



Project Inshore

Stage 3 - Strategic
Sustainability Review

Devon & Severn Inshore
Fisheries & Conservation
Authority

Report prepared by



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And input from the Project Inshore Advisory Group comprising: Seafish; Marine Stewardship Council (MSC); Shellfish Association of Great Britain (SAGB); Association of IFCAs; Department for Environment Food & Rural Affairs (DEFRA); Direct Seafoods; M&S; National Federation of Fishermen's Organisations (NFFO); Natural England; New Under Ten Fishermen's Association (NUTFA); WWF



Glossary

ACOM	Advisory Committee (ICES)
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
CAB	Conformity Assessment Body
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFCA	Community Fisheries Control Agency
CFP	Common Fisheries Policy
CITES	Convention on Trade in Endangered Species of Wild Flora and Fauna
COM	Common Organisation of the Markets
Defra	Department for Environment, Food and Rural Affairs
D&SIFCA	Devon and Severn IFCA
EC	European Commission
EEZ	Exclusive Economic Zone
EFF	European Fisheries Fund
EMS	European Marine Site
ETP	Endangered, Threatened and Protected Species
EU	European Union
FCI	Food Certification International
HCR	Harvest Control Rule
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authorities
IUCN	International Union for Conservation of Nature
IUU	Illegal, unreported and unregulated
JNCC	Joint Nature Conservation Committee
OSPAR	Oslo and Paris Conventions
MCS	Monitoring, Control & Surveillance
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MoU	Memorandum of Understanding
MPA	Marine Protected Area
MSC	Marine Stewardship Council
NEAFC	North East Atlantic Fisheries Commission
NFFO	National Federation of Fishermen's Organisations
NGO	Non-governmental Organisation
NUTFA	New Under Ten's Fishermen's Association
Nm	Nautical mile
PI	Performance Indicator
PO	Producer Organisation
PSA	Productivity Susceptibility Analysis
RAC	Regional Advisory Council



RBF	Risk based Framework
RSA	Recreational sea angling
SAC	Special Areas of Conservation
SAGB	Shellfish Association of Great Britain
SG	Scoring Guidepost
SI	Scoring Issue
SICA	Scale Intensity Consequence Analysis
SIFCA	Southern IFCA
SPA	Special Protection Areas
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
UoC	Unit of Certification
VMS	Vessel Monitoring System
WGNEW	Working Group on New MoU Species.



Executive Summary

1. Project Inshore is an ambitious initiative led by Seafish, Marine Stewardship Council (MSC) and Shellfish Association of Great Britain (SAGB) launched in June 2012. It seeks to work towards an environmentally sustainable future for English inshore fisheries.
2. The MSC standard for sustainable fisheries provides a useful indicator of where a fishery is in relation to the FAO Code of Conduct for Responsible Fisheries. It also provides a structure to guide the development of future management action, which should lead to a fishery that is well managed. However, it is the choice of operators within a fishery whether to seek certification against the MSC standard through an assessment.
3. This report presents Stage 3 of Project Inshore where findings of stage 1's data gathering on fisheries within each IFCA and the results of stage 2's MSC pre-assessment conducted for fisheries around England's coast (involving over 400 different species, stock and gear combinations) are considered to provide a Strategic Sustainability Review tailored to the Devon & Severn IFCA.
4. The stage 2 pre-assessment found that some stocks fished in the English Inshore are already 'well managed' and fished sustainably, indicating that they could proceed with full MSC assessment (at least when fished by certain gears).
5. For these fisheries the report outlines the steps needed in preparation for full assessment and the benefits of increasing the size of the client group (typically up to the spatial range of the stock) for any full assessment
6. Most of the stocks recommended for full MSC assessment are managed under EU quotas, with regular and routine scientific advice (as provided by ICES) and ideally managed under a Long Term Management Plan.
7. Other fisheries considered to be at or close to the MSC standard are mainly spatially restricted inshore bivalve fisheries where management responsibility is clearly devolved to a local grantee, such as an IFCA, or managed under a Several / Regulating / Hybrid Order.
8. All the other stocks considered are identified as having "gaps" meaning that they are not currently recommended to proceed to full MSC assessment, until these gaps can be adequately addressed. Typically this would also mean that they do not meet, or cannot be demonstrated to meet "Good Environmental Status" targets.
9. Project Inshore has worked with IFCAs in order to identify those fisheries in their region that are locally important and those fisheries where IFCA-led management may be appropriate. For Devon and Severn IFCA the priority species identified are brown crab, lobsters, whelks and scallops.
10. The stocks that IFCAs are best placed to lead on management are typically shellfish, although not all shellfish (some are already subject to national or EU level management such as scallops and Nephrops). Of the priority species in English inshore waters, lobster, native oyster and cockle are more suited to IFCA-led management, while grey mullet and sea bass management should be developed at a national level. Suggested actions responding to the pre-assessment findings for species suited to Devon & Severn IFCA-led management is provided in section 7 of this report.
11. IFCAs are facing increasing demands on their time and resources with the management of European Marine Sites (EMS). IFCA-led fisheries management is therefore only likely to occur for priority species in the short to medium term.
12. Inshore fisheries require specific management, with sufficient understanding of stock status to enable adaptive stock management defined by management rules. From an MSC point of view this bridges the requirements of both P1 (the stock) and P3 (the management).
13. This report provides IFCAs with guidance in the development of adaptive stock management for those stocks or species that the IFCAs maybe best placed to lead on stock management.



14. For crab and lobster, CEFAS has recently defined stocks and provided stock assessment and it is appropriate to manage as joint management units with other IFCA's. Crab and lobster already have defined stock assessment units pointing to regional management involving the relevant SW England IFCA's.
15. A key issue is the time required to develop and agree a fishery management plan. This may not be realistic for IFCA's given their current and projected workload. Therefore an alternative approach to the development the necessary fisheries management is under a Fishery Improvement Plan (FIP) that can be funded and driven by other parties. IFCA's would be essential stakeholders and advisors in what can be an industry-driven FIP process. The IFCA would be asked to enforce the resulting plan, which may require the adaptation of existing bylaws or adoption of new bylaws, but the often-lengthy development and consultative process could be effectively out-sourced by the IFCA, although they would retain a strong lead role.
16. There remain a significant number of species / stocks which are not obviously being managed at an EU / multinational level, and which are not suited to local (inshore) adaptive stock management. It must be identified where management responsibility should lie for these stocks and for management to be planned to also ensure 'Good Environmental Status'. The IFCA's are still expected to play an important role as key stakeholder and a partner in management.
17. Stage 4 of Project Inshore will continue until 2015. During this stage 4 the focus of the MSC English Fisheries Outreach team will be on providing support for those fisheries wishing to move into full MSC assessment, but will also facilitate the development of FIPs.
18. For all other stocks (including some locally important fisheries such as scallops, sole, plaice and cuttlefish) the Devon and Severn IFCA still play an important role as key stakeholder and a partner in management. The IFCA remains responsible for enforcement of relevant legislation on these fisheries within their jurisdiction. Additionally, the IFCA have the power to act to further safeguard the resource, should they wish, such as through the introduction of technical measures, however, though this may contribute to responsible stewardship of the resource, it should be recognised that the overall success of stock management – namely whether or not the stock is overexploited – is beyond the IFCA's control.



1. Introduction

1.1. Project Inshore background

Project Inshore is an ambitious initiative led by Seafish, the Marine Stewardship Council (MSC) and the Shellfish Association of Great Britain (SAGB) launched in June 2012. – Project Inshore is about working towards an environmentally sustainable future for English inshore fisheries. The UK Fisheries Minister, Richard Benyon noted at the time that Project Inshore “...should help to ensure that our inshore fleet can continue to flourish, that fish stocks are managed sustainably and our marine environment is given the protection it needs”. This project has carried out MSC pre-assessments for an extensive range of fisheries around the English coast and used the results of these pre-assessments to form the basis for Strategic Sustainability Reviews for English Inshore fisheries to provide a road map to guide future management decisions.

The funding for the project comes from a diverse range of sources notably the European Fisheries Fund (EFF), the Sustainable Fisheries Fund and industry (Seafish, UK retailers and processors). Other partners in the project include the Marine Stewardship Council, Shellfish Association of Great Britain and Seaweb’s Seafood Choices.

The Sussex Inshore Fisheries and Conservation Authority (IFCA) (previously the Sussex Sea Fisheries Committee) piloted a multi species fishery methodology in 2010 with its ‘Navigating the Future’ Inshore Fisheries Sustainability Pilot (Dapling et al., 2010). ‘Navigating the Future’ utilised the MSC pre-assessment criteria to evaluate the performance of 26 local inshore fisheries. Project Inshore carries this model forward on a nationwide scale for key commercial fisheries operating within the remaining IFCA districts.

Food Certification International Ltd (FCI) undertook stages 1 & 2 of Project Inshore, with concluded with MSC pre-assessment findings. For the advisory work required for Stage 3 of Project Inshore, Acoura Ltd has assembled a team comprised of many of the team members from stages 1 & 2. The Stage 3 project team comprises of independent experts from Poseidon Aquatic Resource Management Ltd, Marine Institute (Ireland), PAH Medley, Nautilus Consultants and TD Southall.

1.2. Project Inshore Stages

English inshore fisheries to strategic targeted action as follows:

- Stage 1: Macro analysis and profiling of English inshore fisheries including:
 - Data collection/ information gathering phase.
 - Broad scale analysis of English fisheries.
 - Development of list of fisheries (species/gear combination) to progress to:
- Stage 2: Pre-assessment of English fisheries based on an aggregated/matrix approach for assessing each selected fishery (species / gear combination) in relation to the Marine Stewardship Council (MSC) standard. The key output of Stage 2 will provide a preliminary determination of how closely each performance indicator of each fishery meets the MSC standard.
- Stage 3: Development of bespoke Strategic Sustainability Reviews for each English Inshore Fisheries and Conservation Authority (IFCA) to facilitate English inshore fisheries moving towards a level judged sustainable by the MSC standard.

The output of stage 1 was delivered in October 2012. The output of Stage 2 was delivered in June 2013. Both Stage 1 & 2 outputs are now publicly available on-line from the Seafish website.

1.3. Report Aims & Objectives

This report forms an output of Stage 3 of Project Inshore and provides a Strategic Sustainability Review for the Devon & Severn IFCA. The reporting outputs of Stage 1 and Stage 2 of Project Inshore provided national overview documents for English Inshore Fisheries. By contrast, this report is tailored to the requirements of a single IFCA; Devon & Severn. A further 8 such reports¹ are being produced for other English IFCAs as part of this third stage of Project Inshore.



This report therefore seeks to provide a Strategic Sustainability review for Devon & Severn IFCA (D&SIFCA). In doing so this seeks to:

- Recap the key characteristics of the IFCA district and the fisheries within the district.
- Provide a review of the findings of the MSC pre-assessment process for fisheries in the region that was carried out in Stage 2 of Project Inshore.
- Highlight the process and next steps required for those fisheries identified as ready for full MSC assessment
- Provide a strategic structure to guide future management actions for those fisheries where the IFCA is responsible for stock management to show how they can move towards a level deemed sustainable by the MSC standard.
- Highlight those fisheries where stock management initiatives need to be taken at a greater scale of management jurisdiction.

This report is advisory only and is intended to provide a blueprint for developing local stock management initiatives and action where this is deemed appropriate.

¹ Similar work was undertaken for the Sussex district as part of the ‘Navigating the Future’ project and is therefore not covered by Project Inshore.

2. IFCA Profile

2.1. Governance structures

The Marine and Coastal Access Act (MaCAA) 2009 establishes and sets out the responsibilities and powers for the Inshore for the Inshore Fisheries and Conservation Authorities. In terms of Governance the Secretary of State retains oversight of all IFCA operations, including byelaw development, but is charged with providing guidance on best practice that the IFCAs should follow.

The Devon & Severn IFCA was established under the 'Devon & Severn Inshore Fisheries and Conservation Order 2010'. The IFCA took on its full statutory role from the 1st April 2011. The Order defines the landward and seaward extent of the district. The district covers two distinctly different coasts, these being (i) the south Devon coast from Plymouth in the west to Lyme Regis in the east, (ii) and north coast with the Severn Estuary stretches from Countisbury Cove as far as Maisemore Weir to Chepstow and includes Lundy Island. It also includes the River Avon through Bristol and all other rivers entering the sea within the district. The district extends to sea from baselines to 6 nautical miles or the boundary with Welsh Territorial Waters in the north of the area (see figure overleaf). In total it covers 3,306 km² of sea, 1,314 km of coastline and 1,754 km² of Marine Protected Areas (MPAs).

2.1.1. The IFCA Committee

The IFCA committee is made up by representatives of the Devon, Somerset and Gloucestershire County Councils and representatives from the Torbay, North Somerset and South Gloucestershire Councils, and the Plymouth and Bristol City Councils. In addition the committee includes representatives of Natural England (NE), the Environment Agency (EA) and the UK Marine Management Organisation (MMO). The MMO also appoints a further fifteen stakeholder representatives including commercial (various sectors) and recreational fishers. The committee members' role is to decide and comment on overall strategy and direction and decide on budgets and staffing levels etc. Interestingly, in the context of Project Inshore, the IFCA annual plan also notes that it is the role of the committee members to decide on "stock management measures". As will be seen in the context of later discussions, this clearly indicated a role for the IFCA in stock management.

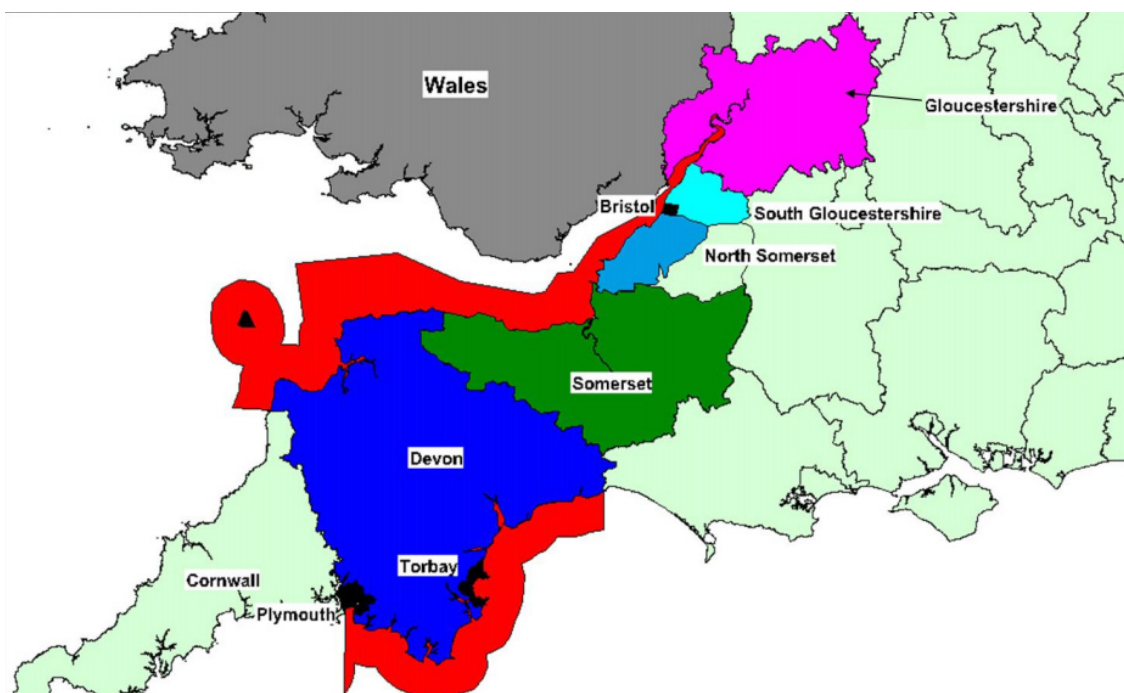


Figure 1:
Devon & Severn IFCA
District



2.1.2. IFCA Staff

In terms of governance, it is the officers and administration staff, led by the Chief Officer, which implement the strategic decisions of the Authority (i.e. members) and report back to the committee on a quarterly basis on progress against those strategic goals.

The IFCA currently has 11 members of staff: 1 Chief Officer, 1 Deputy Chief Officer, 1 Principal Environment Officer, 1 Senior Environment Officer, 2 Senior Inshore Fisheries and Conservation Officer, 2 Fisheries and Conservation Officer, 1 Environment Officer, 1 Research Assistant, and 1 Office Manager.

Nine of Devon & Severn IFCA's fisheries officers with enforcement powers, with other staff providing research and administrative support. The areas of staff responsibility are set out in the Annual Plan, encompassing all aspects from enforcement, science and conservation to administration and PR. Additionally, the IFCA strategically seeks to ensure that staff members are able to perform secondary duties.

Examples of the types of duties that may be added to a staff members remit alongside their primary role are enforcement, habitat mapping, data compilation and entry (GIS), communications and other research. In this way the capacity of the IFCA staff group is enhanced.

2.2. Strategic Objectives

Management of English 'inshore' fisheries is a shared responsibility of the MMO and IFCAs. Both have a duty to deliver all EU fisheries regulations under the CFP with the opportunity to apply more restrictive measures. A memorandum of understanding (MOU) exists between the two organisations to better ensure a co-ordinated approach to management. Inshore Fisheries and Conservation Authorities replaced the existing Sea Fisheries Committees from April 2011 and in doing so the remit was extended beyond simply managing inshore fisheries, to take on new marine conservation duties as set out in the Marine and Coastal Act (MCA) 2009. The national vision for IFCAs, which forms the key strategic objective which all IFCAs share is:

“To lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry”.

Below this overarching vision there are seven nationally-agreed 'success criteria' (with associated high-level objectives, outcomes and performance indicators) which have been agreed and are again applicable to all IFCAs:

1. IFCAs have sound governance and staff are motivated and respected
2. Evidence based, appropriate and timely byelaws are used to manage the sustainable exploitation of sea fisheries resources within the District
3. A fair, effective and proportionate enforcement regime is in place
4. IFCAs work in partnership and are engaged with their stakeholders
5. IFCAs make the best use of evidence to deliver their objectives
6. IFCAs support & promote sustainable management of the marine environment
7. IFCAs are recognised and heard

The above criteria are set within a timeframe up to 2015. In addition, Article 153 of the MCA (2009) sets out the duties for all IFCAs. These are restated in the Devon & Severn IFCA annual plan:

- To provide a professional, effective, efficient and equitable enforcement regime in the inshore waters around the Devon and Severn coasts;
- Ensure the best possible general and fishery management practices and research techniques are utilised as an on-going process;



- Continue to improve our standards and monitor our performance;
- Provide stakeholders and the general public with information and/or data, and improve access to that information/data by electronic means;
- Work in partnership with other organisations (e.g. CEFAS, MMO, EA, NE, research bodies, NGOs) to help ensure a better service is delivered through shared sources of information; and
- Proactive Involvement with stakeholders and interested parties by means of public meetings and structured presentations, and obtain feedback.

D&SIFCA consider their current main priorities to be the protection of the European Marine sites (EMS'), shellfish management and the regulation and protection of recreational fishing, esp. in the Severn Estuary. In the past strategic planning was driven by the SFC, but is shifting towards a greater stakeholder involvement, although it does not yet involve formal workshops or other structured mechanisms. The Devon & Severn IFCA annual plan (2013 – 2014) sets out work priorities under each of the seven success criteria outlined above. This details how the high level objectives will be translated into local action. In addition, the IFCA has produced an Annual Research Plan (2012 – 2013).

2.3. Capacities & funding

Devon & Severn IFCA is based in Brixham and has one officer based in the Somerset Wildlife Trust office. D&SIFCA operates the following five vessels of various sizes, including:

1. 22 m patrol vessel (FPV Drumbeat of Devon)
2. 8 m research vessel
3. 6.5 and 5.4 m Rigid Inflatable Boats (RIBs)
4. 4 m aluminium work boat for shellfish surveys.

The April 2013 – April 2014 budget income is £736,000. Around £409,000 is via Defra's New Burdens Funding from government to the councils. The current 40% New Burdens Funding will end in 2014. The other 60% is direct from the authorities. Expenditure is mainly in the form of administration (mainly staff costs for the IFCA officers, 61% of the 2012 / 2013 base), boat costs (14%), vehicles and travel (5%) and equipment and services expenses (16%).

However, as stated in the D&S IFCA 2013 – 2014 Annual Report, *“One of the difficulties in the IFCA planning process and budgeting is predicting the amount of work that D&SIFCA will face in delivering and implementing its duties and powers connected to the byelaw review process with impact assessments required and with the management of the EMS. It is also hard to predict exactly the levels of management and enforcement that will be connected with the EMS and MCZ process within D&SIFCA district”*.

A statement in the neighbouring Southern IFCA 2013 – 2014 Annual Report is also relevant to D&S: *“Budgets and reserves are coming under increasing pressure due to a variety of factors, not least that the EU Commission and Defra require IFCAs to use their own budgets to obtain newly imposed tools i.e. Omega gauges. New powers, duties and obligations under MaCAA have raised expectation levels of some sectors to unattainable levels. This expectation has to be managed by prioritising the Authority's activities and being proactive in explaining this prioritisation”*.

2.4. Existing activities, obligations & commitments

In the context of Project Inshore Stage 3, which looks at strategic future direction for IFCA fisheries management actions, it is important to consider the existing commitments that currently shape much of the IFCAs working priorities and which are over and above the routine operation of enforcement, control, research and monitoring that is the core business of any fisheries management authority. The IFCA priorities are set out in the Annual Plan. These are detailed below:



2.4.1. European Marine Sites

There are currently six areas designated as EMS in the Devon & Severn IFCA District (see Figure 4 on page 16 for map of SACs, SPAs & MCZs in the district), including:

- Lyme Bay and Torbay SAC
- Start Point to Plymouth Sound and Eddystone SAC
- Plymouth Sound and Estuaries SAC
- Lundy SAC
- Severn SAC

The drawing up of management measures to protect the sites from fishing activities by the end of 2013 will require a great deal of joint working to produce coherent protection for the sites. In total there are 1,754 km² of EMS within the D&SIFCA district or part of joint management sites for the IFCA.

Following a Ministerial review, all IFCAs have been tasked to make use of the powers invested by the Marine and Coastal Access Act 2009 to make byelaws that protect sensitive designated features (specifically in SACs and SPAs which form part of the Natura 2000 network) from activities that could impact these features as identified by the European Marine Sites Implementation Group. This requires the introduction of legislation to protect “High Risk” features by 2013, followed by consideration of the need to protect “medium and low risk” sites by 2016. In all cases this will need to be supported by consultation and impact assessment work. The Devon & Severn IFCA 2013-2014 Annual Plan makes the point that this significant work stream was unforeseen when establishing the current 4 year budget allocation and is not featured as an objective under the seven success criteria in the DEFRA guidance to IFCAs.

2.4.2. Marine Conservation Zones (MCZs)

In addition to the Natura 2000 sites referred to above, four of the 27 Tranche 1 MCZs announced by DEFRA are in the Devon & Severn District (Lundy on the north coast, and Skerries Bank & surrounds, Tamar Estuary and Torbay on the south coast). Devon & Severn IFCA have responsibility for developing appropriate management measures for these sites. This involves a stepwise process, working with partners, such as Natural England, to (i) assess any immediate risk to the designated features of these sites, (ii) undertake a review of the protected features of the MCZ sites and of activities occurring in the vicinity of those sites and (iii) develop a management plan for each MCZ site and agree a timetable for implementation.

2.4.3. Byelaw Development

D&SIFCA revised all the byelaws inherited from the D&S SFC in 2011. As a result of the work on the identification of high risk features of EMS’s Devon & Severn IFCA has recently developed a new mobile fishing permit byelaw. In order to protect sensitive reef features from possible damage by bottom-towed fishing, from 1st January 2014, no bottom towed gear will be permitted across the sensitive features within the SAC. The Byelaw introduces a flexible approach to mobile fishing activities and conservation management within the Authority’s District. The Authority recognises that with further survey work and the introduction of new technologies greater access to vessels using bottom towed gear within SACs may be possible in the future. This Byelaw forms part of a review of all of the Authority’s byelaws with a Potting and Shellfish Permit Byelaw to follow in March 2014 and further byelaw changes over the next few years. Otherwise D&SIFCA intends to and develop specific byelaw targets and condense the current 43 byelaws into around five ‘super byelaws. In particular, D&SIFCA are pioneering mechanisms to allow adaptive management through permitting byelaws, which allows the lawful sub-delegation of executive powers and thus speeds up changing permitting conditions. This is a major step forward in developing meaningful harvest control rules and decision-making processes for England’s inshore fisheries (see Section 6.3.3).



2.4.4. Shellfish management

The second major area of focus has been addressing the long term sustainability and management of the shellfisheries within the district. Finfish stocks are for the main controlled through national management measures but shellfish stocks are within the management control of the IFCA. The Potting and Shellfish Permit byelaw is currently out for pre-consultation with a view to getting the new permitting byelaw in place by the end of March 2014. This new byelaw will provide the same protection as the previous byelaws, which will be revoked once the new permitting byelaw is in place.

2.4.5. Recreational sea angling

The third area of development work for the IFCA over 2013 has been a greater focus on recreational sea angling (RSA) within the district. Work undertaken during previous years has identified important areas to the RSA sector and the need for protection of some of the sites as well as addressing concerns over illegal fishing and fish minimum landing sizes. Greater engagement with the RSA sector will be promoted during the year. A full audit will be undertaken to allow the IFCA to make decisions over possible future development for the angling sector in this important area nationally to the RSA building on the national Angling 2012 programme. A recent report on RSA in the England suggested that the average spend per angler per day trip in D&S IFCA is around £27 for shore anglers and £48 for boat angler (Brown et al, 2013). In England as a whole, over 2012, sea anglers resident in England spent £1.23 billion on the sport, equivalent to £831 million direct spend once imports and taxes had been excluded. This supported 10,400 full-time equivalent jobs and almost £360 million of gross value added (Armstrong et al, 2013).

2.4.6. Other focus areas

Fisheries enforcement remains a key role of the IFCA and continues to be targeted at high risk activities and areas. The Devon & Severn IFCA works with other relevant organisations, such as the MMO and Environment Agency, as well as neighbouring IFCAs to ensure compliance across jurisdictional boundaries.

2.5. District Fisheries profile

2.5.1. Key species

Stage 1 of Project Inshore presents a national overview of key fisheries statistics. This includes a section profiling the key fisheries of the Devon & Severn district. A section of the report (1.2.1 - Data Uncertainties and Information Constraints) points out there are a number of problems when seeking to interpret national data to obtain an accurate picture of inshore landings, within the IFCA boundary. This discusses the challenge of defining what is 'inshore' and the limitations in landings data for the inshore fleet in particular. The best initial estimate of inshore landings is then taken from the MMO national landings database of all landings caught within the overlapping ICES statistical rectangles – a much larger area than the IFCA area.

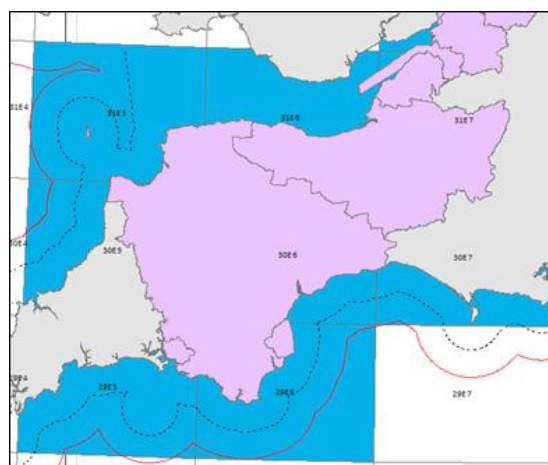


Figure 2:
ICES rectangles
overlapping the IFCA

Even within this area there are problems with the data estimates, with some landings not being represented. In particular there are problems with estimating landings for inshore vessels. Many under 10m vessels which are not required to fill in log books do submit monthly shellfish returns, but this data in many cases does not seem to be reflected in the national database. Instead it is the information from Registration of Buyers and Sellers (sales note returns) that is thought to form the main tool for estimating inshore landings. In some cases inshore landings do not get sold



through these channels, often quite legitimately.

Part of the consideration for this Stage 3 of Project Inshore will be to consider how best to obtain the required information for inshore stock management. An accurate understanding of catches is an essential pillar of this along with effort and other time series data (see later in this report) and is therefore likely to be a key determinant of success of any future local stock management initiatives.

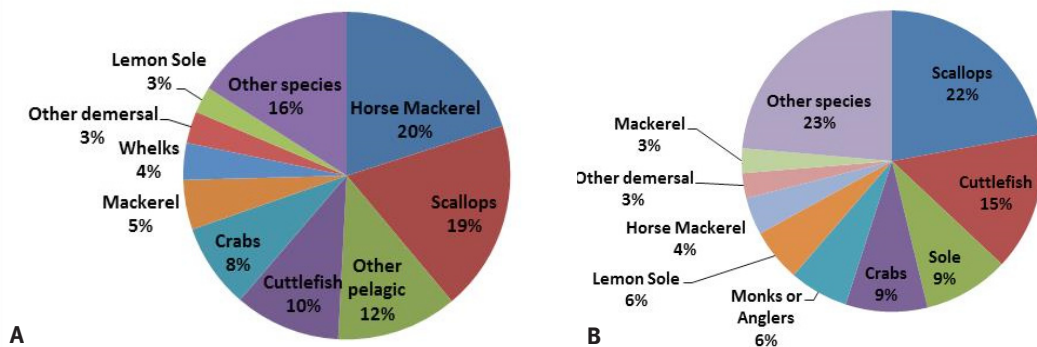
In 2012 around 38,000 tonnes of fish and shellfish were landed into ports in the Devon & Severn IFCA district. Around 20% of this was horse mackerel, with scallops (19%), cuttlefish (10%) and crabs (8%) the other main species landed by volume. In value terms, this catch was worth around £53 million, with scallops (22%), cuttlefish (15%), sole (9%) and crab (9%) the top four species by value.

Figure 3:

Proportional volume and value of 2012 landings into ports in D&S IFCA

- A. Proportion of catch by volume
- B. Proportion of catch by value

Source: MMO



2.5.2. Fleet & Port Characteristics

The District has around 420 vessels, of which around 60% are estimated to be full-time (Sarah Clark, D&S IFCA, pers. comm., 09 Jan 2014). In terms of ports, Plymouth had the largest landings by volume (15,586 t or 24%), mainly of horse mackerel, mackerel and scallops. As such, most landings will be from vessels operating outside of the IFCA area. Brixham was a close second (15,003 t or 40%), with a much higher proportion of shellfish, especially scallops and cuttlefish, as well as demersal finfishes, such as gurnard, plaice and soles. As such, it accounts for the majority of landings from Devon’s south coast inshore fisheries. The remaining 18 ports in the district between then account the remaining 18% of catches landed by volume. Ilfracombe on the north coast specialises in skates and rays from the Bristol Channel, as well as whelks, Salcombe is almost only landing brown crab.

Table 1:

Landings by port on the D&S IFCA District

Source: MMO

See table overleaf for landings into these ports by of species

Port	Landed volume (t & %)	
Plymouth	15,683	42%
Brixham	15,003	40%
Teignmouth	1,980	5%
Salcombe	1,363	4%
Ilfracombe	1,067	3%
Exmouth	837	2%
River Dart	737	2%
Dartmouth	398	1%
Appledore	221	1%
Torquay	166	0%
Beer	73	0%
Bideford	66	0%
Beesands	24	0%
Axmouth	18	0%
Sidmouth	5	0%
Lynmouth	5	0%
Bridgwater	1	0%
Kingsbridge	1	0%
Bristol	0	0%
Grand Total	37,648	100%



Species Group	Appledore	Axmouth	Beer	Beesands	Bideford	Bridgwater	Bristol	Brixham	Dartmouth	Exmouth	Ilfracombe	Kingsbridge	Lynmouth	Plymouth	River Dart	Salcombe	Sidmouth	Teignmouth	Torquay	Grand Total
Demersal	49	4	11	4	58	1	0	4,190	78	79	288			1,897	2	28	5	56	73	6,822
Bass	1	1	1	2	5	0	0	64	5	9	29			62	1	0	0	4	1	185
Brill	0	0	0	0	0	0	0	114	0	2	1			28	0	0	0	0	3	149
Cod	0	0	2	0	1	0	0	46	3	2	8			54	0	1	0	1	1	121
Dogfish	12	0	1	0	2	0	0	32	0	0	52			9	1	0	0	0	0	110
Gurnard	1	0	0	0	1	0	0	741	0	3	3			142	0	0	0	0	8	900
Haddock	0	0	0	0	0	0	0	76	0	0	5			146	0	0	0	0	0	228
Hake	0	0	0	0	0	0	0	1	0	0	0			130	0	0	0	0	0	131
Lemon Sole	1	0	0	0	0	0	0	542	1	13	1			400	0	6	7	4	975	
Ling	0	0	0	0	0	0	0	13	2	0	0			19	0	0	0	0	35	
Megrim	0	0	0	0	0	0	0	16	0	0	0			23	0	0	0	0	39	
Mussels or Anglers	0	0	0	0	0	0	0	278	0	1	1			112	0	1	0	0	3	396
Other demersal	5	0	1	0	6	0	0	912	3	11	17			224	0	1	0	3	6	1,393
Plaice	0	1	0	0	2	0	0	594	3	14	6			179	0	0	1	3	22	826
Pollack (lythe)	0	1	2	0	1	0	0	78	49	1	0			87	0	1	0	1	2	223
Saithe	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0
Sand Eels	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0
Skates and Rays	26	0	3	1	35	0	0	78	11	9	149			27	0	13	2	5	1	361
Sole	1	1	0	0	2	0	0	313	0	7	13			98	0	0	1	1	18	454
Turbot	1	0	0	0	1	0	0	109	0	1	2			23	0	0	0	0	2	140
Whiting	0	0	0	0	2	0	0	182	0	6	1			134	0	0	0	24	1	351
Whelks	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0
Arctic	0	0	1	0	2	0	0	3,022	3	93	0	0	0	9,790	0	0	0	1,789	41	14,741
Blue Whiting	0	0	0	0	2	0	0	57	0	0	0			117	0	0	0	5	7	137
Herring	0	0	0	0	0	0	0	39	0	0	0			67	0	0	0	0	0	137
Horse Mackerel	0	0	1	0	0	0	0	39	0	0	0			7,521	0	0	0	15	23	7,560
Mackerel	0	0	1	0	0	0	0	88	3	2	0	0	0	1,714	0	0	0	1	23	1,847
Other pelagic	0	0	0	0	0	0	0	2,692	0	91	0			2	0	0	0	1,700	10	4,496
Sardines	0	0	0	0	0	0	0	146	0	0	0			369	0	0	0	68	1	584
Shellfish	172	14	62	21	6	1	7,791	317	664	779	1	5	5	3,996	735	1,334	0	135	52	16,084
Crabs	34	9	25	13	0	0	175	264	12	68	0	0	0	501	714	1,319	0	17	0	3,153
Cuttlefish	0	0	0	0	0	0	3,043	9	48	0	0			787	0	0	0	5	48	3,947
Lobsters	8	0	1	2	0	0	6	5	2	22	6			6	10	12	0	3	0	78
Other shellfish	0	0	0	0	0	0	175	33	0	0	0			32	0	0	0	2	2	242
Scallops	19	3	0	6	0	0	4,053	2	359	0	0	1	5	2,634	0	0	0	0	1	7,083
Shrimps and Prawns	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0
Squid	15	0	35	0	6	0	135	0	1	28	0			36	0	0	0	0	1	222
Wheals	95	0	0	0	0	0	205	4	242	661	0			0	11	2	0	109	0	1,364
Grand Total	721	18	73	24	66	1	0	15,053	399	637	1,007	1	5	15,683	737	1,334	5	1,269	166	37,618

Table 2:
Landings into key ports into Devon & Severn IFCA district by species over 2012

Source: MMO (<http://www.marinemanagement.org.uk/fisheries/statistics/documents/ukseafish/2012/port.zip>)

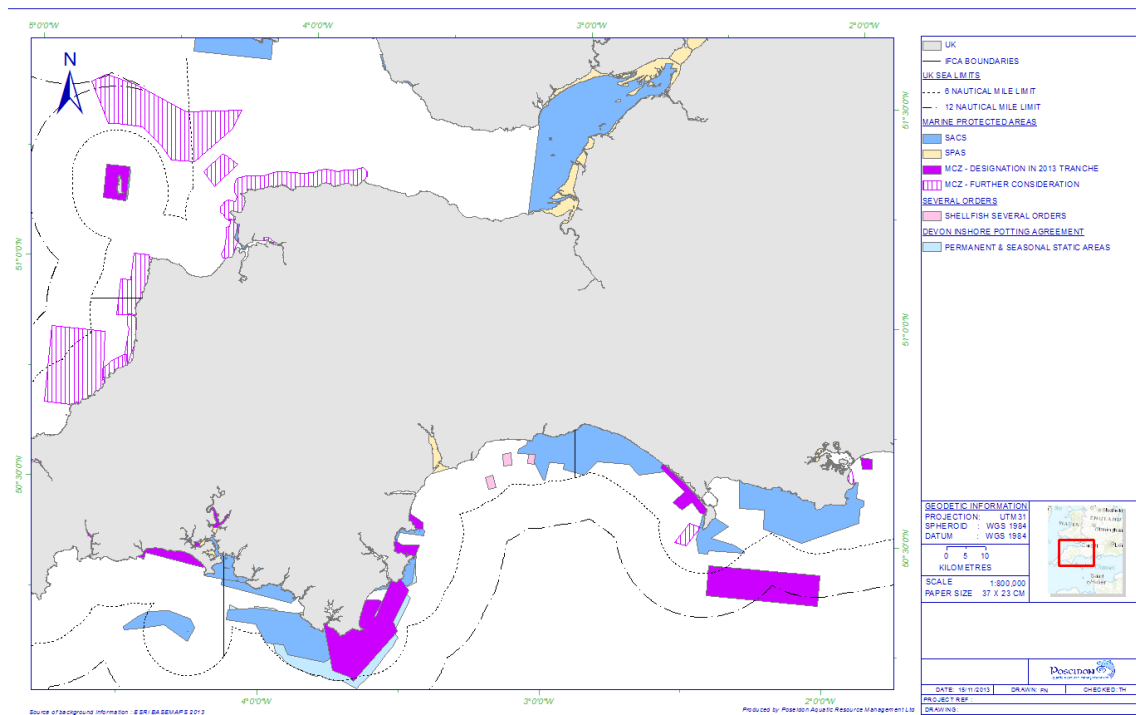


Figure 4:
SAC, SPA and MCZ Designations in the Devon & Severn IFCA District



3. Stage II Pre-assessment Findings

3.1. Strategic Summary of Stage II findings

A significant issue for English Inshore fisheries is the lack of accurate fisheries information – both of effort and landings. Although this to some extent undermines scoring of the information performance indicators, it will likely prove to be of even greater critical importance when seeking to address the management weaknesses identified for English Inshore fisheries. Many of the problems identified in this pre-assessment of English fisheries stems from this lack of information. In some instances (informing P2 and P3) this could be rectified relatively quickly. Other aspects such as stock information may require time-series data and therefore require a long-term plan to develop an information base before the MSC standard can be met.

There is no centralised data management for inshore fisheries, accessible to all relevant agencies, which undermines effort at management.

3.1.1. Principle 1

Many inshore resources targeted in by fishermen in the Devon & Severn district the stocks which are targeted are poorly defined. This undermines attempts to implement good management and leads to uncertainty over management jurisdiction. Where stocks are poorly defined, the management authority needs to adopt a working solution, which is both practical and precautionary. This is part of the decision-making process more than a scientific process in most instances. Careful consideration is required to determine how the functional stock management boundaries of those English inshore stocks where stock boundaries have not already been defined, will be defined.

For EU pressure stocks, subject to full annual ICES working group scrutiny with a long term management plan in place and functioning as intended, there are likely to be relatively few obstacles to certification (under P1). The only exception to this is where stock status is below the limit reference point.

For stocks where it is not possible to determine status relative to reference points from the available information it is necessary to use the MSC risk based framework. The majority of English Inshore fisheries fall into this category, simply as a result of the fact that stock boundaries have not been defined and stock assessments are not carried out at the scale of the stock. However, most stocks which are commercially exploited but where stock status is uncertain are likely to score at high risk under the risk based framework. This does not mean that those stocks are overexploited or depleted, but merely that the risk of over-exploitation is such that good management can only be assured if based on more fishery specific information.

Even for highly productive species (typically bivalve) where it can be demonstrated that a risk from even of a targeted fishery is low, it can still be difficult to demonstrate that the risk to future productivity of the stock will always remain low without management safeguards. Bivalve stocks can be extirpated completely in unmanaged situations, so some understanding of stock status (standing stock) should be known to inform (and limit) exploitation.

3.1.2. Principle 2

Principle 2 requires that the status of the particular fishery under assessment is scored against five different criteria. This is only possible with good fishery specific information on the fisheries and associated habitat and ecosystem.

In the absence of fishery specific data, expert judgment, qualitative information and analogous information can be drawn upon, but only at a lower level of scoring. To achieve scores of 80 or over for many principle 2 performance indicators quantitative fishery specific data is required. It is therefore routine for pre-assessments to recommend that a fishery wishing to proceed to full assessment should undertake some independent and scientifically robust quantitative assessment of the fisheries ecosystem impacts. Fisheries which have supporting information based upon observer work which is able to detail catch profiles – including discard and ETP profiles - are therefore likely to score higher.



More detailed information on catch profiles will also help determine what are considered ‘main’ retained and bycatch species. If a fishery is able to quantitatively demonstrate that it does not have any ‘main’ retained or bycatch species, then scores of 80 are automatically achieved for these performance indicators.

The nature of mixed fisheries in the Devon & Severn district and beyond means that many fisheries have the potential to retain a number of other species. In the scoring exercise the status of all the other species likely to be retained by the same gear in the same area are used to inform the status of retained species for a given fishery. This highlights that there are a relatively small number of stocks which would lead to detrimental scoring (<60) when retained by a particular gear.

By addressing all commercial species as potentially retained, only non-commercial bycatch species are treated as discards. The scoring indicates that no single non-commercial discard species is likely to cause a fishery to score at less than SG60 but that there are some species which could be vulnerable to certain gears and where there is a clear need for more information (in particular in relation to catch profiles) to support scoring at full assessment. The same applies in the case of Endangered, Threatened and Protected (ETP) species. It should also be noted however that the requirements for management are greater for ETP species than for other P2 criteria (requiring a ‘strategy’ rather than a ‘partial strategy’ at SG80) therefore any fishery wishing to move forward with MSC certification would benefit by developing a fishery specific management policy for ETP species – this is something that could be coordinated at an IFCA level.

For habitats and ecosystem, scores are generally lower for mobile demersal gears, such as trawl, beam trawl and dredges. There are scale issues which have a significant bearing on some of the gears under principle 2. The scoring is generally based on the impact of the full range of the gear, this often means that local inshore management measures are only credited where it can be shown that the fishery is spatially restricted (such as the case of the spatially restricted Salcombe scallop fishery).

There is at least the potential for all fishing gears operating in Devon & Severn Inshore fisheries to pass MSC certification and in most cases examples of certified gear already exists somewhere. However for more impacting gears, the level of information and precautionary management required is likely to be considerably greater in order to demonstrate that management can ensure that impacts are not serious or irreversible. For these more impacting gears, such as dredges and demersal towed gear the low scores presented in the stage 2 pre-assessment results do not necessarily present a definitive barrier to certification but they do indicate that further work appears to be required before they can confidently enter the full assessment process.

3.1.3. Principle 3

There is a comprehensive governance and legal framework meaning that overall scores in these areas are generally good. Although the commentary in relation to these applies to the EU and UK institutions and legislation, it is applicable to the local IFCA context.

Where management is carried out at an international level through ICES / EU channels, and where there is full annual ICES working group scrutiny and a long term management plan is in place, then a fishery is likely to pass P3 (the only exception being where the international agreement has broken down, such as the current case with mackerel).

Where fisheries are effectively managed locally by local managers with the tools to limit exploitation, the information on which to base that decision, and the necessary fishery specific structures of management are in place (such as consultation, transparent decision making, research and review) then fisheries also have the strong potential to pass P3. The most obvious examples of local fisheries with the requisite tools, information and management structures are those fisheries managed by Regulating Orders. In these cases it has been possible to score well under the fishery specific elements of principle 3 (in particular those PIs relating to fishery specific objectives, decision making and monitoring & evaluation) because there is clear evidence of active and holistic management focused on the performance of a specific fishery under the clear remit of a single primary management authority.



Although IFCA's now have more effective tools to actively and adaptively manage inshore fisheries, the ability to make use of these is often undermined by lack of information (and in some cases the lack of available resources or management priority) to actively manage fisheries. For many inshore fisheries in the Devon & Severn district there is a lack of clarity about the precise division of roles and responsibilities, both between the EU and the UK, but perhaps more significantly between the MMO and IFCA's. This lack of clarity about roles is mirrored in the division of responsibility for providing management with scientific advice and information.

There are many finfish stocks which do not receive annual ICES advice and which do not have an EU TAC. For these stocks it is not always clear who will take a lead on management. There is a disincentive for local fishery management (IFCA's) to take management action on these stocks which also pass well beyond their jurisdiction meaning any impact of more restrictive management measures would only be felt by local inshore vessels for an uncertain stock benefit. A key determining factor of management success or failure is the 'reliability' of the stock response. Trying to manage the unmanageable (a stock which may be mainly outside of the management area) is futile and undermines the relationship between managers and local industry, who feel they are being unfairly restricted. For these cross jurisdictional stocks a clearer understanding of management responsibility and stronger (institutional) links between IFCA's and with MMO is required to determine an appropriate path for management.

For stocks (in particular shellfish) which do not receive annual ICES advice and which do not have an EU TAC, but which are more geographically restricted there is likely to be a greater overlap between the stock boundaries and the IFCA boundaries. In these cases management by IFCA's can be based on sound local information, is more likely to receive the support of local industry and critically, is more likely to bring about the intended response. However it is important to consider how best to incentivize fishing activities within this area. Any system of licencing, or permits or even allocations (either of quota or effort) do go some way toward ensuring that the fleet with access to the resource are likely to derive a future benefit from any management measures. By contrast, where a fishery is perceived as 'open access', without the tools to limit access (other than to vessels on the national fleet register), support for local management measures may be less and therefore less likely to succeed.

3.2. Devon & Severn fisheries recommended for full assessment

Of the 187 species / stock / gear units examined in the Devon & Severn IFCA area noting the, in some cases, data limited and therefore precautionary nature of a pre-assessment, three fisheries over 80 on average for each of the three Principles offer the prospect of almost immediate entry into the MSC full assessment, these being:

Table 3:
Fisheries scoring greater than 80 in the Stage 2 pre-assessments

Species	Stock	Gear type
Plaice	Western Channel (VIIe)	Trammel net
Sole	Western Channel (VIIe)	Drift net
		Trammel net
Cod	Celtic Sea (VII e-k)	Drift net
		Long line
		Trammel net

The pre-assessment scoring exercise indicates that fisheries for **plaice** and **sole** using static gears are likely to score best – in particular drift and trammel nets – indicating a likely pass at MSC full assessment. The indication from the pre-assessment is that gill net fisheries would score more poorly, but this result is mainly due to a lack of information, in particular in relation to catch profiles of other species. It is possible that an exercise to quantify the catch profiles of static gear nets could lead to increased scores. For trawl and beam trawl the level of supporting information to provide evidence that the gear does not pose a risk of serious or irreversible harm to both habitats and bycatch species is likely to be greater – but may still be possible to demonstrate in the longer term. Both plaice and sole are far more widely distributed than the Devon & Severn IFCA boundary,



and D&S IFCA is not the primary management authority for these species, however this in no way precludes local fishermen from pursuing MSC certification of these fisheries on these stocks. Due to the widely distributed nature of the stocks, there is the potential for a large scale Unit of Certification – for example, including all English Inshore static gear vessels fishing these Western Channel stocks. This will be explored further in section 5 of this report.

One other stock has potential to be considered for immediate certification, Celtic Sea **cod** (drift nets, longline and trammel net catches). However the volumes of this catch is very low (approx. 25 tonnes respectively per annum) that it is not likely to be economically viable for certification, even in combination with other IFCAs (e.g., Cornwall and the Isles of Scilly).

There is a small **scallop** fishery based from Salcombe that may be a candidate for MSC certification, given its limited entry (governed by a local permitting scheme) and large minimum landing size.

3.3. (IFCA) Fisheries requiring additional action prior to full assessment

14 of the 216 species / stock / gear units scored between 60 and 80² on average for each of the three Principles (see Table 4 overleaf). Of these, 22 species / stock / gear units (consisting of thirteen species) are managed by the EU and only one (the bycatch of Western Channel brown crab in gill net fisheries) is locally managed.

In terms of the bycatch of Western Channel crab in finfish-directed gill net fisheries, the main weaknesses in P1 are generally easy to address, these being a need to more regularly review harvest control strategies, provide more information on mortality from other gears and a greater analysis of uncertainties in the stock assessment. In P2 there is a need for more information on the amount and consequences of discarded bycatch in particular, and there appears to be little information on the interaction between gill nets and ETP species. In terms of P3, there are concerns over the lack of control of access to the fishery, variable compliance levels and the need for further external review of fishery-specific management measures. It should be recognised that this only a small catch, with many of the fisheries involved operating outside of the IFCA’s jurisdiction.

A further 185 species / stock / gear units scored less than 60 on average across each of the three Principles and are considered as challenged and thus need further work (see Table 5 on page 24).

Species	Stock	Gear Type
Cod	Celtic Sea (VII e-k)	Gill net
Haddock	Western and Channel (VII b-k)	Gill net
Hake	Northern Stock (IIIa IV VI VII VIII a/b/d)	Gill net
Horse mackerel	Western Stock	Gill net
		Hand, rod and line
		Pelagic trawl
Ling	Southern (IIIa IVa VI VII VIII IX XII XIV)	Gill net
Megrim	Celtic Sea & West of Scotland (VIIb–k & VIIIa,b,d)	Gill net
Monkfish / Angler	Western and Channel (VII b-k, VIII a/b/d)	Gill net
Pilchard	Bay of Biscay	Drift net
		Gill net
		Hand, rod and line
		Encircling net

Table 4:
Fisheries scoring between 60-80 in the Stage 2 pre-assessments

² If the species / stock / gear unit scores over 80 it is recommended for potential assessment under the MSC standard. If it scores 60-80 then it could be assessed, but conditions would likely be incurred. If the fishery scores less than 60, there would be challenges to becoming certified under the MSC standard.



Plaice	Western Channel (VIIe)	Gill net
		Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
Sole	Western Channel (VIIe)	Gill net
		Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
Sprat	Channel (VIId,e)	Pelagic trawl
Whiting	Western (VIIe-k)	Gill net

Table 5:
Fisheries scoring below
60 in the Stage 2 pre-
assessments

Species	Stock	Gear
Anchovy	Southwest	Encircling net
Bass	NE Atlantic	Drift net
		Gill net
		Trammel net
		Hooks & line (trolling)
		Demersal trawl (TR1: >100mm)
		Pelagic trawl
		Beam trawl
		Black Sea-bream
		Demersal trawl (TR1: >100mm)
		Beam trawl
Blonde ray	North Sea and Channel (IVa VII d/e)	Gill net
		Long line
		Demersal trawl (TR1: >100mm)
		Beam trawl
	Irish and Celtic Sea (VII a/f/g)	Gill net
		Long line
Demersal trawl (TR1: >100mm)		
	Beam trawl	
Brill	North Sea and Channel (IV+IIIa VIId/e)	Gill net
		Trammel net
		Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
		Beam trawl
Brown crab	Western Channel	Pots
		Gill nets
		Beam trawl
	Celtic Sea	Pots
		Gill net
		Beam trawl
Brown shrimp	Bristol Channel	Beam trawl
Cod	Celtic Sea (VII e-k)	Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
		Beam trawl
Crawfish	Southwest	Pots
		Gill net
		Demersal trawl (TR1: >100mm)
		Beam trawl



Cuckoo ray	North Sea and Channel (IVa IIIa VIId)	Gill net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
	Irish and Celtic Sea (VII a/f/g)	Gill net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Cuttlefish	Channel	Pots Trap (cuttlefish) Demersal trawl (TR2: 80-100mm) Beam trawl
Dab	Western (II, V, VI, VII (excl. d), VIII, IX, X, XII, XIV)	Gill net Trammel net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm)
	Channel (VII d)	Gill net Trammel net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Dab	Western (II, V, VI, VII (excl. d), VIII, IX, X, XII, XIV)	Beam trawl
Flounder	Channel (VII d/e)	Gill net Trammel net Demersal trawl (TR1: >100mm) Beam trawl
Grey Gurnard	Celtic Sea and West of Scotland (VI VII a-c, e-k)	Gill net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Grey mullet	Channel and North Sea (IV VII d-f)	Drift net Gill net Hooks & line (trolling) Hand, rod and line Demersal trawl (TR1: >100mm) Beam trawl
Haddock	Western and Channel (VII b-k)	Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Hake	Northern Stock (IIIa IV VI VII VIII a/b/d)	Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
John dory	Western Approaches (VIIe-j VIII a,b)	Gill net Demersal trawl (TR1: >100mm) Beam trawl
Lemon sole	Western and Channel (VII a/f/e)	Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Ling	Southern (IIIa IVa VI VII VIII IX XII XIV)	Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl



Lobster	Southwest	Pots Gill net
Mackerel	NEA Mackerel	Gill net Hooks & line (trolling) Hand, rod and line Pelagic trawl
Megrim	Celtic Sea and West of Scotland (VIIb-k and VIIIa,b,d)	Demersal trawl (TR1: >100mm) Beam trawl
Monkfish / Angler	Western and Channel (VII b-k, VIII a/b/d)	Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Mussel	Teign Estuary (outside Regulating Order area)	Shellfish dredge
Other Gurnards	NE Atlantic	Gill net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Periwinkle	Devon & Severn	Hand collection
Plaice	Western Channel (VIIe)	Beam trawl
	Celtic Sea (VII f/g)	Gill net Trammel net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Pollack	Celtic Sea and West of Scotland (VI VII a-c, e-k)	Gill net Hooks & line (trolling) Hand, rod and line Demersal trawl (TR1: >100mm) Beam trawl
Pouting	Undefined	Gill net Demersal trawl (TR1: >100mm) Beam trawl
Red Gurnard	Western (VII d-k)	Gill net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Red mullet	Celtic Sea and Western Channel (VII e-g)	Gill net Demersal trawl (TR1: >100mm) Demersal trawl (TR2: 80-100mm) Beam trawl
Scallop	Western Channel	Scallop Dredge in Cornwall, Devon & Severn, Eastern and North Eastern SCUBA
Small-eyed ray	Celtic Sea (VII f/g)	Gill net Demersal trawl (TR1: >100mm) Beam trawl
	Channel (VII d/e)	Gill net Demersal trawl (TR1: >100mm) Beam trawl



Smoothhound	NE Atlantic	Drift net
		Gill net
		Trammel net
		Long line
		Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
Sole	Western Channel (VIIe)	Beam trawl
Spider crab	South West	Pots
		Gill net
Spotted ray	Irish and Celtic Sea (VII a/f/g)	Gill net
		Demersal trawl (TR1: >100mm)
		Beam trawl
Thornback ray	North Sea and Channel (IVa IIIa VII d/e)	Drift net
		Gill net
		Trammel net
		Long line
		Demersal trawl (TR1: >100mm)
	Demersal trawl (TR2: 80-100mm)	
	Irish and Celtic Sea (VII a/f/g)	Drift net
		Gill net
		Trammel net
		Long line
Beam trawl		
Turbot	North Sea (IV+IIIa)	Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
		Beam trawl
		Gill net
		Trammel net
	Channel (VII d/e)	Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
		Beam trawl
		Gill net
		Trammel net
Velvet crab	South West	Pots
Whelk	Bristol Channel	Whelk pot
	Western Channel	Whelk pot
Whiting	Western (VIIe-k)	Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
		Beam trawl
Witch	Western approaches (VII f/e)	Demersal trawl (TR1: >100mm)
		Demersal trawl (TR2: 80-100mm)
		Beam trawl

When looking at the stock units that are under the control of the IFCA, the majority of issues can be fairly easily addressed, although in some cases they may be more fundamental. In general, the following weaknesses were noted:

P1 Stock status and management: For many of the inshore bivalve species e.g., cockles there have been limited stock assessments conducted. However as discussed later in this report this can be relatively simply addressed through assessing trends in abundance, and where data are limited,



utilising the risk-based framework (RBF). The lack of knowledge of stock status means that it is difficult to establish reference points and harvest control rules (HCR). Whilst many shellfish stocks have a size-based HCR, this might not be able to limit total effort. In the case of lobster, stocks are reported to be below the limit reference point yet there is no comprehensive stock rebuilding plan, even if recruitment is probably stable. The HCR are also not considered able to achieve stock management objectives and have not been subject to regular review. Of the two finfish species managed by the IFCA, grey mullet are not subject to any form of harvest strategy or rules. In the case of bass, there is a harvest control strategy, but this is largely unproven and there is a considerable and uncontrolled recreational catch.

P2 Ecosystem, bycatch / ETPs / habitats: the main issue with P2 is the lack of information on discarded catch, both in terms of species, volumes and consequences. This is also the case for ETP interactions. Anecdotal information suggests that interactions with ETP species in the district are limited, but as these are rarely reported nor have been objectively studied, potential MSC scores are inevitably depressed.

It is probably fair to say that the P2 scoring was particularly precautionary, and that subsequent discussions with D&S IFCA have indicated that some fishing methods are less damaging to the seabed and its communities than first considered. However there is little objective evidence to support this (e.g., direct studies of the impact of such fishing methods) and again this is likely to depress MSC scores. In addition, the proposed mobile gear permit bylaw may well have positive benefits across many gear types, especially when used in reef areas.

P3 Fisheries management / governance: one of the main criticisms of the pre-assessment is the lack of clarity over non-quota shellfish stock management in UK waters. Discussions with D&S IFCA suggest that where stocks are wholly contained within 6 nm, their primary jurisdiction is clearly understood. Another common weakness is the inability to restrict the numbers of new entrants to fisheries. Related to this are difficulties in managing illegal and unreported fisheries, especially in logistically challenging areas. With lobster and crab, one criticism was the lack of fisheries-specific management (see Bannister, 2009). Other generic issues included a lack of formal research plans for many species, a lack of formal fishery-specific objectives and a lack of control over recreational fishing catch.



4. Scoping IFCA Fisheries

4.1. Key Management Responsibility

In moving from the simple results phase of the England-wide MSC pre-assessment exercise that occurred in Stage 2 of Project Inshore toward an IFCA focused strategic management review that is the focus of Stage 3 of Project Inshore, it is useful to pass through a scoping stage where the fisheries in the district are prioritised and categorised to consider both their local importance and local management influence and priority in order to help strategically prioritise IFCA management action.

As part of the Project Inshore Stage 3, the team, together with D&S IFCA staff, have undertaken a further simple scoping exercise of the fisheries that occur in the Devon & Severn district, adding further parameters of importance to determining future management priorities. These do not at this point refer to the results of the MSC pre-assessment process (i.e. readiness for MSC is not one of the parameters used to determine management priority – although this will be introduced later in the planning process). The parameters used in the Management Scoping exercise were:

Scoping Parameter	1 - lesser local management priority	2	3 - higher local management priority
Value of landings	Graduated scale 1 = low value, 3 = high value		
Degree of EU Management	EU lead with defined quotas	Some EU / ICES involvement but no quotas	no fishery specific EU involvement
Stock boundary	Defined – widely distributed or migratory	Undefined & highly mobile	Undefined & sedentary
Local cultural & socio-economic importance	Occasional bycatch, no recreational catch	Commercial bycatch and occasional recreational catch	IFCA Priority Species (i.e. important commercial or recreational catch)

Table 6:

Scoping Parameter and scoring key for IFCA management prioritisation exercise

It is important to highlight what this management prioritisation exercise is and is not intended to do. This is focused solely on fish (both finfish and shellfish), and more specifically stocks, to help prioritise local stock management measures. It does not consider any site conservation or any gear impacts (at this point) and clearly the IFCA has many other important (and statutory) priorities which are outside of the remit of this scoping exercise. This exercise is simply to help focus in on the stocks which are locally important and which are best placed to warrant local stock management measures, led at an IFCA level.

The results of this scoping exercise are contained in Appendix 2 of this report and are discussed in the following sections below.

4.1.1. EU Quota species

Using the local management ranking exercise described above to scope the fisheries of the Devon & Severn IFCA results in relatively low ranking scores for stocks which are already spatially defined by management, already subject to EU quota management and where science is already coordinated at an ICES level. This is not to say that these stocks do not necessarily warrant management attention – merely that it is unlikely to be the IFCA that is best placed to lead on that management. This is a logical conclusion as more widely distributed and commercially important stocks require a high level of both science and management, coordinated at an appropriate spatial scale of the resource; i.e. international.

Key commercial species on the south coast such as **sole, cuttlefish, squid, plaice and pilchards** fall into this category. This means that though these species are locally important, overall responsibility for stock management is at a higher jurisdictional level. For these stocks the IFCA still clearly plays an important role both as a key stakeholder and as a partner in management. The IFCA remains responsible for enforcement of relevant legislation on these fisheries within their jurisdiction. In some cases there will be management measures, applied at a higher level, where the IFCA may even have primary responsibility for – such as protection of inshore nursery grounds. Additionally the IFCA has the power to act to further safeguard the resource, should they wish,



such as through the introduction of technical measures (gear restrictions, minimum landing sizes, spatial or seasonal restrictions), however, though this is clearly good and responsible stewardship of the resource, it should be recognised that the overall success of stock management – namely whether or not the stock is overexploited – is beyond the IFCA's control. Local measures which apply disproportionately to local inshore vessels, which do not result in overall stock benefits, are likely to be unpopular and may even be counter-productive, in particular in reducing support for management measures on other stocks where the IFCA is best placed to lead on stock level management. As well as those previously identified IFCA priority species, other species landed in the district such as lemon sole, turbot, brill and sprats fall into this category.

4.1.2. Species suited to local stock management

By contrast there are other stocks fished within the Devon & Severn IFCA district which are more suited to being managed at a smaller spatial scale such as an IFCA. Typically these will not already feature in any EU management, or any ICES science, other than in very general terms, such as general fleet technical measures, or general ecosystem science. As such the management is not dependent on the EU, so there is no barrier to IFCA's from engaging in stock management.

The following table summarises those species listed in Annex 2 that ranked most highly in the IFCA prioritisation exercise and were considered most suitable for local IFCA management. These are discussed in the section below, but some important local species (e.g., scallops, brown crab and bass) are discussed in the subsequent section where primary management responsibility for stock management may have to be agreed with other agencies where their stock shares boundaries with other jurisdictions.

Table 7:
Summary of species considered as high priority for IFCA-level management

Species	Gear	Landings (t)	Value £ (avg. 2006-2010)	Ranking	
				By value	Scored
Lobsters (S&N coast)	Pots	194	£1,862,071	10	2
Whelks	Pots	4,279	£2,669,255	7	7
Cuttlefish (South coast)	Pots	20	£30,805	86	n/a

Of those stocks which are not managed in any meaningful fisheries specific way at an EU level, there are some which are suited to an IFCA stock management more than others and which therefore score more highly in the scoping / ranking exercise. In short, the more sedentary the species, the more suited they are to local stock management measures. Of course there are other factors that are also important in justifying the spatial scale of stock management, such as length of planktonic larval phases, or fishing patterns or even local bathymetry, and these will be discussed in more detail later, but as a simple proxy for scoping fisheries, it is the sedentary nature of the stocks which most lend themselves to local management.

Three key species, **whelks, lobster and cuttlefish** fall into this category. These are stocks which are of local economic importance and which are not the subject to any fisheries-specific either national or international stock management. It is interesting to note that crab and scallop are less likely to fall into this category. In the case of crab they are more likely to migrate over longer distances, there is a significant fishery beyond 6nm and there is already some degree of international scientific cooperation, so they are less immediately obvious candidates for inshore adaptive stock management. In the case of scallop, again there is an important offshore fishery, with coordinated scientific effort but in addition there is more fisheries specific management – both at a national level (led by DEFRA) and an international level (such as the EU effort regime). Cuttlefish have been shown to migrate large distances from the mid channel to the inshore areas to spawn (see EU CRESH Project outcomes)⁴. A huge amount of research was done on the genetics of the inshore and offshore stocks and where they originate from and migrate to and therefore again the IFCA will not have sole management for this species.

⁴ <http://www.unicaen.fr/ufr/ibfa/cresh/?lang=en>



4.1.3. Stocks where primary management responsibility is unclear

Species	Gear	Landings (t)	Value £ (avg. 2006-2010)	Ranking	
				By value	Scored
Scallops	Mechanized dredges	5,867	£8,658,099	1	1
Brown Crab (S&N coast)	Pots	5,527	£7,718,990	2	2
Velvet / green crabs	Pots	1,213	£865,360	20	2
Plaice	Otter trawls	382	£546,672	22	5
Sole	Otter trawls	87	£715,190	21	5
Bass	Otter trawls	280	£1,640,250	13	7
Skates and Rays	Otter trawls	1,148	£1,501,825	14	9

Table 8:

Summary of species considered as high priority for IFCA-level management but for which primary management might be shared with other authorities

Of the identified IFCA priority species, it can be concluded that current management action is less obviously being led by either EU or national processes, or that the species or fishery characteristics mean that they are less obvious candidates for inshore stock management. These are more likely to be lower value finfish species such as **bass, red mullet, grey mullet** plus the previously discussed **crab** and **scallop**. Other lower priority species landed in the district such as **John Dory, black sea bream, gurnard** and **pollack** would fall into this category. Discussions and guidance over most appropriate stock management measures for these species is best conducted at a larger jurisdictional scale (i.e. national or international).

5. Preparations for immediate full assessment

For any stocks, fisheries or Units of Certification being considered for full assessment, it will be important to review the conclusions of the Project Inshore Stage 2 pre-assessment – both the report and the scoring database. These contain a lot of useful information and insight into the scoring process. Clearly it will be important to address any ‘gaps’ identified to seek to further increase scores and so increase assurance of a successful assessment process, but equally it can often be useful to seek to increase scoring in some areas with no gaps – perhaps targeting scores of 100, in order to increase the overall average scores at the principle level.

5.1. EU Quota stocks ready for full assessment

5.1.1. Proposed UoCs & Overlapping IFCAs

The Project Inshore Stage 2 pre-assessment exercise reveals that some EU managed stocks landed in the Devon & Severn district are ready for full assessment. The initial conclusion of the pre-assessment was that sole caught by drift net and trammel net and plaice fished by trammel net were the only 3 Units of Certification⁵ ready for full assessment.

In providing advice as part of stage three, this list of just five Units of Certification has been added to in anticipation of improved P2 scores for certain static gears on the provision of increased information of catch profiles.

Table 9:
Proposed Units of Certification of EU managed stocks landed in the Devon & Severn IFCA region, which are prime candidates for MSC certification.

Species	Stock	Gear
Plaice	Western Channel (VIIe)	Gill net
		Trammel net
Sole	Western Channel (VIIe)	Drift net
		Gill net
		Trammel net

Should there be other static gear catch combinations of the above stocks (although these are not reflected in MMO statistics) then these could also likely be included as a primary candidate for MSC assessment.

5.1.2. Opportunities for Stakeholders

For the static gear fisheries on the Western Channel (VIIe) plaice and sole stocks, the Unit of Certification has the potential to be increased in size. The overwhelming advantage of increasing the size of the Unit of Certification is that the cost of assessment, surveillance and re-assessment is shared, effectively bringing individual costs down. A bigger Unit of Certification may also be able to exert greater leverage in order to achieve any conditions placed upon the fishery at the time of full assessment.

It would be possible for all English registered inshore fishermen targeting those species in the Western Channel (VIIe) in particular to come together under a single assessment. As these stocks are not managed at an IFCA level and are also fished outside of 6nm there is no particular advantage to restricting the UoC to a single IFCA. The only exception to this would be if it was felt that there were particular advantages to scoring of P2 issues, such as reduced local habitat impacts or improved gear performance due to local byelaws, however for the static gear fisheries discussed here this sort of local improvement in scores is less likely.

So a single assessment could be used for all English Inshore Fishermen catching the 3 Western Channel stocks. This single assessment would contain multiple Units of Certification (1 UoC for each combination of stock and gear). By combining many units of certification under a single assessment, the costs are also reduced. This could bring together inshore fishermen of the Southern and the Isle of Scilly IFCAs.

⁵ The MSC guidelines to Certifiers specify that the unit of certification is “The fishery or fish stock (biologically distinct unit) combined with the fishing method / gear and practice (=vessel(s) and / or individuals pursuing the fish of that stock) and management framework”.



With a larger assessment, or Unit of Certification such as this, it is important to consider who the client would be of any future assessment and what is the 'glue' that binds the individuals within the client group. This is particularly important in order to demonstrate that any commitments made (such as Codes of Practice) are effectively complied with and any conditions resulting from the full assessment are enacted across the certified fleet. As such it is likely that some form of fishermen's association may be best placed to take a lead on first ascertaining the level of interest for any such assessment, and second on pulling together the funding and requirements to enable the full assessment process to begin.

At least for the static gear finfish fisheries discussed here, it is not anticipated that the IFCA would necessarily have any particular role to play, other than highlighting the potential opportunity to fishers targeting those resources within the district, and possibly in assisting with preparation for full assessment.

5.1.3. Stakeholders to consult with in full assessment

The following is a preliminary listing of those bodies and interested parties that will need to be contacted during the consultation phases of assessment on fisheries managed at an EU level:

- owners and management of member vessels - provision of operational data and other data collected by the client;
- skippers and mates of member vessels - provision of operational data;
- fisheries managers – (MMO).
- various fishery research institutes involved with regional fisheries and regional marine management - (CEFAS)
- details of at-sea and port inspections, checks on recent fishing infringements, information on fishing practices and discards - coastguard and national inspection authorities;
- fishermen's / producer organisations - details of licensing, quota management and uptake, log book records, fishing practices;
- other environmental organisations and special interest groups. For static gear fisheries this could include RSPB. It is our experience that it is best to include all possible NGOs with an interest in the stakeholder list, so they are aware of the assessment processes and have the opportunity to comment if interested.

5.1.4. Collection of supporting evidence

Supporting evidence is a crucial aspect of a successful MSC assessment process. The onus is on the client fishery to demonstrate their sustainability. Any supporting evidence provided to the assessment team is likely to increase the likelihood of a successful outcome and speed up the assessment process (an important consideration as the MSC timeline conditions have been tightened, so at worst a delay could lead to failure to complete the assessment in the requisite timeline).

For both Principle 1 and Principle 3 for stocks managed at an EU level with advice from ICES much of the requisite information is readily publically available. For P2 there is often more of a shortage of information which can lead to significantly reduced scores. It is therefore important to demonstrate:

- The catch profile of the gears under assessment, including the discard and ETP profile.
- The area of the fishery (ideally VMS or succourfish – or informed estimates if these are not available for inshore vessels) compared to the habitat types.
- Any fleet level management initiatives – such as gear modifications to reduce impact, Codes of conduct designed to minimise impact, reporting requirements to demonstrate reduced impact, reports from observers, membership of responsible fishing schemes etc.



- Any appropriate assessments of gear impacts in European marine sites, or any management plans for those sites indicating that the impacts of the gears under assessment are acceptable.

5.2. Locally managed fisheries ready for full assessment

5.2.1. Proposed UoCs & Overlapping IFCAs

As yet there are no locally-managed fisheries in the Devon & Severn District that are ready for MSC certification.

6. Developing IFCA Stock Management

6.1. Candidate fisheries for improvement

As identified in Appendix 2, the candidate fisheries for a Devon & Severn IFCA led approach to stock management are:

Species	Gear	Landings (t)	Value £ (avg. 2006-2010)	Ranking	
				By value	Scored
Scallops	Mechanized dredges	5,867	£8,658,099	1	1
Lobster (S&N coast)	Pots	194	£1,862,071	10	2
Brown Crab (S&N coast)	Pots	5,527	£7,718,990	2	2
Velvet / green crabs	Pots	1,213	£865,360	20	2
Plaice	Otter trawls	382	£546,672	22	5
Sole	Otter trawls	87	£715,190	21	5
Whelks	Pots	4,279	£2,669,255	7	7
Bass	Otter trawls	280	£1,640,250	13	7
Skates and Rays	Otter trawls	1,148	£1,501,825	14	9
Cuttlefish (South coast)	Pots	20	£30,805	86	n/a

This list was developed over a number of meetings with D&S IFCA in early October 2013 in Brixham, Devon. These meetings culminated with an evaluation of the pre-assessment results of these species. **The results of this analysis, together with the D&SIFCA commentary, can be found in Table 9 on page 58.**

These species are all of substantial local value, both in terms of first sale value, but also in creating both upstream and downstream economic benefits. They are also of cultural importance with many of the species having a local reputation and market and are an important element of the inshore fisheries regional livelihood. These species are not currently subject to any international coordinated science (through ICES) and little nationally coordinated national level science. Additionally these species are not subject to any fishery specific national or EU controls, other than more general gear specification and licencing and landing regulations, other than perhaps a stipulated minimum landing size. In short stock level management is not likely to be driven by an EU led approach, nor would such an approach be necessarily appropriate or necessary. If stock level management is to be applied it is most likely to be applied at a local level. As such these species are prime candidates for IFCA stock management.

Of these 10 species groups, only clams have in place many of the attributes required for 'good management' and have been identified as a potential for MSC assessment in the short term. The guidance below is provided for all the listed species.

6.2. Characteristics of successful management

Having identified that there are some species, for which stocks or more accurately management units can be defined within the IFCA jurisdiction, and which the IFCA wishes to lead on adaptive stock level management, the IFCA then has an almost blank sheet of paper upon which to design a management system – albeit within the confines of existing legislation. In the following section, the report discusses some of the characteristics of successful management. Many of these characteristics are directly linked to MSC performance criteria, and for simplicity they are set out in the order of the MSC principles, but some others are less explicitly stated in the MSC model.

6.2.1. Principle 1

Principle 1 introduces the idea that successful adaptive stock management should seek to understand and manage all fishing mortality upon that stock, or management unit. This includes all catches from all fleets, any mortality of discard species, or any unreported landings. The following characteristics are of key importance:



Clear management units

It is essential for management to clearly identify what it is managing. Where are the boundaries to the stock or management unit that is being managed and what is the rationale or assumptions on which this management unit has been defined? By clearly stating the assumptions, these are not only openly acknowledged but they can also be tested over time with thorough review and evaluation.

Collection of appropriate information

Information is essential for adaptive stock management. This information should be tailored to the needs of any stock assessment or management analysis. Where fishers are involved in this collection of information, the reasons for the data collection should be explained and it should be demonstrated how this information is used. Data should be collected at an appropriate spatial scale – to correspond to the management jurisdiction and the conduit for information should be via the managers.

Understanding of stock status

Although understanding stock status may seem an obvious characteristic of good management, there remain many examples of fisheries management seeking to take measures without fully understanding either the need for those measures or the response of the stock to those measures. Small fortunes can be spent on getting a more a more precise understanding of stock status, but it is also possible to make precautionary, informed and adaptive management based on simpler and less data hungry and expensive assessment models. Of course any loss of precision needs to be acknowledged and uncertainties identified and where necessary an increased level of precaution needs to be built into the management decision making process.

A pre-defined adaptive management response

In simple terms, a harvest control rule (HCR) simply states what stock level the fishery is targeting, what measures will be used to reach there, and what management actions will be taken and at what points (reference points) to ensure that management response to a declining stock status is appropriate and timely to prevent impairing the ability of the stock to recruit future generations. The MSC standard does provide more description and requirements about the exact characteristics of these rules, but the key principle is that they are both transparent and pre-determined. This means that negotiations over management response do not have to occur at times of reduced catches, as these decisions are effectively taken and evaluated before a need arises.

Transparent decision rules with stakeholder buy-in

Engaging stakeholders in the process of determining the harvest control rules greatly enhances the likelihood that these rules will be adhered to and eases the process of their application. In some cases this may also allow economic considerations to be included in the decision making process – provided this is not seen to be anti-competitive and it can be demonstrated that management actions are taken before there is a biologic risk to the stock. Working with stakeholders to agree on decision rules also means that stakeholders, in particular fishers, have a better understanding for the reasons for management action.

Review & Evaluation

Periodically it is important that the performance of the management system is reviewed holistically; is the stock responding to management actions as expected; are the underlying assumptions appropriate; are the tools used to set the exploitation rate appropriate; is the stock assessment model appropriate or should others be tested. This can be done as an internal exercise but having an external review often provides the benefit of fresh perspective and consideration of alternative approaches. This is part of the ongoing process of management refinement and improvement.



6.2.2. Principle 2

Principle 2 considers the impacts of fishing gears on the ecosystem. In an MSC assessment this would be the particular gear that is under assessment (and defined in the UoC) however for a wider fishery management remit, as might be included in a fisheries management plan it may be more appropriate to consider the impact of all gears targeting the resource in the management area.

Key considerations for Principle 2 would be to identify vulnerable species and habitats, assess the status of those on an on-going basis, and implement appropriate management to ensure that impacts are either minimised or mitigated. Much of this has already taken place and continues to take place. Recent work to identify sites for protection and undertake impact assessments of activities on those sites and ensure that high impacts are avoided counts toward being able to demonstrate good Principle 2 management. In addition, the following actions should be considered.

Data – discards, ETP interactions and ecosystem impacts

As with Principle 1, data is a critical element of good management. Appropriate data provides managers with a quantitative understanding the impacts of a fishery on an ecosystem. From an MSC assessment point of view, a lack of data on impact of fisheries or an over reliance of qualitative data will lead to more precautionary (lower) scores. In preparation for a full assessment, provision of appropriate data of gear impact (ideally independently verified, or in some cases based on risk assessment) will assist in the scoring process. Data enables managers to make changes where warranted, but equally it may provide support for managers not taking precautionary management action, where it can be demonstrated that it is not necessary.

Information of ecosystem characteristics / distribution

Information about the ecosystem in which the fishery takes place is also important and this can provide an understanding of changes over time. In many cases this information will already exist (for example through national habitat mapping projects), in which case it would not be necessary for managers to require any local primary research.

Understanding of spatial distribution of fleet (appropriate to scale of potential impact)

It is important for managers to understand where fishing takes place so that the relationship with the underlying ecology can be considered. However this understanding only need be appropriate to the scale and intensity of the fishery. Before requiring all vessels to have VMS or Succorfish, managers should be clear on what the reasons for that are. In collecting data for Principle 1, capturing a spatial element can be useful for understanding catch per unit effort patterns. This can also help identify changes in fleet patterns over time. Inshore fishers are themselves increasingly keen for their spatial patterns to be understood and recorded, both so they can demonstrate that certain vulnerable habitats may already be avoided or for highlighting commercially important fishing grounds in time of increasing competition for space with other marine industries.

Review mechanism to allow for management action in event of ecosystem impacts or risk caused by fishing (supported by decision rules where appropriate).

As with principle 1, some form of review is an important pillar of management. This enables managers to review available information and be assured that the management in place is appropriate. If not, management can propose an action either spatial, temporal or technical, as appropriate, and subsequently review the response to that management action.

Codes of Conduct – industry led

In a number of MSC certified fisheries some form of Code of Conduct has proved valuable. In some cases this simply sets out what is existing good practice, but it can be an opportunity to highlight that good practice. In other cases it is an opportunity for the fleet to think about actions in event of certain ecosystem impacts, and the appropriate response or mitigation to any such impact. In many cases these can include incident reporting forms. This information can be used by managers to demonstrate either that existing management is appropriate or that management response



can be tightly tailored to address an identified issue of concern. Both data (referred to above) and meaningful codes of conduct can contribute to considerably increased principle 2 scores in a full MSC assessment, but are also good practice in a well-managed fishery regardless of any aspirations for certification. Some gears have perceived impacts in certain areas whilst other gears have perceived impacts in other areas. For example, it may be perceived that a heavy trawl is more likely to impact bycatch species and habitat, whereas a static net may be perceived to have a greater impact on P2 species. A full MSC assessment would seek quantitative understanding of such impacts and in many cases this may show that the impact is less than that perceived. A Code of Conduct provides a valuable opportunity for the fleet to set out how they ensure that perceived impacts are indeed minimized. Where a Code of Conduct calls for action by the fleet, consideration should be given to how it can be verified that the fleet is indeed undertaking that action.

This said, voluntary Codes of Conduct only really work in small scale fisheries with a small number of discreet vessels within the fishery. If used on the open coast with open access fisheries those 'nomadic' vessels with no investment in the fishery may well break any code of conduct. From a regulators point of view the expectation derived from a voluntary code means additional pressure to manage the area but with no real powers to prevent incursions.

6.2.3. Principle 3

There is considerable cross over between Principle 1 and Principle 3. Principle 3 seeks to capture the apparatus and processes of management. There are some important characteristics of good management that are not contained in the MSC principle 3, but which should none the less be part of the management consideration. In particular notions of capacity and profitability are not explicitly mentioned. Fisheries with excess capacity or fisheries that are not profitable are less likely to succeed and less likely to engender a sense of stewardship. The notion of profitability is not inviting excess, and is not limitless, but should rather be about ensuring that whilst seeking to maximise the number of fishers sustainably engaged in the fishery, this is not to the detriment of all. Other characteristics of successful management in principle 3 are:

Appropriate jurisdiction to stock management scale.

This mirrors principle 1. Simply put, it is about ensuring that management decisions are likely to produce the expected stock level response, by selecting an appropriate scale of management prior to commencing management action. This is why some stocks need coastal states engagement, some can be managed within the EU and some can be managed locally as an inshore resource. Seeking to manage cockles through international agreement would be futile and would fail to safeguard local populations, whilst seeking to manage mackerel within a single inshore jurisdiction would fail to address the majority of fishing mortality that occurs on the stock when it is not in the local area and would therefore also be similarly futile.

Limited entry / ring fencing / community ownership / stewardship of resource

The relationship between a common resource and private ownership is sometimes somewhat grey in fisheries management and has and will likely again be tested in the courts. Any new approach to management which seeks to limit access to the resource must be fair, non-discriminatory and equitable. Ideally this should also set out possible routes for new entrants to join the fishery. Should access to fisheries not be intended to be an ownership right, then this should be set out in management. Some form of limited access is likely to greatly increase the sense of stewardship in the resource which in turn may lead to increased support for sometimes unpalatable management actions, if it is known that those fishers taking the pain will also be the beneficiaries of any gain. The increased sense of stewardship can increase the role that informal approaches such as peer pressure can play in enforcement, stimulating good compliance and at best, reducing costs of enforcement. A key test here is what would happen to exploitation patterns (and how much control would managers have over that) if the price were to double. If it is concluded that many other boats not previously in the fishery would come and exploit the resource and the management system allows this, then the management is unlikely to succeed in meeting its objectives.



Stakeholder engagement in management process

For inshore fisheries, perhaps more so than offshore or cross jurisdiction fisheries (i.e. those managed at an EU level) there is an increased potential to engage fishers in the management process. This is not only about seeking to obtain appropriate and accurate data of fisheries performance but also in engaging them in the development of decision rules and critically in providing feedback of management performance. There are many examples where annual fishery meetings play an important role in engaging fishers in the process of management. This can be an opportunity to provide update on stock status, outline any changes to management rules and the reasons for any such changes and highlight any enforcement priorities. Of course it is also an opportunity for managers to listen to the concerns, ideas and information from the fleet. This addresses many of the MSC criteria relating to consultation, provision of explanations for how information is used, understanding of management processes etc. Above all this has the potential to give a real sense of stewardship in “our” fishery. Of course sometimes such engagement may be challenging or even initially hostile, but should in time lead to a more inclusive and supported approach to management.

Define fishery specific objectives and decision-making processes

Stakeholder engagement in the management process can also be fruitful when it comes to setting out both the fishery specific management decision making processes and the objectives which will guide those management decision making processes. The act of explicitly setting out how management decisions will be taken is critically important to determining the overall success of management. Part of this will be about setting the Principle 1 harvest decision rules into a wider management context; how will the rules be applied, by whom, how often and when? However there may be many other management decisions which principle 1 alone cannot address; how many permits should be issued; what gears should be permitted; what area or seasonal closures (if any) should apply; what technical conservation measures should be in place; what will the enforcement regime be; what are the sanctions for any infringements; what is the consultation and appeals process? These, and many more besides, are all important management questions so in describing the management framework in a **Fisheries Management Plan**, the process for reaching these decisions should be set out. Typically decisions are taken in the context of pre-stated objectives and the success of management decisions should be judged against how well those decisions deliver against objectives. So as well as setting out the decision making process, the management plan should clearly highlight what the objectives are.

Research and information collection tailored to the needs of management

It is important that a relationship exists between science and managers, to ensure that the needs of management can be best addressed by research, and so that the results of research can be best presented to management to enable a management response. In international fisheries this close relationship can sometimes be difficult to achieve however in smaller locally managed fisheries the relationship can and should be both clear and mutually beneficial.

Management & enforcement appropriate to the scale (and risk) of the fishery

Enforcement need only be appropriate to the scale of the fishery, but management will need to determine what that is. The MSC standard introduces the notion of informal approaches to enforcement, where the design of the management system engenders a collective sense of stewardship of the resource and incentivizes positive compliance with the management regime. Notions such as restricted access, along with open and transparent decision making processes and explanation of how fisheries information is used (all described above) all help engender that sense of stewardship. Of course such self-policing stewardship is an aspiration, which may be difficult to achieve, especially initially. It is therefore important for the fisheries management plan to set out what the formal approaches to enforcement will be and what physical checks will be required to ensure compliance.



Review and Evaluation

Finally, as with both principle 1 and Principle 2 there is a requirement for periodic review and evaluation of the performance of both the parts of the management system (for example, control & enforcement or data collection) and a holistic evaluation of how the constituent parts of the management system are working together to deliver the management objectives. Which of the objectives are being met, which are not and what are the reasons for the observed patterns in meeting those objectives.

6.3. Approach to developing stock management

The following strategic Approach to developing local adaptive stock management is intended to guide the IFCA in the process, for those stocks that they are best placed, and wish to take a lead in adaptive stock management. These are ordered in a more chronological order, illustrative of the management process, as opposed the arrangement by principle in the previous section. This does not really discuss Principle 2. This is because Principle 2 is less critical to developing successful stock management (by definition P2 is about the impact on other things), so these considerations can be included elsewhere in the management process.

For each stock that the IFCA intends to lead on adaptive stock level management the IFCA should produce a Fishery Management Plan. The approach set out below should be used in the development of the Fishery Management Plan.

6.3.1. Management unit

For English Inshore fisheries which are considered best candidates for inshore management (led by the IFCAs) there is an immediate question to define the extent of the stock, or more accurately determining the working hypothesis to underpin the determination of the stock. Management will initially be faced with uncertainty about the range, distribution, life cycle and population dynamics of stock and may also be confronted by the fact that the perceived stock range does not exactly overlap with existing management jurisdictions.

Spatial genetic discreteness is unlikely to coincide with jurisdictional boundaries, so at some point managers must make pragmatic decisions to enable management to proceed. Seeking definite evidence based solutions from science will (and has) lead to delay and may result in scientifically accurate, but practically unmanageable conclusions, which are most likely to result in a lack of management action. By contrast, if IFCA managers state which important local fisheries they believe can be managed locally, within their jurisdiction and present the practically minded management rationale to support this, then it paves the way for precautionary stock level adaptive management to begin. By clearly identifying the working hypothesis about stock structure, or 'management units', the approach to management is open and transparent and clearly highlights uncertainties, enabling these to be periodically reviewed by management evaluations. Should these assumptions be shown by evaluation to be false, then the scale of the management unit can be adjusted.

The exercise of determining the rationale to support local stock management should be done by managers using the expertise within the IFCA team. For the bivalve species above, it could be argued that it is appropriate to manage as single management units within the Devon & Severn jurisdiction because:

- The estuarine water flow and recirculation characteristics of many of Devon & Severn's major estuarine rivers means there are ecosystem characteristics which may support the rationale for managing certain species as an inshore management unit.
- Shellfish are more likely to be self-recruiting.
- In their adult phase the species are either sessile or have a low range and are not migratory.
- For bivalves, international examples of best practice support geographic based management on beds.



- The species are all of significant importance to the inshore fishery and the level of fishing beyond the IFCA boundary is comparatively less.

The above examples of rationale should be examined more thoroughly as an initial step in a stock specific fishery management plan.

It should also be demonstrated how and why this management unit is precautionary. If the assumption is incorrect, management would respond to a declining stock status, but would fail to halt the overall decline, but critically this would still mean that management was taking the correct response in their jurisdiction. Bigger management units at multi-jurisdictional levels are not in immediate prospect for lower value or more sedentary inshore resources.

Ensure management coordinated at appropriate scale to fishery. Is coordination with other IFCAs required and what is the level of engagement with MMO.

6.3.2. Information

Firstly, map what data is already available for use. What is the most recent landings data and is this appropriate to the scale of the chosen management unit? Does it capture inshore fishers landings accurately and does it capture effort? What other useful information is available? Processors will often hold useful data, such as volumes landed, proportions of different size grades over time, length–weight ratios etc.

Secondly, management will need to tailor on-going data collection to the needs of management and use in HCR calculation (landings / effort / size) and / or other proxies. This should ensure that data is collected at the scale of the fishery management unit (jurisdiction) and that other fisheries mortality (recreational / discards) is either collected or estimated. For example, though overall responsibility for collection of landings data remains with the MMO, it is vitally important that IFCAs access the information that they need for management. Ideally data would be collected in computerised form, and, as will be seen later, any data that includes historic time series is also likely to be useful in informing assessments.

6.3.3. Develop Draft HCR

Appendix 3 to this report (see page 64) details the process of developing an appropriate stock assessment for local inshore resources and using this to inform the selection of appropriate empirically justified reference points which are incorporated into a harvest control rule. This discusses the selection of appropriate indicators of stock status and understanding how these relate to stock size. How to in turn determine reference points for the selected indicator (begin first with the target reference point) and what should inform this:

- established fisheries science (yield per recruit, spawners per recruit etc.)
- empirical method (unexploited reference time or reference area) or;
- bio-economics of fishery operation or;

This also explores how techniques such as simulation testing may provide increased robustness.

Once the assessment and the reference points are established the next step is to define the management actions that will be taken at each of those points to ensure rate of exploitation is reduced appropriately. These tools or measures could include closed areas, seasons, temporal curfews, pot limits, effort restriction, quota, MLS or technical measures, provided in each case that these can be demonstrated to reduce fishing mortality as intended. In particular it is important to define the level of fishing effort below the limit reference point.

It is important that there is stakeholder review and engagement in the drafting of the HCR. One useful approach is to use simulations to help explanation of scenarios and increase stakeholder understanding by providing clear explanation of proposed management response. By secure stakeholder buy-in, the chances of successful implementation in the future are greatly enhanced.

The final element of the HCR development and testing process should be to define how often, how



and by who the HCR should undergo testing and evaluation of performance.

6.3.4. Develop management framework

Once a stock assessment is in process and reference points and harvest control rules are in development or consultation it is important to place these tools into a wider fisheries management and legislative context. In many cases the development of a specific **Fisheries Management Plan** is the ideal vehicle for providing this wide context and setting out the overarching management policy and process, as well as detailing the more specific management measures.

A Fishery Management Plan should begin by stating the overarching (high level) objectives. These are likely to include the High Level Objectives, set out in either the Marine & Coastal Access Act (2009) or the DEFRA guidance to IFCA, but local level management allows for more locally specific objectives to also be included. This should state both short term & long term objectives and state how these will be measured. This could include social objectives and should include ecosystem objectives (MSC principle 3 requires that management includes ecosystem objectives). It is also worth explicitly stating in the management framework what will be the approach to precaution, in particular where data is lacking.

The management framework needs to highlight any needs for linking with other jurisdictions, if needed. For most inshore resources, where stocks will be managed adaptively by IFCA, it is likely that the resource is also fished in the neighbouring IFCA. Though it may be practical, reasonable and precautionary to assume an IFCA jurisdiction is the management boundary, it is best practice to engage with the neighbouring jurisdiction so that each can be aware of management actions and stock status in the other jurisdiction.

As well as detailing the reference points and the harvest control rule, the management plan should also detail how the HCR will be applied – by whom. Sensibly, for locally managed stocks such as these this would be done within the IFCA, but if so this should be added to a job description. Should there be a named fishery officer for each stock that the IFCA is taking a lead on adaptive management?

The fishery management plan should also detail the management decision making process and cycle. Where does ultimate responsibility for decision making lie? What information will decisions be based on? How will decisions be informed by consultations? How will decision making process respond to information presented? One successful approach in a number of more locally managed fisheries is to develop a **fishery working group**. Even if this body does not have power in terms of decision making it can play a vital advisory capacity and be the recognised conduit for stakeholder engagement in the management process. Another important element of management is communication – how will decisions and the reasons for those decisions be widely communicated to interested parties – again transparency is a key principle for such local stock management initiatives. Sensibly such a body would be engaged early on in the development of the Fishery Management Plan and perhaps coordinate wider stakeholder engagement in the various stages of HCR and management plan development.

6.3.5. Define management actions

The decision making entity should, through the decision making and consultation process give consideration to the requisite management measures. This is linked very much to the development of the harvest control rules, and the selection of measures which can be used to restrict fishing mortality in event of stock status falling below trigger reference points. However, other management measures may be included which are not directly linked to the harvest control rule. For example, these may be considered simply good and precautionary practice, or may already be successfully adopted bylaws, or may warrant inclusion in order to meet some of the wider fishery management objectives, such as reducing impacts on other ecosystem attributes, or reducing conflict with other users of marine resources.

A likely key consideration is whether there is a need for some form of permitting or limited entry.



This is likely to be required for most fisheries, partly as the permitting process is a tool to introduce flexible (adaptive) conditions of entry in the fishery, for example reflecting management response to changes in outcome status. This also plays an important role in engendering the sense of stewardship, which is an important step toward successful inshore management. However, if such an approach is not required, then it should be stated why it is not required, by illustrating that management retains the capacity to appropriately respond to changing stock status (or P2 ecosystem conditions).

When selecting measures and tools to control participation in the fishery (permitted / restricted vessels, gear, seasons, area, technical measures, move on rules etc), best practice is to consider how selection of those measures may positively incentivise responsible fishing. A good management planning process will consider likely behavioural responses to management measures and seek to avoid loopholes or perverse incentives. This is an explicit stage in the management planning process.

6.3.6. Determine Management Oversight

Management can only take an oversight of the success or otherwise of management actions with appropriate information feedback. This information feedback comes in many forms. Crucially, there is a requirement for routine monitoring of fishery performance to inform the on-going and timely calculation of the harvest control rule, so that restrictions can be applied as required. The Fishery Management Plan should define this process and data should be collected at an appropriate scale and in an appropriate form. Consider how best to engage stakeholders in the information collection process

Most fisheries require some form of enforcement of management rules. At best a system may be self-policing when management design leads to strong stewardship or incentives reward compliance. However, it is likely that some more formal enforcement will be required. The Fishery management planning process should therefore consider the risk factors for non-compliance and demonstrate how the enforcement strategy is tailored to address these risks. The Management Plan should also set out the penalties, in order to demonstrate effective deterrence, but also stipulate the right of appeal.

If historically the enforcement of logbooks and landing declarations has been the role of DEFRA agencies (MFA or MMO), it is important that the IFCA give explicit consideration to how the verification of landing declarations will work for those local shellfish resources being managed locally as any additional landing requirements (resulting from local management) will be outside the remit of the MMO.

6.3.7. Institutional, capacity & funding requirements

The resource implications associated with proposed future management activities maybe significant and have the potential to exceed the current capacity of S IFCA, especially given the existing on-going commitments described in section 2.4 of this report.

The fisheries management planning process should therefore consider what will be the costs of management and how will these costs be met? Are there the in house staffing capacities in order to undertake the additional management tasks? Is further training required in-house in order to undertake the tasks?

It may be important to therefore consider what if any external funding opportunities may be available for specific programmes and to what extent the requirements of management can be addressed within exiting budgets. Of course, opportunistic funding though extremely beneficial is no substitute for secure core funding and in house capacity.

Stage 4 of Project Inshore will continue until 2015. During this stage 4 the focus of the follow up available from the MSC English Fisheries Outreach team will be focussed on providing support for those fisheries wishing to move into full MSC assessment or undergo assistance though Fisheries Improvement Plans (FIPs). This has the potential to engage with those fisheries in a position to almost immediately enter the assessment process (section 3.2 of this report) and discussing



how best to form client groups, how best to address any remaining issues in preparation for full assessment and importantly to explore possible funding options. In addition the outreach work of Stage 4 might include working with IFCA's for those fisheries where the IFCA's are embarking on the process of stock management and provide support both in that process and in interpreting the results of Stage 2 and the advice of Stage 3.

6.3.8. Reviewing & Improving Management Performance

As well as routine and on-going monitoring needs, designed to ensure oversight of the fishery, there may be additional research requirements. A research planning process can be an important part of the wider management planning process and is an opportunity to consider gaps in knowledge and the research needs of management. In the context of the IFCA's, it is vital that in developing fishery specific management plans for those management units which can and will be managed locally that it is clearly understood at the outset what research capacity and funding is available. In particular it is important that it is clearly stipulated what scientific support is available from CEFAS and to what extent IFCA's will be charged for this. Clearly for some stocks, in some areas CEFAS take an active lead, but the management plan should clearly define where responsibility for research lies. This should help to identify any need for local capacity building in research, or budgets to be allocated to research as required, all as part of the management cycle.

Holistic Review and evaluation of management performance is also an important periodic task of any well run fishery. The process, timing and capacity needs for such evaluations should also be set out in the management plan. Valuable exercises in review and evaluation can be done 'in house' but valuable lessons can also be learned from inviting external review. One idea here might be for IFCA's to periodically review the performance of another IFCA's fishery specific management. This could be a useful tool to sharing best practice.

It is also important to engage stakeholders and in particular fishers in this process of management review, so that there is a wider understanding of how management is succeeding, or otherwise. An annual fishery stakeholder meeting has proved successful in many fisheries for this process.

6.3.9. Establish Management in Legislation

Once the above stages have been brought together into a Fishery Management Plan, the next stage of the process is to enshrine key aspects into legislation. Not everything will necessarily be required to be formally codified, but key technical aspects will be. Whether or not the actual fishery management plan would be referred to in legislation will be determined on a case by case basis and in some cases it may be simpler simply to define key aspects in legislation.

The byelaw making powers defined in the Marine & Coastal Access Act (2009) is likely to be the main process of making the management measures contained in the Fishery Management Plan legally binding. In some instances the Sea Fisheries (Shellfish) Act 1967 may be the appropriate vehicle in order to establish either a Regulating or Several Order, although this is a slower process, which may not be necessary if the byelaw making process allows sufficient scope for introducing adaptive permitting, or any other such measures deemed appropriate.

Section 155 of the Maritime and Coastal Access Act (2009) empowers IFCA's to make bylaws in order to carry out their duties, although these do not come into effect until confirmed by the Secretary of State. Section 156 of the Act sets out the types of management measures that may be taken. This provides an extensive range of possible measures which includes:

- Restrictions on gears, vessels, seasons or areas,
- Permits and the ability to both charge for and limit the number of permits
- Ability to limit the amount taken by either individuals or vessels

³ Although section 157 of the act does give the IFCA's powers to make emergency byelaws in event of urgent need or unforeseen circumstance, it is anticipated that this would be the appropriate route by which to introduce adaptive management measures for local stocks.



- Ability to require certain data collection and monitoring measures

Section 157 of the Act introduces the possibility for byelaws to include different provisions for different cases or different circumstances, including (in particular):

1. different parts of an IFC district;
2. different times of the year;
3. Different descriptions of sea fisheries resources.

Section 157 part c in particular indicates that the byelaw may include provision to adapt management measures in response to different stock status indicators. This appears to pave the way for introducing harvest control rules, relative to reference points, indicating what management measures would be taken in event of changes in stock status.

Use by IFCA of these increased powers, including this apparent scope for introducing adaptive fishery management measures, remains relatively untested since the act came into force in 2009. However, if efforts to introduce adaptive management of local stock management units are to be effective, and if required, that those also meet the principles and criteria of the MSC, then it seems likely that it is these additional powers which will need to be taken advantage of.



7. Developing management for priority fisheries

7.1. Potential responses to pre-assessment issues

The scoping exercise carried out as part of Project Inshore has identified four fisheries in the district which are locally important and where the Devon and Severn IFCA are best placed to lead on the development of stock management. These are:

- Brown crab
- Lobsters
- Whelks
- Scallops (with MMO)

For these fisheries Project Inshore has identified gaps, both in terms of being able to proceed to MSC full assessment, or in being able to demonstrate that stocks status and management controls are assuredly at the level of good management. This is not to say that these stocks are poorly managed, or over-exploited, merely that the current systems do not provide that assurance, so there may be challenges in demonstrating that the stocks are sustainably managed, either for regulatory or certification purposes.

For these fisheries, it is worth recapping here the pre-assessment scores and against each PI scoring below 80 (i.e. a gap) and highlight the types of research or management action which would address the gap. By highlighting areas where improvements are possible to inshore fisheries it is intended that IFCAs are able to use the Project Inshore outcomes as a roadmap towards more sustainable inshore fisheries. This seeks to link the theoretical findings of the pre-assessment with practical management actions. This is not intended to dictate a certain management direction, or provide definitive management steps but instead provide industry and regulators with practical steps that could be undertaken to enhance management. In each case, more comprehensive explanation of each of the suggested actions is provided elsewhere in the report. The fisheries are addressed in turn in order of management priority as determined by discussions with the IFCA officers.

The following tables present suggested actions in response to the issues highlighted by the pre-assessment specific to the priority stocks identified. At first sight these measures appear extensive, but many are applicable across all the SW fisheries and so can be tackled together and through the development of joint management plans involving all relevant IFCA districts. Those related to P1 for crab and lobster are for consideration by CEFAS.

Key	Recommended for FA	Conditions Likely	Challenges
	>80	60-80	<60

7.1.1. Brown crab (Western Channel) - pots

Summary results

Pre-assessment result		
P1	P2	P3

Potential actions

Brown Crab (pots)			Potential remedial work	
P1	1.2.1	60-80	Harvest Strategy	Regular review of the harvest strategy, including harvest control rules. This is likely to reflect existing measures, along with any additional measures deemed necessary.
	1.2.2	60-80	HCR	Develop, define and consult on appropriate harvest control rules, which reflect management targets (reference points). Need to take in to account uncertainties inc. growth rates and systemic changes to recruitment.



	1.2.3	60-80	Info & Monitoring	Collect and collate all relevant time series data. Ensure on-going data collection is at an appropriate spatial scale, tailored to needs of assessment with timely receipt and analysis. Consider unaccounted removals, inc. beam trawl discards and recreational catch (pots and divers)
	1.2.4	60-80	Stock assessment	Although the pre-assessment scored this PI at >80, this was due to default scoring triggered by the use of the MSC risk based framework to determine scores. Future management is likely to require the development of an empirical stock assessment. CEFAS Stock assessment should be peer reviewed
P2	2.1.1	<60	Retained Outcome	The pre-assessment scores are reduced by a potential bycatch of spider crab, some of which may be retained. This can be addressed either by demonstrating that spider crab is not a main retained species (>5% of catch) in the crab fishery, esp. in parlour pots.
	2.1.2	60-80	Retained Mgmt	Develop steps to ensure that the lobster fishery does not impact spider crab stocks. If spider crab is shown to not be a main retained bycatch (see above), then management is likely to score 80 without further steps.
	2.3.1	60-80	ETP Outcome	A fishery wishing to proceed with MSC certification should identify which are the ETP species which potentially interact with the fishery. The status of each should be reviewed in the context of information on the fishery impact. Consider indirect impacts.
	2.3.2	60-80	ETP Mgmt	Develop strategy to manage fishery's impact on ETP species. Review the ETP species with possible interactions, define if and where management action is required. Link to fleet operations, ensuring that appropriate action is being taken and the efficacy of management is reviewed.
	2.3.3	60-80	ETP Info	Provide quantitative data on the interaction between ETP species and the fishery. Detail how this data will be updated on a periodically appropriate timescale.
	2.4.3	60-80	Habitat Info	A fishery wishing to proceed with MSC certification should provide fleet specific information on spatial and temporal interactions between fishing gear and habitats (in particular vulnerable habitats). Management should also have some information on spatial patterns of the fishery and their change over time (which may provide indications in changes in stock patterns). iVMS will be an important potential tool.
P3	3.1.2	60-80	Mgmt Roles	A management plan, inc. a clear identification of different agency roles, should clearly define the limits of the fishery being managed, the underlying assumptions and where responsibility lies for management, science and enforcement.
	3.1.4	60-80	Incentives	Review whether open access (albeit permitted) provides a disincentive to sustainable operation. Consider linking access and gear restrictions to resource status. Investigate whether positive incentives can be introduced in the fishery as part of new management proposals.
	3.2.1	60-80	Objectives	A management plan set short and long term objectives, referencing both local priorities and objectives in higher level policy. This should reflect both Principle 1 (target stock status) and Principle 2 (ecosystem) objectives. Where possible these should be well defined and measurable.



	3.2.2	60-80	Decision making process	Fully define management and processes in a management plan including consultative processes. How will key decisions be taken? What information will be used to inform these? How will stakeholders participate in the decision-making process?
	3.2.3	60-80	Compliance & Enforcement	Current practise may already meet the requisite SG80 level, however, a fishery specific management plan should review and demonstrate that enforcement is appropriate and effective and focused on risks of non-compliance. Consider potential to incentivise self-regulation in the fishery and system of cross-checks.
	3.2.5	60-80	Monitoring & Evaluation	The Management plan should specify a programme of monitoring and evaluation – both routine internal evaluation and periodic external evaluation.

7.1.2. Lobster (South-west) - Pots

Summary results

Pre-assessment result		
P1	P2	P3

Potential actions

Lobster (pots)			Potential remedial actions	
P1	1.1.1	60-80	Status	Demonstrated to be High Risk during MSC risk based scoring exercise, therefore empirical assessment required to demonstrate stock status. Maybe focus on LPUE rather than CPUE trends via shellfish return data.
	1.2.1	<60	Harvest Strategy	Detail an overarching harvest strategy, including harvest control rule, with regular review. This is likely to reflect existing measures, along with any additional measures deemed necessary.
	1.2.2	<60	HCR	Develop, define and consult on appropriate harvest control rules, which reflect management targets (reference points).
	1.2.3	60-80	Info & Monitoring	Collect and collate all relevant time series data. Ensure on-going data collection is at an appropriate spatial scale, tailored to needs of assessment with timely receipt and analysis. Consider unaccounted removals, inc. beam trawl discards and recreational catch (pots and divers).
	1.2.4	60-80	Stock assessment	Although the pre-assessment scored this PI at >80, this was due to default scoring triggered by the use of the MSC risk based framework to determine scores. Future management is likely to require the development of an empirical stock assessment.
P2	2.1.1	<60	Retained Outcome	The pre-assessment scores are reduced by a potential bycatch of spider crab, some of which may be retained. This can be addressed either by demonstrating that spider crab is not a main retained species (>5% of catch) in the lobster fishery.
	2.1.2	60-80	Retained Mgmt	Develop steps to ensure that the lobster fishery does not impact spider crab stocks. If spider crab is shown to not be a main retained bycatch (see above), then management is likely to score 80 without further steps.
	2.3.1	60-80	ETP Outcome	A fishery wishing to proceed with MSC certification should identify which are the ETP species which potentially interact with the fishery. The status of each should be reviewed in the context of information on the fishery impact. Consider indirect impacts.



	2.3.2	60-80	ETP Mgmt	Develop strategy to manage fishery's impact on ETP species. Review the ETP species with possible interactions, define if and where management action is required. Link to fleet operations, ensuring that appropriate action is being taken and the efficacy of management is reviewed.
	2.3.3	60-80	ETP Info	Provide quantitative data on the interaction between ETP species and the fishery. Detail how this data will be updated on a periodically appropriate timescale.
	2.4.3	60-80	Habitat Info	A fishery wishing to proceed with MSC certification should provide fleet specific information on spatial and temporal interactions between fishing gear and habitats (in particular vulnerable habitats). Management should also have some information on spatial patterns of the fishery and their change over time (which may provide indications in changes in stock patterns). iVMS will be an important potential tool.
P3	3.1.2	60-80	Mgmt Roles	A management plan, inc. a clear identification of different agency roles, should clearly define the limits of the fishery being managed, the underlying assumptions and where responsibility lies for management, science and enforcement.
	3.1.4	60-80	Incentives	Review whether open access (albeit permitted) provides a disincentive to sustainable operation. Consider linking access and gear restrictions to resource status. Investigate whether positive incentives can be introduced in the fishery as part of new management proposals.
	3.2.1	60-80	Objectives	A management plan set short and long term objectives, referencing both local priorities and objectives in higher level policy. This should reflect both Principle 1 (target stock status) and Principle 2 (ecosystem) objectives. Where possible these should be well defined and measurable.
	3.2.2	60-80	Decision making process	Fully define management and processes in a management plan including consultative processes. How will key decisions be taken? What information will be used to inform these? How will stakeholders participate in the decision-making process?
	3.2.3	60-80	Compliance & Enforcement	Current practise may already meet the requisite SG80 level, however, a fishery specific management plan should review and demonstrate that enforcement is appropriate and effective and focused on risks of non-compliance. Consider potential to incentivise self-regulation in the fishery and system of cross-checks.
	3.2.5	60-80	Monitoring & Evaluation	The Management plan should specify a programme of monitoring and evaluation – both routine internal evaluation and periodic external evaluation.

7.1.3. Scallops (Western Channel) – Mechanised dredges

Pre-assessment result		
P1	P2	P3

Summary results

The following analysis focuses on scallops landed in the Devon and Severn District. It is estimated that around 2/3 of scallops are harvested within IFCA waters, with the remainder being outside the 6 nm limit. One specific fishery – the Salcombe scallop fishery - may be a particular candidate for MSC certification, as it has limited entry via a permitting scheme (11 boats) and a MLS 110 mm



(not the usual 100 mm).

Potential actions

Scallops			Potential remedial work	
P1	1.1.1	<60	Status	Demonstrated to be High Risk during MSC risk based scoring exercise, therefore empirical assessment required to demonstrate stock status.
	1.2.1	<60	Harvest Strategy	Detail an overarching harvest strategy, including harvest control rule. This is likely to reflect existing measures, along with any additional measures deemed necessary.
	1.2.2	<60	HCR	Develop, define and consult on appropriate harvest control rules, which reflect management targets (reference points).
	1.2.3	60-80	Info & Monitoring	Collect and collate all relevant time series data. Ensure on-going data collection is at an appropriate spatial scale, tailored to needs of assessment with timely receipt and analysis.
P2	2.2.1	60-80	Bycatch Outcome	The pre-assessment scores are reduced by a potential bycatch and dredge-associated mortality of brown crab, some of which may be retained. This can be addressed either by demonstrating that brown crab and other mobile & non-mobile fauna is not a main retained species (>5% of catch) in the scallop fishery.
	2.2.2	60-80	Bycatch Management	Develop steps to ensure that the scallop fishery does not impact brown crab stocks, or any other major (e.g., >5%) component of the catch. If brown crab is shown to not be a main retained bycatch (see above), then management is likely to score 80 without further steps.
	2.2.3	60-80	Bycatch Info	Provide quantitative data on the interaction between bycatch species and the fishery. Detail how this data will be updated on a periodically appropriate timescale.
	2.3.1	60-80	ETP Outcome	A fishery wishing to proceed with MSC certification should identify which are the ETP species which potentially interact with the fishery. The status of each should be reviewed in the context of information on the fishery impact. Consider indirect impacts.
	2.3.2	60-80	ETP Management	Develop strategy to manage fishery's impact on ETP species. Review the ETP species with possible interactions, define if and where management action is required. Link to fleet operations, ensuring that appropriate action is being taken and the efficacy of management is reviewed.
	2.4.1	<60	Habitat Outcome	Scallop dredge fisheries have the potential to cause significant benthic impact. Whether this is serious or irreversible, as per the MSC definition depends on the wider efforts of management and requires good empirical evidence to support justification.
	2.2.2	60-80	Habitat Management	Dredge fisheries have a greater need to demonstrate that potential habitat impacts are fully understood and where necessary mitigated by management and the actions of the fleet. This is particularly the case where a fishery wishes to pursue MSC certification.
	2.4.3	60-80	Habitat Info	A fishery wishing to proceed with MSC certification should provide fleet specific information on spatial and temporal interactions between fishing gear and habitats (in particular vulnerable habitats in amber areas). Management should also have some information on spatial patterns of the fishery and their change over time (which may provide indications in changes in stock patterns). iVMS will be an important potential tool.



P3	3.1.2	60-80	Mgmt Roles	A management plan, inc. a clear identification of different agency roles, should clearly define the limits of the fishery being managed, the underlying assumptions and where responsibility lies for management, science and enforcement.
	3.1.4	60-80	Incentives	Investigate whether positive incentives can be introduced in the fishery as part of new management proposals.
	3.2.1	60-80	Objectives	A management plan set short and long term objectives, referencing both local priorities and objectives in higher level policy. This should reflect both Principle 1 (target stock status) and Principle 2 (ecosystem) objectives. Where possible these should be well defined and measurable.
	3.2.2	60-80	Decision making process	Fully define management and processes in a management plan including consultative processes. How will key decisions be taken? What information will be used to inform these? How will stakeholders participate in the decision-making process?
	3.2.3	60-80	Compliance & Enforcement	Current practise may already meet the requisite SG80 level, however, a fishery specific management plan should review and demonstrate that enforcement is appropriate and effective and focused on risks of non-compliance. Consider potential to incentivise self-regulation in the fishery and system of cross-checks.
	3.2.4	60-80	Research Plan	A management plan should define areas requiring further research to support management. Responsibility for research should be clearly defined. In the past CEFAS have led on much research – will this continue under a new definition of management unit?

7.1.4. Whelks (Western & East Channel Stocks) - Pots

Pre-assessment result		
P1	P2	P3

Summary results

Whelks			Potential remedial work	
P1	1.1.1	<60	Status	Demonstrated to be High Risk during MSC risk based scoring exercise, therefore empirical assessment required to demonstrate stock status.
	1.1.2	>80	Reference points	Although the pre-assessment scored this PI at >80, this was due to default scoring triggered by the use of the MSC risk based framework to determine scores. Future management is likely to be based on a more empirical form of stock assessment; therefore this should include appropriate reference points.
	1.2.1	<60	Harvest Strategy	Detail an overarching harvest strategy, including harvest control rule. This is likely to reflect existing measures, along with any additional measures deemed necessary (notably inclusion of an HCR).
	1.2.2	<60	HCR	Develop, define and consult on appropriate harvest control rules, which reflect management targets (reference points). These should be implemented.
	1.2.3	<60	Info & Monitoring	Collect and collate all relevant time series data. Ensure on-going data collection appropriate to needs of assessment, at an appropriate spatial scale and passes to management.
P3	2.3.1	60-80	ETP Outcome	A fishery wishing to proceed with MSC certification should identify which are the ETP species which potentially interact with the fishery. The status of each should be reviewed in the context of information on the fishery impact. Consider indirect impacts.

Potential actions



	2.3.2	60-80	ETP Mgmt	Develop strategy to manage fishery's impact on ETP species. Review the ETP species with possible interactions, define if and where management action is required. Link to fleet operations, ensuring that appropriate action is being taken and the efficacy of management is reviewed.
	2.3.3	60-80	ETP Info	Provide quantitative data on the interaction between ETP species and the fishery. Detail how this data will be updated on a periodically appropriate timescale.
	2.4.3	60-80	Habitat Info	A fishery wishing to proceed with MSC certification should provide fleet specific information on spatial and temporal interactions between fishing gear and habitats (in particular vulnerable habitats). Management should also have some information on spatial patterns of the fishery and their change over time (which may provide indications in changes in stock patterns). Recognise this is underway through DORIS and C-scope.
P3	3.1.2	60-80	Mgmt Roles	A management plan, inc. a clear identification of different agency roles, should clearly define the limits of the fishery being managed, the underlying assumptions and where responsibility lies for management, science and enforcement.
	3.1.4	60-80	Incentives	Review whether open access (albeit permitted) provides a disincentive to sustainable operation. Consider linking access to resource status. Investigate whether positive incentives can be introduced in the fishery as part of new management proposals.
	3.2.1	60-80	Objectives	A management plan set short and long term objectives, referencing both local priorities and objectives in higher level policy. This should reflect both Principle 1 (target stock status) and Principle 2 (ecosystem) objectives. Where possible these should be well defined and measurable.
	3.2.2	60-80	Decision making process	Fully define management and processes in a management plan including consultative processes. How will key decisions be taken? What information will be used to inform these? How will stakeholders participate in the decision-making process?
	3.2.3	60-80	Compliance & Enforcement	Current practise may already meet the requisite SG80 level, however, a fishery specific management plan should review and demonstrate that enforcement is appropriate and effective and focused on risks of non-compliance. Consider potential to incentivise self-regulation in the fishery and system of cross-checks.
	3.2.4	60-80	Research Plan	The Management plan should define areas requiring further research to support management. Responsibility for research should be clearly defined (in particular with CEFAS).
	3.2.5	<60	Monitoring & Evaluation	The Management plan should specify a programme of monitoring and evaluation – both routine internal evaluation and periodic external evaluation.

7.2. Potential timeline for development of management

It is difficult, and perhaps inappropriate, for an external project such as this to make recommendations about possible project timelines. This is particularly so in this case given the existing commitments already placed on IFCA's, referred to in section 2.4 of this report. Below we instead set out a theoretical timeline and, equally important, a chronology of the steps taken toward implementing adaptive stock management. This is set in a single fishery example so would need to be adapted where multiple fisheries are moving through the process at the same time. This timeline could be both shortened or lengthened depending on available capacity, however the process should not be unduly rushed and time should be allowed for proper consultation, testing and establishing in law.

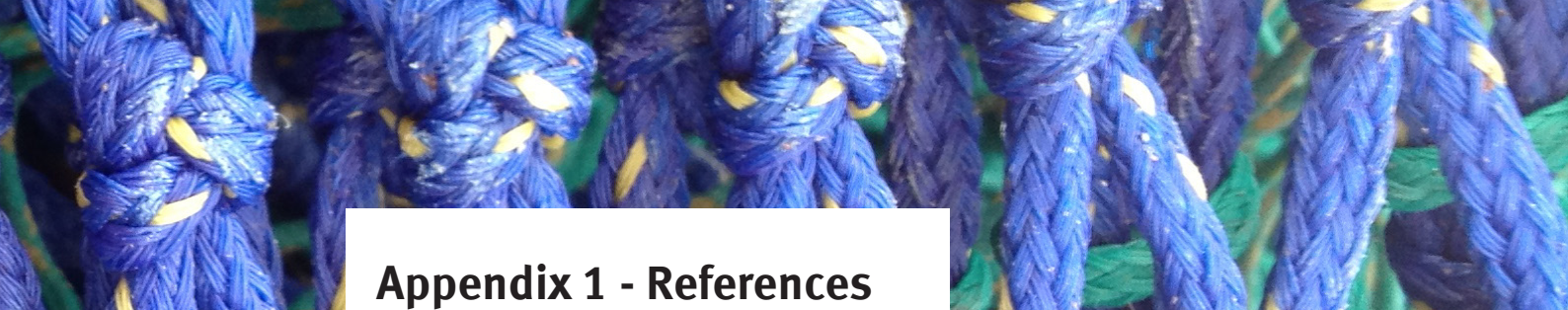


	Stage	1	2	3	4	5	6	7	8
Identify stocks to be locally managed & develop supporting rationale for local stock management unit	X								
Identify stakeholders and establish initial fishery 'Working Group'	X								
Collate and review available stock & time series data	X								
Define fishery objectives, decision-making processes, consultation mechanisms and communication methods.	X								
Undertake initial empirical assessments of available data and if possible make initial HCR and reference point proposals.	X	X							
Define the on-going stock monitoring data requirements and determine how management will meet these.		X							
Define management measures and restrictions – review existing byelaws and identify where additional measures required (in particular to allow adaptive exploitation rates)		X							
Define capacity and funding requirements		X							
Determine on-going scientific costs and capacity needs and how these will be met.		X							
Where required draw up additional MoUs with other fisheries sector bodies to clarify roles & responsibilities		X	X						
Draft Fisheries Management Plan. And comment process of ensuring binding requirements codified as byelaws.		X	X						
Consult of proposed stock management process and seek stakeholder 'buy-in' for management decisions.		X	X						
Commence operation of fishery under the terms of the Management Plan, with exploitation levels determined by reference to harvest control rule.			X						
Undertake on-going monitoring of stock status and application of HCR.			X	X	X	X	X	X	X
Undertake periodic evaluation & testing of stock assessment and harvest control rules				X					X
Undertake holistic evaluation of overall performance of the fishery management system.									X
Begin MSC assessment process (if required)			X	X					

Table 10:

Potential timeline for development of local adaptive stock management.

Stage 1-3	Proposed FIP Stage
Stage 3-4	Potential MSC Assessment Stage
Stage 3-8	Routine Evaluation of Fishery



Appendix 1 - References

- Armstrong, M, A. Brown, J. Hargreaves, K. Hyder, S. Pilgrim-Morrison, M. Munday, S. Proctor, A. Roberts and K. Williamson (2013).** Sea Angling 2012 – a survey of recreational sea angling activity and economic value in England. Downloaded from <http://www.marinemangement.org.uk/seaangling/documents/finalreport.pdf>
- Bannister, C. (2006).** Towards a national development strategy for shellfish in England. Downloaded from <http://www.shellfish.org.uk/files/60186Bannister.pdf> on 20 December 2013.
- Brown, A., M. Munday, A. Roberts, M. Armstrong, K. Hyder and E. Oughton (2013).** Annex 2: The Economic and Social Value of Recreational Sea Angling in England. In ‘Sea Angling 2012 – a survey of recreational sea angling activity and economic value in England.
- Dapling T.M., Clark R.W.E., & Vause B.J., Medley, P., C.R.C. Carleton. 2010.** “Navigating the Future”. Developing Sustainable Inshore Fisheries. The UK Inshore Fisheries Sustainability Project.
- Devon & Severn IFCA (2012).** IFCA Annual Research Plan 2012-2013. Available from http://www.devonandsevernifca.gov.uk/sitedata/Misc/D_SIFCA_Research_Plan2012-.pdf
- Devon & Severn IFCA (2013).** Devon & Severn IFCA Annual Report (2013-14). Available at http://www.devonandsevernifca.gov.uk/sitedata/Misc/DSIFCAAnnualPlan13_14.pdf
- EC (1992).** Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
- EC (2009).** Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds
- Honey KT, Moxley, JH, Fujita, RM (2010).** Managing Data-Poor Fisheries: Case Studies, Models & Solutions 1:159–184, 2010.
- Marine Management Organisation (2012).** Memorandum of Understanding between the Marine Management Organisation (MMO) and Inshore Fisheries and Conservation Authorities (IFCAs). Available on-line at: <http://www.marinemangement.org.uk/about/documents/mou/ifcas.pdf>
- Pilling GM, Apostolaki P, Failler P, Floros C, Large PA, Morales-Nin B, Reglero P, Stergiou KI & Tsikliras AC (2008).** Assessment and management of data-poor fisheries. In: A Payne, J Cotter, T Potter (eds) Advances in Fisheries science: 50 years on from Beverton and Holt, pp. 280-305. Blackwell Publishing, CEFAS.
- Rochet, M-J., and Rice, J. C. (2005).** Do explicit criteria help in selecting indicators for ecosystem-based fisheries management? e ICES Journal of Marine Science, 62: 528e539. Available from <http://icesjms.oxfordjournals.org/content/62/3/528.full.pdf>
- UK Government (2009).** Marine and Coastal Access Act 2009. Available from <http://www.legislation.gov.uk/ukpga/2009/23/contents>
- UK Government (2010).** The Devon & Severn Inshore Fisheries and Conservation Order 2010 (Statutory Instruments 2010 No. 2198). Available from <http://www.legislation.gov.uk/uksi/2010/2198/made>
- UK Government (2012).** The Conservation of Habitats and Species (Amendment) Regulations 2012. No. 1927. Available from <http://www.legislation.gov.uk/uksi/2012/1927/regulation/20/made>

Appendix 2 - IFCA Stock Management Scoping

IFCA Priority	Species	Gear	Landings (t)	Value £ (avg. 2006-2010)	Ranking		Scoring				
					By value	Scored	Management level	Stock / jurisdiction	Value	Socio-economic	Aggregate score
High	Scallops	Mechanized dredges	5,867	£8,658,099	1	1	3	3	3	3	2.63
	Brown Crab (S&N coast)	Pots	5,527	£7,718,990	2	2	3	2	3	3	2.38
	Lobster (S&N coast)	Pots	194	£1,862,071	10	2	3	3	2	3	2.38
	Velvet / green crabs	Pots	1,213	£865,360	20	2	3	3	3	1	2.38
	Plaice	Otter trawls	382	£546,672	22	5	2	2	3	2	2.00
	Sole	Otter trawls	87	£715,190	21	5	2	2	3	2	2.00
	Bass	Otter trawls	280	£1,640,250	13	7	2	2	2	3	1.88
	Whelks	Pots	4,279	£2,669,255	7	7	1	3	2	3	1.88
	Skates and Rays	Otter trawls	1,148	£1,501,825	14	9	2	2	2	2	1.75
Cuttlefish (South coast)	Pots	20	£30,805	86	n/a	2	1	2	2	1.63	
Low	Cuttlefish	Beam trawls	2,183	£3,566,981	4	10	2	1	2	3	1.63
	Monks or Anglers	Beam trawls	610	£1,647,413	12	10	2	1	2	3	1.63
	Plaice	Beam trawls	1,214	£1,851,746	11	10	2	1	2	3	1.63
	Sole	Beam trawls	659	£6,150,514	3	10	1	1	3	3	1.63
	Brill	Beam trawls	167	£1,049,641	17	14	2	1	2	2	1.50
	Cuttlefish	Otter trawls	1,195	£1,922,913	9	14	2	1	2	2	1.50
	Lemon Sole	Otter trawls	661	£2,481,014	8	14	2	1	2	2	1.50
	Lemon Sole	Beam trawls	192	£920,810	19	14	2	1	2	2	1.50
	Squid	Otter trawls	668	£3,139,893	5	14	2	1	2	2	1.50
	Turbot	Beam trawls	96	£1,002,292	18	14	2	1	2	2	1.50
	Pilchards	Otter trawls - midwater	9,846	£2,817,660	6	20	1	2	2	1	1.38
Sprats	Otter trawls - midwater	4,706	£1,049,827	16	20	1	2	2	1	1.38	



This assessment was derived from the Stage 2 pre-assessment. Please note that text in italics is based on comments made to the author during a meeting with the D&SIFCA on Friday 4 October 2013.

Table 11:
Assessment of the
current status of
key fisheries in the
IFCA district and the
D&SIFCA commentary

	Recommended (>80)	Conditions likely (60-80)	Challenges (<60)	
	Species / gears	P1 Stock status and management)	P2 (Ecosystem, bycatch / ETPs / habitats)	P3 (Fisheries management / governance)
Scallop / Dredges (1)	No reference points, RBF high risk, no harvest strategy (exc. MLS which protects spawning potential but is not responsive to stock status). <i>Has a closed season July – Sept (<6 nm to allow spawning recovery). Curfew 7 pm -7am</i> <i>A small scallop fishery in Salcombe may be a candidate for MSC certification, as it has limited entry via a permitting scheme (11 boats) and a MLS 110 mm (not the usual 100 mm)</i>	Status and info on discards? (e.g., ocean quahog?). <i>No regular recording. IFCA do monitor MLS. 4-5 trips per season (Salcombe fishery).</i> <i>Habitats: need for spatial management</i> <i>Major closures already e.g., Lyme Bay SI, IPA, estuaries, Lundy MPA. Sara to work out areas). New permitting bylaws will be increased restriction to towed gear, but will allow access to non red and potentially amber areas when AA's done. Towed gear guidelines will ensure that gear must be lashed and stowed on areas of high risk in EMS's.</i>	Jurisdictional confusion over MMO / IFCA rules? <i>Rules and byelaws are clear. Good working relationship with MMO, inc. joint MCS deployments.</i> Restricted days (Western Effort rules) may concentrate effort inshore. Decision-making impacted by uncertain high level environment Misreporting (Vlld to e) MMO involvement. Linking research to strategic objectives <i>need more biological research, maturity levels, larval movement and settlement and need for juvenile protection</i> <i>iVMS – intention to roll out to all commercial vessels.</i>	
Brown crab / pots (2=)	Need to review HC strategy and better understand uncertainties. Need to better understand CPUE (via digitization of the shellfish returns) which will provide CPUE and encourage more robust returns) and unaccounted for fishing mortality (crabs retained for whelk bait – D&SIFCA examining, esp. If smashed up. Needs external review.	Unknown spider crab bycatch. Mostly parlour pots with an escape gap. <i>Mostly thrown back with a presumed low level of mortality.</i> Poor knowledge of and management of interactions with ETPs. <i>Very limited interactions. Not a known issue. Some CEFAS make observations.</i> Habitat info scores constrained by lack of spatial knowledge of inshore activity <i>Will be covered by iVMS in time. Have potting surveys for both coasts. Last done in 2008 but status not significantly changed. Some doubt over recreational potting.</i>	Is there a lack of clarity over non-quota shellfish stock management in UK waters. <i>Shellfish are a major IFCA focus. MMO only monitor landings.</i> IFCA IS a statutory consultees for marine planning. Poor ability to restrict effort, esp. out of district vessels. <i>Will do so via potting permitting byelaw (March 2014) . Will include number of pots, vessel details. iVMS may become a permitting condition in time.</i> <i>But a lot of recreational pots. But will be a recreational limit of 5 pots and limited catch. Will inc. Scallops</i> Lack of fisheries-specific management (see Banister 2009) <i>New stock assessments by Cefas. Looking to Brown Crab management.</i>	
Lobster / pots (2=)	Stock above LRP, but no full rebuilding plan. HCR unlikely to achieve objectives, with male biomass declining to Blim. HCR not subject to regular review. CPUE robustness needs improvement – <i>maybe focus on LPUE rather than CPUE with shellfish return data. Close escape gaps for survey work so get better idea of abundance. Lots of lobster work around Lundy, but could be extended to other key areas.</i> <i>Considering a maximum landing size and slot size for male lobsters. Have data collected, but needs analysing. Fisher support for max LS.</i>		Variable compliance. <i>Little undersize brown crab, but offenses on undersize lobster possible e.g., misreported lobster. But new deeming law will reduce the latter.</i>	



Velvet crabs / pots (2=)	Stock unknown (RBF high risk) HCR (MLS) not monitored, evaluated or proven to be effective. <i>Has a MLS. Not a major fishery, has to use inkwells and is more of a bycatch.</i>		Same as above, plus velvets not included in research planning. <i>Insufficient</i>
NOTE WAS 'OTHERS. MAY BE OVER-STATING CATCH	Info on landings insufficient to monitor stock status. SFR specify velvets? <i>Yes certainly new ones as well as whelks</i>		
WC Plaice / TR2 OTB (5=)	Reference points defined, except no formal LRP.	Possible brill bycatch, discarding of cod, dogfish & ocean quahog; <i>discarding may be banned in CFP reform. Not an IFCA concern.</i>	Need for long-term objectives for this fishery.
WC Sole / TR2 OTB (5=)	No firm LRPs HCR not fully evaluated		
Bass Otter trawl (7=)	Harvest control strategy in place, but unproven No limits on fishing mortality, esp. in recreational fisheries. <i>Is an IFCA / MMO target fishery. Protected in estuaries by nurseries areas. Most anglers don't target below 40 mm. Reviewing netting byelaws (2014) on mullet and bass. . Difficult to limit H&L bag limits. Cefas 20112 study across all IFCAS. Will inform other potential controls. More detailed work in the Severn. May focus on controlling certain recreational fisheries / species / areas / gears .</i> Stock structure now well known.	ETP interactions? Shad, angel shark & common skate? <i>Is an issue in Severn and Plymouth Sound EMS'. None are high risk red areas, but will undergo appropriate assessments as amber areas. Mobile nets, fixed nets and seine netting and trawling. But these areas will be no trawl areas.</i> Habitat: vulnerability and management <i>Most vulnerable habitats are contained in EMS and subject to appropriate assessments (AAs).</i>	Is there a lack of clarity over non-quota finfish stock management in UK waters. Disincentive to control local boats if foreign / recreational fisheries not controlled. <i>Trying to bring in parity in byelaws. Non-local boats will have to have a towed permit.</i> No fisheries-specific objectives Lack of control of recreational fisheries SEE P1
Whelks / Pots (WC & BC stocks) (7=)	Stock status not known and high risk (RBF) HCR (MLS) may be higher than size at maturity. <i>Finished yearlong survey at size at sexual maturity on both coasts and are analysing data with the review to revising the MLS in D&S responsibility.</i> Lack of stock status indicators. <i>Shellfish returns will include whelks and allow LPUE calculations.</i>	No information on possible ETP interactions; Need positional information for habitats interactions. <i>Included in potting surveys (not as detailed as brown crab). Will eventually be included in iVMS. Recent survey of whelk fishery included spatial grids.</i>	Is there a lack of clarity over non-quota shellfish stock management in UK waters IFCA IS a statutory consultees for marine planning. Poor ability to restrict effort, esp. out of district vessels Lack of fisheries-specific management (see Banister 2009) Variable compliance
Cuttlefish / Beam trawl C (9=)	Stock status not known and high risk (RBF) No harvest strategy or rules. <i>Need to understand inshore spawning / stock importance interaction. Participated in the crèche project. Need to allow the eggs to hatch. Need to encourage inshore fleet to leave pots in the water or allow them to survive. Eelgrass beds are a natural spawning substrate and will be protected within ems.</i> Very little stock information / stock status indicators	Green / swimming crab & dogfish discards? ETP interactions? Shad, angel shark & common skate? Habitat: vulnerability and management Brill: Dab bycatch issue?	Is there a lack of clarity over non-quota shellfish stock management in UK waters. Open access fishery, esp. foreign / non-IFCA vessels No byelaws for this species, so no fisheries-specific management No IFCA led research and limited overall research . <i>CRESH project is important.</i> Not clear if IFCA / MMO managed. <i>No management so could be either! But IFCA will manage inshore spawning habitats (eelgrass).</i>
Plaice / Beam Trawl WC (9=)	Reference points defined, except no formal LRP.		Need for long-term objectives for this fishery.



Sole / Beam Trawl WC (9=)	No firm LRPs HCR not fully evaluated		
Brill / Beam trawl (13=)	Stock status unknown HCR likely to prevent over-fishing, but has not been tested or evaluated No fisheries objectives, reference points or management plan. <i>Towed gear byelaw.</i>		Short-term management objective is effectively the TAC – but this can deviate from scientific advice. No species-specific research No fisheries plan M&E
Cuttlefish / TR2 (13=)	Stock status not known and high risk (RBF) No harvest strategy or rules Very little stock information / stock status indicators	Possible brill bycatch, discarding of cod, dogfish & ocean quahog; ETP interactions? Shad, angel shark & common skate? Habitat: vulnerability and management	Is there a lack of clarity over non-quota shellfish stock management in UK waters. Open access fishery, esp. foreign / non-IFCA vessels No byelaws for this species, so no fisheries-specific management No IFCA led research and limited overall research Not clear if IFCA / MMO managed
Lemon sole / TR2 (13=)	No target reference point No HCR (e.g., MLS or TAC) <i>Used to until 2000, but no longer.</i>	Possible plaice bycatch, discarding of cod, dogfish & ocean quahog; ETP interactions? Shad, angel shark & common skate? Habitat: vulnerability and management	Is there a lack of clarity over non-quota finfish stock management in UK waters e.g., who would impose any MLS, etc. No relevant byelaws (although towed byelaw will restrict spatial effort) Disincentive to control local boats if foreign / recreational fisheries not controlled
Lemon sole / Beam trawl (13=)		Plaice bycatch?	
Turbot / Beam trawl (13=)	Unknown stock, heavily fished (mainly as a bycatch) and at high risk.	Green / swimming crab & dogfish discards? ETP interactions? Shad, angel shark & common skate? Habitat: vulnerability and management Brill bycatch. Otherwise as above	No fisheries-specific objectives Neither IFCA, CEFAS nor ICES have any species-specific research.
Pilchard / PS (19=)	Low risk stock, but poorly understood	Potential but un-estimated ETP impacts	Is there a lack of clarity over non-quota finfish stock management in UK waters e.g., who would impose any MLS, etc. No relevant byelaws Disincentive to control local boats if foreign / recreational fisheries not controlled No fisheries-specific objectives Need to coordinate with CEFAS research
Sprat / Pelagic trawl (19=)	Stock status is unknown. HCR in place, but not known if effective / responsive to the stock status.	Horse mackerel discards – stock is over-fished. Possible shad (ETP) bycatch, not managed. Most shad are estuarine / inshore in nature	Short-term management objective is effectively the TAC – but this can deviate from scientific advice. No species-specific research No fisheries plan M&E
Cuttlefish / Cuttle trap (21)	Stock status not known and high risk (RBF) No harvest strategy or rules Very little stock information / stock status indicators	No information on possible ETP interactions; Need positional information for habitats interactions <i>CRESH project and encouraging fishers to leave egg-coated pots. Have dine mast projects on substrate preferences.</i>	Is there a lack of clarity over non-quota shellfish stock management in UK waters. Open access fishery, esp. foreign / non-IFCA vessels No byelaws for this species, so no fisheries-specific management No IFCA led research and limited overall research Not clear if IFCA / MMO managed



Appendix 3 - HCR development for lobster

To meet all requirements under Principle 1, it should be possible to develop and implement a Harvest Control Rule (HCR) framework. This determines stock status (PI 1.1.1-3), and can be built on appropriate data and assessment (PI 1.2.3-4) as well as play a central role in the harvest strategy (PI 1.2.1-2).

A generic solution to harvest control rules is presented in Appendix 3. A specific example of the strategy that might be adopted is described here for lobster. The process can be divided into four tasks:

1. Define management units
2. Define set of possible HCRs for each management unit
3. Develop stock assessment model to evaluate HCR
4. Conduct a stakeholder review to determine HCR to be implemented

The tasks above apply to all fisheries implementing HCRs, but applying the same management system to small scale fisheries (e.g. lobster) as used by large scale fisheries (e.g. North Sea autumn spawning herring) is not possible. There are insufficient financial and technical resources available to develop this sort of management, and therefore a more appropriate scale of management is required.

A more appropriate HCR for inshore fisheries would have the following attributes:

- Promote engagement with all stakeholders, particularly managers, scientists and fishers.
- Inexpensive to implement, and specifically can be administered within the financial and technical resources available to manage these fisheries.
- Makes the best use of all available information.

It is important to involve as wide a selection of stakeholders as possible in the inshore fisheries management processes. Although this is also good practice in large scale fisheries, it is almost a requirement in small scale fisheries. Apart from anything else, enforcement is made much easier if all stakeholders support the management controls that are being applied.

Generally, IFCA's have good systems to consult with stakeholders, and this should meet requirements under MSC Principle 3. For fisheries operating under regulating orders, the fishing community is fully engaged with the management process, including the stock assessment. This represents a good model to implement in other inshore fisheries. Therefore, IFCA's should seek to develop an appropriate management system that meets the same criteria as regulating orders, where regulating orders cannot be implemented. Central to the idea of engagement is to involve stakeholders in developing and agreeing an appropriate HCR.

Define Management Units

Clear management units (stocks) need to be defined. This should be based on stock biology, fishery units and jurisdiction. Adult lobster are not thought to be migratory, although larvae are pelagic and could be more widely dispersed. The best approach is likely to be to define management units based primarily on jurisdiction, but with reference to adjoining IFCA's to coordinate management. However, it is most important to set up a working hypothesis for management units. This is precautionary. Although these hypotheses might be challenged, the onus should be disproving this hypothesis (that these units can be managed under the current system) rather than changing management units based on the balance of scientific evidence alone, which does not address management needs.

Although many issues might be resolved by extending the IFCA jurisdiction from 6 to 12 miles, it makes more sense to designate all stocks that can be managed locally as "inshore" and therefore the responsibility of the IFCA regardless of where they are caught (within or outside the 6 or 12 mile limit). Lobster should be made the responsibility of the relevant IFCA's.

The possible effect of any exchange with other stocks can be tested as part of the HCR evaluation.



This can be done either as a sophisticated migration model, or running separate stock assessments with catches split or combined depending on the stock area, for example. It is likely that, as long as HCRs are harmonised across IFCAs, the harvest strategy is likely to be robust across a range of hypothetical management units.

Define the Set of Possible HCRs

Once a management unit is defined, possible HCRs can be developed. HCRs should be determined by the available data, effective management controls, costs of implementation and the need for stakeholder engagement.

Alternative indicators could be based on subsets of data (e.g. discards for a recruitment index) or different measures (e.g. mean size by sex). Several indicators could be used (e.g. a traffic lights system), but in this case the HCR might begin to become too complex, and stakeholder engagement will be lost. Alternative controls could include variable closed areas or closed seasons, alterations in the MLS and so on. Criteria for the controls are that it should be possible to adjust them at short notice and it should be possible to evaluate their effect. Controls should be divided between those used to achieve the target (i.e. permanent controls that are not adjusted) and those used to bring about a stock recovery (i.e. temporary controls that can be used to reduce fishing mortality over a few years). Of course, recovery controls may also be applied as a target control, but there should be an ability to further restrict fishing when necessary.

Possible indicators can be developed from compiling the available data and considering relationships that might exist between the reproductive potential of the stock and the indicators (Table 14). Effective controls can be identified from considering enforcement issues, likely compliance and whether the control will have the desired effect (i.e. reduce to sustainable levels catches).

In developing HCR, the likely stakeholder will need to be considered. Identifying the set of possible HCR will depend upon the available data and management resources, so engagement in early stages is not necessary, but will need to be considered. Engagement with stakeholders is promoted by:

- Using simple rules that are easy to understand and interpret, particularly so that stakeholders can understand the implications of different outcomes.
- Addressing uncertainties openly. What is not known is equally important to what is known and all management decisions must be taken under risk. By focusing on the decision-making rather than the science, management actions can be rational, timely and precautionary.
- Responding clearly and openly to constructive criticism and review from stakeholders. This is related to dealing with uncertainty. Stakeholders need to agree what is known, and address what is not known by precautionary decision-making and research. Developing a common knowledge base through better communication and using empiricism as the basis for solving disagreements will allow management to progress.

Table 12:
Some possible indicators and controls for use with lobster fisheries

Indicators	Positive	Negative
Catch-per-pot	Related to abundance Can be adjusted by selecting data for particular measures, such as only mature females or discarded undersize.	Catch-per-pot may suffer from hyperstability as an abundance index.
Mean size	Easy to measure	Not necessarily routine reported. Affected and invalidated by changes in selectivity
Target Controls	Positive	Negative
Pot escape hatches	Easily enforced	Changes gear selectivity which needs to be estimated.



Minimum landings size	Can be enforced at landing. Most discarded lobsters should survive.	Some damage possible, so unknown discard mortality.
Prohibition on landing berried females	Can be enforced at landing. Most discarded lobsters and eggs should survive.	Some damage possible, so unknown discard mortality.
Closed areas	May be used to protect vulnerable stock components and habitat	Evaluating the quantitative effect of closed areas is difficult
Recovery Controls	Positive	Negative
Pot limits	Direct control on fishing effort and maximising socio-economic potential of the fishery	Additional management and legislative tools may be needed to implement control Reaching an agreement on how pots are shared out may be difficult
Seasonal closure	Easy to enforce	Socio-economic implications are uncertain Fine adjustments are not possible because fisher response to closed seasons is not certain.

A simple proposal for a harvest control rule for lobster would be a stock size indicator as the mean catch-per-pot (numbers or weight per pot hauled) and the control would be the number of pots set. Pots hauled and the lobster catch are reported routinely, so the indicator is easy to calculate. However, it is not clear whether the number of pots can be controlled or how this might be enforced. Clearly this rule would have to apply to all pots catching lobster whether set inside or outside the 6 mile limit.

Therefore, there are a set of possible indicators that can be proposed based on the available data and a set of possible controls that can be applied based on likely compliance, effectiveness in limiting fishing mortality and cost. Reasonable combinations of indicators and controls are likely to define the set of HCR that might work. This leaves the choice of which particular indicators and controls might be applied, and the conditions when a reduction in fishing mortality might be required, how this might be achieved and by how much.

If MSY reference point is available from a stock assessment, reasonable and precautionary choices can be proposed for other reference points (Table 15). Other default and precautionary options can be proposed for HCRs to undergo testing. Clearly, these can be adjusted based on the stakeholder review and other information received during the review process. The main objective would be to get a management control in place, rather than a perfect HCR which will never need adjustment.

Some default options that might be used for configuring a HCR where other information, such as a stock recruit relationship, are unavailable. Default precautionary values can be drawn from MSC guidance, which is based on international “best practice”.

Configuration	Options
Target Reference Point	All default reference points and HCRs depend upon some estimate of MSY. MSY or a proxy can be estimated from stock assessment. An MSY proxy target often can be proposed, but needs to be justified.
Limit Reference Point	Without a stock-recruitment relationship, this can be set as equivalent to 50% SSB of the target.
Indicator calculation	The indicator variable should be smoothed to reduce noise. Simple smoothers can be used which are easy to understand (e.g. moving average). The amount of smoothing might be estimated from simulations, but results are likely to be robust to this.

Table 13:
Default options for HCR development



Trigger placement	A reasonable choice is at the mid-point between target and limit, or based on an estimate of the residual noise in the indicator after smoothing. This can be tested by simulation, but results are likely to be robust to this. Note however, that a certified fishery may be considered as “rebuilding” by the certification body if the stock is below the trigger point. Therefore, it may be useful to declare an alternative “special measures” rebuilding point below this trigger but still well above the limit, to avoid unnecessary certification costs.
Type of control	<p>For small scale fisheries, controls on fish effort (e.g. days at sea, # traps) are desirable as they reduce the impact of fishing on all components of the ecosystem, reduce fishing costs and are more robust to error and natural fluctuations in stock size.</p> <p>Catch (e.g. kg landed) quotas work well where catches can be well measured and controlled and either the indicators are accurate in assessing stock status or catches can be set very low relative to the stock productivity (i.e. very precautionary).</p> <p>Non-static area closures are not recommended because, apart from any practical enforcement issues, they are difficult to evaluate and the effect is difficult to predict.</p> <p>Seasonal closures are valuable in that they will restrict fishing effort, although their impact will be less precise than managing effort directly.</p>
Minimum effort below limit	If the stock should be reduced below the limit reference point, fishing should be reduced as low as possible. The minimum catch or effort at this point should be determined. With recreational fisheries, other fisheries outside the management control, and a need to continue to collect stock monitoring information, this catch may not be reduced to zero. Under these circumstances, it will need to be verified that the stock can still rebuild.

Develop Stock Assessment Model to Evaluate HCR

HCRs should be designed or selected by stakeholders. In order to make good decisions on HCRs, stakeholders must be given relevant information on the stock and fishery and the impact the HCR is likely to have. This is best carried out using agreed data sets with mathematical models describing what is known about the fishery to estimate how the stock will respond to different HCRs under different scenarios (Table 15).

Scientific advice for small scale fisheries is less about definitive science, although that has a role, than about trying to make the best decisions you can with the available information. Therefore measures and appreciation of uncertainty has to be incorporated into the scientific advice. Although including uncertainty in advice may make advice more difficult for stakeholders to understand, it is necessary that risks are understood for good decision-making.

Part of statutory responsibility for IFCA is to take account of the socio-economic impact of management decisions. Economic issues can be reported on as part of the risk assessment of this sort of modelling. Although previous assessments have produced precautionary advice (CEFAS 2011), it is difficult to adapt them to account for stakeholder concerns, or address socio-economic impact from the decisions. This may explain the lack of management response to this stock assessment. A more decision based approach would allow the assessment to consider not only the “best estimate”, but also the impact errors will have on outcomes, so that decisions can be adjusted accordingly. Furthermore, if the CEFAS assessment is correct, it is likely that overall yields as well as catch rates will increase with reduction in fishing effort. Management action requires that the industry believes this assessment result, and understands the socio-economic benefits for taking appropriate action. Once this is the case, the required trap reduction would be much easier to implement.

The model must be consistent with the available data and the model structure must explain the known biology and fishery relationships. This suggests that model development is best served by implementing it from the beginning in a flexible framework so that on-going investment in the



development is possible.

Because the model is essentially a model of the data, the data available will have a considerable influence on the model structure. Not all data need necessarily be available for all fisheries, but some core data are likely required to fit any model. This primary data are likely to include catch, effort and size/sex composition.

It will also be worthwhile considering how to share information across stocks. For example, stocks with tagging information might be able to estimate growth, which could improve assessments for those stocks where growth cannot be estimated.

Databases	Used to organise data as well as protect confidentiality and data integrity Queries will automatically produce the most up-to-date data set rapidly and consistently Queries can be embedded in other software Open source databases (PostgreSQL, SQLite, MySQL) should be appropriate, and generally all work through essentially the same Standard Query Language.
Spreadsheet	Queries can be embedded into spreadsheets, so updates can, to a large extent, be automated. Spreadsheets are useful to hold data for public review in a widely readable form Data can be combined from several sources, so all data components are in one file Simple graphs and models can be set up to check data Data can be formatted automatically on output to a text file for analysis
ADMB model	ADMB is available for Linux and Windows, and is open source, is very fast and is able to fit hundreds of model parameters. (see www.admb.org) Data are read in as custom text file. Model is in C source code and is compiled, so some knowledge of computer programming is required as well as knowledge of mathematical modelling. MCMC can map probabilities (MCMC) for use in evaluating HCRs through simulation. ADMB is very flexible and a useful repository for research outputs.
R output	R is freeware powerful tool for producing high quality graphics as well as allowing further statistical analyses and diagnostics (on MCMC output for example). R can read text and binary files output from the ADMB model. R code can be used to produce standard output formatted for presentation and for documents.

Table 14:
Components in developing procedures to evaluate HCR

Recently there has been a lot of interest in “data poor” fisheries stock assessment (e.g. Honey et al 2010, Pilling et al 2008, ICES 2012b). Various techniques have been proposed and have their uses. Many try to emulate standard estimation methods applied to fisheries that are not data poor, and most try to simplify calculation methods. This can result in such methods ignoring data which cannot be used, which is not satisfactory particularly in data poor situations, and having strict assumptions which reduce credibility in the results.

Many inshore fisheries, such as lobster, have significant data sets (Table 17). Others, which are of less interest, such as periwinkles, are genuinely data deficient. Nevertheless, data are usually limited in nature. Crustacean fisheries do not have age data, but rely on size which is an imperfect indicator of age. Furthermore, many crustaceans and other shellfish have life history characteristics, which make applying many standard stock assessment approaches inaccurate. Very simple methods do not necessarily measure uncertainty (they concentrate on robustness instead), and may be very restrictive and inflexible, discouraging engagement.



Using HCRs allows the use of methods which focus on the decision-making and management advice rather than attempting to estimate stock status exactly. This is consistent with the modern definition of MSY which takes into account risk. A general methodology already exists in decision theory to deal with data poor situations, and these methods are much more flexible and should make the best use of all available information.

Primary data, which is required and secondary data, which is desirable, for use in fitting the stock assessment model. Secondary data may not be absolutely necessary, but would be valuable where they are available.

Table 15:
Data requirements for lobster HCR development

Primary Data Component	Comments
Total annual catches	All catches (discards and landings) are required for as long a time period as possible. Specifically, the catch time series should extend back to the start of the fishery, so that reference points are estimated relative to the unexploited state. The model should be able to use annual data if monthly data are not available in the early part of the time series. Although the model should be robust to missing data, total annual catches are required for all years in the model.
Total catches by month	As much of the catch data as possible should be aggregated by month. Total catches do not need to be divided by fleet, size or sex (see size grading below), but should cover all catches, including recreational. Because the model fits to catches, if they are estimated, some sort of measurement error can also be provided.
Size and sex sampling	Any sampling of the landings should be aggregated by month, fleet (i.e. with separate selectivity).
Landings, discards and effort	The main abundance index, in the absence of a fishery independent survey, will depend on catch and effort data. This can be based on observations for each month and fleet, but need not be complete.
Secondary Data Component	
Tagging	Any tagging data will be useful for estimating growth and mortality. Outside the model, it may also be used to help define management units.
Size Grading	If landings are sorted into commercial size grades, these landings by size grade can be used as long as the grading is accurate and well-defined.

The current “best practice” in stock assessment is to use statistical dynamic age structured models, which can be made relatively flexible to represent local data and stock biology. The model links what is known about the biology to the available observations (Table 18). These models tend to be complex and have been difficult to fit to data, but new software and methods have addressed this to some degree. It is now possible not only to fit such models to data, but “map” the uncertainty of the fit, all on a standard desktop computer. Software to do this is free. The main problems are likely to be the potential complexity, skills required to develop and maintain such a model and agreement over what is included or excluded in the model.

The stock assessment model should consist of the population model, which tries to capture the most important attributes of the life history and biology, and the likelihood functions which link the population model to the data. A simple but reasonably complete version of the model should be developed for stakeholder review. In particular, it should be possible to assemble the available data and build appropriate likelihood functions for the data. Stakeholder review is most likely to lead to changes in model structure, for example requiring that some fleets may be separated or combined based on assumed differences in selectivity.

Table 16:
Attributes that the stock assessment model is likely to need

Structure	Comments
Unit stocks	A working hypothesis of unit stocks is required. This will determine how data that the model is fitted to are divided up or combined. It may be possible to get some insight into appropriate stock definitions from fitting the model.



Monthly time step	Although seasonality makes modelling more complicated, using a month time step enables the software to use seasonal patterns to fit the model which with an annual time step would not be available.
Separate population models for each sex	The males and females grow differently, so the model should be sex differentiated.
Seasonal growth	The growth model is critical in crustaceans as it is used to convert from age to size. It will need to be resolved whether an explicit model of moulting is required.
Missing data	The model will not tolerate (or it would make the analysis much more difficult) missing catch data. Otherwise the model will need to be able to handle missing data and even some missing components where they are not available.
Code Design	<p>In designing the model, some account should be taken of robustness, future development and accessibility.</p> <p>Design of the software should follow good programming practice and be well-documented.</p> <p>Functions should be organised so that they meet requirements for efficient calculation if the “random effects” module is used (i.e. define Separable Functions). It is quite likely that at some point in the future the recruitment will be best estimated as a “random effect” or that the model could develop into a state-space model because of the uncertainties over growth.</p> <p>The model should be made freely available. This will help check and improve the model without additional investment.</p>
Other requirements	Input estimates (as probability priors or point values) of various parameters will be required. In many cases it is easier to fit sub-models outside the made model frame and provide estimates of parameters. This is likely to be a good approach for natural mortality, sex ratios, the maturity ogive, standardising effort and the growth models, at least in the first instance. The assessment should focus initially on estimating fishing mortalities, catchability, selectivity and recruitment.

ADMB is the best platform for developing a bespoke stock assessment model. This platform is technically demanding, but highly flexible and can fit stock assessment models most other approaches cannot. Data inputs and result outputs can be prepared so that they can be processed automatically to produce outputs for stakeholder review rapidly. Simple HCRs can be evaluated rapidly from Markov chain Monte Carlo (MCMC) outputs with ADMB, so the robustness of the HCR to uncertainties can be tested.

Developing a model is not a simple process, and would require some investment to get it underway. There is considerable free code available for other fisheries, so it would not be necessary to start from scratch. Model code can be adapted for the population and likelihood functions and then improved for the specific use in English lobster fisheries.

Developing the stock assessment model is a different process to evaluating the HCR, and these tasks should be separated. Evaluating the HCR should be done as part of the stakeholder review, whereas the stock assessment model can be developed and fitted by a smaller group of scientists and interested stakeholders. This is because developing and fitting the model is technical and difficult and will take considerable time. Once a satisfactory model has been fitted making the best use of the available data and what is known about the stock, it can be used to evaluate the HCR.

Fitting the assessment model is not trivial. There is a too step process. Firstly, the “maximum posterior” point estimates are estimated. Over-parameterised models may not fit, and therefore it may not be possible to include some model structures even if stakeholders believe they are important (i.e. data is insufficient to support the desired model). Secondly, once a reasonable configuration for the model is found, and it fits the data, the Markov chain Monte Carlo (MCMC) simulation can be used to map the uncertainty. MCMC again can be difficult to apply, can take considerable time to run, and diagnostic evidence is required that it has worked. However, once it has been successful, the outputs can be used to evaluate the HCR very rapidly.



It would be best to start with as simple a model as possible, so that the review process might produce some increase in complexity but avoid the complexity becoming overwhelming. Fit diagnostics may identify changes in the model as well as further research that might be required.

The stock assessment model can also be a focus of research. It is highly likely that the model will identify important uncertainties which can be addressed by further data collection and research. The results from these activities can be included in the model, reducing uncertainty and changing scientific advice. Such research is more likely to have a significant impact on fishery management.

Conduct a Stakeholder Review

Stakeholder review is important to promote engagement in the management process, ensure that the model and HCR has no errors and to provide evidence that the HCR is likely to achieve management objectives. More generally, reviews are an important way to resolve scientific issues, plan progress and provide evidence that advice is credible. Reviews can be internal or external. Internal reviews are valuable, particularly where the issues are not contentious, but can often be challenge on the basis that the review is not fully independent. Where independence is necessary to resolve an issue, external review is better, but more expensive. Using IFCA staff to review each other's management could be a cost effective way not only to provide independent review, but ensure IFCAs are aware of what each one is doing.

Stakeholder review is likely to require one or more meetings to evaluate the stock assessment and decide on an appropriate robust harvest control rule. Technical review of the model should probably be carried out separately by scientist stakeholders, but any review should be kept as open as possible so that any stakeholder who wishes to attend can do so.

The review should ultimately aim to produce a single "current" assessment model and a HCR to implement which can be evaluated by the model and is demonstrated precautionary and appropriate for the fishery (e.g. is consistent with MSY). The review should also recommend research which can be used to update and improve the model in the longer term. Any meeting should have terms of reference to make their tasks clear.

Further independent review by external experts (e.g. from EU, USA or further afield) can be conducted if necessary. While desirable, this can be expensive, but should produce definitive evidence whether the HCR is appropriate and is likely to meet harvest strategy objectives.

The review process should be constructive and inclusive. Stakeholders can be encouraged to suggest alternative models and data, which should if possible be included and tested in the current model. However, it should not be possible to reject a model without proposing some alternative in its place, as this can be counter-productive.

An important challenge is to ensure outputs from the stock assessment and HCR evaluation are in forms that all stakeholders can understand and assimilate. This communication of technical and scientific information may require some development, both in identifying types of output that stakeholders can understand as well as teaching them how to interpret types of output. A lack of understanding of science is one of the most reasons for distrust and ignoring this source of information.

Once the HCR has been accepted and evidence provided that it should work, further frequent assessments are not necessary. It would be good practice to monitor the HCR to ensure that it is functioning as expected and to evaluate the performance of the HCR infrequently so that it might be improved. Operating the HCR for between 5-10 years between assessments may well be sufficient, although some resources might be reserved for special evaluations should the need arise.



Appendix 4 - Stock Assessment

Stock assessment involves modelling of empirical data to examine the status of fish stocks and to provide advice on future catches; essentially how many fish are there, how many were there and how many are likely to remain if certain catches are taken. This is a specialist task which can involve significant data and highly technical mathematical modelling. Resources are unlikely to be available for regular stock assessments of small scale fisheries, but a stock assessment can be a useful tool for designing and simulation testing a harvest control rule.

Stock assessment of shellfish stocks is generally poorly developed in Europe. There are few standardised approaches and data supports are weak in many cases. The majority of species are not included in the EU Data Collection Framework (DCF).

The approach to stocks assessment should take account of the fishery, species biology, life history and data that are available. The stock assessment model will attempt to explain the data based on what is known of the fishery and biology of the stock. Where data are limited, several competing models may provide equally good explanations for observations. However, as long as the harvest control rule can be shown to achieve desirable results regardless of which model may be right, it can be shown to be robust to uncertainty and suitable for the fishery.

Some examples of off-the-shelf assessment models are provided in Table 19. Their complexity and data requirements vary. All software is freely available on the NOAA web site. In many cases, however, bespoke models may be more appropriate, making better use of the available data. In any case, careful interpretation of assessment results will be required and models will need to be tested to ensure that the fit is valid.

Other useful sources, including spreadsheet downloads (<http://www.utas.edu.au/docs/tafi/TAFIHomepage.html>), that allow non-modellers to implement various assessments and estimate model parameters are provided by Haddon (2001)

Fisat II (<http://www.fao.org/fishery/topic/16072/en>) is a program package developed mainly for the analysis of length-frequency data, but also enables related analyses, of size-at-age, catch-at-age, selection and other analyses

ICES provide frequent stock assessment training workshops



Table 17:
Examples of stock assessment models, relative complexity & data requirements⁴

Feature	Model												
	1	1	1	1	1	2	2	3	3	3	3	3	4
Model Complexity													
Data / Observation Error	D C A C	S E I N E	A I M	A S P I C E	C S A	S C A L E	V P A	V P A 2 B O X	A M A K	S T A T C A M	A S A P		S S 3
Total catch (landings+discards)	X		X	X	X	X		X	X	X	X	X	X
Catch at age (CAA)							X	X	X	X	X	X	X
Catch at length (CAL)						X							X
Address variation in CAA or CAL		X							X	X	X	X	X
Age specific indices of abundance for tuning							X	X	X	X	X	X	X
Age-aggregated tuning indices			X	X	X	X	X	X	X	X	X	X	X
Tag-recapture								X					X
Process / Model Specification	D C A C	S E I N E	A I M	A S P I C E	C S A	S C A L E	V P A	V P A 2 B O X	A M A K	S T A T C A M	A S A P		S S 3
Stock recruitment function									X		X	X	X
Sexual dimorphism in growth rates						X		X					X
Spatial heterogeneity								X					X
Incorporate long term historical landings	X			X	X	X			X	X	X	X	X
Handle gaps in age or length information		X				X			X	X	X	X	X
Multiple fleets									X	X	X	X	X
Handle differences between sexes						X		X					X
Automatic retrospective analyses			X	X			X			X	X		
Independently est. temporal changes in catchability for surveys									X		X	X	X
Address variations in biological sampling intensity over time									X	X	X	X	X
Consider measurement error for individual time series observations									X		X	X	X
Uncertainty / Forecasting / BRPs	D C A C	S E I N E	A I M	A S P I C E	C S A	S C A L E	V P A	V P A 2 B O X	A M A K	S T A T C A M	A S A P		S S 3
MCMC									X	X	X	X	X
Bootstrap			X	X	X		X	X					X
Estimation of BRP for F			X	X					X	X	X	X	X
Estimation of BRP for SSB				X					X	X	X	X	X
Linkage to external/internal forecasting program			X	X			X				X	X	X

⁴ From <http://nft.nefsc.noaa.gov/> Models can be downloaded from the NOAA website. The models are all implemented in the NMFS stock assessment tool box.

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