



MARINE ECOLOGICAL SURVEYS LTD

Fish for Our Future research group

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PRE-ASSESSMENT REPORT FOR THE EAST COAST BROWN AND PINK SHRIMP FISHERIES -THE WASH, THE HUMBER AND THE NORTH NORFOLK COAST-



Statement

Marine Ecological Surveys Limited (MESL) agreed to undertake a Marine Stewardship Council (MSC) pre-assessment using MSC methodology (using the 'standard assessment tree') for the brown and pink shrimp fisheries in the Wash, Humber and North Norfolk coast for the clients John Lake Shellfish Ltd and Lynn Shellfish Ltd. The report is intended to initiate the improvement in sustainability of the brown and pink shrimp fisheries for the benefit of the fishing community, the marine environment and the shrimp stocks around the Wash, Humber and North Norfolk coast. It is hoped that this pre-assessment will also act as a management aid for the shrimp fishing industry, Marine Management Organisation and the Inshore Fisheries and Conservation Authorities (IFCAs) to work towards improved sustainability hopefully culminating in the achievement of MSC accreditation for the shrimp fisheries. This report summarises and evaluates data provided to MESL by the client and the Eastern (IFCA), together with background data from various sources. Using this information MESL has performed a preliminary evaluation of how the fisheries are likely to fare against the MSC principles and criteria. MESL is a member of the Institute of Environmental Management and Assessment (IEMA) and is a leading participant in the National Marine Biological Analytical Quality Control (NMBAQC) scheme.

It should be noted that a pre-assessment of a fishery does not attempt to duplicate a full assessment against the MSC standard. MESL does not have certification body status, the MSC only formally counts pre-assessments conducted by MSC certified bodies as 'official' pre-assessments. Therefore, this pre-assessment provides a provisional assessment of a fishery based on information provided by the client and available background information in the allotted timeframe, and can provide guidance only. As such, MESL accepts no liability for any delays in MSC certification. A full assessment involves expert team members and public consultation stages that are not included in a pre-assessment. Any recommendations or evaluation results given in this report provide general guidance only and any management plans should be fully verified and discussed with industry experts, and fisheries scientists with knowledge of the MSC methodologies and marine fisheries ecology. The outcome of a full assessment will be subject to deliberation and analysis by a certified body and may not be influenced by any actions based on evaluation results or recommendations given in this report.

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Fishery name	East Coast Brown Shrimp Fishery <i>and</i> East Coast Pink Shrimp Fishery	
Fishery location	ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (See Figure 2.2.1.)	
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ACRONYMS

BAP	A Biodiversity Action Plan is an internationally recognised program addressing threatened species and habitats and is designed to protect and restore biological systems.
Cefas	The Centre for Environment, Fisheries & Aquaculture Science is the UK's largest marine science centre which contributes to the development and implementation of policy.
CFP	The Common Fisheries Policy is the fisheries policy of the European Union (EU). It sets quotas (catch limits) stating how much of each type of fish member states are allowed to catch.
CVO	Coöperatieve Visserij Organisatie (CVO) is the Dutch processors organisation.
DEFRA	The Department for Environment, Food and Rural Affairs is a government department in the UK. They develop policy and legislation, and work with others to deliver policies in the natural environment, biodiversity, plants and animals, food, farming and fisheries, and environmental protection and pollution control.
EC	The European Commission drafts proposals for new European laws and manages the day-to-day business of implementing EU policies and allocating EU funds. It also makes sure that everyone abides by the European treaties and laws.
EMS	European Marine Site (as defined by the Habitats Regulations) refers to those marine areas of both Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), which are protected under the EC Habitats and Birds Directives.
ESFJC	Eastern Sea Fisheries Joint Committee (now the Eastern Inshore Fisheries and Conservation Authority)
ETP	Endangered Threatened or Protected species as defined by the MSC.
FAM	The Fisheries Assessment Methodology provides the detailed interpretation of the fisheries standard.
FAO	The Food and Agriculture Organisation of the United Nations is a specialised agency of the United Nations that leads international efforts to defeat hunger.
ICES	The International Council for the Exploration of the Sea coordinates and promotes marine research on oceanography, the marine environment, the marine ecosystem, and on living marine resources in the North Atlantic.
IFCA	Inshore Fishery and Conservation Authorities are either committees or joint committees of the local authorities that fall within a specific district. They are tasked with the sustainable management of inshore sea fisheries resources in their local area.
JNCC	The Joint Nature Conservation Committee is the public body that advises the UK Government and devolved administrations on UK-wide and international nature conservation.
LPUE	Landings Per Unit Effort is a relative abundance of fish, where landings = weight of fish landed, and effort = time taken to fish.
MESL	Marine Ecological Surveys Limited work in the marine consultancy sector, and have a rich tradition of conducting scientifically based commercial and academic research, often in collaboration with other organisations.
MMO	The Marine Management Organisation has been established by the UK government to make a significant contribution to sustainable development in the marine area and to promote the UK government's vision for clean, healthy, safe, productive and biologically diverse oceans and seas.
MSC	The Marine Stewardship Council is probably the world's leading certification and eco-labelling program for sustainable fish products.
MSY	Maximum Sustainable Yield is the theoretical largest yield (or catch) that can be taken from a species' stock over an indefinite period.
Nm	Nautical mile (~1.85 kilometres).
PI	Performance Indicators provide performance requirements for fishing impacts detailed in the evaluation tables for each of the three MSC principles.
PSA	Productivity-Susceptibility Analysis is used in the RBF to examine attributes of each species that contribute to or reflect productivity and susceptibility to provide a relative measure of risk.
RBF	The MSC Risk-Based Framework is a set of assessment methods contained in the FAM. It is used while carrying out an MSC fishery assessment where there is insufficient data to assess the fishery using the standard assessment tree.
SAC	Special Areas of Conservation are protected sites designated under the EC Habitats Directive.
SICA	Scale Intensity Consequence Analysis is used as a 'screening tool' in the RBF to identify which activities lead to a significant impact on any species, habitat or ecosystem.
SPA	Special Protection Areas are protected sites classified in accordance with Article 4 of the EC Birds Directive, which came into force in April 1979.
t	Tonne(s) (metric).
TAC	Total Allowable Catches are catch limits that are set for most significant commercial fish stocks.
UEA	The University of East Anglia is an internationally renowned university in Norfolk, UK.

1. EXECUTIVE SUMMARY

Marine Ecological Surveys Ltd (MESL) agreed to undertake a Marine Stewardship Council (MSC) pre-assessment of the East Coast Brown and Pink Shrimp Fisheries (coastal waters around the Wash, Humber and North Norfolk coast) with John Lake Shellfish Ltd and Lynn Shellfish Ltd. It is hoped this pre-assessment will act as a management aid for the shrimp fishing industry and the Eastern Inshore Fisheries and Conservation Authority (IFCA) to work towards sustainability and ultimately help achieve MSC accreditation for the shrimp fishery.

UK East Coast Brown Shrimp Fishery: The pre-assessment evaluation has highlighted several areas of concern which mean that the East Coast brown shrimp fishery, in its current mode of operation, will not meet standards required for MSC certification. The main obstacle to certification is the lack of information required to implement important management measures to ensure sustainability of the fishery. In particular, it is likely that the fishery needs to put in place stock management measures which may include reference points and a harvest control strategy. It is also likely that the fishery needs to improve understanding, management and monitoring of by-catch and assess the impacts of the fishery on habitat and ecosystem structure and function.

UK East Coast Pink Shrimp Fishery: The pre-assessment evaluation has highlighted several areas of concern which mean that the East Coast Pink Shrimp fishery, in its current mode of operation, will not meet standards required for MSC certification. The main obstacle to certification is the lack of information required to implement important management measures to ensure sustainability of the fishery. There is little information available about the population dynamics and recruitment patterns. It is likely that the fishery needs to put in place stock management measures which may include reference points and a harvest control strategy. It is also likely that the fishery needs to drastically improve understanding, management and monitoring of by-catch and assess the impacts of the fishery on habitat (particularly *Sabellaria spinulosa* reef) and ecosystem structure and function.

A full non-technical summary is available from the Eastern IFCA.

2. INTRODUCTION

This MSC pre-assessment is a confidential report which presents the results of a pre-assessment of the Wash and East Coast Shrimp Fisheries. Brown shrimp (*Crangon crangon*) and pink shrimp (*Pandalus montagui*) (also known as Aesop shrimp or striped shrimp) in the Wash, Humber and North Norfolk Coast fisheries were scored against the Marine Stewardship Council's (MSC) Principles and Criteria for Sustainable Fishing (the 'MSC standard'). This pre-assessment reviews the brown and pink shrimp fishery, in particular considering potential obstacles to MSC certification. The final part of this report (Recommendations, Section 8) provides general guidance and recommendations which may improve the likelihood of receiving MSC sustainable status in the future.

The research and evaluation of the fisheries has been undertaken by the 'Fish for Our Future' internal research group at Marine Ecological Surveys Ltd (MESL), which was initiated to respond to the general decline in fish stocks around the UK. Funding for this group was generously provided by Gardline Ltd, and time and resources were provided by MESL. Both organisations recognise fisheries sustainability as an important area of concern.

Both shrimp fisheries are licensed by the MMO, and managed offshore by the MMO (6nm and further) and inshore by the Eastern and North Eastern IFCA's.

2.1 AIMS OF THE PRE-ASSESSMENT

The MSC pre-assessment aims to:

- Determine, using available information, the general position of the fishery in relation to the Marine Stewardship Council (MSC) Principles and Criteria
- Highlight and discuss the important components of the fishery and determine the scope of the main certification
- Identify any obstacles or difficulties for certification

At this stage opinions and verification from all stakeholders will not take place. This would form part of a full assessment which would be open to public scrutiny and comment.

This current report presents:

- Information used in the pre-assessment
- The historical biological background of the brown and pink shrimp fisheries
- The location boundaries, scale and value of the brown and pink shrimp fisheries
- Details of both shrimp fisheries management systems currently in place
- Key stakeholders in the fishery
- Preliminary evaluation of the fishery's position against the MSC Principles and Criteria
- Potential obstacles or problems for certification
- Recommendations

2.2 SCOPE OF THE PRE-ASSESSMENT

It should be noted that a pre-assessment of a fishery does not attempt to duplicate a full assessment against the MSC standard. A pre-assessment provides a provisional assessment of a fishery based on information provided by the client and available background information, and can provide guidance only. A full assessment involves expert team members and public consultation stages that are not included in a pre-assessment. The outcome of a full assessment will be subject to deliberation and analysis by a certified body and may not be influenced by the pre-assessment.

The Marine Stewardship Council Guidelines to Certifiers specifies that the unit of certification is:

“The fishery or fish stock (=biologically distinct unit) combined with the fishing method/gear and practice (=vessel(s) pursuing the fish of that stock).”

The definitions of the fisheries under this pre-assessment are therefore:

1. The East Coast Brown Shrimp Fishery (*Crangon crangon*) – brown shrimps caught by beam trawl, in coastal waters between Hornsea and Felixstowe [ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (See Figure2.2.1.).]
2. The East Coast Pink Shrimp Fishery (*Pandalus montagui*) – pink shrimps caught by beam trawl, in coastal waters between Hornsea and Felixstowe [ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (See Figure2.2.1.).]

The client groups are John Lake Shellfish Ltd and Lynn Shellfish Ltd together with the aid of the Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA).

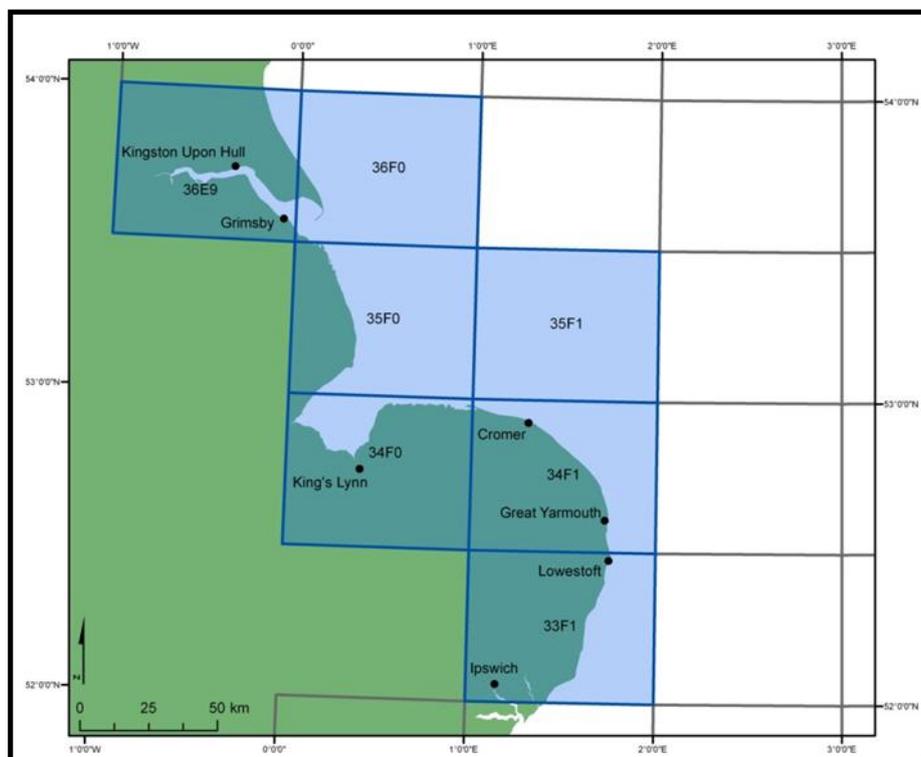


Figure 2.2.1 The assessment area showing ICES statistical rectangles included in the assessment: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (www.ICES.dk).

2.3 CONSTRAINTS TO THE PRE-ASSESSMENT

Unfortunately, the following data was not available at the pre-assessment stage:

- MMO LPUE (landings per unit effort) brown shrimp data was not made available, however, LPUE of the UK brown shrimp fishery is commented on in ICES reports.
- MMO LPUE pink shrimp data was not available.
- MESL were unable to obtain the following report which may be of use:
van Marlen B., F. Redant, H. Polet, C. Radcliffe, A. Reville, P.S. Kristensen, K.E. Hansen, H.J. Kuhlmann, S. Riemann, Th. Neudecker, and J.C. Bradant. (1998) Research into Crangon Fisheries Unerring Effect. (RESCUE) - EU-Study 94/044. RIVO Report C054/97.

2.4 MARINE STEWARDSHIP COUNCIL METHODOLOGY

The Marine Stewardship Council (MSC) environmental standard for sustainable fishing is the standard that a fishery must meet to become MSC certified and labelled with the MSC eco-label.

The MSC environmental standard was developed following an extensive international consultation with stakeholders between 1997 and 1999. This consultation included eight regional workshops and two expert drafting sessions, and involved more than 300 organisations and individuals internationally. The standard is based on the Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries and other international conservation instruments.

2.4.1 MSC PRINCIPLES

Under the MSC programme, fisheries are measured against three core principles (see Table 2.4.1.1 for a breakdown of principles in a simplistic form).

Table 2.4.1.1 A summary of the MSC methodology in its simplest form (Clark, 2008)

Principle 1 (P.1) Biological Stock	Principle 2 (P.2) Impact on the Environment	Principle 3 (P.3) Fishery Management
stock status	environment status	rules
stock management	environment management	management
monitoring & feedback	monitoring & feedback	monitoring & feedback

Principle 1: Biological Stock

'The fishing activity must be at a level which is sustainable for the fishery population. Any certified fishery must operate so that fishing can continue indefinitely and is not overexploiting the resources.'

The fishery must show: *It has reliable data on the age and gender patterns of shrimp populations to prevent too many young fish being caught and that other factors that affect the health of the stock have been considered.*

Principle 2: Impact on Environment

'Fishing operations should be managed to maintain the structure, productivity, function and diversity of the ecosystem on which the fishery depends.'

The fishery must show: *Measures are in place to limit by-catch (living creatures caught unintentionally) and impacts on endangered species and habitat integrity.*

Principle 3: Fishery Management

'The fishery must meet all local, national and international laws and must have a management system in place to respond to changing circumstances and maintain sustainability.'

The fishery must show: *Vessel owners have signed a Code of Conduct, shared GPS data, or undertaken research to ensure that their fishery is well managed. Effective management also ensures that all vessels will, for example, change their fishing gear or respect closed zones, when required.*

The three MSC principles are supported by 9 criteria split into 31 more detailed criteria or 'Performance Indicators' (summarised in Table 2.4.5.1, evaluated in Sections 7.3 and 7.4). These defined set of conditions which all MSC full assessments must follow ensure standardisation of fisheries assessments.

2.4.2 MONITORING

When a fishery meets the MSC standard for sustainable fishing and is awarded sustainable status, its certificate is valid for 5 years. During this period, the performance of the fishery will be reviewed at least once a year to check that it continues to meet the MSC standard. After 5 years, the fishery must be reassessed in full if it wants to continue to be certified by the MSC.

2.4.3 CHAIN OF CUSTODY

Once a fishery has been certified, all companies in the supply chain 'from boat to plate' must be certified as meeting the MSC chain of custody standard. This ensures that the product is traceable and only seafood from certified fisheries carry the MSC eco-label.

The potential of the shrimp fishery for future certification will extend to the landing of fish at ports where recording, verification and sampling of landings takes place. This is likely to be mainly at processing plants adjacent to the Wash, specifically those in Kings Lynn. These plants will require Chain of Custody certification.

The fishery must also be able to provide evidence to buyers that shrimp have been collected from within the certified fishery and from within the limits set.

From the point of landing, shrimp from the certified fishery would then be subject to a separate MSC Chain of Custody certification if they are to be marketed under the MSC logo.

2.4.4 SUSTAINABILITY ASSESSMENT

The certification of a fishery depends upon its compliance with the MSC Principles and Criteria. A series of criteria (presented in Section 7.3 and 7.4) have therefore been developed to determine:

- The availability of sufficient information to measure the fishery against the requirements of the Principles and Criteria
- The implementation of management measures to ensure that the fishery is both well managed and sustainably managed

2.4.5 SCORING

During the certification assessment, compliance with the Principles and Criteria will be determined by applying a scoring system to questions (or 'Performance Indicators').

Each Performance Indicator (PI) is scored out of 100 points (see Figure 2.4.5.1.); a score of 100 points represents 'best practice'; a score of 80 represents 'good practice'; a score 60 is set as a level of practice that just meets minimum requirements, and is considered 'sustainably managed'; and a score below 60 is considered 'unacceptable practice' and is considered 'unsustainably managed'. Each Performance Indicator is divided into several criteria which are scored individually (see Table 2.4.5.1.).

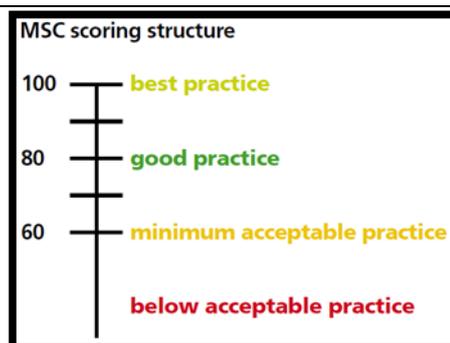


Figure 2.4.5.1 The MSC scoring system (Clark, 2008)

Where the fishery achieves a score of less than 80, but at least 60 for any individual Performance Indicator, the certification body shall set one or more conditions for continued certification. The condition(s) shall improve performance to at least the 80 points level within a period set by the certification body but no longer than the term of the certification.

Table 2.4.5.1 The fisheries assessment methodology scores fisheries against 31 Performance Indicators that fall under three Principles and nine Criteria(Clark, 2008).

Principle	Criteria	Number of Performance Indicators
P.1 Health of Fish Stock	Outcome	3
	Harvest Strategy (Management)	4
P.2. Impact on the Ecosystem	Retained Species	3
	By-catch Species	3
	ETP Species	3
	Habitats	3
	Ecosystem	3
P.3 Management System	Governance & Policy	4
	Fishery Specific Management System	5

2.4.6 ACHIEVING MSC CERTIFICATION

To achieve MSC certification, a fishery must not receive any scores below 60 and must score 80 or above on each of the three principles. If the fishery scores an average between 60 and 80, the client must agree to implement a programme of work which will bring the score to 80 or above as a requirement for certification (Figure 2.4.5.1).

2.4.7 METHODOLOGY DOCUMENTATION

Using available information, the brown and pink shrimp fisheries general position has been related to a series of generic Performance Indicators in the evaluation section.

The following documents are provided by the MSC to aid the assessment process and are available for download at www.msc.org:

MSC Fisheries Certification Methodology (v6.1): Outlines the steps that must be taken to assess a fishery against the MSC environmental standard, including the requirements for consultation with stakeholders, the submission of reports at specific stages, and so on.

MSC Fisheries Assessment Methodology (v2.1): Detailed guidance on how to score a fishery being assessed against the standard, providing an operational interpretation of the standard.

Consultation Document: Pre-assessment Reporting Template and Guidance (v2): A document providing guidance on the pre-assessment (PA) of fisheries against the MSC fisheries standard and its operational interpretation, the Fisheries Assessment Methodology (use of this document is not mandatory until November, 2011- used as a guide only, not followed implicitly).

2.4.8 RISK BASED FRAMEWORK APPROACH

In the absence of sufficient quantitative data, the Risk Based Framework (RBF) allows certifiers to use a structured framework to assess the risk that a fishery is operating unsustainably with regard to target, by-catch and retained species, as well as habitats and ecosystems.

The Assessment Framework is two-tiered, the first being a qualitative, stakeholder-driven process where expert opinion is gathered. This is followed, if necessary, by a semi-quantitative assessment based on the productivity of the species concerned and their susceptibility to fishing gear.

The RBF methods have been developed for assessing the 'Outcome' or 'Status' of Performance Indicators (PIs) for five key receptors (target species, retained species, by-catch species, habitats, and ecosystems). MSC Outcome Performance Indicators look at the actual situation of the target fish stock and other affected species, habitats, and ecosystems (impact of fishing activities and status). The remaining Information and Management Performance Indicators must all be scored using the standard Fisheries Assessment Methodology (FAM) scoring guideposts, however, additional guidance applies, particularly in Principle 1, to some other PIs when the RBF is being used.

The RBF procedure fits within the MSC FAM as a whole. If, during the course of an MSC assessment using the FAM, the assessment team confronts Outcome Performance Indicators which cannot be scored using the default FAM scoring guideposts due to lack of data, the RBF assessment methods are used to arrive at a score for those PIs. The assessment then continues as usual using the default Performance Indicators and Scoring Guideposts for the rest of the PIs.

Any fishery can use the RBF, but only in instances where there is not enough data to use the default Performance Indicators and Scoring Guideposts. If a fishery has enough data it is always advantageous to undergo the standard MSC assessment (based on the default Performance Indicators and Scoring Guideposts), as the additional inbuilt precaution in the RBF will likely result in a lower score than if the available data are used. Additionally, there is guidance within the RBF document requiring certifiers to use all the data available to them to score the fishery in every case. It would be advantageous for a certifier to indicate at the outset of the assessment process if they consider the RBF is required as this would avoid delays due to consultation

requirements with stakeholders. However, if it becomes clear during the assessment process that there is not enough data available to use the standard MSC process, the RBF could still be used on one or more indicators. Stakeholders would need to be notified of this change of methodology and additional stakeholder meetings arranged.

The RBF does not allow an easier pass: where data are limited and thus a potentially higher level of uncertainty exists, the MSC needs to be very confident that the MSC standard is being met. The RBF methods outlined in FAM v2 thus take an even more precautionary approach than the standard MSC assessments using the default Performance Indicators and Scoring Guideposts alone. RBF methodologies are more risk-averse, and insist on additional precaution so as to be absolutely sure that the fishery is not operating unsustainably.

Analyses used in the Risk Based Framework approach:

Scale Intensity Consequence Analysis (SICA)

“The SICA is a qualitative analysis which aims to identify which activities lead to a significant impact on any species, habitat or ecosystem. The SICA operates as a screening tool; a “worst case” approach that is used to measure the impacts of a range of activities on particular scoring elements. For Principle 1 PIs, there is typically only one scoring element being considered (target species of the fishery), but under Principle 2, the full range of retained and by-catch species, habitats, or ecosystems could be assessed. Where judgements about risk are uncertain, the highest consequence score that is still regarded as plausible is chosen.”

Productivity-Susceptibility Analysis (PSA)

The PSA approach examines attributes of each species that contributes to or reflect its productivity or susceptibility, in order to provide a relative measure of the risk to the scoring element from fishing activities. Productivity is the average of seven attributes, while susceptibility is the product of four aspects.”

3. DESCRIPTION OF THE EAST COAST BROWN SHRIMP FISHERY

3.1 BACKGROUND TO THE BROWN SHRIMP FISHERY

3.1.1 HISTORY OF THE BROWN SHRIMP FISHERY

In terms of biomass production, the North Sea is one of the most productive areas in the world (Hufnagl *et al.*, 2010). It is home to an extensive well-established brown shrimp fishery. Historically, the pink shrimp fishery was more important than the brown shrimp fishery. In 1970, for example about 70% of the ~630 t of mixed shrimp landed at Boston and Kings Lynn was pink shrimp and brown shrimp the remaining 30%. However, total landings for pink shrimp have decreased considerably since this time to just over 20t annually by 2010.

The brown shrimp fishery is now one of the largest fisheries in the south eastern North Sea. Germany and the Netherlands dominate the European fishery, with total landings of around 12,000–16,500 t each in 2010 (Figure 3.1.1.1). Denmark, the UK and France combined accounted for the remaining 5,000 t of nearly 36,000 t brown shrimp landed from the North Sea in total. Overall, the total European shrimp landings show an increasing trend (ICES, 2011b).

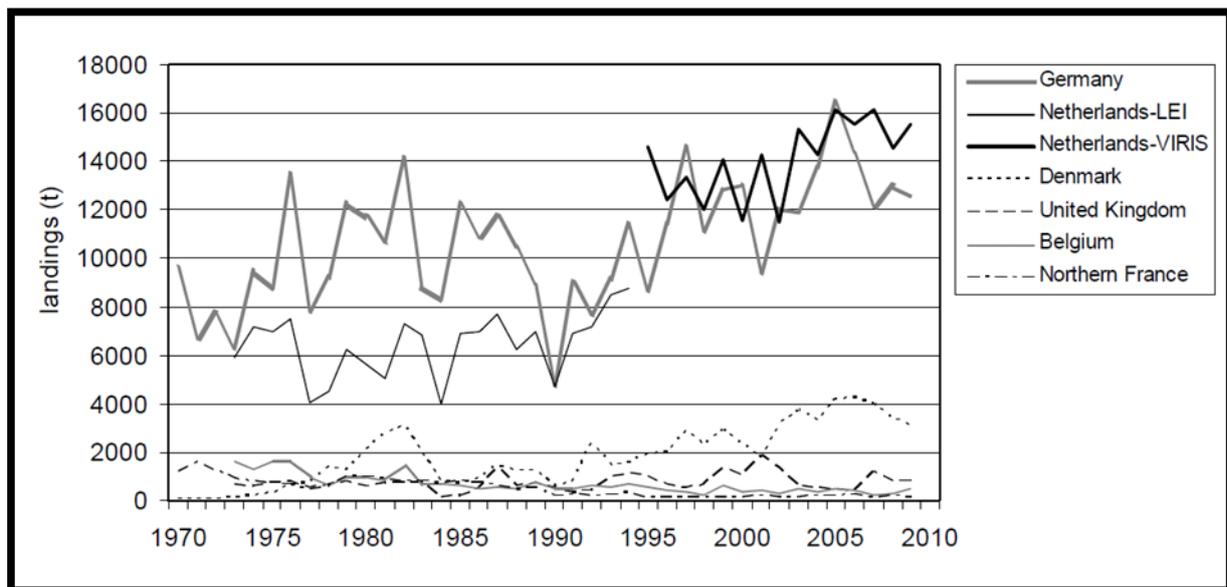


Figure 3.1.1.1 Landings (t) of brown shrimp (*Crangon crangon*) from the North Sea by country. Figure source: (ICES, 2011b). Used with the kind permission of the International Council for the Exploration of the Sea.

3.1.2 PRESENT UK BROWN SHRIMP FISHERY

The UK fishery for brown shrimp usually represents approximately 2-5% of total European landings (ICES, 2006). The landings of brown shrimp in the European continental fishery and the level of demand are the drivers determining the value of the shrimp in any one year and the value of brown shrimp fluctuates significantly (MMO, 2011; pers. comm. Neil Lake & Duncan Vaughan, 2011). This in turn determines the effort and landings of the UK fishing fleet which vary year on year as a consequence, ranging between 432 and 1,839 t over the last 10 years (Figure 3.1.2.1) (MMO, 2011).

The UK East Coast fisheries account for ~95% of all recorded brown shrimp landings within the UK (DEFRA as cited by Addison et al., 2003). The Wash estuary (ICES squares 34F0 and 35F0, see Figure 2.2.1) is the most important area for the UK brown shrimp fishery accounting for 90% of total UK brown shrimp landings (ICES, 2006; MMO, 2011). A full breakdown of annual landings for each ICES statistical rectangle within the assessment area is given in Appendix Figure 1.

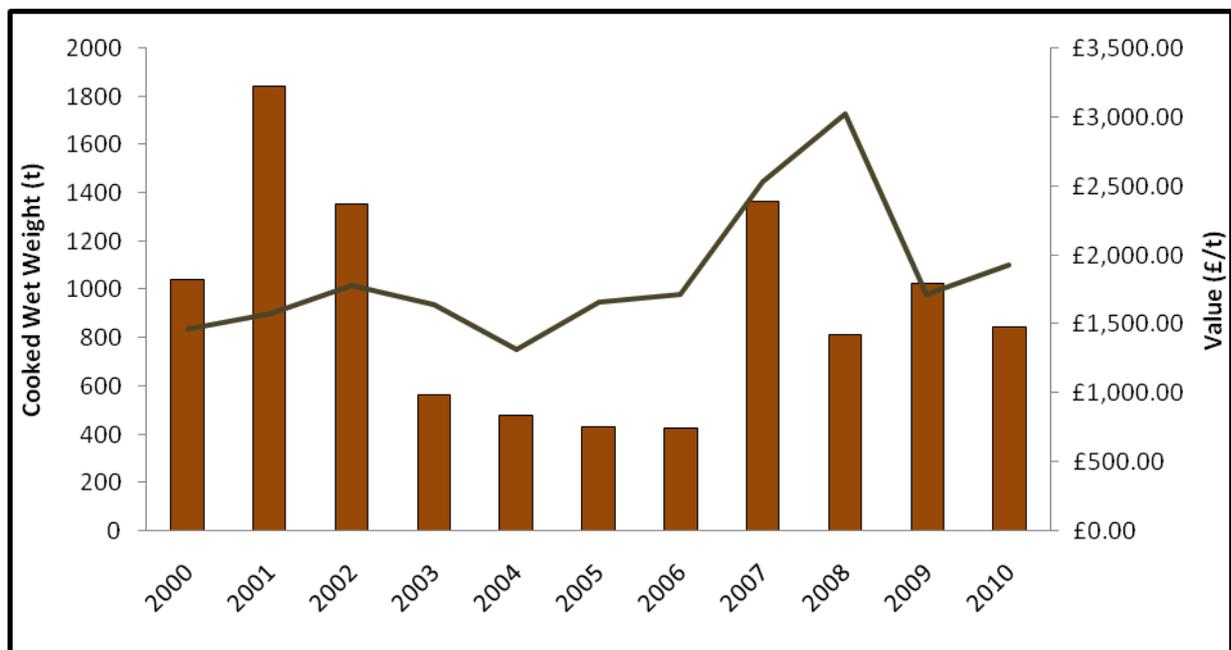


Figure 3.1.2.1 Total UK brown shrimp (*Crangon crangon*) landings cooked wet weight (bars) and associated value (£ per tonne) (line) for brown shrimp caught between 2000 and 2010 in ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (MMO, 2011).

UK landings of brown shrimp are highly variable year on year, ranging from 432 t to 1839 t in the last decade. There appears to be no underlying trend with low landings from 2003 to 2006 followed by a significant increase in 2007 (Figure 3.1.2.1). Moreover, landings per unit effort were the highest in 2007 for this ten year period (Figure 3.1.2.4) which also corresponds with a high market value (Figure 3.1.2.1) due to increased continental demand (ICES, 2009).

The good recruitment that provided the high landings in the autumn of 2007 also contributed to a good fishery in the winter and early spring of 2008. Landings in 2009 show that catches were initially moderate in the first half of the year but were good in the peak fishing season (August to December) (Figure 3.1.2.2). Landings in 2010 were similar to those in 2008 (Figure 3.1.2.1) (ICES, 2009, MMO data, 2011).

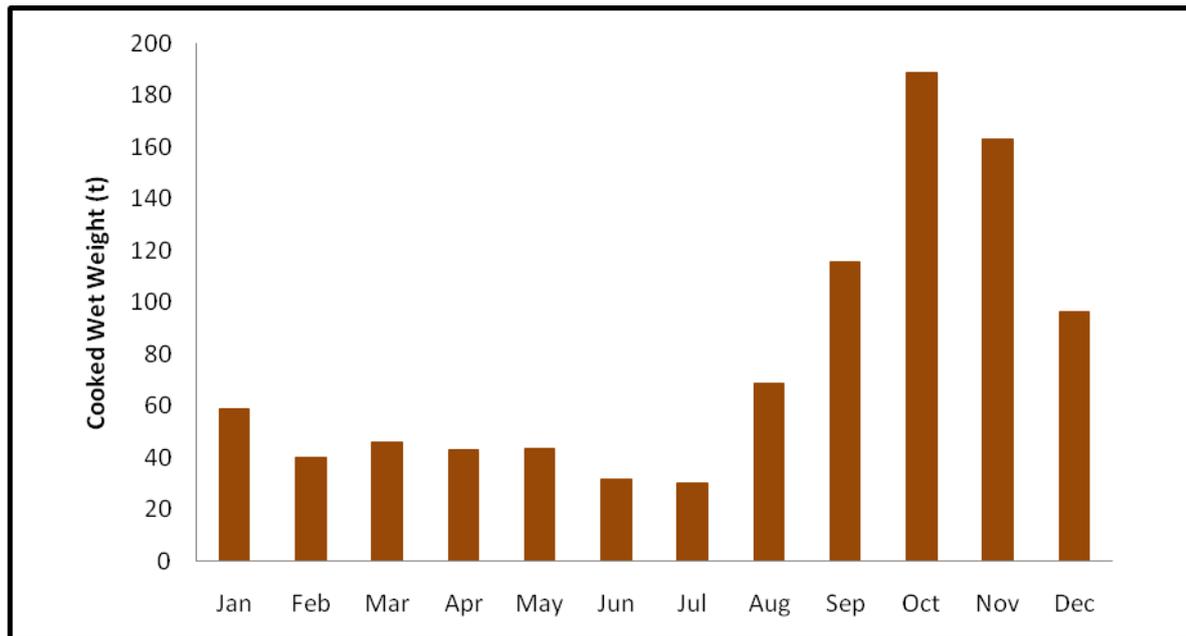


Figure 3.1.2.2 Average brown shrimp (*Crangon crangon*) cooked wet weight (t) of monthly landings between 2000 and 2010 caught in ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (MMO, 2011).

The shrimp fishery is in operation all year round although landings of brown shrimp are greatest between August and December (Figure 3.1.2.2; MMO, 2011). This is because fishermen target other local shellfish stocks between May and July (Walmsley & Pawson, 2007), and in the winter months fishing can be restricted due to stormy weather or cold temperatures which drive shrimp offshore or deeper into the sediments (pers. comm. Duncan Vaughan, 2011).

Based on LPUE data assessed by ICES, there are no indications that brown shrimp stocks are being overexploited. Trends in LPUE (Figure 3.1.2.4.) are, on average, fairly constant, indicating the brown shrimp stock is stable.

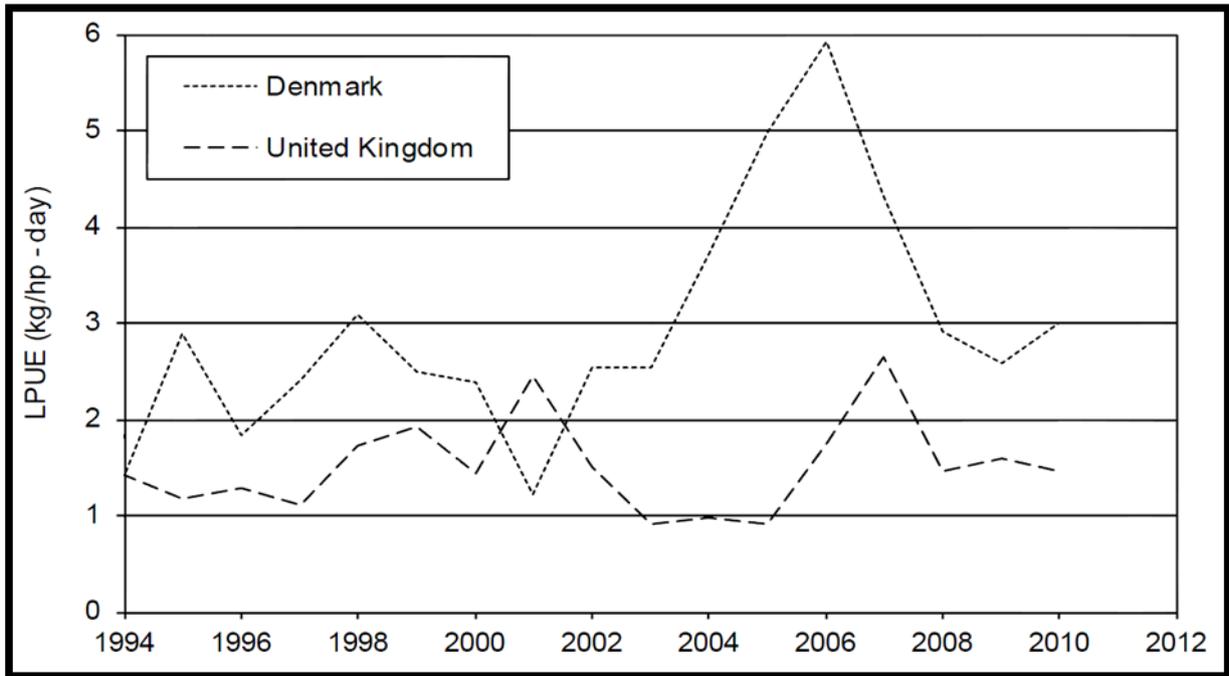


Figure 3.1.2.4 Brown shrimp (*Crangon crangon*) landings per unit effort (LPUE) (kilograms per horse-power day; kg/hp-day) in the UK and Danish fishing fleets. Figure source: ICES (ICES, 2011b). Used with the kind permission of the International Council for the Exploration of the Sea.

3.1.3 LANDINGS DATA

Fishing activity is reported in the form of landings declarations made by individual vessels greater than 10 m and typically as summary records for the below 10 m fleet. Landed weights are obtained at the merchants/processors as cooked weights of commercial-sized shrimps. In most cases, these estimates should be reasonable given the small size of these vessels often limiting the operational range of these boats to day trips in local ICES rectangles. A comparison of MMO landings data with export data provided by one of the two east coast shrimp processors indicates that MMO data is fairly accurate.

Improvements in reporting have also led to most landings since 1988 being accompanied by corresponding effort information in the form of the engine power of the vessels and the days fished (rounded to the nearest whole day). Since 2007, all landings have appropriate engine power and days fished information enabling computation of 'horse-power days' for each landing, and monthly and yearly summaries (ICES, 2010).

Fishermen's observations suggest that shrimps are more available or abundant between September and December, and this is supported by monthly landings data (Figure 3.1.2.2). Fishermen report that catch rates are highly variable from year to year and that this would make a stock assessment difficult. They also note that if it is a 'hard winter', catches fall, even with same effort, and that the inner grounds can be devoid of shrimp. In comparison, in good winters stocks seem to remain stable and catches are high (pers. comm. Neil Lake and Stephen Williamson, 2011).

Fishermen will only target commercial shrimp grounds where demand and shrimp density are high enough, and fuel prices low enough for fishing trips to be financially viable. There are many known targeted grounds which will be fished initially, and if these are not fruitful, fishing vessels will prospect for other viable grounds. Where brown and pink shrimp co-habit, the fishing ground is considered "bad" because sorting is very time-consuming (pers.

comm. Stephen Williamson, 2011). Brown shrimp are often targeted “on the edges of slopes” and catch rates are therefore very dependent on the skill of the fishermen.

3.1.4 PORT ACTIVITY AND FLEET STRUCTURE

In 1996, the brown shrimp beam trawl fleet comprised 98 vessels, of which 80% (79) actively fished. A survey by Catchpole *et al.* (2008) showed that by 2006, the number of active vessels fell by 23%, to 60 with 60% of the vessels identified in the 1996 survey no longer registered as commercial fishing vessels. There was also a marginal increase in the mean length of vessels during the period 1996–2006. The smallest vessels in 1996 operated single beam trawls, but none of these were reported in 2006. As the majority of brown shrimp landings originate from the Wash or outer Humber estuary, Kings Lynn is the most important port.

There are two processing plants which process and grade brown shrimp close to the fishing port at Kings Lynn and almost exclusively buy East Coast brown shrimp landings. However, Grimsby, Boston and Lowestoft also receive notable landings (MMO, 2011) (Figure 3.1.4.1).

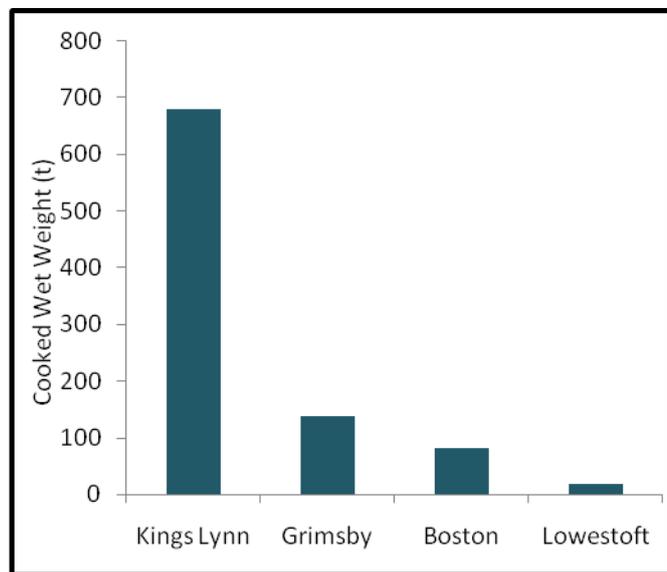


Figure 3.1.4.1 Average annual brown shrimp (*Crangon crangon*) total cooked wet weight (t) for landings between 2000 and 2010 for ports reporting landings >5 t caught in ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (MMO, 2011).

Kings Lynn

Brown shrimp are landed throughout the year at Kings Lynn (Walmsley & Pawson, 2007). This port has over 30 active vessels which use twin beam trawls to catch shrimp, or dredgers for collecting cockles and mussels.

Grimsby

The local fleet at Grimsby has greatly declined in recent years, and now consists of approximately 8 beam and otter trawlers, 4 seiners, 4 gillnetters, 2 long-liners and 1 potter. Approximately 10 boats are confined to fishing inshore, several of which are only active in the Humber Estuary. Inshore trawlers target sole during the summer and from autumn the smaller trawlers exploit brown shrimp, sometimes joined by larger vessels from the Wash (Walmsley & Pawson, 2007).

Boston

There are 13 boats, 7-14 m in size, that operate from Boston. These vessels regularly beam trawl for brown and pink shrimp from the end of summer to spring depending on fishery health and market value (Walmsley & Pawson, 2007).

3.1.5 MAIN COMMERCIAL MARKET

The two main processors of brown shrimp operating in the assessment area are located in Kings Lynn. The brown shrimp from the East Coast Brown Shrimp Fishery, almost exclusively purchased by these two main processors which is then sold mainly to the European market.

The EU market for brown shrimp is dominated by two Dutch companies, HEIPLOEG and KLAAS PUUL, who buy approximately 30,000 t of brown shrimp a year. This represents around 80% of the total European brown shrimp

purchased (European Parliament, 2011). Other important companies are HEYKO (who sell only to HEIPLOEG), and TELSON.

Table 3.1.5.1 The weight of brown shrimp (*Crangon crangon*) purchased by Dutch companies with associated turnover and contribution to total company turnover (European Parliament, 2011).

Company	Brown shrimp purchases (t/yr)	Turnover 2010 (Mil €)	% of company's overall turnover
HEIPLOEG	17-20,000	213	30
KLAAS PUUL	11,000	143	30
HEYKO	2,500	11	100
TELSON	2,400	5.5	95

HEIPLOEG is the market leader and largest supplier of shrimp in Europe, accounting for 54% of market share (Figure 3.1.5.1 & Table 3.1.5.1). This company buys 17-20,000 t of North Sea brown shrimp of which 80-90% comes from contracted fishermen and the rest in auctions (European Parliament, 2011). HEIPLOEG is an export-oriented company, with the Dutch market accounting for only 10% of total brown shrimp sales (European Parliament, 2011). The main destinations for the brown shrimp are Belgium (approx. 70% of sales), Germany (10%) and France (10%) (European Parliament, 2011).

KLAAS PUUL buy nearly 11,000 t of shrimp from Denmark and Germany where they have processing plants, and at auction in the Netherlands (European Parliament, 2011). In Germany the shrimp are bought from fishermen who sign contracts on a yearly basis. Belgium is also the main market for KLAAS PUUL (~45% of sales), followed by Germany (~23%), the Netherlands (~22%) and France (~4%). Total sales reached €143 million between 2009 and 2010 (European Parliament, 2011).

HEYKO buys 2,500 t of raw brown shrimp per year in the Dutch auctions which are sent to be peeled by an independent company in Morocco (European Parliament, 2011).

TELSON acts as a service provider organising transport and peeling of brown shrimp for external clients. In 2010 TELSON handled 2,400 t of brown shrimp (European Parliament, 2011).

Belgium is the main consumer market for peeled shrimp (more than half the total EU market), followed by the Netherlands and Germany. The main market for unpeeled shrimp is France. The export of shrimps to Morocco for peeling is about 24,000 t per year, of which approximately 75% is fresh and the remainder frozen (European Parliament, 2011).

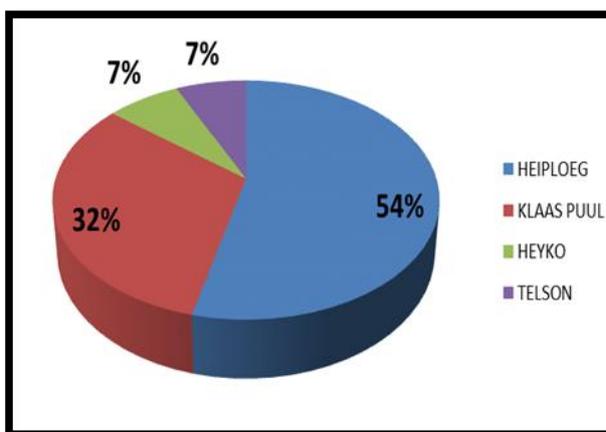


Figure 3.1.5.1 Approximate percentage brown shrimp (*Crangon crangon*) market share of main European brown shrimp buyers (European Parliament, 2011).

3.2 PRINCIPLE ONE: TARGET SPECIES BACKGROUND

3.2.1 SPECIES INFORMATION

Brown shrimp (*Crangon crangon*) are widely distributed and commonly found around the Atlantic coast of Europe. They are mottled brown in colour, have a wide anterior end that narrows to a fan tail and are distinguishable from the pink shrimp by the short blunt-ended rostrum and the position of the eyes on the head

(Figure 3.2.1.1).



Figure 3.2.1.1 The brown shrimp (*Crangon crangon*).
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Distribution

Brown shrimp are common around the UK (Figure 3.2.1.2). The main distribution is 'in highly productive areas with strong tidal movements of brackish water masses in the temperate climatic zone of Europe between 45° and 57° N on sandy and muddy substratum' (Kuipers & Dapper, 1984). Densities of brown shrimp sufficient for commercial exploitation are mainly found around the coastal areas of the North Sea and English Channel. Brown shrimp are commonly found on sandy bays, beaches and tidal flats from mid-shore down to 150 m (Neal, 2008). Preferred sediments are muddy sand to coarse sand with optimal particle sizes of 125-710µm for easy burial (Pinn & Ansell, 1993).

Densities of shrimp are highest between June and September with fewer found during the winter months (Beukema, 1992). Larger shrimps are often found in deeper waters whereas juveniles are thought to use the shallower tidal flats as transit nurseries (Beukema, 1992). The relative abundance of males changes with season and can also vary between fisheries.

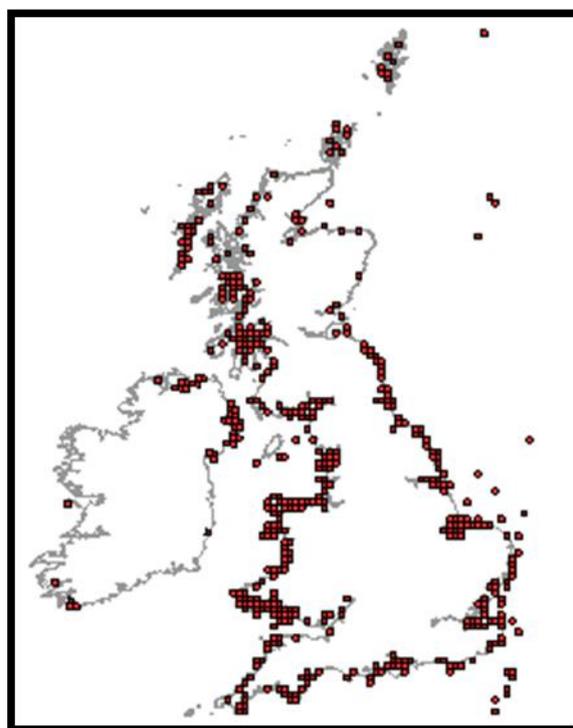


Figure 3.2.1.2 Distribution of brown shrimp, (*Crangon crangon*) in the UK. Red squares show presence in 10km squares (National Biodiversity Network, 2011 & NERC, 2004)

Feeding

Brown shrimp are opportunistic feeders and their diet is often determined by the composition of the benthic community and the abundance of available prey (Oh *et al.*, 2001). Studies of brown shrimp diet reveal a largely carnivorous diet of amphipods, polychaetes, meiofauna, juvenile fish, molluscs and juvenile brown shrimp, as well as green algae (especially *Ulva lactuca* and *Ulva intestinalis*). Brown shrimp are found in areas of extremely high turbidity and in areas where they can feed actively at night whilst avoiding predators (Addison *et al.*, 2003).

Reproduction

Egg laying first occurs at the age of 10 months when the shrimp is around 50mm in size (Meixner, 1966). Spawning occurs in all months of the year with peak egg production occurring during the summer and winter months (Arnold, 1993; Boddeke, 1982). Egg development lasts from 3.5 to 13 weeks depending on the water temperature (Arnold, 1993) after which a pelagic larval is released. The larva goes through five pelagic stages of development over a further five weeks (Kuipers & Dapper, 1984). Meixner (1966) observed renewed growth of the female reproductive gland only a few days after the first egg laying.

Larval settlement occurs on tidal flats, with peak settlement and recruitment from May to June when shrimp reach 10-20 mm. Small post settlement brown shrimp migrate to inshore nursery areas for better foraging and predation protection where they remain for 2-3 weeks before heading back offshore (Cattrijsse *et al.*, 1997). It is thought that this generation contributes significantly to the 'exploitable' autumn stock (Boddeke, 1996; del Norte-Campos & Temming, 1994; Temming & Damm, 2002) and the higher landings observed later in the year.

Monthly sampling of brown shrimp over a period of 5 years showed that brown shrimp numbers rise to a maximum in summer then decline to a winter low, the summer peak persisting longer offshore than inshore. A similar seasonal pattern of size distributions has been seen in the Wash, characterised by the arrival of a strong cohort of new juveniles in midsummer and a small cohort in winter. Egg bearing adults are few in winter, peak in May to June, and are virtually absent in late autumn. In the Wash, the small winter cohort of new juveniles may be derived from eggs of the last of the egg bearing females in the summer (Duran, 1998).

Ecological importance

Brown shrimp is an ecologically important benthic predator and prey item within the North Sea food web, particularly in intertidal areas where it is most abundant. This species plays an essential role in the transfer of energy from low trophic level invertebrate species in the benthos to commercially valuable fish at high trophic levels such as whiting, cod and pout (Dolbeth *et al.*, 2008; Hufnagl *et al.*, 2010; Pinnegar, 2009; Vinagre *et al.*, 2008). Numbers of brown shrimp appear to be inversely related to large numbers of whiting, cod, and sprat (Duran, 1998).

Growth

The maximum reported age for brown shrimp is just over three years. Populations are generally structured with 70-90 % of individuals in the first year class, 10-20% in the second year class and the remainder in the third (Oh *et al.*, 1999). The growth of brown shrimp is dependent on frequency of moulting occurrences which relate to the temperature of the habitat (every 13-30 days at 12° and 8-9 days at 16-18°) (Lloyd & Yonge, 1947). Increases in size of 1-3mm are observed with each moult. Brown shrimp males have a size range up to 55mm, females up to 85mm (Lloyd & Yonge, 1947) and exhibit high growth rates increasing from ripe egg to around 54 mm body length in the first 4 months (Boddeke *et al.*, 1986).

Behaviour

Revill *et al.* (2000) observed a relationship between the escape response and body length. Results showed larger shrimp could 'jump' higher in the water column and this increased in warmer waters. Light intensity increased the activity of brown shrimp, and it was also suggested that brown shrimp respond to clear water by burying themselves to avoid exposure to predators.

3.2.2 MONITORING

SOURCES OF DATA FOR THE EAST COAST BROWN SHRIMP FISHERY

Eastern IFCA (formerly Eastern Sea Fisheries Joint Committee)

The Eastern Inshore Fisheries and Conservation Authority (IFCA) monitored brown shrimp stocks at six sites in the Wash during the 1990s and early 2000s, ceasing in 2002. Regular sampling enabled a bank of data to be built up relating to brown shrimp abundance, distribution and population structure in the Wash. The surveys were established to help understand the recruitment strategy of brown shrimp in the Wash, and to improve our knowledge on seasonal patterns of catch rate and migration.

University of East Anglia

The School of Biological Sciences at UEA have also collected and analysed brown shrimp data in previous years. This data included comparisons of catch from the shoreline at Heacham. Their work has involved establishing models for the life cycle of the shrimp in the Wash.

Cefas

Extensive annual (71 sites) and monthly (21 sites) surveys have been carried out by Cefas since 1995 in the Wash, further up the Lincolnshire coast and offshore. Its primary aims were to assess brown shrimp abundance in relation to areas of offshore aggregate dredging in Aggregate Dredging Area 107.

Environment Agency

Similarly, brown shrimp surveys have been initiated as part of the long-term environmental monitoring plan (required as a condition for the granting of a license to increase freshwater abstraction from the River Great Ouse). Monitoring, undertaken by the Environment Agency, is concentrated on the south-east part of the Wash at the mouth of the river, with survey sites nearer Boston for control purposes. Catch rate and size distribution are monitored.

ICES

ICES have a Crangon Work Group which meets annually to discuss brown shrimp issues. In the most recent meeting (May, 2011), landings, distribution of effort, by-catch programmes, pollution load and stock assessments were discussed.

3.2.3 STOCK ASSESSMENTS

There are no formal assessments of the stock status of brown shrimp fishery in the UK. However, several statistics are collated by ICES Working Groups to broadly monitor the stocks in European waters. These include time trends and seasonal and spatial patterns of landings, species-specific fishing effort and landings per unit effort. Updates are also given on the latest advancements in key findings from studies relating to brown shrimp population trends and European MSC certification.

Brown shrimp stocks are difficult to assess because there is an unclear stock recruitment relationship, they are a short-lived species with high interannual variability and the minimum commercial size is not constant (unlike minimum landing size in many fish species). The combination of high mortality, short life span, lack of age determination and high variability in local catch rates makes most analytical assessment approaches impossible

to apply to brown shrimp populations. The high spatial variability in shrimp also means that catch rates in any scientific survey with a limited number of tows will most likely yield highly uncertain stock estimates.

Catch rates and landings are highly variable, often increasing from low levels in previous years, or are poor following a good year. The relationship between spawning stock size and recruitment is poorly understood. The total mortality of brown shrimp depends on fishing mortality and natural mortality (ICES, 2009).

The 2010 ICES *Crangon* Working Group looked at alternative approaches to stock assessment and sustainable management. The following three alternatives were discussed:

1) A co-management approach to monitoring and management of shrimp fisheries

This approach involves conducting a survey with a large number of standardised catches from commercial vessels in early and late summer to establish the different cohorts of recruits and to obtain by-catch data.

2) Ad hoc shrimp fishery regulation

A system based on setting reference points calculated from landings per unit effort (LPUE) data to implement a 'traffic light' system of reactions by the fishing fleet depending on weekly catches. Where catch rates fall into the danger zone fishing restrictions are put in place. This is the stock assessment method currently being employed by the Dutch and German shrimp fisheries as part of their strategy to gain full MSC certification in the near future.

3) A combination of indicators of stock status

Rather than having a formal stock assessment, this system uses a combination of stock parameters including; number of berried females, size distributions and maximum length to assess the status of the stock. Various stock parameters (e.g. abundance of berried shrimp) could be monitored in conjunction with other stock assessments (1 or 2) to give a more detailed assessment.

These alternative approaches were discussed in the 2010 ICES *Crangon* Working Group meeting and the *Ad hoc* system was evaluated by the 2011 ICES *Crangon* Working Group (ICES, 2010; ICES, 2011b). (ICES reports available from www.ices.dk).

During the 2011 ICES Working Group meeting it was noted that, until recently, the general belief was that the brown shrimp stock could not be easily overfished and that natural mortality was significantly higher than fishing mortality. However, the levels of exploitation that took place when this mortality data was collected have changed considerably and there is also no up-to-date information to assess predation on brown shrimp. Thus, an alternative way to estimate the ratio of F/M (fishing mortality/natural mortality) using independent information on the total mortality, the total commercial catch and a swept area biomass estimate was discussed as a potential option. Other stock assessments were also further discussed. Good progress was made on both issues during the Working Group meeting which set the foundation for an application of a brown shrimp specific yield per recruit (Y/R) model, which was developed in the frame of a national German research programme. Depending on the finally estimated F/M ratio, either a MSY strategy or the $F_{0.1}$ approach can be applied to the brown shrimp stock. The $F_{0.1}$ approach uses the fishing mortality rate at which an increase in fishing mortality produces a 10 percent increase in yield per recruit relative to the first unit of effort on the unexploited stock (i.e., the slope of the yield-per-recruit curve for the $F_{0.1}$ rate is only one-tenth the slope of the curve at its origin).

Please see the 2010 and 2011 ICES *Crangon* Working Group reports (ICES, 2010; ICES, 2011b) for more details on stock assessment developments.

3.3 PRINCIPLE TWO: ECOSYSTEM BACKGROUND

3.3.1 BROWN SHRIMP: FISHING GEAR AND THE BENTHIC ENVIRONMENT

The Wash and Humber are two of the largest estuarine systems in the UK. The variety of habitats found in the Wash, Humber and the surrounding area support a wide diversity of species (Murby, 1997).

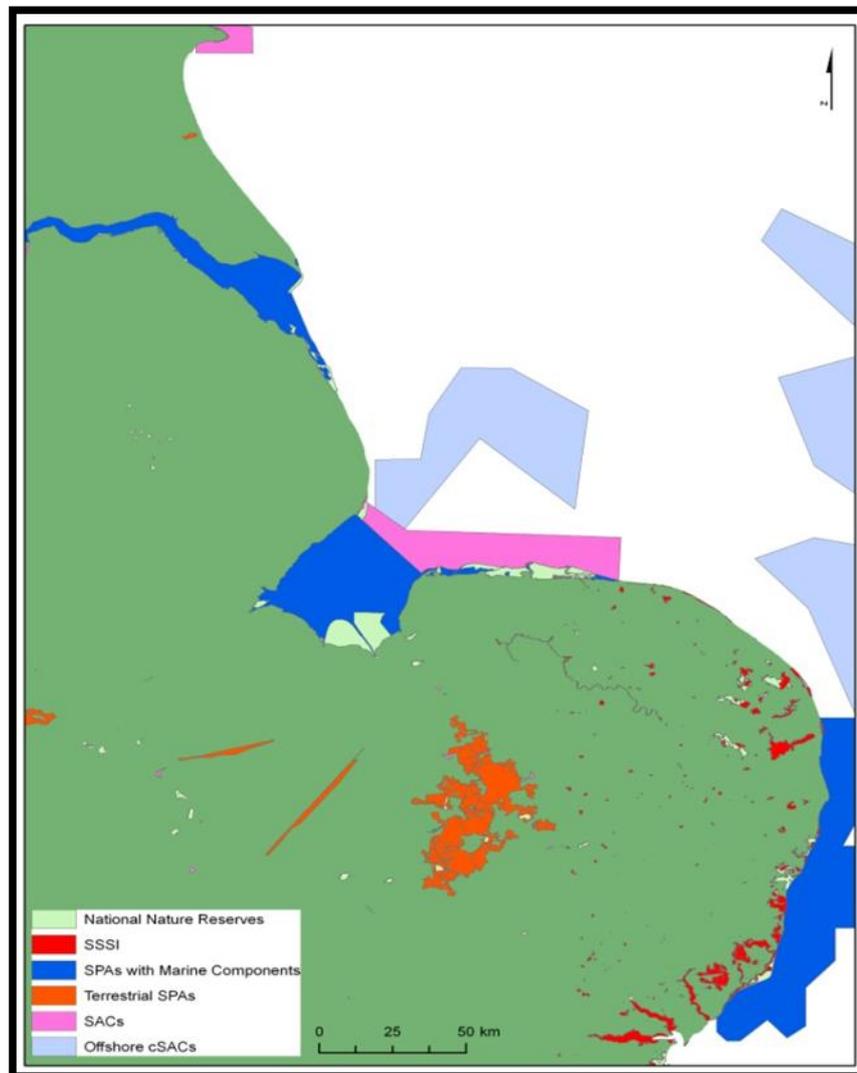


Figure 3.3.1.1 Protected areas around the Wash brown shrimp fishery. Positional data: Natural England, 2011. Data downloaded from http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp

Both estuaries are locally, nationally and internationally important for a variety of plants, birds, marine life and habitats and consequently have a number of protected sites (Figure 3.3.1.1). There are significant Intertidal flats, especially soft mudflats, supporting important populations of marine worms, molluscs and other invertebrates, often in high densities and biomass. These invertebrate populations provide an abundant food source for fish and are of particular importance to waterfowl and wading birds which visit the area in their thousands during the winter months. The Wash contains a large breeding colony of common seals (*Phoca vitulina*) and the North Sea supports a range of marine communities which are of international importance including Ross worms (*Sabellaria spinulosa*), brittlestars, lug worms and sand mason worms (Hartwell, 2011; Murby, 1997).

Subtidal areas provide an important breeding, sheltering and nursery area for fish species. The Wash and Humber are also major spawning areas for plaice *Pleuronectes platessa*, Dover sole *Solea solea*, cod *Gadus morhua*, eel *Anguilla anguilla*, and shrimp (Catchpole *et al.*, 2008; Hartwell, 2011; Murby, 1997; Rogers *et al.*, 1998). Demersal trawl fisheries, such as those for brown shrimp, use methods that involve towing beam trawls over the sea bed. Although designed to aid in the fishing process, the gears can be detrimental to the benthic environment and associated biota through increased contact.

The main fishing areas for brown shrimp fishing also correspond to the nursery grounds of important commercial round fish caught in the North Sea, including plaice, whiting and cod (Catchpole *et al.*, 2008; Rogers *et al.*, 1998).

The majority of brown shrimp fishing vessels in the assessment area use twin shrimp beam trawls (Figure 3.3.1.2). Similar gear used in the Wadden Sea has been described as relatively light (Vorberg, 2000). These bottom trawls work by disturbing the shrimp so that they jump up from the seabed and into the net above. At the end of the tow, the fishermen raise the nets and bring the cod-end aboard to empty the catch so it can be sorted and processed.



Figure 3.3.1.2 A beam trawl used to catch brown shrimp (Catchpole, 2009).

In a recent research report produced by the Eastern Sea Fisheries Joint Committee (ESFJC) (Jessop *et al.*, 2010), the greatest anthropogenic impact on *S. spinulosa* reef is considered to be physical disturbance from fisheries activities, which causes damage to the reef communities by breaking them into small pieces. This damage leads to the reefs being unable to provide suitable habitats for the rich infauna and epifauna normally associated with this biotope (UK Biodiversity Group, 1999 as cited in Jessop *et al.*, 2010). Although dredging, trawling and potting can all cause damage to the reefs, the location of the identified reefs in the central Wash, corresponding to SSSI Unit 58, indicated that the greatest impact is likely to be from the beam trawl shrimp fisheries, particularly those targeting the pink shrimp, *Pandalus montagui*. Whilst in some cases it may be possible for the brown shrimp fisheries to be associated with *S. spinulosa* reef, it is much more likely that the pink shrimp fishery targets these reef areas (discussed in Section 4.3.1).

The effects of trawling are likely to be site-specific and will vary with fishing intensity and benthic community structure. The removal of habitat in sediment systems can significantly decrease their biodiversity (Thrush *et al.*, 2001). However, effects on highly mobile, soft-bottomed habitats are likely to be less significant as the benthic communities are already adapted to the high levels of natural disturbance, consisting of often rapidly recruiting and fast growing 'opportunistic' species.

Shrimp trawls are often reported to make relatively light contact with the seabed in comparison to other trawl gears (Vorberg, 2000) which may limit their impact on benthic habitats. Evidence from muddy soft sediments in the Gulf of Maine indicates that shrimp fishing with otter trawls did not result in long term impacts. However, these habitats may be resilient to trawling damage as there were subject to high levels of natural disturbance from burrowing and pit-digging by benthic megafauna, such as lobsters and fish Simpson and Watling (2006). The environmental impact of the UK brown shrimp fishery has not been assessed in detail as has been done for other shrimp fisheries.

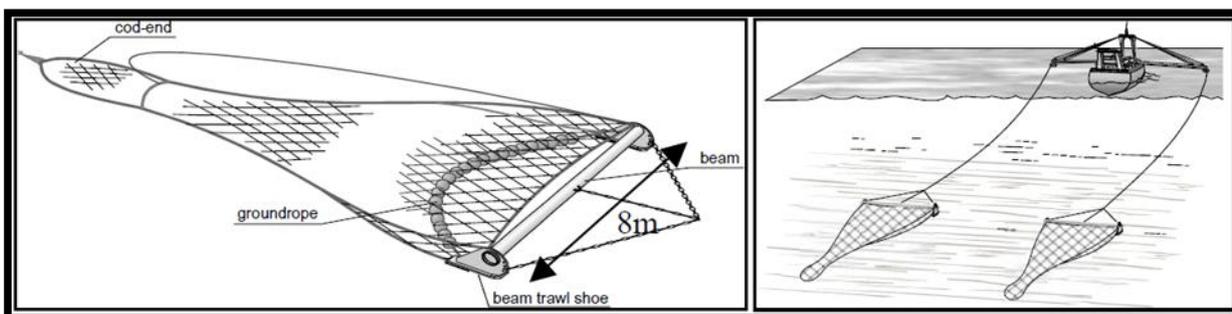


Figure 3.3.1.3 The single beam trawl (left) and a shrimp beam trawler rigged with double beam trawl (Polet, 2003).

In recent years, the UK brown shrimp fishery has generally used twin beam trawls (Table 3.3.1.1 & Figure 3.3.1.2 & 3.3.1.3) between 6 – 18m wide (Catchpole *et al.*, 2008; Reville *et al.*, 1999) mostly operating from the ports of Kings Lynn, Boston and Grimsby. The fleet is far from homogenous and vessels range from small open type boats to much larger vessels. All of the vessels operate in the inshore waters off the Lincolnshire and Norfolk coast. Cod-end mesh sizes are variable; a minimum mesh size of 16 mm is legally allowed however sizes actually used in the fishery range up to 26 mm (pers. comm. Neil Lake, 2011).

The beam trawls are dragged simultaneously along the seabed, generally a sandy/muddy bottom, on either side of the vessel by means of two outrigger beams, and the catch is collected in the cod-end. The length of the haul will vary in duration from thirty minutes to three hours (pers. comm. Stephen Williamson, 2011) depending on weather conditions, catch volume and season.

The catch of each haul is handled on board. On the more modern vessels, catch-handling equipment may be more modernized and automated. Nevertheless, all vessels follow approximately similar procedures (Polet, 2003). The catch from the cod-end is placed into a container and sorted into separate fractions, after which the non-commercial by-catch is discarded. The catch is sorted into fractions by way of a rotating shrimp riddle or a flatbed riddle (Figure 3.3.1.4).

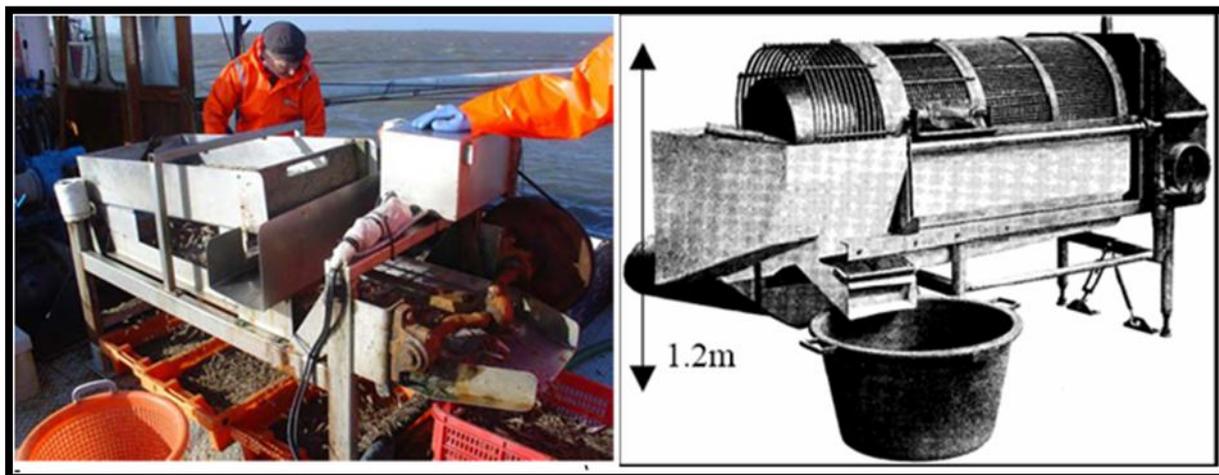


Figure 3.3.1.4 Left: flatbed riddle (Source Catchpole, 2006, reproduced in Doekson, 2006). Right: Rotating shrimp riddle reproduced in Doekson, 2006).

A flow of water leads the collected catch onto a conveyer belt, which leads to the rotating shrimp riddle. The catch fractions are collected in containers (seen in Figure 3.3.1.4) and the commercial shrimp fraction is boiled on board (pers. comm. Neil Lake, 2011). Marketable fish are picked out manually before and/or after the catch has gone through the sorting device. Unwanted by-catch is discarded overboard manually (surface disposal).

Table 3.3.1.1 Percentage of vessels with various wheelhouse and deck equipment in 1996 and 2006 (Catchpole *et al.*, 2008).

Equipment	1996	2006
Twin beams	88%	100%
Shaking sieve	85%	74%
Rotary sieve	33%	40%
VHF	100%	100%
Autopilot	46%	82%
Colour echo sounder	52%	82%
Ground discrimination	13%	26%
Track plotter	40%	94%

3.3.2 By-catch

There is a substantial by-catch in shrimp fisheries as a result of the small size of shrimp and hence small mesh sizes of nets required to catch them. The main fishing areas for brown shrimp are also nursery grounds for commercially important fish including plaice, whiting and cod, resulting in a large by-catch of juvenile fish (Catchpole *et al.*, 2008). A number of non-commercial species are also caught including echinoderms, such as brittlestars, and crustaceans (Catchpole *et al.*, 2008; Mander *et al.*, 1998; Polet, 2002), and this could result in wider ecosystem effects.

By-catch Seasonality

The Eastern Sea Fisheries Joint Committee (now Eastern IFCA) monitoring programme in the late 90's for brown shrimp included monthly surveys of six sites in the Wash (Figure 3.3.2.1). Surveys were conducted using 2 m beam trawls with a 5 mm cod-end, each tow lasting 10 minutes at a constant speed of two knots (Mander *et al.*, 1998). The abundance of species caught was recorded using a relative abundance scale as follows: 0 = none; 1 = 1-5 individuals; 2 = 6-19 individuals; 3 = 20-49 individuals; 4 = 50-99 individuals; and 5 = 100+ individuals. Data from surveys undertaken in the year 1998 have been used in this assessment as a high level of survey success (96 %) was achieved during this period. Sunk Sand was not surveyed in August, and West Common and Ferrier Sand were not surveyed in November due to adverse weather conditions (Mander *et al.*, 1998). Abundance of important by-catch species, cod, plaice, sole and whiting, were separated from the original data and averages of the two sites at the offshore, mid-offshore and inshore locations calculated, allowing an assessment to be made throughout the year (Figure 3.3.2.2).

The survey data does not reflect true by-catch levels as the trawls were conducted with a finer mesh than is used commercially. In addition, most commercial shrimp trawlers now use selective sieve nets (also known as veil nets, see Figure 3.3.4.1), which have been shown to reduce capture rates of many commercial and non-commercial species (Table 3.3.4.1 & Figure 3.3.4.3). Considering the seasonality of by-catch, abundance could help to identify seasons of elevated by-catch. It must also be remembered that the survey data was taken from only one year and thus there is no indication of annual variation.

Occurrences of cod in the trawls were low throughout the year compared to other species, possibly indicative of its poor stock status (ICES advice series; www.ices.dk), and whilst catches of sole were also relatively low they showed small increases during the summer and winter months (Figure 3.3.2.2).

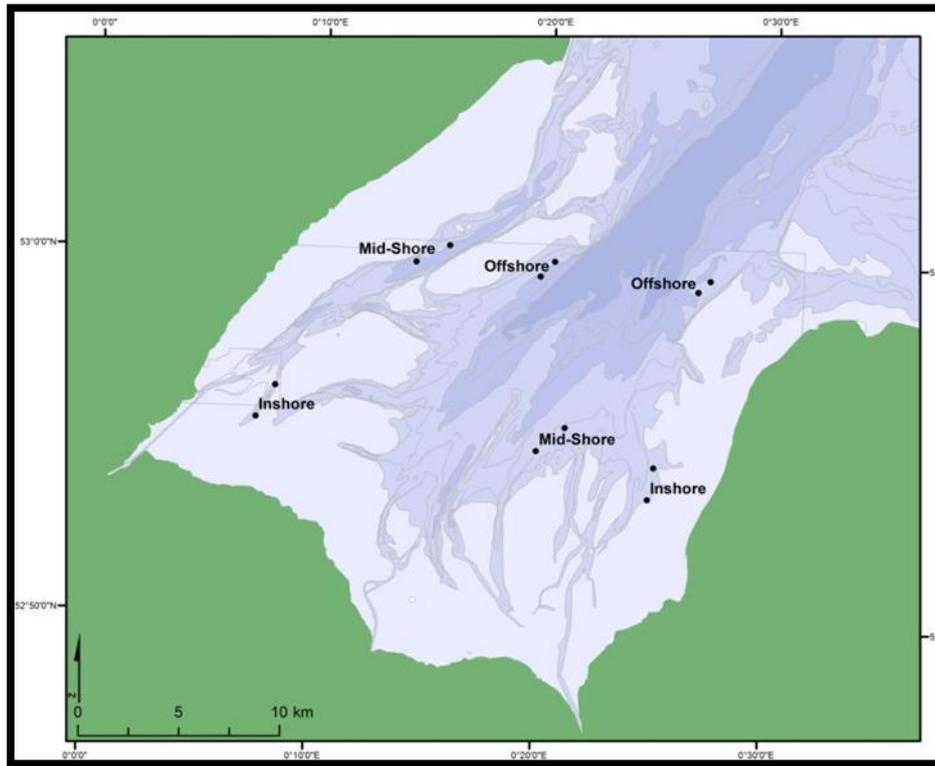


Figure 3.3.2.1 Chart showing the positions of Eastern IFCA sample sites (Mander *et al.*, 1998)

Seasonal trends in by-catch vary geographically; offshore grounds show an increase in total abundance of by-catch from August to November (Figure 3.3.2.2.c), accounted for primarily by increased levels of plaice and whiting. The total of the main commercial by-catch species caught in the mid offshore grounds (Figure 3.3.2.2.b) show a similar pattern remaining at a consistent level throughout the year but increasing in November. This anomaly can be explained as data for the month of November was only available for one site (Boston Deepes) and therefore no average is available which has resulted in a particularly high peak. In inshore grounds, peak by-catch abundance was observed in January, May-June and September-November (Figure 3.3.2.2.a), mainly as a result of the variation in whiting catches.

Variability in by-catch abundance may also be influenced by environmental factors e.g. sea surface temperature, changes in food availability, competition and predation.

Landings of brown shrimp are typically largest during the autumn months (Doekson, 2006; ICES, 2009), consistent with high densities of brown shrimp in the Wash from August to December (Doekson, 2006). This coincides with the highest levels of by-catch observed during the trawl surveys, suggesting it might be difficult to establish a seasonal closure without having an impact on brown shrimp landings.

Alternative sources of By-catch data

Unfortunately, due to time limitations during the current pre-assessment, the raw data that informs the by-catch from Cefas brown shrimp monitoring, Cefas young fish monitoring, and from sieve net studies by Catchpole *et al.* (2008) has not been accessed. Throughout these studies by-catch data was recorded. It maybe possible for the fishery to access this information, which would be of great use for management decisions but the fishery would have to apply directly to the organisations involved in the data collection to comply with The Data Protection Act.

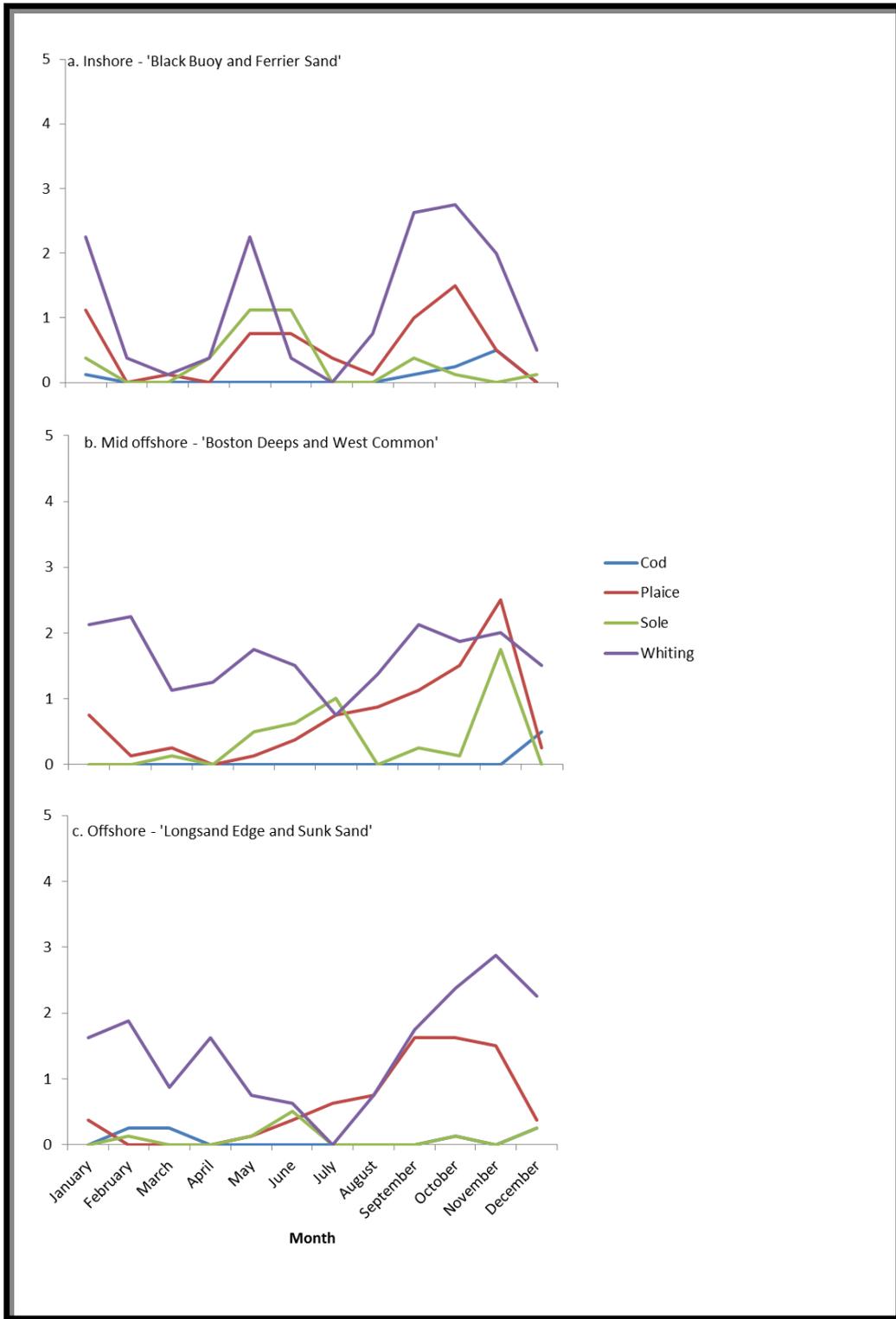


Figure 3.3.2.2 Variation in the average relative abundance of cod, plaice, sole, and whiting caught using a 5 mm mesh beam trawl at (a) inshore sites; (b) mid offshore sites; and (c) offshore sites (see Figure 3.3.2.1 for station locations). Data provided by Eastern IFCA for the year 1998.

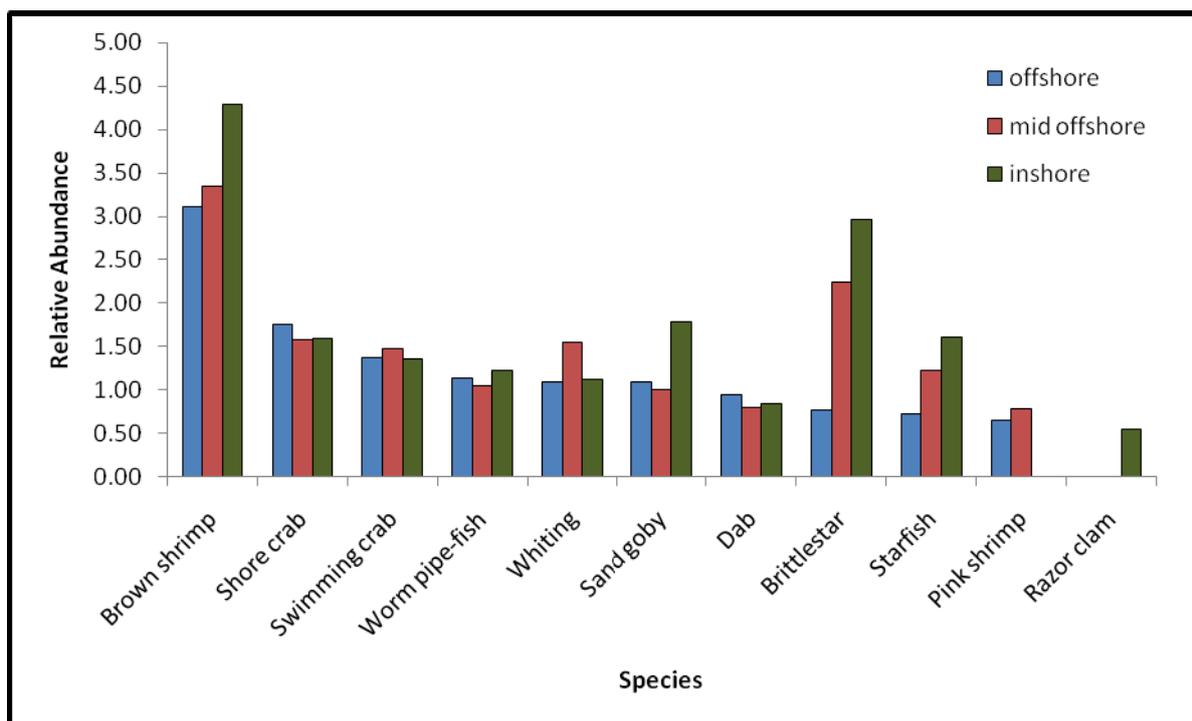


Figure 3.3.2.3 Comparison of the top species (relative abundance) averaged throughout the year for the offshore, mid offshore and inshore sites.

Figure 3.3.2.3 shows a breakdown in the average by-catch abundance in 1998 which indicated the composition of by-catch is constant geographically. When comparing the sites, we see that, generally, the composition of by-catch based on relative abundance scores is almost identical across the offshore, mid-offshore and inshore sites. However, differences can be seen for pink shrimp, starfish, brittlestars, and razor clams. Pink shrimp were only caught at offshore and mid offshore sites in similar abundances, starfish decreased in number with increasing distance from the shore as did brittlestars, and razor clams were, characteristically, only seen in inshore samples. Brown shrimp were the most abundant species and were most abundant at inshore sites.

3.3.3 ENDANGERED, THREATENED AND PROTECTED (ETP) SPECIES

ETP species are predominantly cetaceans and other marine mammals such as seals but also includes basking sharks, seahorses and a number of anthozoan species. There are species present within the assessment area which are protected and some which have 'threatened' status. The MSC criteria aims to protect 'endangered, threatened or protected (ETP) species', which are those that are recognised by national legislation and/or binding international agreements (e.g. CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora) to which the jurisdictions controlling the fishery under assessment are party. Many by-catch species caught have protected status (Table 3.3.3.1); however, none are legally binding, making direct impacts on ETP species, in terms of the MSC methodology, unlikely. The Wash (see Figure 3.3.3.2) is home to a breeding colony of the harbour seal,



Figure 3.3.3.1 Harbour Seal, *Phoca vitulina*
© Marine Wildlife Department at Gardline Environmental.

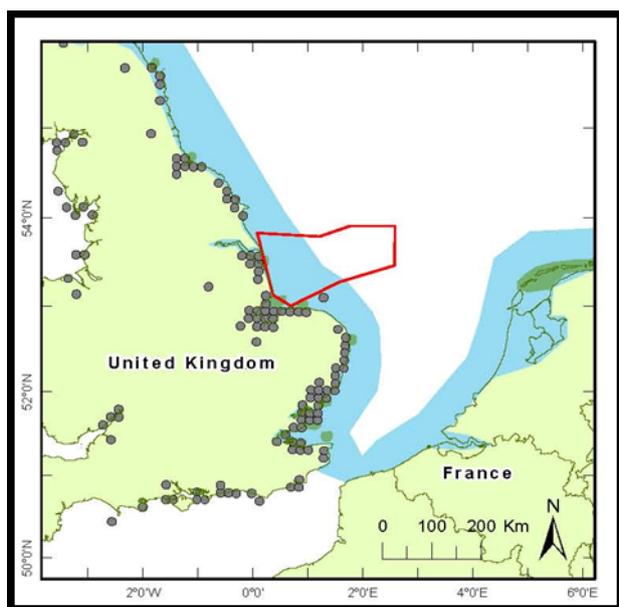


Figure 3.3.3.2 Recorded sightings, distribution and haul out sites of harbour seals, *Phoca vitulina*, (Hammond *et al.*, 2002; NBN, 2010; Reijnders *et al.*, 1997). Figure Source: Humber Regional Environmental Characterisation report (Tappin *et al.*, 2011).

Phoca vitulina (Figure 3.3.3.1). This is the largest colony of common seals in England (Hartwell, 2011), making it particularly important to the UK population. The Sea Mammal Research Unit (SMRU) has been monitoring the haul-out sites used by common seals in the Wash through annual surveys during the moulting and pupping seasons (June to August).

Harbour seals are important predators in the North Sea, commonly consuming prey such as sandeels, gadoids, clupeoid fish and cephalopod species (Hall *et al.*, 1998; Hammond *et al.*, 2002; Pierce & Santos, 2003; Prime & Hammond, 1990). The harbour seals' estimated annual prey consumption is between 65,000 and 95,000 t in the North Sea

(Hammond *et al.*, 2002). The common seal is protected by the Conservation of Seals Act (1970) during the breeding season, and is listed in Annex II of the EU Habitats Directive (Hartwell, 2011).

Table 3.3.3.1 A list of potential by-catch species with their protective designations. Average abundance index was calculated from data supplied by Eastern IFCA, methodology outlined in Section 3.3.2 (Mander *et al.*, 1998).

Scientific Species Name	Common Species Name	Abundance index Average	Reporting Category	Designation	Source (see text in blue box for more information)
Commercial (MSC: 'retained')					
<i>Merlangius merlangus</i>	Whiting	1.36	Biodiversity Lists - England	England NERC S.41	Natural Environment and Rural Communities Act 2006 - Species of Principal Importance in England (section 41) and Wales (section 42)
			Biodiversity Action Plan UK List of Priority Species	Priority Species	UK List of Priority Habitats and Species
<i>Pleuronectes platessa</i>	Plaice	0.57	Global Red List Status	Lower risk - least concern	The IUCN Red List of Threatened Species (2010)
			Biodiversity Action Plan UK List of Priority Species	Priority Species	UK List of Priority Habitats and Species
<i>Solea solea</i>	Sole	0.23	Biodiversity Action Plan UK List of Priority Species	Priority Species	UK List of Priority Habitats and Species
<i>Gadus morhua</i>	Cod	0.06	OSPAR	OSPAR	OSPAR List of Threatened and/or Declining Species and Habitats, 2008
			Biodiversity Action Plan UK List of Priority Species	Priority Species	UK List of Priority Habitats and Species
<i>Clupea harengus</i>	Herring	0.06	Biodiversity Action Plan UK List of Priority Species	Priority Species	UK List of Priority Habitats and Species
Non-Commercial (MSC: 'by-catch')					
<i>Pomatoschistus</i> sp.	Sand goby	1.22	Bern Convention	Appendix 3	Bern Convention

The Natural Environment and Rural Communities (NERC) Act

The Natural Environment and Rural Communities (NERC) Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. Species on this list are those that have been identified as requiring action under the UK BAP (Natural England, 2011

<http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx>).

UK BAP

UK Biodiversity Action Plan (BAP) priority species, for example, cod and plaice, are those that have been identified as being most threatened and requiring conservation action (JNCC, 2011 <http://jncc.defra.gov.uk/default.aspx?page=5705>).

The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention)

The Convention on the Conservation of European Wildlife and Natural Habitats imposes legal obligations to conserve and protect plants, animals and their habitats (listed in Appendices 1 and 2) and to regulate the exploitation of species (JNCC, 2010 <http://jncc.defra.gov.uk/page-1364>).

The IUCN Red List

The IUCN Red List of Threatened Species classifies species on the basis of their risk of extinction. Plaice have been classified as “Least Concern”, and are described as “A widespread species which is vulnerable to overfishing in the sea, but this is not currently thought to be causing a decline great enough to qualify the species as threatened.” <www.iucnredlist.org>. Downloaded on 13 July 2011.

The OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (The OSPAR Convention) was adopted with the intention of addressing matters relating to the protection of the marine environment. Part of the strategy involves the development of a list of species in need of protection (JNCC, 2010 <http://jncc.defra.gov.uk/page-1370>).

3.3.4 SELECTIVE SHRIMP FISHING GEAR

Improving the selectivity of demersal trawls can substantially reduce discards and hence the effect trawls have on the benthic marine environment.

In 2003, legislation for the European shrimp fishery was introduced, requiring the use of selective gear, namely sieve nets, also known as veil nets (Holst & Revill, 2001) or selection grids, in order to reduce by-catch (ICES, 2008). Each member state is responsible for implementing its own legislation. The UK introduced The Shrimp Fishing Nets Order 2002. The order prohibits fishing for shrimps without a separator trawl (sieve net) or sorting grid:

1) No British fishing boat shall carry or deploy a net, whose mesh measures between 16 and 31 millimetres unless—

(a) netting, the mesh of which measures at least twice that of the cod-end and no more than 70 millimetres, is fitted across the entire cross-section of the net in such a way that—

(i) sea fish cannot reach the cod-end without first passing through the netting; and

(ii) there is a hole in the net through which all sea fish that do not pass through the netting are able to escape;

(b) a rigid grid, the spacing between the bars of which is no more than 20 millimetres, is fitted across the entire cross-section of the net in such a way that—

(i) sea fish cannot reach the cod-end without first passing through the grid; and

(ii) there is a hole in the net through which all sea fish that do not pass through the grid are able to escape;

(c) no sea fish have been caught; or

(d) where sea fish have been caught, less than 60 per cent by live weight of the total catch comprises common shrimps (*Crangon spp.*), Aesop shrimps (*Pandalus montagui*) or a combination of the two, and the retention of sea fish on board the boat is consistent with Article 25 of Council Regulation 850/98 of 30 March 1998 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms(d) as last amended by Council Regulation (EC) No 973/2001 of 14 May 2001(e).

(2) The prohibition in this article shall not apply to fishing boats with either—

(a)an aggregate beam width of 8 metres or less; or

(b)a net headline of 8 metres or less.”

Article 25 of Council Regulation 850/98 uses the term “separator trawl” for what is commonly known in the UK shrimp industry as a sieve net (Figure 3.3.4.1); that is a funnel or sheet of netting that is capable of separating white fish from shrimps. Shrimps can pass through the sieve net into the small-mesh cod-end while white fish are directed to an escape hole which allows them to pass out into the sea. During some periods, weed clogging the sieve net was raised as a potential problem that could occur throughout the year for short periods (Catchpole *et al.*, 2008).

The mesh of the sieve net must be at least twice the mesh of the cod-end. As well as the benefits to conservation, sieve nets have been adopted because they lead to a cleaner catch with fewer non-target species, such as small fish and crabs. A variety of mesh sizes are used for sieve nets up to 70 mm. The majority of the East Coast brown shrimp fishing fleet use sieve nets (pers. comm. Neil Lake and Stephen Williamson, 2011). However, some small independent boats still choose not to operate selective devices. It is thought that separator grids are not used by any of the fleet.

Polet *et al.* (2004) evaluated the success of sieve nets used within the Belgian brown shrimp fishery in the North Sea. For fish aged 1 year and older the sieve net was considered successful in its purpose of reducing by-catch, however, selectivity was poor for all fish species measuring less than 10cm, with only one quarter being released (Polet, 2003 cited in Doekson, 2006). A 15% reduction or less was observed in the commercial shrimp catch in favourable conditions, however, this was significantly lower than the losses observed with a selective sorting grid (Polet *et al.*, 2004). It has been suggested that reductions in productivity are felt most strongly by vessels that do not primarily target shrimp (Innes & Pascoe, 2007).

Catchpole *et al.* (2008) assessed the efficacy of the selective gears, in the Wash and around the North Norfolk coast (Figure. 3.3.4.2) with comparable results to Polet *et al.* (2004). Sieve nets were found to reduce the capture of unwanted organisms such as other invertebrate species and were shown to be particularly effective at reducing by-catch of cod, *Gadus morhua*, with a 70% reduction observed. Given the poor size of the cod spawning stock biomass and low recruitment within the North Sea, it is essential that by-catch of this species is minimized. The stock status and percentage reduction in by-catch observed with the use of sieve nets is given in Table 3.3.4.1. Some species with unknown status have relatively low percentage reductions (e.g. sprat, whiting, smelt and sand gobies). It was estimated that during 2006 the UK brown shrimp fishery discarded approximately 4.5 (± 0.5) million plaice, 1.2 (± 0.2) million dab, 1.6 (± 0.2) million whiting and approximately 0.1 million cod during 2006 even with the use sieve nets (Catchpole *et al.*, 2008). However, landings between 2000 and 2010 were lowest during 2006 (Figure 3.1.2.1), thus, average annual numbers of discarded fish are likely to be higher than those suggested by Catchpole *et al.* (2008).

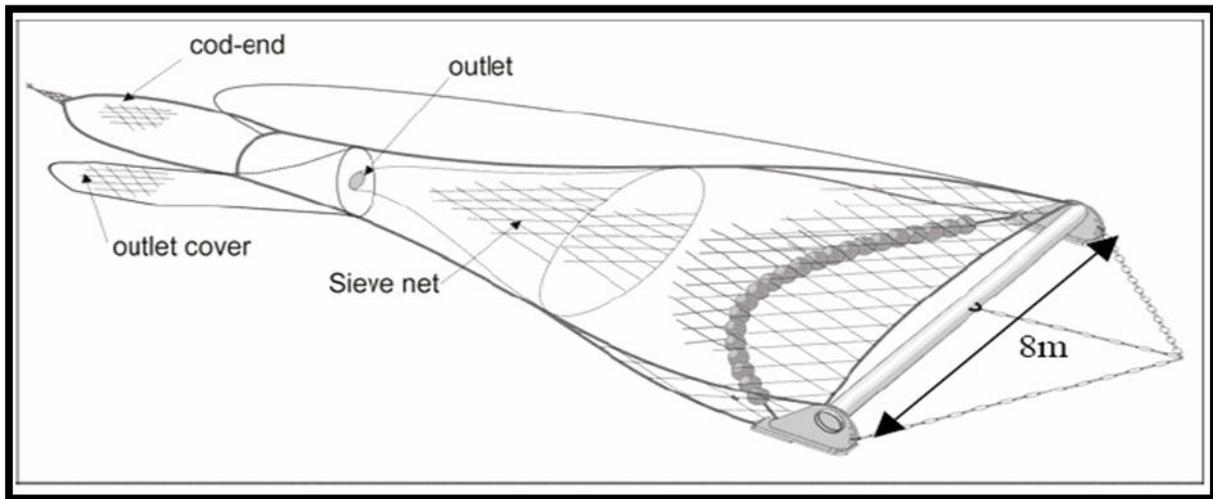


Figure 3.3.4.1 A shrimp beam trawl with sieve net and an outlet cover (Doekson, 2006).

Table 3.3.4.1 By-catch species in order of abundance in hauls showing the percentage reduction in by-catch from hauls when operating sieve nets (Catchpole *et al.*, 2008), and the ICES defined stock status of each species(ICES, 2011a).

Species	Common name	No sieve mean no.	With sieve mean no.	Percentage reduction	Stock status (ICES)
Commercial (MSC: 'retained')					
<i>Pleuronectes platessa</i>	Plaice	307±34	206±25	33%	Within safe biological limits
<i>Clupea harengus</i>	Herring	171±32	141±26	17%	Full reproductive capacity, fished sustainably
<i>Sprattus sprattus</i>	Sprat	142±23	113±18	20%	Unknown
<i>Limanda limanda</i>	Dab	103±14	57±10	45%	Lack of data
<i>Merlangius merlangus</i>	Whiting	99±10	72±7	27%	Undefined
<i>Gadus morhua</i>	Cod	19±5	5±1	70%	Below B_{lim} , poor recruitment
<i>Platichthys flesus</i>	Flounder	9±3	2±1	72%	Lack of data
<i>Solea solea</i>	Sole	0.3±0.1	0.004±0.03	86%	Within safe biological limits
<i>Raja</i> spp.	Thornback ray	0.2±0.006	0.01±0.01	92%	Stable/increasing
Non-commercial (MSC: 'by-catch')					
<i>Pomatoschistus</i> spp.	Sand goby	647±97	492±65	24%	N/A
<i>Osmerus eperlanus</i>	Smelt	70±17	74±22	-6%	N/A
Syngnathidae	Pipefish	37±7	32±7	14%	N/A
<i>Carcinus maenas</i>	Green shore crab	57±12	16±4	71%	N/A
<i>Agonus cataphractus</i>	Pogge	22±4	10±3	53%	N/A
<i>Liocarcinus</i> spp.	Swimming crab	79±45	15±8	81%	N/A
<i>Pegusa lascaris</i>	Sand sole	16±3	9±2	40%	N/A
<i>Liparis liparis</i>	Sea-snail	14±5	2±0.2	83%	N/A
<i>Ophiothrix fragilis</i>	Brittlestar	8±30	5±2	51%	N/A

A “central motivation” behind the introduction of selective gear was to protect the North Sea plaice stocks, which make up a large proportion of the by-catch(Catchpole *et al.*, 2008). However, the technical measures were less effective at reducing by-catch of plaice, with only a 33% reduction observed (Table. 3.3.4.1and Figure. 3.3.4.3). The sieve nets are less effective at excluding plaice in this area because of their small size (predominantly 0-group fish)(Catchpole *et al.*, 2008).However, since this study was published, North Sea plaice stocks have increased to be within safe biological limits.

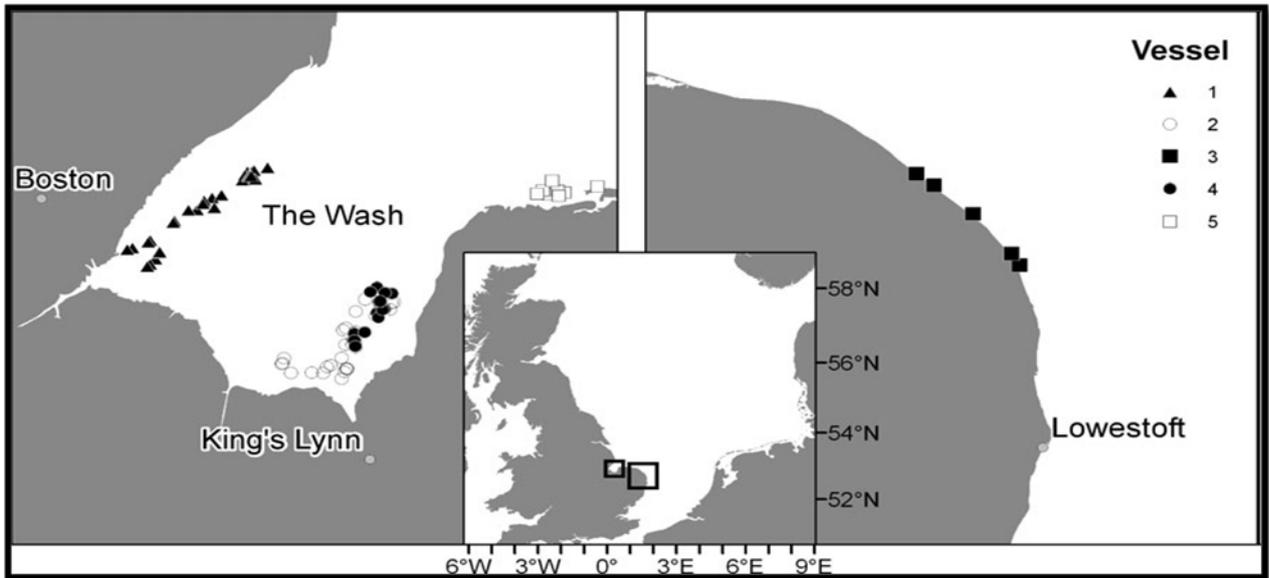


Figure 3.3.4.2 Location of catch comparison trawls conducted on board UK commercial vessels targeting brown shrimp in 2006/2007 (Catchpole *et al.*, 2008).

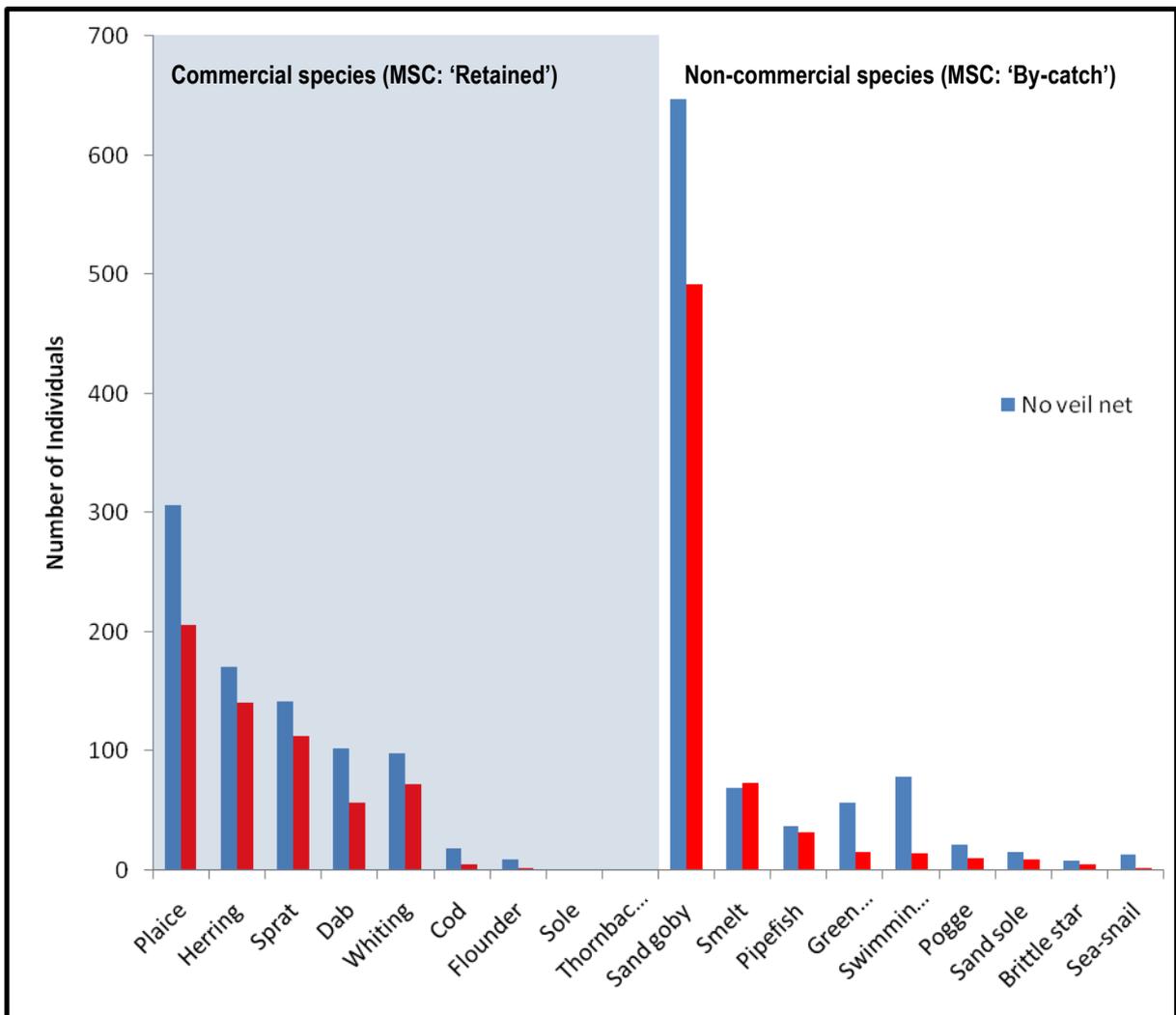


Figure 3.3.4.3 Commercial and non-commercial by-catch species in hauls when operating with sieve/veil nets disabled (blue) and enabled (red) targeting brown shrimp (one hour tow duration). Data source: Catchpole *et al.* (2008).

Separator grids have also been shown to be successful in reducing by-catch in shrimp fisheries in the North Sea (Madsen & Hansen, 2001). Reduction in by-catch of fish aged 1 year and older was “very satisfactory” and the shrimp catch was not usually reduced by more than 15% (Polet, 2002), which is a comparable reduction to that observed using a sieve net. However, the loss of commercial shrimp from catches was significantly lower when using a sieve net under commercial conditions in the Belgian brown shrimp fishery (Polet *et al.*, 2004). Accumulation of animals and plants, such as starfish, seaweed, hydroids and jellyfish, on the grid decreases the catch of shrimp by preventing their passage through the grid (Polet, 2002), making it a less appealing device to commercial fishermen. The sieve net, in comparison, is less susceptible to clogging (Polet *et al.*, 2004). In addition to its advantages in selectivity, the ease of use and durability has led to skippers choosing to use sieve nets over the more difficult to handle, rigid separator grids (Innes & Pascoe, 2007) with the majority of shrimp trawling vessels in the assessment area use sieve nets. This is a positive step towards reducing by-catch though, from a precautionary perspective, it would be better if all trawl vessels within the fishery adopted selective gear.

The European Commission’s proposal for the Common Fisheries Policy (CFP) reform in 2012 includes a discards ban, which will eventually require specific fisheries to land all catch of certain commercial species (European Commission, 2011). According to ICES, the EU management of shrimp fisheries is likely to change:

“It is unlikely that under the new Common Fisheries Policy the current situation of no management will persist”

ICES, 2011a

Overall, the use of selective devices has a positive effect on by-catch reduction, reducing damage to stocks of by-catch species and also benefiting the fishermen by reducing the time and energy spent sorting the catch. Improvements in the quality of shrimp have also been reported when using sieve nets (Innes & Pascoe, 2007). The North Sea fishery, centered around the Wash, accounts for 90% of recorded UK brown shrimp landings (Innes & Pascoe, 2007), and can therefore make a significant contribution to the reduction of brown shrimp fishery by-catch in the UK.

The majority of commercial shrimp vessels (~95%) fishing in the Wash and Humber use 40 mm sieve nets and 24-26 mm cod-ends (pers. comm. Stephen Williamson, 2011) as they reduce sorting time and reduce unwanted by-catch. Some small independent shrimp fishing vessels do not currently use sieve nets and these boats will occasionally catch legal sized commercial species. In other instances, commercially sized species are caught if sieve nets have been damaged. Client’s observations suggest that discards are mostly juvenile flounder, dab, plaice, sole and smelt, but if a significant amount of juvenile whiting are caught then the skipper will usually move away from those grounds as they are major predators of brown shrimp and it would be likely that densities of shrimp were smaller in these areas (pers. comm. Neil Lake, 2011).

Catchpole *et al.* (2008) found that 71% of East Coast brown shrimp fishermen stated that sieve nets could not be used when large amounts of weed accumulated on fishing grounds, because it clogged nets and was difficult to remove. It was estimated that this was more of a problem for around 2-4 months of the year although it was a problem for most of the year in inshore waters.

3.3.5 SURVIVABILITY OF DISCARDS

Despite being returned to the sea, discarded species may not survive due to injuries received during capture and subsequent handling. The duration of the trawl, time out of water and sorting process all affect mortality rates and this will vary from vessel to vessel. Although individual injuries/stressors e.g. skin damage from the net, and exhaustion from sustained swimming, may not be enough to cause mortality alone, the cumulative effects may result in death in some cases (Suuronen, 2005).

It has been suggested that time spent in the haul will result in injuries from crushing, compressive and abrasive forces (Doekson, 2006). Once on board, discards may be exposed to the air and prevailing weather conditions (Lancaster & Frid, 2002). Shrimp catches are typically sorted on deck using a riddle in order to return unwanted by-catch and undersized shrimp to the sea. Sorting is typically regarded as the main source of mortality, during which time significant mechanical damage can be inflicted. Injuries may be survivable depending on the extent, however, they may result in indirect mortality i.e. the animal may die at a later point as a result of injuries which may affect its ability to avoid predation or compete for food (Doekson, 2006). Skin injuries and open wounds may result in infection, and damage to fins may increase infection by bacteria which could result in fin-rot disease (Ludemann, 1993).

A review of 3 different programmes concerning by-catch mortality in shrimp fisheries was carried out in 1992 (Berghahn *et al.*, 1992 as cited in Doekson, 2006). Mortalities increased considerably after the catch passed the onboard sorting sieve. 100 % mortality was detected for whiting (*Merlangius merlangus*) and cod (*Gadus morhua*). Mortalities were approximately 10% for pogge (*Agonus cataphractus*) in the discard fraction. Survival of flatfish depended strongly on the species and the size of the specimens as well as the catch and catch processing conditions, and ranged from 17 to 100%. No differences could be detected in the survival after sorting on different machines (riddles). However, due to better sorting efficiency, the rotary sieve may reduce mortality of fish in by-catch possibly by reducing the amount of time spent onboard. Haul duration also appeared to influence discard mortality in plaice, with longer hauls of 15-30 minutes leading to increased mortality. The hauls in commercial fisheries may range from 30 minutes, when shrimp abundance is high, to 180 min, when shrimp abundance is low, thus potentially affecting discard mortality. Other research results in the study indicated substantial mortality of particular discard species immediately after being caught (with haul duration of 1 hour) and prior to sorting. The 4.5-9cm plaice, for instance, suffered a mean mortality of 70% after trawling. Plaice survival improved with increasing size.

Lancaster and Frid (2002) investigated the survival rate of discarded brown shrimp in the Solway Firth brown shrimp fishery. Onboard survival of undersized brown shrimp was high, with over 99% of undersized shrimp surviving riddling. Survival experiments on shrimps from 10 hauls showed that after 24 h in an aerated tank 92% of riddled brown shrimp were alive compared with 96% of non-riddled shrimps. Survival of riddled brown shrimp correlated negatively with temperature but there was no significant correlation with time onboard. Scavenging seabirds were said to choose discards of fish species that were easier to spot floating on the sea surface when they were abundant. Only when these fish discards had been eaten, or had sunk, were discarded brown shrimp targeted. Taking into account combined estimates of bird predation on living discards, as much as 80% of undersized shrimp entering the shrimp trawl would be expected to survive.

Seabirds consumed dead brown shrimp in preference to live discarded shrimps, presumably because dead brown shrimp turn white and float on the surface making them more visible to these scavengers. In addition, live undersized brown shrimp were often returned back to the sea surface after beginning to swim down the water column, by the wash of the boats propeller, putting them at risk of predation (Lancaster & Frid, 2002).

Berghahn and Rosner (1992) discarded round fish (whiting and smelt) from a shrimp vessel within the North Sea, and recaptured any discards not consumed by seabirds with a stow net. The study found that 68-90% of the discards were consumed by seabirds. Typically, seabirds appear to have a preference for round fish over flatfish (Berghahn & Rosner, 1992). Walter and Becker (1997) found that 41% of offered flatfish, 79% of offered round fish and 23% of offered invertebrate species were consumed (Walter & Becker, 1997).

By returning discards to deeper water with the use of a pipe outlet, any live organisms would be out of reach of predation by seabirds, reducing by-catch mortality. This has already been put into practice by the Dutch shrimp

fishery seeking MSC certification (British Broadcasting Corporation (BBC), 2008) and could be a useful management option for the Wash fishery to consider.

3.3.6 THE ECONOMIC AND BIOLOGICAL CONSEQUENCES OF DISCARDING IN THE EUROPEAN AND UK BROWN SHRIMP FISHERIES

Revill *et al.* (the ECODISC project, 1999) studied substantial discard data collected from European brown shrimp fishing fleets and estimated the potential biological and economic losses associated with European brown shrimp discards. Average effort over ten years for each fleet was used to obtain a brown shrimp directed fishing effort with number of fish discarded per 10,000m² which could be raised to fleet level for each quarter. Fluctuations in abundance in discard species were taken into account. The discard survival rates used were 0% for whiting and cod, 20% for plaice, and 50% for sole (obtained from other studies). Further details on the economic and biological modelling used in this study can be found in the report. This bio-economic analysis showed there was likely to be a net benefit to the EU fishing fleet as a whole from the introduction of technical measures (e.g. sieve nets). Under the study assumptions (with respect to year class strengths, natural and discard mortality rates, etc.) the annual potential lost landings arising from the levels of discarding in the European Brown shrimp fisheries during the study period were estimated to be around 12,000 t for plaice, 2,000 t for cod, 1,500 t for whiting, and 600 t for sole (Table. 3.3.6.1). The study was undertaken during the 1990s before legal measures were installed (The Shrimp Netting Order, 2002) and sieve nets were not fully implemented (~40% of fleet) as they are today (~95% of fleet). Technical measures now in place are likely to give some relief for white fish stocks (such as whiting and cod) but less so for plaice, especially 0 and 1 year groups (Revill *et al.*, 1999). However, since technical measures have been implemented, plaice population status has improved to be within safe biological limits.

Table 3.3.6.1 Predicted annual lost landings arising from levels of discarding in the UK and European brown shrimp fisheries from data collected in 1988-1997 (before sieve nets were widely used). Estimated fish market value of annual lost landings is highlighted in **bold red** (Revill *et al.*, 1999).

Age group	Type of estimate	Plaice		Cod		Whiting		Sole	
		UK (t)	European Total (t)	UK (t)	European Total (t)	UK (t)	European Total (t)	UK (t)	European Total (t)
0+	upper	131	13,242	145	1,242	129	428	11	1,086
	mid	100	8,676	108	791	100	280	8	428
	lower	74	5,436	79	471	76	178	6	74
1+	upper	274	5,391	406	1,942	198	1,862	41	236
	mid	173	3,328	232	1,094	141	1,203	26	144
	lower	99	1,890	106	526	97	679	15	74
2+	upper	12	117	6	13	14	83	14	33
	mid	5	63	3	5	8	42	8	16
	lower	1	23	0	0	4	14	3	4
All ages	upper	416	18,749	557	3,198	340	2,372	66	1,355
	mid	278	12,066	342	1,890	248	1,525	43	588
	lower	175	7,349	185	997	176	871	25	153
			(€17.9 million)		(€2.7 million)		(€1.2 million)		(€3.9 million)

Biological simulations in the study (Revill *et al.*, 1999) showed that potentially large financial gains could be experienced by other European fishing fleets if brown shrimp fishery by-catch was reduced (Table 3.3.6.1). Revill *et al.* (1999) showed that the largest percentage of the potential gains in plaice landings upon a reduction of their discard mortalities to zero, would come from the 0-group (72% of the European total), and 28% would come from the 1 year group. Potential gains for cod and whiting were shown to be smaller than those for plaice. In comparison, sole are not a common non-target species caught in by-catch.

The species with the highest estimated potential loss to spawning stock biomass as a result of European brown shrimp fisheries is plaice (6 – 16% loss) with the UK potentially contributing to 0.2 – 0.5% of the overall loss (Table 3.3.6.2). Current measures in place in the UK fishery have been shown to be variably effective at reducing accidental catch of some of these species (Catchpole *et al.*, 2008).

Table 3.3.6.2 Overall estimated annual losses to commercial landings and spawning stock biomass arising from levels of discarding in the UK and European brown shrimp fisheries from data collected in 1988-1997 (before sieve nets were widely used) (Revill *et al.*, 1999).

	Plaice		Cod		Whiting		Sole	
	Total (tonnes)	% of spawning stock						
<i>upper confidence limit</i>								
U.K.	1,048.5	0.5	275.4	0.3	533.2	0.2	38.3	0.1
Total European	37,378.9	16.2	1,507.7	1.8	4,409.7	1.7	1,430.7	2.2
<i>mid range value</i>								
U.K.	685.2	0.3	165.8	0.2	383.2	0.1	82.7	0.1
Total European	23,851.1	10.3	881.1	1	2,837.2	1.1	711.2	1.1
<i>lower confidence limit</i>								
U.K.	417	0.2	86	0.1	266.1	0.1	45.4	0.1
Total European	14,329.1	6.2	460	0.5	1,603.7	0.6	226.1	0.4

Revill *et al.* (1999) used biological modelling to estimate more than 90% of the lost landings could be ‘recovered’ if the selective device was used in waters where 1-group discards predominated. Conversely, the modelling showed that where 0-group fish (smaller) predominated, the selective device was considerably less effective (particularly for flatfish) and only 21% of the lost German plaice landings could be ‘recovered’ using this device. This is supported by work undertaken by Catchpole *et al.* (2008).

The UK fishery contributes a relatively low percentage of the total European plaice annual predicted lost landings (Table. 3.3.6.3) arising from levels of discarding, and a relatively high percentage of whiting and cod, considering the UK fishery usually accounts for less than 5% of total landings of brown shrimp. Also, a recent investigation by Catchpole *et al.* (2008) has shown that sieve nets, which are widely used in the UK fishery, are effective at reducing cod by-catch (Table 3.3.4.1), and fishermen generally cease fishing in areas where there are high abundances of whiting (pers. comm. Neil Lake, 2011). However, the by-catch of small plaice is not greatly reduced by sieve nets.

Table 3.3.6.3 Relative UK contribution (%) to annual predicted lost landings arising from levels of discarding in the European brown shrimp fisheries (Revill *et al.*, 1999) from data collected in 1988-1997 (before sieve nets were widely used).

Age group	Type of estimate	Plaice	Cod	Whiting	Sole
0+	mid value	0.8%	5.7%	6.5%	1.3%
1+	mid value	1.4%	12.3%	9.2%	4.5%
2+	mid value	0%	0.1%	0.5%	1.4%
All ages	mid value	2.3%	18.1%	16.3%	7.2%

The study by Revill *et al.* (1999) found that the major part of the 0-group plaice population that is affected by shrimp fishing is geographically located in the shallow sea areas (<10m) in the Wadden Sea, where they are common between June and December which coincides with the major UK shrimp fishing season (Figure 3.1.2.2).

Similar nursery areas may exist in UK fishing grounds. It was suggested that the major part of the expected gains in plaice landings would come from the 0-group plaice affected by the fishery.

The study suggested that because of the demonstrable spatial difference in the age composition of the discards, a single management regulation that does not take these differences into account (e.g. The Shrimp Fishing Nets Order 2002) is unlikely to fully realise the predicted potential benefits to plaice stocks and their fisheries. Due to these complexities it was suggested one possible approach to resolve the plaice discard problem could be the introduction of closed seasons and/or areas aimed at maximum protection of the 0-group. However, modelling of a single month closure in the German fishery during 'quarter three' (July to September period) only 'recovered' 11% of the estimated lost German plaice landings. Increased 'recovery' of lost landings could only occur following longer periods of closure.

Revill *et al.* (1999) proposed another approach could involve the introduction of species-selective gears, where the emphasis would be on the protection of 0-group plaice in certain areas (such as the flatfish nurseries in the Wadden Sea), and 1-group plaice in other areas (e.g. the coastal waters outside the nurseries).

3.4 PRINCIPLE THREE: MANAGEMENT SYSTEM BACKGROUND

The management of the brown and pink shrimp fishery focuses on the vessel and gear used, with most vessels privy to category C license restrictions.

3.4.1 NATIONAL MANAGEMENT

The UK shrimp fisheries are managed under the European Common Fisheries Policy (CFP). Monitoring and enforcement of regulations in UK waters is undertaken by the MMO and the IFCAs. The MMO is a national body that conducts both quayside and at-sea inspections. IFCAs are regional associations; the seaward limit of IFCA districts is 6 nm. The main UK brown shrimp fishing grounds fall within the jurisdiction of the Eastern IFCA.

All licensed fishing vessels in the Wash are allowed to fish for shrimp, as this species is non-quota and the normal gear used is not subject to additional restricting conservational measures. However, The Shrimp Fishing Nets Order 2002 (see Section 3.3.4) states that no fishing vessels shall fish for shrimp without a separator grid or sieve net which is at least double that of the mesh size of the cod-end, but no more than 70mm, and stretches across the entire cross-section of the net. Vessels with an aggregate beam width or a net headline of 8m or less are exempt from this Order (e.g. vessels using two beam trawls of width 4 m or less). The Eastern IFCA has not previously enforced the sieve net or separator grid legislation (pers. comm. Ron Jessop, 2011) and whilst the majority of the vessels working in the Wash use sieve nets (pers. comm. Neil Lake, 2011) there are some that do not. Another part of the Order states that brown and pink shrimp must make up at least 60% of the total catch weight, meaning that no more than 40% of the catch can be discards. Contravention to any provision of the Order can lead to various penalties.

European legislation states that sorting shall be carried out immediately after catches have been removed from the net and that quantities of marine organisms caught in excess of permitted percentages shall be returned to the sea prior to each landing (Articles 14 and 15 of Article 25 (1) of Council Regulation (EC) 850/98). The amount of shrimp the fishermen land is not restricted, however, profitability influences catch.

Vessels greater than 10m, using demersal otter trawls within the mesh size range 16-31 mm, are restricted because they are listed as a specified gear within the cod recovery/effort control regulations and as such only vessels with a track record of using that gear within a given reference period are permitted to use it. There are very few vessels in the Wash with this eligibility (pers. comm. MMO & Eastern IFCA, 2011).

3.4.2 LOCAL MANAGEMENT

Vessels operating in the jurisdiction of North Eastern and Eastern IFCA are subject to local regulations or byelaws. Those which affect shrimp fishermen are outlined below:

The Eastern IFCA byelaws (<http://www.esfjc.co.uk/byelaws.htm>)

No fishing vessel above the length of 15.24 m is allowed to trawl within boundaries set out by Eastern IFCA; other byelaws set out by the Eastern IFCA regulate the cockle, mussel, crab and lobster fisheries.

The North Eastern IFCA byelaws (<http://www.neseafish.gov.uk/nesfc/byelaws.html>)

- The overall length of the vessel from which trawling is carried out does not exceed 18.3 m
- The engine power of the vessel does not exceed 400 KW (536 HP)
- The trawl net is raised and cleared at least once in every three hours during trawling

Other than a commercial fishing license, which is required by all UK fishing vessels, there are no additional, fishery-specific entry restrictions. Furthermore, both species of shrimp are non-quota species and as such have no total allowable catch (TAC) quota in place to limit the overall volume of landings.

Other than *ad hoc* meetings held at the Eastern IFCA headquarters there is no exclusive management system for the shrimp fisheries. However, meetings are arranged by the IFCA in which the shrimp fishermen are included. Surveillance of shrimping vessels is carried out and national and local regulations are enforced in order to manage the fishery within the IFCA's area of jurisdiction.

3.4.3 VOLUNTARY MANAGEMENT

Lynn Shellfish Ltd and John Lake Shellfish Ltd each own a fleet of vessels and are responsible for processing the vast majority of shrimp caught in the assessment area. Both producers are working together to reduce undersized shrimp landings (~6.8 mm width carapace) to a level where they constitute less than 15 % of the catch. Both producers aim to do this by increasing the cod-end mesh size to 24-26 mm, significantly larger than the legal minimum mesh size of 16 mm. The two processors plan to impose this regulation on independent vessels supplying their production plant (pers. comm. Neil Lake & Stephen Williamson, 2011).

3.4.4 MONITORING AND ENFORCEMENT

Monitoring and enforcement is undertaken by the MMO, the Royal Navy's Fishery Protection Squadron and Eastern and North Eastern IFCA (responsible for The Wash and Humber area fisheries).

Enforcement officers check:

- Catch composition
- Beam length
- Vessel length
- Mesh size

3.4.5 KEY MANAGEMENT ORGANISATIONS

The Marine Management Organisation

The MMO is responsible for issuing fishing licenses and developing and enforcing fisheries legislation, particularly beyond the 6 nm limit (beyond the jurisdiction of the IFCAs). The MMO are currently implementing a new marine planning system designed to integrate the social requirements, economic potential and environmental imperatives of our seas, a new marine licensing regime that is easier for everyone to use with clearer, simpler and quicker licensing decisions. They are responsible for managing UK fishing fleet capacity and UK fisheries quotas and are working with Natural England and the Joint Nature Conservation Committee (JNCC) to create and manage a network of marine protected areas (Marine Conservation Zones (MCZs) and European Marine Sites (EMS)) designed to preserve vulnerable habitats and species in UK marine waters.

The Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA)

Under the Marine & Coastal Access Act 2009, the newly named Authorities (previously Sea Fisheries Committees) are required to have a stronger focus on sustainable fisheries, including marine environmental protection, rather than just fisheries. IFCAs can directly manage fishing activities, for example, through Regulatory Orders (such as The Wash Fishery Order 1992, under which Eastern IFCA set regulations for the cockle and mussel fisheries in the Wash), or by creating fisheries byelaws in their IFCA districts, for example, the Eastern IFCA applies a byelaw limiting the size of vessels that can trawl in the district (Byelaw 12, inshore trawling restriction).

IFCAs enforce their own byelaws, and support national and European fisheries management strategies by enforcing those (national and European) regulations that apply within their own IFCA districts.

The shrimp fisheries have no 'open' and 'closed' seasons and are not recognised as "plans" or "projects" that would require assessment under the Habitats Regulations 2010. However, in recognition of its biodiversity duties as a public body (under the Natural Environment and Rural Communities Act 2006 and the Habitats Regulations 1994), namely the need to have regard to the purpose of conserving biodiversity and protection of certain habitats in the Wash & North Norfolk Coast SAC, in 2006 the Eastern Sea Fisheries Joint Committee (ESFJC, now the Eastern IFCA) agreed to develop a local byelaw to protect *Sabellaria spinulosa* (Ross worm) reef. Eastern IFCA has held recent meetings (2011) with the MMO (as the competent authority i.e. the licensing authority for these fisheries) and Natural England to discuss possible approaches to protect *S. spinulosa* reef from damage caused by shrimp fishing in The Wash and North Norfolk Coast SAC, and the Inner Dowsing, Race Bank and North Ridge candidate SAC. Further meetings are planned with local fishermen involved in the shrimp fisheries. Natural England, the Environment Agency and the Marine Management Organisation all hold a voting seat on all IFCAs.

The Eastern and North Eastern IFCAs are two of ten IFCAs in England and Wales, working with industry, environmental organisations and other stakeholders to protect inshore fish stocks for the benefit of the local fishing communities and the natural environment. Committees are composed of around 20 members, consisting of county councillors, fisheries fishing sector representatives (including commercial fishermen, recreational fishermen and fish processors) plus persons with a qualified interest in the marine environment, in addition to the Environment Agency, Natural England and the Marine Management Organisation.

The IFCAs conduct research into fisheries management measures to reduce impacts on the environment. The Authorities are currently the lead authority in a management group for the Wash and North Norfolk EMS and Humber Estuary EMS groups which aim to protect the biodiversity of the areas which contain Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). These are protected by international legislation and form part of a network of marine conservation sites throughout Europe (Natura, 2000).

Natural England

Natural England is the statutory body with responsibilities for advising Government and other management bodies, including the Eastern and North Eastern IFCAs, on nature conservation in England and English waters. The Wash and the Humber estuaries are covered by a number of national and international nature conservation designations, including being a designated SAC for habitats and SPA for birds. As such, Natural England works closely with the Eastern and North Eastern IFCAs, but maintains an advisory role rather than a management role.

The Department for Environment, Food and Rural Affairs (DEFRA)

DEFRA is the UK custodian of the marine and aquatic environment and is responsible for administering fishing activity within English waters. DEFRA has contributed to the consultation on the reform of the Common Fisheries Policy (CFP), giving the opportunity to improve conservation of fish stocks, reduce the waste of fish discards and support the long term economic viability of the fishing industry.

The Centre for Environment, Fisheries and Aquaculture Science (Cefas)

Cefas, an executive agency of DEFRA, provides research, assessments and advice on fisheries management.

The International Council for the Exploration of the Sea (ICES)

ICES coordinate and promote marine research on oceanography, the marine environment, the marine ecosystem, and on living marine resources in the North Atlantic. In recent years ICES have developed *Crangon* Working Groups which study brown shrimp life history and their fisheries. The ICES *Crangon* Working Group produces annual reports which highlight scientific developments, recent landings trends and discuss various questions put to them from stakeholders within the brown shrimp fishing industry.

4. DESCRIPTION OF THE EAST COAST PINK SHRIMP FISHERY

4.1 BACKGROUND TO THE PINK SHRIMP FISHERY

4.1.1 HISTORY OF THE PINK SHRIMP FISHERY

In terms of biomass production, the North Sea is one of the most productive areas in the world (Hufnagl *et al.*, 2010). There has been a pink shrimp fishery in the Wash for over 150 years and, historically, this was more important than the brown shrimp fishery. The origins of the English trawl fishery, which was developed to exploit pink shrimp, have gone largely unreported. Approximate landing figures for pink shrimp from the ports of Boston and Kings Lynn are available for between 1925 and 1935 only. The highest landing recorded in this time frame was in 1926 when ~710 t of pink shrimp was landed. About 70% of the ~630 t of mixed shrimp landed at these ports in 1970 was pink shrimp whereas only 20 t of pink shrimp was landed at these ports in 2010.

4.1.2 PRESENT PINK SHRIMP FISHERY

Following improvements in the shellfish markets during the 1980s, the shrimp fishery has expanded. Although, currently, the UK brown shrimp fishery represents a considerably larger proportion of the landings (424 – 1,839 t over the last 10 years, MMO, 2011) than the pink shrimp (10 – 82 t over the last 10 years, MMO, 2011, Figure 4.1.2.1). The landings of shrimp in the European continental fishery and the level of demand are the drivers determining the value of the shrimp in any one year. This in turn determines the effort and landings of the UK fishing fleet which vary year on year as a consequence. The value of pink shrimp fluctuates significantly less than that of the brown shrimp (MMO, 2011; pers. comm. Neil Lake & Duncan Vaughan, 2011) (Figure 4.1.2.1).

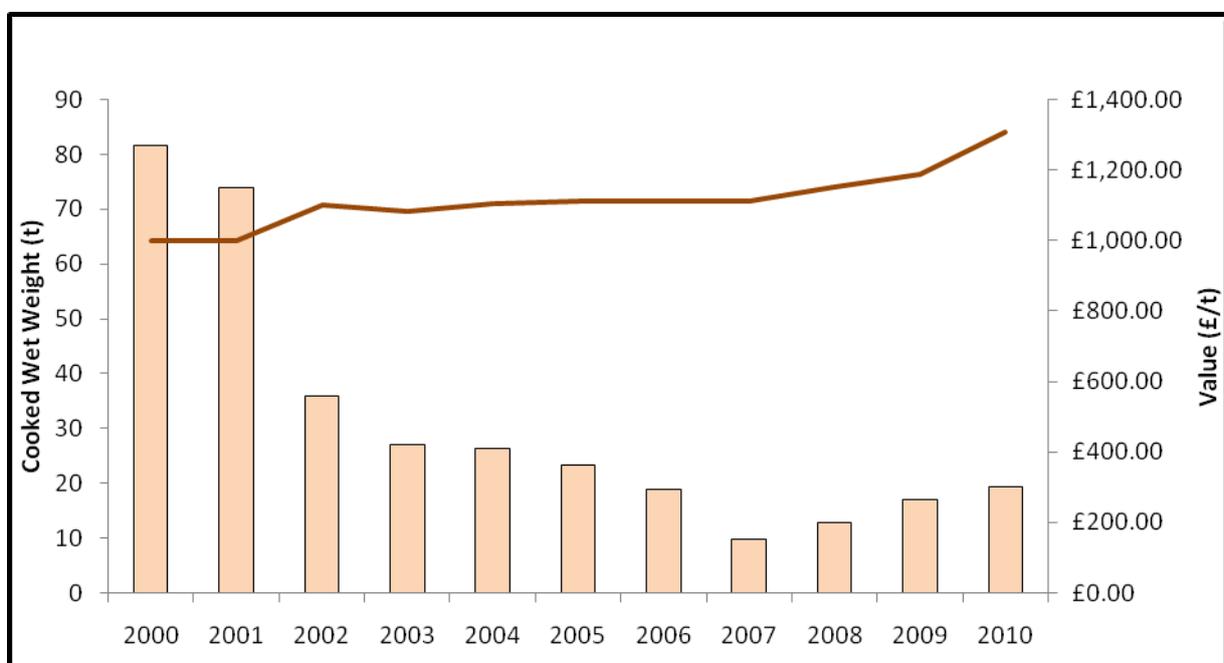


Figure 4.1.2.1 Total landings cooked wet weight (bars) and associated value (£ per tonne) (line) for pink shrimp caught between 2000 and 2010 in ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (MMO, 2011).

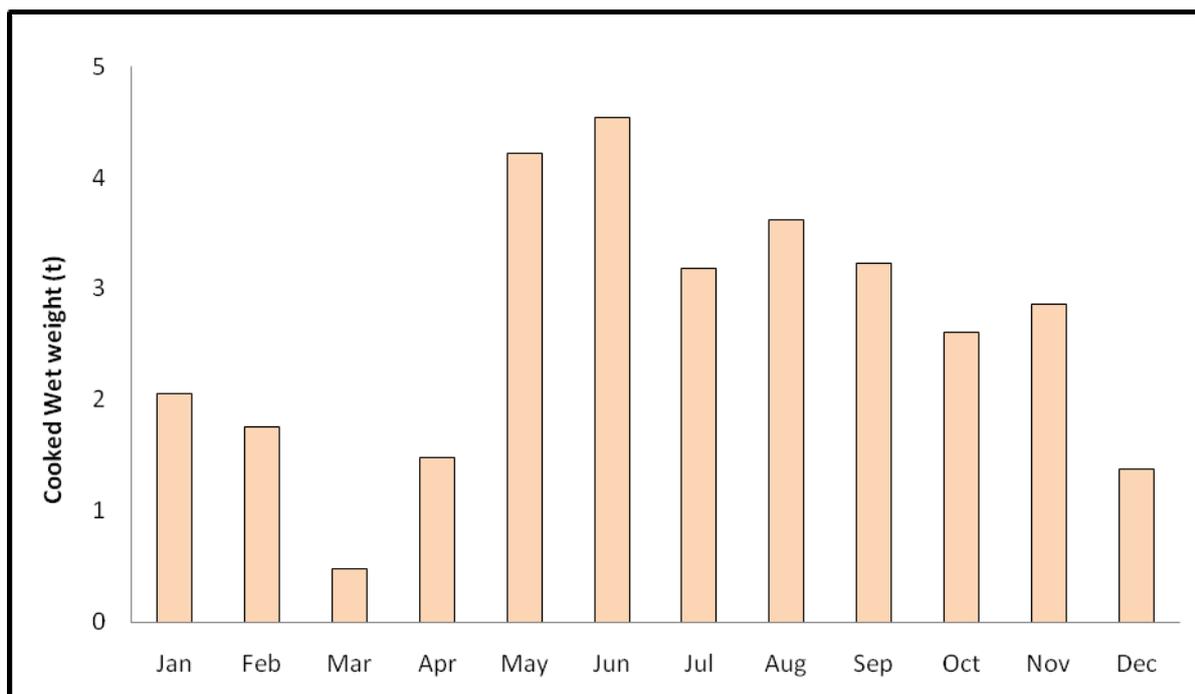


Figure 4.1.2.2 Average cooked wet weight (t) of monthly landings values from 2000 – 2010 of pink shrimp caught in ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (MMO, 2011).

Pink shrimp fishing takes place throughout the year although landings are generally greater between May and August (Figure 4.1.2.2; MMO, 2011). This is due to restrictions on fishing in the winter months due to stormy weather or cold temperatures driving shrimp offshore or deeper into the sediment (pers. comm. Duncan Vaughan, Eastern IFCA).

4.1.3 LANDINGS DATA

Please refer to the brown shrimp fishery section for introductory information on landings data (Section 3.1.3). Less information is available from the processing plants regarding total weights in different size categories.

4.1.4 PORT ACTIVITY – KINGS LYNN

Along the East Coast, pink shrimp are mainly landed at Kings Lynn and occasionally at Boston. Landings total ~346 t (2000 – 2010) with an average of ~31 t annually (less has been landed in recent years), caught in ICES statistical rectangles 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (MMO, 2011).

4.1.5 MAIN COMMERCIAL MARKET

The fishery exports pink shrimp to the continent in small quantities (20 t per year in recent years). If the fishery were to gain sustainable (MSC) status, it would open potential markets, and it is hoped by one processing plant that it would receive significantly more landings (upto ~20 t a week for 5 months of the year) (pers. comm. Stephen Williamson, 2011).

4.2 TARGET SPECIES BACKGROUND – PINK SHRIMP, *PANDALUS MONTAGUI*



Figure 4.2.1.1 The pink shrimp, *Pandalus montagui*. Photograph courtesy of Fiona Crouch, MBA, 2011.

4.2.1 SPECIES INFORMATION

Pink shrimp, *Pandalus montagui*, live on harder substrates and are commonly recorded at depths between 5 and 15m in estuaries and coastal waters but are more common offshore (Moen & Svensen, 2004).

The species (Figure 4.2.1.1) has a semi-transparent body with dark horizontal bands, has a long upturned rostrum, and reaches approximately 160 mm in length (Moen & Svensen, 2004; National Biodiversity Network, 2011). Pink shrimp have an average life expectancy of 4–5 years.

Distribution

The pink shrimp has been observed all around the British Isles (Figure 4.2.1.2) and its range extends to northern Norway.

Temperature, substrate, depth, salinity and food availability affect the distribution of pink shrimp, with low temperature and moderate to high salinity appearing to be the most important determinants (Simpson *et al.*, 1970 cited in Mistakidis, 1970).

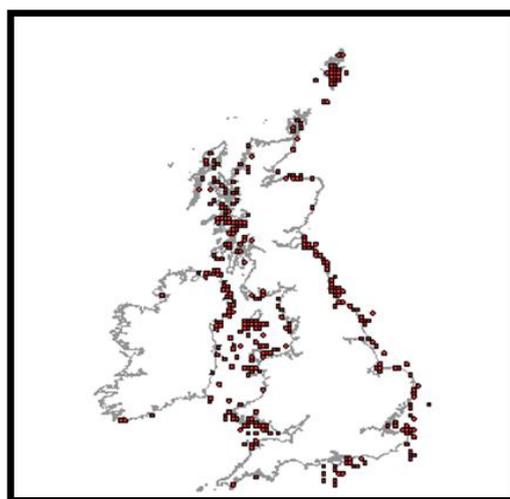


Figure 4.2.1.2 Distribution of pink shrimp, *Pandalus montagui* in 10 Km squares around the UK (National Biodiversity Network, 2011 & NERC, 2004).

Table 4.2.1.1 A Summary of environmental factors affecting distribution of pink shrimp, *Pandalus montagui*.

Depth	Temperature	Substrate	Food availability	Salinity
The depth range of pink shrimp is ~3.7-5.5 m down to ~732 m(Simpson <i>et al.</i> , 1970 as cited in Mistakidis, 1970)although the species is more common in shallow water (18.3-91.5 m)(Mistakidis, 1957 as cited in Simpson et al, 1970).	Adults are found in seas with a temperature range between -1°C and 21°C, however, this species favours the colder portion of this range (Allen, 1963 as cited in Simpson et al, 1970; Mistakidis, 1957 as cited in Simpson et al, 1970; Simpson <i>et al.</i> , 1970; Squires, 1957 as cited in Simpson et al, 1970; Squires, 1961 as cited in Simpson et al, 1970).	Adults are found on all substrates, however, observations suggest that they are more commonly associated with hard bottoms rather than soft sediments (Grieg, 1927 as cited in Simpson et al, 1970; Mistakidis, 1957 as cited in Simpson et al, 1970).	Mistakidis (1957) found that concentrations of pink shrimp often occurred in areas inhabited by <i>Sabellaria</i> spp. Occasionally, complete heads of <i>Sabellaria spinulosa</i> were seen in stomach contents which seemed to suggest that " <i>P. montagui</i> crawls over the <i>Sabellaria</i> spp. colony, cutting off the protruding heads of the sedentary worms". Warren and Sheldon (1967) found that substrate selectivity of pink shrimp was possibly a result of food seeking activity(Warren & Sheldon, 1967).	No information is available regarding salinity tolerances although <i>P. montagui</i> has been recorded in estuaries (Moen & Svensen, 2004). Simpson <i>et al.</i> (1970) stated high salinity appears to affect distribution the distribution of pink shrimp.

Reproduction

Fertilisation in pink shrimp is external and occurs at the time of egg laying which, in the coastal waters of the North Sea, occurs at the beginning of November and continues through to February. Maximum numbers of egg-bearing females generally occur during December (Mistakidis, 1957 as cited in Simpson et al, 1970).

Larger females lay eggs at the beginning of the season followed by 0-group females laying eggs for the first time. Larger females generally produce more eggs than smaller, younger females (Mistakidis, 1957 as cited in Simpson et al, 1970) with both groups producing eggs only once during the breeding season (Allen, 1963 as cited in Simpson et al, 1970). The eggs of pink shrimp are turquoise in colour (Moen & Svensen, 2004).

Pink shrimp populations begin life with even proportions of males and females. The males then begin to transform into females around a year after hatching (February). The transformation occurs throughout the summer months right through to the following January. A small percentage of males have also been reported to remain as males during their second year (Simpson *et al.*, 1970).

Growth is rapid during the first year of life decreasing as the shrimp enter years 2 and 3 (Allen, 1963 as cited in Simpson et al, 1970; Mistakidis, 1957 as cited in Simpson et al, 1970) with females generally larger than males.

Recruitment

Currently, there is no precise information available on the recruitment of pink shrimp. However, on the Northumberland coast, Allen (1963, as cited in Simpson *et al.*, 1970) found that seven times the number of 0-group adults occurred in shallow water compared with deep water. This may be caused by greater predation by offshore plankton feeders and/or tidal currents carrying larvae inshore. This lack of strong knowledge of pink shrimp recruitment highlights the need for future research to fully understand pink shrimp population dynamics.

Feeding

Feeding is thought to occur mostly at slack low water during daylight hours. This may be due to a slower water current and optimal light levels at the sea floor (Warren & Sheldon, 1967). Food found in the stomachs of pink shrimp varies depending on the substrate the shrimps are found on. In general, adult pink shrimp eat small crustaceans, hydroids, encrusting organisms, and bivalve molluscs, together with tube-dwelling worms such as *Sabellaria spinulosa* (Ross worm) and the bristle worm *Pectinaria* spp.. Pink shrimp inhabiting the southeast coast of England were found to feed mainly on polychaete worms, with evidence of *S. spinulosa* contributing up to 30-50% of their diet (Mistakidis, 1957 as cited in Simpson et al, 1970). It is likely that the only time pink shrimp cease feeding is following a moult during which their mouth parts soften (Allen, 1963 as cited in Simpson et al, 1970).

Population Structure

In the first year, 30-50 % of the generation mature as primary females, and the remainder mature as males (Jagersten, 1936 as cited in Simpson et al, 1970). During their second year, the majority of males transform to secondary females (Allen, 1963 as cited in Simpson et al, 1970; Mistakidis, 1957 as cited in Simpson et al, 1970). As a result of this transformation, the catches are usually dominated by females. However, the proportion of males taken is largely dependent on the mesh size due to size differences between the sexes (Simpson et al., 1970).

Behaviour

Although the migration of pink shrimp is largely unknown, there is evidence for a seasonal migration. On the southeast coast, pink shrimp have been shown to be prevalent in shallow waters during spring, generally disappearing in the autumn. This may facilitate breeding and avoid exposure to extremely low temperatures (Mistakidis, 1957 as cited in Simpson et al, 1970). Pink shrimp have also been shown to migrate small distances in shorter time frames, which may be due to the influences of tidal currents (Warren & Sheldon, 1967).

4.2.2 MONITORING

Pink shrimp catches are not formally monitored as it is not currently a major fishery.

4.2.3 STOCK ASSESSMENTS

There are no formal assessments of stock status of pink shrimp in the fishery under assessment.

4.3 PRINCIPLE TWO: ECOSYSTEM BACKGROUND

Please refer to the brown shrimp fishery section for introductory information on the ecosystem background (Section 3.3).

4.3.1 PINK SHRIMP: FISHING GEAR AND THE BENTHIC ENVIRONMENT

The pink shrimp, *Pandalus montagui*, is reported to have a strong affinity to *Sabellaria spinulosa* (Ross worm) reefs (Warren, 1973; Warren & Sheldon, 1967) making this habitat somewhat vulnerable to pink shrimp harvesting activities. A recent Biodiversity Action Plan (BAP) draft (Hartwell, 2011) published by The Wash Estuary Strategy Group states that the core areas of *S. spinulosa* reef are at risk from trawling for pink shrimp, and potentially from seed mussel dredging.

“Mobile fishing equipment can break off parts of the reef, which will no longer be inhabited by the worms and they are unable to rebuild the broken tubes. Associated species are also affected. Within The Wash, the pink shrimp beam trawl fishery is likely to have the greatest impact on the reefs, although this fishery currently operates at a very low level. Beam trawling for brown shrimp is a main fishery in The Wash, but this fishery does not generally operate in areas supporting *S. spinulosa* reef.”

The Wash Estuary Strategy Group, 2011 (Hartwell, 2011).

Trawling, dredging, potting and net fishing are all thought to cause physical damage to *S. spinulosa* reefs (Hendrick, 2007; Holt *et al.*, 1998; Jones, 1998). Where parts of the reef are broken off or damaged, further damage may be caused by wave action as has been reported by Cunningham *et al.* (1994). The Morecambe Bay pink shrimp fishery was implicated by the loss of subtidal *S. spinulosa* reefs in the area potentially caused by the fishing itself (Mistakidis, 1956; Taylor & Parker, 1993 as cited by the UK Marine SACs Project). In most cases, towed fishing gears are used in direct contact with the sea floor to ensure adequate capture rates of target species that live on or within the seabed (Jennings & Kaiser, 1998). The physical damage caused by this activity on *S. spinulosa* reef is therefore unsurprising and can be clearly visualised using acoustic imaging (Figure 4.3.1.1).

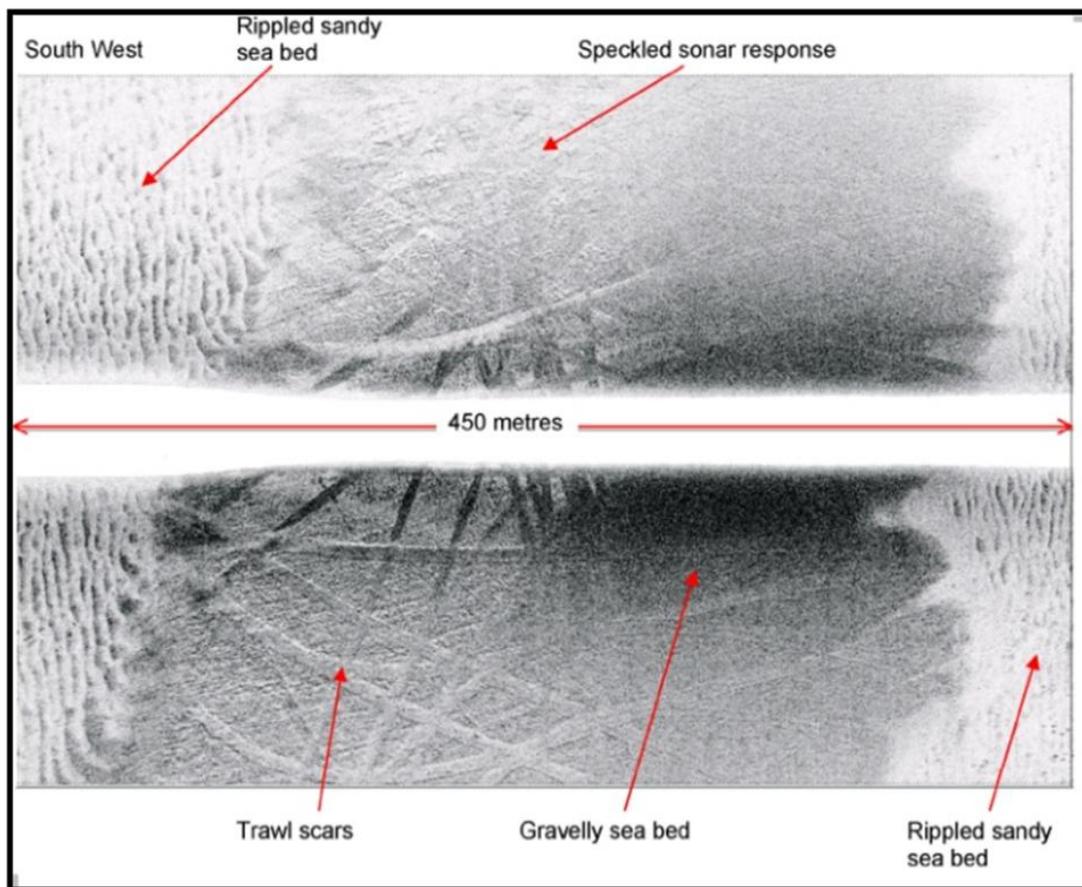


Figure 4.3.1.1 High resolution side-scan sonar image taken at an aggregate extraction site in the English Channel © CEMEX UK Marine Ltd, Hanson Aggregates Marine Ltd and United Marine Dredging Ltd (Pearce *et al.*, 2007).

Sabellaria spinulosa (the Ross worm) is a small tubicolous polychaete which is capable of converting large volumes of sand into intricate biogenic aggregations (Figure 4.3.1.3). The habitat created by *S. spinulosa* increases the complexity of the seafloor and in doing so is thought to enhance biodiversity. Recent studies by Pearce *et al.* (2007; 2011) have identified an enhanced abundance of benthic invertebrates, particularly crustaceans, associated with *S. spinulosa* reefs. The diversity and composition of macro-fauna was, however, found to be comparable to communities associated with adjacent mixed sediment habitats. High densities of *S. spinulosa* and associated fauna have been found to influence the diet of demersal fish (Pearce, 2008; Pearce *et al.*, 2011) and it is therefore likely that these habitats play an important role in supporting marine food-webs.

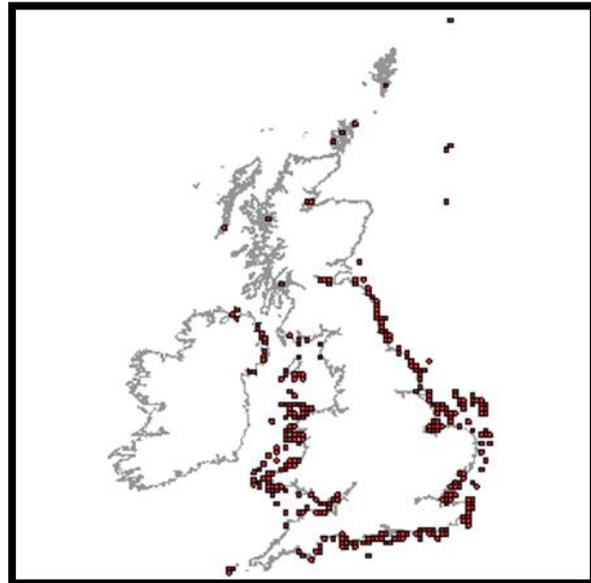


Figure 4.3.1.2 Distribution of *Sabellaria spinulosa* within 10 km squares around the UK (National Biodiversity Network, 2011 & NERC, 2004)

S. spinulosa has a relatively ubiquitous distribution around the UK (Figure 4.3.1.2), occurring mostly in subtidal environments. This species is most commonly encountered as solitary individuals or small clusters and is only rarely encountered as fully developed reefs (pers. comm. Bryony Pearce, 2011). The *S. spinulosa* reefs in the Wash are perhaps the best known example of this habitat in the UK and, as such, have been the subject of considerable survey effort (Foster-Smith *et al.*, 1997; Foster-Smith & Hendrick, 2003; Foster-Smith & Sotheran, 1999; Foster-Smith & White, 2001; Jessop *et al.*, 2010). There are conflicting reports on the height and extent of *S. spinulosa* reefs in the Wash but worm densities exceeding 500 per 0.1m² have been recorded consistently over the past decade (Foster-Smith *et al.*, 1997; Foster-Smith *et al.*, 1999; Foster-Smith, 2001; Foster-Smith & Hendrick, 2003; Foster-Smith & Sotheran, 1999; Foster-Smith & White, 2001) indicating that the reef systems in this area are relatively stable.

Shrimp trawls are lighter than most commercial trawling gear making them less destructive (Vorberg, 2000). There are, however, conflicting reports in the literature in regard to the damage that this activity causes to *S. spinulosa* reefs. The loss of large *S. spinulosa* reefs between the 1920s and 1980s from the Wadden Sea for example is thought by many to have been a consequence of the long-term effect of shrimp trawling (Reise &



Figure 4.3.1.3 Ross worm (*Sabellaria spinulosa*) reef. Photo courtesy of Matthew Green, 2010.

Shubert, 1987; Riesen & Reise, 1982). Local fishermen are reported to have deliberately ground reefs with heavy gear because it damaged nets when fishing for shrimp (Riesen & Reise, 1982). There was, however, no specific evidence of shrimp fishing having caused the Wadden Sea demise, and others have speculated that coastal eutrophication, favouring the blue mussel, *Mytilus edulis*, contributed to the collapse (Reise & Shubert, 1987). *S. spinulosa* reefs elsewhere in the UK have been found to persist despite obvious damage from bottom trawling (Figure 4.3.1.1) (Marine Ecological Surveys Limited, 2006; Pearce *et al.*, 2007), indicating that *S. spinulosa* has some resistance to this activity. However, it is unclear what impact fishing has on the ecological functioning of the reefs.

S. spinulosa is reported to have a fast growth rate (George & Warwick, 1985) and has been found to colonise previously impacted areas within a matter of months (Pearce *et al.*, 2007). Since bottom trawling is unlikely to remove complete reef systems in a single fishing event, fast re-growth helps to mitigate against the impact of this activity. Nevertheless, it is likely that *S. spinulosa* reefs have a threshold in their trawling tolerance, beyond which the reef will begin to breakdown.

OSPAR consider *S. spinulosa* reef habitat to be threatened and/or declining across the whole OSPAR area and ICES agree that evidence for both the decline and the threats to this habitat is sufficient for it to require active protection within OSPAR regions II (Greater North Sea, including the Wash) and III (Celtic Seas) (OSPAR Commission, 2008). *S. spinulosa* reefs are listed under Annex I of the EU Habitats Directive and as such are afforded some statutory protection. For example, *S. spinulosa* reef is a designated feature of the Wash and North Norfolk coast Special Area of Conservation (SAC) and the Inner Dowsing, Race Bank & North Ridge candidate SAC and hence it is particularly important that the pink shrimp fishery is managed carefully in this area.

The Eastern IFCA, Natural England, JNCC and local shrimp fishermen are currently working together to form a fisheries management plan to enable protection of local *S. spinulosa* reefs. Local shrimp fishermen have reported seeing *S. spinulosa* aggregations in their nets but note that it mostly takes the form of crusts and veneers rather than fully developed reef (pers. comm. Neil Lake, 2011). The shrimp fishermen currently avoid known areas of developed reef as their nets are likely to get snagged or damaged, and the presence of *S. spinulosa* in the catch also prolongs sorting times making their fishing excursions less profitable (pers. comm. Neil Lake, 2011). This pink shrimp fishery is very small at present, comprised of just a single vessel, but predictions are that pink shrimp fishing will increase in this area in response to market demand. It is therefore essential that the vulnerability of this habitat is assessed against anticipated fishing pressures.

Management measures for protection and identification of *S. spinulosa* reefs in the Wash and North Norfolk SAC and the Inner Dowsing, Race Bank and North Ridge candidate SAC are currently being reviewed; surveys and research commissioned by the Eastern IFCA and Natural England will highlight areas of *S. spinulosa* reefs requiring protection and will investigate the impacts of shrimp fishing on these habitats and the ecosystem services they provide.

4.3.2 BY-CATCH

There is currently no information available relating to the by-catch of the pink shrimp fishery in the Wash area but there are likely to be similar issues to the brown shrimp fishery (see Section 3.3.2).

4.3.3 ENDANGERED, THREATENED OR PROTECTED (ETP) SPECIES

Direct impacts on Endangered, Threatened or Protected (ETP) species as a result of the pink shrimp fishery are unknown due to the lack of by-catch data available. Information regarding ETP species can be found in the brown shrimp fishery section of this document (Section 3.3.3). It is possible that *S. spinulosa* may be affected by pink shrimp fishing activity but it is the reefs they construct rather than the species which is protected and so they are considered in Section 4.3.1.

4.3.4 APPLICATION OF BY-CATCH REDUCTION DEVICES

For information relating to by-catch reduction devices please refer to the brown shrimp fishery section (Section 3.3.4). It must be noted, however, that during some years, the sieve nets used by the fishery to reduce by-catch have been reported to become clogged with hydroids or green filamentous algae especially in the pink shrimp fishery grounds (pers. comm. Neil Lake and Stephen Williamson, 2011).

4.3.5 SURVIVABILITY OF DISCARDS

For information relating to the survivability of discards, please refer to the brown shrimp fishery section (Section 3.3.5).

4.4 PRINCIPLE THREE: MANAGEMENT SYSTEM BACKGROUND

The management of the pink shrimp fishery focuses on the vessel and gear used, with all vessels privy to category C license restrictions.

4.4.1 NATIONAL MANAGEMENT

National management is the same for both pink and brown shrimp fisheries. Information on this can be found in the brown shrimp fishery section (Section 3.4.1).

4.4.2 LOCAL MANAGEMENT

Local management is the same for both pink and brown shrimp fisheries. Information on this can be found in the brown shrimp fishery section (Section 3.4.2).

4.4.3 VOLUNTARY MANAGEMENT

Shrimp and potting fishermen have a long standing informal agreement that fishermen targeting pink shrimp will fish in a separate area to those using pots reducing damage to both pots and nets. This agreement was renewed at a recent meeting (pers. comm. Duncan Vaughan, Eastern IFCA, 2011).

4.4.4 MONITORING AND ENFORCEMENT

Please refer to the brown shrimp fishery section (Section 3.4.4) with regards to monitoring and enforcement.

4.4.5 KEY MANAGEMENT ORGANISATIONS

Please refer to the brown shrimp fishery section (Section 3.4.5) with regards to the key management organisations.

5. EVALUATION PROCEDURE

5.1 UNITS OF CERTIFICATION

The units of certification are outlined below (Section 5.1.1 and 5.1.2). In this pre-assessment, these combinations of species, gear and geographical areas are assessed using MSC methodology.

5.1.1 BROWN SHRIMP UNIT OF CERTIFICATION

Species: Brown shrimp - *Crangon crangon*

Geographical Area: Coastal waters between Hornsea and Felixstowe [ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (Figure 2.2.1.)]

Method of Capture: Beam trawl

Management System: DEFRA (Common Fisheries Policy)

Client Group: John Lake Shellfish Ltd and Lynn Shellfish Ltd

5.1.2 PINK SHRIMP UNIT OF CERTIFICATION

Species: Pink shrimp - *Pandalus montagui*

Geographical Area: Coastal waters between Hornsea and Felixstowe [ICES statistical rectangles: 36E9, 36F0, 35F0, 35F1, 34F0, 34F1, 33F1 (Figure 2.2.1.)]

Method of Capture: Beam trawl

Management System: DEFRA (Common Fisheries Policy)

Client Group: John Lake Shellfish Ltd and Lynn Shellfish Ltd

5.1.3 CLIENT LIMITATIONS

The assessment will cover all fishing vessels landing pink or brown shrimp at either John Lake Shellfish Ltd or Lynn Shellfish Ltd that were caught in the area of assessment (as outlined by the client and fisheries associations).

5.2 Marine Stewardship Council Assessment Methodologies Used

The methodologies provided by the MSC that were used to assess the fishery against the MSC principles were:

- MSC Fisheries Certification Methodology (v2.1)
- MSC Fisheries Assessment Methodology (v6.1)
- Pre-assessment Reporting Template and Guidance (v2) (currently in consultation)

5.3 SUMMARY OF MEETINGS AND SITE VISITS

Two meetings were held at Eastern IFCA headquarters as part of this pre-assessment:

27/05/11: A meeting was held with Eastern IFCA, a representative from the MSC, representatives from the fishing industry and the shrimp processing plants. The Assessment was defined in consultation with representatives from the fishing association, John Lake Shellfish Ltd and Lynn Shellfish Ltd. Attendees were given a tour round the two local processing plants.

07/07/11: A second meeting was held with the Eastern IFCA and representatives from shrimp processing plants (fishing association representatives were invited but did not attend). This meeting was held to review and discuss the main findings of the literature and data reviews thus far and to ensure MESL were up-to-date with, and fully understood, current working practices and fishing gears used and to identify any gaps in knowledge to assist in the pre-assessment. There was a short tour of a typical local shrimp fishing vessel.

5.4 STAKEHOLDERS TO BE CONSULTED DURING A FULL ASSESSMENT

There are many stakeholders involved in this fishery; all of which should be able to comment on, and provide feedback on the full assessment process:

Fishery/Environmental Management Bodies

- The Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA)
- North Eastern Inshore Fisheries and Conservation Authority (North Eastern IFCA)
- Natural England (NE)
- The Department for Environment, Food and Rural Affairs (DEFRA),
- Ministry Of Defence (MOD)
- Marine Management Organisation (MMO)
- Seafish

Fishing Industry Bodies

- Boston and District Fishermen's Association
- Brancaster Staithe Fishermen's Soc. Ltd
- King's Lynn Fishing Industry Co-operative
- King's Lynn Fishing Vessel Owners & Skippers Association
- Greater Wash Fishing Industry Group
- North Norfolk Fisheries Local Action Group

Academic and Research Organisations

- The Centre for Environment, Fisheries and Aquaculture Science (Cefas)

- University of Hull
- University of East Anglia (UEA)
- Institute of Environment and Health (IEH)
- International Council for the Exploration of the Sea (ICES)

Non-Governmental Organisations

- World Wildlife Fund (WWF)
- Royal Society for the Protection of Birds (RSPB)
- Wildfowl & Wetlands Trust (WWT)
- Marine Conservation Society (MCS)
- British Trust for Ornithology (BTO)
- The Wash Estuary Strategy Group
- Yorkshire Wildlife Trust
- Norfolk Wildlife Trust
- Lincolnshire Wildlife Trust

6 .TRACEABILITY

Information from this section is available in more detail on the MSC website (www.msc.org).

Document: MSC Chain of Custody V2.1 May 2010

The MSC's chain of custody standard for seafood traceability ensures the MSC eco-label is only displayed on seafood products from a MSC certified sustainable fishery. It means that consumers and seafood buyers can have confidence that the products they are buying can be traced back to a fishery that meets MSC environmental standards for sustainable fishing. Therefore, when a fishery is certified with MSC sustainable status the fishery is required to operate a well-managed system to the MSC standard. A record of all MSC certified inputs received shall be maintained, showing the name of the supplier, with relevant certificate information, to allow the tracing of those shrimp products back to the supplier if required. This is especially relevant for processing plants in the Wash.

6.1 SEPARATION AND/OR DEMARCATION OF CERTIFIED AND NON-CERTIFIED FISH INPUTS

The organisation shall operate a system to ensure that when certified shrimp products are received they are clearly identified at all stages of their storage, processing, packaging, labelling or handling.

Data will need to be recorded to allow confirmation of the volumes and/or weights of certified and non-certified fish inputs and outputs over a specified production period.

The organisation shall operate a secure system for the production, storage and application of product labels bearing a claim of MSC certified status or the MSC Logo, and will ensure that only MSC certified produce is labelled as such.

6.2 IDENTIFICATION OF CERTIFIED OUTPUTS

Certified fish and fish products shall be labelled or otherwise be identified (including the organisation's Chain of Custody Certificate number) in a manner that ensures traceability is maintained for all stages of the process.

The organisation shall operate a system that allows any product or batch of products sold by the organisation as certified to be tracked to a sales invoice issued by the organisation.

6.3 RECORD KEEPING

The organisation shall maintain appropriate records of all inputs, processing and outputs of certified fish and fish products:

- The records shall be sufficient to trace back from any given certified output to the certified inputs.
- The records shall be sufficient to allow the conversion rates for the manufacture of certified outputs from given certified inputs over any given period to be determined.
- Records shall be maintained for a minimum of three years.

7. PRELIMINARY EVALUATION

During the pre-assessment, compliance with the Principles and Criteria will be determined by applying a scoring system to these 'Performance Indicators (PIs)' (questions).

In addition, the assessment indicates, on the basis of available information, the extent to which the fishery meets MSC requirements. Any potential issues are identified.

For this pre-assessment, the information available has been used to determine the general position of both the pink and brown shrimp fisheries outlined above.

The position of the fishery in relation to the generic PIs is presented in the tables in Section 7.2, and provides an indication of the availability of information in relation to the various requirements of the MSC Principles and Criteria for Sustainable Fishing. The evaluation also indicates, on the basis of available evidence, the extent to which the fishery meets these requirements.

7.1 THE APPLICABILITY OF THE DEFAULT FISHERIES ASSESSMENT METHODOLOGY

In theory, it would be possible to apply the Risk Based Framework (RBF) to evaluate the sustainability of both the pink and brown shrimp fisheries where data is deficient for the PIs making up Principles 1 and 2. However, its application would be the decision of the certification body undertaking the full assessment if the shrimp fisheries decide to enter a full MSC assessment.

The Risk Based Framework approach is set out to identify data deficient fisheries which are deemed to have a low risk of having a negative impact on the status of the target stock (Principle 1) or other organisms, habitats and ecosystems (Principle 2). Any values scoring worse than a low risk will fail the RBF evaluation and the fishery is likely to be required to be subject to the conventional assessment.

RBF could, in theory, filter unnecessary assessment for both fisheries. However, this is only achieved in extreme cases where fishing mortality and environmental impact is considered low.

Although it is considered that brown shrimp stocks are not below their biological limits, as LPUE is variable but not declining, a RBF (subjective) assessment claiming the fishery was having effectively negligible impact on the target stock may not be sufficient to pass the full MSC assessment.

In addition, due to the potential impact on non-target species and the scale of fishery-related mortality, the brown shrimp fishery is not likely to be considered 'low risk' in certain criteria and would be likely to fail a RBF assessment for these criteria.

As well as potentially having unselective fishing gear (comparatively small mesh), the pink shrimp fishery is thought to have associations with *Sabellaria spinulosa* (Ross worm) reef which is a protected habitat and until this is sufficiently assessed the fishery is likely to be scored as worse than low risk using a RBF approach for the habitat PIs.

Throughout the evaluation tables in Section 7.2, brief comments on the RBF have been made. However, it should be noted that no RBF assessments have been carried out for the current report because of the reasons outlined above and because RBF assessment is beyond the scope of this pre-assessment. Where available information is not sufficient for the basic FAM assessment, recommendations have been made (Section 8) which may improve knowledge and inform management decisions that will assist the fishery to move towards a level of sustainability that is required for MSC certification.

The general position of the pink and brown shrimp fisheries in relation to the generic MSC PIs for each of the Principles (see Section 2.4) is presented in the following tables using the default assessment tree (FAM). This assessment indicates the availability of information in relation to the requirements of the MSC Principles and Criteria for Sustainable Fishing.

7.2 SUMMARY EVALUATION TABLES

Key:

≥80	Pass
60-80	Conditional pass
<60	Fail

Table 7.2.2 Summary of the brown shrimp fishery pre-assessment scoring

Principle One						
Outcome			Harvest Strategy			
1.1.1	1.1.2	1.1.3	1.2.1	1.2.2	1.2.3	1.2.4
60-80	<60	N/A	<60	<60	<60	<60

Principle Two														
Retained Species			By-catch Species			ETP Species			Habitats			Ecosystem		
2.1.1	2.1.2	2.1.3	2.2.1	2.2.2	2.2.3	2.3.1	2.3.2	2.3.3	2.4.1	2.4.2	2.4.3	2.5.1	2.5.2	2.5.3
<60	<60	<60	<60	<60	<60	60-80	≥80	≥80	60-80	60-80	60-80	<60	<60	60-80

Principle Three									
Governance and Policy					Fishery Specific Management System				
3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.2.2	3.2.3	3.2.4	3.2.5	
60-80	≥80	<60	<60	<60	≥80	≥80	<60	≥80	

Table 7.2.3 Summary of the pink shrimp fishery pre-assessment scoring

Principle One						
Outcome			Harvest Strategy			
1.1.1	1.1.2	1.1.3	1.2.1	1.2.2	1.2.3	1.2.4
<60	<60	N/A	<60	<60	<60	<60

Principle Two														
Retained Species			By-catch Species			ETP Species			Habitats			Ecosystem		
2.1.1	2.1.2	2.1.3	2.2.1	2.2.2	2.2.3	2.3.1	2.3.2	2.3.3	2.4.1	2.4.2	2.4.3	2.5.1	2.5.2	2.5.3
<60	<60	<60	<60	<60	<60	60-80	≥80	≥80	<60	<60	<60	<60	<60	<60

Principle Three									
Governance and Policy					Fishery Specific Management System				
3.1.1	3.1.2	3.1.3	3.1.4	3.2.1	3.2.2	3.2.3	3.2.4	3.2.5	
60-80	≥80	<60	<60	<60	≥80	≥80	<60	≥80	

7.3 A PRELIMINARY EVALUATION OF THE EAST COAST BROWN SHRIMP FISHERY

Component	Outcome			
PI 1.1.1 Stock status	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing			
Scoring issues	<SG60	SG60	SG80	SG100
a. Stock status		It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
b. Stock status in relation to target reference point			The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years .
Justification/Rationale				
<p>a. ICES reports indicate there is no evidence to suggest a good stock/recruitment relationship from one year to the next in brown shrimp. Catch rates and landings are highly variable from year to year and a high level year may follow a low level year. UK landings per unit effort (LPUE) have been variable in recent years and there is no evidence of a decline in stock levels after a high landings year (ICES, 2009; ICES, 2010). Therefore, it is generally considered (on the basis of expert judgement by the ICES <i>Crangon</i> Working Group rather than scientific quantitative analysis) that the state of the stock is above the point where recruitment would be impaired by the current levels of fishing effort. However, in the most recent ICES <i>Crangon</i> Working Group meeting (2011) it was suggested that if brown shrimp predator stocks (specifically gadoids) increase there may be more pressure on the brown shrimp. Thus, currently, it is likely that the fishery will score SG60.</p> <p>b. No target reference points, minimum spawning biomass or surrogate measures have been set for this fishery. Therefore, it is likely that the fishery would score below SG80.</p>				
RBF: If RBF is undertaken here, both SICA and PSA must be completed.			Likely Scoring Level: Pass with condition	

Component	Outcome			
PI 1.1.2 Reference points	Limit and target reference points are appropriate for the stock			
Scoring issues	<SG60	SG60	SG80	SG100
a. Appropriateness of reference points	Fail	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
b. Level of limit reference point	Fail		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues .
c. Level of target reference point	Fail		The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome, or a higher level , and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty .
d. Low trophic level species target reference point	Fail		For low trophic level species, the target reference point takes into account the ecological role of the stock.	
Justification/Rationale				
<p>No target reference points exist and no surrogate measures are in place for the brown shrimp fishery, therefore the fishery is likely to automatically fail all of the above scoring issues. Currently, the ICES <i>Crangon</i> Working Group, who meet annually, are in collaboration with experts to look into effective stock assessments with associated target reference points for brown shrimp.</p> <p>The lack of any reference points, or other measures, means that the fishery is likely to score below SG60.</p>				
RBF: When RBF is successfully used for PI 1.1.1 this PI shall receive a score of 80.			Likely Scoring Level: Fail	

Component	Outcome			
PI 1.1.3 Stock Rebuilding	Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Rebuilding strategy design		Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe .
b. Rebuilding timeframes		A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time . For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time . For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
c. Rebuilding evaluation		Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within the specified timeframe .	
Justification/Rationale				
<p>There is currently no evidence to suggest the stock is depleted and needs rebuilding. UK LPUE is variable year on year and no declining trend has been seen (ICES, 2010). Brown shrimp is a short-lived species and no relationship in recruitment from one year to the next has been observed. Catch rates and landings often recover from low levels in a previous year or are poor following a good year (ICES, 2009; ICES, 2010) which indicates high levels of natural variability.</p> <p>There are no reference points in place for the brown shrimp fishery, which results in the fishery automatically failing PI 1.1.1 and 1.1.2, and thus more information would be needed to be able to score this section. Alternatively, the fishery may need to take a risk based approach for the assessment of stock status.</p>				
RBF: When RBF is successfully used for PI 1.1.1 this PI shall receive a score of 80.			Likely Scoring Level: N/A	

Component	Harvest strategy (management)			
PI 1.2.1 Harvest strategy	There is a robust and precautionary harvest strategy in place			
Scoring issues	<SG60	SG60	SG80	SG100
a. Harvest strategy design	Fail	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
b. Harvest strategy evaluation	Fail	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
c. Harvest strategy monitoring	Fail			Monitoring is in place that is expected to determine whether the harvest strategy is working.
d. Harvest strategy review	Fail			The harvest strategy is periodically reviewed and improved as necessary.
Justification/Rationale				
The brown shrimp fishery has no harvest control rules or actions in place and therefore no strategy exists. The fishery has no reference points in place and fishing effort is controlled by demand, profitability and weather conditions. Therefore the fishery is likely to score below SG60 .				
RBF:N/A			Likely Scoring Level: Fail	

Component	Harvest strategy			
PI 1.2.2 Harvest control rules and tools	There are well defined and effective harvest control rules in place			
Scoring issues	< SG60	SG60	SG80	SG100
a. Harvest control rules design and application	Fail	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
b. Harvest control rules account for uncertainty	Fail		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules take into account a wide range of uncertainties.
c. Harvest control rules evaluation	Fail	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Justification/Rationale				
The brown shrimp fishery seeking certification has no harvest control rules or actions in place. The fishery has no reference points in place and fishing effort is controlled by demand, profitability and weather conditions. Although some stock assessments have been undertaken in the last 10-15 years (see Section 3.2.4), none of this monitoring has been fed back to manage the fishery stock levels. Therefore the fishery is likely to score below SG60 .				
RBF: N/A			Likely Scoring Level: Fail	

Component	Harvest strategy			
PI 1.2.3 Information / monitoring	Relevant information is collected to support the harvest strategy			
Scoring issues	<SG60	SG60	SG80	SG100
a. Range of information	Fail	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
b. Monitoring	Fail	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule , and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
c. Comprehensiveness of information			There is good information on all other fishery removals from the stock.	
Justification/Rationale				
<p>a. The following information is available on brown shrimp stocks:</p> <p>Stock structure: various monitoring programmes have taken place (most more than 10 years ago), which have investigated population dynamics, distribution and presence of egg-bearing females. Data on weights of graded shrimp are also available (minimum size varies) from shrimp processors' data which could be used to monitor population dynamics.</p> <p>Stock productivity: Stock production is not fully understood. The latest available report from the ICES <i>Crangon</i> Working Group (ICES, 2009; ICES, 2010) on brown shrimp still states there is a lack of understanding of recruitment and the effect of fishing and natural mortality on populations and productivity.</p> <p>Fleet composition: All fishing vessels are legally required to be licensed and landings data include details of gear used as well as the port used for landings must be recorded. VMS data is recorded for large vessels.</p> <p>Stock abundance: No programmes are currently in place to investigate stock abundance. Stock abundance is difficult to assess as the species is short-lived, and density estimations are highly dependent on assumptions, such as catchability, which are known to be variable (this is currently being investigated by ICES). Some studies have looked at sex composition. LPUE and landings records suggest a variable stock but there is no evidence of a declining trend in stocks over the last 10 years.</p> <p>Fishery removals: Some information is available on the age structure of the population (in graded size category, with assumption of size relating to age). Total landings are recorded by law, and logged in a central database. Although survey data gives an indication of discard species, there is no formal monitoring of discards.</p> <p>Although there are no formal stock assessments, reference points or harvest strategies in place, some information is available to support a harvest strategy. For example, in the North Sea Brown Shrimp Fishery, the harvest strategy is based on LPUE data. In the East Coast Brown Shrimp Fishery some landings data are available but currently it is not possible to convert this information to accurate LPUE data (kg/hours fished) as only days at sea is recorded. Results of assessments are not used in a systematic way for management purposes to support a harvest strategy and so the fishery is likely to score below SG60.</p> <p>b. Stocks are monitored by ICES, and have also been monitored by the Eastern IFCA in the past but no harvest control rule currently exists. Therefore, the fishery is likely to score below SG60.</p> <p>c. All landings are reported and logged in a database by the MMO and the Eastern IFCA. It is difficult for nomadic fishermen to enter this fishery due to vessel size restrictions. Therefore, the fishery is likely to score SG80.</p> <p>Although there is some information available which could help support a harvest strategy, in the absence of a harvest strategy the brown shrimp fishery is likely to score below SG60 and fail.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Harvest Strategy			
PI 1.2.4 Assessment of stock status	There is an adequate assessment of the stock status.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Appropriateness of assessment to stock under consideration	Fail		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the fishery.
b. Assessment approach	Fail	The assessment estimates stock status relative to reference points.		
c. Uncertainty in the assessment	Fail	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
d. Evaluation of assessment	Fail			The assessment has been tested and shown to be robust. PI 1.2.4 Alternative hypotheses and assessment approaches have been rigorously explored.
e. Peer review of assessment	Fail		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Justification/Rationale				
<p>Several monitoring programmes have taken place:</p> <ul style="list-style-type: none"> • Eastern IFCA monitored shrimp stocks at six sites in the Wash during the 1990s and early 2000s, ceasing in 2002. Sampling has enabled a bank of data to be built up, relating to the abundance, distribution and population structure of brown shrimp in the Wash. Data from these surveys are readily available. • The University of East Anglia (UEA) collected and analysed brown shrimp samples and looked into population structure, and investigated recruitment in previous years. This comprised of comparisons of catch from the shoreline at Heacham. Their work has involved establishing models for the life cycle of shrimp in the Wash. • Extensive annual and monthly surveys have been carried out by Cefas from 1995 to 2002 in the Wash, further up the Lincolnshire coast, and offshore. The primary aims were to assess brown shrimp abundance in relation to areas of offshore aggregate dredging. • Similarly, brown shrimp surveys have been initiated as part of the long-term environmental monitoring plan (required as a condition for the granting of a license to increase freshwater abstraction from the river Great Ouse) commissioned by the Environment Agency. • ICES have an annual Working Group meeting to discuss brown shrimp issues. In the most recent meeting, landings, distribution of effort, by-catch programmes, pollution load and stock assessments were discussed. <p>Although this data is technically 'available' none of it has been fed back to the fishery or has been used in relation with or to set up reference points for harvest strategies And no surveys have been commissioned in recent years. Due to this and the lack of a harvest control rule this fishery is likely to score below SG60.</p>				
RBF: When RBF is successfully used for PI 1.1.1 this PI shall receive a score of 80.			Likely Scoring Level: Fail	

Component	Retained Species			
PI 2.1.1 Outcome Status	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Retained species stock status	↓	Main retained species are likely to be within biologically based limits. If not, go to scoring issue c below.	Main retained species are highly likely to be within biologically based limits. If not, go to scoring issue c below.	There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.
b. Target reference points				Target reference points are defined for retained species.
c. Recovery and rebuilding			If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.
d. Measures if poorly understood	Fail	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		
Justification/Rationale				
<p>* Although the amount of non-target species landed by the fishery is extremely small (it is mostly only smaller vessels that don't use sieve nets, representing approximately 5% of the fleet, that occasionally land valuable species) these species are classified as 'retained' in terms of MSC methodology (pers. comm. Dan Hoggarth (MSC), 2011).</p> <p>a & b. Retained species are non-target species that for reasons of commercial value are retained by the fishery. In the East Coast Brown Shrimp Fishery the amount of retained non-target species is very low and mainly limited to a small number of commercial species of marketable size retained by small independent boats (pers. comm. Neil Lake & Stephen Williamson, 2011). Although there is no data to determine which species are retained this could potentially include; plaice, whiting, herring, dab, sprat, cod, flounder, sea bass and sole (Catchpole <i>et al.</i>, 2008). Client observations suggest that most non-target species catch consists of juvenile flounder, dab, plaice, sole and smelt, most of which are small, and therefore discarded. The bulk of the fishery (~95% of fleet) is reported to have no retained species at all (pers. comm. Neil Lake & Stephen Williamson, 2011). However, because a small number individual fish of commercial value are retained and landed, all commercial species identified above are considered under the retained species criteria.</p> <p>Both SG60 and SG80 use the qualifier 'main retained species'. Of all retained species, those which are considered 'main' need to be determined to be able to apply scoring issues. 'Main' in this context is intended to allow consideration of the catch size or vulnerability of species caught. A species that comprises less than 5% of the total catch by weight may normally be considered to be a minor species, i.e. not 'main', unless it is of particular vulnerability or if the total catch of the fishery is large, in which case even 5% may be a considerable catch.</p> <p>Based on information provided by ICES (ICES advice book series www.ices.dk; subject to regular updates), some retained species are currently within safe biological limits, for example, plaice and herring. However, information on the population status of other potential retained species of commercial value, such as whiting and sprat, are limited and thus in many cases remain undefined. North Sea cod populations are defined by ICES as currently suffering reduced reproductive capacity, which may classify this species as particularly vulnerable in the assessment leading it to be classified as a 'main' retained species. As cod is the only species which is considered vulnerable, and so is likely to be considered a 'main' retained species, that is not likely to be within biologically based limits, scoring issues 'a & b' cannot be scored and assessment moves on to scoring issue 'c'.</p> <p>c. Although it is unknown which species are 'main' retained species in terms of biomass, in a by-catch study by Catchpole <i>et al.</i> (2008) total fish biomass (17 species in total) contributed almost 12% with the use of a sieve net, although it is worth noting that "smallest fish" were not separated and not included in the total fish biomass and, unfortunately, the biomass data was not broken down into species so it is not possible to determine if any one species constitutes more than 5% of the total catch. In terms of abundance, the most important commercial species were plaice (17.3% of total fish), herring (11.9% of total fish), sprat (9.5% of total fish) and whiting (6% of total fish). Therefore, based on this data, it seems unlikely that any one of these species contributes more than 5% for total catch biomass,</p>				

particularly as most non-target individuals caught in the working fishery are small (pers. comm. Neil Lake, 2011).

However, due to the scale of the brown shrimp fishery, and the known presence of many commercial fish nursery areas, particularly plaice, within brown shrimp fishing grounds (Rogers *et al.*, 1998), the contribution of retained species could still be large enough, in absolute terms and in terms of vulnerability, to be considered 'main' for the purposes of an MSC assessment.

The status of these retained species can change annually, and the fishery does not have any feedback mechanism to monitor and protect retained species which are below biologically based limits (limits are subject to annual change).

Measures already in place to reduce the risk of harm to retained species:

- The majority of vessels (~95%) fishing in the Wash and Humber use sieve nets with 24-26mm cod-ends (pers. comm. Stephen Williamson, 2011) as they reduce sorting time and unwanted by-catch as well as some undersized retained species. Only small independent boats do not use sieve nets. Occasionally sieve nets are damaged, which increases the likelihood of large by-catch and retained species, however, nets are mended or replaced as soon as possible.
- If a significant amount of juvenile whiting are caught, the skipper will usually voluntarily move away from those grounds as they are major predators of brown shrimp and it is usually not profitable to remain fishing there (pers. comm. Neil Lake, 2011).
- The riddling and sorting process is, in most cases, quick and efficient (pers. comm. Neil Lake & Stephen Williamson, 2011) giving commercial species that are discarded a better chance of survival. However, it appears that some small, juvenile fish (specifically flatfish such as plaice) are not separated from the catch, and instead are cooked.

Survival of discarded species varies and is likely to be due to a number of factors including tow time and time on board. If the animal is still alive when discarded, the chance of mortality in the near future may be high as injuries from the catch and sorting process may leave them vulnerable to infections, predation and/or less able to compete for food.

Although sieve nets generally reduce the capture of unwanted marine species, they have been shown to be more effective on some species than others (Catchpole *et al.*, 2008). For example, sieve nets are successful at reducing by-catch of sole (- 86% [within safe biological limits]), flounder (- 72% [lack of data]), cod (- 70% [reduced reproductive capacity]) and thornback rays (- 92% [stable/increasing]) but have been shown to have little impact on reducing smelt, herring and sprat (all of unknown status). However, as sieve nets have been shown to be particularly effective at reducing the numbers of cod retained (from 20 to 5 individuals per hour per trawl), this is a measure that is in place which ensures the fishery does not hinder recovery and rebuilding of this vulnerable and depleted species, thus, the fishery is likely to score **SG60**.

d. The statuses of whiting, dab, flounder and sprat are unknown. The overall percentage reduction effect of sieve nets on these species is variable (between 20 and 72%). The species-specific biomass contribution these species make to the overall catch is likely to be less than 5% (Catchpole *et al.*, 2008), however, the size of the fishery, and the number of discarded juveniles may present an issue as the species may then be classified as 'main' if it is still a considerable catch. By law, the fishery must return undersized species to the sea, quickly and efficiently, however, survivability in this fishery is unclear. Therefore, the measures in place may not reduce the risk of causing harm to retained species with a poorly known status to be outside biologically based limits or hindering recovery, and the fishery may score below **SG60**.

RBF: RBF may be used. Both SICA and PSA applicable.

Likely Scoring Level: Fail

Component	Retained Species			
PI 2.1.2 Management strategy	There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
b. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
c. Management strategy implementation	Fail		There is some evidence that the partial strategy is being implemented successfully .	There is clear evidence that the strategy is being implemented successfully .
d. Management strategy evidence of success	Fail			There is some evidence that the strategy is achieving its overall objective .
Justification/Rationale				
<p>Current legislation (The Shrimp Fishing Net Order 2002) states that a minimum of 60% of the live weight of shrimp catch needs to be either brown or pink shrimp or a combination of the two. This rule is enforced and monitored using surveillance vessels and penalties by the MMO and the Eastern and North Eastern IFCAs. By law, sorting shall be carried out immediately after catches have been removed from the net. Undersized non-target species are returned to sea and this must be done quickly and efficiently. The majority of vessels (~95%) fishing in the Wash and Humber use sieve nets with 22-26mm cod-ends (pers. comm. Stephen Williamson, 2011) as they reduce unwanted by-catch and the associated sorting time. Only small independent boats do not use sieve nets. Occasionally sieve nets have been damaged, which increase the likelihood of large by-catch although nets are repaired or replaced quickly.</p> <p>a & b. There are voluntary and legal measures in place, such as use of sieve nets, voluntary agreements with static gear fishermen (reducing sieve net damage potential), and if a significant amount of juvenile whiting are caught, the skipper will usually voluntarily move away from those grounds, all of which help maintain stocks of retained species. However, survivability of retained species (discussed in PI 2.1.1) when discarded is unclear so these measures may not be sufficient to maintain the species at levels which are highly likely to be within biologically based limits or to ensure the fishery does not hinder their recovery and rebuilding. This is of concern with high catches of juvenile commercial species, particularly plaice, sprat and herring, even with sieve nets in place. Although, since sieve nets have been more widely used (both in the European and UK fleets) the status of North Sea plaice has improved but it has still been recommended that other measures are needed to reduce non-target species discards (ICES, 2011). Therefore, the fishery is likely score below SG60.</p> <p>c & d. There is not a full strategy implemented therefore the fishery is likely to score less than SG80 and SG 100 respectively.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Retained Species			
PI 2.1.3 Information/Monitoring	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
b. Information adequacy for assessment of stocks	Fail	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
c. Information adequacy for management strategy	Fail	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
d. Monitoring	Fail		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess on going mortalities to all retained species.
Justification/Rationale				
<p>a. Information from surveys using scientific gear (with a much smaller cod-end and net headline than the fishery uses commercially, and with no sieve nets) is available from the Eastern IFCA. However, this data only gives a qualitative indication of 'what are likely to be main' retained species within the area assessed and were collected over 10 years ago. No continuous data on current fishery retained species biomass was taken. Catchpole <i>et al.</i> (2008) quantified the abundance of retained species with and without sieve nets, and directly compared the fishing gears. Despite the absence of species-specific biomass measurements, this research still provides qualitative information for the main areas fished although it does not include the Humber area. Species-specific biomass information may be available on request, but was not given in the report by Catchpole <i>et al.</i>(2008). The availability of some qualitative data is probably likely to enable a score of SG60.</p> <p>b. Studies have been undertaken looking at potential impacts of brown shrimp fishing on Spawning Stock Biomass (SSB) of common retained species: plaice, whiting, cod and sole (Revell <i>et al.</i>, 1999). However, other common species were not investigated and this study was based on data almost 15 years old. Presently, the fleet dynamics are different as many more boats use sieve nets. Although recent research (Catchpole <i>et al.</i>, 2008)has quantified retained species in terms of abundance, it does not provide the biomass data which is required by the MSC assessment. Data showing survivability of discarded species under East Coast working practice is not readily available. Thus, the information available is not adequate to broadly understand outcome status with respect to biologically based limits for retained species and so the fishery is likely to score less than SG60.</p> <p>c. Information is available which positively supports sieve net measures currently in place showing abundance of many retained species is reduced by sieve application (Catchpole <i>et al.</i>, 2008). It has not been possible to determine which retained species qualify as 'main' species mostly due to lack of species-specific biomass data. Also, lack of data on survivability of retained commercial species means that there is not enough information to adequately support measures to manage main retained species and therefore the fishery is likely to receive a score below SG60.</p> <p>d. There is no continued monitoring of retained species levels or status. Lack of real time monitoring means the fishery is likely to receive a score below SG80.</p>				
RBF: RBF may be used. Both SICA and PSA applicable.			Likely Scoring Level: Fail	

Component	By-catch Species			
PI 2.2.1 Outcome Status	The fishery does not pose a risk of serious or irreversible harm to the by-catch species or species groups and does not hinder recovery of depleted by-catch species or species groups.			
Scoring issues	<SG60	SG60	SG80	SG100
a. By-catch species stock status		Main by-catch species are likely to be within biologically based limits. If not, go to scoring issue b below	Main by-catch species are highly likely to be within biologically based limits If not, go to scoring issue b below	There is a high degree of certainty that by-catch species are within biologically based limits.
b. Recovery and rebuilding		If main by-catch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	If main by-catch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	
c. Measures if poorly understood	Fail ↓	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the by-catch species to be outside biologically based limits or hindering recovery.		
Justification/Rationale				
<p>a & b. Although it is unknown which species are 'main' by-catch species in terms of biomass, common by-catch species are sand gobies (the most abundant non-target species), pogge, smelt, shore crab and pipefish.</p> <p>Information on population statuses for these non-commercial species is limited. Species-specific biomass data of by-catch is currently not available, but in the study by Catchpole <i>et al.</i> (2008), total fish by-catch has been shown to be around 12% of the total catch weight. Of this, approximately 41% was sand gobies (<i>Pomatoschistus</i> spp.) but in the absence of biomass data (Catchpole <i>et al.</i>, 2008), it is not known if this species constitutes a 'main' by-catch species. However, it is worth noting that in the study undertaken by Catchpole <i>et al.</i> (2008) total fish biomass did not include "smallest fish" and so may be slightly underestimated.</p> <p>Due to the scale of the brown shrimp fishery, the contribution of by-catch species, even if lower than 5% of total biomass, could still be large enough to be considered 'main' in terms of MSC assessment. As the statuses of all by-catch species is poorly known, the assessment moves to scoring issue c.</p> <p>c. The key selectivity measure in place is the use of sieve nets with 22-26 mm cod-ends. These are used on the majority of vessels (~95%) fishing in the Wash and Humber (pers. comm. Stephen Williamson, 2011) as they reduce sorting time and <i>unwanted</i> by-catch. The percentage reduction effect of sieve nets on common by-catch species is highly variable (reductions of between 0% and 71%).</p> <p>In the absence of data to assess which by-catch species would be defined as 'main', and no knowledge of the statuses of by-catch species, there needs to be evidence that measures in place make it unlikely that the fishery could seriously deplete the populations of by-catch species. In the case of the East Coast Brown Shrimp Fishery there is inadequate information (e.g. population size and survivability) to make this evaluation. It is likely, therefore, that the brown shrimp fishery will receive a score below SG60.</p>				
RBF: If RBF is applied, both SICA and PSA may be applicable.			Likely Scoring: Fail	

Component	By-catch Species			
PI 2.2.2 Management Strategy	There is a strategy in place for managing by-catch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to by-catch populations.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary, which are expected to maintain main by-catch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a partial strategy in place, if necessary, that is expected to maintain main by-catch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a strategy in place for managing and minimising by-catch.
b. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or the species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved. There is clear evidence that the strategy is being implemented successfully .
c. Management strategy implementation	Fail		There is some evidence that the partial strategy is being implemented successfully .	
d. Management strategy evidence of success	Fail			There is some evidence that the strategy is achieving its objective .
Justification/Rationale				
<p>Although no detailed data is recorded, legislation states (The Shrimp Netting Order, 2002) that 60% of the live weight of shrimp catch needs to be either brown or pink shrimp or a combination of the two. This is enforced by the MMO and the Eastern and North Eastern IFCA's. A large contribution of by-catch is undesirable and fishermen target specific areas to obtain as cleaner catch as possible to make sorting easier (pers. comm. Neil Lake, 2011).</p> <p>a & b. The majority of vessels (~95%) fishing in the Wash and Humber use sieve nets with 22-26mm cod-ends (pers. comm. Stephen Williamson & Neil Lake, 2011) as they reduce sorting time and reduce <i>unwanted</i> by-catch. Only small independent boats do not use sieve nets. Occasionally sieve nets have been damaged, which increase the likelihood of large by-catch. If this happens, nets are repaired or mended quickly. By law by-catch must be returned to sea quickly and efficiently following retrieval of the fishing gear.</p> <p>Although there are some measures in place to reduce by-catch, the biological limits of some common by-catch species are unknown and, currently, biomass data is not available which makes it difficult to assess which by-catch species are classed as 'main' in terms of MSC assessment. Selectivity of sieve nets varies between species, particularly in relation to size. Smaller sized species are more likely to be hauled (e.g. sand gobies), whereas larger species are more likely to escape (e.g. swimming crabs)(Catchpole <i>et al.</i>, 2008). This has been observed through a significant reduction in swimming crabs in the by-catch (Figure 3.3.4.3). Due to the lack of data, it is not possible to determine whether the measures already in place sufficiently reduce risk to by-catch species populations and so the fishery is likely to receive a score below SG60.</p> <p>c & d. Use of sieve nets, although widespread, is voluntary, and a small percentage of boats choose not to use them. Although these boats use smaller gear, and therefore their impacts are likely to be smaller, it demonstrates that the use of sieve nets is not an 'objective strategy' but a voluntary practice which helps fishermen on a practical level. Because the majority of boats choose to use sieve nets, it would require minimal effort to convert the entire fleet. No formal 'objective' strategy currently exists and it is unclear if the effect of sieve nets will be enough to maintain main by-catch species at levels which are highly likely to be within biologically based limits. Due to this, the fishery is likely to score below SG80 and SG100 respectively.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	By-catch Species			
PI 2.2.3 Information/monitoring	Information on the nature and amount of by-catch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage by-catch.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		Qualitative information is available on the amount of main by-catch species affected by the fishery.	Qualitative information and some quantitative information are available on the amount of main by-catch species affected by the fishery.	Accurate and verifiable information is available on the amount of all by-catch and the consequences for the status of affected populations.
<i>b. Information adequacy for assessment of stocks</i>	Fail	Information is adequate to broadly understand outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty .
c. Information adequacy for management strategy	Fail	Information is adequate to support measures to manage by-catch.	Information is adequate to support a partial strategy to manage main by-catch species.	Information is adequate to support a comprehensive strategy to manage by-catch, and evaluate with a high degree of certainty whether a strategy is achieving its objective.
d. Monitoring	Fail		Sufficient data continue to be collected to detect any increase in risk to main by-catch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of by-catch data is conducted in sufficient detail to assess on going mortalities to all by-catch species.
Justification/Rationale				
<p>a. Information from surveys using scientific gear (with no sieve nets and using a much smaller cod-end and net headline than the fishery uses commercially) is available from the Eastern IFCA. However, this data only gives a qualitative indication of 'what are likely to be main' by-catch species within the area assessed and were collected over 10 years ago. No data on current fishery by-catch species biomass is available.</p> <p>Catchpole <i>et al.</i> (2008) quantified the abundance of by-catch species with and without sieve nets, and directly compared the fishing gears. Despite the absence of species-specific biomass measurements, this research still provides qualitative information for the main areas fished although it does not include the Humber area. Species-specific biomass information may be available on request, but was not given in the report. The availability of some qualitative data is probably likely to enable a score of SG60 for the fishery.</p> <p>b. Although research has quantified by-catch species in terms of abundance, it does not provide the biomass data which is required by the MSC assessment. Data showing survivability of discarded species is also not available. Thus, the information available is not adequate to broadly understand outcome status with respect to biologically based limits for by-catch species and the fishery is likely to score below SG60.</p> <p>c. Information is available which positively supports sieve net measures currently in place showing abundance of many by-catch species is reduced with sieve net application (Catchpole <i>et al.</i>, 2008). However, it has not been possible to determine which by-catch species qualify as 'main' species. Also, lack of data on survivability of discarded species means that there is not enough information to adequately support measures to manage main by-catch species, and therefore the fishery is likely to receive a score below SG60.</p> <p>d. There is no continued monitoring of by-catch species levels or status. Lack of real time monitoring means the fishery is likely to receive a score below SG80.</p>				
NOTE: When RBF is used to score PI 2.2.1, scoring issue b (text <i>in italics</i> above) need not be scored.			Likely Scoring Level: Fail	

Component	ETP Species			
PI 2.3.1 Outcome Status	The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Fishery effects within limits		Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species. (brown shrimp)	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
b. Direct effects		Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species. There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
c. Indirect effects			Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	
Justification/Rationale				
<p>a. There have been no records of ETP marine species (mostly cetaceans and other marine mammals such as seals but also includes basking sharks, seahorses and a number of anthozoan species) caught in the shrimp fishery's nets. Effects of the fishery on ETP species cannot be said to be known as there is no current monitoring in the Wash, however, disturbance effects on seals or birds is unlikely as the fishing activity occurs at high-tide away from any haul sites. Therefore, effects of the fishery are highly likely to be within limits of national and international requirements and the fishery is likely to score SG80.</p> <p>There are, however, several protected species, designated on non-binding lists that are caught as by-catch and have been considered in Section 3.3.3.</p> <p>b. Direct effects on ETP species by the fishery are considered highly unlikely due to the location of the fishing grounds although effects have not been considered formally. In a recent BAP draft report for the Wash (Hartwell, 2011) the brown shrimp fishing fleet were not highlighted as a direct threat to any national or internationally (binding) species. The BAP draft report indicates the fishery is highly unlikely to create unacceptable impacts to ETP species and therefore the fishery is likely to score SG80.</p> <p>c. Although no formal studies have been carried out it is unlikely that there are any indirect impacts from this fishery on ETPs. One possible indirect impact could be loss of food source through by-catch of the fishery, however, the sieve nets used in the fishery would reduce this likelihood. It is thought unlikely the fishery would fail on this PI although more formal reporting may be required and more detailed information on by-catch required. A score of SG80 is applied.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	ETP Species			
PI 2.3.2 Management strategy	The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place		There are measures in place that minimise mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
b. Management strategy evaluation		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work. There is clear evidence that the strategy is being implemented successfully.
c. Management strategy implementation			There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
d. Management strategy evidence of success				There is evidence that the strategy is achieving its objective.
Justification/Rationale				
<p>Whilst the fishery has no formal strategy in place, ETP species are considered by Natural England and the Eastern and North Eastern IFCAs and if it was thought that these species were at risk, action would be taken by these bodies to minimize this risk.</p> <p>a. There are no ETP species that have been observed to be at risk from the brown shrimp fishery. If there was thought to be a risk to ETPs action would be taken by Natural England and the Eastern and North Eastern IFCAs to minimise this risk. Therefore, effects of the fishery are highly likely to be within limits of national and international requirements and the fishery is likely to score SG80.</p> <p>b. There have been no records of marine ETP species caught in the shrimp fishery's nets. Several protected species, designated on non-binding lists that are caught as by-catch have been considered in Section 3.3.3. In addition, the Wash is home to a breeding colony of the common seal (<i>Phoca vitulina</i>) but no seals have ever been recorded as being caught in the fishery and disturbance effects on seals or birds is very unlikely as the fishing activity occurs at high-tide away from any haul sites. The fishery is therefore likely to score SG80.</p> <p>c. Although there is no actual evidence the fishery is not causing serious risk or harm to seals, the only way there could be mortality of seals would be capture in nets. If mortality could occur from this fishery there would be at least anecdotal notes of the capture of seals, birds or other ETP species in nets of which there is thought to be none. The Wash Estuary Strategy Group has not highlighted the shrimp fishery as a threat to any ETP species, providing some evidence that the appropriate management measure is being implemented successfully. The fishery is likely to score SG80.</p> <p>d. 'ETP species are considered by Natural England and the Eastern and North Eastern IFCAs. Whilst there is no formal strategy in place, there is an absence of records that suggests ETP species are affected by the fishery and this could be construed as evidence to show management of ETP species is successful.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	ETP Species			
PI 2.3.3 Information/monitoring	Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
b. Information adequacy for assessment of impacts		Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
c. Information adequacy for management strategy		Information is adequate to support measures to manage the impacts on ETP species	Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
Justification/Rationale				
<p>a - c. Fishing activities are monitored by the IFCA and MMO. There have been no reported cases of ETP species being affected by the fishery. Seals are monitored formally by the Sea Mammal Research Unit seal breeding survey. There is population monitoring for the SPA bird feature (e.g. monitoring of oystercatchers) but again this does not consider shrimping specifically (pers. comm. Charlotte Johnson, 2011). Information on seal distributions is also collected by Natural England, the Eastern IFCA and other agencies. Therefore, information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and to measure trends and support a full strategy to manage impacts on ETP species. It is likely that the fishery would score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	Habitats			
PI 2.4.1 Outcome Status	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Habitat status		The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
Justification/Rationale				
<p>Fishing is restricted to mobile sediments (muddy sand and mud) and fishermen generally avoid areas supporting sedentary erect species, such as hydroids and algae, and areas of <i>Sabellaria spinulosa</i> reef (pers. comm. Neil Lake, 2011). Shrimp beam trawls are relatively light gear which reduces impacts on the seabed, and investigation of shrimp otter trawls in Maine, USA, (similar latitude to assessment area) on impacts and recoverability of comparable substrates indicate that they do not appear to have a cumulative or lasting impact on the overall habitat or macro-faunal community structure, although significant short-term effects on macro-faunal communities were observed on fishing grounds within 3 months of trawling (Simpson & Watling, 2006). These showed a rapid rate of recovery following shrimp trawling at soft-bottomed sites, with evidence to suggest that high levels of sedimentary disturbance, likely caused by mega-fauna, maintained communities in a low successional state (Simpson & Watling, 2006). Therefore, based on similar research, reduction in habitat structure and function to a point where there would be serious or irreversible harm caused by the fishery is likely to be regarded as unlikely, and the fishery is likely to score SG60.</p>				
RBF: RBF may be applied. <i>SICA only, PSA not applicable.</i>			Likely Scoring Level: Pass with condition	

Component	Habitats			
PI 2.4.2 Management strategy	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place		There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
b. Management strategy evaluation		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
c. Management strategy implementation	Fail		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
d. Management strategy evidence of success	Fail			There is some evidence that the strategy is achieving its objective.
Justification/Rationale				
<p>a. Fishing is restricted to mobile sediments and avoids more complex habitats such as <i>Sabellaria spinulosa</i> reef. There are no formal measures in place (pers. comm. Neil Lake, 2011), however, reduction in habitat structure and function to a point where there would be serious or irreversible harm caused by the fishery is highly unlikely and so the fishery is likely to score SG60.</p> <p>b. The Wash Estuary Strategy Group, in partnership with many, is working to promote the sustainable use of the resources in the Wash area whilst trying to maintain the balance that allows local communities to prosper from features of the area. This group works with various stakeholders including the MMO, Eastern IFCA and Natural England to highlight habitat threats and implement management plans. The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats) and therefore the fishery is likely to score SG60.</p> <p>c & d. There is no specific evidence of there being no serious or irreversible harm to habitat types making scoring of these issues difficult. Therefore, the fishery is likely to score less than 80 and 100 respectively.</p>				
RBF: N/A			Likely Scoring Level: Pass with condition	

Component	Habitats			
PI 2.4.3 Information / monitoring	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		There is a basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
b. Information adequacy for assessment of impacts		Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
c. Monitoring			Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Changes in habitat distributions over time are measured.
Justification/Rationale				
<p>a. Fishing is restricted to mobile sediments (muddy sand and mud) when beam trawling for brown shrimp so effects leading to irreversible harm would not be expected. The associated environment is monitored and assessed as the majority of fishing occurs within SAC boundaries. Brown shrimp trawling was not highlighted as a threat to any of the habitats in the recent Wash BAP draft and so a score of SG80 is likely.</p> <p>b. Studies in other areas indicate that shrimp trawling do not appear to have a cumulative or lasting impact on the overall habitat and Vessel Monitoring Systems VMS data is available for the larger vessels. Therefore, the fishery is likely to score SG60.</p> <p>c. The IFCA's and MMO monitor fishing activity and would identify any increase in activity which could result in an increased risk to habitat. Therefore, the fishery is likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass with condition	

Component	Ecosystem			
PI 2.5.1 Outcome Status	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Ecosystem status	Fail	The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
Justification/Rationale				
<p>The brown shrimp, the target species, and sand gobies (<i>Pomatoschistus</i> spp.), an abundant by-catch species (Catchpole <i>et al.</i>, 2008) are important prey items for commercial fish species (e.g. cod, whiting and gurnards) (Dolbeth <i>et al.</i>, 2008; Pinnegar, 2009) and therefore may be important components of the trophic structure of the ecosystem.</p> <p>It has been established in PI 1.1.1 that on the basis of no obvious decline in brown shrimp LPUE and good recovery from 'bad years', the stock is probably above the point where recruitment would be impaired by the current levels of fishing effort. Thus, this suggests that if recruitment is not impaired then impact on ecosystem services will not cause serious or irreversible harm to the key elements of ecosystem structure and function. Data collected between 1981–1997 by the Cefas young fish survey (Rogers <i>et al.</i>, 1998) showed that sand goby catch rates were variable but not declining although the most recent data has not yet been published. If the more recent data also indicates that there has not been a decline in sand goby catch rates, it is likely that the population levels of this by-catch species is above the point where recruitment is impaired by the current levels of fishing. This is based on judgement only, and currently there is no data to support this. However, it is likely that more supporting evidence would be needed to satisfy the full MSC certification for this PI to gain SG60.</p> <p>Due to there being no control strategy to maintain stock and by-catch levels for brown shrimp and by-catch predators, and no supporting evidence to show there is a negligible effect of fishing on trophic structure, the brown shrimp fishery is likely to score below SG60.</p>				
RBF: RBF may be used. S/CA only not PSA.			Likely Scoring Level: Fail	

Component	Ecosystem			
PI 2.5.2 Management strategy	There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan , in place.
b. Management strategy design	Fail	The measures take into account the potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	The strategy , which consists of a plan , contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
c. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems). (brown shrimp)	The measures are considered likely to work based on prior experience , plausible argument or information directly from the fishery/ecosystems involved.
d. Management strategy implementation	Fail		There is some evidence that the measures comprising the partial strategy are being implemented successfully .	There is evidence that the measures are being implemented successfully .
Justification/Rationale				
<p>The Wash Estuary Strategy Group is working to promote the sustainable use of the resources in the Wash area while trying to maintain the balance that allows local communities to prosper from features of the area. This group works with various stakeholders including the MMO, Eastern IFCA and Natural England to highlight habitat threats and implement management plans.</p> <p>In addition to this, the transition from the North Eastern and Eastern Sea Fisheries Committees to IFCA's under the Marine and Coastal Access Act 2009 reflects a greater responsibility for conservation of the marine environment in conjunction with fisheries management and enforcement duties. There is greater emphasis on achieving sustainability in fisheries and working with stakeholders, including the fishing industry and nature conservation bodies, to achieve sustainability. Changing to an IFCA will not automatically mean they are resourced to gather additional data, although this would be desirable. However, IFCA's are likely to be more pro-active in supporting the fishing industry as it seeks to achieve certification. This means more of an emphasis will be put on marine environmental monitoring. This change in management may work in favour of the brown shrimp fishery as this may provide the fishery with data and management that will help monitor fishing activities.</p> <p>Fishing is restricted to mobile sediments (muddy sand and mud) when beam trawling for brown shrimp so effects on the habitat structure and function leading to irreversible harm would not be expected (discussed in PI. 2.4.1), however, this has not been fully assessed.</p> <p>a - d. There are some measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function. For example, sieve nets reduce discards although the reduction varies between species and small individuals are still caught (e.g. there are still high numbers of juvenile plaice in the by-catch) (Catchpole <i>et al.</i>, 2008). However, because information about the number, weight and survivability of by-catch species is currently inadequate it is not possible to determine potential impacts on parts of the ecosystem such as trophic functioning. Also, there is no formal management strategy currently in place and no measures which specifically aim to maintain brown shrimp stock for natural predators, many of which are commercial. Therefore, the brown shrimp fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Ecosystem			
PI 2.5.3 Information / monitoring	There is adequate knowledge of the impacts of the fishery on the ecosystem.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
b. Investigation of fishery impacts		Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and some have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated in detail.
c. Understanding of component functions			The main functions of the Components (i.e. target, By-catch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, By-catch, Retained and ETP species and Habitats are identified and the main functions of these Components in the ecosystem are understood.
d. Information relevance			Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
e. Monitoring			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Justification/Rationale				
<p>a. The biotopes within the Wash and Humber SAC, and Inner Dowsing, Race Bank and North Ridge cSAC have been mapped for preparation of SAC designation. This gives information to broadly understand the key elements of the ecosystem. By-catch data is available (species abundance and total fish biomass) and some qualitative information is available on prey importance leading to a likely score of SG80.</p> <p>b. Main impacts of the fishery on these key ecosystem elements can be inferred from existing research, and by-catch has been investigated in some detail. However, there are no specific impact studies on brown shrimp fishing grounds in this area. The fishery is likely to score SG60.</p> <p>c. The main functions of the Components (i.e. target species, by-catch, retained and ETP species, and Habitats) in the ecosystem are known (explained in previous PI evaluation tables).The fishery is likely to score SG80.</p> <p>d. Sufficient information is not available on the impacts of the fishery on these Components (impact on brown shrimp stock for predators, impact on non-target population SSB etc.) which does not allow some of the main consequences for the ecosystem to be fully inferred. The fishery is likely to score below SG80.</p> <p>e. Although common seals are monitored and impacts of brown shrimp trawls on habitat is thought to be low, there is no monitoring of non-target species undertaken and fed back to the fishery, therefore, increased risk cannot be detected and for this reason the fishery is likely to score below SG80.</p>				
RBF: N/A			Scoring Level: Pass with condition	

Component	Governance and Policy			
PI 3.1.1 Legal and/or customary framework	The management system exists within an appropriate and effective legal and/or customary framework which ensures that it: - Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; - Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Consistency with laws or standards		The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.		
b. Resolution of disputes		The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective .
c. Approach to disputes		Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with binding judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements binding judicial decisions arising from legal challenges.
d. Respect for rights		The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
e. Monitoring			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures)	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Justification/Rationale				
<p>Dispute resolution is regulated according to the customs of the EU Common Fisheries Policy (CFP), through negotiations between fishermen's organisations, national and local authorities and the European Commission. Within the CFP, the fishery is not considered a pressure stock fishery and is not subject to management by TAC. So far, however, there have not been major disputes over brown shrimp.</p> <p>a. The fishery is subject to control under EU and national and local legislation.</p> <p>The fishery is typically subject to one form or another of national and local inshore fisheries management, control and inspection (which is under the jurisdiction of either the Eastern or North Eastern IFCA or MMO depending on distance offshore). The IFCA's operate within a management structure as laid out by a series of Acts of Parliament (e.g. mainly the 1966 and 1967 Shellfish Acts), but also has</p>				

responsibilities for the marine environment through the Environment Act 1995, the Sea Fisheries (Wildlife) Conservation Act 1992, The Conservation Act (Natural Habitats Regulations &c.) 1994 and The Marine & Coastal Access Act 2009. These pieces of legislation define the processes and focus of the authorisations and are consistent with MSC Principles 1 and 2. Therefore, the fishery is within local and national law and is likely to score **SG60**.

b. IFCA and MMO are required by law to include fishermen and other interested and expert parties in their membership. The DEFRA Minister appoints these Authority members. Decisions are made in a public forum and are minuted. Where illegal fishing is thought to have taken place, cases may be taken to court where a fully transparent mechanism exists to review and prosecute as required. Information on prosecutions is available on the Eastern IFCA website. Any disputes can be raised with members of the Authority, or with IFCA officers directly. Disputes not resolved within the Authority may be referred to the English or EU legal system. This **effective and transparent** management system incorporates or is subject by law for the resolution of legal disputes and so the fishery is likely to score **SG80**.

c. There are not known to be any existing legal challenges to the brown shrimp fishery. Any binding judicial decisions relevant to the IFCA are dealt with swiftly. The fishery is likely to score **SG80**.

d. Legal and customary rights are regulated according to the customs of the EU Common Fisheries Policy with regards to fishing licences, licenses that allow vessels to fish for shrimps with certain fishing gears, and access rights to certain fishing grounds (12 nm, 6 nm and 3 nm). The IFCA has a strong relationship with local fishing communities and other stakeholders, and consider fishermen's interests during decision making. IFCA byelaws restrict length of vessels using towed gear in certain parts of the district; this serves to restrict larger, nomadic vessels from fishing within the district unless they have historic rights. It is unclear whether this is consistent with MSC Principles 1 and 2, and therefore the fishery is likely to score **SG60**.

e. Although there probably aren't enough measures in place for the fishery to be in line with MSC Principles and Criteria, regular monitoring by surveillance patrol boats by IFCA organisations ensure that any increased risk of current rules and law-breaking is identified. The fishery is likely to score **SG80**.

RBF: N/A

Likely Scoring Level: **Pass with condition**

Component	Governance and Policy			
PI 3.1.2 Consultation, roles and responsibilities	The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Roles and responsibilities		Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood .	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
b. Consultation processes		The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used .
c. Participation			The consultation process provides opportunity for all interested and affected parties to be involved.	The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.
Justification/Rationale				
<p>The Eastern IFCA and MMO general consultation approach is consistent with this PI. However, although the Eastern IFCA do not have a formal consultation strategy they do demonstrate an effective consultation process with Wash bivalve fishermen in relation to the Wash Fishery Order. Very shortly they will be consulting with shrimp fishermen in a similar way (pers. comm. Judith Stout, 2011).</p> <p>a. All agencies are government run, and as such there is a structured management system in place. The roles and responsibilities of relevant agencies (IFCAs, Natural England, DEFRA, MMO and EA) are well defined and understood for all areas of responsibility and interaction and are clear to fisheries managers, environmental organisations and the rest of the fishing community. The fishery would be likely to score SG100.</p> <p>b. IFCA members are required to represent fisheries being managed. A code of conduct for members is available. The membership of each IFCA, including the North Eastern and Eastern IFCAs, includes representatives of local fishermen and other interested parties (including an MMO representative) to ensure that stakeholders are an integral part of the management process. Additionally, the Councillors who form the other half of the authority are elected officials who can be contacted by the public on management issues; therefore consultation provides opportunity for all interested parties to be involved. The Eastern IFCA regularly has open meetings about current fisheries issues to which appropriate fisheries associations and Natural England are invited. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge demonstrating consideration of the information obtained. The fishery is likely to score SG80.</p> <p>c. IFCAs are required to meet quarterly. These statutory meetings are open to the public and representatives from the fishing industry providing opportunities for all interested parties to attend and contribute. Minutes are taken at these meetings which are available for scrutiny. This pre-assessment process is an example of the Eastern IFCA providing opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement. Processors, Natural England and fisheries associations have been involved in the process. This collaboration and facilitation could aid the success of changes within the fishery and ultimately help with MSC certification. The fishery is likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	Governance and Policy			
PI 3.1.3 Long term objectives	The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Objectives	Fail	Long term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are implicit within management policy.	Clear long term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within management policy.	Clear long term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy
Justification/Rationale				
<p>The vision of the newly developed IFCA is to lead, champion and manage a sustainable marine environment and inshore fishery network by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas and a viable industry (DEFRA, 2011). New legislation (The Marine and Coastal Access Act 2009) requires that fisheries within the IFCA district undergo sustainable assessment and suitable management for which this pre-assessment forms a part.</p> <p>Also, the new Common Fisheries Policy reform aims to ensure that all fish stocks will be brought to sustainable levels by 2015, which is in line with the commitments the EU has undertaken internationally. An ecosystem approach will be adopted for all fisheries, with long-term management plans based on the best available scientific advice. The proposals also include: clear targets and timeframes to stop overfishing; market-based approaches such as individual tradable catch shares; support measures for small-scale fisheries; improved data collection; and strategies to promote sustainable aquaculture in Europe.</p> <p>New legislation and differences in top-down management may help the fishery with long-term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, however, there are no specific management plans or long-term objectives currently in place for the shrimp fishery which will fulfil MSC Principles and the fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Governance and Policy			
PI 3.1.4 Incentives for sustainable fishing	The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Incentives	Fail	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices.
Justification/Rationale				
<p>Although there is effective management within current legal regulations (e.g. restrictions on boat length, beam length and cod-end mesh size), historic understanding of the shrimp fishery is that a harvest control strategy is not necessary. This is probably not consistent with MSC Principles and by-catch levels may be an issue. In addition, the management system probably does not provide incentives to be consistent with achieving the outcomes expressed by MSC Principles. Recent discussions between the Eastern IFCA, Natural England and the MMO have initiated development for a management system. Until a management system is introduced the fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Fishery-specific management system			
PI 3.2.1 Fishery-specific objectives	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC Principles 1 and 2.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Objectives	Fail	Objectives , which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system.	Short and long term objectives , which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.	Well defined and measurable short and long term objectives , which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.
Justification/Rationale				
There are no harvest control (other than processors informally limiting landings of undersized brown shrimp) or by-catch rules in place and no management objectives that deal with these issues specifically. As there are no specific objectives that deal with these issues or potential overfishing as result of these issues, the brown shrimp fishery is likely to score below SG60 .				
RBF: N/A			Likely Scoring Level: Fail	

Component	Fishery-specific management system			
PI 3.2.2 Decision-making processes	The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Decision-making processes		There are informal decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
b. Responsive-ness of decision-making processes		Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
c. Use of precautionary approach			Decision-making processes use the precautionary approach and are based on best available information.	
d. Transparency of decision-making			Explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
Justification/Rationale				
<p>a. Decision-making by the MMO and IFCA's is undertaken through a clearly defined structure. Relevant information is collected and presented to the Committee by the Officers, and then a decision is taken through a standard 'propose, second and vote' procedure. These decisions could be used to put measures or strategies in place that could potentially help the fishery to achieve any future objectives. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge demonstrating consideration of the information obtained. The brown shrimp fishery is likely to score SG80.</p> <p>b. The process of collecting and presenting data enables relevant information to be considered during the authority decision-making process. The Eastern IFCA has a dedicated research team and helps other organisations with environmental monitoring and research. As an example, the Eastern IFCA has conducted numerous surveys since 2006 to identify and map seabed features such as the biogenic reefs formed by <i>Sabellaria spinulosa</i> due to them being a feature of interest in the Wash and North Norfolk Coast marine Special Area of Conservation (SAC) and the Wash Site of Special Scientific Interest (SSSI). This type of research provides information to assist with the management process. It is Eastern IFCA's responsibility to protect these types of features from fishery disturbance, within 6nm limits (it is the MMO's responsibility outside 6nm limits), through the facilitation of voluntary agreements or new byelaws. It is likely that the results of research will be used in future decisions and therefore the fishery is likely to score SG80.</p> <p>c. A significant number of research projects have been carried out through the years by the Eastern IFCA and other organisations which provides information for relevant decision making processes. The <i>Sabellaria spinulosa</i> research is a great example of this and can be used to put measures and strategies in place to aid the fishery in reaching a more sustainable level. The fishery is therefore likely to score SG80.</p> <p>d. Explanations for decisions can be derived from the minutes of authority meetings (where MMO are present) and all members of the authority can be contacted to discuss the decisions if required. Information is also available online. The fishery is therefore likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	Fishery-specific management system			
PI 3.2.3 Compliance and enforcement	Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with.			
Scoring issues	<SG60	SG60	SG80	SG100
a. MCS implementation		Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
b. Sanctions		Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.
c. Compliance		Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
d. Systematic non-compliance			There is no evidence of systematic non-compliance.	
Justification/Rationale				
<p>a. IFCA's and the MMO constantly strategically monitor vessels to ensure they are acting within the law. The IFCA's check catch composition, beam length, vessel length and mesh size. Vessel tracking is undertaken for larger vessels which is recorded for the MMO by Cefas to record where the vessel has been. This monitoring, control and surveillance system works full time in the Wash. Illegal activities are dealt with swiftly, and successful prosecutions have taken place in the past. The fishery is likely to score SG80.</p> <p>b. Where the MMO or IFCA Fishery Officers encounter a suspected infringement of regulations they will issue a caution and clearly explain the fisher's rights. The Fishery Officer may conduct an interview, take statements, collect evidence, and seize equipment or catch, and where this is done a receipt will be issued. In instances where infringement of regulations are suspected, the IFCA will endeavour to investigate the matter in a timely manner and individuals will always be provided the opportunity to attend an interview with investigating officers which will be recorded in accordance with the Police and Criminal Evidence Act. Any decision to take legal action against an individual is not taken by the Fishery Officer on the scene but by the Clerk & Chief Executive Officer in consultation with the Chairman and Vice Chairman of the IFCA.</p> <p>Vessels which do not comply with regulations will be dealt with according to local or national law. There have been examples of the Eastern IFCA taking skippers to court and being successful in prosecution leading to the skippers receiving relevant fines. Therefore, sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.</p> <p>The monitoring, control and surveillance system which has been implemented in the fishery under assessment has demonstrated an ability to enforce relevant management measures, strategies and/or rules and there are sanctions in place to deal with non-compliance which are consistently applied, therefore the fishery is likely to score SG100.</p> <p>c. Even with regular inspection, there are very few recent infringements of regulations. Therefore, some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery leading to a likely score of SG80.</p> <p>d. It would seem there is no evidence of systematic non-compliance with current regulations within the fishery, as explained in point c, and the fishery is likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	Fishery-specific management system			
PI 3.2.4 Research plan	The fishery has a research plan that addresses the information needs of management.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Research plan	Fail	Research is undertaken, as required, to achieve the objectives consistent with MSC Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC Principles 1 and 2.
b. Research results		Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion.	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available .
Justification/Rationale				
<p>a. The Eastern IFCA employs a team of three staff to undertake routine and novel research as required in order to manage the fisheries that occur within the Committee's district. Appropriate assessments also require that information is collected and considered against the specific objectives of the SAC, SSSI or SPA designations within the area (for example, <i>Sabellaria spinulosa</i> mapping research). However, there are several areas highlighted by this evaluation where research is probably needed, and although much of the information may be available in the current literature, some primary research maybe helpful. Despite the research that occurs within the Eastern IFCA, there is currently no formal research plan for the brown shrimp fishery. The research that does take place does not achieve the objectives consistent with MSC Principles 1 and 2 and therefore the fishery is likely to score below SG60.</p> <p>b. Specific results related to particular issues are provided to relevant parties, usually in the form of a letter, and the Committee publishes an annual research report which details the results of work undertaken during the preceding year. Information is available on the Eastern IFCA website and live twitter feeds. Research results are disseminated to all interested parties in a timely fashion, giving the fishery a score of SG80.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Fishery-specific management system		
PI 3.2.5 Monitoring and management performance evaluation	There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system.		
Scoring issues	SG60	SG80	SG100
a. Evaluation coverage	The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system.	The fishery has in place mechanisms to evaluate all parts of the management system.
b. Internal and/or external review	The fishery-specific management system is subject to occasional internal review.	The fishery-specific management system is subject to regular internal and occasional external review.	The fishery-specific management system is subject to regular internal and external review.
Justification/Rationale			
<p>a. Management measures, as proposed by the Fisheries Officers, are reviewed internally as part of the normal authority process. The fishery has mechanisms in place, such as regular meetings with stakeholders, to evaluate key parts of the management system, therefore the fishery is likely to score SG80.</p> <p>b. IFCA and Natural England (and latterly, the MMO) have frequent liaison meetings to discuss management of the shrimp fishery specifically with regard to protection of <i>Sabellaria spinulosa</i> reef features in SACs. Results of annual <i>S. spinulosa</i> monitoring are discussed and this helps focus management discussions. This liaison will continue when <i>S. spinulosa</i> protection measures (e.g. spatial restrictions) are in place. Wherever IFCAs and Natural England fail to agree an approach to fisheries management within protected European sites, DEFRA and the Fisheries Minister externally review the fishery processes and will provide a final decision. Therefore the fishery is likely to score SG80.</p>			
RBF: N/A		Likely Scoring Level: Pass	

7.4 A PRELIMINARY EVALUATION OF THE EAST COAST PINK SHRIMP FISHERY

Component	Outcome			
PI 1.1.1 Stock status	The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Stock status	Fail	It is likely that the stock is above the point where recruitment would be impaired.	It is highly likely that the stock is above the point where recruitment would be impaired.	There is a high degree of certainty that the stock is above the point where recruitment would be impaired.
b. Stock status in relation to target reference point	Fail		The stock is at or fluctuating around its target reference point.	There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years .
Justification/Rationale				
<p>a. There is a lack of research (there is no ICES Working Group for pink shrimp) and no LPUE data have been reviewed for this fishery and therefore it is difficult to assess stock levels, even broadly. Therefore, the fishery is likely to score below SG60.</p> <p>b. There is little information on the pink shrimp's life cycle and there are no target reference points, minimum spawning biomass or surrogate measures set for this fishery. Therefore, the fishery would probably score below SG80.</p>				
RBF: If RBF is undertaken here, both SICA and PSA must be completed. Particularly applies to the pink shrimp fishery where little is known of stock size, other than landings (which are affected by market demand).			Likely Scoring Level: Fail	

Component	Outcome			
PI 1.1.2 Reference points	Limit and target reference points are appropriate for the stock.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Appropriateness of reference points	Fail	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
b. Level of limit reference point	Fail		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues.
c. Level of target reference point	Fail		The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome, or a higher level,
d. Low trophic level species target reference point	Fail		For low trophic level species, the target reference point takes into account the ecological role of the stock.	and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
Justification/Rationale				
<p>No target reference points exist and no surrogate measures are in place for the pink shrimp fishery, therefore the fishery is likely to automatically fail all of the above scoring issues. Currently, the ICES <i>Crangon</i> Working group, who meet annually, are in collaboration with experts to look into effective stock assessments with associated target reference points for brown shrimp. There is currently no such research for pink shrimp.</p> <p>The lack of any reference points, or other measures, means that the fishery is likely to score below SG60.</p>				
RBF: When RBF is successfully used for PI 1.1.1 this PI shall receive a score of 80.			Likely Scoring Level: Fail	

Component	Outcome			
PI 1.1.3 Stock Rebuilding	Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Rebuilding strategy design		Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success are in place.	Where stocks are depleted rebuilding strategies are in place.	Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
b. Rebuilding timeframes		A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
c. Rebuilding evaluation		Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within the specified timeframe.	
Justification/Rationale				
<p>Data from the MMO (MMO, 2011) show a decline in landings of pink shrimps for the past 10 years which is likely to be due to changes in demand rather than any changes in stock levels. Fishing effort has decreased in this fishery, which has been characteristically low in the last decade with annual landings between 10 and 82 t (MMO data, 2011).</p> <p>There is little information on pink shrimp other than MMO landings data from the last 10 years; therefore our understanding of the stock is limited. There are no reference points in place for the pink shrimp fishery. More information is needed to be able to score this section. Alternatively, the fishery may need to take a risk based approach to assessment of stock status.</p>				
RBF: When RBF is successfully used for PI 1.1.1 this PI shall receive a score of 80.			Likely Scoring Level N/A	

Component	Harvest strategy (management)			
PI 1.2.1 Harvest strategy	There is a robust and precautionary harvest strategy in place.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Harvest strategy design	Fail	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
b. Harvest strategy evaluation	Fail	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
c. Harvest strategy monitoring	Fail			Monitoring is in place that is expected to determine whether the harvest strategy is working.
d. Harvest strategy review	Fail			The harvest strategy is periodically reviewed and improved as necessary.
Justification/Rationale				
The pink shrimp fishery seeking certification has no harvest control rules, actions or reference points in place. Fishing effort is controlled by demand, profitability and weather conditions. Therefore the fishery is likely to score below SG60 .				
RBF: N/A			Likely Scoring Level: Fail	

Component	Harvest strategy			
PI 1.2.2 Harvest control rules and tools	There are well defined and effective harvest control rules in place.			
Scoring issues	< SG60	SG60	SG80	SG100
a. Harvest control rules design and application	Fail	Generally understood harvest control rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
b. Harvest control rules account for uncertainty	Fail		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules take into account a wide range of uncertainties.
c. Harvest control rules evaluation	Fail	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
Justification/Rationale				
The pink shrimp fishery seeking certification has no harvest control rules, actions or reference points in place. Fishing effort is controlled by demand, profitability and weather conditions. Therefore the fishery is likely to score below SG60 .				
RBF: N/A			Likely Scoring Level: Fail	

Component	Harvest strategy			
PI 1.2.3 Information / monitoring	Relevant information is collected to support the harvest strategy.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Range of information	Fail	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly relevant to the current harvest strategy, is available.
b. Monitoring	Fail	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule , and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
c. Comprehensiveness of information			There is good information on all other fishery removals from the stock.	
Justification/Rationale				
<p>a. Information available on pink shrimp stocks:</p> <p>Stock structure: Other than limited research in the 1970s [See section 4.2.1: Pink Shrimp, <i>Pandalus montagui</i> - species information], there is limited understanding of life history. No other information could be found.</p> <p>Stock productivity: There has been no research carried out and productivity in the pink shrimp fishery is not understood.</p> <p>Fleet composition: All fishing vessels are legally required to be licensed and landings data must include details of gear used as well as the port used for landings. VMS data is recorded for large vessels.</p> <p>Stock abundance: Not known.</p> <p>Fishery removals: Total landings weight is recorded by law, but there is no information on the size structure of landings currently available.</p> <p>There is currently no harvest strategy in place and it is unlikely that there is enough information to support a harvest strategy if one did exist. Therefore, the fishery is likely to score below SG60.</p> <p>b. Stocks are not monitored. Therefore, the fishery is likely to score below SG60.</p> <p>c. All landings are reported and input into a database by MMO and the Eastern IFCA. It is difficult for nomadic fishermen to enter this fishery due to vessel size restrictions. Therefore, the fishery is likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Harvest Strategy			
PI 1.2.4 Assessment of stock status	There is an adequate assessment of the stock status.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Appropriateness of assessment to stock under consideration	Fail		The assessment is appropriate for the stock and for the harvest control rule.	The assessment takes into account the major features relevant to the biology of the species and the nature of the fishery.
b. Assessment approach	Fail	The assessment estimates stock status relative to reference points.		
c. Uncertainty in the assessment	Fail	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
d. Evaluation of assessment	Fail			The assessment has been tested and shown to be robust. PI 1.2.4 Alternative hypotheses and assessment approaches have been rigorously explored.
e. Peer review of assessment	Fail		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
Justification/Rationale				
No data has been collected on pink shrimp stock status and there are no reference points or harvest strategies in place. Due to the lack of any assessment of stock status the fishery is likely to score below SG60 .				
RBF: When RBF is successfully used for PI 1.1.1 this PI shall receive a score of 80.			Likely Scoring Level: Fail	

Component	Retained Species			
PI 2.1.1 Outcome Status	The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Retained species stock status	↓	Main retained species are likely to be within biologically based limits. If not, go to scoring issue c below.	Main retained species are highly likely to be within biologically based limits. If not, go to scoring issue c below.	There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.
b. Target reference points	↓			Target reference points are defined for retained species.
c. Recovery and rebuilding	Fail	If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	
d. Measures if poorly understood	Fail	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		
Justification/Rationale				
<p>* Although the amount of non-target species landed by the fishery is extremely small these species are classified as 'retained' in terms of the MSC methodology (pers. comm. Dan Hoggarth (MSC), 2011).</p> <p>The by-catch research undertaken has focused on brown shrimp fishing grounds, which have been shown to differ from those of the pink shrimp. Thus, information on the by-catch and retained species levels in the pink shrimp fishery is insufficient.</p> <p>Until the fishery's retained species contribution is assessed, it is difficult to assess this PI and the pink shrimp fishery is likely, therefore, to score below SG60.</p>				
RBF: RBF may be particularly useful for pink shrimp where there is limited information. Both SICA and PSA applicable.			Likely Scoring Level: Fail	

Component	Retained Species			
PI 2.1.2 Management strategy	There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
b. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
c. Management strategy implementation	Fail		There is some evidence that the partial strategy is being implemented successfully .	There is clear evidence that the strategy is being implemented successfully .
d. Management strategy evidence of success	Fail			There is some evidence that the strategy is achieving its overall objective .
Justification/Rationale				
<p>Current legislation (The Shrimp Netting Order, 2002) states that a minimum of 60% of the live weight of shrimp catch needs to be either brown shrimp or pink shrimp or a combination of the two. This rule is enforced and monitored using surveillance vessels and penalties by the MMO and the Eastern and North Eastern IFCA's. By law, sorting shall be carried out immediately after catches have been removed from the net. Undersized non-target species are returned to sea and this must be done quickly and efficiently. The majority of vessels (~95%) fishing in the Wash and Humber use sieve nets with 22-26mm cod-ends (pers. comm. Stephen Williamson, 2011) as they reduce unwanted by-catch and the associated sorting time. Only small independent boats do not use sieve nets. Occasionally sieve nets have been damaged, which increase the likelihood of large by-catch although nets are repaired or replaced quickly.</p> <p>The pink shrimp fishery uses similar gear to that of the brown shrimp fishery therefore similar issues are likely to be encountered. However, until the fishery's species specific biomass percentage contribution of by-catch and retained species is assessed, this scoring issue will probably receive less than SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Retained Species			
PI 2.1.3 Information/Monitoring	Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality	Fail	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
b. Information adequacy for assessment of stocks	Fail	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
c. Information adequacy for management strategy	Fail	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a comprehensive strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
d. Monitoring	Fail		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess on going mortalities to all retained species.
Justification/Rationale				
<p>The limited shrimp fishery related research undertaken on non-target species has focused on brown shrimp fishing grounds, which have been shown to differ from the pink shrimp fishing grounds. For these reasons information on these by-catch and retained species levels is insufficient to make assessments about the pink shrimp fishery.</p> <p>Until the fishery's by-catch and retained species biomass percentage contribution and survivability are assessed, the fishery is likely to receive a score below SG60.</p>				
RBF: RBF may be particularly useful for pink shrimp where there is less information. Both SICA and PSA applicable.			Likely Scoring Level: Fail	

Component	By-catch Species			
PI 2.2.1 Outcome Status	The fishery does not pose a risk of serious or irreversible harm to the by-catch species or species groups and does not hinder recovery of depleted by-catch species or species groups.			
Scoring issues	<SG60	SG60	SG80	SG100
a. By-catch species stock status	↓	Main by-catch species are likely to be within biologically based limits. If not, go to scoring issue b below	Main by-catch species are highly likely to be within biologically based limits If not, go to scoring issue b below	There is a high degree of certainty that by-catch species are within biologically based limits.
b. Recovery and rebuilding		If main by-catch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	If main by-catch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	
c. Measures if poorly understood	Fail	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the by-catch species to be outside biologically based limits or hindering recovery.		
Justification/Rationale				
Until the fishery's by-catch species contribution is assessed, it is difficult to assess this performance indicator so is likely to receive a score below SG60 .				
RBF: If RBF is applied (it may be more useful for pink shrimp where there is less information). Both SICA and PSA may be applicable.			Likely Scoring: Fail	

Component	By-catch Species			
PI 2.2.2 Management Strategy	There is a strategy in place for managing by-catch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to by-catch populations.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary, which are expected to maintain main by-catch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a partial strategy in place, if necessary, that is expected to maintain main by-catch species at levels which are highly likely to be within biologically based limits or to ensure that the fishery does not hinder their recovery.	There is a strategy in place for managing and minimising by-catch.
b. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or the species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
c. Management strategy implementation	Fail		There is some evidence that the partial strategy is being implemented successfully .	There is clear evidence that the strategy is being implemented successfully .
d. Management strategy evidence of success	Fail			There is some evidence that the strategy is achieving its objective .
Justification/Rationale				
<p>Although no detailed data is recorded, legislation states (The Shrimp Netting Order, 2002) that 60% of the live weight of shrimp catch needs to be either brown shrimp or pink shrimp. This is enforced by the MMO and the Eastern IFCA and North Eastern IFCA. A large contribution of by-catch is undesirable and fishermen target areas to obtain as 'clean' a catch as possible (pers. comm. Neil Lake, 2011).</p> <p>Although sieve nets are used, the by-catch research undertaken has focused on brown shrimp fishing grounds which have been shown to differ greatly from the pink shrimp fishing grounds. For these reasons information on by-catch levels in the pink shrimp fishery is insufficient for this pre-assessment.</p> <p>Until the fishery's by-catch species biomass percentage contribution and survivability is assessed, the fishery is likely to receive a score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	By-catch Species			
PI 2.2.3 Information/monitoring	Information on the nature and amount of by-catch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage by-catch.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality	Fail	Qualitative information is available on the amount of main by-catch species affected by the fishery.	Qualitative information and some quantitative information are available on the amount of main by-catch species affected by the fishery.	Accurate and verifiable information is available on the amount of all by-catch and the consequences for the status of affected populations.
b. Information adequacy for assessment of stocks	Fail	Information is adequate to broadly understand outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty .
c. Information adequacy for management strategy	Fail	Information is adequate to support measures to manage by-catch.	Information is adequate to support a partial strategy to manage main by-catch species.	Information is adequate to support a comprehensive strategy to manage by-catch, and evaluate with a high degree of certainty whether a strategy is achieving its objective .
d. Monitoring	Fail		Sufficient data continue to be collected to detect any increase in risk to main by-catch species (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the strategy).	Monitoring of by-catch data is conducted in sufficient detail to assess on going mortalities to all by-catch species.
Justification/Rationale				
<p>The limited research undertaken on non-target species within shrimp fisheries has focused on brown shrimp fishing grounds, which have been shown to differ greatly from the pink shrimp fishing grounds. For these reasons information on by-catch and retained species levels is insufficient to make assessments about the pink shrimp fishery.</p> <p>Until the fishery's by-catch and retained species biomass percentage contribution and survivability are assessed, the fishery is likely to receive a score below SG60.</p>				
NOTE: When RBF is used to score PI 2.2.1, scoring issue b. (text <i>in italics</i> above) need not be scored.			Likely Scoring Level: Fail	

Component	ETP Species			
PI 2.3.1 Outcome Status	The fishery meets national and international requirements for protection of ETP species. The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Fishery effects within limits		Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
b. Direct effects		Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.
c. Indirect effects			Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
Justification/Rationale				
<p>a. There have been no records of ETP marine species (mostly cetaceans and other marine mammals but also includes the basking shark, seahorses and a number of anthozoan species) caught in shrimp fishery's nets. Effects of the pink shrimp fishery on ETPs cannot be said to be known as there is no current monitoring in the Wash, however, disturbance effects on seals or birds is unlikely as the fishing activity occurs at high-tide away from any haul sites. Therefore, effects of the fishery are highly likely to be within limits of national and international requirements and the fishery is likely to score SG80.</p> <p>There are however, several protected species, designated on non-binding lists that are caught as by-catch and have been considered in previous sections (see brown shrimp).</p> <p>b. Direct effects on ETP species by the fishery are considered highly unlikely due to the location of the fishing grounds although effects have not been considered formally. In a recent BAP draft report for the Wash (Hartwell, 2011) the pink shrimp fishing fleet was not highlighted as a direct threat to any national or internationally (binding) species. The BAP draft report indicates the fishery is highly unlikely to create unacceptable impacts to ETP species and the fishery is likely to score SG80.</p> <p>c. Although no formal studies have been carried out it is unlikely that there are any indirect impacts from this fishery on ETPs. One possible indirect impact could be loss of food source through by-catch of the fishery, however, the sieve nets used in the fishery would reduce this likelihood. It is thought unlikely the fishery would fail on this PI although more formal reporting may be required and more detailed information on by-catch required. A score of SG80 is applied.</p>				
RBF: N/A			Likely Scoring Level: Conditional Pass	

Component	ETP Species			
PI 2.3.2 Management strategy	The fishery has in place precautionary management strategies designed to: - meet national and international requirements; - ensure the fishery does not pose a risk of serious or irreversible harm to ETP species; - ensure the fishery does not hinder recovery of ETP species; and - minimise mortality of ETP species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place		There are measures in place that minimise mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
b. Management strategy evaluation		The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work. There is clear evidence that the strategy is being implemented successfully.
c. Management strategy implementation			There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
d. Management strategy evidence of success				There is evidence that the strategy is achieving its objective.
Justification/Rationale				
<p>Whilst the fishery has no formal strategy in place, ETP species are considered by Natural England and the Eastern and North Eastern IFCAs and if it was thought that these species were at risk, action would be taken by these bodies to minimize this risk.</p> <p>a. There are no ETP species that have been observed to be at risk from pink shrimp fishery. If there was thought to be a risk to ETPs action would be taken by Natural England and the Eastern and North Eastern IFCAs to minimise this risk. Measures such as the application of sieve nets to reduce by-catch species (variable reduction rates between species) are taken to lessen the extent of indirect impacts of the fishery. The effects of the fishery are therefore highly likely to be within limits of national and international requirements and the fishery is likely to score SG80.</p> <p>b. There have been no records of marine ETP species caught in the shrimp fishery's nets. Several protected species, designated on non-binding lists that are caught as by-catch have been considered in Section 3.3.3 (the brown shrimp fishery). The Wash is home to a breeding colony of the common seal (<i>Phoca vitulina</i>) but no seals have ever been recorded as being caught in the fishery. Disturbance effects on seals or birds is very unlikely as the fishing activity occurs at high tide away from any haul sites. The fishery is likely to score SG80.</p> <p>c. Although there is no actual evidence the fishery is not causing serious risk or harm to seals or other ETP species, the only way there could be mortality of seals would be capture in nets. If mortality could occur from this fishery there would at least be anecdotal notes of the capture of seals, birds or other ETP species in nets of which there is thought to be none. The Wash Estuary Strategy Group has not highlighted the shrimp fishery as a threat to any ETP species, providing some evidence that there is no risk to ETPs. The fishery is likely to score SG80.</p> <p>d. 'ETP species are considered by Natural England and the Eastern and North Eastern IFCAs. Whilst there is no formal strategy in place, there is an absence of records that suggests ETP species are affected by the fishery and this could be construed as evidence to show management of ETP species is successful.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	ETP Species			
PI 2.3.3 Information/monitoring	Relevant information is collected to support the management of fishery impacts on ETP species, including: - information for the development of the management strategy; - information to assess the effectiveness of the management strategy; and - information to determine the outcome status of ETP species.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
b. Information adequacy for assessment of impacts		Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
c. Information adequacy for management strategy		Information is adequate to support measures to manage the impacts on ETP species.	Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
Justification/Rationale				
<p>a. - c. Fishing activities are monitored by the IFCA and MMO. There have been no reported cases of ETP species being affected by the fishery. Seals are monitored formally by the Sea Mammal Research Unit seal breeding survey. Information on seal distributions is also collected by Natural England, the Eastern IFCA and other agencies. Therefore, information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species, and to measure trends and support a full strategy to manage impacts on ETP species. It is likely that the fishery would score SG80 for this scoring issue.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	Habitats			
PI 2.4.1 Outcome Status	The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Habitat status	Fail	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
Justification/Rationale				
<p>a. The pink shrimp is reported to have a strong affinity to <i>Sabellaria spinulosa</i> (Ross worm) reefs (Warren, 1973; Warren & Sheldon, 1967) making this protected habitat somewhat vulnerable to pink shrimp harvesting activities. A recent Biodiversity Action Plan draft (Hartwell, 2011) published by The Wash Estuary Strategy Group states that the core areas of <i>S. spinulosa</i> reef are at risk from trawling for pink shrimp, and potentially from seed mussel dredging. Trawling, dredging, potting and net fishing are all thought to cause physical damage to <i>S. spinulosa</i> reefs (Hendrick, 2007; Holt <i>et al.</i>, 1998; Jones, 1998). Where parts of the reef are broken off or damaged, further damage may be caused by wave action as has been reported by Cunningham <i>et al.</i> (1994). However, fishermen actively avoid significant reef areas (pers. comm. Neil Lake, 2011) and don't always target <i>S. spinulosa</i> grounds, generally choosing to target the slopes on the edges of reef areas to avoid parts of the reef clogging the nets.</p> <p>The Eastern IFCA surveys the Wash throughout the year to map the distribution of <i>S. spinulosa</i>. This programme focuses on five specific regions that previous broad scale surveys identified as supporting <i>S. spinulosa</i> aggregations. Recent results found a reduction in <i>S. spinulosa</i> beds (Jessop <i>et al.</i>, 2010).</p> <p>Natural England is currently commissioning research into the effects of shrimp fishing on <i>S. spinulosa</i> reefs and associated biodiversity. The reefs do appear to provide a food source for several fish species, particularly the flatfish dab and Dover sole and to a lesser extent plaice (Pearce <i>et al.</i>, 2011), and so there may be potential effects on the ecosystem if damage to reefs does occur. Until this research and analysis is complete (due in early spring, 2012) there is not enough information to properly assess the fishery's effects as 'unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm'. There are also discussions currently taking place about voluntary closures to areas containing <i>S. spinulosa</i> reef. Once these agreements are decided on and appropriate monitoring of their success in place, the fishery may reach a higher scoring for this component. Due to the lack of information at this point, the pink shrimp fishery is likely to score less than SG60.</p>				
RBF: RBF can be used for the pink shrimp fishery but would probably still require information on the effects of trawling effects on <i>Sabellaria spinulosa</i> . <i>SICA only, PSA not applicable</i>			Likely Scoring Level: Fail	

Component	Habitats			
PI 2.4.2 Management strategy	There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
b. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
c. Management strategy implementation	Fail		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
d. Management strategy evidence of success	Fail			There is some evidence that the strategy is achieving its objective.
Justification/Rationale				
<p>a – d. It is still unclear as to whether the pink shrimp fishery reduces <i>Sabellaria spinulosa</i> reef habitat structure and function to a point where there would be serious or irreversible harm. This is a matter which will be investigated by Natural England and then managed appropriately by the Eastern IFCA and MMO. There is currently not enough information to properly assess the fishery's effects as 'unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm' therefore is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Habitats			
PI 2.4.3 Information / monitoring	Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		There is a basic understanding of the types and distribution of main habitats in the area of the fishery.	The nature, distribution and vulnerability of all main habitat types in the fishery area are known at a level of detail relevant to the scale and intensity of the fishery.	The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.
b. Information adequacy for assessment of impacts	Fail	Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.	Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.	The physical impacts of the gear on the habitat types have been quantified fully.
c. Monitoring	Fail		Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Changes in habitat distributions over time are measured.
Justification/Rationale				
<p>a. There is an understanding of the distribution of <i>Sabellaria spinulosa</i> reefs within the Wash; data is collected by the Eastern IFCA using acoustic devices so a score of SG60 is likely.</p> <p>b. It is still unclear as to whether the pink shrimp fishery reduces <i>S. spinulosa</i> reef habitat structure and function to a point where there would be serious or irreversible harm. The associated risk and extent of effect will be investigated by Natural England and then managed appropriately by the Eastern IFCA potentially with a new byelaw. Until then the pink shrimp fishery will probably automatically fail this criteria, scoring below SG60.</p> <p>c. The IFCA's and MMO monitor fishing activity and would identify any increase in activity which could result in an increased risk to habitat. Changes to <i>S. spinulosa</i> reefs are monitored by the Eastern IFCA but whether any changes are due to shrimp fishing is currently under assessment. Therefore, as the risk is unknown, the fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Ecosystem			
PI 2.5.1 Outcome Status	The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Ecosystem status	Fail	The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.	There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.
Justification/Rationale				
<p>It is still unclear as to whether the pink shrimp fishery reduces <i>Sabellaria spinulosa</i> reef habitat structure and function to a point where there would be serious or irreversible harm. This is a matter which will be investigated by Natural England and then managed appropriately by the Eastern IFCA and MMO. In addition, pink shrimp by-catch data is not available so effects on ecosystem integrity in relation to by-catch species cannot be determined. Pink shrimp may be an important prey item for some predators and the removal of this species through fishing activity may potentially affect the trophic structure of the ecosystem. There is not enough information to properly assess the fishery's effects as 'unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm'. Therefore, the fishery is likely to score below SG60.</p>				
RBF: RBF can be used. However, the pink shrimp fishery would probably still require information on the effects of trawling effects on <i>S. spinulosa</i> reefs.			Likely Scoring Level: Fail	

Component	Ecosystem			
PI 2.5.2 Management strategy	There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Management strategy in place	Fail	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan , in place.
b. Management strategy design	Fail	The measures take into account the potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	The strategy , which consists of a plan , contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
c. Management strategy evaluation	Fail	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems).	The measures are considered likely to work based on prior experience , plausible argument or information directly from the fishery/ecosystems involved.
d. Management strategy implementation	Fail		There is some evidence that the measures comprising the partial strategy are being implemented successfully .	There is evidence that the measures are being implemented successfully .
Justification/Rationale				
<p>The Wash Estuary Strategy Group is working to promote the sustainable use of the Wash area's resources while trying to maintain the balance that allows local communities to prosper from features of the area. This group works with various stakeholders including the MMO, Eastern IFCA and Natural England to highlight habitat threats and implement management plans.</p> <p>In addition to this, there has been a transition from the North Eastern and Eastern Sea Fisheries Committees to IFCA's under the Marine and Coastal Access Act 2009. This change reflects a greater responsibility for conservation of the marine environment in conjunction with fisheries management and enforcement duties. There is greater emphasis on achieving sustainability in fisheries by working with stakeholders, including the fishing industry and nature conservation bodies. Changing to an IFCA will not automatically mean they are resourced to gather additional data, although this would be desirable. However, the IFCA's are likely to be more pro-active in supporting the fishing industry as it seeks to achieve certification. This means more of an emphasis will be put on marine environmental monitoring. This change in management may work in favour of the shrimp fisheries as this may provide the fishery with data and management which will help monitor fishing activities.</p> <p>a - d. It is still unclear as to whether the pink shrimp fishery reduces <i>Sabellaria spinulosa</i> reef habitat structure and function to a point where there would be serious or irreversible harm. This is a matter which will be investigated by Natural England and then managed appropriately by the Eastern IFCA and MMO. Pink shrimp may be an important prey item for some predators and the removal of this species through fishing activity may potentially affect the trophic structure of the ecosystem. There is not enough information to properly assess the fishery's effects as 'unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm'. Therefore, until information is available, it is difficult to assess these criteria with any accuracy and the pink shrimp fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Ecosystem			
PI 2.5.3 Information / monitoring	There is adequate knowledge of the impacts of the fishery on the ecosystem.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Information quality		Information is adequate to identify the key elements of the ecosystem (e.g. trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
b. Investigation of fishery impacts	Fail	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, but have not been investigated in detail .	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and some have been investigated in detail .	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated in detail .
c. Understanding of component functions	Fail		The main functions of the Components (i.e. target, By-catch, Retained and ETP species and Habitats) in the ecosystem are known .	The impacts of the fishery on target, By-catch, Retained and ETP species and Habitats are identified and the main functions of these Components in the ecosystem are understood .
d. Information relevance	Fail		Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
e. Monitoring	Fail		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Justification/Rationale				
<p>a. The biotopes within the Wash, the Humber, Inner Dowsing, Race Bank and North Ridge cSAC have been mapped for preparation of SAC designation and this gives information to broadly understand the key elements of the ecosystem. Therefore, the fishery is likely to score SG80.</p> <p>b. Work currently being undertaken by Natural England will highlight any significant impacts (information should be available in Spring 2012). However, there are still uncertainties which have not been investigated in detail. Therefore, the fishery is likely to score below SG60.</p> <p>c. Sufficient information is not currently available on the impacts of the fishery on these components to allow some of the main consequences for the ecosystem to be inferred. By-catch studies have generally been centred around the brown shrimp fishery, as this is the much more intensive of the two fisheries. Therefore, the fishery is likely to score below SG80.</p> <p>d. For the reasons given above, this criterion is likely to be scored below SG80.</p> <p>e. Monitoring of <i>Sabellaria spinulosa</i> reefs is undertaken by the Eastern IFCA. However, by-catch data are not recorded or monitored for the pink shrimp fishery, so it is not possible to assess ecosystem effects. Therefore, the fishery is likely to score below SG80.</p>				
RBF: N/A			Scoring Level: Fail	

Component	Governance and Policy			
PI 3.1.1 Legal and/or customary framework	The management system exists within an appropriate and effective legal and/or customary framework which ensures that it: - Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; - Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and - Incorporates an appropriate dispute resolution framework.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Consistency with laws or standards		The management system is generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2.		
b. Resolution of disputes		The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective .
c. Approach to disputes		Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with binding judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements binding judicial decisions arising from legal challenges.
d. Respect for rights		The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to observe the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
e. Monitoring			Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.
Justification/Rationale				
<p>Dispute resolution is regulated according to the customs of the EU Common Fisheries Policy (CFP), and through negotiations between fishermen's organisations, national and local authorities and the European Commission. Within the CFP, the fishery is not considered a pressure stock fishery and is not subject to management by TAC. To date there have been no major disputes in the UK over pink shrimp.</p> <p>a. The fishery is subject to control under EU and national and local legislation.</p> <p>The fishery is typically subject to one or another form of national and local inshore fisheries management, control and inspection (which is under the jurisdiction of either the Eastern or North Eastern IFCA or MMO depending on distance offshore). The IFCAs operate within a management structure as laid out by a series of Acts of Parliament (mainly the 1966 and 1967 Shellfish Acts), but also has responsibilities for the marine environment through the Environment Act 1995, the Sea Fisheries (Wildlife) Conservation Act 1992, The Conservation</p>				

(Natural Habitats Regulations &c.) 1994 and The Marine & Coastal Access Act 2009. These pieces of legislation define the processes and focus of the authorisations and are consistent with MSC Principles 1 and 2. The fishery is within local and national law and therefore likely to score **SG60**.

b. The IFCA and MMO are required by law to include fishermen and other interested and expert parties in their membership. The Defra Minister appoints these Authority members. Decisions are made in a public forum, and are minuted. Where illegal fishing is thought to have taken place, cases may be taken to court where a fully transparent mechanism exists to review and prosecute as required. Information on prosecutions is available on the Eastern IFCA website. Any disputes can be raised with members of the Authority or with IFCA officers directly. Disputes not resolved within the Authority may be referred to the English or EU legal system. This **effective and transparent** management system incorporates or is subject by law for the resolution of legal disputes and the fishery is likely to score **SG80**.

c. There are not known to be any existing legal challenges to the pink shrimp fishery. Any binding judicial decisions relevant to the IFCA are dealt with swiftly. The fishery is likely to score **SG80**.

d. Legal and customary rights are regulated according to the customs of the EU Common Fisheries Policy with regards to fishing licences, licenses that allow vessels to fish for shrimps with certain fishing gears, and access rights to certain fishing grounds (12 nm, 6 nm and 3 nm). The IFCA has a strong relationship with local fishing communities and other stakeholders, and consider fishermen's interests during decision making. IFCA byelaws restrict length of vessels using towed gear in certain parts of the district; this serves to restrict larger, nomadic vessels from fishing within the district unless they have historic rights. It is unclear whether this is consistent with MSC principles 1 and 2. Therefore, the fishery is likely to score **SG60**.

e. Although there probably there aren't enough measures in place for the fishery to be in line with MSC Principles and Criteria, regular monitoring by surveillance patrol boats by IFCA organisations ensure that any increased risk of current rules and law-breaking is identified. The fishery is likely to score **SG80**.

RBF: N/A

Likely Scoring Level: **Conditional Pass**

Component	Governance and Policy		
PI 3.1.2 Consultation, roles and responsibilities	The management system has effective consultation processes that are open to interested and affected parties. The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties.		
Scoring issues	SG60	SG80	SG100
a. Roles and responsibilities	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood .	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
b. Consultation processes	The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used .
c. Participation		The consultation process provides opportunity for all interested and affected parties to be involved.	The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.
<p>Justification/Rationale</p> <p>The Eastern IFCA and MMO general consultation approach is consistent with this PI. However, although the Eastern IFCA do not have a formal consultation strategy they do demonstrate an effective consultation process with Wash bivalve fishermen in relation to the Wash Fishery Order. Very shortly they will be consulting with shrimp fishermen in a similar way (pers. comm. Judith Stout, 2011).</p> <p>a. All agencies are government run, and as such there is a structured management system in place. The roles and responsibilities of relevant agencies (IFCAs, Natural England, DEFRA, MMO and EA) are well defined and understood for all areas of responsibility and interaction and are clear to fisheries managers, environmental organisations and the rest of the fishing community. The fishery would be likely to score SG100.</p> <p>b. IFCA members are required to represent the fisheries being managed. A code of conduct for members is available. The membership of each IFCA, including the North Eastern and Eastern IFCAs, includes representatives of local fishermen and other interested parties (including an MMO representative) to ensure that a range of different stakeholders are an integral part of the management process. Additionally, the Councillors who form the other half of the authority are elected officials who can be contacted by the public on management issues. Therefore, the consultation process provides opportunity for all interested parties to be involved. The Eastern IFCA regularly has open meetings about current fisheries issues to which appropriate fisheries associations and Natural England are invited. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge demonstrating consideration of the information obtained. The fishery is likely to score SG80.</p> <p>c. IFCAs are required to meet quarterly. These statutory meetings are open to the public and representatives from the fishing industry providing opportunities for all interested parties to attend and contribute. Minutes are taken at these meetings which are available for scrutiny. This pre-assessment process is an example of the Eastern IFCA providing opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement. Processors, Natural England and fisheries associations have been involved in the process. This collaboration and facilitation could aid the success of changes within the fishery and ultimately help with MSC certification. The fishery is likely to score SG80.</p>			
RBF: N/A		Likely Scoring Level: Pass	

Component	Governance and Policy			
PI 3.1.3 Long term objectives	The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Objectives	Fail	Long term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are implicit within management policy.	Clear long term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within management policy.	Clear long term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy
<p>Justification/Rationale</p> <p>The vision of the newly developed IFCA is to lead, champion and manage a sustainable marine environment and inshore fishery network, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas and a viable industry (DEFRA). New legislation (The Marine and Coastal Access Act, 2009) requires that fisheries within the IFCA district undergo sustainable assessment and suitable management for which this pre-assessment forms a part.</p> <p>Also, the new Common Fisheries Policy reform, aims to ensure that all fish stocks will be brought to sustainable levels by 2015, which is in line with the commitments the EU has undertaken internationally. An ecosystem approach will be adopted for all fisheries, with long-term management plans based on the best available scientific advice. The proposals also include: clear targets and timeframes to stop overfishing; market-based approaches such as individual tradable catch shares; support measures for small-scale fisheries; improved data collection; and strategies to promote sustainable aquaculture in Europe.</p> <p>New legislation and differences in top-down management may well help the fishery with long term objectives to guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach. However, there are no specific management plans currently in place for the shrimp fishery which will fulfil MSC principles and the fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Governance and Policy			
PI 3.1.4 Incentives for sustainable fishing	The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Incentives	Fail	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices.
Justification/Rationale				
Although there is effective management within current legal regulations (e.g. restrictions on boat length, beam length and cod-end mesh size), there is no harvest control strategy, and by-catch levels may be an issue. In addition, the management system probably does not provide incentives to be consistent with achieving the outcomes expressed by MSC Principles. Recent discussions between the IFCA, Natural England and the MMO have initiated development for a management system. Until a management system is put in place, the fishery is likely to score below SG60 .				
RBF: N/A			Likely Scoring Level: Fail	

Component	Fishery-specific management system			
PI 3.2.1 Fishery-specific objective	The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC Principles 1 and 2.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Objectives	Fail	Objectives, which are broadly consistent with achieving the outcomes expressed by MSC Principles 1 and 2, are implicit within the fishery's management system.	Short and long term objectives, which are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, are explicit within the fishery's management system.	Well defined and measurable short and long term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC Principles 1 and 2, are explicit within the fishery's management system.
Justification/Rationale <p>There are no harvest control or by-catch rules in place and no management objectives that deal with these issues specifically. As there are no specific objectives that deal with these issues or potential overfishing as result of these issues, the pink shrimp fishery is likely to score below SG60.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Fishery-specific management system			
PI 3.2.2 Decision-making processes	The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Decision-making processes		There are informal decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
b. Responsive-ness of decision-making processes		Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
c. Use of precautionary approach			Decision-making processes use the precautionary approach and are based on best available information.	
d. Transparency of decision-making			Explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
Justification/Rationale				
<p>a. Decision-making by the MMO and IFCA's is undertaken through a clearly defined structure. Relevant information is collected and presented to the Committee by the Officers, and then a decision is taken through a standard 'propose, second and vote' procedure. These decisions could be used to put measures or strategies in place that could potentially help the fishery to achieve any future objectives put in place. The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge demonstrating consideration of the information obtained. The pink shrimp fishery is likely to score SG80.</p> <p>b. The Eastern IFCA has a dedicated research team and helps other organisations with environmental monitoring and research. As an example, the Eastern IFCA have conducted numerous surveys since 2006 to identify and map seabed features such as the biogenic reefs formed by <i>Sabellaria spinulosa</i> because they are an interest feature of the Wash and North Norfolk Coast marine Special Area of Conservation (SAC) and the Wash Site of Special Scientific Interest (SSSI). It is Eastern IFCA's responsibility to protect these types of features from fishery disturbance, within 6nm limits, (and the MMO's responsibility outside 6nm limits) through the facilitation of voluntary agreements or new bylaws. The process of collecting and presenting data such as this enables relevant information to be considered during the authority decision-making process. It is likely that the results of research will be used in future decisions and therefore the pink shrimp fishery is likely to score SG80.</p> <p>c. A significant number of research projects have been carried out through the years by the Eastern IFCA and other organisations which provides information for relevant decision making processes. The <i>S. spinulosa</i> research is a great example of this and can be used to put measures and strategies in place to aid the fishery in reaching a more sustainable level. The pink shrimp fishery is therefore likely to score SG80.</p> <p>d. Explanations for decisions can be derived from the minutes of authority meetings (where MMO are present) and all members of the authority can be contacted to discuss the decisions if required and information is available online. The pink shrimp fishery is therefore likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass	

Component	Fishery-specific management system		
PI 3.2.3 Compliance and enforcement	Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with.		
Scoring issues	SG60	SG80	SG100
a. MCS implementation	Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.	A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.	A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.
b. Sanctions	Sanctions to deal with non-compliance exist and there is some evidence that they are applied.	Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.	Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.
c. Compliance	Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.	Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.	There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.
d. Systematic non-compliance		There is no evidence of systematic non-compliance.	
Justification/Rationale			
<p>a. IFCA's and the MMO constantly strategically monitor vessels to ensure they are acting within the law. The IFCA's check catch composition, beam length, vessel length and mesh size. Vessel tracking is undertaken for larger vessels which is recorded for MMO by Cefas to record where the vessel has been. This monitoring, control and surveillance system works full time in the Wash. Illegal activities are dealt with swiftly, and successful prosecutions have taken place in the past. The pink shrimp fishery is likely to score SG80.</p> <p>b. Where MMO or IFCA Fishery Officers encounter a suspected infringement of regulations they will issue a caution and clearly explain fishermen's rights. The Fishery Officer may conduct an interview, take statements, collect evidence, and seize equipment or catch, and where this is done a receipt will be issued. In instances where infringement of regulations are suspected, the IFCA will endeavour to investigate the matter in a timely manner and individuals will always be provided the opportunity to attend an interview with investigating officers which will be recorded in accordance with the Police and Criminal Evidence Act. Any decision to take legal action against an individual is not taken by the Fishery Officer on the scene but by the Clerk & Chief Executive Officer in consultation with the Chairman and Vice Chairman of the IFCA.</p> <p>Vessels which do not comply with regulations will be dealt with according to local or national law. There have been examples of the Eastern IFCA taking skippers to court and being successful in prosecution leading to the skippers receiving relevant fines. Therefore, sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.</p> <p>Overall, the monitoring, control and surveillance system which has been implemented in the fishery under assessment has demonstrated an ability to enforce relevant management measures, strategies and/or rules and there are sanctions in place to deal with non-compliance which are consistently applied. The pink shrimp fishery is likely to score SG100.</p> <p>c. Even with regular inspection, there are very few recent infringements of regulations. Therefore, some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery. The fishery is likely to score SG80.</p> <p>d. It would seem there is no evidence of systematic non-compliance with current regulations within the fishery, as explained in point c, and the fishery is likely to score SG80.</p>			
RBF: N/A		Likely Scoring Level: Pass	

Component	Fishery-specific management system			
PI 3.2.4 Research plan	The fishery has a research plan that addresses the information needs of management.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Research plan	Fail	Research is undertaken, as required, to achieve the objectives consistent with MSC Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC Principles 1 and 2.
b. Research results		Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion.	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available .
Justification/Rationale				
<p>a. The Eastern IFCA employs a team of three staff to undertake routine and novel research as required in order to manage the fisheries that occur within the Committee's district. Appropriate assessments also require that information is collected and considered against the specific objectives of the SAC, SSSI or SPA designations within the area (e.g. the <i>Sabellaria spinulosa</i> reef mapping research). There is currently no formal research plan for the pink shrimp fishery. However, there are several areas highlighted by this evaluation where research is probably needed, and although much of the information may be available in the current literature, some primary research maybe helpful. The fishery is likely to score below SG60.</p> <p>b. Specific results related to particular issues are provided to relevant parties, usually in the form of a letter, and the Committee publishes an annual research report which details the results of work undertaken during the preceding year. Information is available on the Eastern IFCA website and live twitter feeds. Research results are disseminated to all interested parties in a timely fashion, giving this criterion SG80.</p>				
RBF: N/A			Likely Scoring Level: Fail	

Component	Fishery-specific management system			
PI 3.2.5 Monitoring and management performance evaluation	There is a system for monitoring and evaluating the performance of the fishery-specific management system against its objectives. There is effective and timely review of the fishery-specific management system.			
Scoring issues	<SG60	SG60	SG80	SG100
a. Evaluation coverage		The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system.	The fishery has in place mechanisms to evaluate all parts of the management system.
b. Internal and/or external review		The fishery-specific management system is subject to occasional internal review.	The fishery-specific management system is subject to regular internal and occasional external review.	The fishery-specific management system is subject to regular internal and external review.
Justification/Rationale				
<p>a. Management measures, as proposed by the Fisheries Officers, are reviewed internally as part of the normal authority process. The fishery has mechanisms, such as regular meetings with stakeholders, in place to evaluate key parts of the management system. Therefore, the fishery is likely to score SG80.</p> <p>b. The IFCA and Natural England (and latterly, the MMO as well) have frequent liaison meetings to discuss management of the shrimp fisheries (specifically with regard to protection of <i>Sabellaria spinulosa</i> reef features in SACs). Results of annual <i>S. spinulosa</i> monitoring are discussed and this helps focus management discussions. This liaison will continue when <i>S. spinulosa</i> reef protection measures (spatial restrictions) are in place. Wherever IFCA and Natural England fail to agree an approach to fisheries management within protected European sites, DEFRA and the Fisheries Minister externally review the fishery processes and will provide a final decision. Therefore, the fishery is likely to score SG80.</p>				
RBF: N/A			Likely Scoring Level: Pass	

8. RECOMMENDATIONS

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The following sections provide ideas and concepts which may be helpful to the fishery if they decide to improve the brown and pink shrimp fishery's sustainability; they have been formulated with Marine Stewardship Council methodology in mind. These recommendations are directed at the clients John Lake Shellfish Ltd and Lynn Shellfish Ltd. However, it is likely that the majority of recommendations are relevant to management organisations (MMO and Eastern IFCA), and it will be beneficial to the processors if they work closely and transparently with other fishermen, Natural England, the German/Dutch Cooperative (CVO), ICES, Cefas, and Seafish in order to achieve improved sustainability in the shrimp fisheries (see Table 8.1 for guidance).

MSC assessments usually result in corrective action being required as a condition of ongoing certification. These conditions often require addressing areas of weakness (relative to the MSC standard) identified during the assessment. Addressing these conditions often requires the co-operation of management bodies (e.g. MMO and Eastern and North Eastern IFCAs). Therefore, consultation with the relevant authorities, and their endorsement and involvement, would be strongly encouraged prior to commencing a full MSC sustainability assessment.

** It should be noted that recommendations in this section will give ideas and concepts and provide general guidance only. Any management plans regarding any of the subjects mentioned in this report should be fully verified and discussed with industry experts and fisheries scientists with knowledge of the MSC methodologies and marine ecology. A full MSC assessment involves expert team members and public consultation stages that are outside the scope of the pre-assessment. The outcome of a full assessment will be subject to deliberation and analysis by a certified body and may not be influenced by these recommendations or pre-assessment results.*

Table 8.1 A summary of recommendations for the brown shrimp fishery, with suggested collaborators. All recommendations are directed at the pre-assessment clients as outlined in the pre-assessment scope section (Section 2.2 of the pre-assessment report) (i.e. the Kings Lynn shrimp processors).

Principle	Recommendation	Suggested collaboration and advisory organisations
Principle 1: The Stock	1.1 Develop a stock harvest strategy in collaboration with experts	IFCA, ICES & CVO
	1.2 Use relevant information from other European brown shrimp fisheries	Cefas, ICES & CVO
	1.3 Use and adapt information already recorded	MMO & IFCA
	1.4 Reduce undersized shrimp mortality	Academics, Seafish, ICES, Cefas & IFCA
	1.5 Verify management plan	MMO, ICES, CEFAS & IFCA
Principle 2: The Environment	2.1 Improve fishing selectivity of the whole fleet	ICES, Seafish, CEFAS & IFCA
	2.2 Obtain industry specific non-target species data	IFCA, Cefas & IFCA
	2.3 Monitor the ICES status of non-target species	ICES
	2.4 Obtain information on non-target species survival after discarding	Academics, Seafish, IFCA, ICES & CVO
	2.5 In situ feedback on high non-target species by-catch levels	MMO, IFCA & CVO
	2.6 Implement monitoring of endangered, threatened and protected species by-catch levels	JNCC, IFCA & NE
	3.1 Create and verify management plan	Cefas, IFCA & ICES
	3.2 Effect of trawls on seabed habitat	NE, IFCA & Academics
	3.3 Monitoring and management of habitat	NE, IFCA & Academics
	3.4 Map fishing effort	Cefas, MMO & IFCA
	3.5 Consult Natural England on <i>Sabellaria spinulosa</i> issues	MMO, NE and IFCA
	3.6 <i>Sabellaria spinulosa</i> habitat monitoring and avoidance	MMO, NE and IFCA
	3.7 Monitor and manage important low trophic species	Cefas, IFCA & ICES
3.8 Review similar management plans	CVO & ICES	
Principle 3: Management	4.1 Commitment to a management plan	MMO, NE and IFCA
	4.2 Compliance with the management plan	MMO, NE and IFCA
	4.3 Information management	MMO, NE and IFCA

8.1 RECOMMENDATIONS FOR BROWN SHRIMP (*CRANGON CRANGON*)

The pre-assessment evaluation has highlighted the fact that the East Coast Brown Shrimp Fishery, in its current mode of operation, will not meet the standards required for MSC certification. The main obstacle to certification is the lack of formal management strategies, measures and rules in place and associated information required to implement important management measures necessary to ensure sustainability of the fishery. In particular, the fishery needs to put stock management measures in place such as reference points and a harvest control strategy. The fishery also needs to improve understanding, management and monitoring of by-catch and assess impacts of the fishery on ecosystem structure and function. In light of this, the following areas are identified as requiring attention:

- Principle 1: The Stock (Page 129-132)
- Principle 2: Environment (Page 133 - 138)
- Principle 3: Management (Page 139 - 141)

8.1.1 PRINCIPLE ONE RECOMMENDATIONS: THE STOCK

PRINCIPLE ONE

“A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery.

Intent:

The intent of this principle is to ensure that the productive capacities of resources are maintained at high levels and are not sacrificed in favour of short term interests. Thus, exploited populations would be maintained at high levels of abundance designed to retain their productivity, provide margins of safety for error and uncertainty, and restore and retain their capacities for yields over the long term.

Criteria:

1. The fishery shall be conducted at catch levels that continually maintain the high productivity of the target population(s) and associated ecological community relative to its potential productivity.
2. Where the exploited populations are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level consistent with the precautionary approach and the ability of the populations to produce long-term potential yields within a specified time frame.
3. Fishing is conducted in a manner that does not alter the age or genetic structure or sex composition to a degree that impairs reproductive capacity.”

MSC Fishery Standard Principles and Criteria for Sustainable Fishing V1.1, 2010

Obstacle:

Proving the stock is above the point where recruitment would be impaired; lack of a harvest control rule and precautionary reference points.

Recommendation 1: Monitoring and Management of Stock (Evaluation Table PI 1.1.1 – 1.2.4)

Recommendation 1.1: Develop a stock harvest strategy in collaboration with experts

Before any decision is made on a harvest strategy, it would be essential that the brown shrimp fishery management team read the 2010 and 2011 ICES *Crangon* Working Group reports and contact ICES and Cefas to discuss the best options. ICES discussions are summarised below.

Harvest strategies should be responsive to changes in the stock, well-defined and clear to all stakeholders within the fishery. Fishermen should understand the regulations and why they are in place. The harvest strategy the fishery develops should be in line with advice given by the ICES *Crangon* Working Group. Once developed, harvest strategies should be assessed by brown shrimp fishery experts. Appendix Table 1 outlines ideal MSC stock management criteria expectations.

Stock assessments

In 2010, the ICES *Crangon* Working Group discussed methods available for carrying out stock assessments:

- 1) **A co-management approach to monitoring and management of shrimp fisheries**
Involves conducting a survey with a large number of standardised catches from commercial vessels in

early and late summer to establish the different cohorts of recruits and to obtain by-catch data.

2) Ad-hoc shrimp fishery regulation

A system based on setting reference points calculated from landings per unit effort (LPUE) data to implement a 'traffic light' system of reactions by the fishing fleet depending on weekly catches. Where catch rates fall into the danger zone, fishing restrictions are put in place. This is the stock assessment method currently being employed by the Dutch and German shrimp fisheries as part of their strategy to gain full MSC certification in the near future.

3) A combination of indicators of stock status

Rather than having a formal stock assessment, this system uses a combination of stock parameters including number of berried females, size distributions and maximum length to assess the status of the stock. Various stock parameters (e.g. abundance of berried shrimp) could be monitored in conjunction with other stock assessments (1 or 2) to give a more detailed assessment.

Potential future stock assessments

In addition to the advice given in 2010, during the 2011 *Crangon* meeting, ICES discussed the possibility of Maximum Sustainable Yield (MSY) strategy, or the $F_{0.1}$ approach, which may be able to be applied to the brown shrimp stock but this depends on estimates in fishing mortality compared with natural mortality (specifically gadoid fish). These approaches are briefly discussed in the 2011 ICES *Crangon* Working Group Report (ICES, 2011b).

In addition, food web based management has been successfully applied to shellfish fisheries management in the Wash (e.g. The Wash cockle fisheries), where a calculation is made of the ecological food requirements of birds eating shellfish, and this quantity is subtracted from the total stock to arrive at the quantity available for sustainable fisheries. This management ensures that the fishery does not negatively affect the carrying capacity of the species for its predators. However, food requirements of species that eat brown shrimp are still difficult to quantify. Brown shrimp are an important food source for many fish and other species, including those for which we have no information on population size or food requirements. To compare total shrimp consumption to the standing stock, a reliable stock estimate is required, the calculation of which is prone to large uncertainties. This strategy could be a very useful route and this research topic has been suggested as one of the priority tasks on the list of the future ICES *Crangon* Working Group agenda (ICES, 2011b). This kind of stock assessment is likely to be favored when considering ecosystem impacts during a full MSC assessment.

Evaluation of current 'MSC guided' management plan

The management plans developed by the CVO have been evaluated by ICES in the most recent ICES *Crangon* Working Group Report (ICES, 2011b). This evaluation is likely to influence any refinements of the management plan and should be read thoroughly by the brown shrimp fishery.

Catch control rule

The ICES Working Group concluded the 'Ad hoc' fisheries assessment implemented in the German and Dutch management plans, based on landings per unit effort (LPUE), is valid. However, a "justification for the now set LPUE is lacking". The Working Group proposed a more "thorough study" of LPUE assessment technique. The Group stated that in order to do this, the fishermen should register their effort.

In 2011, the ICES *Crangon* Working Group proposed that the catch control rule can be implemented but evaluation of the proposed LPUE is necessary. It was commented that complete registration of catches is still lacking in the Dutch fishery, but it is a necessity for the implementation of a 'traffic light rule' for catch control

(ICES, 2011b). The Group also stated that training fishermen in comparable data recording was essential for the LPUE system to work.

Recommendation 1.2: Use relevant information from other European brown shrimp fisheries

The German and Dutch North Sea brown shrimp fisheries are currently working towards MSC certification. The UK East Coast Brown Shrimp Fishery can learn a significant amount from these fisheries as they implement their management plans to improve sustainability of their brown shrimp fishing fleets. If these shrimp fisheries gain certification, their management plans will be proven to be sustainable in terms of MSC methodology and could be adopted and refined for the UK fishery.

The Dutch and German brown shrimp fisheries have adopted the 'Ad-hoc' assessment method; however, ICES are yet to assess the approach in terms of whether it is precautionary enough. A formal stock assessment is still under development but, in the meantime, it is believed the 'Ad-hoc' method is the best practice (pers. comm. Conny Loonstra, 2011).

The German and Dutch North Sea brown shrimp fisheries management plans have implemented various measures to reduce the pressure on shrimp and non-target species stocks, ecosystem structure and function, and habitat structure (The Cooperative Fisheries Organisation (CVO), 2011). Examples of measures used by the German and Dutch fisheries to reduce pressure on shrimp stocks are given below. The suitability of such measures to the Wash fishery will need to be considered as some may not be applicable.

- *Limits on number of vessels with licences (membership after initial application only possible for an existing licence holder)*
- *Weekend fishing prohibition*
- *Limit of fishing effort to 9 out of 14 days*
- *A plan to implement limited time restrictions in various fishing areas*
- *Mesh size restrictions (cod-end and sieve net)*
- *Limits on vessel capacity (engine power)*
- *Use of a standardised sieve, with a maximum percentage of undersized shrimp allowed*

Table 8.1.1.1 Contacts and reports which may be useful to the UK fishery.

Dutch North Sea brown shrimp fishery	German North Sea brown shrimp fishery
<p>Producer's Organisation: Coöperatieve Visserij Organisatie (CVO).</p> <p>Contact: Conny Loonstra Onder de Toren 30 Emmeloord 8302 BV Netherlands</p> <p>Phone: + 31 527 698151 Mobile: +31 644 980594 E-mail: c.loonstra@visned.nl</p>	<p>Producer's Organisation: Landesvereinigung für Nordseekrabben und Küstenfischerei.V</p> <p>Contact: Mr. Knud Bußmann c/o 25761 Büsum Am Fischereihafen 7 Germany</p> <p>Phone: +49 4778 888771 E-mail: lv-krabbenfischer-sh@t-online.de</p>
<p>March 2010 CVO management plan http://www.cranqon.nl/wp-content/uploads/2011/05/Management-plan-version-March-2010.pdf</p> <p>February 2011 CVO management plan http://www.cranqon.nl/wp-content/uploads/2011/05/Management-plan-version-February-2011-ENG.pdf</p> <p>Other Relevant Downloads http://www.cranqon.nl/literatuur/</p>	

Recommendation 1.3: Use and adapt information already recorded

The fishery could use information which is already recorded to develop a harvest strategy (surveys and research on brown shrimp already undertaken are discussed in Section 3.2 of the pre-assessment report). For example, landings and effort data can be used to calculate LPUE, and data on the weight of shrimp in different size categories could potentially be used to monitor size-frequency distributions.

It is likely that some information recorded will need to be refined. For example, the 'Ad hoc shrimp fisheries information' harvest strategy may require effort to be recorded in different units as LPUE requires actual hours fished to be recorded rather than 'days at sea', a less accurate measure which is currently recorded. As brown shrimp is a fast-growing, short-lived species, all information should be collected in a timely fashion to ensure management decisions are best informed.

Recommendation 1.4: Reduce undersized shrimp mortality

The mesh size of both the sieve nets and the cod-end, and the size of sieves used in the riddling process will affect the number of undersized shrimp retained. Many of the vessels in the UK fishery use a cod-end mesh size considerably larger than the legal minimum size (16 mm) and so have already made progress in reducing undersized shrimp mortality. This application of a larger mesh size could be formalised in the management plan and hence adhered to by all vessels in the fishery. Revill *et al.* (Revill *et al.*, 2000) investigated losses associated with varying cod-end mesh sizes, and sieve net designs with increasing sizes of cod-ends, and this work maybe of some use to the fishery. The riddle efficiency is also likely to affect discards of juvenile shrimp and this may need to be investigated.

There are already plans in place to reduce the percentage contribution of undersized brown shrimp accepted by the processing plants to a maximum of 15% (pers. comm. S. Williamson & N. Lake, 2011). This will encourage low catches of undersized shrimp and is an excellent step forward in the sustainability of the fishery. There may, however, be a need for studies to determine catch composition in relation to shrimp size, and formalisation of this measure.

Returning undersized brown shrimps back to the sea efficiently may provide the brown shrimp stocks with some relief as survival has been shown to be relatively high (Lancaster & Frid, 2002). Additionally, this survivability could be improved if seagull predation were minimised. Some Dutch fishermen have chosen to use a pipe outlet which returns the non-target species and undersized shrimp deeper in the water column to avoid sea bird predation. Care should also be taken to ensure discards are not affected by the propeller of fishing vessels. It may help the fishery towards MSC certification if measures already in place are refined and formalised into a management plan.

Recommendation 1.5: Verify management plan

It would be useful to seek external advice and verification on stock management plans from organisations with experience of the stock and MSC methodology, such as ICES and Cefas. Advice in the initial stages may save time and money in the future. A formal management plan is a key measure to increase the likelihood of the fishery gaining MSC certification.

PRINCIPLE TWO

“Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

Intent:

The intent of this principle is to encourage the management of fisheries from an ecosystem perspective under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

Criteria:

- 1. The fishery is conducted in a way that maintains natural functional relationships among species and should not lead to trophic cascades or ecosystem state changes.*
- 2. The fishery is conducted in a manner that does not threaten biological diversity at the genetic, species or population levels and avoids or minimises mortality of, or injuries to, endangered, threatened or protected species.*
- 3. Where exploited populations are depleted, the fishery will be executed such that recovery and rebuilding is allowed to occur to a specified level within specified time frames, consistent with the precautionary approach and considering the ability of the population to produce long-term potential yields.”*

MSC Fishery Standard Principles and Criteria for Sustainable Fishing V1.1, 2010

Obstacle:

Insufficient information on by-catch was available at the pre-assessment stage. Full assessment will require data to define those species that are classed as ‘main’ by-catch. The pre-assessment has also raised concern over the interaction the fishery has with the seabed ecosystem, the extent to which the fishery affects non-target species even if returned to the sea, and the impact on species which depend on brown shrimp and non-target species as a food source.

Recommendation 2: Monitoring and Management of Non-target Species (Evaluation table PI 2.1.1 – 2.3.3)

There is little room for doubt of the potential negative direct impacts of shrimp trawling on non-target organisms. With careful management it may be possible to reduce this impact to improve the overall sustainability of the fishery.

The ICES *Crangon* Working Group reports may be an important resource for advice and information on issues raised in Principle 2.

ICES 2011 recommendation:

“For both the discard rates as well as the bottom impact, any reduction in effort would directly translate into a reduction of the negative impacts. Therefore, a management strategy should target at the lowest fishing effort that still allows a profitable fishery.”

Appendix Table 2 outlines ideal MSC environmental criteria expectations for Principle 2.

Recommendation 2.1: Improve fishing selectivity of the whole fleet

Sieve nets have been shown to be successful in the reduction of the catch of some, but not all, non-target species (Catchpole *et al.*, 2008). Therefore, adopting a precautionary approach, all boats in the area of certification should consider installing sieve nets. Catchpole *et al.* (2008) found that some skippers disabled the sieve nets when weed was prevalent, and some modified the exit hole to retain marketable fish. A formal

management plan may be adopted to formalise agreements between fishermen and management organisations regarding fishing gear.

The mesh size ranges, of sieve nets, riddles and cod-ends, are likely to affect the retention of non-target by-catch, and it would be useful to investigate and discuss compromises between profitability and selectivity to get maximum selectivity at an acceptable profit level. Decisions made on optimal mesh sizes should be included in the formal management plan.

It is also important to ensure that the fishery remains up-to-date on new, more sustainable gear developments, such as the 'electric beam trawl' and 'letter box' ideas that are currently being discussed on the Dutch industry website (www.crangon.nl) and by the 2011 ICES *Crangon* Working Group Report. Unfortunately, this web forum is currently mainly in Dutch, however, the CVO are in the process of developing an English version which will be available in the near future (pers. comm. Conny Loonstra, 2011).

Recommendation 2.2: Obtain industry-specific non-target species data

There is very little up-to-date data on the catch of non-target species in the shrimp fishery and where by-catch has been identified it has been recorded in terms of abundance not species-level biomass. Biomass data are required to determine which non-target species are classified as 'main' by-catch (greater than 5% of total catch biomass or vulnerable species although it also depends on the scale of the fishery). Main species are those that would be subject to specific monitoring and management plans. Non-target species size data (e.g. fish length) may also be useful to collect as the current measures that have been put in place to decrease discards have been shown to be less effective for smaller individuals (Catchpole *et al.*, 2008).

Abundance data and total fish biomass (excluding smallest fish) from a study of by-catch by Catchpole *et al.* (2008) has been used to provide a rough estimate of the biomass for each species recorded. These estimates suggest that no one non-target species would constitute more than 5% biomass of the total catch but this would need to be verified from specific data or new surveys.

There are potentially a large number of juvenile commercial fish (e.g. plaice, *Pleuronectes platessa*; whiting, *Merlangius merlangus*; dab, *Limanda limanda*; and herring, *Clupea harengus*) included in the fishery by-catch. There are also high numbers of sand gobies (*Pomatoschistus* spp.) which have been shown to be the most common non-target species caught (Catchpole *et al.*, 2008). These small fish are an important food source for many demersal piscivorous predators, specifically North Sea gadoids and flatfish (Pinnegar, 2009). It has been observed that sand gobies rarely survive being hauled (personal observations Matthew Green, 2011) so the impact may not be reduced by returning these fish to the sea. Research investigating ways of reducing this component of the by-catch and/or investigating the acceptable level of impact on this species is recommended.

Given the importance of the area as a nursery ground for many commercial and non-commercial species (Rogers *et al.*, 1998), it would be useful to assess by-catch on a regional and seasonal basis. It is therefore recommended that regular, standardised, structured, representative surveys of by-catch are undertaken on a representative number of commercial boats working under current typical working practice employed at an appropriate scale in the assessment area. It may be beneficial for work to be carried out by, or in association with, marine scientists to ensure data are accurate and externally validated. Regular monitoring will highlight seasonal and spatial variability in by-catch which could inform seasonal or spatial closures to protect vulnerable species.

The German and Dutch fisheries are currently developing a system where, on occasion, the fishermen will land all of their by-catch (observers on-board will verify by-catch levels are realistic). The landed by-catch will then be analysed once the fishing vessel has docked (pers. comm. Conny Loonstra, 2011).

It may also be possible to obtain more quantitative (biomass) information about the fishery by-catch and retained species from Cefas (see Section 3.2.3 'Stock assessments' of the pre-assessment report) who have commissioned monitoring in the area. Unfortunately, this data was not available at the time of writing the pre-assessment.

Revill *et al.* (1999) suggested one possible approach to resolve the discard problems would be the introduction of closed seasons and/or areas aiming at maximum protection of the smaller and/or juvenile fish (specifically plaice). The study suggested another approach could involve the introduction of species-selective gears, where the emphasis would be on the protection of 0-group in certain areas and 1-group plaice in other areas. Data highlighting spatial and temporal discard trends could aid this approach.

As part of their research plan (2011-2014) the Dutch brown shrimp fishery are using biological modelling similar to that used by Revill *et al.* (1999) to look at total numbers of discards and % Spawning Stock Biomass (SSB) of species in relation to young fish surveys potentially affected by the fishery as part of the fishery's by-catch monitoring. This may be a useful tool especially with regard to the MSC certification process (pers. comm. Conny Loonstra, 2011).

Recommendation 2.3: Monitor the ICES status of non-target species

The vulnerability of non-target species is important because non-target species classified as vulnerable (i.e. below biological limits) by ICES are likely to be automatically categorised as 'main' by-catch (even if less than 5% biomass of whole catch) and will therefore require a programme of monitoring and assessment for MSC certification. For example, North Sea cod is suffering reduced reproductive capacity and is therefore considered a 'main' non-target species of the shrimp fishery. Management plans to reduce catch of North Sea cod should be put in place.

The ICES status of fish populations is updated on an annual basis and this needs to be monitored to check for changes that may affect the classification of non-target species. For example, if the status of plaice, which is a common by-catch species in the shrimp fishery (Catchpole *et al.*, 2008), were to fall below biological limits, it would change the management requirements of the fishery and would have important implications for the MSC full assessment/continued certification. Therefore, it is recommended that the shrimp fishery management monitor non-target species status using the ICES advice series to inform management decisions when required.

ICES advice web forum: <http://www.ices.dk/advice/icesadvice.asp>

Cefas carry out annual surveys of young fish in and around the assessment area. Commercial and non-commercial species could be monitored by the fishery management using these data (Rogers *et al.*, 1998). If these data were made available they may be useful to indicate various species population trends and could help identify vulnerable species caught by the fishery. Any declining trends could be investigated and appropriate action taken as necessary. Other sources of information may need to be investigated.

Recommendation 2.4: Obtain information on non-target species survival after discarding

If the catch of non-target species cannot be drastically reduced, the survivability of non-target species may be a key issue in a full MSC assessment. Survivability of discards will affect the extent to which the fishery impacts non-target species populations. Unfortunately, there is little information available regarding the survivability of non-target species using practice generally adopted by the East Coast Brown Shrimp Fishery, and so it is not currently possible to fully assess the impact of the fishery on these species. There are, however, measures taken in the European fisheries that could be employed in the UK. A method to improve survivability, employed by the North Sea brown shrimp fisheries, is to sort the catch using a recognised handling method (The Cooperative Fisheries Organisation (CVO), 2011). The methods employed are reported to ensure by-catch has the best

chance of survivability although, unfortunately, no detail on the actual process was available at the time of writing the pre-assessment. Some Dutch fishermen have chosen to use a pipe outlet which returns the non-target species and undersized shrimp deeper in the water column to avoid sea bird predation (British Broadcasting Corporation (BBC), 2008).

If by-catch can be shown to have a high chance of survival, it is likely to be less of an obstacle in a MSC full assessment. It is recommended, therefore, that a code of practice for optimal handling is developed. Research could be undertaken (possibly initially as a desk-based literature review) on survivability of non-target species discarded using this protocol or there may be useful information available from the Dutch and German management organisations currently under certification. This research could be fed back to continually improve the handling protocol. The Dutch and German brown shrimp fisheries handling protocol has not yet been fully implemented, however, many vessels comply with the criteria of having a specific sorting machine, details of the protocol will be available online (www.crangon.nl) in the near future (pers. comm. Conny Loonstra, 2011).

Recommendation 2.5: In situ feedback on high non-target species by-catch levels

Another possible measure is that well-researched and defined acceptable amounts of by-catch could be set with percentage thresholds which could trigger a number of management actions such as a real time closure of that area. However, in situ feedback of non-target species by-catch was tested during the development of a Dutch fishery management plan and it proved to be unreliable as fishermen didn't have a high enough incentive to report high by-catch levels in certain areas (pers. comm. Conny Loonstra, 2011). Therefore, this measure may be difficult to monitor and enforce, and would require further investigation and discussion as well as better incentives to report high by-catch levels.

Recommendation 2.6: Implement monitoring of endangered, threatened and protected (ETP) species by-catch levels

Although there have been no recorded direct effects of fishing on ETP species, it is recommended that fishermen carry a list of potential ETP species with them and report any sightings or conflicts to the management, who could then take appropriate action. The Dutch and German brown shrimp fisheries are currently developing a full list of potential ETP species which will be available soon (pers. comm. Conny Loonstra, 2011) and this could be used by the East Coast Brown Shrimp Fishery as a starting point for developing an east coast-specific list. The effect of the shrimp fishery on ETP species could also be further assessed externally.

Furthermore, there is a possibility of indirect effects from the shrimp fishing activities, such as potential effects on (non-target) seal prey species (even with wide use of sieve nets). It would be helpful for the fishery to assess this potential effect and incorporate any findings into a management plan.

Recommendation 3. Monitoring and Management of Habitat and Ecosystems (Evaluation table PI 2.4.1 – 2.5.3)

Recommendation 3.1: Create and verify a management plan

It is very important for the fishery to decide on measures which collectively form a robust strategy to deal with the environmental effects of the fishery with clear and understood objectives. These processes should be regularly reviewed and tested by industry experts with knowledge of MSC methodology.

Recommendation 3.2: Effect of trawls on seabed habitat

Current information for the effects of shrimp trawls on seabed habitat is largely non-existent. Given the protection status of the areas involved, the potential effects may deserve further exploration. We recommend that further investigation into the effect of shrimp fisheries on the seabed is carried out. New fishing techniques such as the electric beam trawls may be very useful in reducing negative effects of fishing on seabed habitats and non-target species. However, such new techniques might also increase the efficiency of the gear which may lead to a higher fishing mortality at the same nominal effort levels. The effects of such efficiency changes should also become a research priority prior to the permission of using such gear in the commercial fishery. ICES (2011) have recently recommended this to the Wadden Sea fishery currently undergoing the MSC certification process. This information could be very useful for the UK fisheries should the research be carried out.

Recommendation 3.3: Monitoring and management of habitat

The impact of brown shrimp fishing on the local marine environment is not, in general terms, considered to be significant for several reasons. Firstly, the fishing gear used in the brown shrimp fishery is reported to be comparatively light (British Broadcasting Corporation (BBC), 2008; Vorberg, 2000) and, secondly, brown shrimp often inhabit areas of highly dynamic water regimes. Such dynamic habitats are known to have relatively quick recoverability because they are subject to high levels of natural disturbance (Hill *et al.*, 2011; Simpson & Watling, 2006). However, the habitat impacts of brown shrimp fishing in the area of assessment have not been fully investigated and it is essential to determine if the impacts of the fishing gear are detrimental.

Given this uncertainty, additional information is required for the assessment of habitat and ecosystem impacts and the eventual evaluation of the sustainability of the fishery. In particular, it would be useful to produce habitat maps of the Wash, Humber and Lincolnshire coastal areas where shrimp fishing occurs. Some habitat information may already be available as the fishing areas are, in many cases, within designated protected areas which require some form of monitoring. Thus, available data should be consulted and investigated to determine the adequacy of the data to inform the fishery about areas of particular vulnerability.

The habitat maps could then be overlaid with data on fishing effort and non-target species catch. Although some data are available, it may be necessary to undertake additional research, particularly as much of the current data are over 10 years old. Impacts and recovery are also likely to be affected by how frequently an area is trawled (Simpson & Watling, 2006). Management decisions regarding habitat effects may consider using vessel effort data to highlight areas most at risk, which could be managed using various measures such as “closed areas”.

There may also be research data available from other brown shrimp fisheries seeking MSC certification. The German and Dutch North Sea brown shrimp fisheries have designated areas for scientific research to aid a three-year investigation to help assess the impact of the fishery on the habitat/ecosystem and by-catch (pers. comm. Conny Loonstra, 2011).

Recommendation 3.4: Mapping fishing effort

In addition to the landings, effort and number of active vessels data, it may be useful for the fishery to provide positional data (e.g. VMS or GPS) from brown shrimp fishing vessels in order to identify both areas affected by the fishery and spatial patterns in fishing activity. A similar system has been agreed in the European fishery where Dutch fishing ministries and research institutions have access to positional data, and the data generated could inform monitoring practices. The Dutch and German brown shrimp fisheries are currently developing a black box to obtain more accurate data on positions and fishing activity (pers. comm. Conny Loonstra, 2011).

Recommendation 3.5: Consult Natural England on Sabellaria spinulosa issues

Natural England is in the process of assessing the vulnerability of *Sabellaria spinulosa* reefs to shrimp fishing. It is currently recommended that, as a precautionary approach, vessels should actively avoid areas of significant *S. spinulosa* reef, and it is thought that brown shrimp fishing grounds are generally not home to *S. spinulosa* reef. When the results of the research project have been finalised and published by Natural England (due Spring 2012), the fishery may wish to adopt the findings into their management plan. Recent and current research on the distribution of *S. spinulosa* reefs, commissioned by Natural England, may also prove to be useful in the development of management plans. The Eastern IFCA, with Natural England and the MMO, are in the early stages of developing a voluntary scheme for fishermen to avoid core reef areas, in prescribed closed boxes, based on historic and recent information on *S. spinulosa* reef distribution. The Authority intends to call a special meeting with shrimp fishermen and processors to discuss this in the coming months. This monitoring and management is likely to help the brown shrimp fishery improve sustainability.

Recommendation 3.6: Sabellaria spinulosa habitat monitoring and avoidance

The fishermen themselves can play a key role in the monitoring of important habitats affected by the fishery. For example, skippers could record any *Sabellaria spinulosa* hauled and include data such as approximate volume of reef in the haul and co-ordinates to show where it was collected. These data collected by the fishing vessels could provide additional information for the Eastern IFCA which could be fed into management. This is particularly relevant for *S. spinulosa* reef habitats, which are known to be fairly dynamic and subject to changes in distribution, and may allow review of closed areas according to most recent information on reef distribution. Advice could be sought from fisheries research organisations such as ICES and Cefas, and environmental organisations such as The Wash Estuary Strategy Group and Natural England, in collaboration with the IFCAs' own management plans.

Recommendation 3.7: Monitor and manage important low trophic species

Potentially high numbers of brown shrimp and non-target species are caught in the fishery and have been identified as important food items for benthic predators, which are often commercial species. Feeding requirements for predators of brown shrimp could be built in to the harvest control rule. Low trophic level species, specifically common non-target species such as sand gobies (*Pomatoschistus* spp.), may be monitored. This would involve specific surveys or use of existing data such as Cefas' young fish data, which are collected annually. The management may be able to collaborate with Cefas to ensure that information is received in a timely manner.

Recommendation 3.8: Review similar management plans

There are several examples of the measures that the German and Dutch North Sea brown shrimp fisheries have included in their management plans which could be applicable to the East Coast Brown Shrimp Fishery. Such measures include:

- Participants have the objective of reducing non-surviving undersized shrimps "substantially" in the next 5 years. Catch levels will be monitored and comparative studies will be undertaken to measure success (pers. comm. Conny Loonstra, 2011)
- Participants will have to use a specific sieving technique
- Identification of sensitive areas and implementation of closed areas

Please consult Recommendation 1.2 for more examples.

8.1.3 PRINCIPLE THREE RECOMMENDATIONS: MANAGEMENT

The current management system is mainly employed by the Eastern IFCA, who have a good reputation and have the capacity for research, monitoring, surveillance and the inclusion of members of the fishing community in the decision making process.

PRINCIPLE THREE:

“The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable. ”

“Intent:

The intent of this principle is to ensure that there is an institutional and operational framework for implementing Principles 1 and 2, appropriate to the size and scale of the fishery.

A. Management System Criteria:

The fishery shall not:

- 1. be conducted under a controversial unilateral exemption to an international agreement.*

The management system shall:

- 2. demonstrate clear long-term objectives consistent with MSC Principles and Criteria and contain a consultative process that is transparent and involves all interested and affected parties so as to consider all relevant information, including local knowledge. The impact of fishery management decisions on all those who depend on the fishery for their livelihoods, including, but not confined to subsistence, artisanal, and fishing-dependent communities shall be addressed as part of this process;*
- 3. be appropriate to the cultural context, scale and intensity of the fishery – reflecting specific objectives, incorporating operational criteria, containing procedures for implementation and a process for monitoring and evaluating performance and acting on findings;*
- 4. observe the legal and customary rights and long term interests of people dependent on fishing for food and livelihood, in a manner consistent with ecological sustainability;*
- 5. incorporates an appropriate mechanism for the resolution of disputes arising within the system*;*
- 6. provide economic and social incentives that contribute to sustainable fishing and shall not operate with subsidies that contribute to unsustainable fishing;*
- 7. act in a timely and adaptive fashion on the basis of the best available information using a precautionary approach particularly when dealing with scientific uncertainty;*
- 8. incorporate a research plan – appropriate to the scale and intensity of the fishery – that addresses the information needs of management and provides for the dissemination of research results to all interested parties in a timely fashion;*
- 9. require that assessments of the biological status of the resource and impacts of the fishery have been and are periodically conducted;*
- 10. specify measures and strategies that demonstrably control the degree of exploitation of the resource, including, but not limited to:*
 - a) setting catch levels that will maintain the target population and ecological community's high productivity relative to its potential productivity, and account for the non-target species (or size, age, sex) captured and landed in association with, or as a consequence of, fishing for target species;*
 - b) identifying appropriate fishing methods that minimise adverse impacts on habitat, especially in critical or sensitive zones such as spawning and nursery areas;*
 - c) providing for the recovery and rebuilding of depleted fish populations to specified levels within specified time frames;*
 - d) mechanisms in place to limit or close fisheries when designated catch limits are reached;*
 - e) establishing no-take zones where appropriate;*

11. contains appropriate procedures for effective compliance, monitoring, control, surveillance and enforcement which ensure that established limits to exploitation are not exceeded and specifies corrective actions to be taken in the event that they are.

**Outstanding disputes of substantial magnitude involving a significant number of interests will normally disqualify a fishery from certification.*

B. Operational Criteria

Fishing operation shall:

12. make use of fishing gear and practices designed to avoid the capture of non-target species (and non-target size, age, and/or sex of the target species); minimise mortality of this catch where it cannot be avoided, and reduce discards of what cannot be released alive;

13. implement appropriate fishing methods designed to minimise adverse impacts on habitat, especially in critical or sensitive zones such as spawning and nursery areas;

14. not use destructive fishing practices such as fishing with poisons or explosives;

15. minimise operational waste such as lost fishing gear, oil spills, on-board spoilage of catch, etc.;

16. be conducted in compliance with the fishery management system and all legal and administrative requirements; and

17. assist and co-operate with management authorities in the collection of catch, discard, and other information of importance to effective management of the resources and the fishery."

MSC Fishery Standard Principles and Criteria for Sustainable Fishing V1.1, 2010

Obstacle:

Although the MMO and Eastern and North Eastern IFCAs all have good management processes in place, they do not fully manage the brown shrimp fishery in a way that would be viewed as being implicit with MSC Principles and Criteria. In particular, despite there being some informal management measures in place, no formal objective management plan exists, which would be a requirement for MSC certification.

Recommendation 4: Management (Evaluation table PI 3.1.1 – 3.2.5)

There is a great need for the fishery to produce a robust management plan which is backed by scientific research and monitoring. Brown shrimp fisheries are generally in ecologically important nursery areas, using highly unselective gear (mesh sizes are amongst the smallest used (20 mm cod-end) in any fisheries). It is unlikely that under the new Common Fisheries Policy the current situation of no management will persist. Most of the fisheries occur within Special Areas of Conservation and internationally recognised nature areas such as the Wash. Even if scientific evidence is lacking or insufficient, the precautionary approach should be adopted and cooperation from the fishing industry is essential.

For the fishery to achieve MSC accreditation it is very likely that various management strategies and measures are implemented. Without such management in place the fishery is unlikely to fulfil the MSC Principles and Criteria. The management plans should be informed, transparent and inclusive. Appendix Table 3 outlines ideal MSC management criteria expectations. To give the fishery the best possible chance, management should consult PI indicators and fishery methodology whilst creating a management plan to deal with issues raised by Principles 1 and 2.

European brown shrimp fisheries already in the process of MSC assessment have invested time and money into extensive consultation with various advisory organisations to refine their management plans. These plans may provide useful guidance when developing UK plans and include the following:

By-catch

The Dutch and German management plan includes measures to reduce the by-catch volume of non-marketable, living organisms other than brown shrimp. The following measures are established:

- Use of a specific sieve
- Application of mesh restrictions
- Use of a sieve net to sort catch with a recognised 'sorting with the aim of returning by-catch to sea alive' method to maximise feasible extent
- Incentive prices for initiatives that lead to further by-catch reduction.

The ICES *Crangon* Working Group (2011) concluded that the proposed measures are not sufficient for the reduction of by-catch of juvenile flatfish species (especially plaice <10cm). Therefore, ICES recommend additional measures (technical or other) for this group of juvenile fish. The group do not explicitly advise which additional measure they recommend, however, various measures are discussed in the 2011 ICES *Crangon* Working Group Report (ICES, 2011b).

Habitat and Ecosystem

The Dutch and German management plans state *'when a participant would like to apply a new fishing technique that, according to the CVO, will lead to a greater degree of impact of habitat and ecosystem and/or to a higher by-catch level than existing techniques with a given number of fishing hours, he/she can only continue to participate in this management plan when the number of fishing hours is reduced to compensate for the impact on habitat, ecosystem and by-catch'*.

The ICES *Crangon* Working Group concluded new fishing techniques should be extensively studied to determine their effects on unwanted by-catch and the seabed habitat and ecosystem, and monitored once in place. If the effect turns out to be adverse, the technique should not be allowed according to the Working Group (ICES, 2011b).

Recommendation 4.1: Commitment to a management plan

Individuals participating in the German and Dutch North Sea brown shrimp fishery have signed an agreement and are required to be part of a recognised Producer's Organisation (PO) who are also signatories to this agreement. This ensures that rules set in the management plan will be adhered to. Processing plants in Kings Lynn are in a strong position to implement a similar system. These processing plants buy the vast majority of brown shrimp fished in the area of assessment, and can offer strong incentives to fishermen who want to participate. A consultative process between fishery and involved stakeholders should be set up to ensure all management implementations are best informed and effectively communicated.

Recommendation 4.2: Compliance with the management plan

It may be useful for management proposals to be verified by an inspector. Inspectors could produce reports to be sent to management. Violations could be penalised in accordance with a specific penalty regulation. Compliance could also be monitored using electronic equipment such as GPS receivers. Employing inspectors has proved very useful for the Dutch fisheries and so is highly recommended (pers. comm. Conny Loonstra, 2011).

Recommendation 4.3: Information management

Systems for accurate and systematic data recording are essential to the operation of a good management plan. For example, electronic log books and standardised data registration can enhance the responsiveness of the fishery to changes in stock levels or non-target catch.

8.1.4. SOURCES OF INFORMATION FOR BROWN SHRIMP

Source 1: ICES Crangon Working Group

The ICES *Crangon* Working Group is comprised of expert fisheries scientists and is an excellent resource for the brown shrimp fishery management team. It is therefore recommended that the fishery management consult previous ICES *Crangon* Working Group reports (available from www.ices.dk) and contact the Working Group members and work together to produce a robust harvest strategy based on the best available science. The harvest strategy should be in line with the expectations summarised in Appendix Tables 1, 2&3 to ensure the fishery has the best chance of obtaining MSC certification.

Source 2: Dutch and German shrimp fisheries currently preparing for full certification

It is well known that the North Sea brown shrimp fisheries are in the advanced stages of MSC certification (<http://www.msc.org/>). The Dutch and German fisheries have been advised by ICES for a number of years, and have developed a management plan (The Cooperative Fisheries Organisation (CVO), 2011) and a web forum (www.crangon.nl). Having undergone MSC pre-assessment in 2006, and now in the advanced stages of MSC certification, the North Sea brown shrimp fisheries provide a very important resource for the UK shrimp fishery. In particular, the UK fishery can use the outcome of the European assessment, both areas of success and failure, to inform the development of a management plan for sustainability. The UK East Coast Brown Shrimp Fishery is on a much smaller scale and the recent advancements in understanding of brown shrimp research by ICES, in collaboration with other well regarded institutions, should aid the UK assessment process. Contact details of programme leaders are given in Table 8.1.1.1.

Source 3: Pre-assessment research material

There is a wealth of material used in the pre-assessment which is likely to be useful in the development of a management plan and sustainable practices. These reports and other resources are cited in the relevant sections of the pre-assessment evaluation and referenced in full in the corresponding report bibliography. Doekson (2006) provides an extensive review of the European brown shrimp fisheries which may be especially useful for any desk-based studies that may need to be carried out as part of improving sustainability of the fishery.

8.2 GENERAL RECOMMENDATIONS FOR PINK SHRIMP (*PANDALUS MONTAGUI*)

The pink shrimp fishery, in its current mode of operation, is extremely unlikely to gain MSC certification. This is primarily because there is a real paucity of data on almost all aspects of the fishery that would need to be evaluated for sustainability.

Unfortunately, a risk-based framework assessment was beyond the scope of this pre-assessment. It may be possible to apply the risk-based framework approach to the pink shrimp fishery although it is likely to have some similar impacts associated with the brown shrimp fishery. The by-catch may be large due to relatively small mesh sizes, and possible effects on ecosystem and habitat structure and function may be deemed as 'risky'. In particular, the association of the fishery with *Sabellaria spinulosa* reef habitats, which are protected under the Habitats Directive, is very likely to be a barrier to certification. If research due to be carried out by Natural England establishes a significant impact of shrimp fishing on *S. spinulosa* reefs, it is likely the only course of action for the fishery would be to avoid significant designated *S. spinulosa* reef habitats. There are discussions currently taking place about voluntary closures to areas containing *S. spinulosa* reef prior to this information being reviewed although this would require appropriate monitoring of their success to comply with MSC guidelines. A system of data collection would be required to establish compliance with such measures.

There is no ICES Working Group, or any other advisory body of experts, for the pink shrimp and there are considerably less data on by-catch and population dynamics in the UK fishery. Unfortunately, with such a lack of data for this currently small fishery, it is difficult to give specific recommendations other than the need to collect data on the stock and investigate the effect of the fishery on non-target species populations and habitat structure. However, similar pink shrimp fisheries (*Pandalus* spp.) have gained MSC sustainable certification in the past and so, in time, it may be possible for the Wash pink shrimp fishery to gain sustainable status. There is more information available regarding *Pandalus borealis*, a deeper water shrimp species, which is likely to have similar life cycle traits and population dynamics. Research on this species may be helpful when arranging management plans for the *P. montagui* fishery (Simpson *et al.*, 1970).

Current plans to develop voluntary closed areas where core *S. spinulosa* reef is found (see brown shrimp Recommendation 1) would apply to both brown and pink shrimp fisheries. This action may support the attempt to certify both these fisheries.

It is recommended that, as a starting point, the UK fishery consults documents outlining other pink shrimp fishery management plans. These options could be discussed with the relevant experts to then put the necessary measures in place for the Wash fishery.

Similar certified shrimp fisheries are outlined below (information available from www.msc.org):

- The Canadian offshore Northern (*Pandalus borealis*) and striped (*Pandalus montagui*) shrimp fishery has recently become certified. This case study may provide invaluable information to the UK fishery
- The Canadian offshore and Gulf of St. Lawrence fisheries (*Pandalus borealis*)
- Oregon pink shrimp trawl fishery (*Pandalus jordani*)

Similar fisheries currently in the process of MSC assessment for certification (information available from www.msc.org):

- Germany North Sea brown shrimp and CVO Dutch North Sea brown shrimp fisheries (*Crangon crangon*)
- Scotian Shelf shrimp, West Greenland coldwater prawn, Fogo Island coldwater shrimp, Skagerrak, Kattegat and Norwegian deeps prawn (all *Pandalus borealis*)

8.2.2 SOURCES OF INFORMATION RELATING TO THE MSC CERTIFIED SHRIMP FISHERY IN CANADA

The Northern (*Pandalus borealis*) and 'striped (known as pink in the UK)' (*Pandalus montagui*) shrimp fishery in Canada recently gained MSC certification in June 2011 but this only became eligible as of 3rd August 2011. The fishery uses otter trawls of minimum mesh size 40 mm and an accompanying Nordmore separator grate to capture both shrimp species whilst reducing levels of by-catch (Department of Trade and Industry (DTI), 2011). Fishing primarily occurs between 200 and 500 m depth and the products are marketed primarily in Russia, Ukraine, China, Japan and Western Europe (Department of Trade and Industry (DTI), 2011). (Revill *et al.*, 2000)

Table 8.2.2.1. Websites where further information regarding the MSC certified shrimp fishery in Canada can be found.

Information	Date	Website Name	Website
Canadian shrimp fishery season, TACs and management measures	May 2007	Fisheries and Oceans Canada	http://www.dfo-mpo.gc.ca/decisions/fm-2007-gp/nshrimp-crevetten07-eng.htm
Article announcing the Canadian shrimp fishery was to go through a MSC assessment	June 2009	Fish Information & Services	http://www.sea-world.com/fis/techno/newtechno.asp?id=32892&ndb=1
Article announcing the Canadian shrimp fishery was to go through a MSC assessment	June 2009	World Fishing Today	http://www.worldfishingtoday.com/news/default.asp?nyld=3531
Scientific advisory report 2010/024: Assessment of Northern shrimp (<i>Pandalus borealis</i>) in SFA 0, 2, 3 and striped shrimp (<i>Pandalus montagui</i>) in SFA 2, 3 and 4 west of 63°W.	May 2010	Fisheries and Ocean Canada: Canadian Science Advisory Secretariat	http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2010/2010_024-eng.htm
Article announcing Ocean Choice International received MSC certification	May 2011	Fish Information & Services	http://fis.com/fis/techno/newtechno.asp?id=44003&l=e&ndb=1
Article announcing the Canadian shrimp fishery received MSC certification	June 2011	fishnewseu.com	http://fishnewseu.com/latest-news/world/6065-sustainability-certification-for-canadian-shrimp-fisheries.html
Article announcing the Canadian shrimp fishery received MSC certification	June 2011	World Fishing Today	http://worldfishingtoday.com/news/default.asp?nyld=7122
Article announcing the	June	Marine	http://www.msc.org/newsroom/news/canadian-offshore-shrimp-

Canadian shrimp fishery received MSC certification	2011	Stewardship Council	fishery-gains-msc-certificate
Marine Stewardship Council (MSC) information on the certified fishery:			
MSC Certified Canada Offshore Northern and Striped Shrimp Fishery Information	July 2011	Marine Stewardship Council (MSC)	http://www.msc.org/track-a-fishery/certified/north-west-atlantic/Canada-offshore-northern-and-striped-shrimp
MSC Certified Canada Offshore Northern and Striped Shrimp Fishery Unit of Certification	July 2011	Marine Stewardship Council (MSC)	http://www.msc.org/track-a-fishery/certified/north-west-atlantic/Canada-offshore-northern-and-striped-shrimp/unit-of-certification
MSC Certified Canada Offshore Northern and Striped Shrimp Fishery Contacts	July 2011	Marine Stewardship Council (MSC)	http://www.msc.org/track-a-fishery/certified/north-west-atlantic/Canada-offshore-northern-and-striped-shrimp/contacts
MSC Certified Canada Offshore Northern and Striped Shrimp Fishery Assessment Downloads (inc. full report)	July 2011	Marine Stewardship Council (MSC)	http://www.msc.org/track-a-fishery/certified/north-west-atlantic/Canada-offshore-northern-and-striped-shrimp/assessment-downloads

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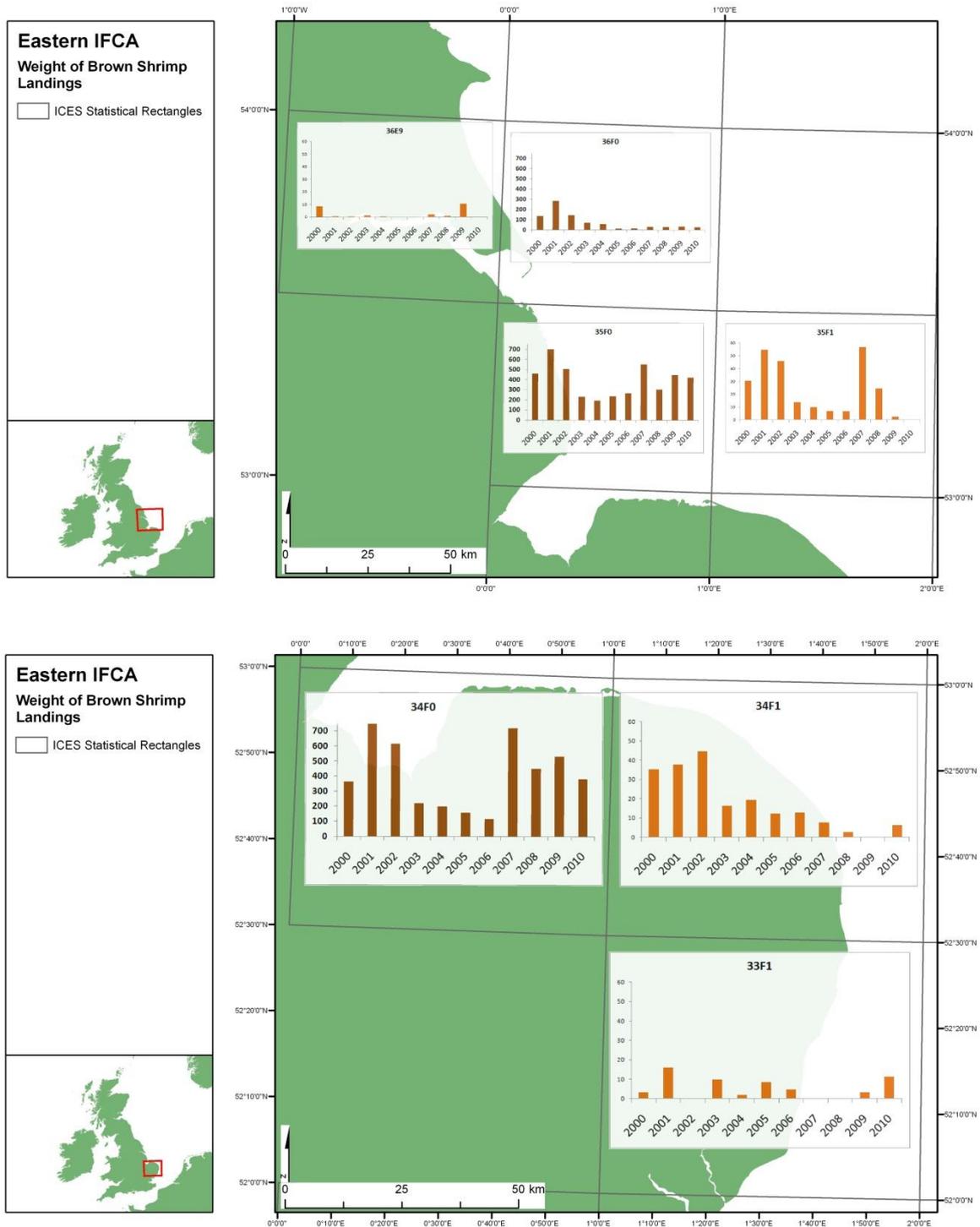
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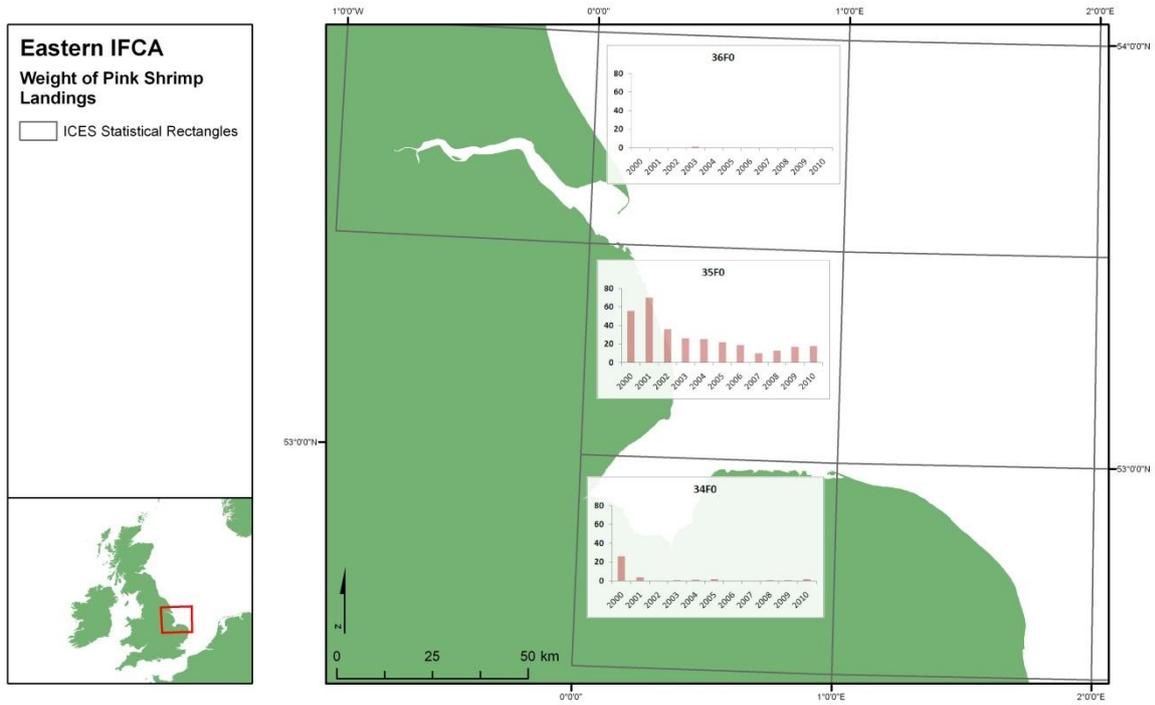
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10. APPENDIX



Appendix Figure 1 Landing weight (t) of brown shrimp (*Crangon* spp.) for 2000 – 2010 for each ICES statistical rectangle included in the MSC pre-assessment for the Wash region (top) and North Norfolk coast (bottom). Note: dark brown graphs use a larger scale to that of the light brown graphs.



Appendix Figure 2 Landing weight (t) of pink shrimp (*Pandalus montagui*) for 2000 – 2010 for each ICES statistical rectangle included in the MSC pre-assessment.

Appendix Table 1 A summary of MSC ideal expectations for a sustainable harvest strategy based on Fisheries Assessment Methodology and pre-assessment guidance material (available at www.msc.org).

P1. Shrimp Stock Considerations	
Adequate Assessment	There should be an adequate assessment of the stock status which takes into account the major features relevant to the ecology and biology of the brown shrimp (PI 1.2.4a) and estimates the stock in relation to reference points taking uncertainty into account (PI 1.2.4b & c). The assessment should ideally be shown to be tested and robust, with alternative approaches investigated (PI 1.2.4d).
Appropriate Reference Points	Reference points incorporated into the harvest strategy are appropriate for the stock and can be estimated (PI 1.1.2a) and the limit reference points set are above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of relevant precautionary issues (PI 1.1.2b). The target reference points should be consistent with Maximum Sustainable Yield or some measure or surrogate with similar intent/outcome and should take into account of the ecological role of the shrimp (PI 1.1.2c & d).
Responsive	The strategy should be responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points (PI 1.2.1a).
Evaluative	The performance of the harvest strategy should be fully evaluated, with evidence existing to show that it is achieving its objectives including being clearly able to maintain stocks at target levels (PI 1.2.1b).
Monitor	Monitoring should be in place that is expected to determine whether the harvest strategy is working (PI 1.2.1c).
Review	Ideally, the harvest strategy and stock assessment should be periodically reviewed internally and externally and improved as necessary (PI 1.2.1d; 1.2.4d). The ICES <i>Crangon</i> Working Group may be able to help with this.
Defined Rules and Tools	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached (P1.2.2a). The harvest control rules should take into account a wide range of uncertainties by being precautionary (P1.2.2b) and available evidence should show tools in use are effective in achieving exploitation levels in line with the harvest strategy (P1.2.2c).
Adequate Information	Information supporting the harvest strategy should be relevant and comprehensive e.g. stock structure, stock productivity, fleet composition, stock abundance, fishery removals and environmental information (PI 1.2.3a). Information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of the inherent uncertainties in the information (any data issues) and the robustness of assessment and management to this uncertainty, which help incorporate precaution to the strategy (PI 1.2.3b & c).

Appendix Table 2 A summary of MSC ideal expectations for a fishery to meet MSC Principle 2 based on Fisheries Assessment Methodology and pre-assessment guidance material (available at www.msc.org).

Environmental considerations	
Retained and by-catch species (commercial and non-commercial species)	
Species stock status	There should be a high degree of certainty that non-target species are within biologically based limits and fluctuating around their target reference points (PI 2.1.1a & b; PI 2.2.1a), and if main non-target species are outside the limits there should be a strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding (PI 2.1.1c; PI 2.2.1b). If the status is poorly known there should be measures or practices in place that are expected to result in the fishery not causing the non-target species to be outside biologically based limits or hindering recovery (PI 2.1.1d; PI 2.2.1c).
Management	There should be a strategy in place, if necessary, that is expected to maintain the main non-target species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding (PI 2.1.2 a; PI 2.2.2 a). Testing should support high confidence that the strategy will work, based on information directly about the fishery and/or species involved, and there is clear evidence that the strategy is being implemented successfully and achieving its overall objective (PI 2.1.2 b – d; PI 2.2.2 b - d).
Information and Monitoring	Accurate and verifiable qualitative information (abundance and biomass) is available on the catch of all non-target species and the consequences for the status of affected populations (PI 2.1.3a; PI 2.2.3a). Information is sufficient to quantitatively estimate outcome status with a high degree of certainty and support a strategy to manage non-target species with a high degree of certainty that it is successfully achieving its objective (PI 2.1.3b & c; PI 2.2.3b & c). Monitoring of non-target species should be conducted in sufficient detail to assess ongoing mortalities to all non-target species (PI 2.1.3.d; PI 2.2.3.d).
Endangered, Threatened and Protected Species	
National Requirements	There should be a high degree of certainty that the effects of the fishery are within limits of national and international requirements for the protection of ETP species (PI 2.3.1.a).
Effects of Fishery	There should be a high degree of confidence that there are no significant detrimental direct or indirect effects of the fishery on ETP species. (PI 2.3.1.b & c).
Management	There should be a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species (PI 2.3.2 a). The strategy should mainly be based on information directly about the fishery and species involved, and a quantitative analysis supports high confidence that the strategy will work (PI 2.3.2b). There should be clear evidence that the strategy is being implemented successfully and achieving objectives (PI 2.3.2b - d).
Information and monitoring	Sufficient information should be available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species (PI 2.3.3a). Accurate and verifiable information should be available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species (PI 2.3.3b). Information should be adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives (PI 2.3.3c).
Habitats	
Habitat status	There should be evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm (PI 2.4.1a).
Management	There should be a strategy in place for managing the impact of the fishery on habitat types (PI 2.4.2a). Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved (PI 2.4.2b). There should be evidence that the strategy is being implemented and achieving objectives successfully (PI 2.4.2c & d).
Information and monitoring	The distribution of habitat types should be known over their range, with particular attention to the occurrence of vulnerable habitat types (PI 2.4.3a). The physical impacts of the gear on the habitat types should be fully quantified (PI 2.4.3b). Changes in habitat distributions over time should be measured (PI 2.4.3c).
Ecosystem	
Ecosystem status	There should be evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm (PI 2.5.1a).
Ecosystem management	There should be a strategy, consisting of a plan (PI 2.5.2a), containing measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures should be in place. The plan and measures should be based on well-understood functional relationships between the fishery and the components and elements of the ecosystem. The strategy should provide for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm (PI 2.5.2b). The measures should be considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved (PI 2.5.2c) and there should be evidence that measures are being implemented successfully (PI 2.5.2d).

Information and Monitoring	There should be adequate information to broadly understand the key elements of the ecosystem (PI 2.5.3a). It should be possible to infer the main interactions between the fishery and these ecosystem elements, and these should be investigated in detail (PI 2.5.3b). The impacts of the fishery on Target, By-catch, Retained and ETP species and Habitats must be identified and the main functions of these Components in the ecosystem should be understood (PI 2.5.3c). There should be sufficient information available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred (PI 2.5.3d). There should be sufficient information to support the development of strategies to manage ecosystem impacts (PI 2.5.3e).
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Appendix Table 3 A summary of MSC ideal expectations for a fishery to meet MSC Principle 3 based on Fisheries Assessment Methodology and pre-assessment guidance material (available at www.msc.org).

P3. Management System	
Legal obligations	The management system should be generally consistent with local, national or international laws or standards that are aimed at achieving sustainable fisheries in accordance with MSC Principles 1 and 2 (PI 3.1.1a) .
Resolution of disputes and respect of rights	The management system should incorporate or be subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective (PI 3.1.1b) . The management system or fishery should act proactively to avoid legal disputes or rapidly implement binding judicial decisions arising from legal challenges (PI 3.1.1c) . The management system should have a mechanism to formally commit to the legal rights created explicitly or established by custom on people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2 (PI 3.1.1d) .
Monitoring	There should be sufficient information to support the development of strategies to manage ecosystem impacts (PI 3.1.1e) .
Defined consultation roles and responsibilities	Organisations and individuals involved in the management process should be identified. Functions, roles and responsibilities should be explicitly defined and well understood for all areas of responsibility and interaction (PI 3.1.2a) .
Consultation and participation	The management system should include consultation processes that regularly seek and accept relevant information, including local knowledge. The management system should demonstrate consideration of the information and explain how it is used or not used (PI 3.1.2b) . The consultation process should provide opportunity and encouragement for all interested and affected parties to be involved, and facilitate their effective engagement (PI 3.1.2c) .
Long term objectives	Clear measurable long and short term objectives should be in place which guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, and which are explicit within and required by management policy (PI 3.1.3a) . These should be demonstrably consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and be explicit within the fishery's management system (PI 3.2.1a) .
Incentives	The management system should provide for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly consider incentives in a regular review of management policy or procedures to ensure that they do not contribute to unsustainable fishing practices (PI 3.1.4a) .
Decision-making processes	There should be established decision-making processes that result in measures and strategies that achieve the fishery-specific objectives (PI 3.2.2a) . Decision-making processes should be precautionary (PI 3.2.2c) and respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions (PI 3.2.2b) . Any decisions should be formally reported to all interested stakeholders with descriptions of how the management system has responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity (PI 3.2.2d) .
Compliance and enforcement	A comprehensive monitoring, control and surveillance system should be implemented in the fishery under assessment and demonstrate a consistent ability to enforce relevant management measures, strategies and/or rules (PI 3.2.3a) . There should be sanctions to deal with non-compliance which are consistently applied and demonstrably provide effective deterrence (PI 3.2.3b) . There should be a high degree of confidence that fishers comply with the management system under assessment, including providing information of importance to the effective management of the fishery (PI 3.2.3c) and there should be no systematic non-compliance of the management system (PI 3.2.3d) .
Research plan	A comprehensive research plan should provide the management system with a coherent and strategic approach to research across the MSC principles, and reliable and timely information sufficient to achieve the objectives consistent with MSC Principles 1 and 2 (PI 3.2.4a) . The research plan and results should be disseminated to all interested parties in a timely fashion and be made widely and publicly available (PI 3.2.4b) .
Management performance evaluation	The fishery should have mechanisms in place to evaluate all parts of the management system (PI 3.2.5a) and should be subject to regular internal and external review (PI 3.2.5b) .



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