils may have requirements for the development of equipment, facilities or capability, for which there is no existing capability in Higher Education Institute, Research Institutes or IROs. In these circumstances Research Councils may fund organisations which do not otherwise satisfy the conditions for eligibility. If the Aquaculture Centre establishes itself as a specialist aquaculture research centre, and there is demand through NERC or BBSRC for aquaculture research, this may also be a possible avenue for accessing Research Council funding. However, like IRO status, this would not be an immediate option but may develop with time and the increasing experience and status of the Centre.

6.2.3 Satellite or Branch Campus of an Existing Higher Education Institution or University

A facility in Northern Devon could potentially function as a satellite or branch campus, remote from another Higher Education Institution. Such campuses usually requires less space, fewer support staff and faculty members and lower overall fixed costs compared to the main institution campus. The separate campus may be under the same accreditation and share resources, or they may share administrations but maintain separate budgets, resources and other governing bodies. Advantages for the main institution include attracting local students who may not have considered attending higher education or who are unable to enrol at the main campus for financial or other reasons, earning extra tuition fee revenue and building links with universities and businesses in other regions or countries. Establishing such campuses is also seen as a way of boosting local economies.

Given the current economic climate, this operational model is currently unlikely to be feasible in the near future. Universities may be better placed than higher education institutions with regards to the financial resources to establish a satellite campus however, unless the area has a particular research quality or facility which is not available at the main institution, or a customer base (i.e. from the aquaculture industry) that requires training, this is unlikely to be an attractive option.

6.2.4 Community Interest Company (CIC) or Charitable Status

An Aquaculture Centre should provide a positive benefit to the local community, as well as contributing nationally through high quality aquaculture research. Having Charitable Status and/or by being established as a Community Interest Company (CIC) would provide access to grants and funding for not-for-profit enterprises, and the potential to receive donations from the public or other benefactors.

A CIC¹⁰ is formed for the benefit of the community and has two main features: an 'asset lock' whereby the assets and profits must be permanently retained within the CIC, and used solely for community benefit (or transferred to another organisation which itself has an asset lock), and the Community Interest Statement and Report, which certifies that the company is formed to serve the community rather than private profit motives and describes the activities of the CIC. A CIC may be limited by shares or by guarantee. It could therefore be established through the limited company structure described above, although consideration of whether the Aquaculture Centre should have a profit-generating function as well as a community interest function, or should solely be a community interest company, should be considered.

An organisation with Charitable Status must be registered with the Charities Commission¹¹ and must conform to a number of regulations set out in charity law. It must have exclusively charitable purposes under English law and must exist to serve the public benefit. A CIC cannot also be a charity, but a company limited by guarantee (with charitable objects) can become a registered charity. Having charitable status has tax benefits associated with it, including being able to reclaim VAT at 20%, and gift aid on donations. It is possible for organisations to operate dual or multiple administrative bases where part of the operation follows a charity model and another part is commercial.

Under the Charities Act 2006, a series of charitable purposes are set out. The most relevant for an Aquaculture Centre would be:

- The advancement of the arts, culture, heritage or science; and
- The advancement of environmental protection or improvement.

The consideration of which administrative model to use for an Aquaculture Centre should include eligibility for different funding sources. Some grants are only available to registered charities, but often CICs, not-for-profit companies and charities are eligible for certain funds. Additionally, some funding opportunities may be available for commercial companies.

The tax benefits of being a registered charity (reclaiming VAT, receiving gift aid on donations) may be considered to be important, in which case an administrative model including charitable status should be considered. The CIC model, which highlights the asset lock, where profits and assets must be used for community benefit, may also be an attractive option for an Aquaculture Centre, and the option to reinvest profits for community benefit and towards the objectives of the Centre could be more attractive than a limited company where profits are paid to shareholders, as the question arises of who the shareholders would be. The CIC highlights local community benefits and interests, whereas a charity model could be considered to also highlight wider social and environmental benefits (national, international).

¹⁰ <https://www.gov.uk/government/organisations/office-of-the-regulator-of-community-interest-companies>

¹¹ <https://www.gov.uk/government/organisations/charity-commission>

6.2.5 Lessons Learned from Previous Aquaculture Centres or Initiatives

In assessing a potential operational model for an Aquaculture Centre, it is important to consider the following key points:

- An Aquaculture Centre must be financially sustainable. Most funding agencies will only commit funds for a few years and so cannot be relied on for long-term support;
- Margins on commercial activities are rarely sufficient to subsidise other more charitable activities such as research or teaching, particularly if there is a need to also repay investment costs and/or to operate in a competitive market place; and
- Whilst there is some attraction in a broad remit to increase chances for funding and support, there is a risk that too many conflicting priorities or lack of focus will cause problems. There may be an advantage to being highly focused in one area and therefore better able to communicate the Centre's purpose and gain support.

Some further guidance can be drawn from the experience of other aquaculture centres in the UK.

A notable recent failure was the Astec Aquaculture Business and Science Centre in Northumberland. This was established in 2010 as an aquaculture business incubator with "Plug in and go" fully equipped wet laboratories, scalable outdoor production space and on-site bespoke technical and business support and advice including links with Newcastle University. However, it failed to attract the anticipated business start-ups and spin-out research and subsequently closed. The reasons for this have not been researched and published, but several risk factors can be identified:

- The facility was built in a region with little existing aquaculture so a minimal critical mass with respect to expertise, experience or synergies between companies was not present;
- The initiative was launched during an economic recession when bank loans and equity financing were restricted;
- The types of projects anticipated may not have been sufficiently and critically assessed with respect to business viability and hence were viewed as too risky by the business community;
- The generic facilities provided may not have met the needs of specific project ideas;
- Sponsors may have concentrated more on potential opportunities than actual market demand;
- Insufficient budget may have been allocated to marketing the facilities.

Particular care needs to be taken when planning facilities for research. Firstly for trials to be scientifically robust there needs to be facilities for an appropriate number of replicate treatments and the ability to adequately control environmental and other relevant independent variables. Such research may also require access to sophisticated analytical, imaging and genomic facilities which can be expensive and require substantial expertise to utilise effectively. More critically, experiments on fish come under animal experimentation regulations and both facilities and responsible staff need to be registered with the Home Office and only approved procedures used. This includes the humane dispatch of fish at the end of any experimental

trial. Perhaps less obvious is the need for research to involve a suitable range of scientific expertise, which suggests aquaculture research centres require a critical mass of staff expertise, or at least good access to expertise through collaboration with other organisations. Recruiting good research staff for a new facility could be difficult as many academic researchers will feel their career would suffer if they are not employed by a well-recognised and well-resourced research organisation. Close collaboration with one or more academic organisations may go some way to addressing these issues.

A more basic 'practical' research facility focusing on developing 'know-how' rather than 'know-why' and using more intuitive trial and error approaches can be attractive to many people especially in industry, and should be less costly and difficult to implement. Such an approach would also fit better with a function as a training centre and/or pilot production unit. However, in that case, income from more advanced research contracts should not be relied on in any business model.

Other examples that might prove useful include the Ardtoe Marine Research Facility in Scotland which was originally built and operated by Seafish, then passed to the Scottish Association for Marine Science, who sold it to a private company – Viking Aquaculture. There was then a management buy-out and most recently it was taken over by Benchmark Holdings as part of a portfolio of investments to enter the aquaculture sector. The research centre has always had a good reputation for its work, but has struggled as a financially independent entity. Much of its work has been with species that have been identified as having commercial potential (originally flatfish especially halibut and then cod and more recently urchin, seaweed, and wrasse) but which have largely failed to make a substantial economic impact.

The St Abbs Marine Station on the Scottish East Coast is another private research laboratory established in 2012, which has more focus on marine conservation. It is run as a not-for-profit limited company and is a registered charity. However, accounts show that turnover has fallen over the past 3 years from £905,000 in 2012 to £415,000 in 2013 and £236,892 in 2014, suggesting again that it can be challenging to maintain funding after the original impetus.

The Millport Field Centre also in Scotland could be used as an example of a marine biology field station. It was originally built in 1897 and for most of its history was owned and operated by the University of London, with facilities made available for other universities and organisations to use. The facilities are substantial (including research vessels) and in 2012 there were 30 staff. However, declining revenues, increasing costs and lack of reinvestment led to alternative ownership and management models being considered involving for instance the Scottish Association of Marine Science and the University of St Andrews. Eventually the station was sold to the Field Studies Council allowing it to reopen at the start of 2014 with fresh investment and broader remit.

6.3 Potential Funding Opportunities

This section identifies and summarises information on potential sources of funding for the aquaculture industry. This information was primarily obtained from Seafish Aquaculture Funding Guides, supplemented by internet searches and relevant information obtained from stakeholders.

The Aquaculture Funding Guides recently produced by Seafish (Seafish, 2015), identified 17 funding streams related to aquaculture, including 13 from Europe and 4 from within the UK. The funds' purpose and eligibility criteria are summarised in Table 6.2.

It should be noted that public funding sources shown in Table 6.2 is predominantly European and match funding would need to be sought. Inclusion of a funding source in the summary table does not necessarily imply that the funding source would be appropriate in the short or longer term, however, all funding sources have been included to provide a comprehensive summary. Those funding streams that are considered to be most suitable for supporting the development of aquaculture initiatives and/or an Aquaculture Centre are highlighted in **Bold** in the table and are considered to be the European Maritime and Fisheries Fund (EMFF), Fishery Local Action Group, the Leader5 Rural Development Programme, Seafish Strategic Investment Fund and Esmée Fairbairn Foundation.

Table 6.2 Summary of Aquaculture-Related Funding Streams

Fund Name	Supportable Activities	% Funding	Industry Eligibility	Information Source
EU Funding Streams				
Atlantic Area Transnational programme	Aquaculture likely involved through Axis 1 and 2.	75% (85% for technical assistance).	Western seaboard of UK. Have to operate as a partner within a larger project.	Seafish (2015)
France (Channel) England programme	Maritime industries.	Potentially 50-75%.	Likely to allow strategic-level, micro-level and cluster projects.	Seafish (2015)
European Maritime and Fisheries Fund	Sustainable aquaculture.	Likely 50:50 (with producer organisations for instance receiving up to 25%).	Small and medium sized enterprises (SMEs).	Seafish (2015)
European Regional Development Fund	Aquaculture likely involved through research and innovation (eco-innovation) as well as increasing SME competitiveness, resource efficiency, employment social and educational infrastructure, and social inclusion.	50-80% depending on the category of the region.	Social, cultural and educational institutions, NGOs, companies, SMEs, micro-enterprises, social economy enterprises and associations.	Seafish (2015)
European Social Fund	Aquaculture likely involved through improving access to employment, vocational training and boosting the adaptability of workers.	50-85% depending on wealth of region and total project costs.	Aquaculture industry to train, support and develop work force. Also support for entrepreneurs and other business development.	Seafish (2015)
Fishery Local Action Groups (EMFF)	Adding value to fishery products, diversification of business and environment culture and society are the focuses of the funding likely to benefit aquaculture.	Match funding. Typically 60% for voluntary and community projects, 40-50% for businesses.	Interest in developing the local area is essential to get funding and must include an element of Community-led Local Development.	Seafish (2015)
Horizon 2020	Optimising sustainable contribution of aquaculture to food security. Implementation of ecosystem based aquaculture of particular note.	Joint projects 100% funded. For SMEs 70%.	Small aquaculture businesses would be main focus of funding. Only 20% of the budget allocated to SMEs.	Seafish (2015)

Fund Name	Supportable Activities	% Funding	Industry Eligibility	Information Source
INTERREG EUROPE	Aquaculture likely to be involved through strengthening research and innovation, increasing commercialisation of R&D, support SMEs, move toward resource efficient economy and respond to obstructions in business growth.	85% for public bodies, 75% for non-profit bodies.	Businesses and SMEs as project partners. Regional or Local authority involvement vital for success, as would be research and academic institutions.	Seafish (2015)
North Sea Regional Programme	Aquaculture likely involved through Axis 1 (supporting growth) and Axis 2 (stimulating the green economy).	To be announced	NGOs and research institutions as well as private partners can be involved. Large partnership is likely to be required with large-scale ambitions and projects.	Seafish (2015)
INTERREG North-West Europe	Focus relevant to aquaculture is on strengthening research, technological development and innovation, and resource and materials efficiency.	Likely to be 50:50	Partnership required with at least two partners from North-West Europe member states. Must address areas of focus and have a clear lead partner and management structure.	Seafish (2015)
Northern Periphery and Arctic Programme	Access through Axis 1, innovation to develop and maintain robust and competitive communities, and Axis 2, Entrepreneurship and SME support.	Projects must provide 35-50% of the funding themselves. Where SMEs involved, they must supply at least 50% of the funding themselves. Share dependent on location.	Businesses in aquaculture are likely to be able to participate due to the need to invest in SMEs and innovation. Contact regional coordinator for more information.	Seafish (2015)
2 Seas Cooperation Programme	Aquaculture likely to be involved through Axis 1 (tech and social innovation) and Axis 4 (resource efficient tech)	Contribution to matched funding required. Amount required has not been specified.	Partnerships required, between what type of organisations is not provided.	Seafish (2015)

Fund Name	Supportable Activities	% Funding	Industry Eligibility	Information Source
Leader 5 Rural Development Programme (administered through North Devon+)	Small grant scheme for local rural businesses	Grant up to £10,000 to be matched by at least 60% by the business.	Support for key areas, including micro/small businesses (not aquaculture specific) that fit with identified 'priorities' which will bring economic benefits to the Torridge and North Devon area.	http://www.northdevonplus.com/wh-at-we-do/leader5.aspx
UK Funding Streams				
BBSRC	Aquaculture is a key part of this funding and involved through addressing food security issues, promotion of research capacity and general aquaculture research, knowledge exchange and post graduate training.	Research funded ~90%. Industry involvement may differ.	Several ways for funding to engage with industry including but not limited to: Industrial partnership awards; Join an industry club; Participation through LINK scheme; Innovate UK; Collaborative research; Fellowships; and Follow-on funding.	Seafish (2015)
NERC	NERC funding has a sector specifically for sustainable aquaculture. Priority areas within are: disease; health; immunology; diagnostics, experimental resource and environmental systems; new tech for predicting/ monitoring hazards; interactions between wild and farmed fish; and environmental capacity for increased production.	Some projects fully covered, however may need to provide up to 20% of cost.	Funding normally given to research institutions but engagement with industry is required due to key requirement of knowledge transfer. Funding comes from BBSRC, NERC, Cefas, AFBI and Marine Scotland.	Seafish (2015) and http://www.nerc.ac.uk/research/funded/programmes/aquaculture/
Heritage Lottery Fund	Aquaculture likely to be involved if sites provided visitor activities/facilities.	Projects under £100,000 can be fully funded. Grants between £100,000 and £1m contribution of at least 5% required, over £1m 10% required for both planning and delivery phases.	Contribution individually or through partnerships.	Seafish (2015)

Fund Name	Supportable Activities	% Funding	Industry Eligibility	Information Source
Other funding streams				
Esmée Fairbairn Foundation	Support for initiatives that produces higher quality food in ways that are better for people, environment and livestock, and that raise awareness.	Up to 100%	Funding given to Charities, social enterprises and intermediaries. Research is rarely funded and projects must have a social aspect.	http://esmeefairbairn.org.uk/
Lottery Heritage Enterprise Fund	Support to aquaculture if building being used is a heritage site that needs to be restored.	Grant of less than £1million, contribute at least 5% of the conservation deficit. Grants of £1million or more, contribution of at least 10% is required.	Contribution individually or through partnerships.	http://www.hlf.org.uk/looking-funding/our-grant-programmes/heritage-enterprise#.VT9hB9L4_cs
Lottery Townscape Heritage Fund	Aquaculture likely to be involved if the project will benefit the local areas community and economy, especially if the area has some history in fishing/ aquaculture. Project should aim to create vibrant and attractive places where people will want to live, work, visit and invest.	If grant request is less than £1million partnership must contribute at least 5% of the costs of development phase and 5% of the costs of delivery phase. If total grant request is £1million or more, partnership must contribute at least 10% of the costs for both the development and delivery phase.	Partnerships of local, regional and national interests that aim to regenerate economically disadvantaged historic areas are supported.	http://www.hlf.org.uk/looking-funding/our-grant-programmes/townscape-heritage#.VT9hGtL4_cs
Shell Springboard	Aquaculture could be involved if project aims to undertake low-carbon aquaculture research and/or shows one or more innovative elements.	Three winners from two regional finals receive £40,000 each. Overall winner of these six businesses gets an additional £110,000.	Any UK-registered SME can apply.	http://www.shellspringboard.org/

Fund Name	Supportable Activities	% Funding	Industry Eligibility	Information Source
The Crown Estate	A broad range of topics concerning aquaculture research are funded.	Amounts not specified. Some funding in partnership with other sources.	Charities, private companies and research institutions.	http://www.thecrownestate.co.uk/coastal/research/aquaculture-research/
Coastal Community Fund (note three rounds of funding were made available between 2010-2015 – no further funding rounds anticipated – see Coastal revival Fund below).	Aquaculture could be involved if the project is to help create sustainable economic growth and jobs.	Funding in excess of £50,000 is available. There is no upper limit, except in Wales (max £300,000). Funding from other sources is encouraged but not essential.	Local authorities, Development agencies in Scotland, Wales and Northern Ireland, Local enterprise partnerships in England, Other public sector bodies, Charities, Voluntary and community sector organisations, Social enterprises, including co-operatives and community ownership initiatives, Private sector companies.	https://www.biglotteryfund.org.uk/global-content/programmes/uk-wide/coastal-communities
Coastal Revival Fund (further to the Coastal Community Fund which had three rounds between 2010 – 2015).	The Coastal Revival Fund is a £3 million capital fund to help support local heritage or community assets to have new economic uses. Information on the capital funding available was not published at the time of writing (and hence the relevance as a potential source of funding for a North Devon Aquaculture Centre could not be confirmed).	Not known at time of writing	Not known at time of writing	https://www.gov.uk/government/publications/2010-to-2015-government-policy-economic-development-in-coastal-and-seaside-areas/2010-to-2015-government-policy-economic-development-in-coastal-and-seaside-areas#appendix-3-coastal-revival-fund
Regional Growth Fund (RGF) - only available in 2015 & 2016.	Aquaculture could have access to funding if it is to create jobs for the local area and positively affect the local economy. Such funding would be administered by North Devon+.	Between £25,000 and £499,000. Amount dependent on size of business, location, and job creation outputs.	Public and private sector. Small, medium and large businesses.	http://www.northdevonplus.com/

Fund Name	Supportable Activities	% Funding	Industry Eligibility	Information Source
Seafish	Funding may be available to the aquaculture industry if employees undertake additional safety training.	N/A	All aquaculture businesses.	http://www.seafish.org/industry-support/funding-and-awards
Seafish Strategic Investment Fund (SIF)	The Strategic Investment Fund (SIF) has been set up as a part of Seafish's Corporate Plan which describes their work programme between 2015-2018. SIF allows funding of additional, strategically important work that is consistent with the Plan's objectives. Priority will be given to submissions that address gaps in knowledge, including in relation to aquaculture.	The preferred range of awards is £20,000 - £50,000 (but small-scale projects with a strong strategic value will also be considered). The maximum available will normally be c£75,000. The total available is £250,000 for each of the three years of the Corporate Plan. Additional funds or contributions 'in kind' from the applicant will be viewed very favourably. Applications that involve a funding package will also be welcome but a strong preference will be for those applications where SIF is the primary funding source and other funds are 'added-on'.	Not stated specifically but preference will be given to applications that are innovative, supply-chain and quality orientated, and reflect the diversity of current and potential seafood offerings to consumers in the UK and elsewhere	http://www.seafish.org/industry-support/funding-and-awards/funding/strategic-investment-fund
Small Business Research Initiative	Could be of benefit to aquaculture by generating new business opportunities for companies, providing a route to market for ideas and bridges the seed funding gap.	N/A	SMEs	https://sbri.innovateuk.org/

6.4 Aquaculture Centre Options for Northern Devon

Based on the characterisation of existing aquaculture centres, demand analysis and option appraisal above, there are three possible options for the overall structure of the Northern Devon Aquaculture Centre:

- Local aquaculture information service;
- A cluster of private initiatives; and
- A public facility with commercial tenants (i.e. a mixed approach of public and private enterprise).

Each of these is described in more detail below. A strengths, weaknesses, opportunities and threats (SWOT) analysis is provided for each option in Table 6.3.

6.4.1 Local Aquaculture Information Service

In addition to the requirement for a national level information hub or one stop shop for the aquaculture industry, there is also a clear demand from local businesses in Northern Devon for easily accessible information regarding the aquaculture consenting process and for assistance and support during this process. Furthermore, barriers (regulatory hurdles) to the development of aquaculture in the area have been identified, for example, in relation to the establishment of Several Orders.

The simplest and lowest cost option is to produce a concise but comprehensive guidance document for aquaculture businesses, detailing the organisations which regulate aquaculture development, advise the regulators, grant seabed rights and establish Fishery Several Orders. An example of such a guidance document for developers in Scotland is shown in Appendix B.

An alternative option would be the development of a website that brings together relevant information resources, regularly updated to reflect the latest planning guidance and funding opportunities. The website would need a domain name and hosting package, and there would be development costs to design and prepare the website, including technical inputs to prepare the relevant information. There would be ongoing costs, albeit at a low level, to maintain the site and update the information. If the information hub were to provide a telephone enquiry line, this would also need to be resourced and staffed.

Stakeholder dialogue between fishery, conservation and aquaculture business interests should continue to be promoted to help define innovative approaches that will address the concerns of all groups.

This option would not result in an identifiable 'Aquaculture Centre' of the concept outlined in the project specification and it is not considered that there is any comparable advantage to developing an Aquaculture Centre in Northern Devon to host a national information hub for the industry.

6.4.2 'Cluster' of Private Initiatives/Companies

An aquaculture 'cluster' of private initiatives would comprise a network of local companies operating in the aquaculture sector, facilitated by supportive local planning and business development policies to stimulate growth of the sector.

There are a number of existing aquaculture businesses in Northern Devon, most of which focus on freshwater aquaculture (predominantly trout); only one is currently involved in marine aquaculture. To have a functioning 'cluster' there would be a need to attract and stimulate further growth of the aquaculture sector, potentially in the long term through the creation of an environment where planning and infrastructure is in place to support the industry (note, see Table 6.1). This would need to be supported through the local marine planning process.

The 'cluster' would involve individual businesses being established in their own business premises, across the region. There would be no specific geographical focus of activities and potentially no identifiable 'Aquaculture Centre'. It therefore appears that this is more of a 'status quo' scenario, potentially catalysed with a favourable planning regime, but not an 'Aquaculture Centre' of the concept outlined in the project specification.

6.4.3 Public Facility with Anchored Tenants (private businesses)

A public facility (for example, built with public funding) would provide a physical Aquaculture Centre that can provide research, tanks and office facilities to support the aquaculture sector in Northern Devon. An Aquaculture Centre building could offer business premises for lease by aquaculture start-up (and established) businesses, at preferential rates to promote the development of the sector. This would provide a focus for aquaculture development activities in the region. The Aquaculture Centre could also have its own core staff (director, head of research, administration and finance) to steer the activities of the Centre and implement its own research and development activities for aquaculture in the Northern Devon region. This might include on-shore recirculating aquaculture systems, appropriate at-sea aquaculture (e.g. mussels, spat production), and other potential opportunities identified in Section 5 and 6.

Having other aquaculture businesses as tenants in the Aquaculture Centre would provide a stable source of income for the Centre, as well as a focus for the sector which could help to generate collaboration and innovation, developing new opportunities. This will also help to create a 'critical mass' of aquaculture businesses in the region, which can be mutually supporting and jointly access larger funds.

6.4.4 Strengths, Weaknesses, Opportunities and Threats Analysis of Options

The strengths, weaknesses, opportunities and threats of the three options described above in Sections 6.4.1, 6.4.2, 6.4.3 are provided in Table 6.3.

Table 6.3 SWOT Analysis of Three Options for the Proposed Aquaculture Centre

	Public Building with Anchored Tenants	Cluster of Private Initiatives	Local aquaculture information service
Strengths	<ul style="list-style-type: none"> ▪ Provides a focus for aquaculture development and opportunities ▪ Two option sites identified by local councils ▪ Interest from existing aquaculture operators ▪ Tenants would contribute income to the centre 	<ul style="list-style-type: none"> ▪ Low start-up/ investment costs ▪ Lower risk 	<ul style="list-style-type: none"> ▪ Low start-up/ investment costs ▪ Lower risk
Weaknesses	<ul style="list-style-type: none"> ▪ Higher capital/ investment costs ▪ Higher operational/ running costs ▪ Higher risk (as challenging business model relating to viability of anchored tenant businesses); 	<ul style="list-style-type: none"> ▪ Requires supportive aquaculture and business development environment to be promoted by councils ▪ Lack of economic weight (economy of scale?) ▪ Not an aquaculture centre <i>per se</i> 	<ul style="list-style-type: none"> ▪ No reason for it to be based specifically in Northern Devon ▪ Needs to be kept up-to-date, requires ongoing staffing/funding beyond establishment ▪ Not an aquaculture centre <i>per se</i>
Opportunities	<ul style="list-style-type: none"> ▪ Centre can explore new opportunities as they arise ▪ Possibility for grant funding for research, grants and loans for business development, private sector income and charitable work and donations ▪ Potential to access larger-scale funds than individual aquaculture enterprises 	<ul style="list-style-type: none"> ▪ Private initiatives can respond to opportunities as they arise – flexibility 	<ul style="list-style-type: none"> ▪ Provide information and support to start-up aquaculture businesses in Northern Devon
Threats	<ul style="list-style-type: none"> ▪ Lack of interested tenants would threaten viability of centre ▪ Failure to obtain funding, particularly in current economic climate 	<ul style="list-style-type: none"> ▪ Private initiatives continue to operate as individual enterprises, no joined-up network 	<ul style="list-style-type: none"> ▪ Seafish/Cefas establishing a national information hub for support to aquaculture

The SWOT analysis indicates that a public facility with anchored commercial tenants (i.e. a mixture of public and private enterprise) would likely be the optimal approach, although the ability to secure capital funding in the current economic climate is a key threat. Hence the potential to utilise any existing buildings or facilities which may be suitable would be beneficial. Potential sites have been identified by the local councils at Appledore and Yelland and are discussed further in Appendix A.

This operational model also has the highest risk level due to the requirement for anchored tenants in the form of private businesses. However, the option most conforms to the concept of an Aquaculture Centre which would provide a positive role by enhancing the ‘clustering effect’ – i.e. bringing together numerous companies and individuals engaged in similar or complementary activities.

7. Conclusions and Recommendations

The demand analysis showed that there was a high level of interest in the development of aquaculture, and potentially an Aquaculture Centre, from stakeholders both in Northern Devon and further afield in the UK.

However, the study highlighted that there are several key barriers to the development of the aquaculture industry in this area. These barriers related to:

- Water quality in the Taw Torridge Estuary (where aquaculture would be most likely to develop in the short term);
- Exposed conditions outside the Taw Torridge Estuary where the viability of aquaculture techniques suitable to the conditions would need to be established;
- Planning and regulatory hurdles, particularly in relation to the establishment of Several Orders in Northern Devon.

In addition, the lack of an aquaculture development strategy or plan for England means that there are no key drivers for the expansion of this industry at a national or local level.

The remit of the study was to scope the feasibility of establishing an Aquaculture Centre, however, based on the outcomes of the demand analysis and consideration of the constraints, it was concluded that at the current time the development of an Aquaculture Centre is not a desirable approach. Instead, an incremental approach to addressing the barriers to aquaculture development should be adopted and if the barriers identified can be overcome, as aquaculture businesses in the area start to reach a critical mass, an Aquaculture Centre could be reconsidered at that time. Appendix A sets out recommendations for incremental steps that could be taken towards achieving development of sustainable aquaculture in the Northern Devon region.

The study has collated and undertaken an initial feasibility assessment of the potential opportunities for aquaculture development suggested by both local and national stakeholders. Commercial aquaculture activities to focus on initially could include expansion of shellfisheries and/or hatchery production of shellfish species (e.g. oyster, scallop), although any hatchery development would need sufficient associated farms (customers) for the operation to be viable. There may also be potential to use aquaculture-based culture, for example of lobster, to restock local populations, for example, through collaboration with the National Lobster Hatchery in Padstow, although the requirement for this would need to be further assessed and undertaken in the context of a wider stock and fishery management programme to be effective.

There is demand for education and training in Northern Devon, and once a critical mass of industry has formed, short courses, vocational training and/or specific modules for Colleges or Universities could form part of the products and services offered by an Aquaculture Centre. Colleges in the South West which run fisheries and aquaculture courses and hence which may have an interest in using any facilities established in Northern Devon in the future potentially include Falmouth Marine School, South Devon College and Bridgewater College. With respect to proximity to Universities, there may be potential for links with the University of Plymouth in South Devon and/or the University of Swansea in South Wales, especially if a ferry link

between Ilfracombe and Swansea is established as has been proposed on a number of occasions. A Visitor Centre attached to an Aquaculture Centre could provide accessibility to the public, general education/outreach and potentially an alternative source of funds.

The study has also provided a high-level review of potential operational models should an Aquaculture Centre be developed in the future. Based on a SWOT analysis, the most feasible option for an Aquaculture Centre would likely be a mixed approach of public and private enterprise potentially comprising a public facility with anchored tenants undertaking commercially viable aquaculture-related activities. Although this option is higher risk compared to the development of a 'cluster' of private aquaculture businesses, it is the option that best conforms to the concept of a 'centre' and it would provide a focus for aquaculture development in the region and should aim in the longer term to develop facilities and collaborative partnerships that help to support development of the wider UK industry.

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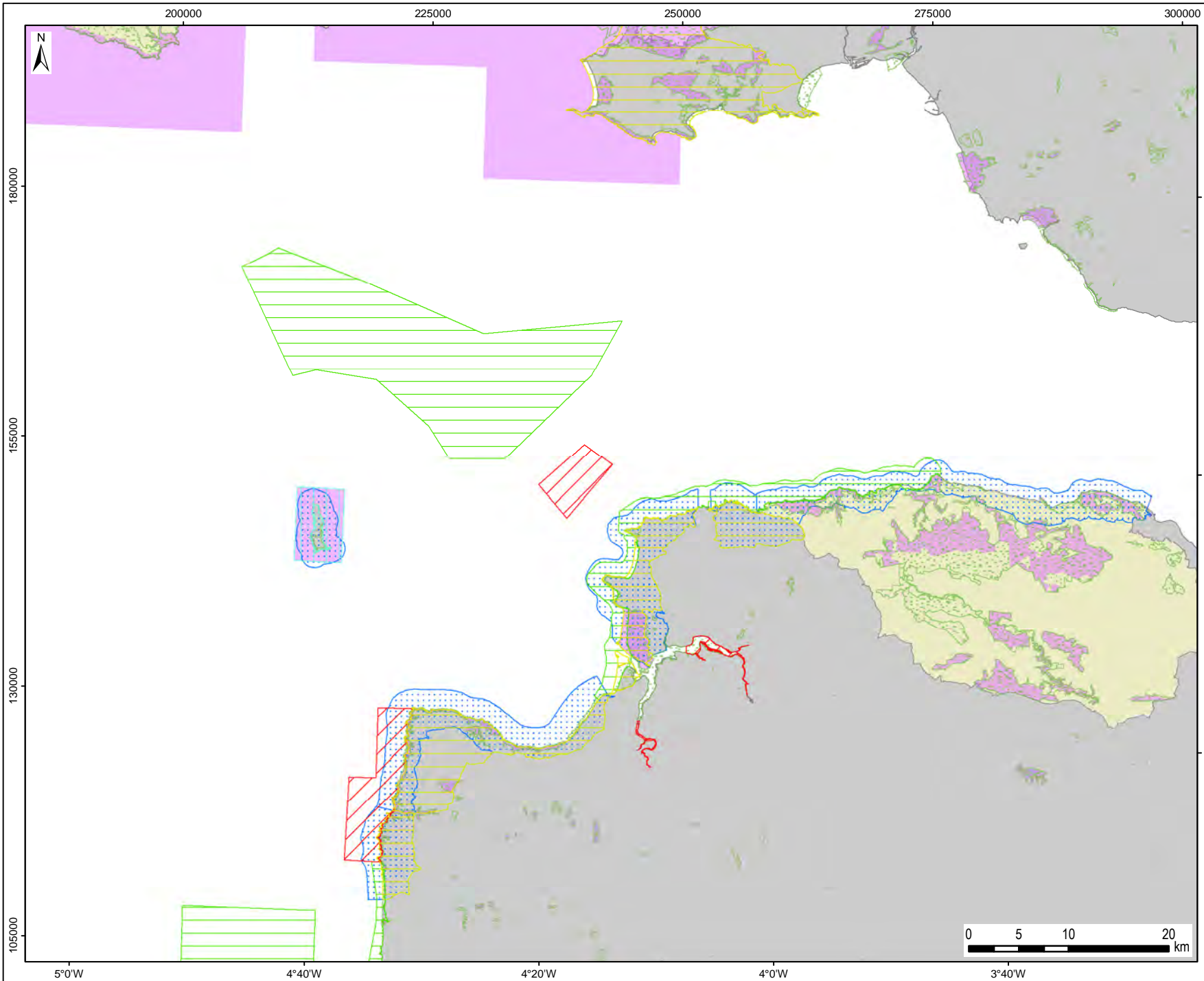
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Figures





- Areas of Outstanding Natural Beauty
- Designated Marine Conservation Zone
- Recommended Marine Conservation Zone
- Proposed Tranche 2 Marine Conservation Zone
- Site of Special Scientific Interest
- English Heritage Coast
- Special Area of Conservation
- National Park

Date	By	Size	Version
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Coordinate System		British National Grid	
Projection		Transverse Mercator	
Scale		1:520,000	
QA		FMM	
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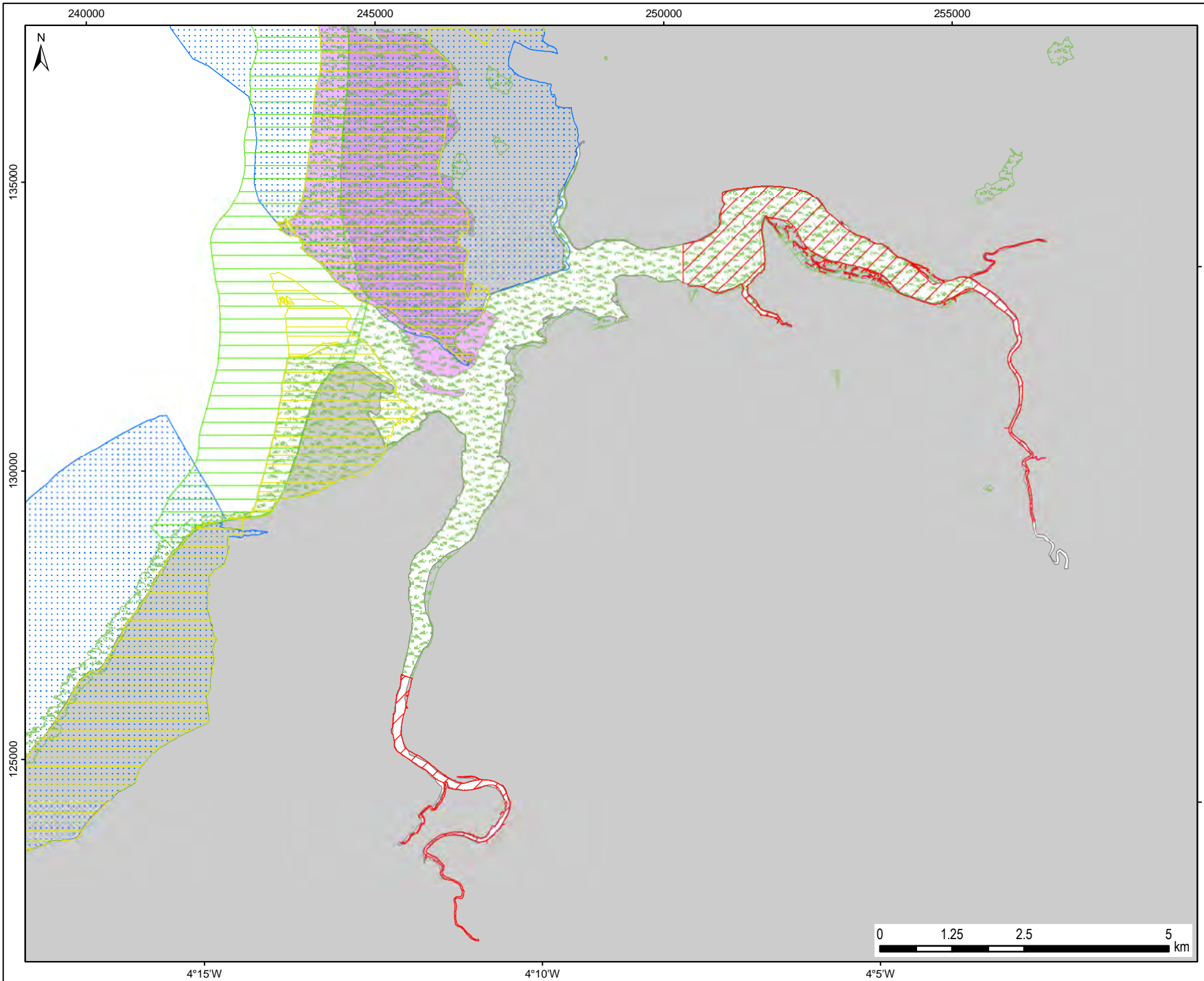


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Nature Conservation Designations - North Devon

Figure 1



-  Areas of Outstanding Natural Beauty
-  Recommended Marine Conservation Zone
-  Proposed Tranche 2 Marine Conservation Zone
-  Site of Special Scientific Interest
-  English Heritage Coast
-  Special Area of Conservation

Date	By	Size	Version
Jul 15	DLW	A4	1
Coordinate System		British National Grid	
Projection		Transverse Mercator	
Scale		1:90,000	
QA		FMM	
Fig2_Designations.mxd			
Produced by ABPmer			



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Nature Conservation Designations - River Taw

Figure 2

Appendices



Appendix A

Aquaculture Development Plan



A. Aquaculture Development Plan

A.1 Introduction

Aquaculture is currently an underdeveloped sector in Northern Devon. However, at a national and local level, aquaculture has been identified as sector with the potential to underpin sustainable economic growth, both in rural and coastal communities and in the wider economy. In Northern Devon, development of aquaculture activities has the potential to provide diversification opportunities for local fishermen and employment and educational opportunities in general within the local area.

The original specification for this study was to provide a high level Business Plan for an Aquaculture Centre in Northern Devon, which may form the basis of a capital funding bid. However, the demand and SWOT analysis in the current study indicate that whilst an Aquaculture Centre could play a valuable role in supporting development of the industry in the area, an Aquaculture Centre would need to be part of a wider aquaculture strategy for the region for it to be a viable enterprise. This appendix sets out the priorities and potential for the development of aquaculture in Northern Devon, to which an Aquaculture Centre could contribute/play an important part in the future.

The Plan identifies:

- Key constraints to the development of aquaculture in the area and recommended areas of further research/action to address these;
- Key opportunities to support aquaculture development (nationally and locally);
- Recommendations for developing sustainable aquaculture in Northern Devon, including potential available sites and requirements for development of aquaculture-related facilities;
- Potential funding sources.

A.2 Key Constraints to the Development of Aquaculture

The outcome of the study indicates that the main constraints to the development of sustainable aquaculture in Northern Devon are (see also Section 6.1 in main report):

1. Water quality within the Taw Torridge Estuary;
2. Exposed conditions outside the Taw Torridge Estuary;
3. Lack of national and local aquaculture development strategy or plan; and
4. Planning and regulatory hurdles (nationally and locally).

Each of these constraints is discussed below.

A.2.1 Water Quality within the Taw Torridge Estuary

Aquaculture production currently occurs in the Taw Torridge Estuary, where further development of the industry is most likely to occur in the short term future due to the sheltered physical environment (see Section A.2.2). However, water quality is one of the main constraints to further aquaculture

development and poses a key risk to the economic viability of any aquaculture related initiative within the Estuary.

The North Devon and Torridge District Council joint response to the draft update of the South West River Basin Management Plan in April 2015¹² notes that diffuse pollution, mainly from agriculture and land management practices accounts for 50% of the reasons for water bodies in the catchment area failing current water quality standards. Pollution from waste water, mainly from sewage discharges containing phosphates and ammonia, accounts for 25% of the reasons for failing. Other reasons include physical modifications to the river shape and flow (8%), quarrying and mining, industry and urban/transport pollution.

There are 11 representative monitoring points (RMPs) for food hygiene classification purposes (designated in accordance with the controls laid down in Annex II of EC Regulation No. 854/2004) at which statutory shellfish flesh monitoring is undertaken in the Taw Torridge Estuary (see Figure A.1). A summary of the microbial results from these RMPs are shown in Table A.1. Graphs showing the variation in monitored microbial levels over time at stations close to the two sites which have been proposed as suggested locations for an Aquaculture Centre — Appledore and Yelland — is shown in Image A.1. The location of sampling stations changed in 2014 and therefore separate timeseries are shown for 2010–2013 and 2014–2015.

Table A.1 Shellfish Monitoring Results from RMPs in the Taw Torridge Estuary

RMP	Species Sampled	No. Samples	No. E. Coli (Mn)	No. E. Coli (Max)	No. E. Coli (Geometric mean)	Sampling Period
Zeta Berth	Mussels	86	20	920000	1476	21.01.08-15.06.15
	Pacific oysters	17	78	5400	1013	13.01.14-15.06.15
Westleigh	Pacific oysters	16	170	7900	1109	12.02.14-15.06.15
Pulley Ridge	Mussels	71	20	24000	984	09.01.08-03.12.13
Lifeboat slipway	Mussels	72	20	16000	605	09.01.08-03.12.13
Appledore	Mussels	18	45	16000	1261	13.01.14-15.06.15
Spratt Ridge	Mussels	71	20	24000	1059	09.01.08-03.12.13
Spratt Ridge East	Mussels	16	220	9200	1468	13.01.14-15.06.15
Cool Stone – Instow	Mussels	88	80	240000	882	21.01.08-15.06.15
Power Station – Yelland	Mussels	70	20	35000	1594	21.01.08-03.12.13
Under Power Station Jetty	Mussels	18	490	16000	2201	13.01.14-15.06.15
Blackstone Rock	Mussels	69	20	54000	1896	21.01.08-03.12.13
Chivenor Outfall	Mussels	17	80	17000	1096	28.01.14-15.06.15

Bivalve mollusc (shellfish) harvesting areas are classified according to the extent of contamination shown by monitoring of E. coli in shellfish flesh. The classification categories are:

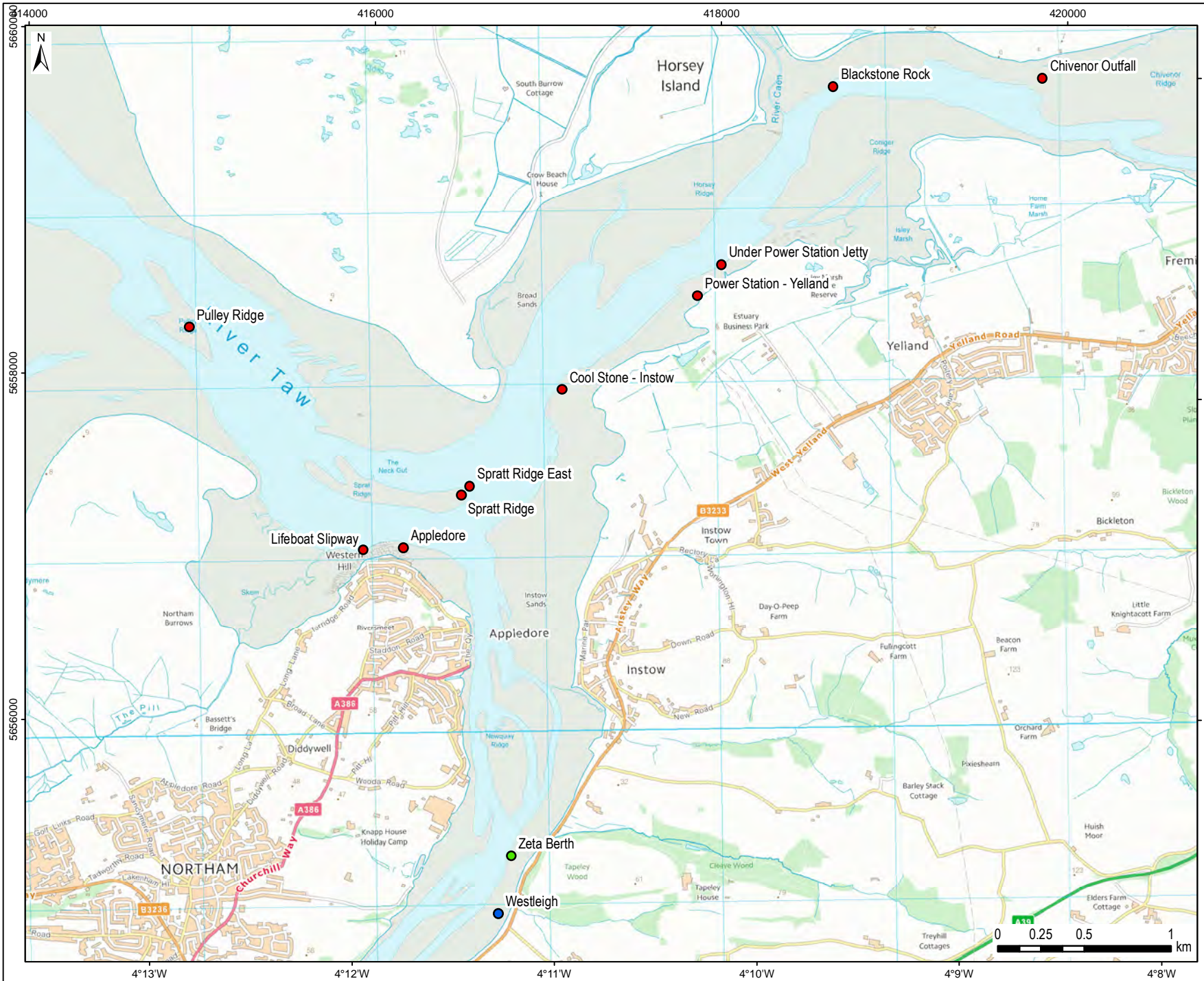
Class A (≤ 230 E. coli/100g) - molluscs can be harvested for direct human consumption

Class B (90% of samples must be ≤ 4600 E. coli/100g; all samples must be less than 46000 E. coli/100g.) - molluscs can be sold for human consumption after purification in an approved plant, or after re-laying in an approved Class A re-laying area, or after an EC-approved heat treatment process.

Class C (≤ 46000 E. coli/100g) - molluscs can be sold for human consumption only after re-laying for at least two months in an approved re-laying area followed, where necessary, by treatment in a purification centre, or after an EC-approved heat treatment process.

(Source: Cefas, 2015)

¹² The Environment Agency website: Draft update to the river basin management plans: South West river basin district; North Devon and Torridge District Council – Joint overview and scrutiny committee; available online at: https://consult.environment-agency.gov.uk/portal/ho/wfd/draft_plans/consult?pointId=s1405418011983



Shellfish Sampling Sites

- Mussels
- Mussels and Pacific Oyster
- Pacific Oyster

Date	By	Size	Version
Jul 15	DLW	A4	1
Coordinate System		WGS 1984 UTM Zone 30N	
Projection		Transverse Mercator	
Scale		1:30,000	
QA		FMM	
4285 - FigA1_Shellfish.mxd			
Produced by ABPmer			



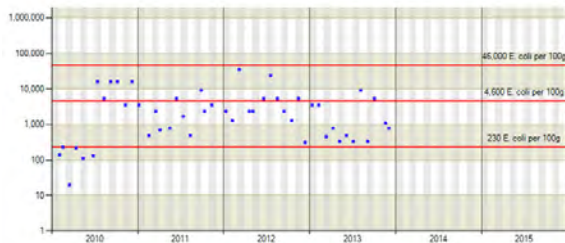
© ABPmer, All rights reserved, 2015. Data Source: CEFAS, 2015; Contains Ordnance Survey data © Crown copyright and database right 2015. NOT TO BE USED FOR NAVIGATION



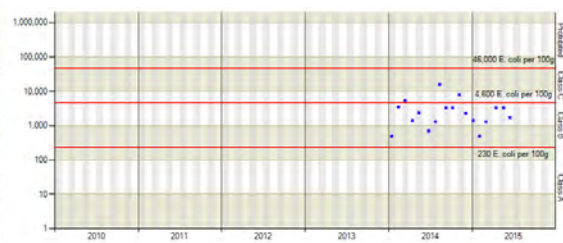
Shellfish Monitoring Sites

Figure A1

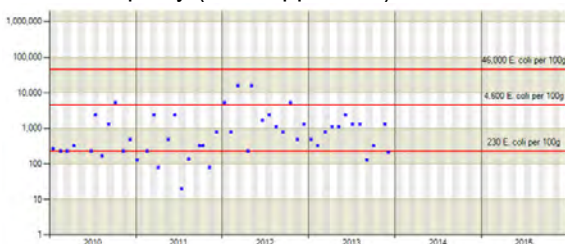
Yelland Power Station



Under Power Station Jetty



Lifeboat slipway (near Appledore)



Appledore



(Source: <https://www.cefas.co.uk/publications-data/food-safety/classification-and-microbiological-monitoring/england-and-wales-classification-and-monitoring/shellfish-monitoring-results/>)

Image A.1 Shellfish monitoring results close to Yelland and Appledore (2010–2015)

In general, Class B shellfish harvesting areas are required to ensure the economic viability of an aquaculture production business and there is a risk to investors and developers if water quality standards are not reliably falling within the Class B criteria in relation to microbial (*E. coli*) parameters. The North Devon and Torridge District Council joint response to the draft update of the South West River Basin Management Plan states that shellfish (mussel) flesh testing has shown that *E. coli* levels have at times exceeded the prescribed limit at all representative monitoring points in the estuary. Shellfish from harvesting areas which receive the Class C classification require relaying in 'Class A' waters for at least two months, which can make production uneconomic. Furthermore there are no Class A classified areas in Northern Devon. Hence if a production/harvesting area cannot consistently achieve a Class B classification, or is downgraded to a Class C classification, production is not economically viable.

To support any further aquaculture development within the estuary there is therefore a need to improve water quality in the estuary. It has been identified that an investment of approximately £15 million per annum over a five year period is required to address water quality issues related primarily to diffuse pollution sources in the Taw Torridge Estuary (Andrew Bell, North Devon Biosphere Reserve, *pers. comm.*). Some of this funding will be met through stewardship schemes and small grants to farmers (e.g. via the catchment sensitive farming project) and projects which will help to reduce diffuse pollution which have received funding include the Nature Improvement Area, Taw River Improvement Project and the Diffuse Pollution Pilot Project. However, additional funding will be required (for example from the European Regional Development Fund) and is currently being sought.

The River Basin Management Plan also identifies improvements to be made in the combined sewer overflows (CSOs) storage and monitoring of flow and duration as a key priority for the estuary. Other improvements suggested in the Catchment Based Approach (CaBA) Action Plan include exploration of de-coupling surface water drains from foul sewer drains and increased urban sustainable urban drainage systems (SUDS) to reduce CSO events (Andrew Bell, North Devon Biosphere Reserve, *pers. comm.*).

Improvements in the water quality in the medium to long term will be beneficial to the aquaculture industry, reducing the economic risk to current and start-up businesses and investors.

A.2.2 Physical Conditions Outside the Taw Torridge Estuary

It may be assumed that water quality (in terms of microbial loading) off the Northern Devon coast would compare favourably to that within the Taw Torridge Estuary. However, the viability of aquaculture production in the more exposed conditions outside the estuary is currently unknown due to the more physically challenging conditions. A key message from the demand analysis, was to understand what type of aquaculture (species and culture methods), if any, may be possible off the Northern Devon coastline, outside of the sheltered estuary conditions.

As characterised by the Atlas of UK Marine Renewable Resources (BERR, 2008), the Northern Devon coastline experiences a relatively large tidal range (mean spring range 7-8m). Strong tidal currents (up to 2 m/s) can occur around Hartland Point, Lundy and elsewhere within the Bristol Channel, although currents tend to be weaker (<1 m/s) within Bideford Bay. The area is also generally exposed to long fetches to the West from the North Atlantic, resulting in a relatively energetic wave climate offshore and along most of the coastline. The viability of current culture technology (for fish or shellfish) would need to be proven in these conditions.

With regard to finfish culture, existing technology is unlikely to be suitable in such challenging physical conditions. If more robust systems were developed it is likely that their high capital cost would mean that relatively large scale production would be required to be economically viable in such conditions and would require well-established land-based infrastructure and supply chain businesses to handle such volumes of production. Hence, for these reasons, combined with public opposition to sea-based marine finfish farming (see Table 6.1 in the main report), sea-based culture of finfish species is unlikely to be a potential area for development in Northern Devon even in the long term future. It should also be noted that whilst there may be more potential (from a technology point of view) for land-based RAS finfish production, such initiatives have yet to be shown to be economically viable in the UK (due to market competition from both cheaper farmed species produced in other countries and wild capture fisheries) and in general such enterprises should be established close to potential markets to ensure low transport costs.

Two case studies which provide initial information on the potential viability of some shellfish culture techniques outside the sheltered estuary environment are briefly described below.

A.2.2.1 Porlock Oysters

A community project¹³ in Porlock Bay (on the North Somerset coast) has recently successfully started growing and selling Pacific oysters. Initial trials were undertaken to establish the viability of culturing mussels using bouchot poles¹⁴ and Pacific oysters using trestle tables in the intertidal. The mussel trials were unsuccessful (the bouchot poles were washed away), however, the oyster trials were successful and the initiative is now successfully using this culture techniques for the small scale production of Pacific oysters.

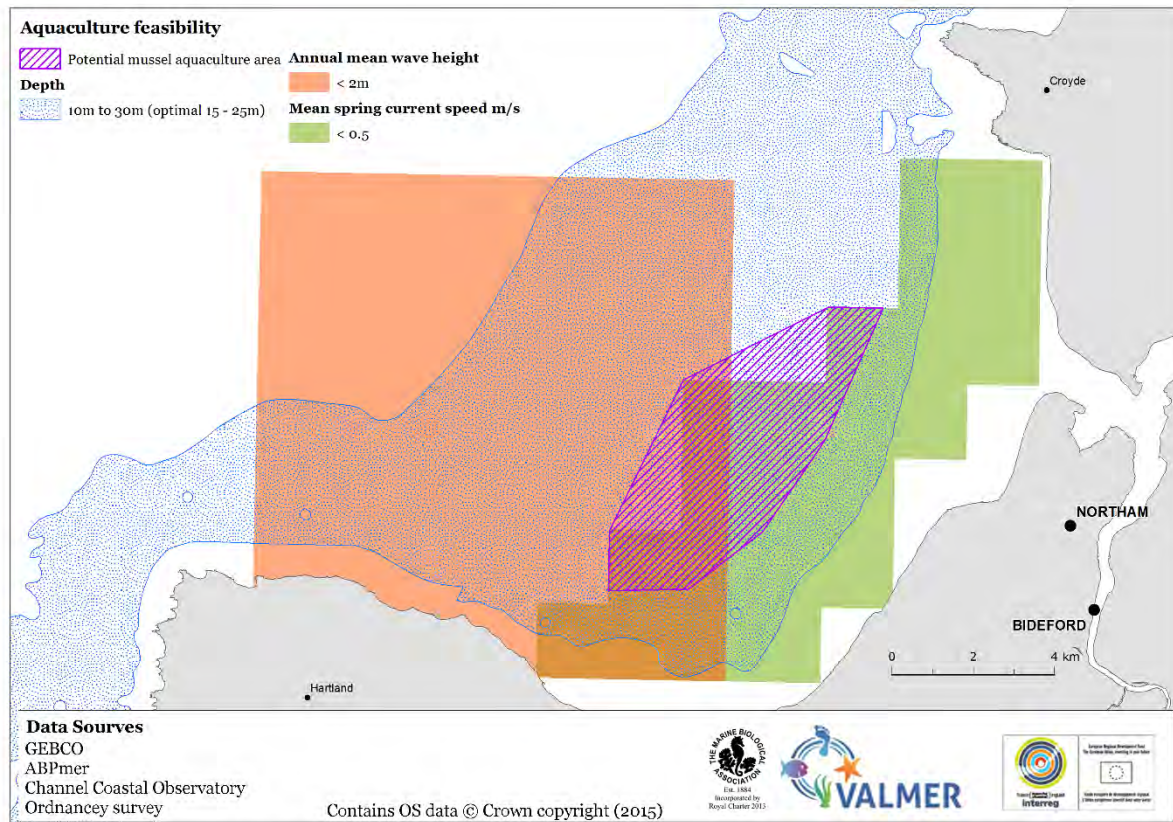
A.2.2.2 VALMER Project

The Valuing Ecosystem Services in the Western Channel (VALMER) project was undertaken to examine how improved marine ecosystem services assessment can support effective and informed marine management and planning (VALMER, 2015). As part of the study, theoretical scenarios were devised to explore the impacts of marine developments on marine ecosystem services in six case study locations. One case study area was Northern Devon, where one of the scenarios was the development of an offshore mussel farm in Bideford Bay. Of relevance to the current study was the way in which this scenario was developed through spatial modelling of physical parameters to identify areas which may be potentially suitable for the offshore cultivation of rope grown mussels. Through spatial mapping of areas where current speeds were < 1 knot (0.51m/s), wave heights <2m and water depth between 10-30m (optimal 15-25m) (all based on information from Cefas, 2008) an area within Bideford Bay was identified as having potential for suspended mussel cultivation (see Image A.2). The size of the area identified was based roughly on the size of the UK's first offshore mussel farm in Lyme Bay (assigned approximately to the area identified as potentially suitable). This scenario suggests that an area with appropriate conditions for rope grown mussel cultivation potentially exists in Northern Devon. However, it should be noted, that this area was identified purely based on the physical characteristics of the marine area; constraints imposed by other marine sector uses, any associated infrastructure and the economic viability of such a development were not considered within the scenario development.

The scenario development within the VALMER study demonstrates how areas of 'potential' for aquaculture may be explored further. Spatial models, which have also incorporated data relating to other marine sector activity and essential infrastructure in addition to physical characteristics, have been used to assess the potential for aquaculture in the East and South Coast Marine Plan Areas (see MMO, 2013) and in the Welsh Marine Plan Area (Welsh Government, 2015). However, it should be noted that both of these studies highlighted limitations in identifying areas of potential related to data gaps and insufficient resolution of some data sets (e.g. salinity, water quality).

¹³ Initiated by a group called Porlock Futures which has set up a Community Interest Company (Porlock Futures C.I.C), which will ensure that all profits will be used for the benefit of the community. The initiative is situated in a Class A harvesting area.

¹⁴ Vertical poles in the intertidal area to which ropes carrying young mussels are wrapped around. As the mussels grow they move onto the pole where they will grow until they reach their commercial size.



(Source: Supplied by MBA, June 2015 (work conducted under the INTERREG IVA European cross-border cooperation project VALMER, Valuing Ecosystem Services in the Western Channel))

Image A.2 Feasibility of mussel farm and optimal site

The two case studies suggest that some forms of aquaculture may be viable in the more exposed environment outside of the Taw Torridge Estuary, however, such viability is currently untested.

It was suggested by stakeholders that the area may provide an opportunity for a trial or testing area, in which such trials could be undertaken, particularly as it is generally recognised that in the long term future, the UK aquaculture industry is likely to need to move offshore, into more exposed areas, in order to continue expanding, given that there is so much competition for space with other marine sectors in shallower coastal waters.

A.2.3 Lack of Aquaculture Development Strategy or Plan

Although a draft aquaculture strategy for England was formulated in 2012, a final strategy document has yet to be published. Hence there is currently a lack of aquaculture strategy to drive the expansion of sustainable aquaculture at a national level.

Under the Marine Policy Statement and Marine and Coastal Access Act 2010, the MMO is tasked with delivering statutory marine plans in the areas that make up English inshore and offshore regions. The objective of the plans is to contribute to the achievement of sustainable development in the marine area by enabling strategic management of all marine activities, integrating different objectives, managing

conflicts and taking account of how ecosystems function. Marine planning in England started with the East Coast Marine Plans (which are now published) and the South Coast Marine Plans (currently being consulted on). With regard to aquaculture, the plans aim to raise the profile of the sector, try to ensure areas are identified for future use, thereby increasing the certainty regarding availability of future sites for development. The South Marine Plans also contained specific policies relating to water quality which is another key issue for the industry (Stacey Clarke, MMO, pers. comm.). The time frame for developing the South West Marine Plans is not currently known.

Although the statutory marine plans described above will provide information relating to current, and potential future aquaculture sector requirements, the demand analysis in the current study indicated that local stakeholders and the Project Steering Group believed that a more site specific 'aquaculture strategy' was required to underpin any development of the sector in Northern Devon. However, in order for any such local strategy or plan to constitute a 'material consideration' within the statutory marine plan process, it would need to be underpinned by statute (e.g. adopted by the relevant statutory undertakers).

Development of Seafish's Domestic Aquaculture Strategy Programme (2015-2018), which will identify opportunities for Seafish to support the UK aquaculture industry to address key issues and constraints, should help to further support development of aquaculture in England.

A.2.4 Regulatory Hurdles (Nationally and Locally)

Information and guidance to support existing and new start-up aquaculture businesses, for example in relation to the required consents, has been highlighted as a priority at both a national and local level. The permissions and licences required for an aquaculture development in England depend on the type and location of the proposed development and may include the following (from Defra, 2014):

- Planning permission from the relevant Local Authority (for any landside development);
- Authorisation by the Fish Health Inspectorate under Aquatic Animal Health (England and Wales) regulations 2009 and the Alien and Locally Absent Species in Aquaculture (England and Wales) Regulations 2011 if applicable;
- Land use consent (lease) from The Crown Estate or other land owner;
- Abstraction licence from the Environment Agency;
- Local Authority permission (in relation to food hygiene and safety);
- Marine Development/Construction licence from the Marine Management Organisation (dependent on nature and size of development – see exemptions below); and
- Discharge consent from the Environment Agency.

For shellfish developments, it can be noted that a Marine Licence is not required from the MMO for the deposit of any shellfish, trestle, raft, cage, pole, rope, marker or line in the course of shellfish propagation or cultivation provided certain conditions are met (related to giving notice of carrying out the activity, not making deposits for the purpose of disposal or creating artificial reefs and not causing any danger to navigation) (Gov.UK, 2015). Neither is a Marine Licence required for dredging or removal activities carried out for the purpose of moving shellfish within the sea in the course of its propagation or cultivation (i.e. harvesting or depositing of shellfish seed/spat).

Those operating in the aquaculture sector must abide by the Gangmasters (Licensing) Act 2004. Activities also need to comply with environmental regulations if located within or near an area of statutory protection (such as SSSI, European Marine Site, or Marine Conservation Zone) and will need to be consented and/or assessed accordingly by the Competent Authority (Natural England).

Feedback from local stakeholders indicated that it is extremely difficult to find all of the relevant information required in relation to the necessary consents and licences which provides further barriers for developers interesting in invested in a new initiative.

As noted above, regulatory hurdles have also been identified as a constraint to development of the industry at a national level. Provision of an information hub or aquaculture one stop shop to provide such information for the industry, including in relation to consents and licences, was a recommendation arising from the Seafish Review (Seafish, 2014). This was also discussed at the project workshop as a need for the sector in Northern Devon. In Scotland, there are numerous resources for the aquaculture industry including Scotland's Aquaculture Database and pre-application consultation guidance for developers, which lists the consent or authorisation required for finfish, shellfish and seaweed developments, identifies the responsible party (regulator/authority) for each consent or authorisation required and provides the associated contact details (including for each of the Local Authorities responsible for granting planning permission; see Appendix B).

Seafish are likely to lead the initiative to develop a national information hub or one-stop shop, however, this is not likely to be completed in the immediate future (Lee Cocker, Seafish, pers. comm.). There is potential for such an initiative to provide area specific information, or alternatively more regional or local hubs may be established as aquaculture development occurs within given regions, which could include the South West.

A.3 Key Opportunities to Support Aquaculture Development

The demand analysis revealed that specific areas of research have been identified as being required to support the UK industry generally and these may provide opportunities for Northern Devon (see Section 5.3 in main report). The areas of research include:

- Innovative and technical developments that open up commercially-viable new productive areas;
- Innovative and technical developments that reduce the shellfish sectors reliance on wild seed supplies (including multi-species shellfish hatcheries);
- Improvements in water quality;
- Technology to enable aquaculture to move into more exposed sites;
- Health and nutrition of aquaculture species including novel fish feeds and nutritional feed trials;
- Reproduction and breeding;
- Interactions with the environment;
- Vocational training.
- R&D into high value ingredients from cultured species for use in other industries (and the potential requirement for scale-up facilities for production of the above);
- Improved detection of contaminants in seafood;
- Sustainable production of ornamental aquaria species; and
- Breeding of endangered species (for conservation purposes).

Specific research needs, facilities and services to support existing and new start up aquaculture initiatives in Northern Devon were identified which included:

- Research or trials to establish what types of aquaculture developments are suited to local conditions;
- Information to facilitate and support local aquaculture initiatives; and
- End product testing facilities to reduce costs for existing producers.

A.4 Recommendations for Developing Sustainable Aquaculture in Northern Devon

The following provides recommendations to address the barriers and viability issues described in Section A.2 to support the development of sustainable aquaculture in Northern Devon. The recommendations are split into three phases: short, medium and long term and are designed to provide an incremental step by step approach to providing the environment and support for aquaculture businesses to set up and establish in Northern Devon.

Short Term (Year 1):

- Establish Several Orders to support current local shellfisheries and aquaculture production businesses;
- Continue to foster stakeholder dialogue and in particular cross fertilisation between fishery, conservation and aquaculture business interests to help define innovative approaches that will address the concerns of all groups;
- Develop a guidance sheet providing information regarding the consents and licences required for different types of aquaculture businesses (finfish, shellfish, seaweed) and relevant contact details to support current and any potentially new aquaculture developers. An example of the type of information provided for developers in Scotland is shown in Appendix B. It is important that any initiative to advance this recommendation should be undertaken in liaison with the Aquaculture Development Manager at Seafish, and the relevant local authorities and regulators to prevent any duplication of effort and to ensure all available expertise is captured;
- Discuss potential for development of a local coastal/marine management plan which takes account of potential future aquaculture activity with statutory authorities (i.e. Local Authorities, Natural England, Environment Agency, MMO). Any local plan produced would likely only constitute a material consideration within the South West Marine Plan if it is adopted by the relevant statutory undertakers; and
- To assist in the development of a local plan/strategy (if taken ahead), undertake spatial modelling to further identify areas of 'aquaculture potential' which incorporate all marine spatial planning consideration (e.g. other marine sectors activities, infrastructure, designations) as well as suitable natural resources and physical conditions (i.e. build on the Northern Devon case study from the VALMER project). The outputs of such a model can be used as a tool by potential developers and regulators to identify and focus on areas where there may be the least constraints to development. The utility of such a model would depend on the availability, coverage and resolution of available data for coastal and marine waters in the Northern Devon region.

Medium Term (Year 2-5):

- Ensure that catchment sensitive farming methods/investment is implemented to improve water quality. Assess whether further investment is needed by water companies to address water quality failures related to sewage discharges;
- Undertake small scale projects to test concepts developed during the initial phase, e.g. shellfish trials to establish most suitable species/methods for cultivation; and
- Establish network of aquaculture businesses.

Long term (Year 5+):

- Further to demonstrable long term improvements in the water quality in the Taw Torridge Estuary, establishment of viable marine culture techniques, development/expansion of existing and new aquaculture businesses and creation of a supportive aquaculture development environment (through development of a wider coastal management plan), an Aquaculture Centre could be developed. The SWOT analysis indicated that the optimal approach for an Aquaculture Centre in Northern Devon would be a facility (for example, built using public funding, or utilising an existing building or site; see Section A.4.1) with private aquaculture-related businesses as ‘anchored tenants’, to provide a core income for the centre. This represents a mixed approach of public and private enterprise, which could help to generate collaboration, innovation and new development opportunities.

A.4.1 Potential Available Sites for Development of Aquaculture-Related Facilities

Two sites were identified by stakeholders as having potential to support aquaculture-related facilities in the longer term. Information that was made available relating to the two sites is summarised below.

For both sites, any planning permission and licence requirements would depend on the requirements of an Aquaculture Centre (e.g. with regard to detail of processes to be undertaken etc.) and hence cannot be anticipated in the current study.

Table A.2 Sites Identified as Potentially Available for Development of Future Aquaculture-Related Facilities

Location	Site Description	Size	Existing Building	Existing Facilities	Funding Options	Ownership	Rates
Yelland	Brown site – former power station	40 ha	No – would need to be new build	n/a	Grants/public funding sources. Potential for S106 to be used to secure some funds/a new build property.	Site in private ownership – so options would be freehold or lease.	Business rates would be applied (setting up a Centre as a charity would reduce the rates)
Appledore	Bideford Fishermen’s Co-operative building		Yes			Owned by Torridge District Council	

A.4.2 General Requirements for Aquaculture-Related Facilities

Given the feasibility study has not enabled a clear remit or demand for an actual Aquaculture Centre at the time of writing, it is not possible to provide a high level inventory of the potential equipment required for such a facility. In general, whilst it may be possible to adapt some equipment for different research purposes, specific species-related research (particularly into reproductive biology) requires equipment that cannot easily be utilised for studies of other species. As such, more specific requirements for such a facility cannot be assessed in the current study. However, general requirements for a standard site undertaking marine-related research include the following:

- A location close to the coast to enable extraction of seawater of as high water quality as possible (note for land-based recirculation systems there are limited abstraction requirements as the majority of pumping requirements relate to the recirculation system);
- Storage tanks to store seawater when abstraction not possible (i.e. during low tide);
- Relatively low elevation to minimise seawater pumping costs;
- The ability to discharge a modest volume of water to the marine environment, away from the water abstraction point. Locating a facility on a spit of land is useful for separating water intake and discharge.

A.5 Potential Funding Sources

Potentially suitable funding sources for existing or start-up aquaculture businesses include (based on information in Table 6.2 in main report):

- European Maritime and Fisheries Fund/ Fishery Local Action Groups;
- Leader 5 Rural Development Programme;
- Regional Growth Fund (administered through North Devon+)
- Seafish Strategic Investment Fund;
- Private funding (e.g. Virgin Media Business)

Potentially suitable funding sources for development of an aquaculture Centre in the longer term future include (based on information in Table 6.2 in main report):

- Heritage Lottery Fund (HLF) / Lottery Townscape Heritage Fund;
- Esmée Fairbairn Foundation;
- Coastal Revival Fund.

A.6 References

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Appendix B

Example of Consultation Guidance for
Aquaculture Developers in Scotland



B. Example of Consultation Guidance for Aquaculture Developers in Scotland

B.1 Aquaculture Development in Scotland

B.1.1 Pre-Application Regulator/Authority Consultation Guidance for Developers

The organisations listed below are those that regulate aquaculture development, routinely advise those regulators, or grant seabed and foreshore title rights. Failure to acquire the required consents listed for development, or agreement on favourable recommendations for those consents, or secure seabed/foreshore rights, will preclude any development. It is therefore essential that all those authorities relevant to the particular development proposed are consulted at an early stage to identify any significant and potentially insurmountable issues prior to proceeding with any application process.

Regulator/Authority	Regulatory/Authorising Remit	Consent/Authorisation	Applicable Species		
			Finfish	Shellfish	Seaweed
Local Authorities	Granting of development consents for fish farms	Planning Permission	Yes	Yes	No*
Marine Scotland Licensing Operations Team	Licensing of fish farms where navigational hazards are deemed present (exemption no longer applies to aquaculture development)	Marine Licence	Yes	Yes	Yes
Marine Scotland Science (MSS)	Statutory consultee to planning authorities on specific environmental impacts of development proposals, and cumulative environmental impacts arising.		Yes	Yes	Yes
Fish Health Inspectorate (FHI)	Authorisation of aquaculture production businesses (APBs) under the Aquatic Animal Health (Scotland) Regulations 2009	Authorisation to operate an APB	Yes	Yes	No
Scottish Environment Protection Agency (SEPA)	Licences waste and veterinary discharges from fin fish farms. Statutory consultees to Local Authorities for development consents Tasked to deliver water quality objectives for protected shellfish growing waters so consultees for applications for shellfish	Controlled Activities Regulations (CAR) Licence	Yes	Yes	No
The Crown Estate	Grant seabed/foreshore rights for aquaculture developments	Seabed/Foreshore Lease	Yes	Yes**	Yes
Northern Lighthouse Board	Navigational marking for aquaculture installations at sea to inform the mariner of the hazard (Marine Licence & Local Authorities planning permission)	Navigation marking of site	Yes	Yes	Yes
Scottish Natural Heritage (SNH)	Government advisors on natural heritage protection, particularly designated conservation areas. Statutory consultees to planning authorities		Yes	Yes	Yes
Food Standards Agency (Scotland)	Classification and administration of shellfish harvesting areas and biotoxin monitoring.			Yes	

* Seaweed farms do not fall under Local Authority planning controls, and are dealt with by Marine Scotland's Licensing Operations Team. Nevertheless the relevant Local Authority should be consulted anyway in regard to other development issues that may prevail.

** Shellfish farms located on the foreshore may fall on non-Crown land, and so require permission from the landowner

B.1.2 Contact Details

Regulator/Authority	E-mail	Telephone	Website
Local Authorities - in main marine fish farming areas	Argyll & Bute: Major Applications Team centralvalidationteam@argyll-bute.gov.uk	01546 604840	http://www.argyll-bute.gov.uk/planning-and-environment/aquaculture
	Highland Council: Coastal Planning Team planning@highland.gov.uk	01349 886606	http://www.highland.gov.uk/cgi-bin/MsmGo.exe?grab_id=0&page_id=276&query=Aquaculture&hiword=AQUACULTURAL%20Aquaculture%20
	Comhairle nan Eilean Siar: Planning Service planning@cne-siar.gov.uk	01851 822690	http://www.cne-siar.gov.uk/planningservice/mmfdev.asp
	Shetland Islands Council: Marine Planning Service marine.planning@shetland.gov.uk	01595 744800	http://www.shetland.gov.uk/planning/Marine_Forms_Policies.asp
	Orkney Islands Council: Development Management planning@orkney.gov.uk	01856 873535 ext 2504	http://www.orkney.gov.uk/Service-Directory/A/Aquaculture.htm
Marine Scotland Licensing Operations Team	ms.marinelicensing@scotland.gsi.gov.uk	01224 295579	http://www.scotland.gov.uk/Topics/marine/Licensing/marine
Marine Scotland Science	MS.FFPlanning@scotland.gsi.gov.uk	01224 295681 01224 295525	http://www.scotland.gov.uk/Topics/marine/Fish-Shellfish/18716 http://www.scotland.gov.uk/Topics/marine/Fish-Shellfish/18716/fish-farm/mssplanning
Fish Health Inspectorate	ms.fishhealth@scotland.gsi.gov.uk	01224 295525	http://www.scotland.gov.uk/Topics/marine/Fish-Shellfish/FHI/authorisation
Scottish Environment Protection Agency (SEPA)	SEPA Local Offices – details on this link: http://www.sepa.org.uk/about_us/contacting_sepa/regional_offices.aspx		http://www.sepa.org.uk/water/water_regulation/regimes/aquaculture/marine_aquaculture.aspx
The Crown Estate	enquiries@thecrownestate.co.uk	0131 260 6070	http://www.thecrownestate.co.uk/coastal/aquaculture/working-with-us/
Northern Lighthouse Board	navigation@nlb.org.uk	0131 473 3100	https://www.nlb.org.uk/ourlights/responsibility.htm
Scottish Natural Heritage (SNH)	SNH Local Offices – details on this link http://www.snh.gov.uk/contact-us/offices/		http://www.snh.gov.uk/planning-and-development/marine-aquaculture/
Food Standards Agency (Scotland)	scotland@foodstandards.gsi.gov.uk	01224 285100	http://www.food.gov.uk/business-industry/farmingfood/fish-shellfish/

Appendix C

Stakeholder Consultation



C. Stakeholder Consultation

The stakeholder consultation list was drawn up using through the knowledge of the project team (ABPmer and Stirling Aquaculture) and the North Devon Coast AONB, supplemented by a brief internet search and further suggestions from stakeholders when they were contacted. The stakeholders contacted are shown in Table C.1. The project workshop agenda, project background information and a list of the attendees are shown in Section C.2. The project workshop outputs are provided in Section C.3. An example of the introductory correspondence and questionnaire sent to 'wider' national stakeholders is shown in Section C.4.

C.1 Stakeholders Contacted

Organisation / Business Name
Appledore Fishermen's Co-operative
Aquafish Solutions
Aquavision
Bangor University
Bideford Fisheries Ltd (now T&T shellfish Ltd)
Bideford Harbour Master
Blakewell Fisheries
Brixham Sea Farms
Cefas
Chris Dennis Food Service
Christie Estates (landowner)
Clovelly Estate
Clovelly Shellfishermen's Association
Coastwise
Coombe Fisheries
CSAR University of Swansea
Cybercolloids Ltd
Deep Dock Ltd
Defra
Devon and Severn IFCA
Devon County Council
Devon Wildlife Trust
Environment Agency
Environmental Health, North Devon District Council
Exmoor National Park Authority
FAI Aquaculture (Ardtoe Marine Laboratory)
Falmouth Marine School
Ifracombe Aquarium
Ifracombe harbour Master
Landfish Ltd
Llyn Aquaculture
Local Enterprise Partnership
Lundy Company, Landmark Trust
MMO
National Lobster Hatchery
National Marine Aquarium
National Trust

Organisation / Business Name
Natural England
ND AONB
ND FLAG
Newcastle University (Dove Marine Laboratory)
North Atlantic Fisheries College
North Devon Biosphere
North Devon District Council
North Devon Fishermen's Association
Ocean Fish Ltd
Offshore Shellfish Ltd
Plymouth University
Pontus Research Ltd
RAS Aquaculture research Ltd
RSPB
Salmon and Trout Association Devon
Scottish Association of Marine Science
Seafish
Shellfish Association of Great Britain (SAGB)
Skillfish
South staffordshire college - Rodbaston Aquaculture Centre
South West Water
Southern IFCA
Sparsholt College
St. Abbs Head Marine Station
Taw Fisheries Association
Taw Torridge Estuary Forum
The Crown Estate
The Glorious Oyster Business
Torridge Fisheries Association
Torridge District Council
Torridge Oysters and Mussels
University of Portsmouth (Langstone Harbour Marine Laboratory)
University of Southampton
Walrus Fisheries
West Country Rivers Trust
Zoological Society of London

C.2 Stakeholder Workshop Agenda



North Devon Aquaculture Centre Feasibility Study

Thursday 29 January 2015, 10.30am to 3.30pm

Caddsdawn Business Support Centre, Bideford, Devon, EX39 3DX

Registration and Coffee 10.30 – 11.00

Introductory Session 11.00 – 11.15

- Welcome from the North Devon AONB

Northern Devon Aquaculture Centre: exploration of opportunities and constraints 11.15 – 12.30

- Brief presentation to provide an overview of:
 - The project and workshop aims;
 - Aquaculture and fisheries in Northern Devon;
 - Example opportunities and ideas.
- Plenary discussion, to consider:
 - What opportunities are there to expand aquaculture in the region?
 - What services and facilities would best support current aquaculture and local fisheries in the region? What additional research would be beneficial?
 - What opportunities are there to support fisheries and/or diversification opportunities for the local fisheries sector?
 - What are the main constraints (including environmental concerns) to expanding aquaculture and/or culture-based fisheries in the region?
 - Where would an Aquaculture Centre be best placed in Northern Devon, e.g. in relation to existing infrastructure and available land?
 - What type of facilities would be of most interest to vocational training/education institutions?

Lunch will be provided 12.30 – 13.15

Breakout Groups 13.15 – 14.45

Further exploration of the potential opportunities, ideas, constraints and/or concerns posed in the morning plenary discussion within smaller breakout groups.

Summary and Feedback 14.45 – 15.30

- Feedback from breakout groups and discussion.
- Conclusions from the day and summary of next steps.
-

Workshop Close 15.30





Attendees

Organisation	Attendee
ABP Marine Environmental Research Ltd (ABPmer)	Caroline Roberts
ABP Marine Environmental Research Ltd (ABPmer)	Suzannah Walmsley
Bridgewater College	Shaun Plenty
Centre for Environment, Fisheries and Aquaculture Science (Cefas)	Neil Auchterloine
Clovelly Estate	John Rous
Clovelly Shellfishermen's Association	John Balls
Coombe Fisheries	Iain Spear
Cybercolloids Ltd / Coastwise	Sarah Hotchkiss
Devon and Severn Inshore and Fisheries Conservation Authority (IFCA)	Sarah Clark
Devon County Council	Steve Guilbert
Environment Agency	Sophie Cocks
Environmental Health, North Devon District Council	Dean Davies
National Lobster Hatchery	Dominic Boothroyd
Natural England	Mel Parker
Natural England	Andrew Knights
Northern Devon Fisheries Local Action Group (FLAG)	Steve Pitcher
North Devon Biosphere	Andy Bell
North Devon Coast Areas of Outstanding Natural Beauty (AONB)	Chrissie Ingle
North Devon District Council	Sally Nelson
Ocean Fish Ltd	Andy Matchett
Offshore Shellfish Ltd	Nicki Holmyard
Salmon and Trout Association Devon	Steve Phelps
SkillFish	Debbie Cashmore
SkillFish	Brendan Gara
Stirling Aquaculture, University of Stirling	John Bostock
Taw Torridge Estuary Forum	Rose Day
The Crown Estate	Alex Adrian
Torridge Fisheries Association	Charles Innes
Torridge District Council	Sean Kearney
Torridge Oysters and Mussels	Phoebe Chope
West Country Rivers Trust	Scott West





North Devon Aquaculture Centre Feasibility Study

Project Background

The expansion and diversification of existing marine sector-related businesses has been identified as a priority economic opportunity for Northern Devon. Furthermore, the Northern Devon Fisheries Local Action Group (FLAG) Development Strategy aims to create the conditions for the sustainable development of Northern Devon's fishing communities, through encouraging innovation, new catching methods and technologies. Aquaculture is currently an under-developed sector in Northern Devon and it has been proposed that this sector could play an important role in achieving the aims of both of these Strategies, whilst providing diversification opportunities and potential benefits to the local fishing communities. However any expansion of the aquaculture sector (including to support local fisheries) would need to be compatible with the unique coastal and marine environment of Northern Devon, ensuring that sustainable and acceptable practices are proposed which will not damage the environment and will be acceptable to the local communities involved.

Project aim:

The North Devon Coast AONB, supported by the Northern Devon FLAG, Seafish and the Devon and Severn IFCA, has commissioned work to assess the feasibility of establishing an Aquaculture Centre in Northern Devon, scoping the potential demand and operating model, scale and location for such a facility. The project will seek to address issues such as:

1. What are the main opportunities and constraints to the expansion of aquaculture (including culture-based fisheries) in the Northern Devon region?
2. What is the nature and level of need/demand for an aquaculture centre from current aquaculture and fisheries stakeholders (i.e. current aquaculture production businesses, potential start-up businesses and in relation to diversification opportunities)?
3. What are the main concerns (environmental or otherwise) regarding expansion of the aquaculture industry in Northern Devon? What would be dealt with via regulation and mitigation?
4. What would be the benefits to Northern Devon of aquaculture industry expansion? Where might this occur e.g. coastal waters, offshore, land-based? Where would a centre be best placed in the region e.g. in relation to existing infrastructure and available land?
5. What type of facilities would be of most interest to vocational training/education institutions?
6. What research and services are currently provided by other aquaculture centres in the UK and what additional facilities, services and research is needed to fill gaps or increase current capacity? What is the level of interest in using a new aquaculture centre and its facilities?

The purpose of the project workshop is to enable local stakeholder input to the above feasibility study. In parallel, consultation is being undertaken with academic, research and aquaculture-related training and education institutions around the UK.



C.3 Workshop Outputs

North Devon Aquaculture Centre Feasibility Study - Project Workshop Outputs

Key points arising from stakeholder discussions at the Project Workshop are summarised below. Note, all of the stakeholder discussions from the workshop will be used to inform the option appraisals, SWOT analysis and recommendations in the project report.

Northern Devon Aquaculture Centre: Exploration of Opportunities and Constraints

The stakeholders were given an overview of the background and aims of the project. The initial group discussion focussed on what the stakeholders considered to be general opportunities and constraints to the development of sustainable aquaculture in Northern Devon, what type of services and facilities an Aquaculture Centre could provide to support such expansion of the industry (locally and nationally) and potential locations for such a Centre. The main themes raised during the initial group discussion are summarised below.

Opportunities:

- The study provides an opportunity to demonstrate exemplar aquaculture practices in line with the ethos of Northern Devon conservation designations (Areas of Outstanding Natural Beauty (AONB), Biosphere Reserve, National Park etc.) which could be replicated in other areas.
- There was good general support for the concept of developing sustainable aquaculture in Northern Devon to support existing fishing and aquaculture activities and/or develop new activities. Need to provide opportunities for existing fishermen and attract new generation into these sectors. Need 'buy in' from current fishermen to ensure ownership;
- It was acknowledged that conditions in Northern Devon may be challenging for sea-based aquaculture (mariculture) e.g. in relation to wave, tides etc. Need to explore what type of mariculture is suitable for Northern Devon and if there is any unique selling point (USP) e.g. as space is extremely limited in sheltered inshore coastal areas, mariculture will look to move offshore into more challenging conditions - could Northern Devon provide a 'demonstration area' to test what is viable (e.g. like demonstration sites for offshore renewables)? Mariculture occurs in other countries with 4m tides e.g. mussel rafts in Iceland;
- Northern Devon has 'static gear' fisheries which are viable in the local conditions. Develop industry here by trialling different growing methods (e.g. oysters and scallops in cages, pearl nets). If the infrastructure is in place, commercial opportunities will follow;
- Need to develop an 'aquaculture sympathetic development environment' and inform local stakeholders of the benefits of aquaculture. Need a 'Plan' to facilitate aquaculture development, supported by all regulatory agencies. Readily available information (e.g. via an information hub) for developers would be very helpful;
- Create an 'identity' for Northern Devon – the 'place for aquaculture'. If have local community aspiration to do this, contact the Environment Agency and MMO etc. to provide clear guidance – they offer opportunity and support for this kind of development;
- Specific opportunities mentioned:
 - Hatchery – for restocking existing or new species. Potential for shellfish (e.g. scallop) or crustaceans (e.g. lobster). Examples in South Devon (hatchery and farming methods for scallop) may be of interest. Trial native oysters, scallops in cages, pearl nets to see what viable;

- Freshwater and marine finfish cultivation via land-based recirculation aquaculture systems (RAS). Sea-based mariculture of marine finfish (i.e. in sea cages) less likely as too many issues (e.g. biosecurity) and faced strong opposition in other parts of the South West;
- Seaweed – macroalgae (sea-based) and/or microalgae (land-based tank culture). End product use of macroalgae depends on whether used for bioremediation (improving water quality). Industry faces same issues fish/shellfish farming (e.g. water quality, regulatory barriers, matching market with opportunities – see below).
- Appledore Fish Dock was highlighted as an existing facility (with tanks) in Northern Devon that could potentially be utilised e.g. for feed trials, commercial initiative, education, products for sale.

Constraints/concerns:

- Designations:
 - The Taw Torridge Estuary is a SSSI and any aquaculture development would be required to be sensitive to this;
 - Would further MCZ designations pose constraints to development of the aquaculture industry in Northern Devon (may depend on site)?
 - Stakeholder experience that development e.g. of hatchery in an AONB can be complicated and costly;
- Stakeholders have experienced numerous barriers to setting up aquaculture businesses in relation to consents, licensing etc., despite EU, national and local strategies promoting the development of the industry. Need to call on regulators for a clearer framework;
- Activity must support current fishing activity and not displace it;
- Important that any restocking activities do not increase fishing pressure on existing stocks through increasing intensity of fishing activity e.g. potting for lobster or dredging for scallop;
- Water quality historically has been an issue in the Taw Torridge estuary and is vulnerable to farming in the catchment area. On neap tides and after heavy rainfall, insufficient flushing occurs. Classified shellfish beds in estuary are vulnerable to water quality issues and would be a potential issue for hatcheries, shellfish and seaweed cultivation. Significant investment and catchment sensitive farming programmes are underway to address water quality issues in the estuary – hence in long term this could support this initiative.
- Is lack of shellfish waters a constraint compared with e.g. South Devon?
- Disease and biosecurity (need to be looked at);
- Need to consider sites very carefully – can have competing industries e.g. docks, aggregate extraction;
- Issues facing current activities in Northern Devon include:
 - Lack of Several Orders for mussel beds (currently public resource and vulnerable to exploitation from larger vessels from outside area);
 - Lack of relay beds for depuration purposes if mussel bed classifications are downgraded (fishermen could be involved in relaying);
 - Getting historical shellfish beds re-opened/re-classified e.g. off Lynmouth;
 - No nearby laboratories for end product testing - nearest at the moment is Somerset and high cost of postage. Other accredited laboratories are very expensive;
 - Current demand for depuration facilities and vivier tanks.

Potential operational model:

- An Aquaculture Centre would need to have a commercial aspect (i.e. be a commercial entity) to ensure long term sustainability;
- There is support for the provision of vocational training and demand for the provision of short courses for people working in aquaculture. Would want to link to other institutions and would need areas of industry nearby for students to gain practical experience;
- Raising awareness of aquaculture (marine and freshwater) and seafood generally to the public and school children is important (i.e. education and outreach). Scottish Government does this well and may be a good example to look at. Need 'buy in' from schools;
- Also a potential for a link to tourism e.g. Centre could have a visitor aspect, however, whilst important this would need to be a secondary function (i.e. not the primary or sole function of the centre as would not be sustainable in the long term and Northern Devon already has many visitor centres). Tourist could provide the market for the products aquaculture is producing.

What the Aquaculture Centre should not be:

- Just a building – needs to be a centre of excellence/opportunity and a focus for networking;
- Just a Visitor Centre - Northern Devon already has lots of visitor centres.
- General opinion at workshop – there is not a requirement for aquaculture-related research facilities e.g. for issues such as disease, pharmaceuticals etc. Lots of institutions already undertake aquaculture-related research and the Centre would need to prove its credentials [i.e. face competition]. Unsure what Northern Devon could offer in this respect.

Afternoon – Breakout Group Discussions

1. *Development of an information hub/aquaculture development zone:*

- The industry would benefit from a Centre to facilitate and support applications [to expand/set up new aquaculture initiatives];
- The process would involve getting the 'right parties' together, creating an information network to address what permissions/consent are needed and who from. Would need a website;
- Would need to involve all the 'agencies' and local stakeholders;
- Need an agreed 'marine plan' that identifies appropriate areas for aquaculture, where it will be positively supported, so that licensing decisions will be made in the context of the agreed plan [Note, the requirement for the establishment of regional marine plans under the Marine and Coastal Access Act 2009/Marine Policy Statement]. Look to examples from France e.g. Ile de Ré, a site specific to aquaculture. Is it possible to have a 'simplified planning zone' similar to those on land?
- 3 phases of funding would be required: for feasibility, development and operational phases;
- Maybe the AONB could 'host' the development phase. Could one of the 'agencies' host the operational phase? If a training centre is developed, it would require full-time staff;
- Sources of funding – European funding is possible. Funding from Local Enterprise Partnership? Maybe from business growth, marine industries?

2. *Conservation, restoration opportunities:*

- Aquaculture contributes to food production but may also provide an opportunity to be a 'restorative' industry in Northern Devon e.g. use aquaculture in a bioremediation and/or

bioengineering capacity to provide beneficial ecosystem services. 97% of nitrates in the estuary come from the catchment and there is £15-20m investment per year to clean it up via catchment sensitive farming programmes. Can we help address water quality the estuary with shellfish aquaculture? Are there the opportunities to use aquaculture as a tool to maintain and enhance conservation objectives?

- A recent VALMER study in the UNESCO Biosphere Reserve looking at ecosystem restoration – results will be relevant to the present study;
- A Centre could be used for research, education etc. for restorative function of aquaculture. Would need to check the level of demand for this. Have had postgraduate students coming to Northern Devon to do research, but they need accommodation. Is there potential for a hosting facility for conservation-related fieldwork? Lundy is a key area for such research. Can we create larger demand for such facilities via diplomas, vocational activity etc?
- Could link restorative work into an overall 'Northern Devon' brand identity – restoring the environment not just using it;
- How far we can extend inter and sub-tidal shellfisheries, what kind of species would be used, or not used? Need a Plan or Framework so that it is clear to the industry what they can do or can't do, to avoid confusion?
- The Taw Torridge Estuary is one of the best natural mussel beds in the country, is there an opportunity to create spat for reselling, relaying elsewhere? Relaying areas – if someone puts effort into putting down spat in estuary, need to be able to relay to another areas before harvesting;
- Hatchery for production of shellfish spat (mussel, oyster – any demand for increased triploid oyster spat production?)
- Restocking of salmonids is already taking place in Northern Devon, is more needed? (group answer - yes);
- Is there the opportunity for an eel fishery in ND?
- Is it possible to restock Spiny lobster (*Palinurus elephas*; MCZ Feature of Conservation Importance)?

3. *Education and training opportunities:*

- The discussion highlighted the lack of opportunities in fisheries, fisheries management (especially freshwater) and the need for career development through the industry. Two main themes emerged:
- Awareness raising – high priority:
 - Seafood and schools etc.;
 - Raise profile of seafood;
 - Raise awareness of job opportunities and potential salaries in seafood sector. The Scottish Government is very proactive at this. This is an important prerequisite to build interest in the sector, to be able to subsequently provide industry-based training courses later on;
 - A Visitor Centre would be an 'add on' to the centre, not the main purpose of the Centre.
- Short courses to train people for jobs in the aquaculture industry:
 - Vocational training;
 - Needs to be based on industry needs and demands - can't specify subject matter of courses at this stage;
 - Training should focus on short courses e.g. rather than PhDs;

- However, there may be an opportunity to act as a research and accommodation base for PhD students;
 - Training will be a high priority if the industry takes off in the region. An Aquaculture Centre could be a centre of excellence, of good practice, such as e.g. Sparsholt College in Hampshire. Another example of a vocational institution is Bridgwater College which has set up an eel rearing facility and undertake restocking and rearing to support existing fishery. Also have run a successful small-scale oyster farm for one year. A large component is vocational training to existing fishermen and to students in sustainable fishing and also running school engagement projects. It was highlighted that many people go there just interested in carp farming, but at the college they try to broaden their horizons, provide work experience placements. People often go to Scotland, USA;
 - An Aquaculture Centre would have potential to include a commercial fishing aspect to training - but may come into competition with other training providers (e.g. Western Training, Seafood Cornwall, which are part funded by Seafish to provide some fishing industry training courses) - so may not be viable;
 - Centre could provide specific industry qualifications ('tickets') that are needed. Teaching can draw on semi-retired/ex-fishermen to provide experience, mentor students. Courses would also need to address Health & Safety aspects, which are a big thing these days;
 - Possible formats for teaching:
 - Weekend courses;
 - Long-distance online courses;
 - Specific modules for Plymouth University, Bridgwater College, Petroc etc.
 - Requirements/facilities:
 - Rooms (teaching room);
 - Staff/expertise;
 - Links with other institutions.
4. *Diversification of fisheries and aquaculture activities:*
- Stock enhancement (e.g. via a hatchery) is a key opportunity – scallop? lobster?
 - Could also be a commercial opportunity in the hatchery production of shellfish spat e.g. oyster (Pacific oyster triploids?), mussel?
 - Need to be careful with promotion of Aquaculture Centre in an area to avoid conflict with current commercial fisheries – stress that the industries can cohabit. Seaweed cultivation could benefit wild fish; mussels and lobsters –provide mutual benefits (mussels support juvenile lobster). The public perception of aquaculture also needs to be addressed;
 - Another opportunity is habitat enhancement – lagoon cultivation, led by shoreline management plan, also provide flood attenuation;
 - Constraints:
 - Transport links into the area;
 - Water quality;
 - Food regulations;
 - Red tape - needs to be addressed through identification of sites that are specific to aquaculture use (e.g. Ile de Ré in France). Changes to licences and policy in 2020 (under CFP reform) and other European [policy] drivers may help deal with red tape.
 - Need to consider how to manage waste produced from aquaculture (e.g. biofuel, recycling) – funding for this is available.

- Potential production systems discussed:
 - Marine – seaweed, bivalves – on seabed, rope grown, trestles.
 - Finfish (net pens) - marketing point of farmed finfish is the size – can have smaller fish, as no Minimum Conservation Reference Sizes (MCRS; previously referred to as Minimum Landing Size (MLS)). Potential for bass or rainbow trout in Northern Devon. Seabream possible. But juveniles would have to be imported. Introduction of ‘nasties’ [non-native species] could be issue;
 - Shore-based [Recirculation Aquaculture Systems]. Seawater pumps, oxygenation systems, temperature control. Could develop crustacean (shrimp) aquaculture.
 - Freshwater – trout, salmon hatcheries.

Table C1. Strengths, Weaknesses, Opportunities and Threats of an Aquaculture Centre

Strengths	Local fishermen’s knowledge of best areas for aquaculture potential e.g. substrate, tides etc
	Lots of ideas for aquaculture projects locally, just need to facilitate them
	Existing networks and expertise
	Devonians
	Willingness to start something
Weaknesses	Where we are! Out on a limb for contact with e.g. testing labs
	Funding for long-term?
	Regional and national aquaculture strategy/plan
	Needs a carefully thought out business plan
	No training, laboratory facilities or production
	Any development will be expensive – who will fund the initial set up and subsequent running?
Opportunities	How do we inspire, motivate and support the next generation – now is the time!
	Could provide a route into fishing industry through taster days on boats for 15/16 yr. olds
	Scallop hatchery and farming enhancement
	Introduce children to aquaculture/fisheries and seafood in general
	Chance to build a network/co-operative for small local producers/harvester with shared resources.
	Chances to secure funding/investment and common routes to market
	To open up our area to the world to start with and people!
	Small lab/research unit to act as hub for all local testing and host visiting researchers for field work for projects specific to the area
	Office/meeting rooms for small businesses operating across production chain
	Should be concentrating on commercial aquaculture and focussing on facilitating growth
	Strong skillset available (mariners)
	Strong regional identity (Devon seafood)
	Offshore bivalve relaying area
	Is there a demand for oyster spat amongst growers?
	Apprenticeships, training
	Supporting existing/new fishery through restocking, vocational training and education
	One stop shop for all advice, regulatory framework, marine planning, possible conflicts for business opportunities
Could provide a whole experience from catch to cook to encourage people to eat fish	
Threats	Bureaucracy
	Public Perception
	Human health issues – E. coli, norovirus
	Sustainable shellfisheries – what support is there?
	Must be relevant and have longevity – who will keep it going? Funding and human resources?
Questions	How does this relate to local enterprise partnerships?
	What does “Aquaculture Centre” mean?
	Would an ‘Aquaculture Centre’ be based on one site or several sites?
	How would different opinions on where it should be located be considered?

C.4 Wider Stakeholder Consultation

Stakeholders identified as aquaculture centres were sent a project introduction email and a brief questionnaire (shown below). Stakeholders who responded were contacted further by the project team via email or telephone with specific questions or clarifications where required, to further inform the demand analysis.

C.4.1 Project Introduction and Questionnaire

Dear All,

North Devon Aquaculture Centre Feasibility Study

The North Devon AONB has commissioned a study to assess the feasibility of establishing an aquaculture centre, with the aim of supporting the development of sustainable fisheries and aquaculture and economic growth in the region. ABP Marine Environmental Research Ltd (ABPmer), supported by the Institute of Aquaculture at the University of Stirling, is carrying out the study, which is funded by the Northern Devon Fisheries Local Action Group (FLAG).

As part of this study we would like to explore what type of centre and facilities would best support sustainable fisheries and aquaculture in Northern Devon and compliment or enhance aquaculture-related services and R&D already provided by other aquaculture centres and academic institutions in the UK. Opportunities may include providing facilities to support current or new commercial aquaculture businesses, culture-based fisheries, aquaculture-related R&D, conservation-related work (e.g. restocking of species) and/or vocational training.

We would welcome your opinions and ideas in relation to such a centre. As such, if you would respond to the 3 questions shown below and return your answers to us we would be very grateful. The questions are also provided in the attached word document.

Your input will help to shape initial discussions with local stakeholders (aquaculture production businesses, local fishermen, supply chain companies, environmental groups, local authorities and regulators) at a workshop to be held in Bideford, North Devon on 29 January 2015 (places at this event are limited, however, if you would like to attend, please contact Caroline Roberts (croberts@abpmer.co.uk; 02380 711857) to see if any places are available).

Further to the workshop, the project team would like to contact you again regarding the best potential opportunities established through this initial enquiry and the local stakeholder discussions, to find out how such a facility could best support or enhance your research or training requirements and to assess the level of interest you may have in using such facilities. If you do not wish to be contacted again by the project team, please indicate in your response below.

Thank you in advance for any ideas and suggestions you provide. If you wish to discuss this further or have any queries, please do not hesitate to contact Caroline Roberts (as above) or the North Devon AONB Project Manager Chrissie Ingle (cingle@northdevonplus.co.uk).

1. Name of Institution/Organisation/Company

2. Main area(s) of expertise/specialism

(e.g. Research and development of aquaculture technology, feed, disease detection or prevention; Education or vocational training; Conservation/restoration/species restocking)

3. What type of centre and facilities would best enhance or compliment current aquaculture research and the sustainable expansion of the industry in the UK?

Please feel free to add any further comments or ideas

I am happy to be contacted further regarding this project / I do not wish to be contacted further regarding this project (delete as required)

Appendix D

Existing Aquaculture Centres in the UK



D. Existing Aquaculture Centres in the UK

Name	Location	Function and/or Primary Focus of Research	Facilities	Vocational Training or Education Provision	Operational Model
Aberystwyth University	Aberystwyth	Provides a module on aquaculture as part of undergraduate course	Tanks	✓	University
Aquavision	Beaulieu	Developing sustainable aquaculture practices and consultancy services	Design and build aquaponic systems	✗	Limited company
Bangor University - School of ocean science (Centre of Applied Marine Biology)	Bangor	Fish and shellfish aquaculture & blue technology R&D	Tropical and cool water marine aquaria, tanks and algae culture equipment	✓	University
CSAR University of Swansea	Swansea	Algal biotechnology research	Recirculating aquaculture systems, tropical fish laboratory, quarantine laboratory, photobioreactor (micro algae cultivation system), rearing tanks, marine ornamental system.	✓	University
Falmouth Marine School	Falmouth	Provides foundation degree	Tanks	✓	College
National Marine Aquarium	Plymouth	Conservation, research and education	Tanks, broodstock and hatchery facilities	✗	Charity
National lobster hatchery	Padstow	Lobster stock enhancement programme	Shellfish culture broodstock and hatchery facilities equipment	✗	Charity
Plymouth University	Plymouth	MSc course in Sustainable aquaculture and R&D of aquaculture technology and novel species.	Freshwater and marine fish holding facilities (aquaria and wet lab facilities), Zebrafish research facility, nutrition facilities (laboratory facilities)	✓	University
Scottish Association of Marine Science	Oban	Research on aquaculture and environment	Aquarium, experimental seaweed farm, analytical facilities	✗	Research Institution
Sparsholt College	Hampshire	Diploma, undergraduate and post graduate education	National aquatics training centre(Purpose built fish house, indoor koi pool, research areas), salmonid rearing and trials centre, sparsholt fishery (one hectare lake)	✓	College

Name	Location	Function and/or Primary Focus of Research	Facilities	Vocational Training or Education Provision	Operational Model
University of Bournemouth	Dorset	Research	-	✗	University
University of Bristol	Bristol	Research	Information not found	✗	University
University of Exeter	Exeter	Research	100 tank freshwater aquarium (Penryn Campus, Cornwall)	✗	University
University of Southampton	Southampton	Module in aquaculture offered under undergraduate course	Research aquarium, coral reef laboratory	✓	University
University of Stirling	Stirling	Research into on sustainable aquaculture	Tree freshwater sites, tropical and temperate freshwater recirculation systems in Stirling and marine facilities in Argyll. Purpose built facility for research in marine aquaculture and commercial scale marine hatchery and nursery/on-growing unit (Machrihanish); Research facility for freshwater studies and Atlantic salmon smolt production (Buckieburn); Commercial salmonid hatchery, smolt production unit, brown trout production for restocking and triploid production (Howietown Fishery)	✓	University
Zoological Society of London	London	Conservation and breeding/captive breeding of threatened species	Aquaria (detail not provided on website)	✗	Charity
FAI Aquaculture (Ardtoe Marine Laboratory)	Acharacle	Aquaculture production and research	Tanks, Shellfish culture equipment, broodstock and hatchery facilities	✗	Limited company
North Atlantic Fisheries College	Scalloway	Applied research, training and advice to marine-based industries	Hatchery, aquaculture farm sites	✓	College
Llyn Aquaculture (and Llyn aquaculture research Ltd)	Pwllheli	Research into Recirculation Aquaculture Systems	Tanks, broodstock and hatchery facilities	✗	Limited company
St Andrews University (Gatty Marine Laboratory/Scottish Oceans Institute)	St Andrews	Provide postgraduate level courses in Sustainable Aquaculture	Aquarium, environmentally controlled warm water and cold water recirculation systems and a Home Office Licensed facility	✓	University

Name	Location	Function and/or Primary Focus of Research	Facilities	Vocational Training or Education Provision	Operational Model
Newcastle University (Dove Marine Laboratory)	Newcastle	Provide postgraduate level courses in Sustainable Aquaculture	Open-plan aquarium with flow through seawater system, wet benches with supplies of running sea water and air, allowing variable short-term experimental designs for small tanks to be set up. Fixed tanks include aquaria deep-water tanks (~3m). Classroom and laboratory facilities.	✓	University
University of Portsmouth (Langstone Harbour Marine Laboratory)	Portsmouth	Module in aquaculture offered under MSc course	Aquarium, sea-water system and laboratory suite. Flow-through and recirculating seawater systems. Temperature-controlled system.	✓	University
St. Abbs Head Marine Station	St Abbs	General research offered (new facility and information limited)	Laboratories, office space, research aquarium, 100,000 litre capacity research mesocosm tank, biofence system for microalgae culture	✗	Charity
Firth of Forth Lobster Hatchery	North Berwick	Hatchery	Tanks, Shellfish culture equipment, broodstock and hatchery facilities	✗	Charity
South staffordshire college - Rodbaston Aquaculture Centre	Lichfield	Production of freshwater fish and education	Ponds, broodstock and hatchery facilities	✗	College
Pontus Research Ltd	N/A	Research into feed culture technology and pharma/vetraceutical.	Recirculation aquaculture systems	✗	Limited company
RAS Aquaculture Research Ltd	N/A	N/A	Information not found	✗	Limited company
Skillfish	Dumfries and Galloway	Training	-	✓	Limited company



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Creating sustainable solutions for the marine environment