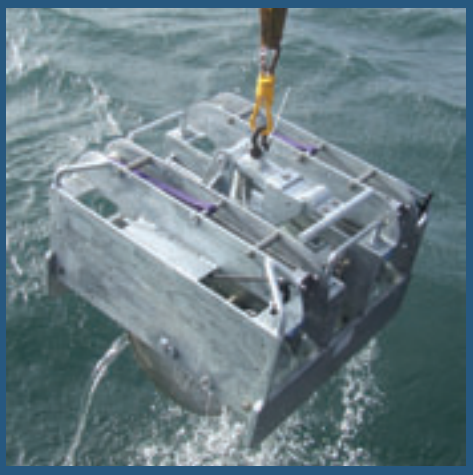
# Marine Aggregate Levy Sustainability Fund (MALSF)

## Achievements and Challenges for the Future



Marine
Aggregate Levy
Sustainability Fund
MALSF

March 2010

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# Achievements and Challenges for the Future - March 2010

# MARINE ALSF STEERING GROUP REPRESENTATION

## Organisations:

Department for Environment, Food & Rural Affairs (Defra)
British Marine Aggregate Producers Association (BMAPA)
Centre for Environment, Fisheries & Aquaculture Science (Cefas)
Communities & Local Government (CLG)
English Heritage (EH)
Joint Nature Conservation Committee (JNCC)
Marine & Fisheries Agency (MFA)
Natural England (NE)
The Crown Estate

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## Acknowledgements

This publication was produced in consultation with the Marine ALSF Steering Group. We are grateful to Project Leaders for their helpful provision of the illustrations used in this publication.

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# Foreword

"The extraction of sand and gravel from the marine environment makes a vital contribution to the UK's construction industry. But with pressures on our seas increasing, it is equally vital that this is done as sustainably as possible. The Marine ALSF is helping us all, whether in Government, the various regulators or industry, to ensure that we have the best available science to meet that twin challenge.

This short report provides a quick and accessible overview of the breadth and depth of the Marine ALSF programme and the many benefits it is bringing to the marine environment.

The particular strength of the Marine ALSF lies not just in the excellence of its science but also the commitment of its partners to commissioning, steering and making practical use of the research. We are immensely grateful to the members of the steering group, to Cefas for their effective management and to the many scientists and researchers who have done the hard work."

*Darius Campbell, Head of Marine Environment Resources, Strategy and Evidence, Defra*

*'The outputs from the Marine ALSF programme have helped to improve the way that the industry plans, assesses and manages its operations. There is no doubt that the investment in environmental knowledge and understanding will influence marine aggregate extraction activity and wider marine management over the next decade and beyond.'*
John Miller, BMAPA Chairman

*"The contribution made by Marine ALSF funding to our understanding of the marine historic environment is hard to overstate. In partnership with the aggregates industry, real progress has been made in developing techniques and approaches which will help manage and conserve our heritage and encourage sensitive aggregates extraction"*
Edward Impey, Director of Conservation and Protection, English Heritage

*"The science delivered by MALSF projects is of international renown and allows Natural England to have greater confidence assessing impacts on nature conservation features. This directly benefits the marine aggregate industry, and its regulation, along with other seabed user groups. Further, many products are aimed at educating the general public about our seas and coastline"*
James Marsden, Director of Marine, Natural England

*" The Crown Estate is pleased to support the Marine ALSF and recognises its valuable achievements to date. Our understanding of the marine environment and extraction impacts has developed significantly since the fund began, providing confidence for the industry and Regulators alike. It has promoted strong science and best practice since its inception to the benefit of all parties and continues to play an important role in management of the industry and resources along with mitigating impacts."*
The Crown Estate


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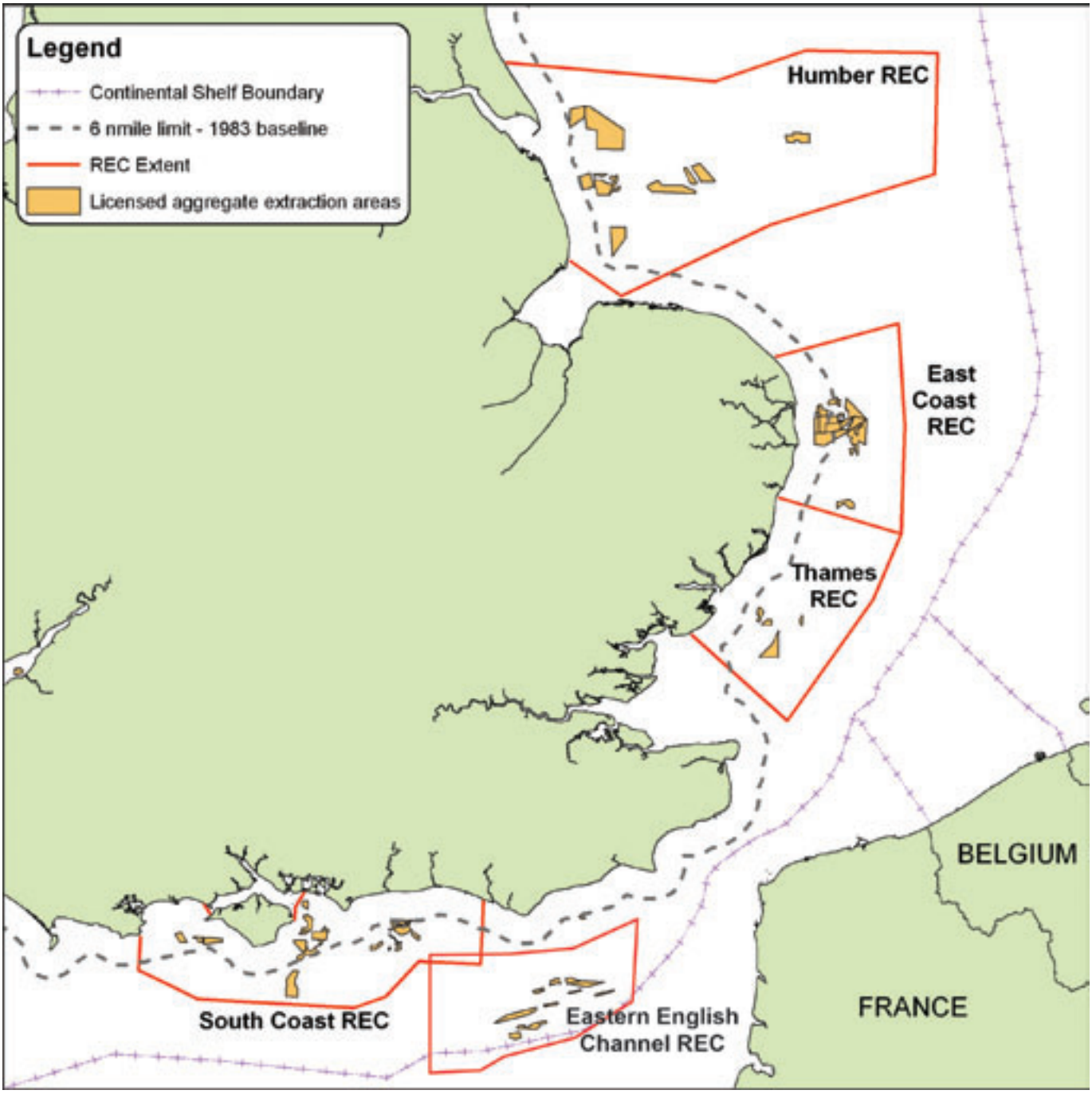
RI4

# Contents




Map of the coastline showing the location of principal aggregate licence areas off the South and East coasts of England. The boundaries of the Regional Environmental Characterisation (REC) survey areas are also shown. Courtesy of Cefas.

# 1. INTRODUCTION

**Marine aggregates play** an important part in the provision of high quality raw materials for both the UK construction industry and for coastal protection. Sand and gravel are generally taken from the seabed by trailer suction hopper dredgers that are capable of loading and transporting cargoes of up to 9,000 tonnes from offshore dredge sites to wharves located close to the point of end-use. The dredge areas are leased from The Crown Estate following an extensive Environmental Impact Assessment (EIA), the stakeholder consultation process and granting of permission by the MFA/MMO. This was formerly regulated through the Department of Communities & Local Government (CLG), before responsibility was transferred in June 2007 to the Marine & Fisheries Agency (MFA), an executive agency of Defra. Following the successful Royal Assent of the Marine and Coastal Access Act in November 2009, responsibility for regulating marine aggregate activities will transfer from MFA to the new Marine Management Organisation (MMO) in April 2010.

The areas of seabed that are under licence for aggregate extraction represent 0.15% of the UK continental shelf area, and the zones that are actively dredged at any one time represent only a small proportion of those areas licensed. Key statistics on the industry's performance during 2008 has recently been summarised in a report by The Crown Estate and the British Marine Aggregate Producers Association (2009)[1] as follows:-

- **A total of 21.24 million tonnes of sand and gravel were dredged from Crown Estate licences in England and Wales during 2008 (23.09 million tonnes in 2007)**
- **The total area of seabed licensed in 2008 decreased to 1,287km$^2$ (1,344km$^2$ in 2007)**
- **Extraction took place within 137.9km$^2$, representing only 10.8% of the licensed area (134.7km$^2$ - 10% of the licensed area in 2007)**
- **The area of seabed dredged for more than 1.25 hours per year (high intensity extraction) decreased to 9.28km$^2$ (10.16km$^2$ in 2007)**
- **90% of extraction from Crown Estate licences took place from an area of 48.22km$^2$ (49.95km$^2$ in 2007)**

Despite the small areas of seabed that are dredged for marine aggregates, it is recognised that aggregate extraction has potential environmental impacts. Our understanding of the nature and distribution of these resources, and the development of improved methods of minimising impacts from aggregate extraction has in the past been mainly supported through Research and Development funds from Defra. Such work has also been supported by the industry through the British Marine Aggregate Producers Association (BMAPA), by individual operating companies, by The Crown Estate and others.

In 2002 the UK Government introduced an additional source of funding which was derived through the imposition of a new Aggregates Levy on primary aggregate sales from both land-won and marine sources. The Levy was introduced as a means to better reflect the environmental costs of winning construction minerals, and to encourage the use of alternative secondary and recycled construction materials. To reduce the environmental consequences of winning primary construction aggregates, a proportion of the revenue raised by the new Levy has been allocated to a research fund, known as the Aggregate Levy Sustainability Fund (ALSF). Of the £20-30m per year released from the Treasury to Defra to support the ALSF in England, about 10% of the net amount has been allocated to projects relating to the marine environment. This is administered through the Marine Aggregate Levy Sustainability Fund (MALSF). The remaining 90% of the ALSF is allocated separately to support terrestrial-based projects.

[1] Marine Aggregate Extraction 2008. The Area Involved – 11th Annual Report. (2009) The Crown Estate & British Marine Aggregate Producers Association. 17pp ISBN: 978-1-906410-11-7

# 2. THE MARINE ALSF PROGRAMME (MALSF)

## 2.1. WHAT WAS THE MARINE ALSF SET UP TO DO?

**The Marine ALSF** programme was essentially set up to reduce the environmental impact of marine aggregate extraction, whilst recognising the important contribution that marine aggregates play in provision of raw materials that are required for the well-being of society. By 2007 a total of approximately £9m had been disbursed through the MALSF in two funding rounds (one of which had a 1-year extension in 2007) to support projects related to this goal .

Defra subsequently reviewed its strategy in 2007 to ensure that the Government was ready for the environmental challenges of the 21st Century. Whilst the new Defra strategic goals are not the same as those for the MALSF, many of the projects supported through the fund provide relevant information required to meet Defra policy objectives. Two high level goals were identified by Defra as essential in tackling the overall goal of living within our environmental means. These were:-

- 'Tackling the causes and consequences of climate change'
- 'Securing a healthy natural environment'

Activities within these strategic goals are aimed at promoting genuinely sustainable consumption and production patterns to help us live within our environmental means whilst boosting productivity and competitiveness.

In the third round of funding under the ALSF programme, the allocation of resources to the MALSF was increased to £13.5m for the financial years 2008-2010 to support work aimed at reducing the environmental footprint of marine extraction and to achieve Defra's vision for the marine environment through the goals outlined above. The work was also aimed at providing information to support Marine Spatial Planning objectives required under the Marine and Coastal Access Act which was at that time being brought before Parliament. *Details of the expenditure under Round 3 (2008-2011) are summarised in an Appendix (Section 6.3)*

Many of the studies currently funded through the MALSF programme are highly relevant to the first of the Defra high-level goals relating to our understanding of the nature and extent of the effects of climate change on our coastal environment. The majority of the work, however, falls into the second of the Defra high-level goals and is aimed at promoting environmentally friendly extraction in the marine environment in England.

These funds are allocated through two Delivery Partners to support the work in the marine environment. These are:-

- The Centre for Environment, Fisheries & Aquaculture Science (Cefas)
- English Heritage (EH)

*Details of the Delivery Partner priorities and contact details are summarised in an Appendix (Section 6.1)*

# 3. STRATEGIC AIMS

**Our understanding of** key issues related to the impacts of marine aggregate extraction on the marine environment has been summarised in a previous Report: 'Marine Aggregate Extraction: Helping to Determine Good Practice. Summary Report' (2007) copies of which are available on www.alsf-mepf.org.uk. Whilst the MALSF had by that time already made a significant contribution to achieving the broad objectives of the fund, it was recognised that there remained a range of areas where our knowledge and understanding needed to be refined or enhanced through further research. This was to ensure that policy, planning and management decisions made by regulators, advisors and industry were based on a clear understanding of the impacts of aggregate extraction on marine resources of conservation and economic significance.

The MALSF Steering Group therefore revised the strategic aims to ensure that the outputs of projects met the policy needs of Defra while at the same time maximising the value for money of the fund. These were:-

1. To develop and use **seabed mapping** techniques to improve the evidence base of the nature, distribution and sensitivity of marine environmental and archaeological resources relevant to marine aggregate activities
2. To increase understanding of the **effects of aggregate extraction** activities, including noise, **and their significance**
3. To develop **monitoring, mitigation and management** techniques where applicable, underpinned by scientific research
4. To research and understand **socio-economic issues** associated with aggregate extraction activities
5. To promote **co-ordination** and establishment of sustainable archives for the **dissemination** of research related to these aims to a wide range of stakeholders

**The object of** this short review is to provide an overview of the extent to which these goals have been met in the period 2007-2010, and to identify areas of uncertainty where further research funding is likely to be needed.

We recognise that the MALSF is responsible for the allocation of significant sums of public money and the Steering Group is mindful of the need to obtain value for money in commissioning work related to the objectives of the MALSF – not only in terms of the direct cost of projects commissioned, but also the potential for projects to deliver added-value benefits to wider marine management objectives. With that in mind, we have indicated the wider value that has been achieved through each of the priority themes and have indicated our State of Knowledge before inception of the MALSF in 2002 and on completion of the current Round 3 in March 2011. (See also Appendix, Section 6.2)

# 4. HAVE WE ACHIEVED OUR NEW STRATEGIC AIMS?

**To a large** extent the MALSF has achieved many of its initial strategic aims, although much additional work needs to be done to enhance our understanding of the wider implications of marine aggregate extraction on the environment. A review of the progress towards achievement of the five strategic aims of the MALSF can essentially be summarised as follows:-

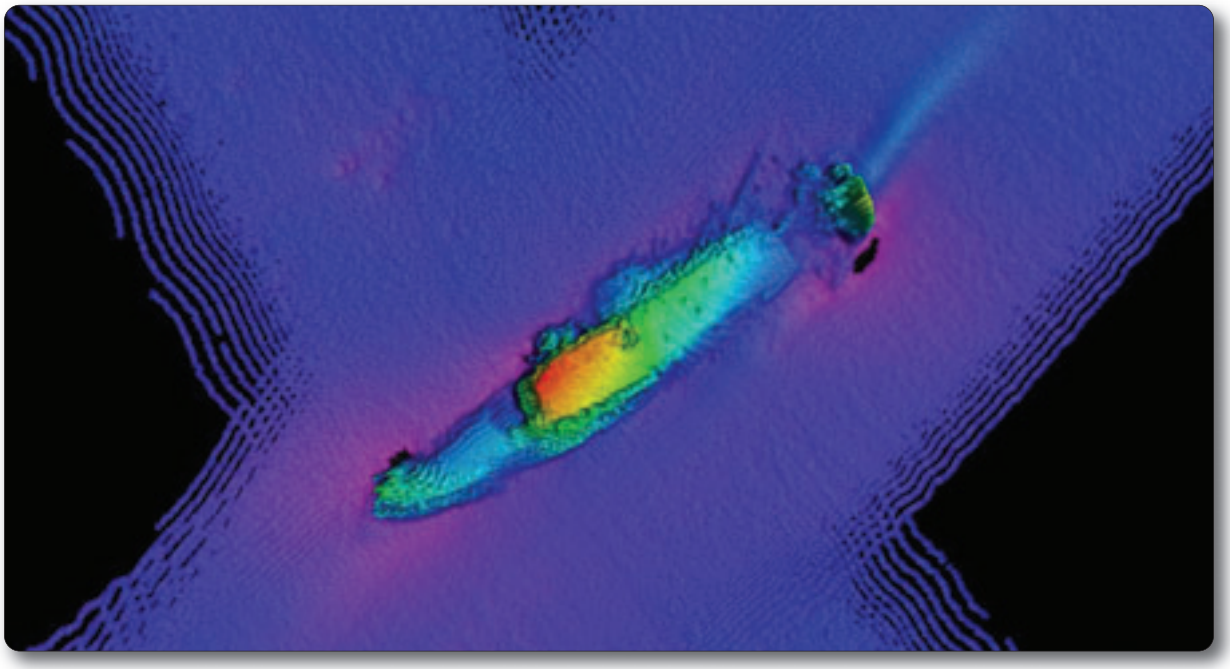
## 4.1. THE DEVELOPMENT & USE OF SEABED MAPPING TECHNIQUES

### 4.1.1. Overview of Progress

**A total of** 31,560km$^2$ of seabed has now been surveyed and mapped in a series of six major Regional Environmental Characterisation (REC) surveys commissioned by the MALSF. They have been carried out to define the regional environmental seabed resources surrounding aggregate extraction sites in English coastal waters. These REC surveys include detailed studies of the seabed geology, archaeology, historical assets, biotopes and species of conservation significance. They have now been completed for the Outer Bristol Channel (2,400km$^2$), the South Coast of England (5,670km$^2$), the Eastern English Channel (5,090km$^2$), the Outer Thames Estuary (3,800km$^2$), the coast of East Anglia (3,600km$^2$) and the Outer Humber (11,000km$^2$).

All of the data are geo-referenced and stored in a Geographical Information System (GIS) secure data depository supported by the MALSF and accessible for use free of charge by third parties (www.marinealsf.org.uk). The world class survey data help to address two of Defra's key strategic objectives:-

- **They provide essential 'baseline' data against which the effects of climate change on seabed communities can be assessed**
- **They provide important background data required to sustain a healthy marine environment**

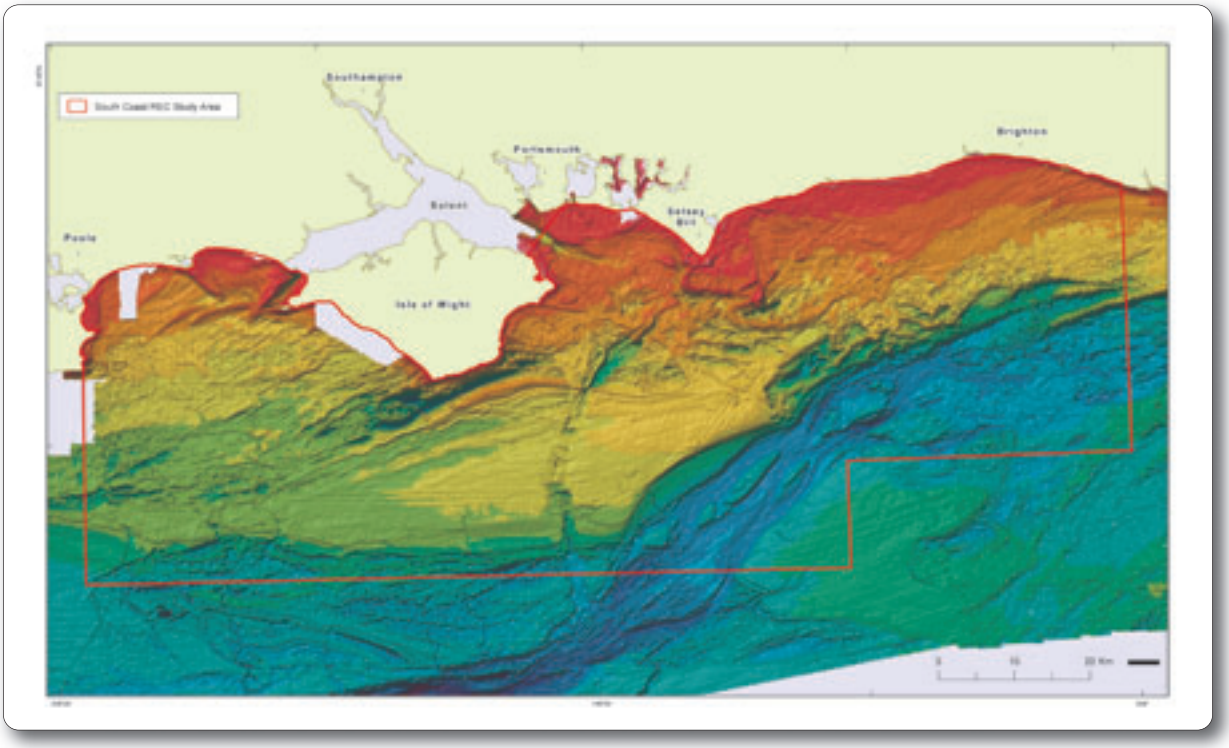


*(Figure 1)*

## 4.1.2. State of Knowledge

**The REC surveys** have significantly enhanced our understanding of seabed resources and are central to Marine Spatial Planning objectives.

| Before MALSF | | After Round 3 |
|---|---|---|
| | Seabed that has been surveyed in REC areas | GOOD |
| | Areas that have not been surveyed | BASIC |
| | Change to the environment over time * | BASIC |
| | Effects of climate change * | BASIC |
| | Significance of North Sea Palaeo-geography | INTERMEDIATE |
| | Significance of other submerged landscapes | INTERMEDIATE |
| | Distribution of habitats of conservation significance | INTERMEDIATE |
| | * Important baseline information to assess this has now been achieved | |




*(Figure 2)*

## 4.1.3. How Much Additional Information Do We Need?

**The Regional Environmental** Characterisation (REC) surveys have been principally aimed at providing information on the nature and distribution of seabed resources over relatively wide areas where aggregate extraction occurs or might be expected to occur in the future. This is essential for Marine Spatial Planning purposes and it allows any potential impacts of marine aggregate extraction to be placed into 'context' in relation to the distribution of environmental resources of conservation and economic significance and sensitivity in the surrounding region. Furthermore, this enhanced level of regional understanding directly helps to support a more integrated ecosystem approach to marine planning, management and protection.

To a large extent these studies will have been completed by the end of the current Round 3 of the ALSF in March 2011. They are both time-consuming and costly. Nevertheless the results of this work have such wide and important implications for supporting the development of marine policy and the subsequent delivery of marine planning and management that it is worthwhile considering the potential end-use of this work, and whether further surveys should be implemented in the future.

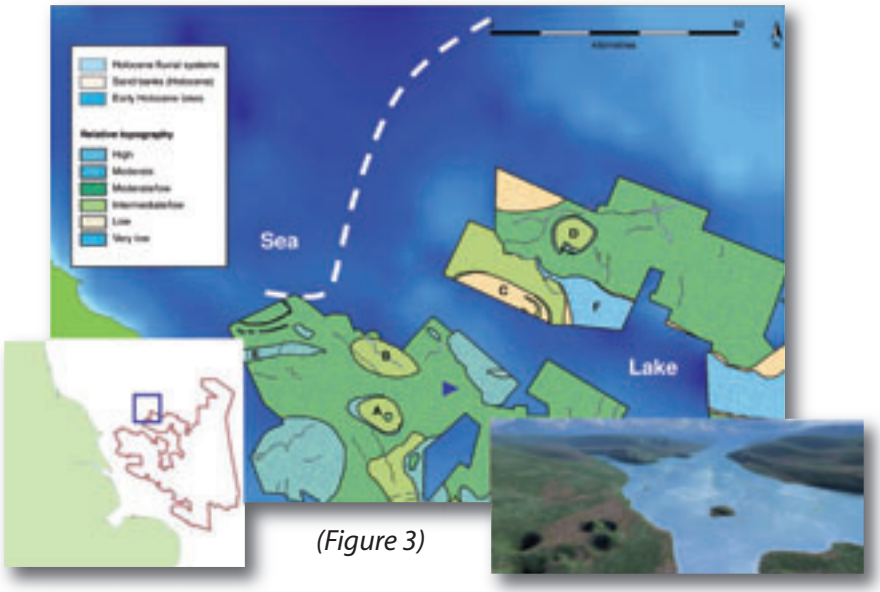
- **The studies provide key information in support of our understanding of the Health of Our Seas for those areas where sand and gravel deposits occur. This covers significant areas of the seabed in the southern North Sea, the Eastern English Channel and Outer Bristol Channel. No comparable information exists for other areas of seabed where there is limited use of the seabed for aggregate extraction, such as in the Bristol Channel and the Irish Sea. Should the remit of the MALSF be extended to include provision of comparable data for areas that are perhaps less relevant to aggregate extraction but which are still needed to support wider Defra policy objectives?**
- **The data that have been acquired for the REC areas so far is of the highest quality and will provide a unique data resource against which the effects of climate change on biological communities on the seabed can be assessed. Such communities have been subject to major changes in the Southern North Sea in recent years. The reasons for this are unknown, and it is uncertain whether changes in sea temperature associated with other factors such as alteration in the penetration of the Gulf Stream into the North Sea could account for significant alterations in biological community composition on the seabed around our coasts. Such communities play a dominant part in fuelling the ecosystem at higher trophic levels leading to fish. A very strong case could be made to repeat some of the REC surveys in a simplified form to track the change in marine community composition over time.**
- **Because of the time, effort and cost of undertaking marine mapping, the data coverage across the REC regions are deliberately broad scale – with corridors of high resolution data used to characterise large areas of seabed. In some locations, there is a case for improving and enhancing the resolution of marine mapping data coverage across the REC regions – particularly where environmental resources of particular interest, significance or sensitivity have been identified.**
- **The work on North Sea Palaeo-landscapes, and within the Outer Thames, East Channel and South Coast REC areas have underlined the significance of submerged landscapes around our coasts. The work on the North Sea submerged Mesolithic landscape – now known as 'Doggerland' – is of international importance. It is likely that significant funding should be made available to support and enhance studies of this type elsewhere around our coastline.**

## 4.1.4. Wider Benefits from Project Outputs

**While the outputs** from the MALSF programme have had a direct impact on the way that marine aggregate activities are planned, assessed and managed, the nature of the project outputs are such that they have the potential to offer significant added value to wider marine planning and management objectives.

The work that has been carried out to date provides essential information for the sustainable management of seabed resources and activities around our coasts, which in turn will help secure a healthy marine environment for the future. No other source of applied funding has been available to support scientific work that focuses on this issue. The MALSF has made a significant contribution to the data required for the identification and designation of areas of national and international nature conservation significance. The data resulting from the REC surveys has also provided detailed baseline information against which the effects of climate change on seabed communities could be assessed in the future. It is also of considerable value for other marine sectors including oil/gas pipeline, cables and offshore renewables.

The REC surveys, and other work funded through the MALSF has revolutionised our understanding of the Palaeo-geography of the seabed, and its significance for early man. The identification of the submerged landscape in the North Sea, now known as 'Doggerland' marks a significant academic achievement that underlines the international contribution that UK marine scientists are able to make when provided with focussed research objectives that are backed by significant funding.

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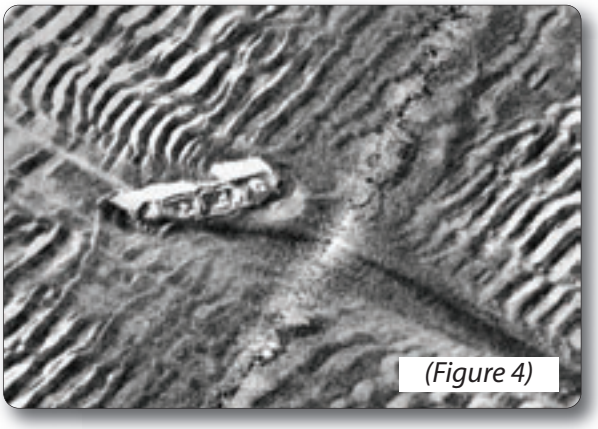
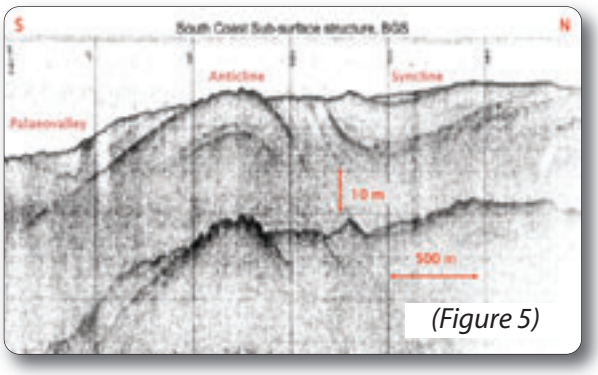


*(Figure 4)*




*(Figure 5)*

## 4.2. THE EFFECTS OF AGGREGATE EXTRACTION & THEIR SIGNIFICANCE

### 4.2.1. Overview of Progress

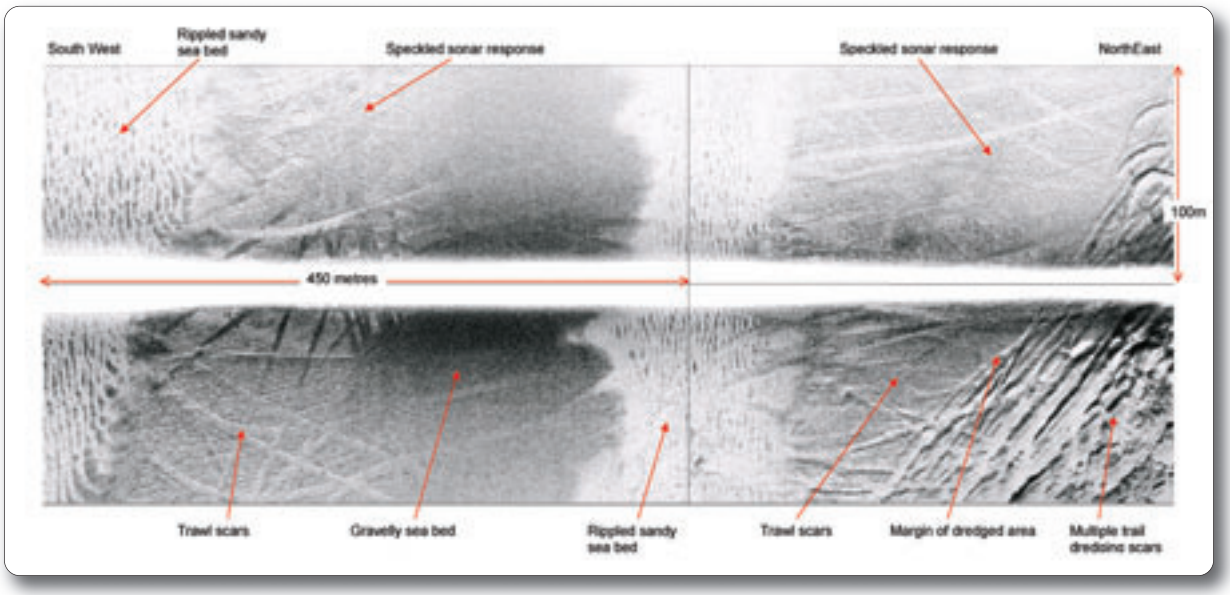
**The MALSF has** commissioned a series of projects that has significantly enhanced our understanding of the beneficial and negative impacts of aggregate extraction on resources of conservation significance both within, and outside the boundaries of dredge sites. Work on methods to improve the detection, reporting and conservation of resources of historic and archaeological significance has also been completed.

Work has also been commissioned to improve our understanding of the wider implications of marine aggregate extraction in the marine environment, and to put these into perspective within the context of other anthropogenic pressures such as trawling. A literature review of the potential impacts of noise arising from marine aggregate extraction operations has been completed, and a major study to measure the noise generated by different extraction methods in a range of marine deposit types has been commissioned to provide key source term data.

Studies have also been carried out to assess the role that seabed communities close to dredge sites may have in supporting food prey species for fish and to assess the possible impacts of aggregate extraction on the marine food web. Other studies include work on regional sediment mobility and the significance of seabed scouring on assets of archaeological significance.

These studies have been rapidly taken up by the Regulators and their Statutory Advisors, and assist in the design of appropriate mitigation and monitoring programmes for marine aggregate extraction aimed at ensuring the sustainable use of the seabed.

Recognising the importance of managing pressures at an ecosystem scale, several projects are currently underway to determine more precisely the significance of both site specific and cumulative impacts arising from marine aggregate extraction at a regional scale.




*(Figure 6)*

## 4.2.2. State of Knowledge

**Knowledge was generally** poor before the MALSF but is now sufficiently robust to ensure sustainable management and protection of seabed resources in the vicinity of marine extraction sites.

| Before MALSF | | After Round 3 |
|---|---|---|
| | Impacts within the dredge zones | GOOD |
| | Impacts outside the boundaries of the dredge site | INTERMEDIATE |
| | Susceptibility of marine life to noise | INTERMEDIATE |
| | Impacts on ecosystem function | BASIC |
| | Cumulative impact from multiple licence areas | INTERMEDIATE |

## 4.2.3. How Much Additional Information Do We Need?

**Whilst we do** have a good understanding of the immediate impacts of aggregate extraction on seabed resources, the potential impacts, both positive and negative, outside the boundaries of the dredge site remains less well understood. This is particularly true for living resources because many other factors unrelated to aggregate extraction play a part in changes in biological community structure. Research effort has considered some of the indirect impacts of marine aggregate operations, resulting from the settlement and subsequent distribution of sediments released by dredge plumes. However, to date these have been largely isolated, site specific studies.

We envisage a continuing need for work to more finely resolve the cumulative effects of multiple licence areas on wider aspects of ecosystem function, including a greater emphasis on potential effects on species and communities of conservation and economic significance at a regional scale. We also see a need for further integrated studies on the food web structure of marine communities near to dredge sites, and impacts that extraction might have on them.

*(Figure 7)*

## 4.2.4. Wider Benefits from Project Outputs

**The work that** has been completed under the MALSF has established with some confidence both the 'footprint' of impact and the likely nature and rate of recovery processes in different seabed types. This work has been taken up quickly by the Regulators and their Statutory Advisors and has assisted in the sustainable management of marine aggregate resources around our coasts. The work has assisted in:-

- Design of appropriate surveys to inform applications for new licences
- Design of appropriate monitoring activities for losses from dredgers
- Design of appropriate monitoring of seabed assets
- Identification of appropriate mitigation to protect archaeological and historic assets
- Identification of appropriate extraction methods to reduce impacts on biological communities

While such outputs are directly relevant to marine aggregate operations, the best practice principles and methodologies which have been established may be directly applied to the management of other pressures and activities taking place in the marine environment. In this respect, the MALSF programme is acting as a pathfinder for new and improved means to mitigate, manage and monitor marine anthropogenic pressures.

Further work will be required to assist our understanding of the potential cumulative effects of multiple licence areas on wider ecosystem function and on the security of the marine food web. Our understanding of the potential effects of dredging noise on living resources is also poorly understood at present and needs to be incorporated into the monitoring and management of marine aggregate extraction if found to be significant.

*(Figure 8)*

## 4.3. MONITORING, MITIGATION & MANAGEMENT

### 4.3.1. Overview of Progress

**Significant support** has been given under Round 3 of the MALSF to projects that are aimed at development of improved monitoring, mitigation and management of the marine aggregate industry. Projects that have been completed, or are underway, include:-

- Development of new grab sampling and video recording equipment for analysis of seabed resources
- Automated sampling equipment for measuring sediment losses from operating dredgers
- An update of the 'Guidelines for the Conduct of Benthic Studies at Marine Aggregate Sites' (2010). This will result in a key management document that incorporates Best Practice Guidelines into work related not only to the aggregates industry but also to environmental impacts studies for other infrastructure and development projects.
- A protocol for the reporting of archaeological and historic material to assist in the conservation of artefacts ranging from Palaeolithic and Mesolithic man and their associated fauna through to material from aircraft lost in World War II
- An analysis of the extent to which 'seeding' of the seabed can encourage recovery of seabed communities after cessation of extraction
- A review of the current Best Industry Practices used for marine aggregate extraction worldwide
- An assessment of how changes in hull design and operating methods may assist in reducing the carbon footprint of extraction vessels operating at sea

*(Figure 9)*

*(Figure 10)*

*(Figure 11)*

## 4.3.2. State of knowledge

**Knowledge gained from** MALSF projects has been successfully incorporated into sustainable management of aggregate extraction and has contributed to a better understanding of how the environmental impact of the dredger fleet can be reduced.

| Before MALSF | | After Round 3 |
|---|---|---|
| | Appropriate Methodology for monitoring | GOOD |
| | Additional factors that may require monitoring | INTERMEDIATE |
| | Appropriateness of seabed restoration | INTERMEDIATE |
| | Design and operational improvements to dredger fleet | INTERMEDIATE |

## 4.3.3. How Much Additional Information Do We Need?

**It is probably** fair to say that we have sufficient information on the immediate effects of aggregate extraction to be able to define the principal monitoring requirements that should be included into licence conditions. The nature and distribution of the sediment plumes associated with extraction are well-established, as are the immediate impacts of extraction on the seabed fauna. Again, experimental work on the nature of the scouring and deposition processes near wreck sites has allowed the establishment of more appropriate exclusion zones to better protect historic assets.

However, environment impact assessments now require consideration of wider secondary impacts such as noise, disturbance and displacement of mobile species such as fish, marine mammals and seabirds. Monitoring and mitigation strategies to assess these diffuse impacts are currently in their infancy.

The traditional monitoring requirements that are now included in most extraction permissions reflect our confidence in those sources of impact that have been identified and quantified. There are, however, new pressures emerging which need to be considered. We still have very little reliable information on what the frequency and magnitude of noise associated with aggregate extraction is under natural conditions and the extent to which this might have a potential impact on marine resources.

There is also uncertainty about whether certain mitigation options or approaches are appropriate or cost-effective, and how these compare with natural regenerative processes that take place over time. Improved management and mitigation of the impacts of aggregate extraction is likely to be an important component of future work related to marine aggregate extraction. We see a need for further work on cost-effective approaches to reduce the 'footprint' of aggregate extraction on the marine environment.

## 4.3.4. Wider Benefits of Project Outputs

**Projects commissioned by** the MALSF have been increasingly focussed on how knowledge gained from work commissioned by the fund can be used to secure a sustainable approach to marine aggregate extraction. The development of new seabed sampling grabs and imagery systems has enhanced our ability to interpret the data obtained by standard oceanographic remote-sensing methods such as side scan sonar. This has allowed real progress to be made in our understanding of the distribution of marine biotopes in English coastal waters. Such developments in technique have underpinned the broad scale Regional Environmental Characterisation (REC) surveys that have contributed key information for the Marine Spatial Planning required to maintain the health of our seas and to manage the wide range of activities and associated pressures that occur.

Technical developments made by projects funded through the MALSF have also played an important part in the development of new 'Guidelines for the Conduct of Benthic Studies at Marine Aggregate Sites' (2010) in the marine environment. These guidelines are of fundamental importance in providing agreed standard data acquisition, interpretation and data storage for a wide range of stakeholders. The use of such guidelines underpins environmental impact surveys and monitoring not only by the aggregate industry but also for other infrastructure projects including ports, offshore wind farms and the petrochemical industry. They therefore assist in safeguarding the marine environment as well as providing an essential database for assessing possible future impacts of climate change on seabed communities off our coastline.

Recent projects commissioned by the MALSF have focussed on whether there are cost-effective options for improvement of the environmental performance of dredgers, either through changes in design or through changes in operating procedures. This is not yet completed, but represents a further way in which the fund should be able to support the reduction of the environmental 'footprint' of marine aggregate activities and enhance the sustainability of essential marine aggregate supplies.

*(Figure 12 on opposite page 13)*

*(Figure 13)*

## 4.4. SOCIO-ECONOMIC ISSUES

### 4.4.1. Overview of Progress

**The need for** a comprehensive socio-economic assessment of the effects of marine aggregate supply has been recognised for some years to assist robust, evidence-based decision making to inform both wider policy decisions and site-specific cases. Policy recommendations have generally been limited by a lack of sufficient information to make valid comparisons between land-won and marine aggregate supplies on a national scale. Some progress has been made in making such assessments on a regional scale, and in placing a 'value' on biological resources so that these can be incorporated into an estimate of the value of goods and services provided by the marine environment at aggregate dredge sites.

Although this approach allows some assessment of 'value' of living and historic resources on the seabed, it is still not possible at this stage to make any assessment of the relative effects of aggregate extraction compared with other activities of man in the marine environment. There also continue to be challenges in making valid comparisons between marine and land based aggregate supply options.

Further site-specific assessment of the socio-economic implications of aggregate extraction in a sea area subject to multi-use of the seabed is in progress. This may assist the Regulators by providing an improved approach to assessment of socio-economic factors in the Environmental Impact Assessment (EIA) process.

*(Figure 14)*

## 4.4.2. State of Knowledge

**Prior to the MALSF** there was virtually no information on this subject. Work supported through the fund has established potential methods for assessment of socio-economic impacts of marine aggregate extraction. However, more site-specific studies need to be carried out.

| Before MALSF | | After Round 3 |
|---|---|---|
|  | Implications of land versus marine aggregate supply | INTERMEDIATE  |
|  | Economic cost to ecosystem goods & services | INTERMEDIATE  |
|  | Methodology for socio-economic assessment | INTERMEDIATE  |
|  | Availability of data to support socio-economic assessment | BASIC  |

## 4.4.3. How Much Additional Information Do We Need?

**Assessment of potential** socio-economic impacts of aggregate extraction is severely limited by the lack of quantifiable data for the marine environment and the activities that occur there. One approach will be the application of the concept of 'Ecosystem Goods & Services' to specific sites where marine aggregate extraction occurs along with other legitimate uses of the seabed.

We await the outcome of a recently commissioned case study using this approach to see whether the methodology can be developed. Socio-economic issues are generally highly site specific. We therefore envisage a need for further case studies to develop this important component of the Environmental Impact Assessment (EIA) process.

## 4.4.4. Wider Benefits of Project Outputs

**Much of the** earlier work commissioned by the MALSF was necessarily focussed on understanding the nature and distribution of seabed resources and their susceptibility to disturbance by marine aggregate extraction. At the same time the Steering Group recognised that there were wider potential impacts on other legitimate uses of the seabed and on the benefits that marine resources, including sands and gravels, have for society as a whole.

The work that has been commissioned is of importance in developing a methodology to assist Planning Authorities where a choice may need to be made between land-won and marine aggregate resources that are needed to supply the sand and gravel required to meet society's needs. This work needs to be refined and tested using the 'case study' approach that has just been initiated.

The approaches that have been emerging from MALSF projects also have considerable wider value in helping to develop robust, science-led methodologies to support sustainable decision making. Such tools will be required to help support the delivery of wider marine policy, planning and management objectives.

## 4.5. CO-ORDINATION & DISSEMINATION

### 4.5.1. Overview of Progress

**An important component** of the marine fund's policy has been to support secure archives for the data that have been acquired from the marine surveys carried out under the MALSF. This is required both to disseminate the results of work commissioned by the MALSF, and to secure the maximum legacy potential for this unique and extensive data set by providing an archive to allow access by third parties in the future.

Dissemination of the work carried out by the MALSF has been achieved through an annual Work in Progress Conference and MALSF Science Review as well as individually by the project teams. The significant number of peer-reviewed publications in the international literature resulting from work supported through the MALSF reflects the strong science-base related to aggregate research that UK marine scientists have developed in recent years. The MALSF Work in Progress Conferences form an important forum for co-ordination and interaction between participants in the MALSF programme, as well as an opportunity to review projects and identify areas where further research is needed.

The **M.Sc bursary scheme** has been aimed at introducing suitably qualified young scientists to the research work carried out by the MALSF. It has supported up to seven young scientists per year since 2007, and has developed important interactions between participants in MALSF projects and Universities that offer M.Sc courses in Applied Marine Science. This programme has been a considerable success, and has allowed the students and universities to better understand the environmental work that is carried out through the MALSF, while at the same time building new capacity and capability in UK marine science.

There has also been a significant investment in improving public awareness of the diversity of marine life on the seabed surrounding our coasts, the importance of science in supporting sustainable development in the marine environment, and the steps that are being taken to sustain the biodiversity of communities in sands and gravels. Public awareness of the activities of the MALSF remains patchy, and continuing investment is needed to inform the


*(Figure 15)*

*(Figure 16)*

public of the progress that has been made in safeguarding environmental assets in the vicinity of aggregate licence areas.

Projects have been aimed at the public through museum displays at the National Marine Aquarium at Plymouth, displays at the National Museum Wales, Museum of Barnstaple and North Devon, Kew Bridge Steam Museum and Kettering Museum, as well as projects aimed at young school children and adults. The MALSF is also commissioning a major series of dissemination projects aimed at informing the public of the results of the Regional Environmental Characterisation (REC) surveys that have recently been completed.

Outputs from MALSF dissemination and outreach projects such as 'Derek the Dredger', 'Explore the Sea Floor' and 'Mineral Wealth - Seabed Health' provide resources beyond the life of the projects themselves. They demonstrate the demand and need for such products that use innovative methods of disseminating complex scientific research to all.

The issue of public awareness of the level of understanding that we now have on both the marine resources of sands and gravels, and the impacts of aggregate extraction is an important one which warrants further support in the future.

The wider use and uptake of MALSF research outputs – both by stakeholders involved in marine aggregate management and those involved in wider marine policy, planning, management and development needs to be developed further. The first stage in achieving this is developing the mechanisms to allow project outputs and data to be stored and easily accessed. The second stage is increasing the awareness of the work that has been completed, and the potential that this offers in supporting the management of wider marine activities.

The results of the Round 3 programme will be presented in a final technical conference and Science Review planned for February 2011.

## 4.5.2. State of Progress

**Dissemination of MALSF** work has been successfully achieved through a variety of mechanisms.

| Before MALSF | | After Round 3 |
|---|---|---|
| | Provision of a secure data archive | GOOD |
| | Provision of geo-referenced meta data archive | GOOD |
| | Co-ordination between project scientists | GOOD |
| | Dissemination at schools & colleges | GOOD |
| | Legacy publications | INTERMEDIATE |
| | Wider awareness of MALSF activities | INTERMEDIATE |
| | Wider awareness of relevance to aggregate dredging | INTERMEDIATE |

## 4.5.3. How Much Additional Information Do We Need?

**One of the** difficulties faced in promoting wider awareness of issues related to marine aggregate extraction, and the contribution that the MALSF has made to the regulation of the industry and protection of marine resources is that there is a wide spectrum of stakeholders, each of which requires very different products or information.

We see a continuing need for awareness and dissemination projects aimed at the general public as well as targeted audiences in schools, colleges and elsewhere. The M.Sc bursary scheme has been a huge success in introducing young scientists to the work of the MALSF, and we envisage a continuing need for disbursement through this scheme.

We also see a need to make the wider marine community (policy makers, regulators, advisors, developers, consultants) aware of the wide range of work that has been completed by the MALSF programme, and the potential value that this may offer in supporting their interests.

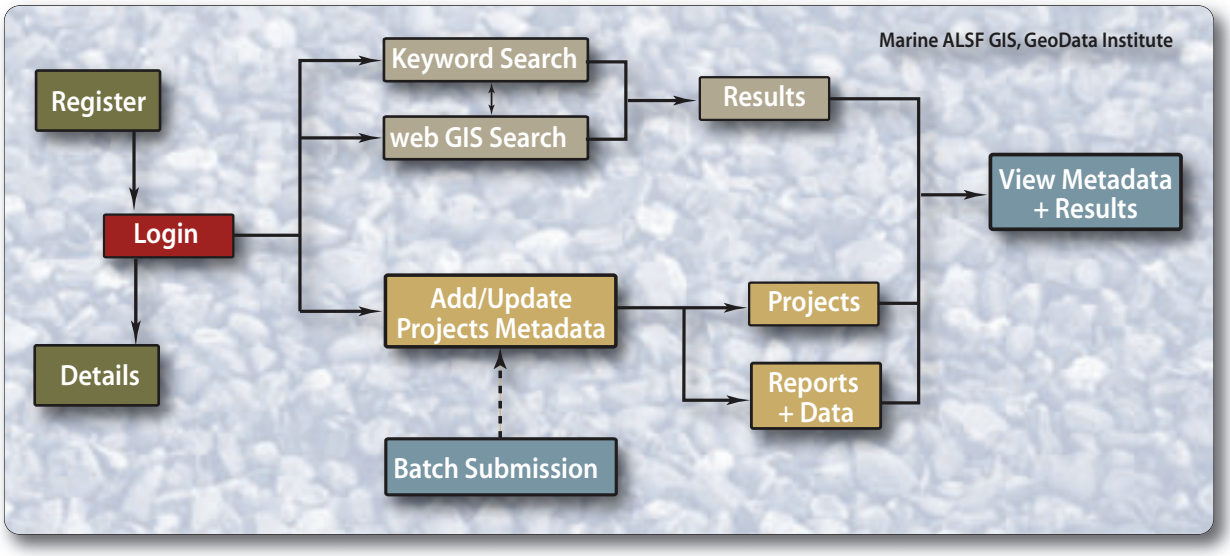
A key resource is the data archiving and secure storage of data from MALSF programmes both now and in the future. We envisage a need for continuing support for secure storage of meta-data and original data from MALSF projects in the future.

## 4.5.4. Wider Benefits of Project Outputs

**The data storage** and dissemination projects involve a direct interaction with the wider stakeholder community, including the general public. Project data and reports of project work carried out through the MALSF are freely available and accessible through a web-based GIS archive. The data represent a unique archive of material for third party use and have already been extensively downloaded for environmental assessment outside the aggregate industry.

The development of dissemination projects within schools and through the M.Sc bursary scheme to universities and colleges has been a notable success, and remains in high demand for the future. Dissemination to the general public has been successful through the museum displays and at public events, but it remains the case that much needs to be done to improve awareness, by target audience such as universities, of the activities of the MALSF and the role that it has played in safeguarding the marine environment.

*(Figure 17)*



# 5. A SUMMARY OF PROGRESS 2002 - 2011

1. **The MALSF represents** a 'success story' as far as meeting the original aims and objectives of the fund are concerned. An important objective of the MALSF has been to seek practical ways in which the impacts of aggregate extraction could be minimised, and the way in which the outputs of MALSF research are now feeding into conditions attached to new extraction permissions reflects this.

2. **An important first** step to achieving this goal was to improve our understanding of the nature and distribution of resources of geological, biological and historic significance in the vicinity of aggregate extraction sites. This work is essential for Marine Spatial Planning purposes and to set any potential impacts of marine aggregate extraction into 'context' in relation to the distribution of environmental resources of conservation and economic significance in the surrounding seabed as a whole. To a large extent this has been achieved through completion of Regional Environmental Characterisation (REC) surveys covering all of the major sand and gravel areas where aggregate extraction takes place off the coasts of England.

3. **A total of** 31,560km$^2$ of seabed has now been surveyed and mapped in a series of six major REC surveys commissioned by the MALSF. These have been carried out to define the environmental resources over much of the seabed surrounding aggregate dredge sites in English coastal waters. The REC surveys include detailed studies of the seabed geology, archaeology, historical assets, biotopes and species of conservation significance. They have now been completed for the Outer Bristol Channel, the South Coast of England, the Eastern English Channel, the Outer Thames Estuary, the coast of East Anglia and the Outer Humber.

4. **Apart from meeting** the objectives of the MALSF, the survey data meet two of Defra's key strategic aims:-
   - They provide essential 'baseline' data against which the effects of climate change on seabed communities can be assessed
   - They provide important background data required to sustain a healthy marine environment

5. **An important component** of policy has been to support secure archives for the data that have been acquired from the marine surveys carried out under the MALSF. This is required both to disseminate the results of work commissioned by the MALSF, and to provide a unique source of data for use by third parties in the future. All of the data are geo-referenced and stored in a Geographical Information System (GIS) secure data depository supported by the MALSF and accessible for use free of charge by third parties.

6. **Other work funded** through the MALSF has focussed on understanding the nature and scale of potential impacts of marine aggregate extraction on seabed resources of conservation significance. We now have a good understanding of the scale of the 'footprint' of impact of extraction on seabed resources, as well as an understanding of the nature and rate of

recovery processes in biological communities. Novel work on methods to detect assets of historic and archaeological importance has led to the development of appropriate methodologies for the identification and protection of historic and archaeological assets on the seabed. The results of this work commissioned by the MALSF have been rapidly taken up by the Regulators and their Statutory Advisors to underpin an evidence-based approach to licensing, and the development of appropriate monitoring and management tools to protect environmental resources in the vicinity of dredge sites.

7. **Projects commissioned by** the MALSF have been increasingly focussed on how knowledge gained from work commissioned by the fund can be used to secure a sustainable approach to marine aggregate extraction. The development of new seabed sampling equipment and imagery systems has enhanced our ability to interpret the data obtained by standard oceanographic geophysical methods. This has allowed real progress to be made in our understanding of the distribution of marine biotopes in English coastal waters. These technical developments made by projects funded through the MALSF have played an important part in the development of new 'Guidelines for the Conduct of Benthic Studies at Marine Aggregate Sites' (2010) in the marine environment. These guidelines are of fundamental importance in providing agreed standard data acquisition, interpretation and data storage for a wide range of stakeholders.

8. **Recent projects commissioned** by the MALSF have focussed on whether there are cost-effective options for improvement of the environmental performance of dredgers, either through changes in design or through changes in operating procedures. This is not yet completed, but represents one way in which the industry may be able to reduce it's environmental 'footprint' and enhance the sustainability of its operations.

9. **Much of the** earlier work commissioned by the MALSF was necessarily focussed on understanding the nature and distribution of seabed resources and their susceptibility to disturbance by marine aggregate extraction. The need for a wider socio-economic assessment of the effects of marine aggregate supply has, however, been recognised by the MALSF Steering Group for some years. Studies have generally been limited by a lack of sufficient information to make valid comparisons between land-won and marine aggregate supplies on a national scale. Some progress has been made in making such assessments on a regional scale, and in placing a 'value' on biological resources that are not targeted for fisheries.

10. **Further site-specific** assessment of the socio-economic implications of aggregate extraction in a sea area subject to multi-use of the seabed is in progress. This may assist the regulators by providing an improved approach to assessment of socio-economic factors in the Environmental Impact Assessment (EIA) process.

11. **Dissemination of the** work carried out by the MALSF has been achieved individually by the project teams, as well as through an annual MALSF Science Review, an annual Work in Progress Conference and numerous publications in the international peer-reviewed literature. These underline the significant contribution that UK marine scientists have made to our understanding of the marine environment through work supported through the MALSF in

recent years. The MALSF Conferences form an important forum for co-ordination and interaction between participants in the MALSF programme, as well as an opportunity to review projects and identify areas where further research is needed.

12. **The development of** dissemination projects within schools and through the M.Sc bursary scheme to universities and colleges has been a notable success, and remains in high demand for the future. Dissemination to the general public has been successful at aquaria and museum displays elsewhere, but it remains the case that much needs to be done to improve public awareness of the activities of the MALSF and the role that it has played in safeguarding the marine environment.

**The work that has been funded through the MALSF since its inception in 2002, including final reports, has been summarised in a series of Science Reviews that are available on the following website:- www.alsf-mepf.org.uk/.**

## 5.1. FUTURE DIRECTION

**The Marine ALSF** has been a 'success story' in providing the firm evidence base upon which sustainable management and regulation of marine aggregate extraction is now based. We have however less detailed understanding of the implications of marine aggregate extraction on features such as ecosystem function and recoverability, marine food webs and socio-economic interactions with the community as a whole.

Future requirements within the Marine ALSF are therefore likely to centre on enhancing our understanding of wider impacts including potential interactions between adjacent sites where multiple licences occur (cumulative effects), interactions with other activities of man and how improvements in the design and operation of the dredger fleet can be used to reduce the 'carbon footprint' of the marine aggregate industry.

An important aspect of the Marine ALSF has been the provision of information for Marine Spatial Planning that is of value in the management of a wide range of activities that are unrelated to the aggregate industry. The seabed mapping programme for example, provides a unique and pioneering resource that has allowed identification of resources of conservation significance. This work is mainly confined to sites of primary importance for aggregate extraction but there is an important need to extend these studies to include other sea areas around our coasts that require management but about which very little is known.

# 6. APPENDIX

## 6.1. DELIVERY PARTNER PRIORITY OBJECTIVES

### CEFAS

**The allocation to** Cefas under the MALSF is disbursed through the Marine Environment Protection Fund (MEPF). The objectives of the MEPF are to ensure that the MALSF is used to procure projects which deliver programmes that:-

- Promote environmentally-friendly practices for the extraction of marine aggregates
- Undertake strategic research into the environmental consequences of marine aggregate extraction
- Reduce the local effects of marine aggregate extraction
- Reduce the environmental impacts of using marine aggregate in coastal protection schemes

Further information on the Marine Environment Protection Fund can be obtained from: www.alsf-mepf.org.uk. This site contains copies of MEPF Reports, current projects that have been commissioned and priorities for funding in the future.

Cefas

### ENGLISH HERITAGE

**The main focus** of marine projects disbursed from the MALSF by English Heritage is on the marine historic environment.

Key priorities include:

- Identification and characterisation of the historic environment in ey existing or potential areas of aggregate extraction
- Research and development of practical new techniques to locate seabed historic environment assets; to improve our understanding of direct and indirect impacts of extraction on such conservation and management of the resource
- Marine historic environment training, dissemination and communication

It includes the following main areas:

- Understanding the Marine Environment
- Engaging with Stakeholders
- Marine Historic Environment Protection
- Education, Outreach and Community

Details on marine research priorities, information on current projects and application guidelines can be obtained from:- www.english-heritage.org.uk/server/show/nav.1315

ENGLISH HERITAGE

## 6.2.NOTES ON STATE OF KNOWLEDGE INDICATORS

**Assessment of the** State of Knowledge is based on what was known prior to initiation of the MALSF in 2002 *(indicated on the left-hand side of the charts)* and what is currently or is likely to be known at the end of Round 3 in March 2011.This allows a comparison of the improved evidence base for management of marine aggregate extraction that has occurred mainly as a result of projects supported through the MALSF. The State of Knowledge is necessarily subjective but is based on an input by the Marine ALSF Steering Group, which represents a wide range of informed stakeholders.

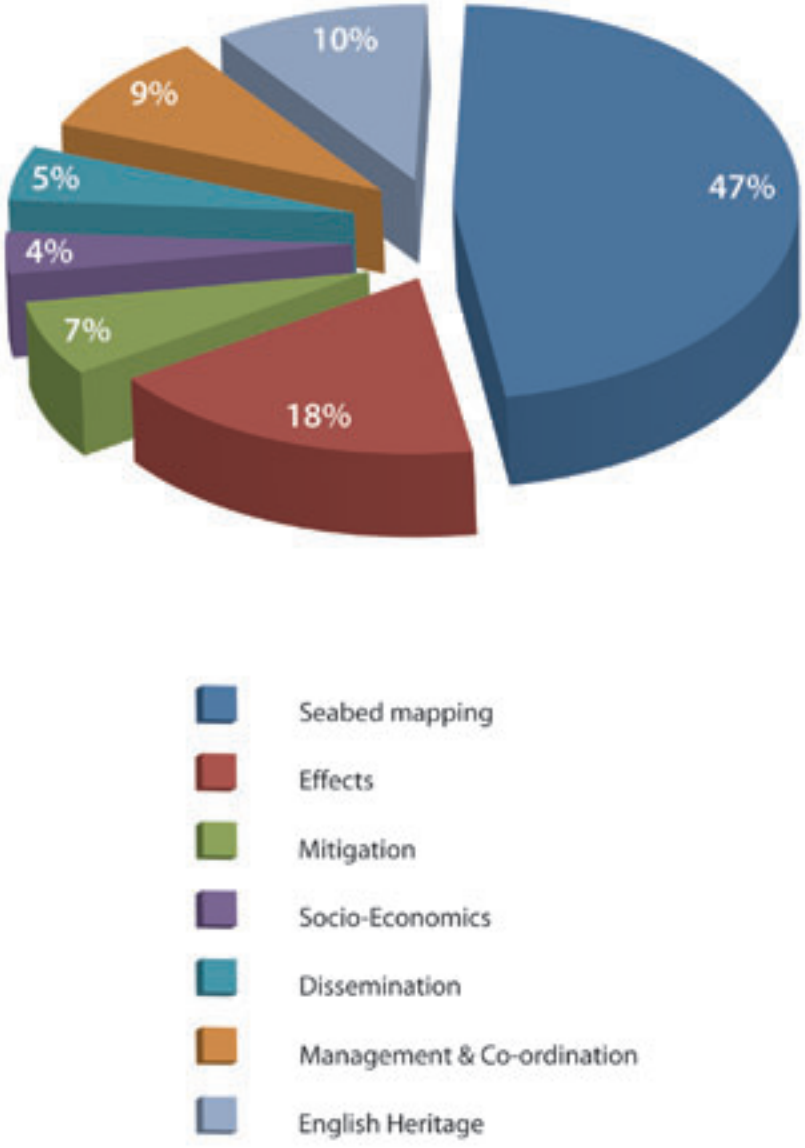
**The State of Knowledge assessments have been grouped into 3 categories as follows:**

| | |
|---|---|
| **BASIC :** | **Very limited information available** |
| **INTERMEDIATE :** | **Some information available but further work required to support management of the Industry** |
| **GOOD :** | **Detailed information available allowing a firm evidence-base for management and regulation of the Industry** |

**It should be** noted that whilst further work may be required to enhance the evidence base, the quality of information available for management of marine aggregate extraction is generally higher than that for many other sectors.

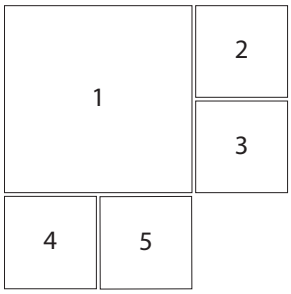
## 6.3. MARINE ALSF ALLOCATION OF FUNDS

An approximate breakdown of the £13.5M allocated under Round 3 (2008-2011) to the Marine ALSF is shown in the figure below. From this it will be noted that about half of the fund was allocated to Seabed Mapping (biological, geological and heritage) with a further 18% spend on projects related to the effects of aggregate extraction. The other categories each represented less than 10% of the total budget. Disbursement by English Heritage on projects related to the historic environment totaled £0.5M per annum of which approximately half was allocated to projects on prehistoric assets and the other half to multi-period projects.



## 6.4. LEGENDS TO FIGURES & ILLUSTRATIONS

### Front cover:




1 Operational Trailor Suction Hopper Dredger. Courtesy of HR Wallingford

2 Dredger drag-head and suction pipe. Courtesy of BMAPA

3 Newly developed Costerus Grab. Courtesy of Gannett Scientific Services

4 Flint implements. Courtesy of Wessex Archaeology

5 Dredged marine aggregate

### Inside:

1 Multibeam bathymetric image of submarine wreck on seabed. Courtesy of Cefas

2 South Coast REC Sea Bed Morphology. Single beam echo sounder data © British Crown & Sea Zone Solutions Ltd. 2008.All rights reserved. Data Licence 052008.012

3 Submerged landscape in the North Sea, now known as 'Doggerland'. Courtesy of University of Birmingham

4 Side-scan sonar image of seabed wreck. Courtesy of Cefas

5 South coast sub surface geology. Courtesy of British Geological Survey

6 Side-scan sonar image showing dredge trails and trawl scars on the seabed. © CEMEX UK Marine Ltd, Hanson Aggregates Marine Ltd & Tarmac Marine Dredging Ltd

7 Image of seabed community in marine gravel. Courtesy of Wessex Archaeology

8 Divers prepare to enter the water to dive on the 'Mystery Wreck', Eastern Solent. Courtesy of Hampshire & Wight Trust for Maritime Archaeology

9 New seabed imaging system on towed sledge. Courtesy of Envision Mapping Ltd

10 Automated sampling equipment for measuring sediment losses. Courtesy of HR Wallingford

11 Divers photograph the wooden hull structure of the 'Mystery Wreck', Eastern Solent. Courtesy of Hampshire & Wight Trust for Maritime Archaeology and D.McElvogue

12 Seabed trials of new Costerus Grab. Courtesy of Gannett Scientific Services

13 Aggregate Dredger - the Sand Falcon

14 Whitstable harbour with aggregate distribution depot and near-shore fishing vessels

15 Dissemination of seabed archaeology. Courtesy of Wessex Archaeology

16 Dissemination to schools. Courtesy of Hampshire & Wight Trust for Maritime Archaeology

17 Marine ALSF GIS application flow. Courtesy of GeoData Institute, University of Southampton

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