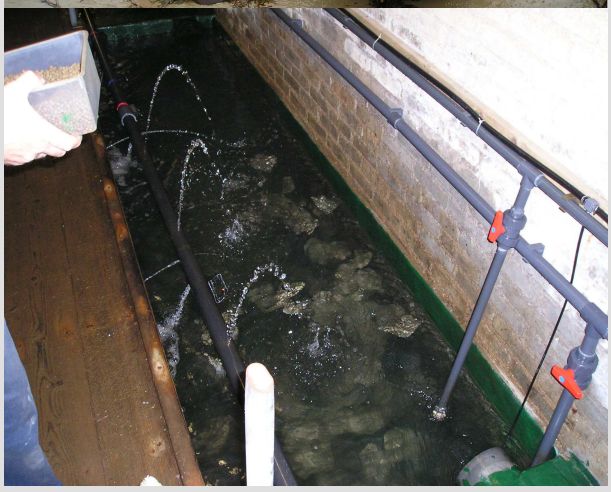
Aquafish Solutions Limited
Aquaculture and Fisheries Research, Consultancy & Training

DEVELOPMENT OF AN AQUACULTURE STRATEGY FOR JERSEY

VERSION 1.0

For: Fisheries and Marine Resources, Environment Division, Planning and Environment Department



DEVELOPMENT OF AN AQUACULTURE STRATEGY FOR JERSEY

FOR: FISHERIES AND MARINE RESOURCES, ENVIRONMENT DIVISION, PLANNING AND ENVIRONMENT DEPARTMENT, STATES OF JERSEY

VERSION: 1.0-FD-B

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AUTHORS NOTE

This study has been undertaken on behalf of and is funded by the States of Jersey. This Strategy is intended as a guidance document to assist with the development of an agreed Strategy for all marine stakeholders and users in the Island of Jersey. The views and suggestions expressed in this report are those of the Authors and are not therefore necessarily representative of Fisheries and Marine Resources. All references to and descriptions of Strategy Options are included in order to stimulate dialogue between the marine stakeholders and users during further development work. The Strategy Options should not therefore be viewed, either explicitly or by implication, as a policy statement in this respect by Fisheries and Marine Resources.

ACKNOWLEDGEMENTS

The Authors would like to express their sincere thanks to all those Consultees that took part in the meetings held in February 2010 and then in subsequent correspondence and discussions. Their help was invaluable in allowing the Authors to obtain an understanding of how the different marine stakeholders and users interact, the current status of the aquaculture industry in Jersey and how the industry might be further developed in a responsible and sustainable manner taking into account the needs and rights of those other stakeholders. A list of main Consultees is contained in the Appendix of this Report.

RECORD OF STRATEGY DEVELOPMENT

Version	Date	Reason for Change	Author(s)
1.0-WD-C	18 March 2010	Working Draft – Version C – Sections 2; 4; 5; 6; 9; 11	ASL/AF
1.0-WD-D	07 April 2010	Working Draft – Version D – Sections 2; 3; 4; 5; 6; 9; 11	ASL/AF
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1.0-WD-E	06 May 2010	Working Draft – Version E – Sections 1; 2; 3; 4; 5; 6; 7; 8; 9; 11	ASL/AF
1.0-WD-F	14 May 2010	Working Draft – Version F – Sections 1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11	ASL/AF
1.0-WD-G	14 June 2010	Working Draft – Version G – Sections 1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11	ASL/AF
1.0-FD-A	07 July 2010	Finalised Draft – Version A – Sections 1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11	ASL/AF
1.0-FD-B	17 December 2010	Finalised Draft – Version B – Includes feedback	ASL/AF

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EXECUTIVE SUMMARY AND SELECTED STRATEGY OPTIONS

AIMS

- The development of an Aquaculture Strategy for Jersey was cited as a requirement under the 2008 Integrated Coastal Zone Management Strategy particularly with respect to helping to improve management in the Island's Ramsar sites.

- The strategy must consider the needs of the Island as a whole including other marine stakeholders as well as helping to ensure the continued sustainable and responsible development of the aquaculture sector both onshore, intertidally and offshore in Jersey.

- The proposed Aquaculture Strategy for Jersey has a principal focus on promoting sustainable and responsible aquaculture production without adverse impact on Jersey's marine environment.

- The draft strategy is intended to serve as a framework for discussion of the various issues, challenges and opportunities facing the Island in the management of its marine resource with respect to aquaculture.

- The Project Brief states that the policy developed should be relevant to the development of aquaculture for the next 10-50 years with a suggested review period of every 5 years.

METHODOLOGY

- The main consultation on the development of an Aquaculture Strategy was carried out with marine stakeholders through a series of meetings held in the Island during February 2010.

- A review and analysis of other strategies, both national and regional for the UK, was undertaken to assess if there are potential similarities with Jersey or indeed lessons to be learned.

AQUACULTURE INDUSTRY OVERVIEW

- Jersey aquaculture production is primarily shellfish based with over 1,000 tonnes production in 2009 with an estimated value of around £1.75 million.

- The Pacific oyster (*Crassostrea gigas*) is the most commercially important shellfish species farmed in Jersey. Some onshore finfish culture is also undertaken with production of approximately 2.6 tonnes of turbot (*Psetta maxima*) for the table and around 10-12,000 rainbow trout (*Oncorhynchus mykiss*) for restocking of sport fisheries within the Island.

- The production of Pacific oysters in Jersey for 2008 at ~830 tonnes is comparable to the entire production for Scotland, England and Wales for the same period at 901 tonnes.

- A comparison between the total shellfish concession areas in 2005 and 2009 shows an increase of approximately 9% whereas total production has increased by almost 58% which demonstrates that concessions have probably been more fully utilised in recent years.

- The majority of the Jersey Pacific oyster production is exported to the French market. King scallops, mussels and turbot are primarily sold locally.

- The majority of the shellfish production is centred on the south east coast of the Island with other subtidal concessions in St. Aubins Bay and to the north-east of Gorey.

- The Jersey aquaculture sector has a reputation for producing high quality produce from clean and Disease Free waters. However, recently the industry has been faced with a number of threats including a perceived deterioration in seawater quality and significant mortality events in Pacific oysters caused by the emerging disease Oyster herpes virus which has also caused large scale mortalities in France.

SWOT ANALYSIS AND INTERPRETATION FOR THE JERSEY AQUACULTURE INDUSTRY:

- The main Strength of the aquaculture industry as described by Jersey Aquaculture Association was the high quality and very good growth of their aquaculture products. Sustainability and the existing performance of aquaculture businesses were also highlighted.

- Transport was agreed by Jersey Aquaculture Association Members to be a clear Weakness for the aquaculture sector including transport costs, times, weight restrictions, availability and a monopoly on supply. Other main Weaknesses were described as a lack of competitive government support and the difference in treatment of the agriculture and aquaculture sectors.

- The general opinion of the Jersey Aquaculture Association was that there was an Opportunity for both the shellfish and finfish farming sectors for modest expansion. There was also a perception that the shellfish growers would benefit from a decrease in French oyster production. The potential for local shellfish seed production and for new species development were also highlighted.

- The main Threat to the industry was considered to be that of transport costs and issues of transport generally. Another clear Threat was considered to be declining water quality.

ONSHORE AQUACULTURE:

Establish a public/private working group with multi-department representation to pursue and assess integrated polyculture operations.
Development of an all department coherent planning guideline in order to provide a rational for planning decisions in keeping with Island Plan commitments.

INTERTIDAL AQUACULTURE:

Industry to investigate the potential for dual culture system production of Pacific oysters through a research trial to assess the practicalities, effectiveness and environmental impacts of this approach.

SUBTIDAL AND OFFSHORE AQUACULTURE:

To require organisations investigating offshore power generation to encompass an assessment of the potential for aquaculture within their proposals.
Policy review for offshore aquaculture to provide operational and EIA guidelines to industry.

SEAWEED / ALGAE CULTIVATION AND UTILISATION:

Update and revision of the seaweed law 'Loi (1894) Sur La Coupe Et La Pêche Des Vraics' which limits the dates and times when seaweed can be collected. Required in order to help develop ormer culture in Jersey.

WATER QUALITY AND SHELLFISH CLASSIFICATIONS:

Storm water and foul water separation such as through the adoption and retrofitting of SUDS. This will reduce waste water spill frequency allowing a possible restoration of Class A status shellfish waters.
Water quality investigations to establish relative risks between contaminant sources.
Implement Island-based accredited impedance analytical capability.
Develop Proactive Shellfish Management System.
Recommence Shellfish Liaison Group. This would result in better information sharing between stakeholders.
Establish shellfish quality objectives for Liquid Waste Strategy and Water Framework Directive thus providing clear planning requirements and standards.

INDUSTRY STRUCTURE:

The States of Jersey through the Economic Development Department and the Jersey Aquaculture Association should work together to identify new and existing market development opportunities that may result from the accreditation of responsibly and sustainably cultivated aquaculture species and products.
A cost-benefit analysis should be considered by the Jersey Aquaculture Association to help describe the likely increase in operating, management and audit costs that would result from industry participation in an aquaculture certification scheme versus the relative benefits that may accrue in terms of new markets, market perception, increased market share, improved prices etc.
The question of whether aquaculture is considered a component of agriculture for both planning and environment purposes requires investigation and clarification by the Planning and Environment Departments as there is presently a disparity in the way the aquaculture sector is treated in this respect.
The Strategy considers that the current aquaculture licence application system is unnecessarily onerous for both industry and the relevant States Departments and requires streamlining into one coordinated application.

DISEASE MANAGEMENT:

Clarify under the new Aquatic Animal Health Regulations the position with respect to the importation of ormer seed from hatchery producers outside of the Island.
Jersey Aquaculture Association and the States Veterinary Officer to investigate the potential for establishing a cross-Channel Working Group with Cefas and Ifremer to tackle the emergent disease Oyster herpes virus (OsHV-1 µvar).
Develop a Disease Management section of a Code of Good Practice for the Jersey aquaculture industry including an undertaking whereby agreed industry measures by the Jersey Aquaculture Association are implemented by Association Members.

CLIMATE CHANGE:

Undertake baseline monitoring of invasive non-native species such as the slipper limpet to ascertain if impacts are increasing on marine activities such as aquaculture or commercial fishing.
A periodic review should be undertaken of climate change predictions to assess potential impacts on the Jersey aquaculture industry and other marine stakeholders.

ENVIRONMENTAL IMPACTS:

Formation of a joint working group with input from Jersey Aquaculture Association, States of Jersey and Fisheries and Marine Resources' officers (Impact Assessment Group) to assess potential aquaculture activities which may impact upon the Ramsar site.
'Impact Assessment Group' to review baseline studies with appropriate 'ground truthing' in order to better define the potential sensitivity of the aquaculture/Ramsar area.
States of Jersey Departments need to internally clarify legislative definitions and EIA/EIS requirements.
Jersey Aquaculture Association working with Fisheries and Marine Resources to develop Codes of Good or Best Practice for general aquaculture operations.
Fisheries and Marine Resources to arrange incorporation of Codes of Good or Best Practice as part of the aquaculture application process and in use as mitigation for standard applications with respect to EIAs. This may allow the development of a streamlined process for aquaculture applications.

SECTION 1 – AQUACULTURE STRATEGY FOR JERSEY

1.1 Introduction

The development of an Aquaculture Strategy for Jersey was cited as a requirement under the 2008 Integrated Coastal Zone Management Strategy (Le Claire, 2008). The need for a management plan for aquaculture was particularly highlighted in terms of helping to improve management in the Island's Ramsar sites.

1.2 Project Brief

The development of an Aquaculture Strategy for Jersey was commissioned by Fisheries and Marine Resources, Environment Department, with a contracted man power allocation by the authors of 20 man days. The authors are Martin Syvret of Aquafish Solutions Ltd. who has a background in finance, aquaculture research, development and training and Andrew FitzGerald who is an environmental scientist and consultant. Both Aquafish Solutions Ltd. and FitzGerald form part of the Southern Shellfish Training Centre established in collaboration with the National Lobster Hatchery and Sea Fish Industry Authority.

The Project Brief given to the authors clearly sets out that the Aquaculture Strategy should seek to "both protect the Island's resources and allow the sustainable development of the aquaculture industry". In effect the final strategy must consider the needs of the Island as a whole including other marine stakeholders and users as well as helping to ensure the continued sustainable and responsible development of the aquaculture sector both onshore, intertidally and offshore in Jersey. The draft strategy developed by the authors is intended to serve as a framework for discussion of the various issues, challenges and opportunities facing the Island in the management of its marine resource. The Project Brief states that the policy developed should be relevant to the development of aquaculture for the next 10-50 years but recognises that periodic reviews will be necessary to ensure that the strategy remains relevant to the Island's needs. The suggested review period is therefore every 5 years.

1.3 Context

The UK has recently published its strategic review of UK aquaculture (James & Slaski, 2009) which clearly sets out a planned approach to maximise the benefits resulting from aquaculture with a principal focus on food security. This is in addition to other strategy documents such as that produced by Syvret and Utting (2004) for the Sea Fish Industry Authority and Bannister in 2006 who provided a road-map towards a National shellfish strategy and the 2007 report by Lake and Utting entitled 'English Shellfish Industry Development Strategy - securing the industry's future'. In addition to a UK national perspective many regions have already also produced aquaculture strategy documents (e.g. South West Pesca Ltd for South West England; Solway Firth Partnership for the Solway Firth) and Strategic-type Action Plans such as that produced by the South West Regional Development Agency. The success and the implementation of these initiatives are influenced both by resources available to initiate schemes and according to how well any aquaculture strategy is integrated into other priority strategies from related sectors.

The proposed Aquaculture Strategy for Jersey resulting from a recommendation of the previous Integrated Coastal Zone Management study (Le Claire, 2008) has a principal focus on promoting sustainable aquaculture production without adverse impact on Jersey's marine environment. The interaction between the various marine sectors is key to the success of ICZM. Furthermore, from an aquaculture perspective an understanding of other marine users' needs and wider environmental changes are fundamental to the threats and opportunities which face the industry.

Marine Conservation - The ICZM report highlights that Jersey is not currently meeting all of its obligations under the coastal and marine multi-lateral environmental agreements (MEAs) and in particular Ramsar designations. Although aquaculture can be complimentary to Marine Conservation Areas in some respects there may be potential for conflict where shellfish infrastructure or operations are perceived to significantly adversely alter the marine habitat.

It is noted that the Minister for Planning and the Environment is taking action by "*developing a marine Biodiversity Action Plan with targets for marine and coastal habitats and species*" (ICZM proposition - Le Claire, 2008). It will be vital to ensure that production from the aquaculture industry is both responsible and sustainable, without significant impact on the marine environment. Any Aquaculture Strategy will need to have a keen regard for proposed and existing designations in respect to existing and planned aquaculture projects.

1.4 Research Methodologies

The main consultation that was carried out with marine stakeholders was through a series of meetings held in the Island during February 2010. In addition to these meetings where further discussions were required or if stakeholders were not available for a meeting then conference calls, E-mails and written correspondence also took place. A Record of Conversation was drafted for each meeting or significant conference call and these were forwarded to participants for agreement or follow up as necessary. A list of all main consultees can be found in Appendix 1. Mapping resources were primarily supplied by Fisheries and Marine Resources. A review and analysis of other strategies, both national and regional for the UK, was undertaken to assess if there are potential similarities with Jersey or indeed lessons to be learned.

1.5 Jersey Aquaculture Industry

Table 1 gives an overview of the production levels of the main Jersey aquaculture products. These are primarily shellfish with production in 2009 of over 1,000 tonnes with an estimated value of around £1.75 million. Of the shellfish grown in the Island the Pacific oyster (*Crassostrea gigas*) is the most commercially important. Some onshore finfish culture is also undertaken in Jersey with production of approximately 2.6 tonnes of turbot (*Psetta maxima*) for the table and around 10-12,000 rainbow trout (*Oncorhynchus mykiss*) for restocking of sport fisheries within the Island.

Table 1. Farmed shellfish production (area in hectares; production in kgs)
(Source: Fisheries and Marine Resources, Annual Report 2009)

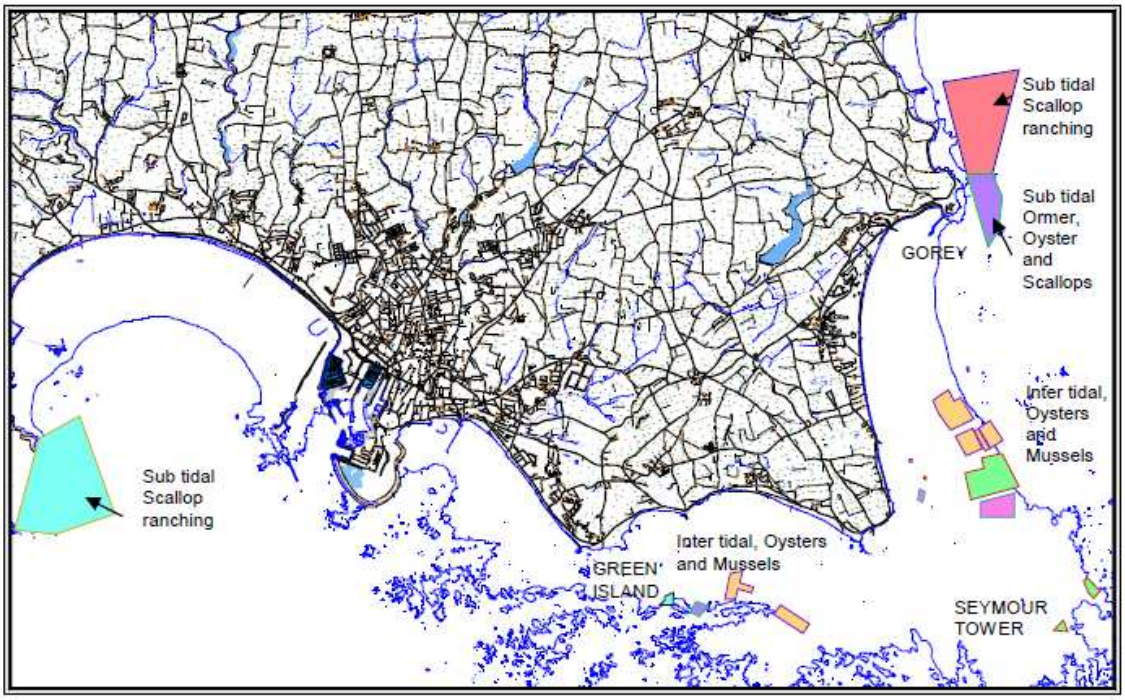
	2003	2004	2005	2006	2007	2008	2009
Intertidal area[1]	54.5	54.5	62.65	62.88	62.88	68	68.76
Subtidal area	100	100	166	166	166	166	166
Pacific Oyster	560 200	720 768	579 915	651 148	737 395	829 952	903 000
King Scallop	1 351	3 571	8 484	2 540	4 100	8 841	2 571
Mussels	108 300	25 000	50 000	117 500	50 000	117 000	101 000
Total	**669 851**	**749 339**	**638 399**	**771 188**	**791 495**	**955 793**	**1 006 571**

Note: 1. Area pre-2004 relates to actual area farmed. 2005 onwards relates to total concession area granted.

A comparison between the total concession areas in 2005 and 2009 shows an increase of approximately 9% whereas total production has increased by almost 58% which demonstrates that concessions have probably been more fully utilised in recent years. To help put the levels of aquaculture production in Jersey waters in context it is interesting to compare this to equivalent species production levels in the UK. Whilst mussel production in Jersey is dwarfed by production in mainland Britain (117 tonnes vs. 20,894 respectively) the production of Pacific oysters in Jersey for 2008 at ~830 tonnes is comparable to the entire production for Scotland, England and Wales for the same period at 901 tonnes (Source: Shellfish News, No. 28, Autumn/Winter 2009). However by way of a European comparison, France produces in excess of 100,000 tonnes per annum of Pacific oysters although production levels will have dropped recently following large-scale mortalities due to Oyster herpes virus (OsHV -1 µvar).

Staffing levels for the aquaculture industry in Jersey are thought to be in the region of 20 full time personnel and 20 part time personnel (T. Legg, pers. comm.). The King scallops, mussels and turbot are primarily sold locally whereas the majority of the Pacific oyster production is exported to the French market. The majority of the production is centred on the south east coast of the Island with other subtidal concessions in St. Aubins Bay and to the north-east of Gorey (see Figure 1).

Figure 1. Jersey aquaculture concessions as of December 2009 (Source: Fisheries and Marine Resources, Annual Report 2009)



The aquaculture industry in Jersey has the enviable reputation of producing high quality produce from clean and 'Disease Free' waters. It also has the potential to increase production in a sustainable and responsible manner and through this contribute more to the Island's economy. However in recent years the industry has been faced with a number of threats including a perceived deterioration in seawater quality and significant mortality events in Pacific oysters caused by the emerging disease Oyster herpes virus which has also caused large scale mortalities in France.

SECTION 2 – ONSHORE AQUACULTURE

2.1 Introduction

The scope of the Jersey Aquaculture Strategy encompasses onshore aquaculture even though there are currently very limited facilities with often challenging conditions limiting development. There may be scope to expand existing operations although new developments are likely to be focused upon high value small foot-print operations possibly in association with hybrid facilities where both infrastructure costs can be shared and revenue sources diversified.

This Section reviews the existing facilities and future development potential.

2.2 Current Onshore Aquaculture Production

2.2.1 Jersey Turbot

The main centre of production for Jersey Turbot is currently based at Les Viviers de St. Catherine which is a converted World War II German gun emplacement and bunker. A second production facility is also currently being established within the arm of the Albert Pier in St. Helier (see Figure 2). Established in 2000 Jersey Turbot specialises in producing a high quality product that is sold either at the farm gate, trimmed in presentational boxes or that is supplied to local restaurants, hotels and similar establishments. Jersey Turbot are members of Genuine Jersey and utilise this mark on publicity information.

Figure 2. Jersey Turbot on-growing facilities
Left-hand image: St. Catherine's production facility; Right-hand image: New tank systems under construction at the Albert Pier (Source: Aquafish Solutions Ltd.)

Juvenile fish are sourced from France Turbot and fish feed is also imported from France. The culture system is based on a flow through rather than recirculation with minimal pre-treatment of the seawater. The water is kept at a suitable temperature due to the cooling effect of the tunnels used for housing the rearing tanks. No significant issues with disease or mortalities have been experienced. Issues over security have arisen in the past and vandals were responsible for a loss of 200 fish in 2003 when an electricity box was damaged causing a loss of power to the air pumps (Jersey Evening Post, 25th June 2003). Permission has now been received to construct a new rearing facility at the St. Catherines site which was originally going to be used to rear juvenile fish. However discussions with other European

turbot producers have now convinced the owners that it is not economically viable to rear their own juveniles and so this facility will be used as an additional on-growing area.

Standing stock at any one time at the St. Catherines facility is normally around 6,500 turbot ranging in size from juveniles up to mature fish of around 3-4 years of age which weigh just over 1 kilo each. Price achieved is around £14.40 per kilo with a current production of 3 to 4 tonnes per year (D. Cowburn, pers. comm.). With the new facility at the Albert Quay it is estimated that in the next 3 to 4 years production will reach 5 to 6 tonnes per annum.

2.2.2 Jersey Water Trout Farm

History/Location - Jersey Water (JW) has operated a trout farm on Handois Reservoir since the 1960s.

Objectives:
Water Supply Monitoring – Rou Reservoir - A principal driver for the trout farm is for monitoring water quality prior to abstraction for drinking water. Handois Reservoir receives a combination of pumped and gravity drained sources from across the Island including from collection points, other reservoirs, streams and even road drainage from outlying country roads (St. Helier surface water is not included).

This is counter-intuitive to most fish farm operators who would seek to utilise a controlled clean abstraction source in order to minimise the risk to their stock. Despite the seemingly high risk potential to the farm they have never suffered a pollution incident which has given rise to a significant fish kill.

Water Supply Monitoring – feeder catchments - Low numbers of surplus stock are provided to private ponds throughout the Island on the understanding that the owners inform JW of any fish kills. This therefore extends the scope of the early warning biological monitoring.

Recreational Freshwater Angling - The majority of stock is provided to Val de la Mare and Queen's Valley reservoirs for the Jersey Freshwater Angling Association (JFAA). The JFAA also operate day passes to allow fishing by tourists. This application subsidies a major proportion of the £34-K operational costs of the hatchery.

Community Relations / Education - The trout farm is located in an idyllic setting and is a frequent site for local school visits where JW can describe their operations, pollution monitoring and the hydrological cycle.

Growth Cycle:
Species - Both brown trout and rainbow trout have been produced at the facility. The Island's current 'Disease Free' status restricts imports to other areas with a disease free status (e.g. Isle of Man). As disease free sources of trout are limited, only rainbow trout can be produced as there are no disease free sources of brown trout currently available.

Hatchery - ~40,000 eyed eggs are imported annually in November from the Isle of Man and hatched in the hatchery within shallow raceways. The low temperatures (5-6^{o}C) along with good husbandry (e.g. low level continuous automatic feeders limiting detritus accumulation) help prevent disease issues and therefore losses are minimal. By mid-February fingerlings are 4-5cm and ready to go out to the nursery. If brown trout are under production they have a slower growth rate and will be stocked out later.

Figure 3. Hatchery and nursery system at Jersey Water Trout Farm
Left-hand image: Hatchery building in background – nursery system in foreground
Right-hand image: Rearing troughs with belt feeders inside the hatchery building
(Source: Aquafish Solutions Ltd.)

Nursery - Fish remain in a meshed 'trough' through-flow area for 5-6 months until they are 10cm long.

On-growing - Fish are on-grown in a variety of tanks, first in the 'round tank' or the adjacent earth ponds until 1 year old and around 14cm before transfer into the x3 tanks alongside the reservoir where stock are grown on until around 16-18 months when they are around 1.25lb (see Figure 4).

Figure 4. On-growing tank and ponds at Jersey Water Trout Farm
Left-hand image: Round tank with fish feeding at the surface ; Right-hand image: On-growing ponds showing central aerators (Source: Aquafish Solutions Ltd.)

Production:

Limitations - Capacity within the current facility is limited and unlikely to be extended. It should also be noted that the trout farm itself will be contributing to nitrate levels which are problematic. Annual production has been scaled back with stocking reduced from x3 to x2 reservoirs. This is in order to minimise offsite culture which used to be undertaken in some of the feeder collection ponds where production was less efficient.

Numbers - Nowadays 10-12,000 fish are stocked annually (with 20,000 stocking at the peak of production).

Production Weight - Final fish age and weight is variable according to the needs of JFAA. Currently around x800 3lb brown trout are the largest fish on site. The majority of stock is removed at ~2lb. Production rates (time to market size) are relatively low as growth rates are

not optimised (e.g. temperature increased) – however, this tends to produce a healthy well toned less 'flabby' fish which suits the key objectives.

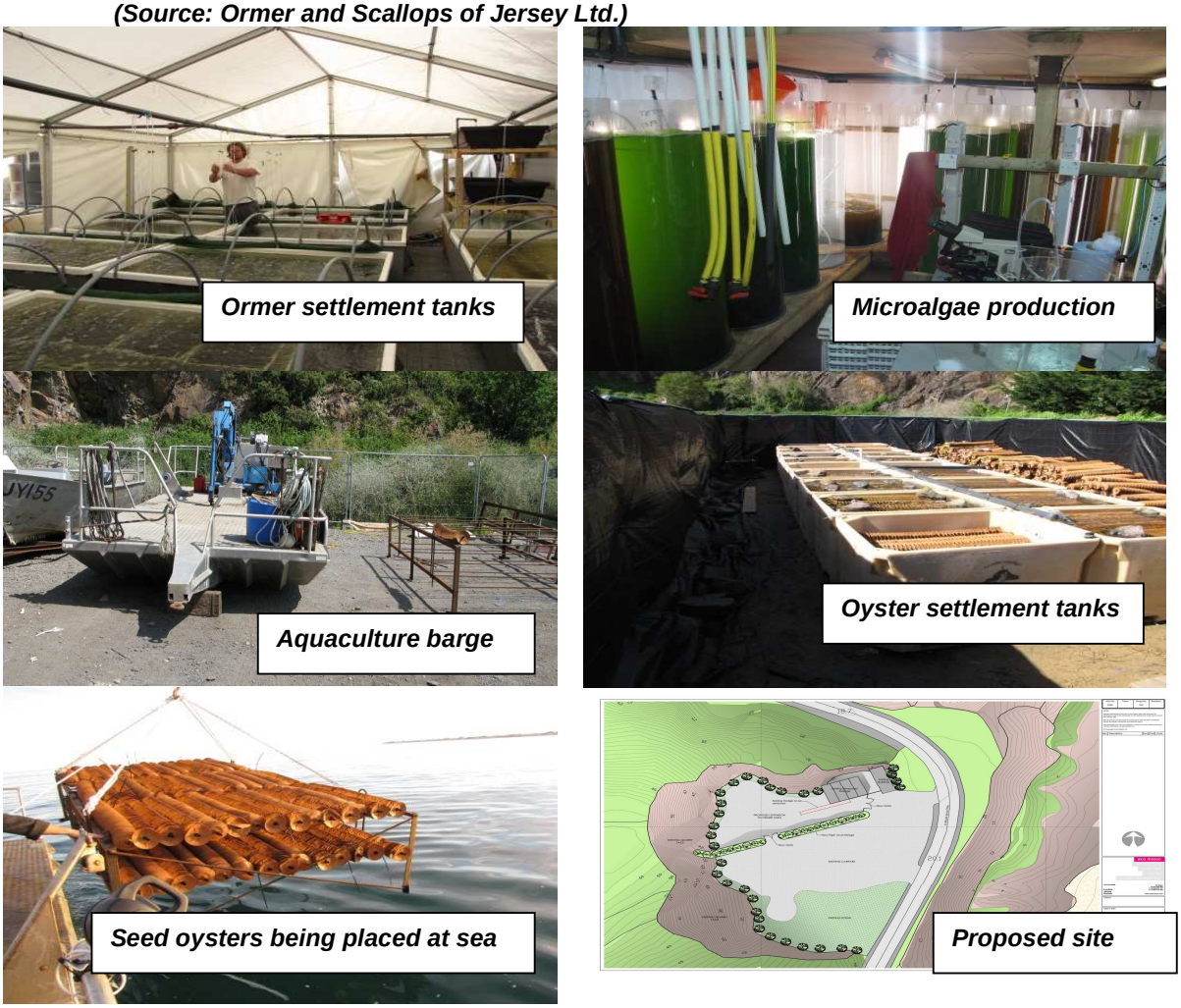
Tonnage - 10-12,000 fish per year of 2lb per fish equates to an annual production rate of ~10 tonnes per year.

2.2.3 Ormer & Pacific Oyster Hatchery

A small scale ormer hatchery run by Ormer and Scallops of Jersey Ltd. (Jersey Ormers) has been operating for a number of years in Jersey near to Gorey. In 2008 this hatchery received a significant sum of private investment and this has enabled the hatchery to move beyond experimental-scale levels of production. Jersey Ormers now report that they have spawned and are rearing ~400 thousand juvenile ormers. These ormers will be on-grown in sea-cages using macroalgae. The hatchery has also just diversified into Pacific oyster seed production with it is believed ~10 million diploid seed oysters currently being on-grown on sub-tidal structures which are serviced using a chaland-type aquaculture barge.

The facilities utilised for this hatchery currently include both permanent and temporary structures and it is understood that there are plans to redevelop the site to better support these levels of shellfish production and to ensure adequate security of the site, equipment and shellfish (see Figure 5).

Figure 5. Jersey Ormer's shellfish hatchery
(Source: Ormer and Scallops of Jersey Ltd.)



Jersey Ormers recognise that further significant levels of investment will be required if they are to continue with the expansion of the business. However, in addition to the ormer seed production they see a potential for up to 50 million seed Pacific oysters being produced per year through this operation which would allow for sales to other local growers.

The role that this hatchery might play in helping to meet the Island's need for seed shellfish together with the development of commercial shellfish hatcheries generally is considered further in Section 7.2.1.

2.3 Development Opportunities and Limitations

2.3.1 Marine Finfish

The greatest limitation for onshore marine aquaculture is site availability. It is hard to find a suitable site with a high salinity, high quality seawater supply at a low pumping head, especially with the price of sea frontage land for development. Abandoned sea-frontage quarries are ideal e.g. Guernsey Sea Farms (see www.guernseyseafarms.com) or the large Selonda sea bass farm in Penmon Quarry on Anglesey, Wales. Whilst there are few potential sites on Jersey's coast La Rosière the desalinisation plant which is located on the South West corner of the Island utilising an abandoned quarry has some potential. The presence of the key seawater abstraction infrastructure placed into clean high quality seawater would make this location an ideal marine fish farm.

2.3.2 Freshwater Finfish

Site availability and water availability will be a major limitation to any freshwater finfish development on Jersey. In addition the already high level of nitrates in the Island's surface and ground waters would be likely to limit large scale traditional open system pond culture due to the increased nitrogen loading from the waste water discharge. Discussions with the Planning and Environment Department indicated that there was no automatic embargo on such developments and each case would be judged on its merits following an EIA which would clearly encompass the potential impact upon the receiving watercourse.

Discussions were carried out with The Jersey Freshwater Angling Association (JFAA) who manage many of the private inland waters on the Island. The JFAA use natural recruitment in the waters for re-stocking their sport fisheries and crop species such as roach, bream, perch and some carp. Two waters are now closed to angling and new fish production in these waters is used for restocking the other fisheries. Previously the JFAA have imported fish for release into the wild but in the last decade the Island has achieved Disease Free status for the main notifiable finfish diseases and this now severely limits where they can import fish from as the Island generally has a higher health status than most other countries.

The JFAA are not aware of how and when the testing was carried out in order to achieve this Disease Free status. To their knowledge there has only been one mass mortality event during their management (spanning 50 years) which resulted from the import of some carp that had supposedly been health tested and certified free of disease (G. Carver, pers. comm.). There have however been unauthorised releases of fish into the wild and these fish will not therefore have been health checked. Examples include gudgeon, which are now found in Millbrook Reservoir, and catfish into the waters at St. Catherines.

The JFAA are actively looking for land on which to dig ponds in order that they might actively culture finfish for restocking, i.e. stripping fish and fertilising eggs, rather than just cropping natural production. The availability of suitable land (i.e. land in which ponds can be dug, filled with water and later drained for harvesting) is however a limiting factor as would be the price of that land. The JFAA have advertised in the Jersey Evening Post but with no

success. The JFAA feel that controlled breeding of fish under culture conditions will become vital within the next 10 years if sport fisheries within the Island are to be maintained.

The JFAA stated that glasshouses would indeed be suitable for rearing fish and that this method was used in other areas in order to on-grow fish for re-stocking. GC felt however that there may be an issue about whether or not using glasshouses or agricultural land would be considered a 'change of use' in terms of aquaculture vs. agriculture. This matter is considered further in Sections 2.3.4 and 7.3.1. The JFAA would certainly be interested in obtaining glasshouse space, with a minimum 4-5 year lease, in order to breed fish for re-stocking. The Disease Free status whilst currently negatively impacting on their ability to import fish might in the future be an advantage if breeding of finfish proved successful and exporting was considered viable. Cormorant predation however now has a major impact on the fish stocks although the JFAA have been unable to obtain permission to cull cormorant numbers. If future exports were to become viable then some method of either controlling cormorant numbers or limiting their access to pond systems would be required.

There may be scope to develop aquaculture as a dual function within certain agriculture operations. For example, the 1997 CREH report (Langley *et al.*, 1997) into stream quality recommended the development of pond/constructed wetlands to help mop up agricultural loads – there may be scope for low intensity pond culture within these facilities perhaps linked with sports angling in the same manner as Jersey Waters' trout stocking.

The utilisation of recirculation systems offers considerably more scope for finfish culture as the potential for impact on watercourses can be limited. However, in the current economic climate it is unlikely that a stand alone recirculation finfish facility would be cost effective once the mark up for equipment, feed and power were factored in. Any commercial facility would also be disadvantaged from mainland facilities which could attract a higher degree of grant support towards the initial capital setup costs. The availability of land is a major limitation for any potential aquaculture development on Jersey as highlighted by the inability of the JFAA to successfully obtain land to construct restocking ponds (G. Carver, pers. comm.).

2.3.3 Koi Carp Farming

Traditionally carp are considered a food aquaculture species particularly in Eastern Europe and China although a niche market for organic carp has also been developing in the UK (as described for Aquavision in Section 2.3.4). Koi carp are however a potentially high value species largely cultured for the ornamental market.

The low footprint requirement and high value for Koi could make it a good candidate for further development. Figure 6 shows a Koi carp farm in Japan where the fish are raised under glass before being sold for stocking ornamental ponds and waters.

Step-by-step instructions are readily available of how to build an 'eco-friendly' modern Koi pond in a glass house (http://www.koicarp.org.uk/koi_pond2.htm). The use of glasshouses for aquaculture and aquaponics is considered further in Section 2.3.4.

Figure 6. Japanese Koi carp farm glasshouse (Source: www.koioriental.com)

The Disease Free status of the Island whilst currently negatively impacting on the ability to import fish might in the future be advantageous if breeding of finfish proved successful and exporting was considered viable. (S. Bossy & G. Carver pers. comm.) However a clear market advantage will be needed to overcome the limitations outlined previously.

2.3.4 Glasshouse Utilisation - Aquaponics

Aquaponics is the integration of aquaculture and hydroponics whereby nutrient rich fish effluent is recirculated through hydroponic grow beds to fertilise the plants and help clean the fish waste.

Although there has been a long history of the use of simple aquaponic systems particularly in Asia where carp have been co-cultured with paddy rice for millennia, it has only been relatively recently that the approach has been incorporated into more 'western' intensive recirculation systems.

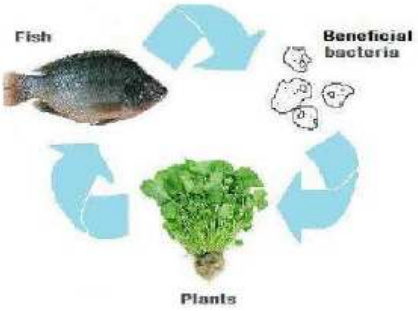
Aquaponic developments in the UK and other industrialised nations have expanded enormously in recent years. The ABLE project (a partner within Aquaponics UK) with its well known strap-line 'cardboard to caviar' has been a high profile illustration of combining agricultural waste utilisation, compositing and aquaculture whilst also undertaking a social-good enterprise in association with industry.

In Wales, Anglesey Aquaponics developed from a hydroponic herb production background into aquaponics with the co-production of trout. Since the start of their aquaponics operations in 2008 plant production has diversified to include brassicas and salad crops.

Figure 7. Angleseyponics – Herb / Aquaculture Pilot Plant
(Source: http://www.angleseyponics.com***)***

Support is available on technical and economic assessments via Aquaponics UK which is a social enterprise supported by the Institute of Aquaculture at Stirling University.

Figure 8. Aquaponics UK Project with Illustration of Aquaponics Recycling Principal
(Source: http://www.aquaponics.org.uk)



In South West England, Aquavision (http://www.aquavisiononline.co.uk) has seen a significant expansion of aquaponics activities with the production of 'organic' carp for the table. Aquavision also run training courses and support consultancy.

In Australia the scope of aquaponics has expanded into a range of domestic systems which has been spearheaded by Backyard Aquaponics (http://www.backyardaquaponics.com) who provide a wide range of support and systems for small aquaponic operations.

The containment of aquaponics facilities lends itself well to Integrated Pest Management and the development of 'organic' farming methods. This approach should be eligible for financial support as outlined in the Rural Economy Strategy commitment to the conversion of agricultural land to organic status which was formerly undertaken through the Countryside Renewal Scheme (CRS) but is proposed to be funded through the Rural Initial Scheme (PR14).

The synergy between aquaculture and agriculture using farm buildings to house recirculation systems has been recognised as a potentially valuable way to allow farm diversification. On Jersey fish farming could receive a beneficial advantage if there was acceptance of utilising redundant glasshouses for aquaculture or using agricultural style buildings. A key factor in determining the viability of this approach is how planning rules are applied in terms of whether 'aquaculture' activities can be considered as types of 'agriculture.' Integrated aquaculture with polyculture of freshwater finfish providing fertiliser to hydroponic crops is an

illustration where aquaculture practices are clearly agriculture. States of Jersey Departmental discussions have highlighted that boundaries are not clear and that definitions are important in terms of planning and land use. Legislative change may be necessary to change this situation. This is a major consideration which is discussed in Section 7.3.

There has been a recent application from a hydroponic tomato grower to allow a change of use to a leisure facility which would remove this facility permanently from agricultural use. It is unfortunate that such a facility could not be developed for aquaponics with an eco-tourism component within a 'hybrid' facility as considered in the following section. This is complimentary to Policy Option PE8 of the Rural Economic Strategy to develop an agri-tourism strategy and action plan for Jersey.

There is also scope to have integrated waste management utilisation (e.g. methane digester to treat farm waste + 20,000T of urban putrescible waste) allowing energy generation. The warm CO_2 rich exhaust gas could then be applied to greenhouses for enhanced growth in early crops (R. Duhamel, pers. comm.). It is understood that there may even be scope for algal bioreactors to be constructed on land, possibly in association with nutrient utilisation from waste waters.

The Island Plan consultation expressed an interest in developing abandoned glasshouses for agricultural applications and it is understood that since 2008 there has been a Ministerial embargo on development for housing (A. Scate, pers. comm.) However, due to the 'hope value' of potentially obtaining some return from future housing developments many owners may refrain from utilising such facilities. So long as glasshouse sites are seen by owners as future potential development opportunities there will be a reluctance to see them used for other activities such as aquaculture.

Any of these novel glasshouse applications will require comprehensive co-operation between industry and a number of States Departments in addition to significant investment. The development of agricultural buildings for integrated culture (agriculture & aquaculture), waste utilisation and even power generation would therefore require a comprehensive multi-disciplinary approach with input from a number of departments. In the absence of any Jersey based business wishing to take on such a complex challenge there will need to be a clear political and financial structure to encourage external investors. Success of such a group would be dependant on a significant contribution from private entrepreneurs to champion any development. It is proposed (Strategic Option 2.1) to establish a working group to pursue and assess these integrated polyculture operations.

Strategy Option: Establish a public/private working group with multi-department representation to pursue and assess integrated polyculture operations.

2.3.5 Hybrid Facilities

There may be scope to develop a combination facility for use by private/public bodies for aquaculture, education and tourism. For example the National Lobster Hatchery in Padstow Cornwall (www.nationallobsterhatchery.co.uk) has fisheries enhancement as its main objective, although it also supports aquaculture research with public exhibition and education/conference facilities – all on a small footprint.

The National Lobster Hatchery also provides a valuable local resource for training and research which are strong themes identified within the Rural Economic Strategy (RES) Policy Option PE6. It may be possible that an external university may be willing to support such a scheme as part of a Jersey based college. This approach has been adopted by Exeter University who have opened satellite facilities under Cornwall College.

There might also be scope for a dual use facility (e.g. public aquarium exhibition and shellfish depuration) as such a facility could share some common infrastructure (e.g. full salinity tidal abstraction, marine storage tanks, disinfected discharge etc.) – however, shared responsibilities would require careful consideration. It is noted from the RES that 'Industry Wide Grants' for the benefit of the wider industry are available up to 80% for the provision of common infrastructure. A hybrid facility could meet these requirements. Policy Option PR11 states that the States of Jersey will continue to support the Rural Initiative Scheme to help encourage entrepreneurial developments in view of perceived high risk/low profit by the banks for agricultural and fishery businesses.

Any public/private partnership will need a clear delineation of liabilities and responsibilities. As mentioned in Section 2.3.4 a multi-stakeholder input would be needed which could be enabled by Strategic Option 2.1.

2.4 Onshore Facilities for Intertidal Operations

The Jersey Aquaculture Strategy needs to include consideration of onshore infrastructure including processing, grading, packing and storage as well as ancillary aspects such as traffic.

The Island Plan consultation incorporated two questions in relation to the development of aquaculture which received generally positive feedback. The question, *"Do you agree that there should be a presumption in favour of the development of land-side facilities in support of aquaculture on the coast*" received a 69% agreement. Yet despite this Jersey Oysters' proposal for an onshore processing facility in 2006 was denied with a petition of x400 people against. This planning dispute is ongoing and unresolved with an absence of a decision at Ministerial level. A definitive judgement is vital to allow this business to move forward. As the issue of depuration and grading facilities are a fundamental infrastructure issue to the long term sustainability of the whole industry it is suggested that these planning issues are one of the most critical aspects to sector viability (see Section 7.3).

If the existing industry is struggling to obtain basic facilities to depurate and grade raw product there is limited scope for extending facilities to produce added value products or undertake secondary processing. The increased requirement for labour could also limit the scope of more intensive applications.

On a financial basis, Jersey companies may receive less grant assistance than equivalent mainland businesses who will be eligible for some capital support such as that provided through the European Fisheries Fund (EFF). The RES outlines some of the financial support schemes available for rural Jersey businesses although it is not clear to what degree these would be available to shellfish businesses.

Strategy Option 2.2 sets out the need for a streamlined planning process to provide rapid decisions with due regard to the commitments within the Island Plan.

Strategy Option: Development of an all department coherent planning guideline.

2.5 Policy and Legislation

Many of the policy and legislation aspects to onshore aquaculture are covered in other Sections relating to:

-Planning Controls (Section 7).
-Disease and Movement Controls (Section 8).
-Environmental Impact Assessments (Section 10).

Section 2. Strategy Option(s)

Section	Strategy Option(s)	Benefit / Importance	Output or Outcome	Cost or Funding Requirement	Timeframe for Implementation
2.1	Establish a public/private working group with multi-department representation to pursue and assess integrated polyculture operations.	**Moderate**	To provide harmonised support for hybrid / integrated polyculture proposals.	**Moderate to High**	Medium Term – 5 to 10 years
2.2	Development of an all department coherent planning guideline.	**High**	To provide a rational for planning decisions in keeping with Island Plan commitments.	**Minimal**	Short Term – less than 5 years

SECTION 3 – INTERTIDAL AQUACULTURE

3.1 Introduction

The Scoping Document for a Jersey Aquaculture Strategy requires a review of where farming is currently carried out within the intertidal zone; an assessment of where it is considered that this can continue or be expanded and where new areas might be developed taking into account the needs of other marine stakeholders. Specifically, areas that may require protection also need to be identified.

In terms of new opportunities this report also requires an assessment of what new species, strains or hybrids might be available for culture. Balanced against this the report also considers what limitations or threats may face the aquaculture industry in Jersey.

3.2 Current Intertidal Aquaculture Production

3.2.1 Bivalve Cultivation

At present intertidal aquaculture in Jersey, i.e. between High and Low Water Spring tide marks, is limited to the cultivation of bivalve molluscs. Production is dominated by cultivation of the Pacific oyster (*Crassostrea gigas*) which in 2009 represented 89.7% of total shellfish aquaculture production by weight at approximately 903 tonnes. The other main species cultivated in the lower intertidal zone is the blue mussel (*Mytilus edulis*) which was recorded as 10.0% of total culture production in 2009 at 101 tonnes. The other 0.26% of culture production was made up of scallop production in subtidal concessions. Total intertidal production is therefore just over 1,000 tonnes per annum with a first sale value of approximately £1.75 million (Source: Fisheries and Marine Resources, Annual Report 2009).

The main cultivation technique employed for Pacific oysters is the traditional French 'poche' bag and trestle method. There is also cultivation carried out by one grower using the ORTAC system which is a rigid plastic container which allows freer movement of shellfish within its structure when compared to the bag and trestle system (see Figure 9).

Figure 9. Pacific oyster cultivation systems
Left hand image = Bag and trestle cultivation system;
Right hand image = ORTAC system (Source: Aquafish Solutions Ltd.).

Mussel cultivation is generally carried out using the French 'bouchot' technique where lines of mussels are secured to poles staked out in the lower intertidal zone (see Figure 10). At times when there are excess mussels produced then these are held higher in the intertidal zone using bag and trestles.

Figure 10. Bouchot mussel cultivation system as used in Jersey
Top left = Mussel seed being landed from the transport boat by amphibious vehicle.
Top right = Mussel seed ropes.
Bottom left = Bouchot poles showing pot for crab collection.
Bottom right = Attaching mussel seed ropes to bouchot poles.
(Source: Aquafish Solutions Ltd.)

Up until recently there has been no local shellfish hatchery (see Section 2.2.3) and so oyster seed or part grown stock has been imported. Hatcheries used in this respect include Seasalter (Walney) Ltd. in the UK and Guernsey Sea Farms whilst the majority of seed imported comes from French hatcheries such as Grainocean S.A. Both diploid and triploid seed are imported and on-grown in Jersey.

Whilst a small amount of Pacific oysters are sold locally the majority of the production tonnage is exported. In the past these export sales have been predominantly for the table market in France with the majority of these oysters exported for the Christmas market. Other export markets have included the UK, Ireland, Germany, Holland and the Middle East. However as Shellfish Classifications have declined then these oysters destined for France are now transported to mainland France where they will be depurated or re-laid prior to sale with a consequent reduction in price achieved. Pacific oysters are sold to the UK for the table market and have also in the past been sold as halfware oysters for on-growing. However the presence of the Oyster herpes virus in Jersey and the associated mortalities that have been experienced resulted in local producers taking the decision not to export to the UK for relaying purposes. Commission Regulation (EU) No. 175/2010 is now in force in this respect until the end of 2010 and this is described more fully in Section 8.3 and Appendix 3. The rope mussels produced are primarily sold to the local market but can also occasionally be exported in bulk.

Land based facilities are required by all concession holders in order to allow grading and packing to take place. At present only one industry member has operational depuration units available to use although a planning application is pending which seeks to develop a facility to allow depuration and handling of oysters and mussels. Access to the intertidal concession areas is generally by tractor and trailer from slipways above the concessions. Occasionally, when for instance new steel trestles have been landed at Gorey, tractors may move directly across Grouville Bay.

3.2.2 Concession Locations and Area

In terms of current concession levels, intertidal aquaculture in Jersey covers an area of approximately 69 hectares on the South East Coast of Jersey. The majority of these concessions (see Figure 11) fall within the South East Coast Ramsar site which itself covers 3,210 hectares. No intertidal culture is currently practiced on any of the Island's offshore reefs.

Figure 11. South East Coast Concessions in Jersey as at 2009 (Source: Fisheries and Marine Resources)

In general the placing of equipment such as bags and trestles is limited to those lower energy sites where exposure to wind and wave action is below a level at which damage to the equipment or loss of stock will occur. This therefore means that the main concessions are placed away from the prevailing south westerly winds or else are sited in gullies or within

the leeward side of rocky areas which provide protection from the worst of the environmental conditions.

3.3 Development Opportunities and Limitations

The scale of any expansion of intertidal aquaculture activities as a whole is considered in more detail in Section 3.3.1. Other limiting factors and issues relating to intertidal culture activities including water quality, Shellfish Classifications, shellfish diseases and water pollution are considered separately in this report. This Section therefore considers individual examples of how production might be increased or optimised.

3.3.1 Increased Production of Pacific oysters

Utilisation of existing concessions- The industry when consulted considered that there was still a "modest scope" for expansion of production of this species in the intertidal area. The need for relatively low energy environments means that any such expansion will most likely be limited mainly to the existing concession areas on the south east coast of Jersey.

From Figure 11 it can be seen that whilst some concessions are fully utilised in terms of trestle cover, at present others still have some limited scope for expansion. Discussions with the JAA indicated that with the Oyster herpes virus mortalities two of the larger operations have between 20 to 30% production capacity unutilised and two other Pacific oyster growers have between 30 to 40% capacity unutilised. If it were not for the mortalities through disease these figures would have been 0 to 20% and 15 to 40% respectively. If practical, were these concessions to be fully utilised then it would seem likely that intertidal Pacific oyster production could reach approximately the 1,000 tonne per annum level.

Expanded concession areas or new sites- The available area for expanding the footprint of intertidal concessions seems limited given the informal agreement by the industry not to expand into the eel grass beds located to the north of the existing concessions and the increasing exposure that would be experienced to the south or east of the existing sites. Any major expansion would also in all likelihood be resisted by other marine stakeholders such as commercial fishermen. However there may be some scope to extend existing concessions further up the shore although these will of course be subject to reducing growth rates as the time available for the oysters to feed is decreased with the consequent increase in exposure.

Efficiencies of use of existing space might be achieved by establishing higher shore holding areas for holding finished stock prior to dispatch to market. Were such areas available then the lower shore sites could be utilised for the juvenile and part-grown stock. If Grade A Classification could be achieved for higher shore holding sites then this might also offer options for finishing products from Grade B sites prior to dispatch i.e. this would achieve the necessary relaying criteria in a higher Classification site.

In discussions with the JAA it is understood that a co-operative holding site was suggested as a means of holding stock prior to dispatch to France for the Christmas market. However the time involved in the application process and requirement for an Environmental Impact Assessment meant that it was not possible to establish this area in time. It appears that no fresh applications have been made for such a co-operative approach although one JAA Member is currently in the process of applying for an area to hold oysters. Such holding areas would be likely to have a very limited environmental impact as they would not be permanently stocked, i.e. would remain fallow for periods of time, and would offer industry increased access to stocks ready for market although higher shore trestles would have a greater visual impact when viewed from the shoreline.

During discussions with the Societe Jersiaise regarding the existing sites covered by aquaculture concessions it was suggested that farming activities should be prohibited from spreading further south into what is described as an ecologically sensitive area running from Petit Seymour, east of Seymour Tower, to Icho as this is "internationally recognised as an outstanding area of seashore, both visually and in terms of biodiversity". This area and potential aquaculture impacts in this respect are described further in Section 10.

Increased stocking densities and new technology- In terms of increasing production from a given area it is certainly not unusual in French Pacific oyster production to see multiple stacked bags on trestles. However, unless the carrying capacity in terms of available food for the oysters is sufficient to support this strategy then there may well be a negative effect on growth rates.

Added to this, oysters towards the middle of the bags may receive a reduced food ration leading to uneven growth rates unless bags are regularly rotated. Given the greater possibility of wave action on the open beaches used in Jersey there may well also be a greater potential for loss of stock were this method to be adopted.

One other method of increasing the overall stocking levels on a given site may be to make greater use of the 3 dimensional aspects of the oyster trestles. In effect the space below the trestles could be used to mount other types of shellfish culture systems such as the ORTAC system or other rigid cylinder systems such as the Australian Aquapurse, BST or SEAPA systems (see Figures 9 and 12).

This approach has been successfully adopted on a Pacific oyster farm located in a South Devon estuary using a combination of the Aquapurse system and self-built rigid cylinders. In order for this type of approach to be successful then trestle height would need to be kept to a level above the seabed whereby the cylinders could be easily accessed. Potential environmental impacts, e.g. increased sedimentation, due to any reduction in water flow through the trestle areas would need to be investigated by establishing baseline species counts both within the existing trestles and within any areas dual stocked with bags and cylinders.

Existing trestle design may also have be to be altered in order to allow practical handling of the cylinders and consideration would have to be given to the infrastructure requirements of handling and transport of these types of culture systems. The handling of the SEAPA system and the AP6 Aquapurse can be partly automated/mechanised although this would require more extensive investments in handling equipment. Monitoring of growth rates of the oysters would need to be undertaken in order to ensure that the time taken to reach market size and the flesh to shell ratios of the oysters were not significantly impacted.

Figure 12. Rigid cylinder systems for shellfish cultivation
Top left = BST system mounted on high tensile steel wires between posts (SE England).
Top right = Aquapurse system mounted on a wooden frame (SW England).
Bottom left = SEAPA longline range of cylinders.
Bottom right = SEAPA multipurpose range of cylinders.
(Source: Aquafish Solutions Ltd. & SEAPA Pty Ltd.)

If the use of sub-trestle mounted cylinders could be practically achieved without a reduction in growth rates or environmental impacts through increased sedimentation then this would have the advantage for growers of allowing increased production without the need for any new concession applications and for other marine stakeholders of no increased visual impact. In order to assess growth rates or environmental impacts through use of a dual culture system it would be recommended that a trial site is first developed. A 12 to 24 month trial would allow an assessment of the factors mentioned previously. This type of research could be carried out by individual operators or co-operatively through the Jersey Aquaculture Association in order to share costs. It is highly likely that student support in running and assessing the results of such trials could be obtained as the authors have contacts at UK Universities and with equipment suppliers to which introductions could be made.

Strategy Option: Industry to investigate the potential for dual culture system production of Pacific oysters through a research trial to assess the practicalities, effectiveness and environmental impacts of this approach.

Another possibility for use of alternative growing systems would be to investigate the use of suspended longline culture using either the SEAPA or Aquapurse systems. These longline systems use high tensile steel cables as a mounting point for the cylinders which are hung between wooden posts (see Figure 12 previously). The advantage of mounting cylinders in this way is that wave energy or water movements are absorbed along the system and so the likelihood of damage or loss of stock is reduced. Therefore this type of system can be used

in higher energy environments which might therefore open up opportunities to grow oysters on sites around the south east coast that would be impossible using the bag and trestle system.

3.3.2 Increased Production of Blue Mussels

Production of blue mussels (*Mytilus edulis*) is only carried out by one industry member using the French 'bouchot' pole system (see Figure 10). This culture activity is hampered by the fact that wild mussel seed cannot be collected in Jersey waters in a manner which would make it suitable for transferring into culture conditions. As such a major limitation on the potential expansion of this culture activity remains the availability of seed. At present therefore seed therefore has to be imported from other areas with an equivalent Approved Zone status which therefore excludes adjacent areas of France. In the past seed has been imported from ephemeral mussel seed beds in the UK or Ireland which has a consequent effect on the economics of production. The issues surrounding 'Disease Free' status and importation of seed are considered further in Section 3.4.

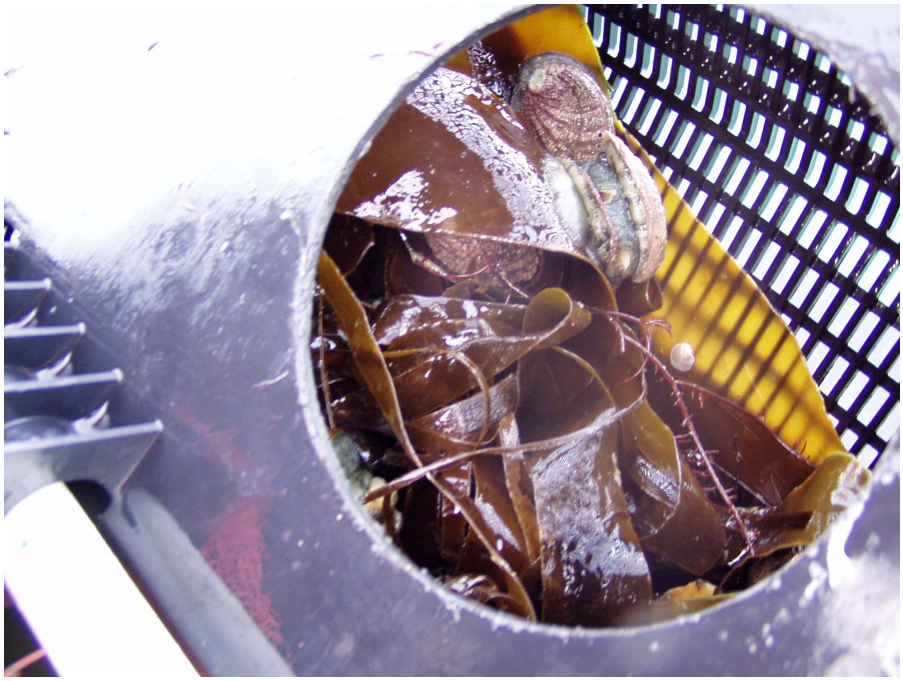
The cost of the seed and transport make it difficult to envisage that any increase beyond the approximately 100+ tonnes of production per year will be economically viable once the costs of transport to market are also factored in. It seems likely therefore that this activity will continue to be carried out largely to serve the local market and as such it is not thought that there will be new entrants to growing this species or significant increases in production tonnages.

3.3.3 Production of Ormers in Intertidal Locations

The ormer or European abalone (*Haliotis tuberculata*) is a high value native marine snail or gastropod mollusc. It is a species that has long been collected by recreational fishermen in Jersey at low water on spring tides. In recent years there have been reports of large scale mortalities both around Jersey and on the adjacent French coast due to disease issues associated with a *Vibrio* species bacterium. As such the recreational fishery for ormers is closely managed with a strict limit on minimum size and times of collection. The ormer does rival its Asian counterparts in taste and texture and so is also highly regarded as an ingredient in oriental dishes. Indeed an article in the Jersey Evening Post dating back to 1998 reports how a black market trade was then taking place with ormers being exported to Chinese restaurants in London.

There is therefore a local, national and international market for this abalone species and as such it has been the subject of intertidal culture trials in Jersey waters since the 1990s. Intertidal growth trials have been previously carried out by Jersey Sea Farms using the ORTAC system (see Figure 13).

Figure 13. Ormers being grown in an ORTAC container (Source: Aquafish Solutions Ltd.)



More recently a European FP7 Project entitled 'Sustainable Development of European SMEs Engaged in Abalone Aquaculture' (SUDEVAB) has carried out trials testing an adapted French macro-cage system for abalone culture. The trials carried out under this project have helped in the development and design of a new abalone cage system called Abblox which may well have potential for use in Jersey waters. Limitations on developing an intertidal culture method for this species are the same as those for offshore culture described in Section 4.3, namely these have been an inability under current legislation to harvest seaweed as a feed for abalone and the availability of seed.

Local hatchery efforts for ormers are continuing and have been expanded recently (see Section 2.2.3). There have also been requests by industry for amendments of the ancient vraicing legislation. Ormer seed is also available from a commercial hatchery in Brittany and this seed has been imported into the UK under the new Aquatic Animal Health Regulations. However whilst this legislation is currently being drafted for implementation in Jersey there remains concerns locally regarding the import of ormer seed into the Island in case this might act as a method of disease introduction into local ormer stocks. This is discussed in more depth in Section 4.4.2 and Section 8 on Disease Management.

3.3.4 Other New Species for Intertidal Aquaculture

Manila clam (*Tapes philippinarum*)- The culture of Manila clams has been tried previously in Jersey but is included in this section as there is still the potential for culture to recommence in the future. Low intensity culture can be carried out by hand (see Figure 14) with higher levels of production generally requiring mechanisation for laying of nets and harvesting. This species can either be grown intertidally or subtidally and seed is available from commercial hatcheries of a size between 4 to 30 mm. These clams are generally grown in plots under mesh netting to protect them from predators such as crabs.

Figure 14. Low intensity clam cultivation
(Source: Sea Fish Industry Authority Information Leaflet)

In Jersey, Manila clams were originally farmed in the late 1980s and early 1990s by first Jersey Sea Farms at Green Island and La Rocque and then by Trevor Le Cornu at La Rocque only. Tony Legg (pers. comm.) of Jersey Sea Farms described the main challenges to successful culture of this species as being biological in nature. Of these biological challenges by far the most significant were crab predation and an unexplained growth decline after the clams reached 18g in size. It is thought that the growth decline may be related to some form of water quality issue. The disease 'Brown Ring' caused by a *Vibrio* bacteria has never been recorded in Jersey and Dr. Christine Paillard (IFREMER and a partner in the EU SUDEVAB Project) has requested samples for DNA testing as the Jersey stock pre-date the disease outbreak in L'Aberwrach, Brittany where Brown Ring disease was first recorded. Small quantities of the original clams together with new settlement can be found. A low water fisherman in March 2010 was raking in the soft sand just inside the Jersey Sea Farms concession (with permission) and harvested around 10kg of 15-45g Manila clams (T. Legg, pers. comm.) which can only have come from wild settlement.

Mechanised techniques for clam culture were developed by the Jersey operators using tractors to dig a double opposing furrow with a 1m wide platform in the centre. Seed clams from Guernsey Sea Farms (a partner in the La Rocque beds) were then broadcast onto the platform, and an 8mm mesh was then secured over them by backfilling the ploughed trenches. The Jersey Sea Farms experience was that 18g clams could be reared to 10kg per m^2 in two years from a seed size of 5mm. Only minor levels of new equipment (manufactured double plough, mesh roller and then a harvesting system) are described as being needed to reinstate the culture of Manila clams.

Production by 1992 achieved a wholesale value of around £90,000. However, at that time the unexpected generation of wild clams in the North Adriatic lagoons resulted in a decrease in the market price in Spain to one third of its original level. Current market price is thought to be around £6.50 per kg which means that this product is a potentially viable alternative or parallel product to Pacific oyster culture. It is believed that at least two sites retain permission to cultivate clams although large scale production in Grouville Bay could be problematic due to the stumps of mussel posts just at sand surface level which would inhibit mechanised laying of the mesh netting.

Native oyster (*Ostrea edulis*)- In the 19th Century Jersey was a major exporter of native oysters although by the 1870s this industry had largely disappeared. The emergence of Oyster herpes virus and its devastating impact on Pacific oysters has meant that there is now

interest in the UK and Jersey in trying to establish the cultivation of native oysters as an alternative aquaculture species. Small quantities of native oysters can be found attached to the oyster trestles and it is understood that Jersey Sea Farms have now produced about 40,000 juvenile native oysters which are under cultivation on their concession using ORTAC cylinders. This is as part of a move by Jersey Sea Farms to try and develop technologically less sophisticated and more natural ways of producing this species (Dodd, 2010).

There is certainly a market for this species of oyster and a price premium for the native oyster compared to the Pacific oyster. The main questions that would to be answered with cultivation of this species in Jersey waters are whether or not they can be cultivated in enclosed systems whilst maintaining adequate growth rates and whether such cultivation techniques will result in mortalities through disease. With regard to the latter point, whilst Jersey is considered disease free with respect to *Bonamia*, this status it is believed is due to the species not currently being present in numbers significant enough to warrant regular testing. Overall, if cultivation proves successful and disease issues do not arise then the re-establishment on the market place of Jersey native oysters would certainly seem worthy of further investigation and support.

3.3.5 Development of Intertidal Aquaculture on Offshore Reefs

The scoping document for this draft Strategy states that the potential for intertidal culture on Jersey's offshore reefs should be considered. Indeed the intertidal habitat covered by Jersey's Ramsar sites at Les Pierres de Lecq (Paternosters), Les Écréhous and Les Dirouilles and Les Minquiers cover a total of 15,546 hectares (Le Claire, 2008). However the practical reality of the intertidal culture techniques described in Section 3 is that they require regular if not daily access for husbandry operations and for dispatching produce to market. The distances therefore between the current centres of industry operation and the offshore reefs make it highly unlikely that intertidal aquaculture would be considered for these areas. Added to this the costs of specialised craft for servicing any culture systems in these areas, potential for exposure to extreme weather conditions and security of stock and equipment also make intertidal aquaculture unfeasible. As such, it is concluded that it is highly unlikely that any aquaculture activities will be undertaken on Jersey's offshore reefs in the future.

3.4 Policy and Legislation

3.4.1 Aquatic Animal Health Directive

The Jersey equivalent of the European Council Directive 2006/88/EC is due to be enacted in Jersey in the near future following the decision to grant this legislation Law Officer time. Section 3.3.2 describes the problems faced by one industry member in importing blue mussel seed into Jersey due to the Island's Disease Free status for *Bonamia* and *Marteilia refringens*. Whilst the new Aquatic Animal Health Directive shifts the emphasis or burden of proof away from a species having to be proved as being non-susceptible or not a vector of a disease, the blue mussel is listed as being susceptible to *Marteilia*. As such unless *Marteilia* is found in Jersey then the Annex of Commission Decision 2002/300/EC of 18 April 2002 establishing Jersey as being approved for both *Bonamia* and *Marteilia* means that industry will continue to be unable to import mussel seed from the adjacent French coast. The economic impacts of importing seed from other disease free areas such as the UK are considered in Section 3.3.2.

Section 3.3.3 covers the potential for intertidal ormer cultivation and mentions that a major limitation to the development of this species has been the availability of seed. The potential to import ormer seed under the Jersey equivalent of the UK Aquatic Animal Health Regulations 2009 is considered further in Section 4.4.2.

3.4.2 Seaweed Harvesting Legislation

The Jersey legislation concerning the harvesting of seaweed in Jersey waters is the 'Loi (1894) sur la coupe et la pêche des vraics' with amendments. In order for ormer culture to become a practical aquaculture activity then there needs to be regular access to harvest seaweed in order that this can be used as a food source for the ormers. The current issue with updating of this law to allow harvesting in this manner is considered further in Section 5.5.

One possible development in this respect at the time of preparing this Strategy was a report that trials using steel 'staple' trestles to grow seaweed had yielded some promising results. Reasonable levels of seaweed have been produced of a species that would be suitable for use in ormer culture (T. Legg, pers. comm.).

Section 3. Strategy Option(s)

Section	Strategy Option(s)	Benefit / Importance	Output or Outcome	Cost or Funding Requirement	Timeframe for Implementation
3.1	Industry to investigate the potential for dual culture system production of Pacific oysters through a research trial to assess the practicalities, effectiveness and environmental impacts of this approach.	**Moderate**	Potential for increased efficiency of use of the 3 dimensional space occupied by existing intertidal shellfish concessions.	**Low**	Short Term – less than 5 years

SECTION 4 – SUBTIDAL AND OFFSHORE AQUACULTURE

4.1 Introduction

The Bailiwick of Jersey and its surrounding waters cover some 850 square miles including shallow coastal reef plateauxs and deeper offshore areas which have potential to support aquaculture.

The extreme exposure of Jersey's waters to both storms and high current speeds would represent a significant challenge to current conventional offshore near-surface cage/net culture such as salmon culture in the sheltered lochs of Scotland or sea bream in the waters off Greece. Even traditional rope culture of mussels in a high wave environment would be likely to face difficulties with stock likely to be shed from ropes and lost.

The best short term hope for offshore aquaculture rests with extension of the existing seabed culture of shellfish as described in Section 4.2. In the longer term it may be possible that there could be a synergy with other offshore activities such as power generation which could provide a platform for aquaculture as described in Section 4.3. Artificial reefs utilising by-product material may also provide an option for developing enhanced habitats for both ranching and supporting carrying capacity for fisheries.

4.2 Current Subtidal and Offshore Aquaculture Production

4.2.1 Scallop Ranching

Although the majority of Jersey scallop landings originate from wild capture fisheries, scallop ranching is undertaken on concessions in St. Aubins Bay to the south of Jersey and off Gorey to the east. Total subtidal area farmed is 166 hectares with 2.5 tonnes of King scallops being produced in 2009. One of the Gorey subtidal concessions also has permission to undertake oyster and scallop production subtidally.

There is an increasing market demand for 'diver caught' scallops as scallop dredging has increasingly being highlighted as a potentially high impact fishery with questions over its sustainability and has also been implicated as one of the vectors for the spread of slipper limpets. The impact of scallop fishing on the seabed and upon sensitive marine habitats is also a major concern within the UK as highlighted in areas such as Lyme Bay in South West England where large scale areas have recently been closed to mobile gear.

The potential for expanding the low impact activity of scallop aquaculture offers the opportunity of increased market return for 'sustainably' reared diver caught scallops. However, although diver caught scallops are perceived as a premium product with a market advantage over dredged scallops the price differential has been questioned (Jersey Aquaculture Association, pers. comm.) and there may be misrepresentation regarding the origin of some scallops sold locally as 'hand dived' i.e. they may in fact be dredged rather than cultured. This was described by one Jersey Aquaculture Association Member as the single biggest threat to their business and may be something that could be pursued by Trading Standards (part of the Economic Development Department (M. Smith & J. Shrives, pers. comm.).

Strategy Option: Publicise or highlight through Fisheries and Marine Resources that there may be misrepresentation in the labelling of dredged scallops as emanating from dived concessions.

With any future potential increase in production careful consideration must first be given to the size of the local market or effects on prices received should local competition become more widespread.

4.2.2 Ormer Culture

There has been a long history of attempts at ormer culture within Jersey although none have been particularly successful to date. A major limitation to the development of the industry has been the availability of juvenile spat or 'seed'. A small scale ormer farm and hatchery was successfully run by Richard Tostevin at Rocquaine Shellfish in Guernsey for a number of years. Seed production was relatively small as it was primarily geared towards supporting an on-growing business, despite this market production reached around 5 tonnes per year.

Section 2.2.3 reviews the recent developments in hatchery production of ormers by Ormer & Scallops of Jersey Ltd. who report that they currently have 400 thousand juvenile ormers under culture. This is certainly encouraging for the development of this species for Jersey aquaculture and in time may come to play an important role in supplying the industry's requirements for seed if this sector is to be expanded. However any significant commercial levels of production by multiple operators will require security of seed supply and reliance on one seed supplier could therefore be viewed as a potentially risky strategy in terms of both secure production levels and price competitiveness. The potential for shellfish hatchery developments is considered further in Section 7.2.1 whilst the possibilities of importing seed with the advent of the new Aquatic Animal Health Directive are discussed in Section 4.4.

A concession for offshore ormer culture in cages has previously been granted to Ormer & Scallops of Jersey Ltd. and it seems likely that given their increase in hatchery production of seed ormers that production in this respect will increase in the future (as described in Section 4.3.2). A proposal has also been put forward for an ormer 'managed bed' concession immediately below the LWS level where subtidal stock would be surrounded by high intertidal rocks and sandy areas (T. Legg, pers. comm.) as described in Section 4.3.1.

4.3 Development Opportunities and Limitations

4.3.1 Ranching and 'Managed Beds'

Scallop and ormer culture as described in Section 4.2 provide significant scope for future development in Jersey waters. However, there are a number of issues that need to be resolved which are listed as follows:

- Policy guidelines are required to help differentiate between low intensity 'ranching' of scallops which are free to move in and out of a concession area and moderate density 'managed beds' of ormers where stock is unlikely to leave the concession area. It is understood that the ormer managed bed proposal was submitted a number of months ago no decision at the time of preparing this report or indication of when a likely decision will be made. This limitation to development is considered in Section 4.3.4.
- Seed availability for both ormers and scallops has been a significant limitation. Local efforts with scallop spat collectors have not been successful. Import restrictions due to disease issues place a major restriction on development of these activities as described further for ormers and scallops in Section 4.4.2. The potential for obtaining increased seed numbers through Jersey hatchery operations might be one method of avoiding the seed supply issues as considered in Section 7.2.1.
- Possible conflict with the fisheries sector regarding boundary limitations to scallop ranching has been expressed as a concern (D. Thompson, pers. comm.).

- Any expansion of existing concessions or new concessions for scallop ranching may impact on the area available to commercial divers collecting wild scallops or to other recreational divers who have a valid scallop diving permit.
- Scallop concessions for ranching have to date been restricted to relatively sheltered areas i.e. low energy environments. The availability of these types of sites is limited to the south and east coasts of Jersey and applications for space in the marine environment will always be subject to competition from other marine users. Subtidal culture based around Jersey's offshore reefs is unlikely to be either practical in terms of access or advisory in terms of security.
- Public health concerns have been raised in respect to stock that may be obtained outside of a concession area and in close proximity to contamination sources (S. Smith, pers. comm.). It should be noted that there are no control measures to prevent fishing for such stock by dredging operations which could be equally contaminated. It is not known to what degree either the capture or the ranching sectors undertake their own end-product testing.
- Any large scale ormer culture operations will require significant quantities of seaweed feed which currently is the subject of legislative limitations as considered in Section 5.

4.3.2 Offshore Cages

Considerable investment and work by Ormer & Scallops of Jersey Ltd. since 2007 have gone into developing the use of large offshore cages for ormer culture (J. Surcouf, pers. comm.). To date the commercialisation and expansion of this offshore operation has been severely hampered by a lack by seed and seaweed/macroalgae availability. They report however that their ormer hatchery now has 400 thousand juvenile ormers under culture which opens up opportunities for expansion of this activity in the future although the issues regarding the ability to harvest seaweed still need to be overcome. Issues regarding seed and seaweed limitations for offshore cages are the same as those for offshore 'managed beds' as described above.

Figure 15. French abalone culture cage being tested in UK conditions (Source: Aquafish Solutions Ltd.)

One other interesting aspect that emerged from the meetings with stakeholders during the development of this strategy is that there may also be scope for diversification for the fishing community using offshore cage culture for ormers. Discussions with Ian Syvret (pers. comm.) highlighted that some inshore fishermen might consider this type of diversification from their current activities and that this was something they would investigate further with the JAA.

Factors considered included:

- A shortening season for selling lobsters may drive diversification.
- Also, a possible decline in merchant numbers may offer up the potential for the use of their vivier tanks as depuration facilities although rental costs for these sites are high.
- More likely to be trialled by younger Members as more traditional Members may not be interested.
- IS viewed storing lobsters as the same type of security risk as would be experienced growing ormers offshore.
- If ormer seed were available then some of their Members would certainly trial these as a means of diversification. MS/AF described UK efforts to increase diversification for fishermen in this respect. Regulations regarding seed movements would however hamper this type of development at present i.e. seed availability is a limiting factor.
- IS felt that 'ormer pots' over sandy areas wouldn't generally interfere with lobster fisheries and if successful would mean less effort placed on the lobster stocks.
- There would be space between lines of lobster pots to farm ormers as there should not be any interactions between the two types of activity.
- A co-operative approach to try and maximise lobster prices and to buy kit wasn't a success and so an ormer co-op was felt by IS to be unlikely to succeed.

As a result of these discussions the JIFA are now trialling shellfish culture systems as part of a possible diversification into some aquaculture activities.

4.3.3 New Species

Known locally as Petoncle Noir the black or variegated scallop (*Chlamys varia)* has been suggested by the Jersey Aquaculture Association as one possible future candidate for aquaculture in Jersey. A native species of the Channel Islands these scallops have a small often purple shell and they may be mistaken for 'Queenies' (*Chlamys operculata*).

At present little is known about their culture although some trials have been undertaken by Ifremer (Trut *et al*., 1994/05). This species is however in short supply and does obtain a good price on the French market at €6-10 per kg due to their delicate gastronomy level taste. At present Jersey Sea Farms and the French Hatchery France Haliotis are undertaking settlement trials in County Mayo, Ireland to determine timings and volumes of spat fall around one site where they occur naturally in (T. Legg, pers. comm.).

Unlike King scallops this species produces byssus and attaches to rock surfaces, growing to a maximum length of approximately 60mm. They occur naturally at the extreme low tide mark and then sublittorally down to 100m. Jersey Sea Farms have confirmed that if spat fall assessments prove viable then on-growing trials will be carried out using the ORTAC and Abblox systems.

Petoncle Noir are not considered to be a vector for *Bonamia* and so subject to the necessary movement documentation could conceivably be transported into the Island if seed was available. On-growing in Jersey would allow quick access to the French marketplace which is a requirement due to their short transport life (T. Legg, pers. comm.).

Figure 16. Chlamys varia, the black or variegated scallop (Source: Wikipedia)

4.3.4 Artificial Reefs

A proposal to utilise the boulder breakwater at St Catherines was previously rejected (T. Legg, pers. comm.) An alternative proposal using offshore deposition of boulders was also rejected due to concerns that the currents were too strong for such deposits (R. Duhamel, pers. comm.). Offshore reef construction for ranching applications (e.g. ormers or lobsters) such as that constructed in Loch Linnie in Scotland (using waste rock dust as a construction material) utilising purpose designed blocks could have scope for Jersey waters.

Jersey currently faces a significant problem with the disposal of its waste as demonstrated by the current disputes in relation to La Collette and the EfW project. There may therefore be scope for waste binding and encapsulation within stable reef structures. Such work would require comprehensive EIA and FEPA considerations (see Section 4.4). The Poole Bay artificial reef was constructed from PFA blocks with comprehensive work looking at both heavy metal leaching and lobster stock ranching potential (Collins *et al*., 1991).

Strategy option: To develop a phased plan to investigate a best practice model for artificial reef schemes based on previous case studies leading potentially to a pilot scheme.

4.3.5 Offshore Power Infrastructure

Aquaculture might be complimentary to cross-sector initiatives with energy producers from wind, wave or tidal current schemes. Polyculture in association with wind farms has been considered for example by both the UK (Linley *et al.*, 2007) and German authorities.

The potential with respect to offshore power generation involves a complex mix of politics and finance. In 2007 AEA undertook an assessment for the States of Jersey (AEA, 2007) which concluded that there was little scope in terms of financial viability as the Channel Islands obtained their power from France via an undersea cable at a rate 30% cheaper than the UK. However, since the financial crisis and the drop in the value of sterling relative to the Euro this differential has diminished. In addition there have been concerns raised about energy security as damage to both of the current undersea cables would leave Jersey exposed with limited capacity from its existing oil fired power station. In consequence, the EfW scheme on La Collette has commenced and offshore power is being considered. At present tidal power is receiving a high degree of support as the extreme tidal range for Jersey's waters provide an excellent current regime.

A key driver for the development of offshore power may be the potential to co-operate with the French authorities who are also looking at renewable power generation within their territorial waters. There is scope for Jersey to help provide a significant component of France's commitment to renewable power with private power generators funding scheme investigations.

The scope however for aquaculture production in association with offshore power infrastructure remains challenging. Whilst the placement of structures could allow aquaculture moorings there is concern that gear could interfere with power generation (in the case of tidal power) or operational/maintenance access.

The type of culture activity possible may be limited as the high current velocity would place a considerable drag on gear. However, there may be scope for certain species (e.g. ormers) in associate with the scour collars placed around the base of turbines (S. Bossy, pers. comm.)

The integration of aquaculture with offshore power generation is considered to be a long-term possibility. A Strategy Option is therefore recommended that any potential developers be asked to consider aquaculture installations as part of their mitigation and investigation exercises. Although this potential will be long term a Strategy Option has been proposed that the potential of aquaculture is raised with potential developers as part of their mitigation exercises. The Fisheries and Marine Department is well placed to support this development as they will be responsible both for reviewing offshore power generation proposals as well as supporting fisheries development.

Strategy Option: To require organisations investigating offshore power generation to encompass an assessment of the potential for aquaculture within their proposals.

4.4 Policy and Legislation

4.4.1 EIA Requirements

Any offshore culture operation requiring containment and placement of even temporary structures on the seabed or in the water column will require some level of Environmental Impact Assessment (see Section 10). Clearly there is a vast degree of difference in the potential level of impact between deploying gear similar to lobster pots (Section 4.3.1) and major developments permanently covering the seabed such as artificial reefs (Section 4.3.4).

Strategy Option: Policy review for offshore aquaculture to provide operational and EIA guidelines to industry.

4.4.2 Aquatic Animal Health Directive and Movement Restrictions

The Aquatic Animal Health Directive should remove the movement restrictions on abalone seed as a 'non-susceptible' species. It should be noted that a commercial French hatchery based in Brittany has been subject to comprehensive health screening by IFREMER for both *V. harveyi* and rickettsia to produce high quality ormer seed which has been successfully imported under the Aquatic Animal Health Directive into both Spain and the UK in 2009.

To date a Jersey shellfish business participating in the European SUDEVAB Project has been unable to import this high quality French seed as the Aquatic Animal Health Directive had not been adopted into Jersey law. Whilst this legislation has been put forward by the States Veterinary Officer for adoption, there is concern that the regulator currently considers that the legislation may be used to restrict ormer import from France due to potential risk

from ormer diseases. This is a significant issue which requires discussion between stakeholders and a clear resolution which is proposed as a Strategy Option in Disease Management, Section 8.3.

The possible future development of the culture of the black scallop as described in Section 4.3.3 would require the enacting of the new Aquatic Animal Health Regulation in order to allow imports of seed of this species into Jersey.

Scallops (*Pecten maximus*) are listed (EU regulation 1251/2008) as a vector species for *Bonamia*, so under the existing controls on aquatic animal health it would not be possible for movements of this species to occur from an area with *Bonamia* into an area recognised as being free from *Bonamia* (M. Gubbins, Cefas, pers. comm.). This therefore still limits imports of scallop seed to areas of an equivalent Disease Free or Approved Zone status for *Bonamia*. As settlement of this seed in areas such as Mulroy Bay in Ireland can be highly variable from year to year then security of seed supply is likely to continue to be an issue for scallop ranching activities.

4.4.3 FEPA Licensing

Any artificial reef construction would need to obtain a FEPA licence which has historically been a major limitation. Both the Poole Bay and Loch Linnie artificial reef developments in the UK were constructed from 'waste' materials. Fortunately the Loch Linnie work by SAMS encompasses comprehensive work on addressing the FEPA issue. In essence there is scope to utilise by-product material on the basis that the primary rationale for the proposal is made on the grounds of the benefits of reef development and not 'waste disposal.' In practice this means that a company who may wish to utilise their waste material as a 'by-product' cannot be the prime proposers in a scheme.

Strategy Option: Transport and Technical Services to explore 'by-product' material utilisation in artificial reefs.

Section 4. Strategy Option(s)

Section	Strategy Option(s)	Benefit / Importance	Output or Outcome	Cost or Funding Requirement	Timeframe for Implementation
4.1	Publicise or highlight through Fisheries and Marine Resources that there may be misrepresentation in the labelling of dredged scallops as emanating from dived concessions.	**Moderate**	Protection of market and reputation for cultivated scallops.	**Minimal**	Short Term – less than 5 years
4.2	To develop a phased plan to investigate a best practice model for artificial reef schemes based on previous case studies leading potentially to a pilot scheme.	**Moderate**	Pilot scheme for an artificial reef.	**Moderate**	Medium Term – 5 to 10 years
4.3	To require organisations investigating offshore power generation to encompass an assessment of the potential for aquaculture within their proposals.	**Moderate**	Development of a mechanism to develop offshore culture	**Minimal** (if assessed by proposer)	Long term – 10 years+
4.4	Policy review for offshore aquaculture to provide operational and EIA guidelines to industry.	**High**	A streamlined concession permitting procedure.	**Minimal**	Short Term – less than 5 years
4.5	Transport and Technical Services to explore 'by-product' material utilisation in artificial reefs.	**Moderate/Low**	Best practice model leading to a pilot scheme.	**Moderate**	Medium Term – 5 to 10 years