



Coastal partnerships and research strategy development: a review



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CONTENTS

INTRODUCTION..... 2

1.1 Role of science in coastal management 2

From theory to practice: communicating science to management..... 3

Role of coastal partnerships 3

1.2 Methodology 4

2. RESEARCH AGENDA 5

2.1 Impetus for developing a Research Agenda 6

2.2 Aims of a Research Agenda 7

2.3 Development and evolution..... 8

2.4 Delivery and implementation 10

3. RESEARCH ADVISORY GROUP 12

3.1 Role and remit of Research Groups 12

3.2 Membership of Research Groups 14

4. SUPPORTING INFORMATION SYSTEM..... 16

4.1 Purpose of a supporting information system 16

4.2 Coverage and content..... 20

4.3 Database design and function 22

5. CONCLUSION 27

5.1 Lessons learned..... 27

Research Agenda..... 27

Table 2 SWOT Analysis: Research Group..... 28

Table 3 SWOT Analysis: Research Database (document management system*)..... 29

Research Advisory Group 30

Supporting Information System..... 31

REFERENCES 33

APPENDIX 1 INTERVIEW GUIDE 35

APPENDIX 2 INTERNATIONAL EXPERIENCES 38

APPENDIX 3 MERSEY BASIN CAMPAIGN..... 39

INTRODUCTION

In response to increasing recognition that sustainable decision-making needs to be based upon sound scientific evidence, many coastal partnerships have launched initiatives or 'research strategies' aimed at strengthening the scientific and research base of their programme. There is also increasing realisation that coastal partnerships are well placed to facilitate greater interaction between practitioners and the research community and provide a platform for dissemination of scientific research. This report reviews the approach taken by several coastal partnerships, both in the UK and further afield, in developing research strategies and programmes. It reports on the status of development of these research initiatives and describes how they have sought to influence the co-ordination, exchange, and communication of scientific research through active partnerships with universities and the wider research community. The work was conducted as part of an initial scoping exercise into the development of a similar research strategy for the Severn Estuary under the INTERREG IIB funded COREPOINT project.

1.1 Role of science in coastal management

It is generally accepted that policy-making should build on the best available scientific knowledge. Agenda 21 makes 'strengthening the scientific basis for sustainable management' a priority (Taussik and Gilbert, 2002), and one of the five principles from the joint UK Governments' sustainable development strategy, '*Securing the Future*', is the responsible use of sound science in the development and implementation of policy (HMGovernment, 2005). This is particularly relevant in the coastal / marine context, as recognised in the UK Government's Marine Stewardship Report, '*Safeguarding Our Seas*', which emphasised the need for policies based upon robust science (DEFRA, 2002). The draft Marine Bill has focused new attention on the need for scientific information for decision-making, particularly in relation to marine spatial planning.

The recent draft Strategy for Wales on Integrated Coastal Zone Management (ICZM), '*Making the Most of Wales' Coast*', also recognises that the sustainable planning, management and use of the resources within the coastal zone depends on informed decision-making. This requires an understanding of the nature and extent of coastal resources, and the pressures upon them, particularly in the context of climate change (WAG, 2006).

It is widely held that scientific knowledge should contribute to coastal management by informing debates over contentious issues and providing objective information upon which to base decision-making. It has been argued that management decisions are more easily defended and less readily reversed when based upon sound scientific information (Cicin-Sain and Knecht, 1998). It has even been suggested that a failure to incorporate science into the decision-making process is attributable for management failure (Talaue-McManus, 2001).

It should be noted, however, that scientific evidence is 'value-neutral' and does not by itself provide any prioritisation of policy options. Interpretation and valuation are essential intermediate steps between science and policy. This requires close interaction with ICZM stakeholders and an interdisciplinary scientific input integrating natural sciences, socio-economics and humanities in order to avoid biases and make better use of scientific knowledge (ENCORA, 2006). Accordingly, it has been argued that scientists should play a more prominent role in the policy-making process, as opposed to merely providing scientific research as the information base (Ducrottoy and Elliot, 1997; Christiansen and Hunt, 2000).

From theory to practice: communicating science to management

A wide range of scientific data exists in relation to the coastal zone. Some of this has been collected by statutory organisations and other bodies in order to monitor compliance with environmental legislation, whilst a considerable wealth of relevant scientific research is generated by the higher and further education (HFE) sector. However, it is accepted that science will only be used effectively in ICZM if it is communicated clearly and effectively (NRC, 1995)

In this context, communication should be differentiated from dissemination, which is the one-way flow of information from a 'provider' to a 'user' (Taussik and Gilbert, 2002). Communicating science for ICZM is a two-way process and involves scientists and practitioners as both givers and receivers of information. However, because research is undertaken by a number of institutions and commissioned by a variety of organisations, agencies and public bodies, it is not as well co-ordinated or disseminated as it might be. A prerequisite, therefore, for increasing the scientific input into ICZM is the existence of arrangements to facilitate communication between scientists and practitioners.

Concerted efforts to foster interactions between scientists (social and natural) and policymakers are few and far between. Such interactions have traditionally been constrained by several obstacles, including a perceived cultural clash between scientists and non-scientists which hampers communication and understanding; conflict between the short time horizons of public decision-makers and the longer term time horizons of science; and the issue of uncertainty which constrains the ability of scientists to provide definitive answers in situations where management must continue, even in the absence of knowledge. It is also true that most coastal and marine research programmes are science-driven and science funded and may not deliver practical knowledge ready for end-use (GESAMP, 1996).

Deficiencies exist not only at the knowledge-supply side, but also at the knowledge-demand side. Research studies commissioned by coastal practitioners are generally restricted to their own realm of competence; co-ordination of knowledge-demand among practitioners with different competences is more the exception than the rule. This also hampers the development of comprehensive research approaches (ENCORA, 2006).

Role of coastal partnerships

Coastal partnerships are non-statutory, collaborative groupings of stakeholders with an interest in the coast, originally set up in order to provide a more holistic approach to addressing coastal sustainability issues through the active involvement of key agencies and stakeholders (Burbridge 2001, Heaps & Fletcher 2004). The European Recommendation on ICZM (CEC, 2002) emphasised the need for the involvement of all interested parties in the management of the coastal zone, and the important role of coastal partnerships in facilitating this was clearly recognised in the National ICZM Stocktake (Atkins, 2004).

The draft ICZM Strategy for Wales recognises that there is room for better co-ordination of research effort in the coastal zone and a need for improved access to research results – for the benefit of all stakeholders, including research communities (S.7.4). In particular, it highlights scope to build on existing links between the HFE sector and coastal zone practitioners in the public, private and voluntary sectors in order to promote effective information exchange and to share good practice.

Coastal partnerships are ideally placed to facilitate such interaction by bridging the gap between coastal managers and the research community and providing a platform for information exchange. Indeed, many coastal partnerships already work with local academic institutions to undertake research to help address management issues, as identified in the UK Stocktake (Atkins, 2004).

In bringing together a wide range of coastal stakeholders, coastal partnerships can contribute to capacity building in the coastal zone. In particular, they can be the catalyst for the convening of inter-agency and multi-disciplinary research groups (see *section 3*) through which future research agendas (see *section 2*) can be agreed and co-ordinated with management priorities, in line with the ICZM principles of partnership working, stakeholder involvement and local specificity.

The provision of scientific research to coastal partnerships is obviously important to provide critical information needed for the formulation of policy and management interventions (Chua, 1997). Arguably, there is also a need for the work of coastal partnerships to be better informed and shaped by scientific evidence and research. By forging closer links with the research community, partnerships are better placed to communicate these research needs by posing management-relevant questions in ways that allow them to be addressed by science. However, some partnerships have recognised that, in addition to being ‘users’ of information, they can assist research activity by encouraging the sharing of resources and add value to existing research by bringing it to the attention of other coastal stakeholders and the wider community. Various approaches have been adopted in the dissemination of research, including workshops, conferences, published materials and online databases (see *section 4*).

1.2 Methodology

This report presents the results of a telephone survey of coastal partnerships with research initiatives or ‘strategies’ (Table 1), conducted in February 2006. Partnerships with research strategies were identified on the basis of an earlier survey (Dodds, 2005) and through additional internet research of partnerships’ websites; as such the list in Table 1 is not exhaustive. Wherever possible, interviews were conducted with the partnership officer and were typically of the duration 30-45 minutes. The interview schedule is provided in Appendix 1. Not all questions were relevant to all respondents, therefore a semi-structured approach to the interview was adopted.

Table 1 Coastal partnerships that have developed, or are considering, research initiatives

<ul style="list-style-type: none">• Medway & Swale Estuary Partnership• Mersey Basin Campaign• Sefton Coast Partnership• Solent Forum• Solway Firth Partnership• Tamar Estuaries Consultative Forum• Tay Estuary Forum• Thames Estuary Partnership

2. RESEARCH AGENDA

There is increasing realisation that coastal and estuary management efforts are best undertaken from a solid scientific basis. Before actions are recommended or undertaken, a scientific analysis of the problems to be addressed is absolutely necessary. An interdisciplinary approach is needed in addressing these issues, as traditional scientific research may not provide sufficient data or an accurate picture of the inter-relationship of various factors.

In response to this, several coastal partnerships have engaged in the development of a Research Strategy or Agenda, which is best described as a focused multi-disciplinary programme of applied research to support policy-making and management decisions. The Research Agenda is developed in association with academia and other organisations, agencies and public interest groups with research interests in the coastal zone and is intended as a guide in developing collaborative geographically-based research in coastal areas within the partnership's remit.

Box 1: Statements of need for co-ordinated research and information provision in coastal partnerships' strategy documents

Medway & Swale Estuary Partnership

- Encourage the exchange of information between interested organisations
- Bridge the gap between the scientific and technical community, and end users.

Sefton Coast Partnership

- Partners will develop a research strategy for the Sefton Coast encompassing survey, research, monitoring and links to other coastal initiatives. (Policy CMP60)

Tay Estuary Forum

In relation to communication and liaison:

- Encourage the dissemination of data and information relating to the Tay Estuary and adjacent coastline, particularly through the establishment of working links with related groups and organisations.

In relation to information, technology and research (S.1.4)

- Ensure the increased understanding and knowledge of the Tay Estuary and adjacent coastline through the dissemination of data and information, the continued use of available technologies and the support of co-ordinated research and monitoring.
- Develop an information database relating to the Tay coastal region. This may require a substantial review and multidisciplinary collation of information relating to the estuary.
- Obtain a greater understanding of what information is needed, what type of analysis may be required and how and where the information should be stored. Identify a clear approach to gathering information, with detailed knowledge of what subject, format, etc.
- Ensure that information highways are two-way: the Forum should act as a communicator, allowing presentation and distribution, but also providing means to receive information.

Based on the results of the telephone survey, most respondents recognise the value of strengthening the scientific base of their partnership, and many partnerships have a statement of need to this effect in their strategy documents (Box 1). However, whilst several partnerships claim to be considering developing some sort of research initiative to address diverse management needs (e.g. Tamar Estuaries Consultative Forum, Tay Estuary Forum, Medway & Swale Estuary Partnership), only a few partnerships have progressed the concept to a stage where a Research Strategy with supporting task group and information management system exist to assist in the identification of information gaps

2.2 Aims of a Research Agenda

In general, the Research Agenda provides prioritised recommendations for research and identifies existing and future information needs. These recommendations are typically based upon specific goals and milestones derived from the partnership's management plan and other strategic documents, in agreement with key members of the partnership. The document is intended for use by scientists, coastal practitioners and others with an interest in the study area to identify the coastal research/information needs and funding opportunities through partnerships.

Box 2: Priority themes for the Mersey Basin Campaign Research Agenda (2005-06)

The Agenda is based around fulfilling the three key objectives of the Campaign, separated into requirements under each key objective:

Objective 1 Improved water quality

Improving river basin water quality so as to support sustainable fish populations across the entire Mersey and Ribble catchments.

- Heavily Modified Water Bodies and the Water Framework Directive;
- The role of sediments in water quality management.

Objective 2 Sustainable waterside regeneration

- Stimulating the strategic development of attractive, sustainable waterside environments.

Objective 3 Public awareness, education and communication

Promoting public awareness and appreciation of the importance of rivers, waterways and coasts. Creating opportunities for active involvement by individuals, community and voluntary organisations, local authorities and businesses.

- Perception and attitude;
- Engagement: process, representation and evaluation.

The aims and deliverables of any Research Agenda are typically tailored towards the specific management needs of the partnership in question. For instance, the Research Agenda for the Mersey focuses on the Campaign's three priority themes of *improved water quality*, *sustainable waterside regeneration* and *public awareness, education and communication* (Box 2). The Sefton Coast Partnership on the other hand has expressed the need through its evolving Research Strategy to improve the overall understanding of the complex and changing environment of the Sefton Coast, and to ensure that sustainable management decisions are based on the best available knowledge at any given time. The objectives of the Strategy (Box 3) are directed towards delivering this aim.

Based on the information provided by respondents, some broad observations can be made in relation to the reasons for developing a Research Agenda. The over-riding aim of most Agendas is to foster stronger links between the research community, and in particular academia, and other organisations, agencies and public interest groups with links to a particular estuary or stretch of coast in order to:

- Provide a unified and integrated set of (estuary-wide) priority research and information needs;
- Present coastal research priorities of the partnership for which the partnership prefers to direct research and secure funding;
- Encourage co-ordination and collaboration among agencies, groups and institutions at the local and regional level to identify, consolidate, and communicate the partnership's priority research and information needs;
- Encourage involvement and interaction among local and regional coastal practitioners, scientists and other stakeholders in developing programs that address site-specific research and information needs;

- Facilitate collaboration among organisations and agencies in the allocation of funds for regional coastal research and provide a leverage in applying for other funding and resources;
- Integrate academic and other public and private sector research programmes to ensure practical relevance to management questions, exchange of information and technology, and to avoid duplication of effort;
- Disseminate research results for application in attaining the coastal management objectives
- Make contributions to the solution of environmental problems and management of coastal ecosystems and public education.

Box 3: Objectives of the Sefton Coast Partnership Research Strategy

Objectives of the research strategy:

- To set the Sefton Coast in its regional, national and international context and to encourage links with other sites;
- To encourage multi-disciplinary studies to look at complex issues (e.g. the implications of climatic change);
- To encourage studies that look at the whole of the dune system and the wider coastal system;
- To enable the managing agencies to generate and support research work;
- To maintain a register of research or monitoring projects suitable for school, undergraduate and post-graduate studies;
- To encourage research areas in proportion to their capacity to help achieve management objectives;
- To disseminate information about research and monitoring activities being undertaken in and around the Sefton Coast.

2.3 Development and evolution

The coastal partnerships interviewed have adopted different approaches in developing their Research Agendas. However, all recognised that the process should be open and inclusive of all stakeholders. A common element in the development process seems to be a research-focused workshop as a ‘kick-off’ meeting to identify research priorities and opportunities for collaboration.

Developing a Research Agenda relies substantially upon the expression of expert and stakeholder opinion as it is unlikely that the partnership will hold sufficient empirical evidence to identify existing gaps in knowledge. Workshops, bringing together the research community and end-users, have proven successful in generating interest and momentum and providing answers to such questions as (Brooksbank & Jones, 1999):

- What relevant research has or is being undertaken which relates specifically to management issues?
- How can this research be collated and communicated in order to address key management issues?
- What information gaps are critical to achieving the management objectives?
- How can these information gaps be addressed by inter-disciplinary / multi-sectoral research in partnership with agencies, users and special interest groups?
- What opportunities exist to share existing research data and how can future research / monitoring activities be co-ordinated to reduce costs and minimise duplication of effort?

These questions need to be addressed in a collaborative manner, involving:

- Researchers who have been, or are involved in projects relevant to the management of the estuary¹ and/or who are interested in collaborating on research identified by the Agenda;
- Representatives of government agencies / authorities who may be involved in monitoring activities on the estuary;
- Those people who work on the estuary, use it for recreation or have a special interest;
- Other decision-makers on the estuary.

Outputs from workshops are often presented in report format, which provide an overview of the existing knowledge-base relating to the study area and a benchmark against which future progress can be monitored. For example, the Thames Research Agenda was developed in parallel with the *State of the Estuary Report*, which brought together research, information and stakeholders to determine social, economic and environmental values for the estuary as well as key threats and management requirements (Box 4).

Box 4: Drafting the Thames Research Agenda

The Research Agenda is designed to fit in with the *State of the Estuaries Report* and the research themes identified mirror those in the report. These are then broken down into research objectives / proposals. The structure chosen relates to a classification of values, relating to their function as Core Values, Applied Values and Utility Values, as described in the *State of the Estuaries Report*. Values are clustered together in terms of common subject areas. From this, management issues were described and the gaps in research and management identified in the Report.

Core Values relate to values that can be clearly defined and relate to a specific characteristic or feature of the estuary. Core values represent the fundamental physical, chemical or biological factors that support or underpin human values attached to the estuary. *Applied Values* have been classified as readily definable features or characteristics of the river that are supported by one or multiple Core values. *Utility Values* relate to values which provide utility or amenity from estuary features and are underpinned by Core and Applied values.

An understanding of the ways in which values relate to one another is centrally important to identifying the key management issues and in identifying areas for further research in establishing co-ordination between seemingly isolated fields of research.

The methodology devised and applied has focussed on the need to ensure that:

1. Existing research and management is analysed in a focused manner; and
 2. Management and research requirements address the core management issues within the estuary.
- Values, threats and issues can only be accurately accounted for via a process of reviewing existing research and liaison with key stakeholder groups. Only through a considered appraisal of the values and threats of the estuary can any truly focused, integrated review of the research be provided.

Once values are accounted for and tabulated, current research can then be reviewed and the values to which such research relates identified. This task should show:

- Which values a body of research relates to; and
- An account of all research relating to a single value.

Values were derived following direct liaison with stakeholders, both through the Partnership's co-ordinated Action Groups and following two 1-day workshops.

All values have been assessed in regard to:

- the suite of research compiled by the TEP's network of partners;
- the findings of the preliminary workshop; and
- feedback from the Action Group questionnaire's.

¹ The term 'estuary' is used here although it is recognised that Research Agendas have also been prepared for non-estuarine environments e.g. Sefton Coast Research Strategy.

Both the *State of the Estuary Report* and the Research Agenda are outputs from Phase I of the Thames Estuary Programme – ‘*An audit of estuary related information focusing on management needs for a sustainable estuary*’. Similarly, the Solent Forum established a research group (*section 3*) to take forward some of the findings that were identified in the Solent Science Conference, held in 1998. Workshops, therefore, should be viewed as the beginning of an ongoing multi-sectoral research process rather than as a one-off event.

2.4 Delivery and implementation

Several mechanisms have been adopted by coastal partnerships to ensure the delivery of Research Strategy commitments. These include:

- **Research Advisory Group or Forum:** Most partnerships with research initiatives have established some form of advisory group to oversee the process (*section 3*). Such groups typically include representatives from the research community and other key stakeholders with research interests in the coastal zone, which together represent a body of scientific expertise in relation to the estuary (*section 3.2*). Research Groups facilitate networking and collaboration between researchers and other stakeholders and provide a means of working towards achieving a consensus on identification of research priorities and actions (*section 3.1*).
- **Research Officer:** Two of the partnerships with established Research Strategies have elected to appoint a dedicated Research Officer (RO) to co-ordinate the research activities of the partnership and provide a point-of-contact for research related enquiries. This puts the Research Agenda on a stronger footing as it enables the partnerships to budget for dedicated staff time to encourage stakeholder interaction with the Agenda and develop / maintain other initiatives under the Agenda. Other key functions of a RO are show in Box 5.
- **Information Management System:** Most partnerships have developed, or are in the process of developing, an electronic resource or research database that provides access to a central store of information and research relating to their project area. These initiatives are driven by the perceived need to collate all existing research, literature, plans or records and to make these available (to varying extent) to partnership members and the wider public. These resources vary in sophistication from hard copies of meta-data catalogues held by the partnership office to fully searchable on-line databases that provide direct access to the data source (Section 4).
- **Student projects / placements:** Coastal partnerships often provide a variety of work experience for both undergraduate and postgraduate students. Such placements are useful in assisting the partnership carry out a range of activities related to the Research Agenda, e.g. reviewing existing research, populating research databases, and identifying gaps in the knowledge base. Some partnerships, e.g. Solent Forum have encouraged student dissertations and research projects on work that they would like to see progressed by offering a dissertation prize to students from local academic institutions.
- **Meetings and publications:** A key aspect of most Research Agendas is the dissemination and communication of research results. Several partnerships have organised on-going research events, such as workshops and conferences, which provide a useful means of reaching wider stakeholders and placing research within a national context. The *Solent Science Conference* was a particularly successful example, with over 100 delegates attending both days, including representatives from the Solent’s researchers, planners and managers. It provided a sound basis to progress the research agenda for the Solent. The MBC has also used a series of workshops to highlight the research priorities for the Campaign and to progress its Research Agenda along priority themes identified by workshop participants.

With time, any research agenda has to be modified and changed, in line with the principle of adaptive management, as new issues arise and gaps in the knowledge base are filled. Monitoring progress is important for measuring the efficacy of programs, selecting new directions, and ensuring accountability to the public. Most partnerships recognise this and pledge to review and update their Research Agendas on an annual basis, coupled with an objective assessment of the progress of research projects underway, allowing new priorities to be identified and included over time. The review process typically involves a combination of workshops, formal presentations at partnership meetings, feed-back forms from partnership members and direct input at Research Group meetings. This approach holds promise to better accommodate shifting social preferences and new scientific knowledge so that management strategies can be adjusted to ensure progress toward stated management goals.

Box 5: Role of the Research Manager (based upon the Mersey Basin Campaign)

- Identifying what research projects are currently in progress, or have been completed using a number of mechanisms such as the Campaigns' research projects database (Section 4) and events such as research workshops. Also, identifying research synergies and innovative and cross-cutting approaches.
- Promoting ongoing research needs and the activities of the Group through events such as the series of research focused workshops and their report outputs, conferences and publications such as *Source NW*.
- Disseminating the output and results from these research projects through a variety of mechanisms. These include workshop reports, project reports and student projects that can be accessed through the Campaigns website, as well as events such as the research workshops and Integrated River Basin Management Conference held in April 2004.
- Encouraging interaction with the Research Agenda and the wider research requirements of Mersey Basin Campaign by promoting and identifying the gaps and highlighting these through presentations (conferences, workshops and lectures, seminars to students etc).
- Engaging with a wide audience to participate in the research needs of the Campaign. These may include students through projects and placements, both at the undergraduate and post-graduate level as well as active researchers through workshops and conferences etc.

3. RESEARCH ADVISORY GROUP

Scientific research and monitoring has always involved large numbers of people, with different types and levels of expertise, working in a variety of roles, both separately and together, making use of and extending the body of knowledge. However, as noted in Section 1.1, interaction between these individuals and the policy sector and co-ordination of research effort, particularly multi-disciplinary research, is beset with several problems. Arguably, most of these problems can be attributed to a lack of communication, but there may also be issues associated with lack of use, or misuse of each others' products or even lack of mutual understanding (Orbach, 1996). These cultural differences, when not recognised, understood or addressed, can lead to conflict and competition in the place of co-operation.

In response, most of the coastal partnerships who have initiated the development of a Research Agenda have also sought to establish some form of advisory group that brings together the various subcultures including scientists of many different disciplines, policy-makers, businesses and public interest groups, to open up new lines of communication between these individuals. These groups provide a forum to share data and information, promote collaboration, facilitate the identification of existing funding and resources, attract new sources of funding, and develop a unified Research Agenda that will meet the needs of all stakeholders.

3.1 Role and remit of Research Groups

To borrow a phrase from Taussik and Gilbert (2002), Research Groups may be described as '*vehicles for communicative interaction on a particular theme*'; the latter, of course, being a shared interest in research outcomes relating to the same geographical area of coast. They therefore serve to broaden knowledge of existing research and to develop mutual understanding between scientists and policy-makers so that future research activities can be co-ordinated and linked to overall strategic planning goals or management needs.

The Research Groups established by the coastal partnerships interviewed are typically informal, in that they tend to develop their own terms of reference and rules on participation and mode of operation. Generally speaking they exist to bring together managers, planners, academics and other members of the research community in order to co-ordinate research and further knowledge through the creation of collaborative research partnerships. One of their purposes is to provide a focal point for the discussion of research issues shared by those organisations and groups involved, while the other is to encourage the strengthening of existing, and the formulation of new, links between them.

It follows that invariably, they are set up with either a formal intent or in response to a contemporary issue. An example of the latter is the Solent Forum Research Group, which was originally established with the primary objective of being the organising body for the Solent Science Conference held in 1998. The Group also provided an appropriate mechanism through which to take forward specific actions identified in the Conference, thus becoming a stable and permanent body. The original terms of reference, however, were updated in 2002 when the Group changed its focus from research in the physical, biological and socio-economic systems of the Solent to solely looking at socio-economic issues. The Group's revised remit is shown in Box 6.

Box 6 : Role and remit of the Solent Forum Research Group (SFRG)

- Promote research into the socio-economic components of the Solent whilst retaining links with physical environmental and biological research in the Solent;
- Promote and facilitate networking and collaboration between the Solent's researchers, planners and managers;
- Develop a research strategy for the Solent setting out key priorities in regard to the socio-economic system;
- Co-ordinate research in partnership when such research can not be undertaken by one organisation alone e.g. recreation study;
- Provide a body of expertise for other groups with science needs, e.g. Solent European Marine Sites Management Group;
- Facilitate bids for funding;
- Maintain and develop mechanisms for the co-ordination, exchange and dissemination of information.

Similarly, one of the key drivers behind the establishment of the MBC Research Advisory Group (RAG) was the role to be played by the Campaign in providing support for the implementation of the Water Framework Directive for the Mersey and Ribble catchments. The RAG, which was set up in 2000, provides an opportunity for fulfilling these research needs by bringing together academics from the region's 4 universities as well as key Campaign members with active research agendas, to provide a more thorough understanding of the complex interactions between waterways and catchments and the major human pressures upon them.

Other Research Groups were set up in response to less specific, but nonetheless, compelling needs and have evolved to address particular needs. The Thames Estuary Research Forum (TERF) was set up in recognition of the need to improve existing methods of disseminating knowledge and information between the research community and practitioners, to further work towards a sustainable future for the Thames Estuary. TERF's principle aim is to facilitate the process of circulating knowledge by identifying existing resources and information needs for the Thames and determine an agenda for research. The Research Forum has since evolved, following a series of workshops, to focus on six priority research areas (biodiversity, fisheries, flood defence and physical dynamics, planning and environment, recreation access and water quality).

Although some research groups have been sufficiently robust from the outset to establish their own agenda and determine their directional focus, evidence suggests that it is helpful for research groups to concentrate their activities, at least at the outset, on a particular issue or theme. There are several instances where the research initiative has 'lost direction' in the absence of a structured work programme (Box 7). Indeed, the profile of the aforementioned SFRG has declined in recent years, attributed to a lack of direction and insufficient project work to keep it occupied.

Focusing resources, including research group members' time and expertise, upon e.g. a specific management problem enables positive results to be delivered within a relatively short time-scale, adding to the momentum of the initiative. Realising this, the Sefton Coast Partnership have identified 'Coastal Morphology' as a key area for further research and their Research Strategy is currently being developed with this in mind, although this does not preclude developing other areas that Research Task Group consider appropriate.

Similarly, the Lake Ontario Coastal Initiative Action Plan (Appendix 2) (LOCI, 1996) strongly recommends a focus on nutrient management, especially phosphorus, although it notes that other areas of research (notably health effects of endocrine disrupters, nutrients

such as nitrogen, toxic substances such as mercury, and watershed issues such as habitat destruction) should also be encouraged and supported by LOCI. It is worth noting that, as this case illustrates, the success of any Research Group and/or Agenda depends upon a consensus being achieved on priority research areas and the co-operation of partnership members in adhering to the work programme agreed.

Box 7: Medway and Swale Estuary Partnership Research Forum

The Medway and Swale Estuary Partnership Research Forum was set up in 2001 with the aim of facilitating networking opportunities between members of the partnership and, in particular, between academia and practitioners. The main aims of the Forum were to:

- To develop integrated research proposals that reflect socio-economic and environmental importance of the estuary and coast;
- To link the scientific and technical community to end users; and
- To ensure ownership of the research process and of end results.

A series of working groups were established to develop these aims in relation to the partnership's key themes. However, despite some early activity within these groups, the initiative lost impetus and activity has declined. Nevertheless, there appears to be significant motivation to rekindle the Research Forum but, as a result in a shift of focus within the Partnership, a re-launched forum could have a different outlook and more specific role compared to that set out in its original terms of reference.

3.2 Membership of Research Groups

Research Groups typically comprise a mix of the users (planners and policy makers) and the suppliers (academic community) of scientific information relevant to a particular geographic area of coast. Members are drawn from diverse backgrounds, providing a broad spread of specialist knowledge. Part of the rationale of developing a research group is to bring together representatives of different organisations who will bring knowledge from their sector to the network and will, in return, take new ideas and information back to their organisations.

They may be large and diverse enough to develop specialist sub-groups dealing with particular issues or topics, as in the case of the Medway & Swale Estuary Partnership or they may remain limited in scale and focus. Almost a hundred people attended the Thames Estuary Research Forum's (TERF's) inaugural workshop in September 2000. However, a smaller, select Steering Group has been formed comprising of key TERF partners specifically responsible for the management of the Estuary and researchers who offer expertise in estuarine and coastal science (Box 8). Membership of the Steering Group extends to research providers beyond the geographical remit of the Partnership, reflecting the high level of research activity in the Thames Estuary.

Membership of Research Groups is typically by a mixture of invitation and direct approach from potential members. It helps in this respect if key personnel within the Partnership / Research Group are well-connected with academia; it is likely that other organisations to be represented on the Group will already have existing links with the Partnership. In the case of the MBC, the Research Manager had an academic background and had maintained good links with academia. In addition, the Chairman of the Campaign was based at Liverpool University and could also recommend appropriate academic contacts.

Some Research Groups may be open in membership, although this does not always provide for consistency, particularly if the same organisation is represented by different personnel at consecutive meetings. Furthermore, unless there is fixed membership, not all

members turn up to every meeting, depending on the agenda and specialist interest of members. Consequently, valuable input from some key personnel may be lost if the relevance of the agenda items to their organisation is not clearly evident.

It is recognised that there may not always be sufficient expertise within the Research Group in relation to certain issues. For this reason, most Research Groups are supported by wider networks within and beyond the individuals, organisations, stakeholder groups represented. For example, the Solent stakeholder database has over 200 entries and if additional expertise is required, consultants from outside the Group can be drawn in.

Additionally, there are those external to the Group who have considerable 'lay knowledge' - expertise in relation to a particular topic gained through experience. Whilst the majority of partnerships recognise that this is an extremely valuable source of information that should be assimilated whenever possible, it may not appropriate or relevant for these interests to be permanently represented on the research group. Communication of relevant information to these groups may be far more important.

In defining the membership of research groups, individual personalities may often be as significant as 'official positions'. In joining the group, it is hoped that individuals will bring access to other networks of links – to their organisation or to other interest groups – thereby serving as 'gatekeepers' between the different organisations. Clearly, the most successful gatekeeper personnel are those who are well linked both within their own organisation and within the network and who have the skills and personality to bring, and take back, information (Orbach, 1996). It is also advantageous for the Research Group to benefit from strong leadership. The Solent Forum Research Group has benefited from the continuity provided by the Chair being held by the same person over the life of the Research Group, whilst other Research Groups have ensured fresh impetus and the generation of new ideas by having a Rolling Chair for the group.

Box 8: Membership of the Thames Estuary Research Forum (TERF)

English Nature	Port of London Authority
Environment Agency	Thames Angling Preservation Society
Kent County Council	Thames Chase Forest Centre
King's College London	Thames 21
London Borough of Barking & Dagenham	University College London (UCL)
London Port Health Authority	University of Essex
Middlesex University	University of Plymouth
Natural History Museum	University of Portsmouth

4. SUPPORTING INFORMATION SYSTEM

Data collection is undertaken by a wide range of organisations in the coastal zone, including universities, research institutes, statutory agencies, local authorities, port and harbour authorities, dredging companies and research consultants. However, this data is typically collected and stored on a project-by-project basis and it is true to state that there is no central repository to support the use and exchange of scientific coastal data (Stojanovic, 2004). In addition, as these organisations require data for different purposes and utilise a variety of standards and formats, incompatibility of data is commonplace (Millard & Sayers, 2000). It follows that coastal practitioners face significant practical obstacles in sourcing relevant data to support management activities and in determining the usefulness of a dataset for a particular application. Similarly, the research community risks duplication of research effort and faces impediments to maximising the use and exchange of data.

It is widely accepted that effective sharing of data is fundamental to the development of integrated management techniques such as ICZM (see Box 9). Coastal Partnerships with established and emerging research strategies are therefore taking the initiative by developing research databases and other similar electronic means of disseminating the results of relevant research to other stakeholders in the coastal zone. The expectation is that data sharing will lead to data integration and hence more meaningful analysis and improved information. It should also result in reduced duplication of effort and cost savings. These initiatives have demonstrated the potential for the integration of diverse data provision activities, serving different sectors in the coastal zone.

Box 9: Benefits of sharing data (source: adapted from Millard & Sayers, 2000)

The key benefits of maximising data exchange and reuse are:

- Reduced duplication of effort in the capture of data;
- Cost-sharing in the control and processing of data;
- Improved relationships with data providers and end-users;
- Improved analysis and understanding of the environment;
- Better decision-making.

4.1 Purpose of a supporting information system

Based on information provided by the survey respondents, there are three broad reasons for developing a document management system:

1. To collate existing information on relevant research activities and provide this in a readily accessible form.
2. To provide access to a body of information that can be used to inform management decisions.
3. To provide a resource / tool for the research community to guide future research.

The above reasons are not mutually exclusive and Partnerships have designed and adapted their systems to deliver multiple benefits in line with their management priorities.

Collate existing information on relevant research activities

Whilst it is recognised that there is a wealth of potentially relevant research available to coastal practitioners, it is not always clear where such information resides and how useful it will be to inform management decisions. Based on respondents' comments, it is common to experience difficulties and delays in trying to find research, literature, plans, records and other coastal data. Attempting to assess the quality of the data is equally frustrating, as historic data may lack any form of descriptive metadata.

Furthermore, there has been increased emphasis in recent years on collaboration between large multi-disciplinary research teams, greater use of advanced information processing techniques and more of a need to share results between geographically dispersed end-users. Taken as a whole, this suggests that researchers and coastal practitioners are increasingly reliant upon electronic means of accessing and sharing research data.

Recognising this, the Sefton Coast Partnership is currently updating and digitising the Sefton Coast Database, originally developed between 1979 and 1982 in collaboration with Liverpool University with the aim of collating "*all the existing research, literature, plans and records relevant to the coastal hydrodynamics of the Sefton area and to present this information in a readily accessible form*" (Sefton Council, 1982). The original database and accompanying Guide, which brought the information contained in the database into readily accessible summary descriptions of the different areas and processes, suffered from a number of limitations (Box 10) and had never been reviewed or revised. The development of the meta-database will be a major step in the dissemination of coastal processes data relevant to the Sefton Coast.

Box 10: Sefton Coast Database

Limitations of the original database:

- Database and guide are static – have never been reviewed or revised, although the Guide has recently been transferred into digital format with some of the more obvious changes made.
- Database is not easily accessible – much of it is paper copies of original documents in varying standards of reproduction. Guide can be disseminated in hard copy.
- Maps and plans have suffered from poor storage – some materials have been lost / mislaid or are unique / valuable.
- Lack of metadata for some of the data, therefore difficult to use and accuracy called into question.
- Coverage is deficient in a number of areas, such as climate change, archaeology, habitats, human use and management – reflects changes in attitudes and approach to coastal defence.
- No mechanism to update / populate the database – attributed to the limitations of digital technology at the time it was set up.

A number of key changes have also occurred since the database was originally conceived:

Technology – improvements in relation to data collection, analysis, storage and dissemination. Ability to store data in digital format has aided secure storage and handling of data. The internet provides greater potential for dissemination of information and has increased our expectation in terms of access to data.

Social – increased emphasis upon inclusivity and increased expectation from the public that they will be involved in the decision-making. Expectation that data will be provided in useable format.

Economic – value of datasets accrue with time and data needs to be properly managed in order to realise its full value (metadata and secure storage).

Source: Lymbery, G. (2005) *Corepoint – Sefton Coast Case Study*. Draft 19.10.05. Unpublished.

Similarly, the Thames Estuary Partnership recognise that an information database needs to be developed alongside the Thames Estuary Research Forum (TERF) in order to collate existing information on research, documenting both published and unpublished work. This database would be beneficial to both the TERF research community and the wider public who would be able to access the TERF information database online via *ThamesWEB*, the TEP's internet site. Working Group progress would therefore be disseminated both at a local and national scale.

Provide access to information that will inform management decisions

As noted in *section 1.1*, a wide range of data is generated though scientific research in the coastal zone which could be made available for management purposes. Despite disparate information needs, different sectors often have similar data requirements (Millard & Sayers, 2000). Furthermore, because of the high cost of data collection, many organisations also hold data beyond the lifetime of a project. Accordingly, a large proportion of data is available indirectly to other organisations and individuals for potential re-use, offering great practical significance for decision-making applications.

However, there have been relatively few attempts to synthesise this information into a format suitable for resolving practical management issues or even to signpost the availability of such data. In response, some Partnerships have developed their supporting information system with this as the central goal.

The Solway Firth Partnership commissioned a comprehensive review of information to assist the implementation of the Solway Firth Strategy (1998), the Partnership's management strategy. It was recognised that a more up-to-date research and information base was required in order to better inform implementation, assist the Partnership in the task of providing a forum for exchange of resources and expertise, and in identifying monitoring and research requirements. The University of Hull was commissioned to undertake a review of data and information sources on the Solway Firth relevant to integrated coastal zone management and to produce an extended reference list of works that have been published since 1995/6 pertaining to research and information on the Solway Firth (Box 11).

Box 11: Scope of the Solway Firth Data Review

Specific objectives were to:

- Use the 17 coastal zone management issues addressed within the Solway Firth Review (1996)² as a guide to topics in compiling the Data Review.
- Update the research sources for the Solway Firth originally set out in the Solway Firth Review. The references within this review were used as a baseline and additional new sources dating from 1995 were added.
- Address local and national research and information sources and to draw upon academic and research publications; books; reports; conference proceedings and papers.

Recent publications were requested from the following sources:

- Latest available (plus pending) local council, borough council and county council plans (both structural and local) for Dumfries and Galloway Council, Allerdale Borough Council, Copeland Borough Council and Carlisle City Council.
- Other statutory bodies and Government agencies e.g. SEPA, Environment Agency, English Nature, Scottish Natural Heritage and Cumbria Sea Fisheries Committee.
- Voluntary and independent organisations including NGOs e.g. RSPB, Solway Rural Initiative, Wildfowl and Wetlands Trust, and groups and charities' publications and information sources.
- Private sector and consultants, e.g. ICI.

Source: Read, S. (2000) *Solway Firth Data Review: Phase 1*. IECS, University of Hull. March 2000.

The Review was useful in that it provided an overview of the type of research conducted in relation to the Solway during a defined period thereby enabling gaps in the knowledge / research base to be identified. However, the Review is a static document and has not been updated since its publication. As such, it merely represents a snapshot of research activity undertaken on the Solway Firth, and has limited application for management purposes.

In contrast, the Port of London Authority have worked with the Thames Estuary Partnership's Dredging Liaison Group to develop a computer based Information Exchange System (Box 10), designed to facilitate the assimilation of environmental information into the decision-making process when selecting dredging sites. The Information Exchange System is a highly sophisticated tool developed in response to particular management needs. However, other more modest attempts at interpreting scientific data have yielded positive benefits for other Partnerships. For example, the Guide to the Sefton Coast Database previously mentioned, has been useful both as a reference for further research and to inform understanding of coastal processes to inform management decisions. The approach adopted identified deficiencies in the existing information and as a result of this a three-year research programme was initiated to develop a numerical model of waves and tides for this area.

Box 10: Research to inform management decisions– example Information Exchange System

Dredging within the Thames Estuary can potentially result in changes to the physical processes of the estuarine regime, disturbance to archaeological resources and loss of marine and intertidal habitats. In order to improve the process of considering this environmental information when making decisions on dredging, a data management system has been developed in a joint initiative between the Port of London Authority and TEP's Dredging Liaison Group (one of the Action Groups).

The Information Exchange System allows the user to search for a specific dredge site and display the environmental information applicable to that site. This can inform the decision making process by indicating the potential for a significant effect on a particular resource. In this instance the relevant agency would be contacted for further information.

² The Solway Firth Review was a comprehensive and inclusive review of the Solway resources and their use, which informed the development of the Solway Firth Strategy (1998).

Data has been supplied by members of the Dredging Liaison Group and includes:

- Dredged sites within the tidal Thames;
- Water and sediment quality data;
- Fish and shellfish information;
- Environmental designations.

It is hoped bird count and archaeological data will be added in the future.

Resource for the research community to guide future research activity

Datasets need to be publicised so that duplication of effort in collecting information is avoided and potential users are aware of the data available and how it can be obtained. Recognising this, a number of Partnerships have initiated the development of meta-databases that facilitate on-line metadata entry in addition to data search and query. Comparing the information available with the information required enables an 'information audit to be performed' which some Partnerships have found useful in directing further research to fill information gaps.

DISC (Dataset Information of the Solent Catalogue), the Solent Forum's meta-database, is designed to be a 'one-stop-shop' for signposting research data relating to the Solent. Set up in 2001, DISC is being added to constantly and currently holds in excess of 1000 records. It originally focused solely on GIS datasets pertinent to the Solent but has since grown to include reports and other datasets as the Partnership became aware of them. The aim of DISC is to provide a tool and a process to identify sources of data and in so doing forge stronger ties with academia and industry as well as encourage public/private research partnerships. It is intended to enable the wider research community to access information on the type of research activity being undertaken and the nature of data being collected and to assess the suitability of the research/data for a particular application.

Similarly, the Mersey Basin Campaign's online research database was developed in parallel with the Research Agenda and is intended as a comprehensive, searchable source of information on individual research projects focusing upon river basin management in NW England. It has been assembled primarily as a resource for the research community with the aim of informing researchers about projects relevant to the Campaign objectives, that either have been conducted or are in progress. Reviews of the content of the research database will feed into future reviews of the Research Agenda.

4.2 Coverage and content

In discussing coverage and content, observations based on interview responses can be arranged under the following broad themes:

- Type of topics/issues covered
- Geographical coverage
- Sources of information

Type of topics / issues covered

In terms of the topics/issues to be included within the supporting information system, coverage ranges from a focus upon a specific management issue (e.g. coastal processes, climate change) to attempts to incorporate all relevant research conducted within the Partnership's management area. Generally speaking, the focus is largely determined by

the Partnerships management priorities, although considerable steer is typically provided by the Research Advisory Group, if present, who generally oversee the development of the supporting information system.

Evidence suggests that it is probably a good idea, at least at the outset, **to concentrate on a particular issue or management goal that is closely aligned with the Partnership's management priorities in order to focus development efforts and maximise the use of existing resources** (including time and effort). This was the approach adopted by the Mersey Basin Campaign, which successfully re-launched its online research database in 2004. The database is intended as a comprehensive, searchable source of information on individual research projects focusing upon river basin management in the North West of England. Although construction of the database was contracted out to a web design company, the fields for the database were designed by the Research Advisory Group. The respondent advised that it is best to keep the database as focused as possible because:

- It helps to ensure that content is added to the database – if people know that their work is relevant, they are more likely to provide an entry into the database; and
- It is easier to keep the database up-to-date if it is focused on a particular issue.

Similarly, coverage of the Sefton Coast Database currently extends only to coastal processes, which reflects the priorities of Sefton Council's Technical Group, who originally set up the database between 1979 and 1982. Although the Partnership has expressed a desire to expand the database to include other data, particularly that relating to climate change, the key message communicated was to "keep it robust and keep it simple". There are instances where Partnerships have attempted to "bite off more than they can chew" by extending coverage to include all potentially relevant research. However, these initiatives have typically lacked focus and ownership and have subsequently foundered through lack of direction and as a consequence of resources being spread too thinly. The Tay Coastal References Database appears to have suffered from these limitations as it was not set up in relation to any specific management issue or problem and has consequently lost focus and momentum.

There are, however, some notable exceptions to the above, where Partnerships have taken an estuary-wide approach to collating all relevant research in order to inform an understanding of the 'bigger picture' of the estuary and provide links between specific research projects. Prime examples are the Solent's DISC meta-database and the Thames Research Library, both of which provide a holistic estuary-wide perspective of research activity. It should be noted, however, that there are significant resource implications for setting up such an elaborate supporting information system and that the Thames Estuary Partnership has a dedicated Research Officer who is tasked with maintenance of the database.

Geographical coverage

In terms of geographical coverage, most Partnerships have adopted a broadly similar approach in that only research specific to the geographical remit of the Partnership is considered for inclusion in the supporting information system. For instance, all material to be included in the Mersey Basin Campaign's research database must have direct relevance to the Mersey and Ribble catchments. Similarly, research included in the DISC meta-database must have specific relevance to the Solent, although other more generic research may be considered for inclusion if it has some bearing upon the management issues facing the Solent, although this information is not actively sourced. This approach has also been adopted in populating the Thames Research Library – all entries relate to

research conducted within the boundaries of the Thames Estuary and the geographical limits of the TEP. Other relevant material may be considered for inclusion, but is not actively sourced.

Sources of information

With respect to academic research, most Partnerships have found it expedient to source materials from institutions in their immediate vicinity, but will also attempt to accommodate relevant research from institutions further afield, especially if it is brought to the attention of the Research Group.

There is a wide range of research-related materials other than academic research included within the supporting information systems looked at. These include journal papers, scientific survey reports, R&D reports, public inquiries, EIAs, environmental statements, books, maps, site reports, MSc and PhD theses. The Thames Research Library probably holds the most diverse collection of materials out of the Partnerships interviewed (Box 11) although the risks of taking such a comprehensive approach are highlighted above. TERF considered it particularly important that the Library should include grey literature. However, it does not include corporate annual reports and links to raw data, although recognised to be useful, may be collated at a later stage. The Sefton Coast Database is also unusual in that it contains a wide range of historic documents, ranging from statutory agency publications to letters and other formal communications and reports dating back to the 1900s. None of the Partnerships interviewed have made any attempt to capture 'lay/traditional environmental knowledge' within their systems, although most respondents recognised the value of information from this source.

Box 11: TERF's priorities for research documentation

Phase 1	Local Planning Authorities / Public Inquiry information on key sites HR Wallingford / English Nature / Environment Agency / Port of London Authority/ English Heritage / Greater London Authority County Councils that may hold reports / studies / environmental assessments in the Thames Estuary
Phase 2	London Wildlife Trust / Natural History Museum / Ministry of Defence / National Maritime Museum etc. (start at end of Phase 1)
Phase 3	MSc's, MPhil's, PhD's, raw data sets etc. (start end of Phase 2).

4.3 Database design and function

There are several issues to be resolved here, notwithstanding the technical specifications that need to be agreed when designing a supporting information system. It was not considered appropriate to investigate the technical specifications in detail at this stage of the project, therefore comments here are limited to broad observations relating to the key aspects of system design and function.

Format of records

An early decision needs to be made on whether the supporting information system will support direct access to data or signpost users towards relevant information matching their search query. There are several issues associated with providing direct access to data, not

least of which is the issue of copyright, which mitigate against this option. In addition, there are potential technical compatibility issues associated with transferring data, particularly so with the development of complex graphical and non-graphical data models and structures used in databases and GIS. Many respondents feel that effort spent converting data into exchange formats is time consuming and unprofitable, particularly if the supporting information system can direct users to readily accessible data on other organisations' websites. Whilst some respondents expressed an interest in developing their supporting information systems to enable direct access to certain types of data, the majority felt that this would not be practical or cost effective. The use of the CoastWeb platform may provide an important resource in this respect <http://www.coastweb.info/>

For these reasons, many Partnerships have opted to merely signpost relevant research through online meta-databases. Metadata provides information about the dataset content, theme, spatial coverage, and time period and contains many descriptive terms that users are likely to use in database search queries. Good metadata will describe the data in such a way that users can determine if the data is relevant to their particular application, e.g. what the data are, where they were collected, how they have been processed and, importantly, ownership of the data. Most of the meta-databases developed by Coastal Partnerships are relatively simple electronic catalogues, indexes and directories of data held by the Partnership and / or its constituent member organisations. The content ranges from simple data descriptions to full technical data specifications. In some instances metadata are provided on CD-ROMs and as paper documents, but are increasingly being provided on-line over the internet so that they can be searched remotely by users. A case study of 'MedMIS' – the Medway and Swale Estuary Partnership's Information Database is provided in Box 12.

Box 12: MedMIS – Medway and Swale Estuary Partnership's Information Database

The Medway & Swale Estuary Research Forum established an early interest in the development of a meta-database in recognition of the value of metadata as a research tool. However, it was recognised that metadata is expensive and time consuming to compile and that the needs of the researcher often tend to be greater than the capacity of organisations compiling the data. Consequently, in order to maximise the usefulness of the metadata, it was decided to confine the development of MedMIS (Medway and Swale Estuary Partnership's Information Database) to data relating specifically to the Medway and Swale Estuary and to keep the format as simple as possible.

The following inventory contents were agreed:

- Access to existing information;
- Access to existing analysis;
- Access to current research information.

The end product is a series of (hyper)linked tables within a Microsoft Word document, that is available through the Partnership's website or readily distributed by e-mail upon request. The tables are organised under the following broad topic headings:

MedMIS also provides a library list of reports held within the Medway Swale Estuary Centre that can be viewed by appointment. This is not a comprehensive listing of research conducted in relation to the Medway Swale Estuary, and listings are limited to bibliographic details (title/author/commissioning body/date). Direct access to the documents is not available online.

Metadata standards

With incomplete metadata the potential for reuse and sharing of data is severely limited. The adoption of a common standard for metadata would therefore appear to be critical to maximising the use and exchange of coastal data. This would facilitate searching for data and promote compatibility between different meta-databases. However, at present, there is

no universally applied standard for metadata at the coast, and existing metadata standards were found by Respondents to have limited application in a coastal context.

The Sefton Coast Partnership and Solent Forum looked at this particular issue in greatest detail. Following a review of international approaches and protocols on the design of database fields, the Solent Forum concluded that there was no single standard that could be applied and therefore adopted a combination of standard approaches. Similarly, the Sefton Coast Partnership found the Government's standard keyword list to be inflexible and unable to accommodate local descriptors (e.g. place names specific to local area).

Other Partnerships found the range of different standards confusing, were unaware of the existence of standards³ or failed to see their benefits. All Partnerships have, to a greater or lesser extent, therefore, elected to adopt their own procedures, driven by their data sources and user needs. In the absence of an appropriate standard this would seem to be the only way to proceed, although care should be taken when compiling metadata, particularly if the metadata are required for search engines or on-line catalogues that make automated decisions regarding data suitability. A best practice guide to metadata design is provided in Box 13.

Box 13: How to write good metadata (*adapted from Millard & Sayers, 2000*)

- ✓ Do write descriptive dataset titles that include the topic, geographic coverage, and time period in the title. This can be regarded as minimum metadata.
- ✓ Do use lots of synonyms (e.g. precipitation, rain, rainfall, weather, etc.).
- ✓ Do include general topic terms in the abstract and keywords.
- ✓ Do include general geographic terms in the keywords (e.g. if the data relates to Cardiff Bay, include geographic terms such as Severn Estuary, South Wales, Bristol Channel).
- ✓ Do reference other documents and published materials, providing a complete citation.
- ✗ Don't leave blanks in your metadata – it is better to say “unknown” than to leave a metadata field blank.
- ✗ Don't use acronyms, especially in the title. If you must use acronyms, define them.
- ✗ Don't invent your own metadata standard – use one of the existing standards.

Entering and retrieving data

In terms of design and function the models developed by the Thames Estuary Partnership and Mersey Basin Campaign are arguably the best constructed, as they allow the user to search the database through a user-friendly form-type interface. The front-end of the Thames Research Library is illustrated in Box 14. The form enables the Library to be searched by keyword, author, title of document or topic. Alternatively, the user can view all records – currently there are around 3250 entries. An abstract or description is provided where it is not self evident from the title what the document contains. Importantly, details of the location of the data are also provided. The Partnership's Research Officer is tasked with the maintenance of the database.

A similar approach is provided for by the Mersey Basin Campaign's Research Database. The query form and output from a typical search are shown in Appendix 2. The meta-database was constructed by a web design company working with the Partnership's

³ Appropriate existing metadata standards at time of writing (2006) include: ISO19115 (Worldwide) Dublin Core (Worldwide) Gemini 2.0 (UK) E-GMS (UK) and FGDC Standards (US). These may offer a basis for establishing a coastal standard (attempts to develop this have been undertaken by the CoastBase and CoastWeb projects).

Research Manager, and took about 1 year to get up and running. A system has now been established which allows registered users to log on to the database in order to update it with new entries, but there is no evidence to suggest that this occurs regularly. This can be a problem due to demands upon users' time and different priorities.

The Solent Forum's meta-database, DISC, is well populated with over 1000 records, but unlike the Thames and Mersey systems, cannot be searched by keyword or other data descriptor. Data within DISC is organised by topic reports and details of datasets can be retrieved for a specific topic (e.g. ecology / industry / flora and fauna / land use / etc.). Outputs are provided in pdf format and signpost the user to the data, its time period, format and holder (Box 15). Users can then access a data directory to retrieve the holder's contact details. The reports show all forms of research, data or monitoring including GIS datasets (map layers). In addition, there is a table of information behind every map layer / dataset which can be accessed without needing a GIS application. In time the Partnership hope to convert the meta-database into a searchable format, although lack of funding has proved prohibitive in this respect.

Box X: Query form for the Thames Research Library

Thames Research Library

All records

Quick Search

Keyword

This will search for your keyword(s) in the title and abstract of a publication

Additional Search

Author

Enter keywords, part or all of the Title of the publication you wish to search for

Title

Topic

- Agriculture
- Air Quality
- Archaeology
- Biodiversity
- Climate
- Commercial Use
- Conservation Policy
- Dredging
- Education/Community
- Energy

Select one or more

Box X: Search results from the Solent Forum Database

SOLENT FORUM DATABASE OF LOCAL DATASETS AND RESEARCH						
Region	Title	Begin	End	Maintenance	Data format	Data Holder
Pollution						
Langstone Harbour	Foraminifera as proxies for monitoring organic pollution	2000	2003	not available	contact data holder	Southampton Oceanography Centre
New Forest	Report on review and assessment of air quality in the New Forest	1999	2001	one off	excel	New Forest District Council
New Forest	Extended Nitrogen Dioxide (NO2) Survey across the District	1993	on going	on going	excel	New Forest District Council
Other	Benthic diatoms and their use as pollution indicators		1998	one off	Ph.D. thesis	Southampton Institute
Portsmouth Harbour	Effects of heavy metals on reproduction of ragworm (Nereis virens)	unknown	unknown	not available	contact data holder	University of Portsmouth
Solent	Pollution Incidents Hants/IOW	1992	1998	not applicable	map layer	Environment Agency
Solent	The Determination of change in PCB concentration by GC/MS with the SOXHLET extraction and GC/ECD with automated solvent extraction from Portsmouth Harbour	1997	unknown	one off	Ph.D. thesis	University of Portsmouth
Solent	Macrofauna and pollution	2001	2001	one-off	contact data holder	University of Portsmouth
Solent	Pollution Incidents in Hants/IOW	1999	unknown	monthly	map layer	Environment Agency
Solent	Pollution Incidents Sussex	1992	1998	not applicable	map layer	Environment Agency
Solent	Pollution Incidents EP NIRS2 (from June 2001)	2001	unknown	monthly	map layer	Environment Agency
Solent	Pollution Incidents in Hants/Isle of Wight	1997	1998	not applicable	map layer	Environment Agency
UK	Development of a passive sampling system for use in monitoring organic pollutants in aquatic environments	unknown	1999	not applicable	Ph.D. thesis	University of Portsmouth
Pollution - antifouling						
UK	Investigation into the Effects of antifouling Compounds on non target Marine Animals	unknown	2003	not applicable	report	University of Portsmouth
pollution - sediment						
Dibden	Dissolved concentrations of PAH and TPH from resuspended Dibden and Hyde-Cadland sediments	Unknown	Unknown	unknown	Paper copy	Hampshire County Council
Dibden	Table: Dibden - Contamination	Unknown	Unknown	unknown	Paper copy	Hampshire County Council

5. CONCLUSION

Previous sections of this report have described how coastal partnerships across the UK have attempted to strengthen the scientific and research base of their programme in response to increasing recognition that management activities and decision-making should be based upon the best available science. However, there are several obstacles to the effective use of science in policy-making, many of which can be attributed to the lack of communication and interaction between the research community (science providers) and coastal practitioners (science users). Recognising this, several coastal partnerships have initiated research strategies involving research groups and supporting information systems based around a research agenda designed to bring together the disparate research interests of their member organisations and provide a platform for data sharing and exchange.

These initiatives have achieved various levels of success and longevity. Whilst some have lost momentum and foundered due to lack of focus, resources or interest, or have dropped down the list of Partnership priorities, other research initiatives have grown in strength and have delivered practical benefits to those involved in terms of identification of research synergies and opportunities for collaboration; strengthened links with other stakeholders with research interests in the coastal zone, and the development of new ideas and innovative research approaches. These benefits, along with potential limitations are presented in the form of a SWOT analysis in Tables 2 and 3.

It should be noted, however, that these are generic observations and that the rewards, or otherwise, will depend on the characteristics of a particular initiative and the enthusiasm of the personnel involved. This underlines the observation made by several respondents that along with variations in size and structure, different Partnerships have different management priorities which have been shown to influence the development of research initiatives. Nevertheless, this study demonstrates that there is a wealth of experience which can be drawn upon in developing a research strategy. Some of the key lessons to be learned from existing initiatives are summarised in section 5.1.

5.1 Lessons learned

Research Agenda

- A research agenda should address the following three requirements:
 - Long-term monitoring to establish baseline data sets and to determine spatial and temporal trends;
 - Topical short-term projects that address local problems or questions; and
 - Research and monitoring required for adaptive management.
- Developing the priorities for a research agenda relies heavily upon the expression of expert and stakeholder opinion – it is important to proceed on basis of consensus.
- It is intended that research results will be used in policy formulation and decision-making. Therefore, identified research priorities need to be linked to overall strategic planning goals or management needs.
- It appears to be helpful to focus efforts on a particular topic area – select too wide a remit and progress will be slow and resources will be spread too thinly.

Table 2SWOT Analysis: Research Group

<p>Strengths</p> <p>Would strengthen the science base of the Partnership, helping to better inform management decisions.</p> <p>Facilitates the development of new ideas and new research initiatives.</p> <p>Ensures that members of the Partnership are aware of research outputs and management implications.</p> <p>Brings together the region's academic and research community as well as key Partnership members with active research agendas.</p> <p>Encourages discussion and communication between researchers, regulators and users and enables these stakeholders to come together to share their experiences and knowledge.</p> <p>Provides an informed scientific view on issues related to how the Partnership's management priorities might be addressed.</p> <p>Would lead to a better understanding and appreciation of the gaps in the existing knowledge base.</p> <p>Strengthened links with universities would provide the Partnership with a better idea of the type of work being undertaken at different institutions.</p> <p>Promoting ongoing research needs and activities of the Partnership through events such as workshops, conferences and communicating their report outputs.</p> <p>Identification of research synergies and opportunities for collaboration, including innovative and cross-cutting approaches.</p> <p>Identification of a body of knowledge / expertise outside the Partnership, which can be called upon for specialist advice, as necessary.</p> <p>Provides a body of expertise for other groups with science needs, e.g. European Marine Site Mgt Group.</p>	<p>Weaknesses (Challenges)</p> <p>Levels of inclusivity varies between Research Groups. Group may not be representative of all the issues relevant to the Partnership's study area.</p> <p>Difficulties associated in achieving consensus among the different interests represented on the Group.</p> <p>Can be dominated by individuals' agendas.</p> <p>Challenges associated with getting universities to share their research – universities are sometimes protective of their research areas.</p> <p>Achieving a balance between practical 'hands-on' research required to inform management decisions and 'blue skies' research often favoured by universities.</p> <p>Challenges in aligning the different agendas of the universities and other Partnership members– the Partnership has no influence over university agendas, which are often dictated by deadlines and budgets.</p> <p>Focusing on specific issues at the expense of other research areas may be detrimental to the Partnership – it would appear important to align the Group's activities as closely as possible with the Partnership's management priorities.</p> <p>Resource issues – financial, as well as the competency and capacity of personnel.</p> <p>Consistency issues arising from turnover of personnel within member organisations and representation by different individuals within larger organisations.</p> <p>Servicing and attending meetings is time consuming.</p> <p>Confidentiality issues associated with research undertaken by consultancies.</p> <p>Difficulty in targeting an appropriate representative within a large organisation with a wide remit.</p>
<p>Opportunities</p> <p>Research Group provides an opportunity for fulfilling research needs through a co-ordinated research programme.</p> <p>Opportunity to improve communication between academics and practitioners.</p> <p>Focus for the dissemination of research related information, through a variety of mechanisms including workshops and conferences.</p> <p>Help the Partnership determine management priorities and actions for the future.</p> <p>Opportunity for the Research Group to feedback and influence the Partnership's key initiatives and other external plans and programmes.</p> <p>Research group could act as a hub / clearing house for queries from students and support student projects of benefit to the Partnership.</p> <p>Could provide a mechanism through which the Partnership could partner up with academia to bid for Research Council money and other funding.</p> <p>Could advise on the specification and design of information management tools, such as an online research database.</p>	<p>Threats</p> <p>Dynamics of Group could be affected if membership is weighted towards academia, or other interests.</p> <p>Under-representation of key interests upon the Group could bias outcomes.</p> <p>If the Research Group's agenda is too broad based this could lead to a lack of focus and direction.</p> <p>If represented interests are too diverse, the lack of common ground may make it difficult for Research Group members with different specialisms to relate to each other.</p> <p>Sensitivity issues - Individuals / institutions may want to run with a project themselves after identifying the issue as a research priority.</p> <p>Clashes of interest over ownership of research.</p> <p>Attendance at meetings has been shown to decline if the Research Group is not tasked with a project to keep it occupied.</p> <p>Potential to become a 'talking shop' only.</p> <p>Threat of stagnation / loss of momentum if the Group lacks a clearly defined purpose and work programme.</p>

Table 3SWOT Analysis: Research Database (document management system*)

<p>Strengths</p> <p>Provides access to a body of information / data which can be used to inform / justify management decisions.</p> <p>Management of information in a secure and accessible way.</p> <p>Should maximise the use and exchange of data.</p> <p>Best value to increase efficiency and reduce time spent looking for data.</p> <p>Reduce duplication of work and effort.</p> <p>Promotes data standardisation and harmonisation.</p> <p>Adds value to existing data / information.</p> <p>Because of the increasing emphasis upon inclusivity, there is a need for information to be made more accessible to the public.</p> <p>Ability to store data in digital format has aided both secure storage of information and improved the ease of replication of data.</p> <p>Enables storage and handling of very large datasets.</p> <p>Value of datasets accrues with time.</p> <p>Provides a useful initial focus for Research Group activity.</p>	<p>Weaknesses (Challenges)</p> <p>Resource issues – financial, as well as capacity of personnel to collate data, getting it into a suitable format and entering it into the system.</p> <p>Needs of researcher tend to be greater than capacity of organisations compiling the data.</p> <p>Time commitment needed to research, design and populate the database – not a ‘quick fix’.</p> <p>Success dependent upon Partners’ ‘buy in’ and preparedness to populate the database – need to ensure relevance to end user.</p> <p>Data lacking any form of metadata can be both difficult to use and of uncertain accuracy.</p> <p>Existing meta-data standards may be inappropriate and their application difficult – may be unable to accommodate local descriptors (e.g. place names).</p> <p>Problems getting individuals to enter metadata and maintain it in an up-to-date form (fatigue).</p> <p>Difficulties associate with the identification of intuitive keywords for searches.</p> <p>Uncertainty over quality of entries – need quality control system and the use of meta-data to identify data source.</p> <p>Does not generally accommodate the inclusion of ‘lay knowledge’.</p> <p>Maintenance issues - training required in data management.</p>
<p>Opportunities</p> <p>Potential to add further value to data through interpretation and presentation e.g. GIS.</p> <p>Helpful to focus initially on a particular issue linked to management priorities, but system should be able to deal with a broad range of topics to enable expansion at later date if needed.</p> <p>System should enable dissemination of information at a number of levels, accessible to different users.</p> <p>Internet technology provides an opportunity for wider dissemination of information and increases expectation of users that data will be made available through this medium.</p> <p>Service level agreement could be drawn up with Partners to help populate the database.</p> <p>Potential to use existing information systems (e.g. LIS) as platform and ‘front end’ for database.</p> <p>Opportunities to link database with other compatible knowledge-based systems leading to greater potential for exploitation of existing data.</p> <p>Increased future demand for spatially-organised data (e.g. as a result of marine spatial planning).</p>	<p>Threats</p> <p>Data needs to be properly managed in order to realise its full value (metadata and secure storage)</p> <p>Evolving attitudes and approaches may mean that coverage is deficient in certain areas if priorities change.</p> <p>Database becomes static and outdated if insufficient time is allocated to its maintenance.</p> <p>Developments in technology relating to data collection, analysis, storage and dissemination may result in the database becoming outdated.</p> <p>Copyright issues – may be better to signpost relevant research as opposed to providing direct access to documents.</p> <p>Uncertainty over how the data is used once downloaded – agreements must be drawn up for the use of disseminated data to ensure that copyright, legal and other constraints are adhered to.</p> <p>Consistency issues - high turnover of Partnership Officers and changing priorities may lead to loss of momentum.</p> <p>Commercial confidentiality issues may restrict dissemination of some data.</p> <p>Data losses due to equipment failure.</p> <p>Awareness of the resource – needs to be ‘marketed’ to ensure utilisation by all Partners.</p> <p>Potential to ‘bite off more than you can chew’ – need to keep it robust and keep it simple.</p>

* These are generic observations based upon respondents’ experiences. Clearly, the specific design of the document management system will influence its particular strengths, weaknesses, opportunities and threats.

- A decision will need to be taken on whether to have a permanent Chair or for this position to be filled on a rolling basis – both approaches have worked for different partnerships. The former ensures consistency, whilst the latter encourages fresh ideas and renewed impetus. It is recommended that at the outset the Chair should be on rolling basis as the Research group finds its direction.
- Attention needs to be paid to implementation responsibilities, otherwise the Research Group will be relegated to just being a ‘talking shop’.
- On occasions, expertise within the Group may be inadequate and external expertise, outside academia and research organisations, will need to be called upon to give evidence in relation to a particular subject or issue. There is a need, therefore, to ensure that the research group is supported by a wider network of experts including those with lay environmental knowledge of the area. A directory of regional expertise has proven to be useful in this respect.
- Opportunities may exist through the research group members to partner up to draw in funds to commission research projects.

Supporting Information System

- Evaluation of function and design of database to make sure it meets the needs of its users – some means of obtaining feedback from partnership members should be put in place. In addition, some form of record of how often the database is queried (for future justification) would be desirable.
- Don't be too ambitious to start – focus on a particular research issue or topic area and extend the system gradually to cover other research areas.
- Keep the database as focused as possible – it helps to ensure that content is added to the database (people are more likely to provide an entry into the database if they know that their research is relevant) and it's easier to keep up-to-date if it is focused on a particular issue.
- Allow sufficient time to set up database – estimates vary between 1-2 years, depending upon the sophistication and coverage of system. It is critical to get early buy in and support through building relationships with academic institutions and practitioners.
- A fundamental consideration is whether the database will provide direct access to the research data or simply reference metadata for the research project. If the former, then there are issues associated with copyright and permitted use of data, commercial sensitivity of data, as well as potential liability considerations. Integration with the CoastWeb system forms one option <http://www.coastweb.info/>
- The design of the system needs to provide for the dissemination of information at a number of levels accessible to different users but with the ability to ‘drill down’ to the data source if desired. It may be appropriate to contract out this element of the work to ensure functionality and ease of use.
- Budget for developing the information system – clearly resource costs will increase with the size and sophistication of the system and costs of data to be included.
- The Research Group should reach consensus on the fields/keywords for inclusion in the database, most useful way in which database can be searched (e.g. topic area and geographical area). A standard approach to structure needs to be agreed upon to enable compatibility for integration of other data sets, should partner organisations be able to compile their own metadata at a later date.
- It would appear appropriate to extend coverage of the database to all relevant research relating to the partnership's project area. Much relevant research relating to the study area may be conducted by research institutions outside the immediate geographical

vicinity. All research, however, would presumably need to demonstrate direct relevance to the study area.

- A mechanism should be established to ensure that the database is kept up to date. One of the most common complaints from respondents was the difficulty in getting practitioners / academics to enter information into the database. Some partnerships have considered developing a protocol or some form of service level agreement. Summer student placements have also been used to populate databases.
- If direct access to data is provided, a quality assurance mechanism is needed to check quality of the data prior to addition to the database. Metadata is important to ensure the quality of the data is known, but existing standards have limitations for coastal applications. An existing metadata standard should be used, but modified with some coastal fields in order to be useful. Metadata is also time consuming to compile and the needs of the researcher often tend to be greater than the capacity of organisations compiling the data.
- There should be mechanisms to ensure that reviews of the content of any supporting information system will feed into future reviews of the research agenda.

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19. To what extent does the research strategy facilitate the collection and inclusion of lay environmental knowledge in coastal / estuary management (local views of the nature of the environment – e.g. fishermen’s knowledge of the movement of offshore sandbanks)? How is this achieved?
20. Are the findings of key research emanating from the research strategy process disseminated to the partnership and wider stakeholders? How is this achieved?
21. Who is involved in the delivery of actions emanating from the research strategy process (universities (local / other), consultants, etc.)?
22. Is there a Research Forum / Committee that sets / guides the science agenda / development of the Strategy?
23. When was the Research Forum / Committee set up?
24. Why was the Research Forum / Committee set up (gaps in scientific research / concerns over quality of research / lack of information relating to the type of data available?) Was it established in relation to specific identified needs?
25. What are its terms of reference?
26. What is its geographical coverage (i.e. is its remit confined to research conducted in the locality of the estuary or does it extend to wider research relating to the estuary?)
27. Is there an explicit / defined budget for the delivery of the Strategy? If so, what is it and who funds it?

E. Structure and Organisation of Research Committee / Forum

28. Could you tell me about the organisational structure of the Group? What is the ‘make-up’ of the Research Forum / Committee? How many members?
29. What organisations / stakeholders are represented? Are there research institutions / universities involved (local / non-local)? What about research consultancies? Who Chairs the Group? Are there any issues associated with the dynamics / management of the Group (e.g. university-heavy / strong representation of some sectors or under-representation of other sectors)? Would you like to see other people / sectors involved who are not presently represented?
30. How did these organisations become involved? Did they volunteer or were they invited? If so, how did you decide upon which organisations to invite? Did any organisations decline to become involved?
31. Who was involved in scoping membership of the Research Forum / Committee?
32. Would you consider going outside the Group for expert advice if necessary?

F. Focus of Research Committee / Forum

33. Is the Research Forum / Committee an overarching group or are there individual topic groups tasked with specific issues?
34. How were these topics covered by the Research Forum / Committee identified? Have they been prioritised? What process was followed?
35. Was there wider stakeholder consultation involved in identifying priority issues? How was this pursued?

G. Relationship between the Research Forum / Committee and wider Partnership

36. What links exist between the Research Forum / Committee and the Partnership?
37. What reporting structures are in place to feedback to the Partnership? And vice-versa?

- 38. Are there any links with other coastal programmes on research matters, e.g. SMP Groups / River Basin Management Plans / relevant authorities for European Marine Sites? If no, have you considered developing such links? What would the benefits be?
- 39. Do other programmes / stakeholders come to the partnership research forum now for research / scientific information?

H. Evaluation of effectiveness of Research Strategy and/or Research Forum / Committee

- 40. Since developing the Research Strategy / Forum have you identified any obvious gaps in scientific knowledge? What are the practical possibilities of filling these within a realistic time scale? (Who would commission this work? Is there a budget to fund additional scientific research? What is the scale of the budget – are there any new funding streams, including research council monies?)
- 41. What quality assurance procedures are there in place to validate the scientific research conducted?
- 42. Could you give me any examples of how development of the Research Strategy has delivered practical benefits or has strengthened the scientific and research base of the partnership programme?
- 43. Have you undertaken an evaluation of the Research Strategy / Forum? If so, what did the exercise demonstrate and what lessons have been learned? If not, when will the evaluation be conducted? What lessons have you learned so far? ASK FOR COPY

I. Lessons for other Partnerships

- 44. Is there evidence of better integration between science and policy? Could you give me an example that demonstrates this?
- 45. What would you say are the benefits of developing a Research Strategy? Any disadvantages or, rather, obstacles? How were these overcome in your experience?
- 46. Does your partnership communicate / liaise with other partnerships over the research strategy process development? If so, how and where? Would there be a need for this type of networking (e.g. through CoastNET)?
- 47. What advice would you give to a Partnership embarking upon the development of a Research Strategy?
- 48. Would you be interested in providing further information to the Severn or possibly coming to a SEP meeting / doing a presentation to the SEP Management Group / Joint Advisory Committee?



APPENDIX 3

Output from the Mersey Basin Campaign’s Research Database

SEARCH GO I'M LOOKING FOR GO

Projects

- A participatory protocol for ecologically informed design within river catchments
- Bathing Water Quality Monitoring and Management of Salford Quays and the Manchester Ship Canal Upper
- Environmental Impact Assessment of the New River Mersey Crossing
- Integrated Catchment Management and Planning for Sustainability - Case of the Mersey Basin Campaign
- Learning in Transnational Networks
- Leeds Liverpool Canal Extension into Albert Dock, Liverpool
- River Bollin Habitat Survey for Migratory Fish I
- River Bollin Habitat Survey for Migratory Fish II
- River Valley Management Plan for Glossop Brook
- Salford Quays Water Quality and Fisheries Study

SHOWING PAGE: 1 2

Search The Database

Ask your question / enter keyword

SEARCH

View projects in a category

VIEW

VIEW ALL

Environmental Impact Assessment of the New River Mersey Crossing

The work has involved a comprehensive desk study of the baseline ecology of salt marsh, inter-tidal and sub-tidal habitats in the UK. A review of existing literature describing benthic invertebrate populations located within the Mersey estuary has also been compiled from a variety of contemporary and historic sources. The project has involved field surveys for both invertebrates and fish within inter-tidal and sub-tidal habitats of the estuary. Invertebrates were collected using core samplers with the aid of a hovercraft, while fish were sampled employing a beam trawl pulled by a marine RIB. All samples were analysed in the APEM laboratory to species level. Members of APEM staff have also completed wildfowl and wader studies within the estuary, paying particular attention to species using the habitat for feeding and nesting. Regular water quality and sediment monitoring has also been undertaken using a strategic sampling grid, aiming to assess the potential influence of future column construction within the estuary

Project leader : Dr. Keith Hendry
 Email : k.hendry@apemltd.co.uk

- Telephone : 01612262922
- Project : Waterside Regeneration
- Categories : Aquatic Ecology
 Sediments
 Water quality
 Perception and Attitude
 Habitat Restoration
 Biodiversity
 Diffuse Pollution
 Hydrology
 Land Use Impacts
 Coastal and Marine
 Estuaries

Project aim and objectives : Increasing road traffic in the area around the Mersey Estuary has led to the proposal of an alternative road crossing between Runcorn/Widnes. In order to relieve current congestion a number of construction sites have been investigated with APEM Ltd partaking in the Environmental Impact Assessment of each of the options.

Project locations : Mersey Estuary from John Lennon Airport to Fiddlers Ferry.
 Saltmarsh in the area surrounding Runcorn Bridge

Funding source : Giffords

Further information : Further details available at www.apemltd.co.uk



