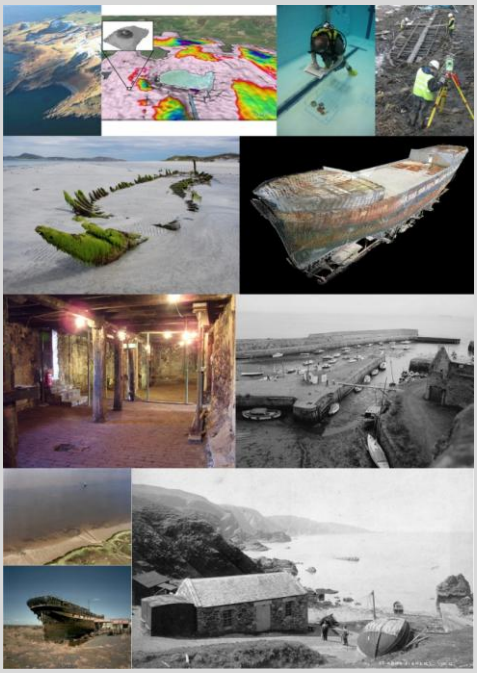
ScARF Scottish Archaeological Research Framework

From Source to Sea: ScARF Marine and Maritime Panel Report



ScARF Summary Maritime Panel Document

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ScARF Marine & Maritime Panel Report

Dan Atkinson & Alex Hale (editors and Panel chairmen)

With panel member contributions from Richard Bates, Graeme Cavers, Sue Dawson, Tom Dawson, Martin Dean, Colin Martin, Paula Martin, Robert Prescott and Sandra Purves.

For contributions, images, feedback, critical comment and participation at workshops: Jonathan Benjamin, Andrew Bicket, Colin Breen, Ruby Ceron-Carrasco, James Barratt, Anne Crone, Ali Dawson, Tony Firth, Joe Flatman, Nic Flemming, Wes Forsyth, George Geddes, Mark Hall, John Hume, Stephen Lancaster, John Lawson, John McCarthy, Roger Mercer, Bob Mowat, Ian Oxley, Peter Pritchard, Jessica Ransley, Dan Rhodes, Philip Robertson, Alistair Roach, Bridget Simpson, Douglas Speirs, Sabina Strachan, Louise Turner, Robin Turner, Shelly Werner, and Caroline Wickham-Jones.

Executive Summary

Why research Marine & Maritime Scotland?

The extent to which Scotland as a nation has developed as a result of its marine and maritime associations has long been recognised. Given the indented nature of Scotland's coastline and the location of the major centres of population, nowhere is far from a coast, estuary or tidal river. Until the development of railways, all major settlements were on the coast or on a navigable river. The marine and maritime historic environment means many things to many people and this is reflected in the diversity, complexity and number of heritage sites and artefacts available for study and enjoyment. These range from, for example, watercraft, harbours, religious sites, and canals, to Fair isle sweaters, fishing gear, cordage and modelling that emphasise the collective association with the sea that forms the core of Scotland.

The recently passed legislation in both Scottish and UK parliaments can be used to engender further impetus for research opportunities in the marine and maritime sphere. Individual approaches to marine and maritime heritage in the past have formed a vital foundation, based on empirical research of the highest quality. It is on this foundation that this ScARF panel aimed to create a framework to enable the next level of research to commence. It is the future use of this document and future events, projects, programmes and strategies that will continue to help understand, document, interpret, archive, and disseminate information about the marine and maritime historic environment of Scotland. It is, thus, both opportune and important that Scotland addresses its marine and maritime historic environment afresh.

Panel Task and Remit

The task that faced the ScARF Marine and Maritime Panel was to provide a critical review of, and identify priorities for, research into the marine and maritime historic environment, independent of period or regional constraints, and building on multi-disciplinary approaches. To this end, the panel undertook: to stock-take the current state of knowledge (i.e. a characterisation of information on, of understanding of, and of the current state of research into it); to identify sources of information whose potential has not yet been exhausted as well as key gaps in knowledge and questions still outstanding; and to suggest approaches and methodologies best suited to addressing these questions.

Future Research

The main recommendations of the panel report can be summarised under four headings:

1. **From Source to Sea**: River systems, from their source to the sea and beyond, should form the focus for research projects, allowing the integration of all archaeological work carried out along their course. Future research should take a holistic view of the marine and maritime historic environment, from inland lakes that feed freshwater river routes, to tidal estuaries and out to the open sea. This view of the landscape/seascape encompasses a very broad range of archaeology and enables connections to be made without the restrictions of geographical or political boundaries. Research strategies, programmes

and projects can adopt this approach at multiple levels; from national to site-specific, with the aim of remaining holistic and cross-cutting.

2. **Submerged Landscapes**: The rising research profile of submerged landscapes has recently been embodied into a European Cooperation in Science and Technology (COST) Action; *Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf* (SPLASHCOS), with exciting proposals for future research. Future work needs to be integrated with wider initiatives such as this on an international scale. Recent projects have begun to demonstrate the research potential for submerged landscapes in and beyond Scotland, as well as the need to collaborate with industrial partners, in order that commercially-created datasets can be accessed and used. More data is required in order to fully model the changing coastline around Scotland and develop predictive models of site survival. Such work is crucial to understanding life in early prehistoric Scotland, and how the earliest communities responded to a changing environment.

3. **Marine & Maritime Historic Landscapes**: Scotland's coastal and intertidal zones and maritime hinterland encompass in-shore islands, trans-continental shipping lanes, ports and harbours, and transport infrastructure to intertidal fish-traps, and define understanding and conceptualisation of the liminal zone between the land and the sea. Due to the pervasive nature of the Marine and Maritime historic landscape, a holistic approach should be taken that incorporates evidence from a variety of sources including commercial and research archaeology, local and national societies, off-shore and on-shore commercial development; and including studies derived from, but not limited to history, ethnology, cultural studies, folklore and architecture and involving a wide range of recording techniques ranging from photography, laser imaging, and sonar survey through to more orthodox drawn survey and excavation.

4. **Collaboration**: As is implicit in all the above, multi-disciplinary, collaborative, and cross-sector approaches are essential in order to ensure the capacity to meet the research challenges of the marine and maritime historic environment. There is a need for collaboration across the heritage sector and beyond, into specific areas of industry, science and the arts. Methods of communication amongst the constituent research individuals, institutions and networks should be developed, and dissemination of research results promoted. The formation of research communities, especially virtual centres of excellence, should be encouraged in order to build capacity.

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1. Introduction

1.1 The Maritime Cultural Landscape

Christer Westerdahl defines a maritime cultural landscape as the human utilization of maritime space by boat; including settlement, fishing, hunting, shipping and its attendant subcultures, such as pilotage, lighthouses and sea mark maintenance (Westerdahl 1992). Within this he defines tangible and intangible aspects, from the built environment of the waterfront to place names. However, maritime culture has subsequently developed into a far broader category of thought, ranging from the material remains of ports and harbours to the varying styles of knitted sweaters from different parts of the northern hemisphere (e.g. a Scottish gansey), to sea shanties and the use of maritime emblems on cultural commodities, such as cigarette packets and beer bottles. This brief overview outlines the value of maritime culture within the ScARF project and some potential avenues for research.

The term 'maritime culture' grew out of a broader understanding of not only the use of the sea by humans, but the attendant structures, cultural identifiers and associations made between people and seafaring. For example, Britain would claim to be a seafaring nation as a result of ship-building traditions on the Clyde and elsewhere, world-wide maritime exploration and the prestige of the Royal Navy. Norse culture is similarly considered maritime due to extensive sea voyages, raiding and the colonisation of land such as Greenland. Today, people driven in cars along roads and over bridges, are in contact with the sea in quite a different way. They often treat the sea more as part of a leisure canvas on which to play beside on holiday, dive into and explore, and sail on, rather than remember that it is still relied on to move cargo, for example. However, coastlines are still referred to as landmarks and now nations increasingly consider underwater resources and oil fields, and not fishing alone, as an important part of national wealth.

Westerdahl has subsequently broadened his definition of maritime cultural landscape as: 'the archaeological concept combining sea and land would be the maritime cultural landscape. It means that the starting point for the subject of maritime archaeology is maritime culture' (Westerdahl 1998). If the holistic approach proposed by this document and the concept of 'Source to Sea' is to be developed, this demands that an even more wide-ranging view be taken, which encompasses modern as well as historic popular culture, to re-define and broaden the definition of marine and maritime cultural landscapes.

There can be no doubt that the maritime and marine historic environment in Scotland enjoys an enviable status with regard to the broad and varied resource located off its coasts, along its coastline, within its estuaries, and inter-connected to the network of inland waters. This research framework was developed in a period of legislative change, and one where there is a growing awareness of the maritime and marine historic resource. As a nation, and as members of the international community, there exists a need to fulfil the obligations conferred for the better understanding, management and conservation of our maritime cultural heritage. An important way in which this goal can be approached is through this cross-sector, thematic research framework document.

European marine cultural heritage obligations such as those set out in the United Nations Convention on the Law of the Sea (UNCLOS) [1] 1982, the European Convention on the

[1] http://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm accessed 28 December 2012

Protection of the Archaeological Heritage (Revised) 1992, (the Valletta Convention) and the UNESCO Convention on the Protection of the Underwater Cultural Heritage[2] 2001 have influenced the exciting developments for the protection of the resource within the UK; notably the UK Marine and Coastal Access Act 2009, and more significantly in the case of this framework, the Marine (Scotland) Act 2010. Statutory bodies and NGOs have worked hard to provide a voice for the maritime and marine historic environment and to ensure there is a place for the historic environment in the new legislation. This is an encouraging start, and hopefully one around which a research framework can grow and develop.

In March 2009 Historic Scotland published a discussion paper, *Towards a Strategy for the Marine Historic Environment* as a result of a wide-ranging consultation. The paper set out the challenges and opportunities that, at that time, lay ahead with regard to the marine historic environment, not only at a national strategic level, but also in regional and local contexts. In addition, the '*Desirable Outcomes*' section also considers how future strategies and initiatives can be measured, indicating areas where this framework can be influential in helping shape how we approach marine and maritime research at a strategic national and regional level. Examples include areas such as 'Challenges and Future Directions' - an identified theme within this framework and one where useful cross-referencing will benefit the development of a long-term and sustainable framework. By effective integration of the objectives of the Marine (Scotland) Act 2010, and those highlighted in the discussion paper, the framework can provide a useful basis for academic and voluntary sector research interests. It is also a useful curatorial tool in helping guide national and local government when making decisions with regard to the priorities for the effective management and understanding of the maritime and marine historic environment.

In addition, this research framework document can also help influence relevant policies and legislation that exist for other areas. This includes terrestrial policies and plans and those of Museums and Galleries concerning the effective management of their maritime material culture and monuments such as historic ships and vessels. Indeed, this inclusive cross sector approach is embodied in the overarching theme throughout this framework, namely 'From Source to Sea'. As will become clear, this approach aims to promote an overarching, holistic and integrated mechanism upon which all areas of the archaeological discipline, at all levels, can actively contribute to understanding of the maritime and marine historic environment. In this respect, it is also important to employ a pro-active position in ensuring full co-operation with trans-boundary research frameworks, such as those in the rest of the UK and beyond.

1.2 From Source to Sea: the scope and remit of the Marine and Maritime Panel

This contiguity of archaeological relationships from the palaeo-seabed to upland rivers led the panel to term its remit 'From Source to Sea', encapsulating the interrelationship of all aspects of human activity that ultimately link archaeological sites to the maritime zone. This wide-ranging definition of the marine and maritime resource requires a holistic approach: the panel addressed the subject in thematic terms, but these themes ranged in type and definition, some geographical (e.g. Coastal Hinterlands, Inland Waters), some site-specific (Ships and Vessels) and some methodological (Submerged Landscapes). This diversity is both a

[2] http://unesdoc.unesco.org/images/0012/001260/126065e.pdf accessed 28 December 2012

reflection of the difficulties of setting remit boundaries discussed below, but also a reflection of the diversity of approaches taken to the archaeology of the marine and maritime environment.

The first task facing each of the ScARF thematic panels is also the largest and most problematic: that of defining the scope of the remit of the panel. In the case of the Marine and Maritime panel, this task was particularly difficult: arguably, with such a high ratio of coastline to land area and with nowhere further than around 80 km from the sea, all of Scotland can be considered maritime. Unlike other panels, the scope of the Marine and Maritime panel was not restricted to any particular chronological range, nor to any geographical region. In defining the remit, the panel necessarily took an inclusive approach to the maritime resource, so that shipwrecks form only one element of the material record of people's interaction with the sea and the coastal zone. All aspects of past human activity whether directly related to the exploitation of the marine environment, or simply located in a maritime setting, were considered to be under the panel's jurisdiction. Such a view leads archaeology of all types to be relevant to this research framework and therefore this document is cross-cutting and inter-leaves with the other ScARF panel research documents. Settlement sites of the earliest hunter-gatherers, prehistoric inundated landscapes, medieval fortifications, historic shipwrecks, fish-traps, modern harbours and vessels still afloat, are all considered part of our surviving maritime heritage. Furthermore, the direct linkage of inland waterways to the coast as 'arteries' of communication, trade and transport, means that the archaeology and history of Scotland's extensive lochs, rivers and canals cannot be excluded – hence the introduction of the 'source to sea' approach.

1.3 Past Achievements, Future Directions

It is often a characteristic of new research agendas that the achievements of past research initiatives are portrayed as incomplete or inadequate, while new directions are listed as the routes to understanding. This, however, would not be an accurate portrayal of the history - or future - of marine and maritime archaeology in Scotland. Archaeological studies of human interaction with the sea have a long history in Scotland, while maritime research in the traditional sense - such as underwater excavations and surveys of shipwrecks - has been a long standing strength. The primary aim of this panel was to identify, collate and summarise the achievements of this previous research as a premise for the identification of the most productive avenues of future research. The changes of 2008 to 2012 (including the Marine [Scotland] Act 2010 and the formation of Marine Scotland) in the marine and maritime sector in Scotland have been positive advances and change is continuing apace: this will be reflected in the changing understandings set out in this, and future, frameworks.

In order to build a holistic approach to the marine and maritime environment, a number of approaches need to be explored, preferably in combination and through collaboration. This includes adopting a *sea-oriented perspective*. Approaching marine and maritime landscapes from the perspective of the sea, both metaphorically and physically by boat, enables researchers to experience seascapes as people would have done, prior to the automobile age. The researcher has to understand landing and launching places, navigation aids, currents, tides and winds, and where sources of certain resources, such as fresh water, can be found. This approach demands an understanding or a source of local knowledge and experience, which is often lost or rarely encountered.

However, historic maps, charts and local knowledge combined can lead to fruitful insights into the maritime geography and history of an area.

Landscape-scale approaches demand limits and islands are particularly suitable as study areas in this respect. Similarly waterways are readily defined by watershed and other factors, whereas sea routes are infinite in variability and the boundaries of study may be more usefully defined by the commerci*al.* political or economic objectives of the navigation. At the other end of the geographical spectrum *site-scale* researches of Scotland's marine and maritime cultural landscapes focus on exemplars such as log-boats, shipwrecks, fish-traps, navigation aids, cleared landing places, vernacular quays and buildings associated with fishing and boats, all of which may lead out into the wider issues alluded to above. Consideration of the land from the sea also gives the advantage of perceiving the land as a transient surface, one that is constantly changing. The present day shore line is but one boundary in an infinite and ever-changing environment that humans have interacted with and adapted to throughout history.

Finally, *artefact and literary study* approaches look at cultural objects and events as indicative of connections, both physical and psychologic*al.* with the sea, from fishing weights and sextants to place-names and sea-shanties, but also to 'associations' such as Capstan navy cut cigarettes, launched in 1894 and is still sold today under the same brand name. This product uses a capstan as a logo, an image redolent in contemporary culture of the 'manly' virtues of strength and teamwork, bonded to the peerless prestige of the pre 1914 Royal Navy.

It is an important aim of this panel to highlight the wealth and diversity of Scotland's maritime archaeological resource, but central to this aim must be the move away from the stereotypical view of 'Maritime Archaeology' as a specialist sub-division of the mainstream discipline. For many reasons, considering maritime archaeology as a specialism is misleading and particularly so, perhaps, in Scotland where marine and maritime culture has pervaded all aspects of human activity in all periods. It is intended that this framework document be used alongside those of the other panels, with the research directions outlined here aligning and complementing those of the other thematic and chronological subject areas

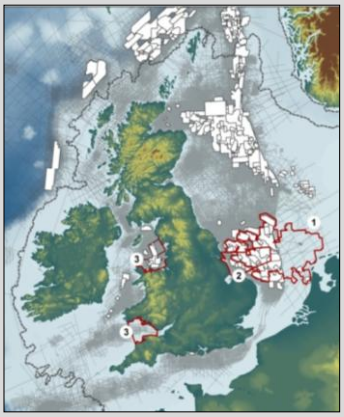
1.4 Panel Themes

The following themes were used to structure the panel report, and a number of recommendations have been made under each theme.

Theme 1: Submerged Landscapes

This synthesis represents an evaluation of palaeo-environmental reconstruction of the present day Scottish coastal corridor (supra-tidal and inter-tidal zone) out to the sub-tid*al.* shelf. It addresses the geographic areas, their particular geological history and the inter-woven prehistoric occupation. The aim of the evaluation was to provide a better understanding of palaeo-environmental reconstruction within the Scottish remit of marine archaeology. The **main recommendations** are the need for:

- Increased precision data on relative sea-level change, especially for island groups.
- Detailed mapping of Scotland showing the coast at various dates and based on evidence, not modelling.
- Predictive modelling for submerged site survi*val.* including 3D modelling derived from the energy and aggregate industries (third party) sources.
- Survey for submerged sites in high-potential locations.
- A database of submerged palaeo-environmental information.
- Work on northern Doggerland and other potential submerged landscapes around Scotland's coastline, which could form part of the current SPLASHCOS EU initiative.



Theme 2: Coastal, Intertidal and Maritime Hinterland

Scotland's coastal and intertidal zones and maritime hinterland is a vast subject area that encompasses a very broad range of archaeological sites. This allows for a massively diverse range of research areas to be pursued. The boundary between the land and the sea is blurred both physically and politically, and hence legislation within the intertidal zone can become confused. The **main recommendations** of this theme include:

- To develop a series of partnership projects to undertake a holistic, multi-disciplinary approach to an area, such as a major Scottish Firth, researching the coastal. intertidal and maritime hinterland archaeology, as outlined in the proposed 'Source to Sea' approach.

- To assimilate all specialised datasets into a national database which could be accessed digitally and would enable marine historic environment data to be characterised.

- To develop site-specific approaches to coastal and marine archaeology which can be chronologi*cal.* thematic or a mixture of the two. Examples include researching fish-traps on a national scale and developing the work already undertaken on marine crannogs.

- Explore the whole spectrum of transport infrastructure, including historic and prehistoric ports, harbours, portages, landing places, fords and bridges.

Theme 3: Inland Waters

For the purposes of this framework, 'Inland Waters' include freshwater environments such as lochs, major rivers, and canals and navigations. By their very nature, inland waters are an integral part, and an extension of the maritime networks around our coasts and estuaries. In many cases aspects of the cultural fabric of Scotland's maritime identity emanate from contact between communities located along our coasts and those situated along these inland 'arteries'. The very nature of the resource, physically and culturally, displays very real synergy with the 'maritime' sphere; and in the case of lochs and rivers, the very medium that is under exploitation. The **main recommendations** of this theme are:

- To focus study on crannog contexts within their wider landscape particularly of the earliest (Neolithic or earlier) and latest (Medieval and post-Medieval) sites.

- To survey under-studied areas in Scotland such as the north Highlands, as well as the remaining parts of the better known areas. This should include underwater survey using remote sensing in order to obtain coverage of large areas and identify the full range of submerged structures to be found in Scotland's lochs.

- To develop 'topical' research in areas such as boatbuilding and shipbuilding.

- To foster partnership projects encompassing rivers and navigations and the mapping of the development of riverine, lacustrine and canal contexts, particularly in connection with arteries to more extensive settlements connected with the sea. This will allow understanding of how people exploited inland waterways and interacted with the coast in a 'Source to Sea' style approach.

Theme 4: Ships and Vessels

Given the vast number of ships and vessels lying as wrecks around Scotland's coasts, it is useful to attempt to categorise them, define them and identify gaps in their research and future approaches to these vital archaeological resources. This chapter outlines the range of archaeological potential of extant vessels, discusses the range and potential of early watercraft, such as log-boats, and defines the archaeologic*al.* historical and wider potential of shipwreck archaeology. The **main recommendations** of this theme include:

- To develop a dating programme for the early vessels of Scotland in partnership with national and local strategies. Early watercraft provide a window into prehistoric settlement, exchange, communication, and belief and archaeological data should be integrated within this wider context.

- To match multi-disciplinary techniques of interpretation and synthesis, with recent technological advances, particularly in the field of non-intrusive survey techniques. The application of such techniques to shipwrecks and extant vessels offers a remarkable opportunity to provide information on the economy of maritime communities.

- To promote and pursue, creative approaches to capture the public imagination and offer the opportunity to provide a context for involving wider communities in educational outreach. Extant vessels and shipwrecks as well as ship and boat-building sites can be seminal for raising awareness of the maritime historic environment generally and can be employed for engaging wider communities and disseminating research as well as providing a rich potential research resource for all periods.

- To promote collaboration between different individuals and institutions in order to ensure that the skills and relevant infrastructure are available to meet all future needs. Realising the potential of, what is almost always fortuitous, discovery requires enhanced archaeological capacity in survey, excavation, post-excavation and subsequent analysis and publication.

- To treat research and analysis into watercraft of any period holistically, integrated within the wider maritime environment. This can be undertaken by applying the methodology, exemplified in the 'Source to Sea' approach.

Theme 5: Challenges and Future Directions

Addressing the challenges and considering future directions will allow a holistic treatment of the rich legacy that the marine and maritime historic environment provides. A number of **strategic recommendations** are proposed:

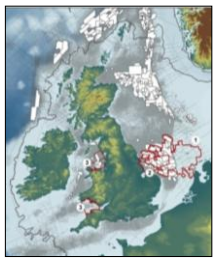
- To raise the international profile of Scottish Maritime Heritage. Research into aspects of Scotland's marine and maritime heritage should be considered in terms of loc*al.* region*al.* national and international contexts. International synthesis should be encouraged in order to highlight the contribution that the Scottish evidence provides to broader understandings of marine and maritime landscapes.

- To broaden the basis of data retrieval to include every available and relevant source, technique and academic discipline. Due to the pervasive nature of the Marine and Maritime historic landscape, a holistic approach must be more fully adopted that incorporates evidence from a variety of sources, including, but not limited to: commercial and research archaeology; off-shore development; local and national societies; techniques including photography and geophysics; and disciplines including history; ethnology; cultural studies; folklore; and architecture.

- To explore collaboration beyond archaeology in order to ensure the capacity to meet research challenges while providing the experience and perspective to ensure research of the highest quality.

- To create a Research Focus that incorporates the complexity of the record and allow full and rich explorations of the past. By considering the areas of research highlighted throughout this document, and by addressing the challenges through collaboration, holistic 'Source to Sea' projects will provide a focus for research.

- To strengthen and broaden the marine and maritime research knowledge-base, which is created, maintained and promoted by and in partnership with regional and historic environment records organisations.



2. Submerged Landscapes

2.1 Introduction

Research of the submerged coastal corridor is by necessity a multi-disciplinary activity that requires adoption and adaptation of both marine and land survey techniques. Many of these have been extensively developed within their own sub-disciplines and it is recognised that it is vital in this research framework, not to repeat current and recent work, but to flag up its presence and indicate where Scotland fits within global palaeo-landscape reconstructions, and thus has direct implications for Scottish submerged archaeological landscape research.

Considerable recent research has highlighted the potential offered by palaeo-landscape reconstruction across the land-sea divide (e.g. Bates *et al.* 2007; Ryan and Pitman 2000; Ballard *et al*. 2000; Stight 1986; Faught 1988; Lambeck 1996). A recent publication (Benjamin *et al.* 2011) provides examples from around the world of research approaches, topics, and methods, highlighting the breadth and variety of results from research into the submerged past.

A number of specific pointers can be immediately highlighted which help to interlink this chapter with external research networks and specifically with the ScARF Palaeolithic and Mesolithic panel document. Three particular areas of research are highlighted here; site types, geomorphological conditions and sedimentary regimes, which are directly linked to the potential for survival (and detection) of submerged archaeology.

Site typologies must currently be based on the known terrestrial Mesolithic and Neolithic sites from Scotland, with additional typologies imported from appropriate comparable countries, such as Ireland, Northern France, the Baltic Sea region (e.g. Fischer, 1995b) and other parts of the North Sea and from Continental Europe.

Extensive and intensive research into geomorphological development has been undertaken across Scotland, although not necessarily directly related to archaeological site survival and detection. However, literature reviews of such published research concerned with shallow water environments, such as Scottish firths, with potentially improved preservation qualities, should be recognised as of high priority for this theme. It is considered that this is a low-cost, high return methodology, which would pay dividends for this research theme.

Similar issues affect sedimentary regimes, so that reviewing existing research material must be recognised as a priority, in order that existing models can be tested and improved with more data points, based on geotechnical assessments of sedimentary datasets, which demonstrate inundation and hence increase the possibility of site preservation.

The following synthesis represents an evaluation of palaeo-environmental reconstruction of the present day Scottish coastal corridor (the intertidal zone and above) out to the sub-tidal shelf. It addresses given geographic areas, their particular geological history and the known inter-woven prehistoric occupation. The aim of the evaluation is to provide a better understanding of current palaeo-environmental reconstruction within the Scottish remit of marine archaeology.

A number of objectives are proposed in fulfilling this aim: to address issues with palaeo-environmental reconstruction, both specific to

Scottish waters, and generically with reconstructions of similar drowned landscapes; to construct a research data base of areas previously researched spatially and temporally; to provide an up to date characterization of archaeological seascape zones within Scottish waters; to complete a brief review of survey methods that are successfully applied to palaeo-environmental reconstruction; to compile a list of work conducted to date - who has done what and where; to review the current capacity to meet future investigation needs; to propose a way forward for future investigation.

2.2 Background – previous work

Scotland and its surrounding shelf area have undergone significant changes over the last 1Ma from the impacts of global glacial to inter-glacial cycles. In particular, over the last 500,000yrs Scotland has experienced at least 6 periods of glaciation with lowering of sea-level to a maximum of c -120m below the present day level. Each of the glacial periods, however, has been separated by intervals characterised by interglacial conditions where exposed landmasses extended terrestrial habitats into large landscapes with favourable conditions for human occupation (Coles, 1998). Subsequent glacial action and flooding by the sea with associated sea level rise have led to conditions conducive to the erosion of these landscapes, and their associated evidence of human occupation. This combined with the general great difficulty today facing those investigating these presently flooded areas has resulted in a great scarcity of information or finds for the period prior to the Mesolithic in Scotland. Modern research techniques and new information resulting from increased activity in the offshore areas of the coast and shelf of Scotland will lead to increased finds and the accompanying increased knowledge of these earlier periods of occupation. This situation is clearly demonstrated in Denmark where commercial dredging activity has led to a quantum increase in material found related to human occupation on the now-drowned North Sea bed.

The coastal edges, near shore and shelf areas therefore have the potential not only to add additional knowledge to a missing period of archaeology, but have the potential to add new knowledge that cannot be gained from onshore sites.

2.2.1 Submerged Archaeological Potential – Scotland and the Palaeo-landscapes of the last 10,000yrs

The relative sea level history of Scotland during the Holocene (conventionally, if arbitrarily dated to the last 10,000 years i.e. approx. 8000 calBC-2000 calAD) is complex. This is due to the distribution and thickness of the overburden of ice when the last Scottish ice sheet covered the region and the different geological terrain that makes up Scotland. Ice cover was concentrated in the western Highlands with thinner areas of cover towards the peripheries of Scotland. Thus, the area around Oban in the west had greater thickness of ice than areas of the Outer Hebrides, the North coast and the Northern Isles. This has led to varying amounts of isostatic rebound or subsidence and therefore, the position in the landscape where we see relict shorelines today. For the Oban area, this translates to visible shorelines dated to c.10ka yrs (c.8000 calBC) up to 10 metres above present OD. However, the same Lateglacial Shoreline is well below present sea level on the islands of Coll and Tiree, Islay and along the Solway coastline. Predicted shorelines for the Outer Hebrides and the Orkney Isles suggest they are located between 20-30 metres below present OD.

The net result of relative sea level change for Scotland is thus that there are areas where the sea bed has been dry land within the last 10,000 years. As this is the period within which

Scotland has a comprehensive record of settlement, it is likely that these areas were once settled. They offer the possibility that submerged archaeological sites may be preserved. Perhaps the best known area is that around the archipelago of Orkney where sea did not reach present levels until about 4000 years ago, but another area lies to the west of the Western Isles, and there are small localized areas elsewhere, e.g. around Coll, Tiree and Islay. Although there is no specific data on relative sea level rise for some of these areas, it is assumed that sea level reached roughly its present level between 5000-3000 years ago suggesting that any submerged archaeological sites are likely to relate to Mesolithic or early Neolithic settlement. Interestingly, both Orkney and the Western Isles stand out from the rest of Scotland in that they currently have little evidence on land for Mesolithic settlement (with some exceptions). Mesolithic sites are few and far between in Orkney and lacking (with the exception of a few dates on anthropogenic deposits) in the Western Isles. Given the importance of coastal resources in the Mesolithic and the apparent concentration of sites around Scotland's coastlands this may be significant as an indication that evidence for the first 5000 years of human settlement in these areas is lying in the present off shore area. Recent field research in Orkney suggests the possible preservation of stone structures relating to the Neolithic on the seabed (Wickham-Jones, Dawson & Bates, 2009; Dawson and Wickham Jones 2009). A recently published paper has proposed an approach for investigating the potential for submerged archaeology to have survived in other parts of Scotland, particularly the northwest (Benjamin 2010).

It is also worth remembering that large areas of the Scottish shelf have been dry land for considerable periods in the last 700,000 years – the period of human (Palaeolithic) settlement in Britain. England and Wales have a good record of early settlement sites, particularly in the south, but there are no dated Palaeolithic sites in Scotland so far. Environmental and osteological evidence suggests that this submerged landscape has, at times, been suitable for human settlement and it is possible that surviving Palaeolithic sites from the "Scottish sector" of the sea bed still survive, comparable sites on land having been destroyed or buried by the actions of the last Ice Age which blanketed mainland Scotland.

Submerged archaeology will comprise a considerable resource for Scotland, a resource that, unlike other parts of Britain (see below), is relatively unexplored in Scotland to date. With the increased pressures on the submarine landscape as a result of renewable energy sources and supplies, archaeologists are faced with opportunities to investigate our submerged landscapes that have not previously been possible.

2.3 Strategic Environmental Assessment for Submerged Archaeology

Scottish waters contain a large range of potential sites for preservation of archaeological material. Sites can be broadly classified into a number of different types based on morphology of the landscape, the glacial history and the nature of deposits. Over the last 5 years the Aggregate Levy Sustainability fund[3], managed by English Heritage, has

[3] Other activity under the ALSF programme included reviews of methodologies for conducting onshore-offshore landscape reconstructions. See for example work in the Arun to Solent areas (Bates *et al.* 2007) and other projects in the Black Sea (Ryan and Pitman, 2000; Ballard *et al.* 2000), Florida Gulf (Stight 1986; Faught 1988) and Gulf of Arabia (Lambeck 1996).

provided support for a number of projects around the coast of the UK in English Territorial Waters aimed at producing wide area seascapes. Seascapes[4] include evaluations of both the present day archaeological heritage at the seafloor and an evaluation of palaeo-landscapes. No seascape type study has yet been conducted in Scottish Waters however a suite of studies has been undertaken by the Department for Business, Enterprise and Regulatory Reform (BERR, formally the DTI) in the form of Strategic Environmental Assessments (SEA) of North Sea Areas[5]. The relevant areas for Scotland include SEA regions 2, 4, 5, 6 and 7. For each of these an evaluation of the archaeological potential of the shelf and near-shore areas has been made although the earlier reviews, in particular for regions 2, 4, 5 and 6 are somewhat outdated in terms of information from the most recent surveys and analysis. The review forms a useful basis to begin considering the offshore areas of Scotland, however, additional detail is suggested where specific land or sea features are known to be of importance.

[4] The Seascapes programme was designed to extend the historic landscape characterization to England's coastal and marine zones. For a review of the overall programme see Seascapes Review, ALSF 5254MAIN: http://ads.ahds.ac.uk/catalogue/archive/seascapes_eh_2008/, while specific regions are also available, e.g. Solent and Isle of Wight http://ads.ahds.ac.uk/catalogue/archive/ehssolent_eh_2007/

[5] http://www.offshore-sea.org.uk/site/scripts/sea_archive.php

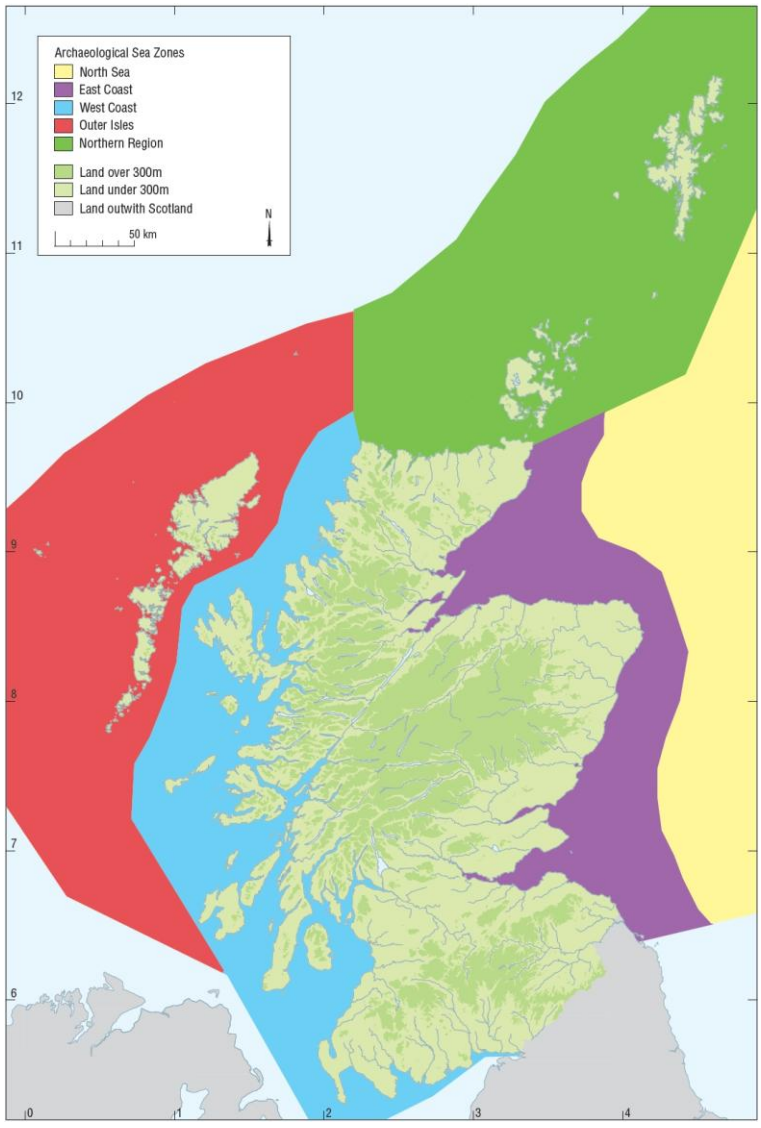


Figure 1: The Scottish coastal and off-shore waters, divided for the purposes of the Strategic Environmental Assessment (SEA) regions, in order that they could be evaluated for cultural heritage potential © BERR.

2.4 Challenges

A number of problems exist with surveying the coastal to shelf sites in Scotland, some of which are particular to the geographical and historical development of the coast and some of which are generic to all coastal landscapes.

2.4.1 Surveying in Hostile Waters

The current depth (up to 150m of water depth) and hostility (storms, wave, currents) of the North Sea has limited archaeological investigations to date. However, recent developments in survey techniques, such as with remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs), are starting to make significant progress to addressing the difficulties and allowing high quality surveying in marginal conditions.

2.4.2 Glacial History

The glacial history of Scotland and the Scottish shelf show a complex sequence of advances and retreats over the last 500,000yrs with field evidence for at least two of the major periods of glacial maximum, the Anglian and Late Devensian (LGM). At their maximum extent the impact of glaciations was not only to cover and scour the land but also to cause significant compression of the land under the weight of the ice with a complimentary bulge in the land beyond the ice limits. However, debate still exists among glaciologists as to whether the last Scottish ice sheet encompassed the Orkney Islands. On retreat, isostatic readjustment of the land surface combined with global eustatic sea level rises resulted in a complex history of flooding and emergence of both seafloor and landmass. Recent investigation and modeling of ice cover has provided a new understanding of palaeo-landmass areas that were available for occupation at different time periods. In particular, low relative sea levels around 10,000 years ago create one large land mass in Orkney and extensive land areas along the entire coast of the Western Isles (SEA4 and SEA7).

2.4.3 Key-hole investigations

A major issue results in the scale problem associated with the large area under investigation, an area that is significantly larger than the onshore Scottish landmass, and the isolated nature of the few finds that have been reported. Placing these small numbers of finds within a larger picture rather than a set of discrete observations requires paradigmatic modelling and an understanding of palaeo-landscapes on a European-wide scale - models that currently may need to be developed. There is a very real danger, due to the lack of contextual information, that isolated finds are interpreted as potential hotspots of activity and thus disproportionately awarding high significance to the finds and the position of the finds within any palaeo-landscapes.

2.4.4 Use of the Landscape

It is speculated that humans have occupied the UK landmass for at least the last 700,000yrs (Parfitt et al., 2005) with strong evidence for presence from at least 500,000yrs. Little hard evidence exists for human settlement in Scotland before approximately 11,000yrs ago, however the lack of direct evidence does not mean that humans did not occupy and use the Scottish land mass and the now submerged land surrounding Scotland. Sites have been reported elsewhere that experienced the over-running of ice and potential loss of evidence, for example at High lodge, Mildenhall (Ashton and Cook 1990). Furthermore, sites have been described in similar northern provinces, such as Russia, where occupation is recorded as far back as 40,000yrs ago (Pavlov *et al.* 2001). At these sites, clear occupation and use of areas very close to the ice margin are reported that demonstrate the importance of not only the coastal corridor but also the bountiful seas that are typically associated with marine ice margins. It could be argued that it is precisely these ice

margins that are the most likely areas to find evidence of occupation.

2.4.5 Buried Surfaces

Many of the surfaces that are of interest are deeply buried. This applies particularly to the Palaeolithic surfaces, while the Mesolithic surfaces possibly lie closer to the present day seafloor. Reconstructing palaeo-landscapes requires spatial data derived not only from the surface, but from lower sediments as well (Gaffney et al 2007). However the methods typically used for data collection tend to be based on point sampling or line transects. It is therefore always necessary that some form of extrapolation is undertaken between the measurements. All forms of extrapolation and modeling require assumptions and so the resulting surfaces are products only as good as the assumptions. The assumptions leading to the final model are typically based on similar landscapes elsewhere, however it is important to remember that these might not be wholly appropriate to the ones being mapped. It is recommended that a Scottish-based context model should be established for future interpretations.

2.4.6 Preservation potential

Preservation of archaeology is a consequence of a number of factors including geomorphology, in particular island archipelagos, gully formation, sediment type (gravel, clay, silt, peat etc), exposure of setting.

Sediment type: The sediment type will affect the survival of archaeological remains. Wenban-Smith (2002) indicates that the burial of intercalated organic deposits within fine-grained and cohesive materials (clays and silts) presents a situation that is more resistant to exposure and erosion. Gravel has also been highlighted as an important sediment with examples of well preserved artifacts recovered from both terrestrial and marine units.

Flooding event: The speed at which a material is covered by a flooding event influences the preservation, in particular if the material is not subject to the effects of wave impact within the surf zone for prolonged periods. It may well be the case that very rapid burial of landscapes by the rising sea level during the early Holocene would lead to a likelihood of survival and not erosion in sheltered coastal localities. The preservation is particularly dependent on the elements of erosion subsequent to the deposition of the units. This however is difficult to assess, rather it is the end results, that is if a deposit exists or it has been eroded that is measured. Scotland has a complex sealevel history that has significant variation both temporally and laterally, thus an increased number of site specific sealevel curves are necessary in order to better map the variation.

Morphology: The morphology of the palaeo-landscape can dictate not only the type of material upon which the archaeology is initially deposited but also the likelihood of that material being subsequently eroded. For example, very good preservation potential sites are offered by caves where subsequent erosive environments such as ice erosion often passes the cave system by. This is particularly the case when the cave openings are in the lee of the advancing ice fronts. An example of this is the Pontnewydd Caves in North Wales where sequences with Neanderthal material are preserved in a glaciated landscape. Ulva cave, off the Isle of Mull provides an example of this type in Scottish waters.

Other situations where preservation potential is enhanced due to the local topography are small erosive gullies subsequently in-filled by material and the sides of river or estuary systems, and areas where large local topographic changes result in sheltered waters such as coastal

indentations, lagoons and near-shore island archipelagos.

2.5 Summary of Marine Palaeo-studies in Scotland

2.5.1 Western Scotland

There is the potential for surviving prehistoric archaeology (10,000 – 5000 years old) most notably to the west of the Western Isles for a distance of some 10km, to a depth of -20m below present OD, and in and among the islands elsewhere (particularly around Islay, Jura, Mull and the Small Isles) along the coast and between S Scotland and N Ireland. The reasons comprise a complex interplay of changing sea -level and the rebound of the land once freed from the depression by ice loading at the end of the last Ice Age. The net result of these physical effects is that 10,000 years ago relative sea level was up to 45m lower along much of the coast and this corresponds with the period of early human settlement in the area. In places this means that considerable areas of submerged land exist. An investigation of bathymetric, sedimentary and tidal data for the area suggests that the prehistoric land surface, including any associated archaeological remains, may survive in many places.

Any archaeological remains that might be found would be highly significant because early remains are so far rare on the islands. Elsewhere in Scotland, archaeological material from this time indicates the importance of the coast suggesting that it is along those submerged coastlands that one might expect to find indications of early settlement, and thus, incidentally, providing one reason why so few remains have been found among the outer islands and coast of western Scotland.

Shiant Isles **-** In 1991 a scallop boat dredged a Bronze Age gold torc from the seabed near the Shiant Isles (Cowie 1994). This artefact dates to the Bronze Age. The characteristics of the Sound of Shiant mean that this artefact could have travelled here from some distance, but the find is also an indication that similar prehistoric material might occur elsewhere on the seabed, but without suitable environmental context this is unknown at present.

Sound of Jura **-** In 1981 a group of divers recovered a gold arm-ring from the sea bed near to Ruadh Sgeir at the north end of the Sound of Jura (Graham-Campbell, 1983). This artefact has been dated to the Viking period, probably 10th century AD, and is assumed to have resulted from a loss at sea. Again it signifies the potential of the seabed for prehistoric remains that relate perhaps to the wider aspects of life rather than to direct settlement.

2.5.2 Northern Scotland

Orkney **-** Bay of Firth, Mainland. Rumours of a submerged chambered tomb following local diver description provide the only evidence in Scottish waters of a possible submerged landscape (Wickham-Jones and Dawson 2008). Geophysical investigation and diving in 2009, and 2010 confirmed the presence of layered stone slabbing, isolated large stones and large (up to 40m diameter) geometric seafloor features in water depths of 1-7m.Seafloor sediment coring in 2011 was undertaken to provide geoarchaeological context to the sites. Full archaeological investigation will be necessary to determine the exact morphology and possible purpose of these features.

The Rising Tide **– Orkney** A project to assess changes in former relative sea-levels and the potential for preservation of archaeological material on the sea-bed[6].

[6] Information to date downloadable from the research section of: http://www.abdn.ac.uk/archaeology/staff/staff.php

2.5.3 Eastern Scotland

North Sea **-** The southern North Sea holds abundant evidence for submerged landscapes and evidence of occupation in Doggerland (Gaffney *et al.* 2007, 2009).

In the northern sector of the North Sea the fossil evidence is spread more thinly and is more fragmentary. The species of mammal recorded from the Scottish North Sea are (in order of abundance of fossils): reindeer, *Rangifer tarandus*; bison, *Bison* sp.; musk-ox, *Ovibos moschatus*; woolly mammoth, *Mammuthus primigenius*; red deer, *Cervus elaphus*; and some woolly rhino, *Coelodonta antiquitatis* (Flemming 2003).

Artefacts, as opposed to unworked animal bone, from the North Sea are mainly to be found in the southern reaches, from the Brown Ridge area (Loewe Kooijmans, 1970-71; Verhart, 2004). With regard to Scotland finds of this kind are limited to a single worked flint from vibrocore number 60+01/46 obtained as part of a BGS programme in the UK shelf some 150km north-east off Lerwick, near Viking bank, in a water depth of 143m (Long *et al.* 1986). While it is possible that this find came from an area of dry land and is thus to be regarded as a submerged indication of prehistoric settlement, it is equally possible that it is the result of a loss at sea, either in ancient or recent times.

2.5.4 Potential finds and hotspots on the seabed.

There is great likelihood of finds relating to the Mesolithic (10,000BP – 6,000BP) and Neolithic (6,000BP – 4,000BP) periods on the shallower parts of the Scottish Shelf (down to c.-45m) in areas where the conditions for site preservation (see 2.4.6 above) can be met. There is also a high possibility of finds relating to the Palaeolithic period, prior to the Mesolithic, especially on lower stretches of the Scottish shelf, though it is difficult to pinpoint hotspots for this at present due to a lack of systematic research. Some known potential hotspots include drowned woodlands and submerged peats. Within Scotland there are many examples throughout the western and northern Isles that allow the potential for submerged and partially submerged landscapes. Notable sites include: Clachan Harbour, Raasay (Dawson 2009, Early Mesolithic lithics and intertidal wood and peats); Skaill Bay, Mainland Orkney; Sanday, Orkney (submerged forest); Borve, Benbecula (Ritchie, 1985, intertidal peats); Isle of Coll, intertidal peat (8,800 BP, Dawson *et al.* 2001). Projects that are aimed primarily at archaeology are currently scarce, however, projects that have studied the shelf and coastal areas for infrastructure development, hydrocarbon exploration, wind farms and aggregate exploitation do provide some measure of archaeological appraisal as part of marine planning guidance. This represents a considerable research opportunity if the various data sets can be synthesized.

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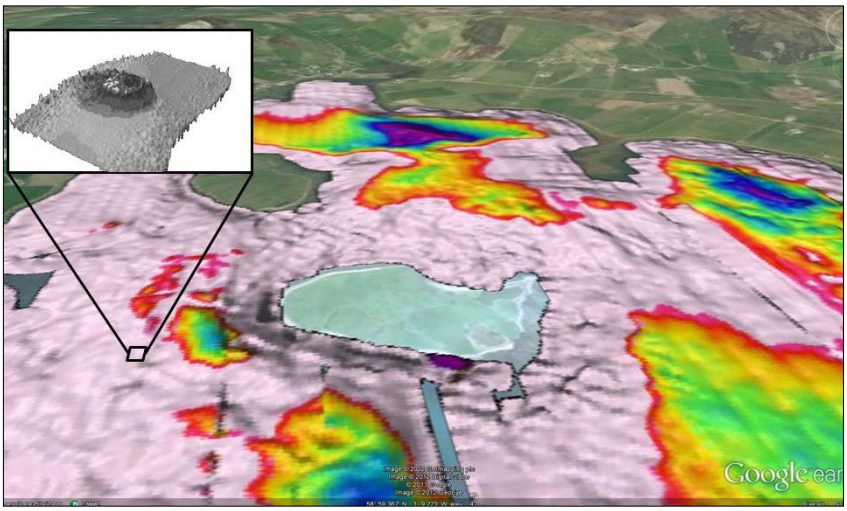


Figure 2: A reconstruction of sea level for the Bay of Firth and an image of the main mound feature located within it, reproduced courtesy of the Rising Tides Project and Richard Bates

Figure 3: Exposed intertidal peats on North Uist's west coast ©RCAHMS

2.5.5 Related Studies to Scottish Waters

Recent research at the University of Ulster, Coleraine has highlighted the previous existence of a low energy strait with various islands between the N Irish coast and the S Hebrides in the early Holocene (Cooper *et al*. 2002) thus confirming the importance of this area as a potential archaeological hotspot. Similar examples of the recognition of settlement opportunities in underwater contexts from the Baltic (e.g. Fischer, 1995b) are impressive, and include surprisingly early material. Momber and Campbell (2005) report on a Mesolithic cooking area, complete with hearth, oven pit, burnt stones, and nearby branches and timbers dating from about 7000 cal BC, at a depth of 12m, in the Solent. Quinn *et al*. (2000) describe on-going work in Northern Ireland; and Fitch *et al* (2005) publish the reconstruction of Mesolithic topographies in the Dogger Bank area or the North Sea. Some cross-cutting research networks have already been set up (e.g. the Submerged Landscapes Archaeological Network)

Submerged landscapes around the coast of Britain[7]

Bouldnor, Isle of Wight

Since 1998 the Hampshire and Wight Trust for Maritime Archaeology has been investigating a submerged archaeological landscape on the north coast of the Isle of Wight. The site lies -11m below present OD, and archaeological deposits comprising peat surfaces contained burnt flints, charred hazelnuts and worked timbers (Momber *et al.* 2011). This Mesolithic site demonstrates not only the preservation potential of this environment, but has focused on the fusion of both archaeological and palaeo-environmental datasets.

The North Sea Palaeolandscapes Project (Doggerland)

This collaborative, multi-disciplinary project was hosted within the University of Birmingham, funded by the Aggregates Levy Sustainability Fund and administered by English Heritage. It is a fine example of a multi-disciplinary, cross-sector project. Its aims were to investigate and interpret the submerged palaeo-landscapes of the southern part of the North Sea, known as Doggerland. This was undertaken using industry-generated and newly acquired 3D seismic datasets. Primarily, it mapped the palaeo-landscapes rather than identified archaeological sites, features and small finds.

Submerged Landscapes Archaeological Network (SLAN)

A recently established research initiative aims to provide an understanding of Ireland's and Newfoundland's submerged archaeological landscapes (Fig. 4). Facilitated by a Coracle Irish-Newfoundland Fellowship from the Memorial University of Newfoundland, a group of researchers recently came together in University College Dublin to share research experiences and opportunities in mapping submerged landscapes and archaeology. The main outcome of the meeting was the creation of the Submerged Landscapes Archaeological Network (SLAN), a consortium of researchers from universities and government agencies in Ireland, Northern Ireland and Newfoundland.

[7] Some other examples of significant work on submarine archaeology and landscapes around Britain include: http://www.arch.soton.ac.uk/Research/Aggregates//shelve-intro.htm; http://www.hwtma.org.uk/projects/bouldnor/index.htm; http://www.iaa.bham.ac.uk/research/fieldworkresearchthemes/projects/NorthSeaPalaeolandscapes/index.htm; http://www.wessexarch.co.uk/projects/marine/alsf/seabed_prehistory/2004-2007/map.html; http://www.bmapa.org/archaeology.htm; http://www.science.ulster.ac.uk/cma/slan/

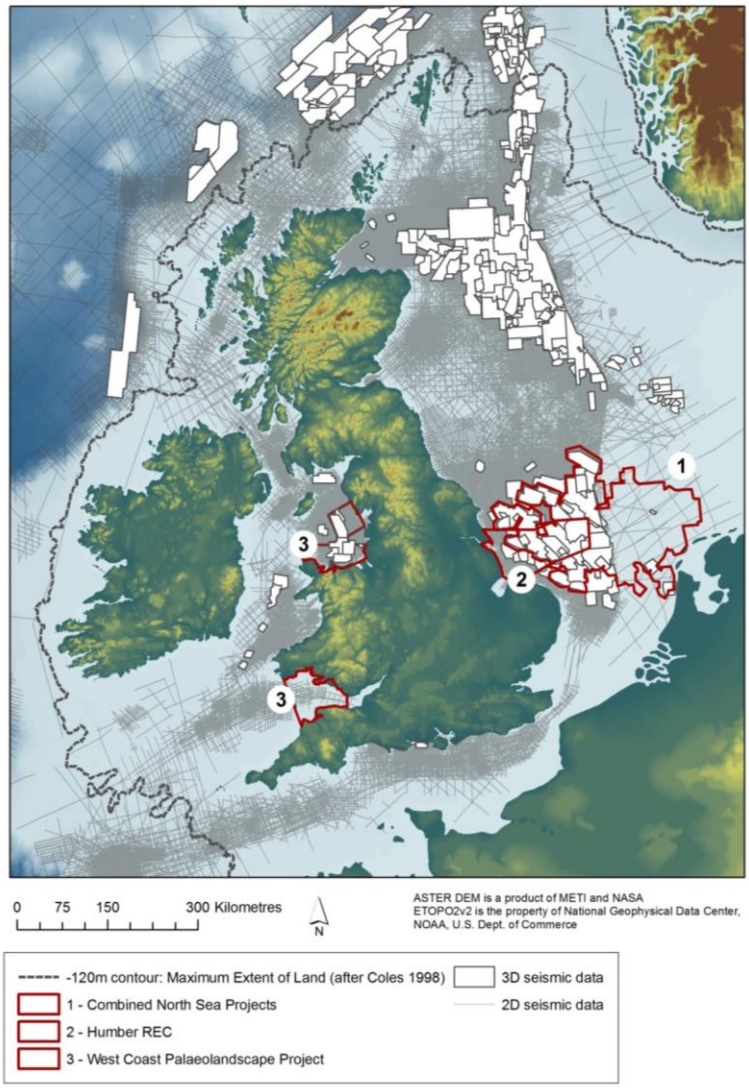


Figure 4: Extent of Doggerland project and others around Britain and Ireland, highlighting the potential for future work in Scottish waters and the data available (Fitch et al 2011), image reproduced courtesy of the North Sea Palaeolandscapes Project.

2.6 Methods

An increasing array of techniques is available for the investigation and mapping of palaeo-landscape surfaces that are both at the present seafloor and are currently buried beneath this. The techniques are applied as part of routine surveys for industry (oil and gas site surveys, pipe line studies, geotechnical investigations, wind farm developments) and occasionally as bespoke surveys for archaeology.

Notable recent work is that by the University of Birmingham (Gaffney et al., 2007, see Figure 4). This has demonstrated the significant potential that data previously acquired by the hydrocarbon industry has in mapping buried landscapes. The project, conducted in the southern North Sea, utilized a large 3D seismic data set to build near surface Holocene palaeo-landscape models. The project mapped early Mesolithic surfaces that consisted of a complex river system with lakes opening out into large estuaries along an embayed coastline. The project covered 23,000km^2 and provides the basis for targeted archaeology on likely habitation hot spots.

2.7 Current capacity[8]

The current capacity to investigate the coastal and offshore areas around Scotland includes both research capabilities and survey capacity. Organisations with research interests and capabilities for addressing the regions are available from the ScARF wiki. The table attempts to evaluate not only the academic capacity for study (the experience) but also the resources for study (field and laboratory facilities). A measure of the survey capacity in Scotland is also included. Individuals, companies and research organizations have been listed together with an indication of the resources and previous experience in different sectors (shallow water to deep water).

[8] The information on current capacity available online is fully updateable and organisations are encouraged to add their details where required.

2.8 Research recommendations

It is evident that there is considerable potential for a vast resource of archaeological information in the near shore zone surrounding Scotland. It is also evident that there is the capacity to meet the needs of investigation in this sector. However, this capacity is relatively diminutive when compared with the wide geographical spread of the potential material. There is clearly a need to build capacity in Scotland to address this through cross-sector collaboration on a number of key projects.

A systematic approach is needed in order to catalogue areas that need investigation. These areas should be subject to targeted investigations following a wide area assessment for palaeo-landscape reconstruction. Specific features of pilot projects should include:

- Increased precision data on relative sea-level change, especially for island groups.
- Detailed mapping of Scotland showing the coast at various dates and based on evidence, not modelling.
- Predictive modelling for submerged site survival including 3D modelling derived from the energy and aggregate industries (third party) sources.
- Survey for submerged sites in high-potential locations.
- A database of submerged palaeo-environmental information.
- Work on northern Doggerland and other potential submerged landscapes around Scotland's coastline, which could form part of the current SPLASHCOS[9] EU initiative.

[9] http://php.york.ac.uk/projects/splashcos/

3. Coastal Intertidal and Maritime Hinterland

3.1 Introduction

The 'Source to Sea' approach advocated pre-supposes a very broad range of archaeological sites and hence allows for a massively diverse range of research areas to be pursued. The boundary between the land and the sea becomes blurred both physically and politically, and hence heritage legislation within the intertidal zone can be difficult to apply consistently. Another issue is that historically the foreshore and inter-tidal zone appear to have fallen between two stools, so there is a backlog of monuments to be recorded and analysed. This is the result not only of administrative boundaries, but of a modern mindset seeing the landscape through the eyes of the motorist or walker, and underestimating the importance of the coast for transport and industry until the recent past. Scotland and England have adjoining intertidal zones in the Solway Firth and this will hopefully enhance both cross-boundary and cross sector projects and allow research to develop outside the constraint of modern political and administrative boundaries.

Past research into the heritage of Scotland's coastal and intertidal zones and maritime hinterland has largely been piecemeal and unsystematic, due, largely to this geographic and chronological diversity. Part of the cause is that Scotland, at 15,000km as measured on a 1:25000 map, has the second longest national coastline in Europe. There are more than 750 offshore islands around Scotland, contributing to well over half of the length of the total Scottish coastline. Although only 96 of the islands were inhabited during the 2001 census, many of the uninhabited islands show evidence of former habitation. Archaeological investigation in some of these offshore locations can be problematic, and this has led to the resource being only partially understood.

3.2 The coastal, intertidal and maritime hinterland heritage resource

Gale (2000) noted that there were five principal uses of the coast, including transport (including all types of boat and their associated docks, cleared ways and slipways); resource exploitation (including fishing, quarrying and the production of salt from sea water); defence (including castles, ramparts and anti-glider traps); leisure (including coastal golf links, piers and promenades); and waste disposal (including shell & other coastal middens and sewage outfalls).

Whereas this can provide a useful basic structure, it artificially separates connected phenomena and is not holistic in the same way as the 'Source to Sea' approach advocated in this framework. A large number of additions could be added to these five classes, including for example habitation sites and places of worship and burial grounds, as a manifestation of the importance of the coast and the sea in religious terms. In fact, almost every type of site found inland will have its equivalent at the coast, which raises an interesting question - should a coastal. intertidal and maritime hinterland research framework only include sites which are specific to the coast and would

Figure 5: Bute illustrates the indented nature of Scotland's coastline. The bay in the foreground has been occupied since the Bronze Age and the rich resources in the area attest to the location of the power base of Iron Age Dunagoil fort, in the distance. The monastic centre of Kingarth lies immediately to the right of the image, © RCAHMS

not be found elsewhere? If the answer to this is yes, then what of intertidal sites that were once inland, but now sit on the beach due to the dynamic nature of the coast? Or those sites buried under sand, an environment both formed and shifting due to coastal processes? What of dwelling houses at the coast edge, built end-on as protection against the prevailing wind?

A flexible approach is therefore needed that moves beyond strict categorisation. Where structure is required, the headings used to provide a framework for the coastal. intertidal and maritime hinterland will be as flexible as possible, and should not be seen as purely self-contained.

3.3 Previous and current coastal. intertidal and maritime hinterland archaeological research projects in Scotland

3.3.1 Coastal Zone Assessment Surveys

In order to help understand the resource better, Historic Scotland has sponsored a series of Coastal Zone Assessment Surveys (CZAS). These record baseline data on archaeological sites, geological and

geomorphological data and information on the erosion status of the coast. The surveys adhered to guidelines published by Historic Scotland (Historic Scotland 1996) and reporting was achieved through a series of maps and gazetteers. All CZAS reports have been digitised and are accessible on the SCAPE Trust's website[10].

To date, over 4,500km (30%) of the coast has been surveyed, recording c. 11,500 sites. The data is available on an interactive map on the SCAPE Trust's website, but a large number of sites are yet to be added to local or national archives. This information, coupled with SMR and RCAHMS database records, is vital for coastal research.

CZAS data collected before 2000 has been summarised (Dawson 2003) and a second study, which includes all sites located since 2000, has highlighted variability in the surveys and has made recommendations for future survey methodology (Dawson 2007). The CZAS reports contain recommendations for future work and a number of secondary research projects have already developed from these recommendations. However, over 3,500 of the recorded sites carry some form of recommendation for further study, and a project to prioritise these recommendations has recently been completed (Dawson 2010). A new project, asking members of the public to update CZAS records is planned to start in 2012. This will utilise interactive web-based mapping and mobile phone apps.

Figure 6: Members of the public using a mobile phone app to record eroding sites as part of SCAPE's new project to update the CZAS data, © SCAPE.

[10] www.scapetrust.org/html/czas.html

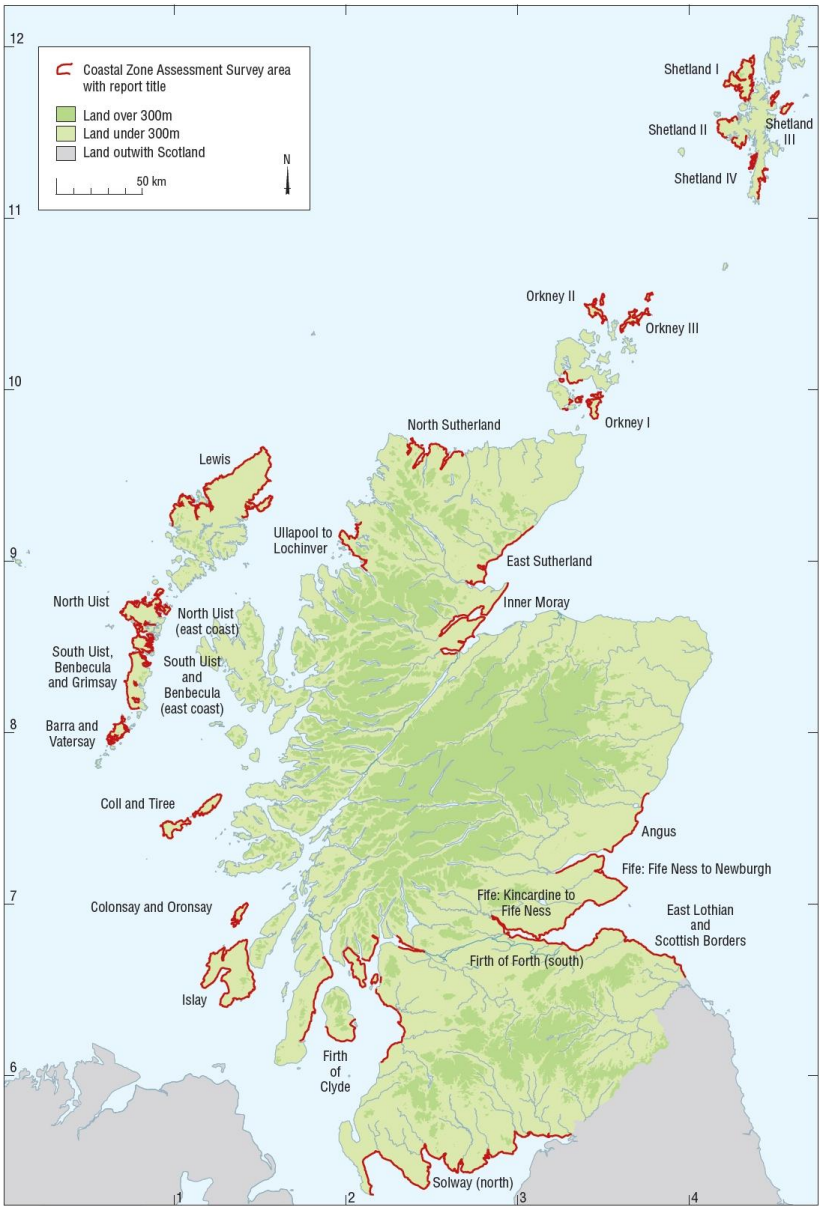


Figure 7: Coastal Zone Assessment Surveys (CZAS) from the 1990s onwards have produced a vast data set of coastal archaeology, erosion threats and an understanding of shoreline processes. This data is important for the future management, understanding and interpretation of the interaction of people with the coastline in the past. The surveys are a representative sample, but those areas that have not been surveyed could provide an opportunity for communities interested in the coast to survey and record, ©RCAHMS.

3.3.2 Maritime landscape studies

For the past 15 years Morvern Maritime Centre (a charitable company with research and educational objectives) has been investigating concepts of maritime landscapes through a survey of coastal features around Mull, Morvern, Ardnamurchan, the Lorn and Lochaber mainland and adjacent islands, and Skye. The research is now being conducted in partnership with RCAHMS through its aerial photography programme. Surveys include fish-traps, harbours and landing places, prehistoric and later fortified sites with maritime associations, and coastal industries (fishing, boat-building, quarrying, mining, metal processing, gunpowder, lime production, and kelp).

Figure 8: Hexakopter aerial drone and operator. Until recently, Morvern Maritime Centre surveys have been conducted with simple field equipment (plane table and tapes), with access where necessary by boat. In 2011, in conjunction with Edward Martin Photography, trials were conducted with a rotary-winged drone to obtain low-level vertical aerial photographs. These can be rectified geometrically as a basis for two-dimensional survey, allowing faster, accurate, and more detailed survey. Such survey systems are highly useful for coastal work, particularly in places of difficult access, © Colin Martin.

3.3.3 Subject area research

Small area studies (temporal. typological or spatial) have been undertaken around Scotland's shoreline and the following provides a flavour of the variety of different subjects covered, which reflect particular aspects of this environment and the specific issues that can be taken from this research and fed into the research framework. The range and breadth of research is vast and this alone poses an issue for gathering all sources together. If we look at some of the individual topics researched we can audit their approaches, assess the results and then begin to define gaps in our knowledge, which could be either real or as a result of project bias.

Transport and Infrastructure

Logboats stand out as one research topic that has been treated systematically and a corpus has been assessed and the results published (Mowat 1996, Gregory 1998). They illustrate a discrete topic that can be undertaken and a gazetteer produced, which can be used as a reference document as and when additional finds come to light. Another manifestation of transport is the large number of post-medieval wrecks found in the intertidal zone. For example, there are at least 13 boat wrecks lying in the intertidal zone on either side of the Firth of Forth, around Kincardine Bridge.

Harbour studies by Angus Graham have provided a useful base on which to build further research and survey (Graham 1967; 1969; 1977; 1984). Marine boathouses are an example of specialised coastal buildings, and one regional study has been published

(Martin and Martin, 2003). The huge number of cleared slipways, roughly built quays and landing places, combined with ferry crossings, fords and bridges, are all part of the transport infrastructure that has been in place for hundreds, if not thousands of years, and whose histories are poorly understood.

Havens, harbours, ports, docks, lighthouses, navigations, and harbour lights

Scotland's lengthy coastline, and the Scots' long association with seafaring as fishermen, merchant seamen and Navy men has resulted in the establishment of numerous havens, harbours and ports, inland and around the coast. Furthermore, travel by river, firth, sea-loch and open sea was a frequent part of the Scottish experience so that ferry harbours and slips can be found, marking crossing points in a communication network often unrelated to more recent patterns of land transport.

These features were sometimes merely sheltered open beaches, or proto-harbours created by clearing obstructions from narrow leads between skerries. On the whole, these sites are usually undeveloped and offer little in the way of archaeological evidence. In some cases however, evidence of rock- cut features such as landing steps and platforms can be seen in the rocky outcrops and skerries at landing places (e.g. at Castle Sands in St Andrews and the old boat harbour at Pittenweem in Fife).

At many points around the coast more elaborate structures were built, providing greater protection and convenience in harbours with one or more enclosed basins. The vast majority of these harbours are vernacular in scale, dependent upon the resources of local communities for their construction. Vernacular harbours comprise the most expensive endeavours these local communities have undertaken and the great cost of harbour works (arising from the harsh environmental challenges they must survive) often means that local harbours have evolved progressively through a series of historical stages, as funds became available.

This is in marked contrast to major commercial docks and harbours such as those at Glasgow and Leith, which have usually developed following parliamentary legislation and which were designed and constructed by renowned engineers, with the aid of central state funding. Developments in transport, trade and commerce in the late 18th and 19th centuries, combined with the advent of steam power, culminated in harbour and port expansions, both great and small, on an unprecedented scale. The relative independence of steamers from the vagaries of wind and weather gave rise to the era of timetables of regular sailings. This in turn demanded the ability to board vessels at any state of the tide, a requirement served by the proliferation of deep-water steamer piers. Many of the great Scottish ports such as Aberdeen, Dundee, Glasgow, Greenock and Leith were developed during this period under the direction of engineers such as Rennie and Telford.

In a few cases, massive harbours of refuge have been built with government finance which can provide a safe haven in adverse weather conditions for substantial fleets of ships, both naval and commercial (e.g. whaling and fishing fleets). Peterhead is a fine example of such a harbour of refuge, comprising a multi-basin inner harbour (with an interesting history of earlier vernacular development) and a large outer harbour protected by a great breakwater, within which a sizeable fleet may lie safely at anchor.

Finally, harbours act as a magnet for the specialised craft skills and services required to run a maritime economy, so that the hinterland immediately around them is often the site of ship and boat-building yards, roperies, sail lofts, cooperages, mission

bethels and other related workshops and social institutions. Remains of these activities succeed in augmenting the harbour archaeological resource.

Vernacular harbours have been expensive to maintain and local records sometimes provide details of a succession of major repairs following storm damage to bulwarks and quays. In recent years the decline in economic activity in local vernacular harbours, following the concentration of commercial operations at a smaller number of larger harbours around the coast, has led to considerable neglect of local harbours, along with a loss of local knowledge as to how to repair and maintain them. Thus, in East Fife during the past 50 years there have been major breaches of bulwarks and collapses of sea-walls and quays at St Andrews, Crail, Cellardyke, Anstruther Wester and Dysart. Other harbours have been abandoned as unusable following changes in sedimentation (sometimes associated with the dumping of mining waste at sea nearby, as in Buckhaven and West Wemyss). This part of the archaeological resource is fragile and very much under threat. This serious problem is compounded by the poor levels of recording that have prevailed in this sector.

Equally fragile are the sites of boat-yards, roperies, cooperages and related activities, for many of these crafts were for long periods carried out wholly or in part in the open air. More recently, as these processes became more profitable, there was a tendency for these open air sites to be developed by the addition of small scale industrial buildings. An excellent example of such progressive development can be seen at Montrose, where an original open air roperie was progressively developed with buildings to protect the increasingly sophisticated machinery employed, culminating in a fully enclosed rope-making process with separate hatchelling house, tar-house and covered laying floor. The complex survives intact, making possible a detailed study of its development over c.225 years (Atkinson & Prescott 2010).

Future research potential: Scotland's havens, harbours and ports comprise a bountiful archaeological resource. However, this extensive resource has thus far only been subjected to limited ad hoc study and there is a case for a broader, more integrated approach to harbour research. This might best be promoted by setting up a multi-disciplinary Harbours Working Group to collaborate over the design and execution of research in this area. The group should bring together historians and archaeologists with civil engineers from universities and research institutions such as HR Wallingford (until 1982 the UK Govt. Hydraulics Research Station) with expertise in marine engineering projects, particularly in tidal zones. Research should lead to a better understanding of the evolution of our harbours, and of the problems to be faced in conserving them. Some suggested topics for research are set out below:

Survey and Recording:

Some general synopses of vernacular harbour works are present in the literature (see e.g. Hume, 1976; 1977a; Graham, 1969; 1977; 1984; Jackson, 1983) but there is a need for more detailed survey and recording work. Such a programme could provide the following outcomes:

- Establishing the principles of harbour design: covering elements such as protective bulwarks in relation to prevailing weather patterns, the value of stilling basins and spending beaches, designs of piers and quay spaces, including the provision of craneage, enclosed docks and facilities for ship maintenance and repair.

- Reviewing the range of construction techniques in vernacular harbours: in relation to sources of available local building stone and to the patterns of wind and tide in various locations.

- Repair and maintenance strategies; and the cost of harbour works in different places and times.

- The introduction of structures such as leaf-gates for retaining tidal water in dock basins: (both as an aid to loading and un-loading at all states of tide and also, at places such as St Andrews, to assist with harbour maintenance by the use of sluices to flush sediment from harbour basins).

- The impact of new technology: for example 19th century use of concrete construction; introduction of graving docks and patent slips for repair work.

- A review of the work of the Stevenson family of civil engineers: whose projects extending many vernacular harbours in the 19th century were well-recorded in the company's records (many now in the NLS Map Room and the National Archives). Their adaptation of traditional methods to 19th century projects could be evaluated afresh in terms of survival of their work on the ground.

Research-based Conservation:

Most vernacular harbours from mediaeval times to the early 19th century were of un-bonded coarse rubble construction and, with regular attention and repair, served well for hundreds of years. Many are listed monuments. The declining economic base in many harbours has resulted in the loss of local control so that maintenance and repair becomes the prerogative of local authorities, often with little experience of working in marine environments. Repairs have often been made with little concern for authenticity (though at Portsoy one can see a recent example of the application of the traditional technique of consolidating an un-bonded quay face with oak wedges, which can be tightened up from time to time after heavy weather). Generally however, there has been much employment of cast concrete and steel reinforcement to repair open block-work structures. The results have been of uneven quality and success. Sometimes expensive works have had to be repeated after relatively short periods in service. There is a growing sense that seemingly primitive open-heart piers may be more resilient than expected and that massively engineered rigid repairs may be less able to withstand the impact of storm waves. There is scope for interdisciplinary research in this area, in which archaeological data on the harbour-building techniques of the past can be allied with science-based models of the best repair techniques that modern marine civil engineers can devise. Such collaboration, if effective, could have far-reaching implications for many coastal communities and their harbours, thus making a significant contribution to cultural resource management.

Scottish Vernacular Harbours

The wonderful archaeological resource represented in the smaller vernacular harbours around the Scottish coast offers sometimes unique opportunities to understand more about the vagaries of their development in many cases over several centuries. The coast of Fife contains a wealth of such examples and perhaps offers one of the finest corpuses of harbours offering amazing relics of the past ingenuity, and technological innovation of coastal communities and the sometimes inappropriate engineering solutions introduced in the more recent past.

Over the last twenty years or so, our understanding of the development of the creek-mouth harbour at St Andrews has benefited from a series of archaeological investigations promulgated through planning conditions associated with ongoing remedial works – often as a result of the inappropriate engineering solutions alluded to above. Between 1996 and 2004 investigations were undertaken along the west quay of the inner harbour; the east and west landfall of the lock gates straddling the inner and outer harbour; the main pier bulwark; and a stone built slipway. These investigations revealed an amazing array of evidence for the development of the harbour and some of the ingenious engineering solutions that normally remain hidden and unavailable for archaeological study. One such example was the remains of a puddle clay barrier confined within two rubble retaining walls built within the structure of the east landfall of the main lock gates - used to contain the water of the Kinness Burn and to periodically flush out the build up of sediments from the inner and outer harbour. This simple but highly effective measure ensured that no water could penetrate the structure and so weaken it. The periodic collapse of this structure since the later medieval and early modern period meant that by the time Rennie, the prominent Scottish engineer, introduced his remedial measures in the early 19th century the structure was in need of a more long-lived solution. It is testament to these measures that the lock gates have not suffered from structural failure since.

Evidence for the intervention of prominent engineers however is only a fraction of the archaeological legacy that embodies the technological innovation and the use of vernacular harbours as 'test-beds' for other notable inventions. Indeed, a fine example of this was the development of Dysart Harbour on the Forth coast. This harbour enjoyed a long developmental history, the location of which moved from the eastern shore to the west when modifications were necessitated by the developments in the coal mining industry and for a short period whale oil production. This development can still be seen in the extant structures of the harbour today, including the coal pit entrance and whale oil boiling house. Perhaps the most significant but regularly ignored feature within the harbour however is the surviving remains of the Morton patent slipway (patented by James Morton in 1818). This design was later adopted and integrated into the large scale shipbuilding operations on rivers such as the Clyde and places like Dundee where a large scale patent slip survives to this day as a protected Category A Listed Structure.

What is clear from these few examples is the amazing archaeological resource available for research evident within small vernacular harbours, and particularly the more obscure and unexpected gems that provide evidence of their place in the wider maritime and engineering contexts that made Scotland such an influential maritime focus for Britain and her colonies. Angus Graham in his extensive work on the east coast harbours (1967, 1969, 1977) gives a flavour of the different types of harbour available for study. Further research would help build upon this great foundation and help to appreciate yet further the research potential available to us.

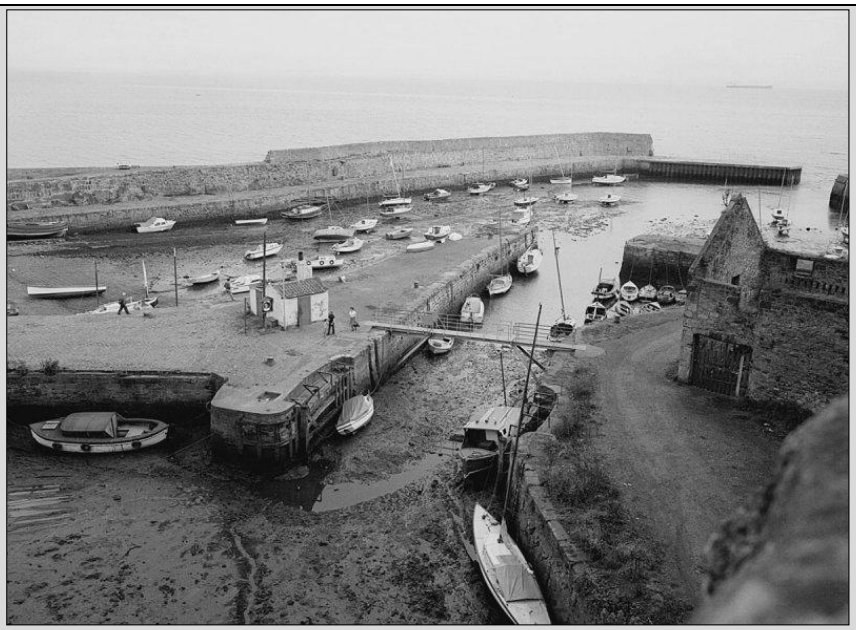
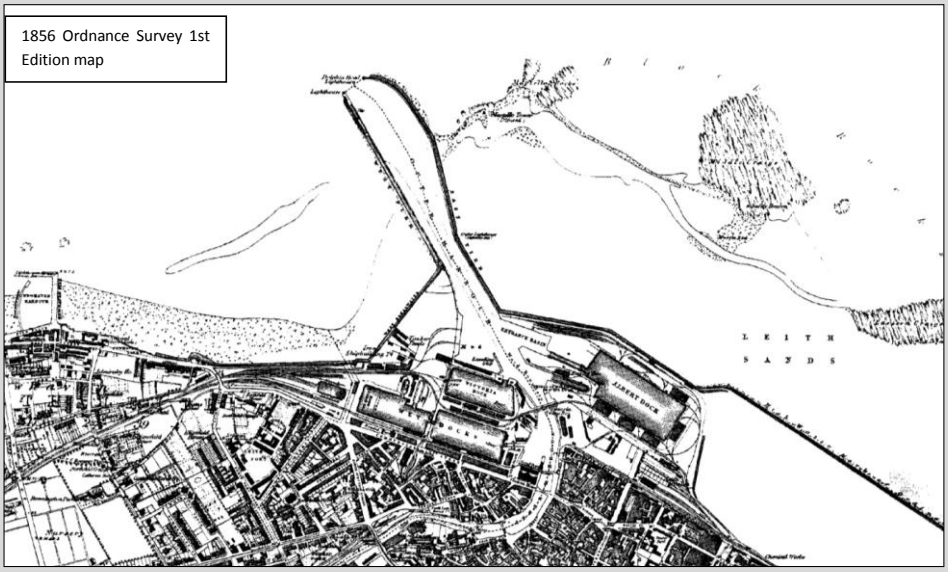


Figure 9: Dysart Harbour, a fine example of a longstanding vernacular harbour, developed and refined through the innovations of eminent engineers of the day, with a surviving example of a Patent Slip © RCAHMS.

The Development of Leith docks.

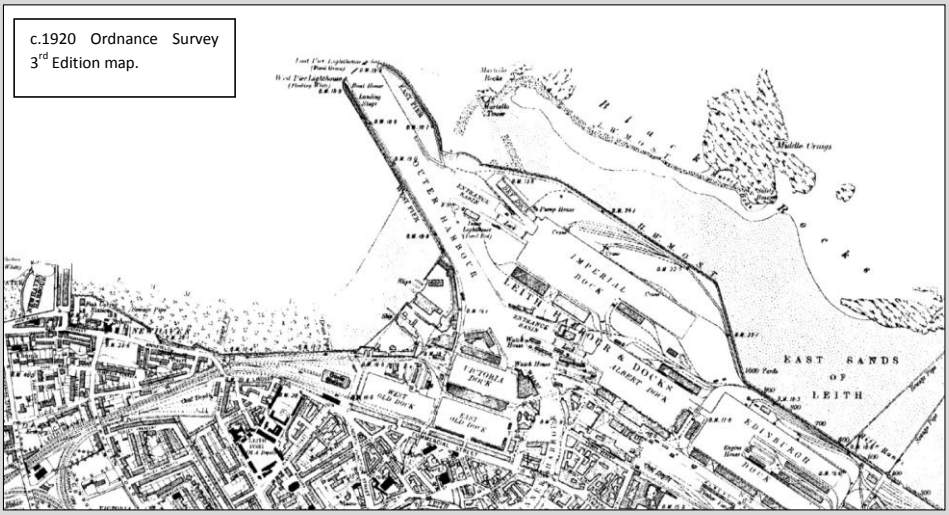
1856 Ordnance Survey 1st Edition map



An extract from Ordnance Survey six inches to one mile scale, 'County Series' sheet 1.16, published 1856.

By the 1850's Leith docks comprised three main dock basins and the outer harbour.

c.1920 Ordnance Survey 3rd Edition map.



An extract from Ordnance Survey six inches to one mile scale, 'County Series' sheet 1.16, published 1920.

The 3rd edition of the Ordnance Survey map was published in 1920 and depicts some of the more subtle changes to the docks infrastructure support, such as the additional railway sidings to the north of Imperial Dock.

The latest Ordnance Survey Open Data map depicts the development of the docks system in a north-east direction, over Leith Sands (see Mowat 1994 for further information). However, the major changes have been to the north-west with the creation of the western harbour. These changes may have resulted in the preservation of archaeological evidence, providing opportunities for the maritime past to be found and researched, © Crown copyright and database rights 2012 Ordnance Survey.

The major technological development of lighthouses, harbour lights and other navigational aids is a rich area for research, which has been pursued by many (Beaver 1971, Hague & Christie 1975, Paxton 2011, Stevenson 1959) and brought into popular culture (Allardyce & Hood 1986, Bathurst 2000). Recent exhibitions, such as Shining Lights[11], curated by the National Museums of Scotland in 2011 (Morrison-Low 2010), and the celebration of the bicentenary of the Bell Rock lighthouse[12], have demonstrated their enduring popularity.

Archives and information contained with the offices and personnel of the Northern Lighthouse Board, RCAHMS, NAS and those at the Museum of Scottish Lighthouses[13], which can be readily accessed, pertaining to the lighthouses of Scotland, ensures that further research can be encouraged. Areas of

[11] http://www.nms.ac.uk/our_museums/national_museum/past_exhibitions/shining_lights.aspx accessed 15 December 2011

[12] http://www.bellrock.org.uk/ accessed 15 December 2011

[13] http://www.lighthousemuseum.org.uk/ accessed 15 December 2011

research that could be pursued include research into the archive material. which should precipitate data accessibility improvements, such as making archive material digitally accessible. Other forms of research could include the locations of lights, tracing their locations over time and their depictions on historic charts, and using aerial photography, both historic and recent, to define the positioning of lights. In addition, their optical qualities, their value for maintaining safe passage in local waters and, of course, the human stories of the lives and deaths on Scotland's coasts, would all enhance the knowledge base of lighthouses and navigations.

Figure 10: The access to some lighthouses was complex and dangerous, such as at Muckle Flugga, Unst, Shetland. The light railway was used to take supplies from vessels up the cliff. The permanent light was established on the most northerly rock of Scotland, when it was lit on 1st January 1858, © RCAHMS DP049358.

Resource Exploitation

Scotland's long coastline is rich in fish, and there is evidence of the consumption of sea-fish from the Mesolithic, though research on prehistoric fish catching and consumption has been mainly concentrated on the Northern and Western Isles (e.g. Cerón-Carrasco 2005). Current work by Ruby Cerón-Carrasco and Claire Ingrem is finding similar patterns of exploitation from the Norse period. and research developed by James Barrett has demonstrated the importance of fishing in the medieval period (e.g. Barrett et al., 1999). However, at some later periods economic exploitation of the resource seems to have proved difficult. This prompted a variety of schemes to encourage fishing both as a source of food and as a way of ensuring a supply of experienced seamen for the navy.

Fishing is a wide topic, some aspects of which are not well studied. The first division is between commercial fishing, which engenders historical records and has been studied to some extent, and subsistence fishing, which produces very few records. Whaling is a minor but perhaps better-documented fishery. Another division is between coastal and pelagic (offshore) fishing. In general terms demersal (white) fish can be caught all year round, but some coastal species are seasonal—the best-known being herring and salmon. Most fishing was done within a few miles of the coast, particularly during the winter. Boats and lines/nets are expensive, and shorter-lasting than many other occupational tools. Until the second half of the 19th century, fishing for white fish with lines, and herring with nets, needed different boats, making commercial fishing even more capital-intensive. As boats got larger during the 19th century, and could no longer be beached, provision of safe harbours was another drain on local capital. and bankrupted some small coastal towns.

Until the coming of the railways, it was harder to supply fish to market quickly and some form of processing would be required if resources were to be transported beyond the local area. Most estates, villages and towns

had enough fishermen to supply the immediate area, but few places had an economy based on fishing. However, seasonal fishing was encouraged by some landlords, such as the long line industry centred on the fishing stations of Shetland (Dawson 2011). Fish could be preserved in the short term by the use of ice (from the mid-eighteenth century), and many ice-houses still survive. Longer-term preservation required drying, smoking or salting. Salting works best with oily fish, and a major problem was that between 1713 and 1825 salt was a customable commodity, and it was not worth establishing salt warehouses in remote places where demand might be low or erratic. Both drying and smoking can preserve all types of fish. There is evidence for drying fish from the Norse period in the Northern Isles, and ethnographic evidence from the East coast. Oily fish such as herring, mackerel and salmon have traditionally been smoked, and from the 18th century white fish as well.

Only with the development of refrigeration and canning in the later 19th century was the preservation of fish made more reliable, though the early 20th century saw the collapse of the market for Scottish salt herring in northern Europe. Fluctuation in fish stocks has long been a problem, exacerbated by over-fishing. Today the commercial fishing industry is in decline, concentrated in fewer, larger vessels, and striving to find new catches and new markets to keep going.

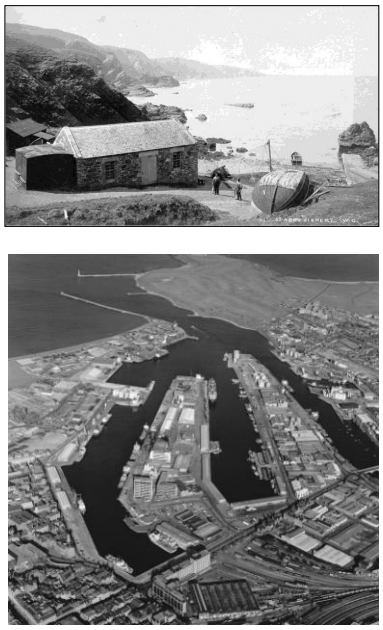


Figure 11: (top) St Abb's Fishery (late 19th century) and (bottom) Aberdeen harbour (late 20th century). The juxtaposition of these two images demonstrates the huge changes that have taken place in our interaction with the sea. These two locations each present challenges that the archaeologist has to overcome in order to survey, record, interpret and research these complex remains in the landscape.©RCAHMS

The exploitation of maritime food resources is wider than fish. Sea mammals were eaten, their fat rendered down for oil, sealskin used for clothes and shoes, and whalebone (baleen) was exploited for its strength and flexibility. Shellfish was important, both directly as food, and as bait for fishing, from prehistory to the present. Shellfish are amongst the easiest of marine foods to gather and were exploited in great numbers in the past. Shell survives well in some environments, and it is not unusual to find shell middens around the coast. Partly due to their high visibility, they have played a key role in understanding the development of

occupation in Scotland (for example, the Scotland's First Settlers Project, Hardy and Wickham-Jones, 2002). Their presence indicates that occupation sites probably lie in close proximity, and excavation has led to the discovery of artefacts, features and structures which might not otherwise have been located (Melton and Nicholson 2007). The present day location of shell middens in relation to the coast has also helped demonstrate how the coast itself has changed since the last Ice Age.

In the past, fish-traps have been analysed in isolation (Bathgate 1948-9), as a suite of landscape features (Dawson 2004), and in some cases accompanied by documentary research to illustrate the practical issues associated with supplying timbers for the structure, and illustrative of the manner in which these ephemeral structures were part of a wider community and were managed by estates for commercial purposes (Hale 2005). The RCAHMS database contains 195 records of fish-traps around Scotland. However, the data from just one Historic Scotland CZAS, that has been incorporated in to the RCAHMS database, contained 62 individual fish-traps. This suggests that there is evidence of many more fish-traps than are recorded in the RCAHMS database, and that targeted survey of intertidal areas will reveal more sites (see Figure 14).

Figure 12: View centred on the coastal slate quarry at Ballachulish, founded around 1693, ©RCAHMS DP026754

Figure 13: Other forms of coastal quarrying have taken more extreme forms of extraction, such as on the island of Belnhua, in Argyll and Bute, ©RCAHMS DP017990

Salt workings are one example of an industrial process that is both land and shoreline based. At least 50 examples of salt works are listed in the RCAHMS database, and a number of sites have been thoroughly investigated (for example, see Lewis et al 1999; Hooper and Aitken 2008; Hambly 2011[14]). Little is known about pre-Medieval saltmaking processes in Scotland. Medieval saltmaking may have largely used the sleeching process, but other methods are also possible; different processes leave very different field remains, and non-recognition and misinterpretation of these may be severely hampering our current understanding. The Late Medieval development of coal-fuelled 'panhouse' saltmaking may have been centred in Scotland and was of major importance to the Scottish economy in the 16th and 17th centuries (Cranstone 2006, 2009). Whatley (1987) has provided a major historical survey of the Post-Medieval industry. Salt was a product that was widely used and hence there is a transportation component that comes with salt works and this can be both land and sea borne. It is these peripheral aspects of sites, processes and communications infrastructure that are often overlooked or not given equal treatment as the sites themselves. However, salt works embody this nodal type of site, which is not an isolated phenomenon and should be considered with a more holistic approach, which includes the attainment of the raw materials and the distribution networks associated with the finished products.

[14] More information on the salt works at Brora can be found on the project webpage: http://www.shorewatch.co.uk/brora/

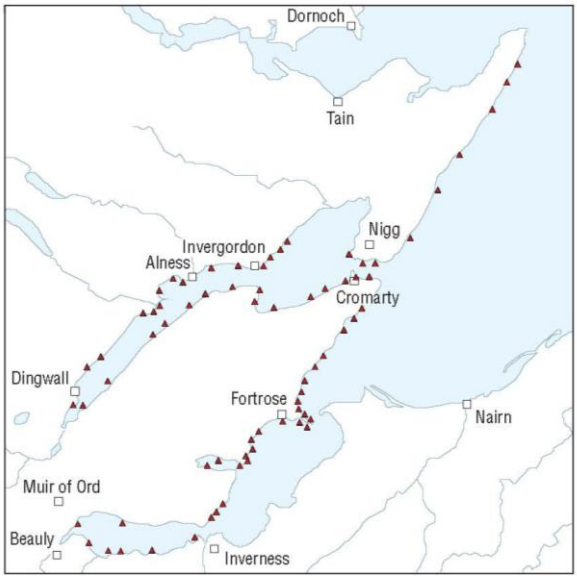
Intertidal fish-traps in the inner Moray Firth

Fishtraps are one of the more common monuments recorded along the intertidal zone. Fishtrap sites have been recorded in English, Welsh and Irish estuaries.

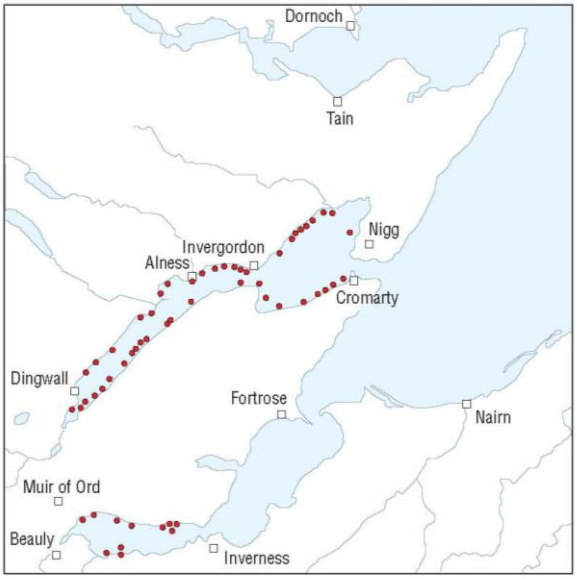
The fishtraps recorded during the inner Moray Firth coastal zone assessment survey (see http://www.scapetrust.org/html/fishtraps.html) were concentrated in two locations; the Beauly Firth and the Cromarty Firth, situated on shallow gradient mud or sand flats. They were built during the 17th-19th centuries to catch fish, especially the salmon that were abundant in the Inner Moray Firth. Seasonal runs of migratory salmon and sea trout swim through marine river channels that at low water often act as holding pools (Hale 2003). The fish would then use the ebb or flood tide to progress further down or upstream. The traps were placed at right-angles or obliquely to the channels so that the fish could be prevented from continuing their journey. Subsequently, as the tides fell the fish would be forced into the angles of the traps where water would pool and they would be unable to swim upstream or towards MHWM (Mean High Water Mark) and could then be caught with hand nets or in static nets.

Three different types of fish trap have been identified from documentary evidence: yairs, stake nets and bag nets. Yairs are curvilinear stone or wooden structures that run at right angles to the shoreline and curve, usually upstream, to form an arc. Wooden stakes interwoven with wattle have been recorded in some yairs, which show complex wattle and stake features at points along their length. Other yairs have been recorded with zigzag plans, designed to trap fish on both the ebb and the flood of the tide. Stake net traps comprise lines of stone mounds into which wooden stakes were driven and between which nets were strung. The third group of fish-traps are bag nets, comprising single lines of nets with stakes at either end, usually at MLWM (Mean Low Water Mark). Evidence of these traps were found as single mounds.

Sixty two fish-traps were recorded in the survey area, compared with over 70 sites marked on cartographic sources dating between 1817-1909. Although the variation is not necessarily significant because it does not define the time-depth of individual monuments, it does indicate that the survival of these monuments is dependent on environment and situation. The surviving sites are located in sheltered situations in the Beauly Firth, Munlochy Bay and the Cromarty Firth and there are no remains found on the rocky shorelines in between these firths and bay. All of the sites recorded were found to be in poor condition, probably caused by the effects of coastal erosion and/or accretion.



Distribution of fishtraps observed from cartographic sources (1817 - 1909)



Distribution of fishtraps observed during the 1998 Coastal Survey

Figure 14: Fish-traps in the Inner Moray Firth demonstrate the different results from cartographic survey compared with coastal fieldwork. A combination of desk-based and fieldwork can produce results that form the empirical basis for further applied research, © RCAHMS.

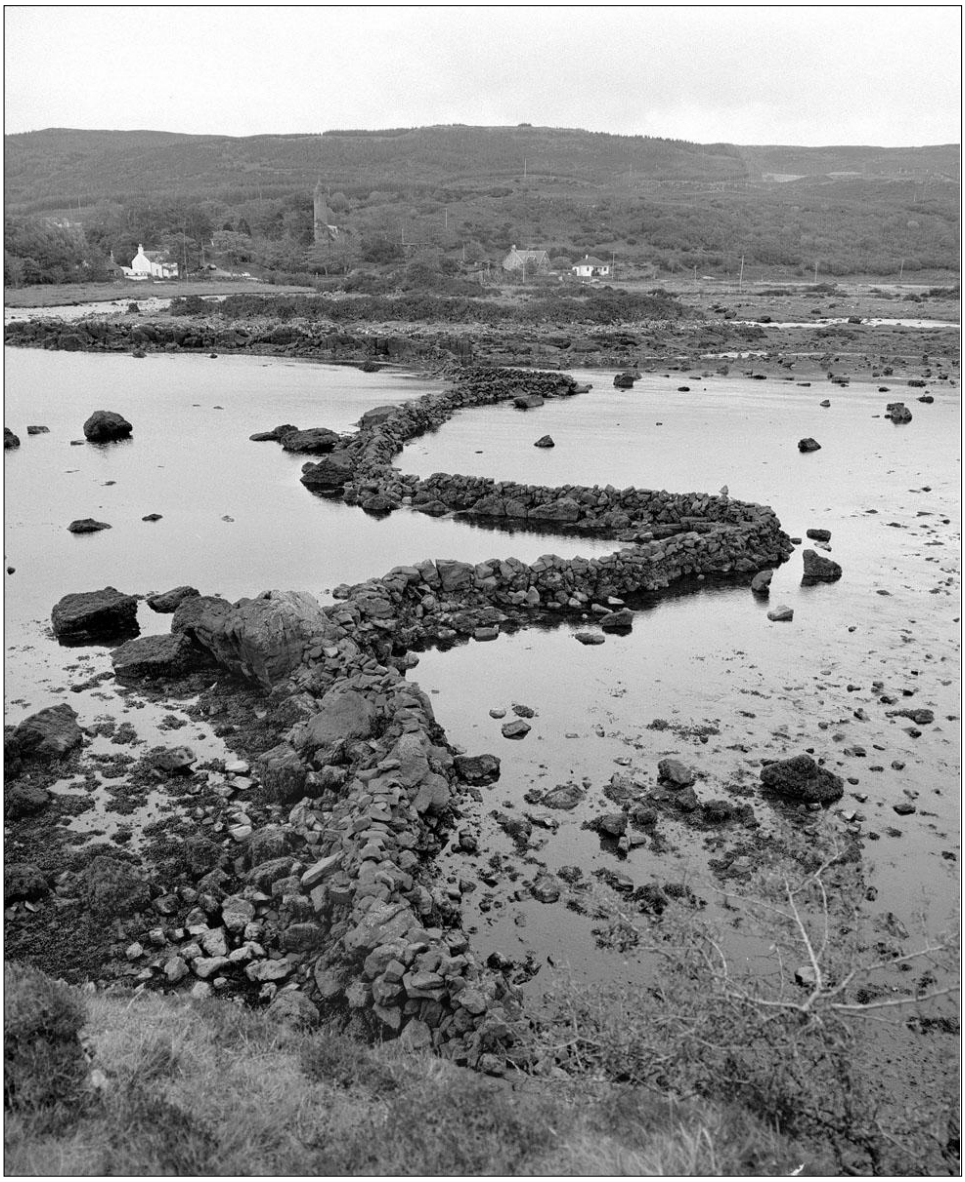


Figure 15: Tidal fish trap at Eilean na Carraidh, Mull. Both place name evidence and the archaeological remains enable the types of research into these relatively common features, to be multi-disciplinary and nationwide in their scope © RCAHMS SC576116

Figure 16: Aerial photograph of a double yair, on the south side of the Beauly Firth, near Inverness. Whether the different forms of trap are indicative of different phase of use, as a result of tidal regime changes or fishing by different methods remains unclear © RCAHMS SC700317

Defence

The sea has borne immigrants, sometimes, doubtless, violent, for millennia, and, with the rise of the nation state, has grown the need to defend against invasion, so a wide variety of structures and installations has been built. It has been argued that Iron Age brochs are primarily defensive strongholds (MacKie, 1974), if not primarily in response to potential over-sea invasion. Castles and structures constructed at times of threat, for example against Napoleon and during the two World Wars, are, often, still obvious in the landscape. Guy (1992-9a, b) has recorded many of the defensive systems of the 20th century, and Barclay (2005) has published a study of the Cowie Line, which although extending inland, was part of the defensive system constructed to slow down the enemy should there be a seaborne invasion of the north-east coast of Scotland. This study has

shown how the World War II defensive network should be seen as a whole, with sites related to each other despite wide geographic separation. It also demonstrates how the influence of the coast can extend far inland, with one end of the Cowie Line being over 20km from the sea.

Much of the RCAHMS ongoing work is in co-operation with Defence Estates/Ministry of Defence whereby surveys include active airfields in Scotland and other former military sites that are to be relinquished. Most recently, Machrihanish was photographically surveyed and other major surveys have been the Orkney-Scapa Flow Survey 1995-2000, Inchkeith and other Forth Islands and many other smaller former military sites throughout Scotland. The Inchkeith survey included several elements of pre-1900 military installations.

In addition John Guy completed a series of rapid survey reports based on the former Regions for Historic Scotland. The survey concentrated mainly on the coastline and the data has been entered into the RCAHMS database. Secret Scotland[15] and other websites provide an ongoing window on the discovery of WW I and WW II sites. There have been several local studies of military sites, available either on-line or in local libraries. Some copies have been supplied to RCAHMS and the location data for these projects will be entered into their database.

[15] http://secretscotland.wordpress.com/

Figure 17: Small-scale changes in tidal regimes have preserved marine crannogs. These sites, often located by aerial survey, present a set of research questions unique to the intertidal zone, © RCAHMS.

Habitation sites

Marine crannogs: are a site type that can provide extensive archaeological and palaeo-environmental data caches for researchers (Hale 2004). They are indicative of how the estuarine environment was previously exploited and can be used for localised sea-level/estuarine system studies. Their positions within the intertidal zone ensure that they are under threat from erosive agencies and their relative paucity (only 9 are known) is indicative of a very limited resource for researchers. Marine crannogs can be used to identify local sea-level change, periods of inundation, habitation sites that were positioned very specifically to take advantage of local dry points that gave access to both estuarine/riverine channels and to the terrestrial hinterland. The preservation on such sites is akin to freshwater wetland remains and provides a vital source of palaeo-environmental data that researches can use to reconstruct their form, function and landscape setting and changes. This indicates that they are an asset of national importance and should be appropriately researched (Hale & Sands 2005).

Standing buildings located on the shoreline: Scotland's coastline have been undertaken for many years and there are a number of sources for information. RCAHMS' Canmore database can be searched for standing buildings located on the shoreline, although researchers will require further refinements to their searches, in order that they can isolate the individual buildings. Buildings such as the grain stores or girnals that surround the Cromarty Firth have been looked at specifically with their coastal location in mind (Alston 1999) and this is also true of fishermen's cottages, and planned settlements such as Cromarty or Ullapool (Alston 1999; Maudlin 2000). However, other buildings, which may appear incidental to

their coastal situation, can often be traced to a maritime source. Many buildings indeed, even far inland, were financed by profits from trade or other maritime activities, including naval prize money and smuggling.

Religious sites

Religious sites have long had connections with Scotland's coastal fringe, from the early dysarts (locations in remote places, often on islands) where holy men found places of retreat away from populous areas (e.g. Sgor Nam Ban-Naomha on Canna), to the well-established Iona Abbey with its attendant high crosses and buildings. Pictish burial cemeteries are known to have been positioned in 'liminal' positions, often on gravel terraces above river courses or in the case of Lunan Bay, Angus on the raised sea beach. This association between religious location and the sea/coast has long been a tradition in Scotland, which has been under-researched in the past.

MacArthur's Store, Dunbar

The re-use of ship timber in terrestrial buildings is a practice for which there are still relatively few authenticated examples in the archaeological record in the UK, and even fewer in Scotland. To date, isolated discoveries are confined to both domestic and industrial buildings located in areas such as the coastal towns of the East Neuk of Fife and city dwellings such as Gladstone's Land on Edinburgh's Royal Mile.

The fascinating discovery an assemblage of re-cycled ship timbers at McArthur's Store in Dunbar offers rare archaeological evidence of such practices in Scottish contexts from the age of sail. The assemblage comprises the largest corpus of re-used ship timbers from a vernacular context found to date in Scotland, a point of considerable historic significance. This assemblage like those discovered elsewhere are almost certainly derived from vernacular craft, such as fishing vessels and coastal traders, probably built, operated and broken up in the numerous coastal communities around the Scottish coast. The timbers as a whole appear to be far removed from the more standardized, higher quality ship timber components derived from naval vessels, such as those discovered at Chatham Historic Dockyard, the former Dockyard at Deptford and the Chesapeake Mill in Hampshire (Atkinson 2001; Prescott and Atkinson, 2003; Atkinson, 2007). The significance of discoveries such as those at Mac Arthur's Store lie in the relative rarity of these finds – and ultimately the information that can be gained from such discoveries.

What is clear is the very apparent un-tapped resource for research into aspects of boat and ship timber re-use in Scotland. The story is potentially extensive, both geographically and temporally, and a well structured research strategy could add considerably to the known maritime cultural heritage resource and evidence for ship-breaking and the recycling of timber in terrestrial vernacular and industrial contexts.

Figure 18: Re-used ship timbers from MacArthur's store in Dunbar. The deck beams from a likely 18th century coastal trader offer rare insights into ship timber assemblages in the Scottish vernacular context and the possibilities that abound to study the tangible remains of the Scottish merchant marine, © Headland Archaeology.

Eroding sites

There have been numerous excavations at eroding sites, and two of Scotland's most informative (and celebrated) multi-period occupation sites - Skara Brae in Orkney and Jarlshof in Shetland -were excavated after being revealed during storms. There are innumerable archaeological sites buried under layers of sand, probably in similar remarkable states of preservation. Although hidden and protected by the windblown sand for centuries or millennia, many of these sites are now threatened with total destruction by the sea.

Some eroding sites probably had a close relationship with the sea, such as the Scar boat burial (Owen and Dalland 1999), whereas others may originally have been inland sites which were later exposed at the coast edge due to erosion, such as the wheelhouse at Cnip (Armit 2006). Eroding sites provide an opportunity for research as they are threatened with destruction and can therefore be fully excavated without any constraint other than that of resources.

Theoretical archaeology at the coast

Andrew Fleming has for a long time discussed issues concerned with islands (Fleming 2005 and Fleming 2008; however see also Rainbird 2007) and how we can assimilate data-gathering of archaeological/geo-historical research into a broader context that incorporates folklore, historical and contemporary literature, fine art and contemporary cultural views. Some of these approaches have already been undertaken by researchers such as Hannah Cobb and Fraser Sturt (Sturt 2004). Using these avenues we can construct diverse narratives, which can be compared with current and past scenarios.

However, it is through theoretical discourse that researchers in the coastal. intertidal or maritime hinterlands discover the fortuitous connections that our subject has with many other overlapping areas of research.

One area where theoretical archaeology and coastal archaeology have been fruitfully integrated is the spread and adoption of religious practices, for example the location of Pictish barrow cemeteries. It is commonly accepted that the positions of Pictish barrow cemeteries are often associated with watercourses and locations adjacent to the coastline (see Cowley 1996, for examples of sites associated with watercourses in Dumfries and Galloway). However, the reasons why these locations become the focus for the burial of individuals and groups are something that can be explored and elucidated through comparisons with other cultures and religious practices. In this way, theoretical perspectives can help us understand a range of coastal sites, encompassing chapels overlooking seaways, hermit's caves, and other dwellings that were located in remote coastal locations.

3.4 Summary of gaps in our knowledge and future approaches

As noted above, SCAPE has published the CZAS data on an interactive website. However, some of the data is not available on local or national databases. A first step to addressing this would be to accession the individual site information into the RCAHMS database. This could be a two-stage process; the first stage would verify the data and ensure it is not duplicating existing sites, (which could require some field visits) and the second stage would be the data-inputting. To help work on stage one, the SCAPE Trust is hoping to launch a major new project that encourages members of the public to revisit sites recorded in the CZAS. Using paper forms or mobile phone apps, the public will be asked to update data, report upon condition and record information to aid the future management of the sites.

The CZAS illustrated that along with the major shoreline infrastructures, there are minor or vernacular remains, such as slipways, harbours and ephemeral portages, which have not been studied in a systematic manner. Often the coastal. intertidal and maritime hinterland sites are treated in isolation, failing to tie them to their associated infrastructure, hinterland features, and trade and communications networks. Conversely, studies of inland towns, for example, need to consider the existence of outports, or other systems of getting goods to the coast for export.

We lack suitable models of past maritime systems in Scotland that approach our sub-discipline from a holistic point of view and this is perhaps understandable, given the breadth of information that would need to be researched. One example of the diversity of a maritime landscape is illustrated in a study of East Fife (Lewis et al 1999, Martin 2000) which demonstrates the broad range of site types encountered and the different types of skills the researcher needs to understand such a complex and multifarious landscape. One specific area where there is a true gap in our knowledge is the fishing industry, and ports and harbours. This includes both vernacular and modern industrial complexes, castles and their often associated portages, and prehistoric to historic slipways, nousts and landing places. Within these areas lie opportunities to apply cross-disciplinary data, such as engineering models for the quality of harbours and coastal defences or predictive modelling approaches, often used in the natural sciences sector, in order to identify areas and sites for further research and to develop best-practices across disciplines, such as using third party data to investigate

submerged prehistoric archaeological landscapes.

An audit of the breadth and depth of archive material that exists for the subjects that fall under the umbrella of 'coastal. intertidal and maritime hinterland' would address a serious gap in current knowledge. Few, if any, land-based archaeological projects have incorporated the foreshore within their project design, as for example was done in the upper Shannon basin, Ireland (O'Sullivan et al 2001). No Scottish project has yet approached the comprehensive coastal survey demonstrated, for example, around Strangford Lough, N. Ireland (McErlean et al 2002). This gap has been touched upon above, when commenting upon the amount of data available only in grey literature, such as the CZAS. Similarly, data held within the RCAHMS database is not necessarily sorted in such a way to be directly useful for researchers into specific topographical niches and a clearer understanding of the intricacies and uneveness of the RCAHMS database would be invaluable.

.Broadening our research remit, to include folklore, iconographic evidence including boat graffiti, oral testimony and literature is an all-important part of our knowledge network that often brings out avenues previously unexplored. This is particularly so in the case of subsistence fishing and small local sites such as kelp kilns. The mass of early photographic records of shipping fleets, combined with oral traditions, is often overlooked, but provide prime evidence for our research area. Looking at contemporary or past societies from other parts of the world can be both enlightening and cautionary for theoretical approaches and remind us of the need for primary data-gathering exercises. The application of data that has been gathered from other research projects, and in other disciplines, can prove fruitful but is often very time consuming and can be hampered by issues regarding cross-disciplinary data sharing.

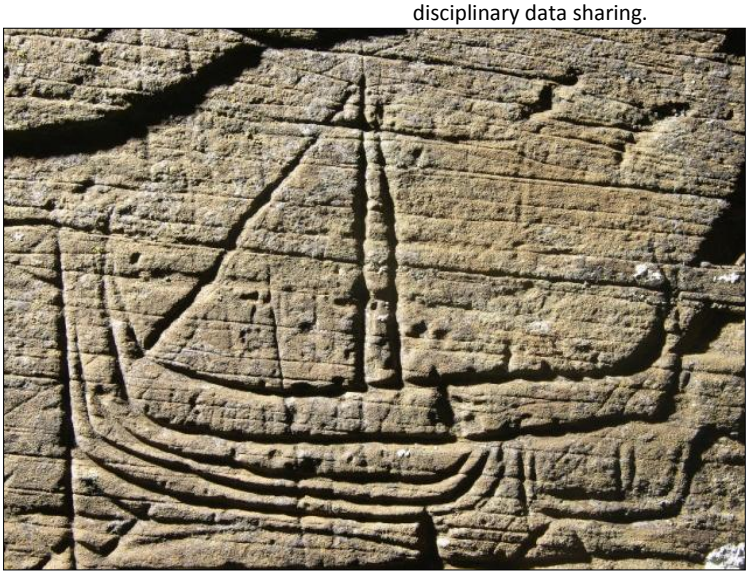


Figure 19: Graffiti from Kilchattan Church, Isle of Luing, Argyll, possibly showing Viking ships or medieval galleys and highlighting another research resource, ©Colin Martin and Paula Martin

3.5 Research recommendations

Potential projects or approaches that this framework deems appropriate to promote and pursue include;

- To develop a series of partnership projects to undertake a holistic, multi-disciplinary approach to an area, such as a major Scottish Firth, researching the coastal. intertidal and maritime hinterland archaeology, such as outlined in the proposed 'Source to Sea' approach;

- To assimilate all specialised datasets into a national database, which could be accessed digitally and would enable marine historic environment data to be characterised;

- To develop site-specific approaches to coastal and marine archaeology, which can be chronological. thematic or a mixture of the two. Examples include researching fish-traps on a national scale and developing the work already undertaken on marine crannogs;

- To explore the whole spectrum transport infrastructure, including Historic and Prehistoric landing places, ports, harbours, portages, landing places, fords and bridges.

4. Inland Waters

4.1 Introduction

For the purposes of the framework, Inland Waters include freshwater environments such as lochs, major rivers, and canals and navigations. By their very nature, inland waters are an integral part, and an extension of the maritime networks around our coasts and estuaries. In many cases aspects of the cultural fabric of Scotland's maritime identity emanates from contact between communities located along our coasts to those situated along these inland 'arteries'. While it could be argued that these 'arteries' may be regarded more as terrestrial entities or classified within other areas of the archaeological discipline (such as industrial archaeology in the case of canals), the very nature of the resource, physically and culturally, displays very real synergy with the 'maritime' sphere; and in the case of lochs and rivers, the very medium that is under exploitation. Clear examples include the fact that many of the major bodies of inland water and canals are connected with the sea, such as Loch Tay and the Forth and Clyde and the Caledonian Canals; and in the case of the latter, are often incorporated into existing rivers and lochs.

In addition, these waterways were often developed for maritime purposes; the dock complexes developed at the coastal interfaces and the furnishing of local coastal trade through boat and shipbuilding on the Forth and Clyde Canal are but two examples. With this in mind, it is hoped that by including Inland Waters within this framework, the maritime sphere can begin a process of greater integration with other elements of the archaeological discipline.

Figure 20: Crannog in Loch Leathan, Argyll and Bute. These partially submerged sites comprise organic and inorganic structural remains, artefacts and ecofacts that can range in age from prehistoric to Medieval and later occupation sites. The large number of crannogs, island duns and other occupied islets across Scotland provides a huge potential for research over three millennia. Recent advances in dating techniques, theoretical approaches and fieldwork have demonstrated the importance of wetland archaeological remains, © RCAHMS.

4.2 The Settlement and Exploitation of Inland Waters

4.2.1 Introduction & big issues

Despite the wealth of Scotland's freshwater archaeological resource being widely recognised, research has been undertaken at a comparatively low level when considered alongside the contemporary terrestrial settlement record. While coherent research directions have begun to develop over the last two decades, and most notably as a result of the recent Scottish Wetlands Archaeology Programme[16] (SWAP) research agenda, there

[16] Further details can be found at: http://www.aocarchaeology.com/research/swap.htm

are still significant holes in our knowledge, and key areas are under-researched in chronologic*al.* geographical and methodological terms. Wetlands and water bodies have been central to life in Scotland since people first settled the northern mainland and, in a country dominated by its precipitation, wetland environments have always been important. Although the exploitation of freshwater environments has been varied and widespread through time, from fishing and foraging to industrial and transportation use, Scotland's wetlands are perhaps most important in that they were clearly central to a tradition of ritually-significant settlement practice that existed from at least the late Bronze Age to the High Medieval period and later: that of the island dwelling or crannog.

Some 400 island settlements/crannogs[17] are listed by the NMRS, and although a proportion of these references can be ruled out as dubious or false reports, this is generally held to be an underrepresentation of the true number based on detection rates during concerted underwater survey (e.g. Dixon 1982). The extent of the resource of related structures found in bogs and mires is very poorly understood, though these are known to exist (e.g. Ballachulish, Christison 1881). Prospection in peatlands has had mixed success, and while important sites are known to exist in Scotland's mires and carses (e.g. Ellis 2001) a spot-sample evaluation of sites located in wetlands returned very variable results (Ellis 1999). Scotland has not seen the large scale drainage and industrial peat extraction work carried out in raised bog areas of Ireland and as such any grasp of the geographic*al.* functional and chronological extent of preserved freshwater archaeology is still basic. Primary field survey and prospection remain the most valuable research initiatives at this stage in knowledge.

4.2.2 Background to freshwater archaeological research in Scotland

Antiquarians in Scotland were among the earliest to systematically investigate freshwater archaeological remains, with many of the crannogs exposed by drainage and land reclamation during the late 19th century observed during inspection by Robert Munro. Inspired by the results of investigation of the Swiss lake dwellings, Munro published his observations of Scottish crannogs, producing a series of papers and culminating in the seminal work *Ancient Scottish Lake Dwellings* in 1882, which remains one of the starting points for modern Scottish crannog studies. Little further work was carried out after this time, however, with the exception of a few notable excavations (e.g. Montieth and Robb 1936; Ritchie 1942; Piggott 1953), and only when Morrison attempted to contextualise crannogs within their landscape context through a combination of review of the existing evidence and new survey (Morrison 1985) was interest in the freshwater resource reignited. Morrison was the first to correlate the evidence for freshwater settlement with its terrestrial counterpart, and to some extent set the paradigm that established crannogs as an integral part of the settlement record of both prehistoric and historic centuries.

It was not until the early 1990s, however, when a campaign of condition survey and monitoring of the crannog resource in SW Scotland provided samples for a range of radiocarbon dates that allowed crannogs to be placed, for the most part, within a broad 'later prehistoric' period, i.e. c.800 BC to AD 500 (Crone 1993; Barber and Crone 1993).

[17] The term 'crannog' is a debatable one: it has been argued that this should only be applied to an entirely artificial islet built mainly of wood, but this definition would exclude many hundreds of stone islets found in the west of Scotland and related semi-natural island dwellings. Such details are to some extent unimportant since all belong to the same conceptual tradition; as such, the term 'crannog' is used here advisedly.

This was to change the focus of lake settlement studies in Scotland, challenging the assumption that 'crannogs' should be defined in terms of the well known royal Early Historic sites in Ireland (e.g. Lagore & Ballinderry, Hencken 1942, 1950). In 1998 Henderson argued that the majority of crannogs are likely to be Iron Age constructions, and that they should properly be considered within the better-established frameworks of terrestrial Iron Age settlement and material culture (Henderson 1998). This approach to Scottish lake settlement within the Iron Age settlement record has formed the basis of the majority of work since the late 1990s, with several recent treatments taking a landscape approach (e.g. Hale 2004; Cavers 2010).

The most significant modern excavations, however, illustrate the chronological diversity of the resource, with Dixon's excavations at Oakbank in Loch Tay (datable to the early Iron Age) and Crone's at Buiston (most significant phase datable to the 6th to 10th centuries AD). The publication of Buiston set the standard for an integrated approach to crannog excavation, with full analysis of wood technology, dendrochronology and multi-proxy sources of economic and environmental information fully employed (Crone 2000). Oakbank crannog remains unpublished aside from summary reports (e.g. Dixon 2004).

Numerous survey programmes have greatly extended our knowledge of the range of the crannog resource in Scotland (e.g. Dixon and Topping 1986; Henderson 1998; Holley 2000; Cavers 2010). Radiocarbon dates are in fact numerous, largely due to the ease with which they can be obtained, particularly during underwater surveys (see for example Henderson 1998a; Cavers 2010; Dixon 2006), but the wide variation in these has prompted concerns over their interpretation, given our developing grasp of the complexity of site construction, reuse and taphonomy (see below).

Studies of the freshwater archaeological resource outside of crannogs, however, have been notably few. Mowat's comprehensive treatment of the logboats of Scotland is one exception (Mowat 1996) and Hunter and Bradley have discussed the evidence for the votive offering of hoards (e.g. Hunter 1994, 1997; Bradley 1998) but, aside from industrial sites from relatively recent periods, even survey and identification of freshwater archaeological sites other than crannogs are almost completely lacking.

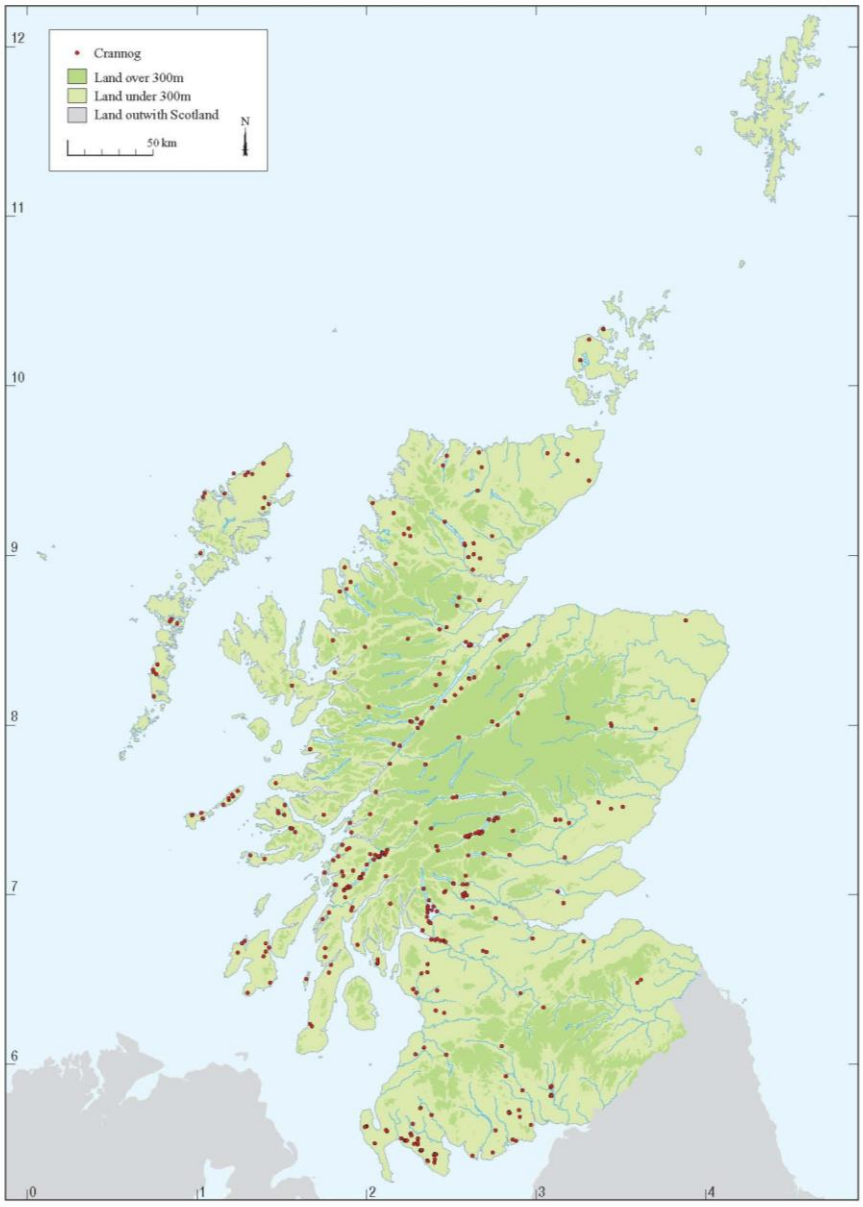


Figure 21: The dots on the map represent crannog sites. The concentrations of crannogs in Lochs Awe and Tay are an artefact of surveys. Whether or not this distribution is truly representative of our past occupation of lacustrine environments remains to be seen, © RCAHMS.

4.2.3 Current paradigms in freshwater archaeological research

Largely due to the work of Coles and Coles (e.g. 1992, 1996) and the meetings of the Wetland Archaeological Research project (WARP) conference in 2005 (SWAP 2007), freshwater archaeologists are united in their aim for the incorporation of wetland remains with their wider landscape contexts; the rationale being that it is impossible to understand wetland sites when treated on specialised terms, when the people who built and used them did not live in isolation. Freshwater archaeological sites present a unique opportunity but also a unique challenge- it is often easier than on dryland sites to identify how and (to a very fine degree) when wetland sites were built and used, but equally it can be impossible to explain *why.* Recent movements in wetland research have aimed to move beyond empirical and functionalist description, to explore issues of motivation, agency and identity (e.g. O'Sullivan and Van der Noort 2006).

These approaches have been more widely explored and applied in Ireland than in Scotland, where regional and chronological studies have explored function and meaning within the various theoretical frameworks of prehistoric and early historical studies (e.g. O'Sullivan 1998, 2008; Fredengren 2002). This has led to a more coherent understanding of the role of lake settlement within the wider settlement system, while concurrent programmes of systematic survey work have greatly increased our appreciation of the range in form, function and status of Irish lake settlements (e.g. Fredengren 2002; Boyle 2004; O'Sullivan 2008). Contextualisations of Scottish crannogs within chronologically-appropriate theoretical frameworks have been somewhat thinner in Scotland, though Hale (2004) considered the role of the Clyde crannogs in relation to the local prehistoric settlement context and Cavers (2005) has correlated the origins and developments of crannogs in the context of the development of settlement forms of the western Scottish Iron Age.

Scottish crannog studies have, however, been successful at exploring the importance of wetland taphonomy, and the recent WARP conference proceedings produced a range of papers that summarise the current state of our knowledge (e.g. Crone 2006; Cavers 2006c; Henderson 2006). This is an important, and in multi-period sites with good organic preservation, taphonomy can be exceedingly complex; it is certain that taphonomic concerns will always be central to the study of sites preserved in Scotland's freshwaters, and the development of new techniques for elucidating taphonomic processes should always be promoted.

4.2.4 The Scottish Wetland Archaeology Programme and other current research

In 2006, following the hosting in Edinburgh of the annual WARP conference, members of SWAP were asked by Historic Scotland to produce a coherent research agenda, within which a programme of field survey and excavation could be carried out (Cavers 2006a). SWAP undertook a systematic assessment of the wetland archaeological resource, and identified Caithness, Skye, Argyll and Galloway as high potential areas for further research. Concurrent with the geographical analysis, SWAP identified a series of research themes to be pursued as a means of approaching the most pressing questions in Scottish wetland research. These focus on the investigation of chronological patterns, the relationship of dating samples to phases of construction and occupation and the investigation of a range of Iron Age crannogs and analysis of their form, function and meaning (see Cavers 2006b:17-8).

Following on from the formation of the SWAP research agenda, several key field projects have been undertaken to explore crannogs in the target study areas. Underwater excavation has been undertaken at the multi-period crannog at Ederline boathouse in Loch Awe (Cavers and Henderson 2005), and at Dorman's Island in Whitefield Loch, Galloway. A larger project has aimed to investigate an unusual promontory site in Cults Loch, near Stranraer, in conjunction with an exploration of the associated extensive cropmark record. These projects are currently at various stages of fieldwork and post-excavation.

Several projects are proceeding outside the direct coordination of SWAP, but nonetheless contribute directly to many of the issues identified by the SWAP research agenda. A comprehensive programme of radiocarbon dating and survey in Perthshire is under way under the direction of Nick Dixon (Dixon *et al.* 2007; Cook *et al.* 2010), while systematic survey of the Loch Awe crannogs using sector scanning sonar by Holley may well provide a new level of insight into the extent of structures associated with crannogs, and has already produced very promising results. It is hoped that these initiatives can be capitalised upon, and methodological advances in surveying and prospection techniques continued.

4.2.5 Gaps in knowledge & requirements for future research

There are several substantial gaps in knowledge, and several areas remain understudied. These gaps in knowledge are chronologic*al.* geographical and methodological: chronologically, both the earliest (Neolithic or earlier) and latest (Medieval and post-Medieval) island settlements require future study; in geographical terms, the north Highlands remain almost completely unsurveyed, and only small pockets of the better known areas have been surveyed in detail. Methodologically, there is still an urgent need for more underwater work, and particularly underwater survey using remote sensing in order to obtain coverage of large areas and identify the full range of submerged structures to be found in Scotland's lochs.

While recent studies have provided more direction and focus to Scottish freshwater settlement archaeology, there are still clear and identifiable areas in need of even the most basic study. Freshwater archaeological sites have repeatedly demonstrated the ability to provide a clear and detailed record of human activity, and the development of new and more efficient techniques for making the most of this high-resolution archaeological data should be a principal aim of future initiatives. As stated above, owing to the patchy and inconsistent understanding of the range of the freshwater resource - a situation which could perhaps be improved by the full inclusion of water bodies in pre-development archaeology - primary field research- survey and excavation- remains most valuable, but it is clear that they must be carried out within considered and contextualised strategies – benefitting research into any understanding of the past.

The Archaeological Potential of Scottish Rivers

Scotland is favoured with extensive freshwater environments and some of the largest and finest river systems in the UK. These systems flow for hundreds of kilometres incorporating riverine catchments and numerous lochs which link ultimately with estuarine environments before issuing into the sea.

Humans have utilised these systems over many centuries, even millennia, the evidence for which forms a tapestry of rich archaeological potential. Opportunities exist for an extensive and broad-ranging study of the human exploitation of these synergistic freshwater and marine systems, encapsulated in a 'source to sea' approach studying a variety of archaeological evidence from prehistory to the modern day.

Examples of similar research includes that undertaken in Northern Ireland which examined the archaeological potential of the great rivers – the Bann, Foyle, Erne, Blackwater and Lagan, and their associated tributaries: http://www.science.ulster.ac.uk/cma/freshwater.html. An examination of the archaeological potential of Ulster's lacustrine environment was also undertaken. The research focused on core themes, such as, riverine crossing points, settlement, rivers as boundaries and defences, the utilisation of rivers for transport and the conscious control of rivers for purposes of navigation, fishing, abstraction and power. Broader research questions associated with the wider river drainage basin or catchments were also explored.

The development of a 'source to sea' project may provide the opportunity to dovetail research into existing initiatives such as the Scotland's Rural Past Project, and in a more curatorial role, with landscape and seascape characterisation. Candidates for this approach include the major river systems and Firths around Scotland, a good example being the River Tay,Tay Estuary and North Sea interface. Opportunities exist for research into the role of the Tay as a main artery for human exploitation in our distant and more recent past. The extension of the riverine and lacustrine study into the marine environment would provide a seamless study of the human relationship with the natural environment since the habitation of Scotland by humans after the last ice age.

4.3 Canals & Navigations

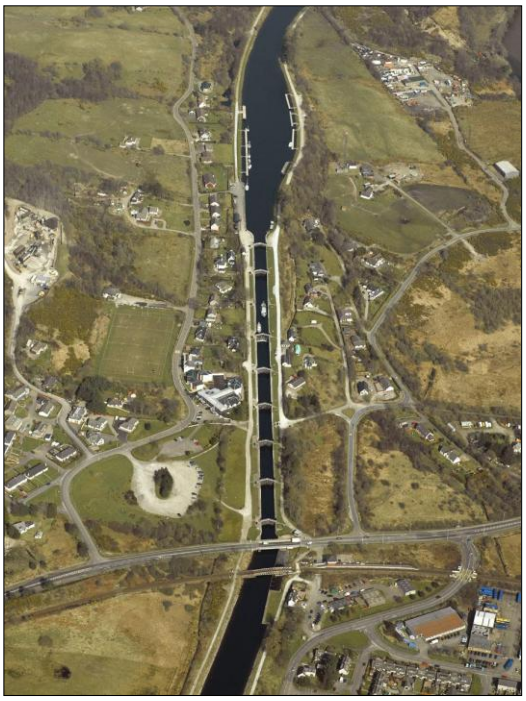


Figure 22: Aerial photograph of the Neptune's Staircase on the Caledonian Can*al.* Banavie near Fort William ©RCAHMS DP023911

4.3.1 Introduction & big issues

The canals and navigations of Scotland are particularly important cultural heritage assets and in many cases represent exemplars in canal development world-wide (for example the first sea to sea link with the building of the Forth & Clyde Canal). This resource, however, is not limited to the more obvious exemplars of the industrial age but also include the extensive riverine contexts in Scotland and examples of relict canals and navigations developed and utilised from early times.

Many of the major Scottish canals fall within Historic Scotland's (HS) remit as most of the waterways are protected as Scheduled Monuments. In addition to identified monuments are the many new sites and less well studied canals and navigations that make up the extensive cultural tapestry of our inland waters.

Scottish Canals manages the inland waterways in Scotland and has taken great steps in recent years to introduce measures to conserve and manage the cultural heritage of the canals – exemplified by the Millennium Link Project[18] which saw the re-opening of the Forth & Clyde and Union Canals. The Project was the culmination of four decades of sustained campaigning by canal societies to reinstate coast to coast navigation. The canals currently under management include the Forth and Clyde, Union, Crinan, Caledonian

[18] http://www.millenniumlink.com/

and Monkland Canals (see Figure 23). These however only represent the tip of the iceberg; the extent and varied nature of the resource means that many facets requiring study are yet to be tapped.

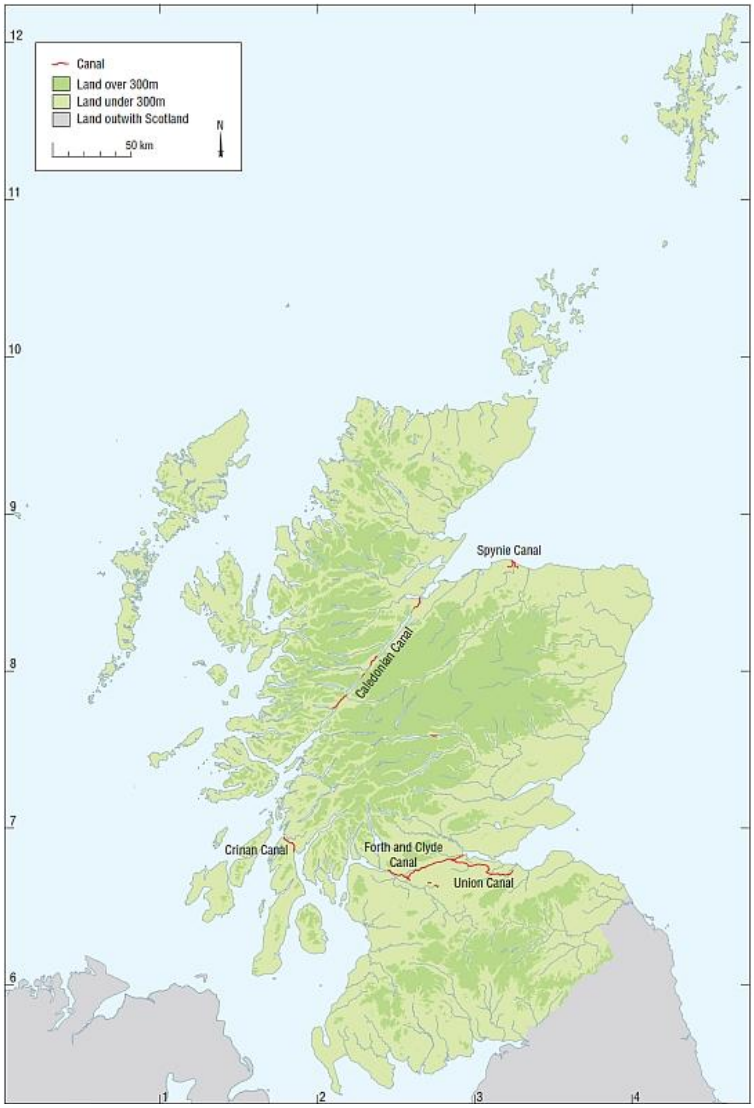


Figure 23: The location of the major industrial canal building programmes in Scotland between the Moray Firth and Forth and Clyde. This shows quite clearly the geographic extent of the industrial enterprise but does not illustrate the many lesser-known and relict inland navigations and waters from earlier contexts, © RCAHMS.

There are a number of principal 'big issues' that need to be tackled to allow us to understand past communities' relationship to waterbodies both as an artery of

communication, and as the context for everyday life:

- There is a need to create a holistic framework that endeavours to quantify the current archaeological and documentary resource – from which targeted, well structured research agendas can be developed.
- These initiatives should not be seen as independent but can be linked with complementary disciplines including industrial archaeology and particular regional research topics and initiatives.
- The canals and navigations need to be placed within the context of the wider cultural heritage landscape.
- The wider resource outwith the remit of Scottish Canals and Historic Scotland needs to be quantified and better understood, leading to targeted research initiatives, perhaps in concert with academic institutions, national bodies and regional archaeological curators.
- The early, pre-industrial evidence for developments in canals and navigations needs to be addressed and better understood.

4.3.2 *Previous work*

Increased awareness of the cultural heritage of the canals in Scotland in recent years has resulted in the launch of various initiatives. Many archaeological aspects of the maintenance and recreational development of canals have been serviced through commercial archaeological contracts, as and when works necessitate intervention. This is usually carried out as part of master-planning and the requirements of the planning process which also necessitate desk based research in addition to archaeological intervention. This is also true of partnership or private canal-side developments, such as those undertaken at the Edinburgh terminus of the Union Canal and the developments planned in the Glasgow area[19]. This work has also been augmented by research undertaken by the various historical societies associated with canal interests in the past. In addition, perhaps one of the most encouraging aspects of recent activity is the joint British Waterways and Historic Scotland funded Senior Heritage Advisor post which ran from 2007 to 2010.

Larger scale research initiatives

The Europe-wide VEV project[20], of which Scotland is a part, is designed to highlight and enhance the value of heritage waterways, and thereby demonstrate their importance to regional development planning. VEV was set up with collaboration in mind and provides the opportunity for different sectors to interact and learn from each others' experience of historic inland waterways. This exchange of experience can inevitably give valuable inspiration to focused and well founded research initiatives.

Comment [EO1]: I've read the web material for this and my understanding is that the EC TERRA funding was for 1999-2000. It supported international conferences and projects. Funding for a seminar in Inverness in 2000 came from this funding but having checked with colleagues we are not aware of any other projects supported from this source. We have had EC or EU funding for projects in Scotland but I don't believe any of these had a research focus. I would therefore debate how relevant VEV is to ScARF or whether it can be called a 'larger scale research initiative'.

British Waterways is a public corporation which, from April 2012, operates only in Scotland as 'Scottish Canals'[21]. The Waterways Trust[22] is its charitable arm. The British Waterways canals in England and Wales are now managed by the Canal & River Trust[23]. British Waterways committed itself to actively involving the community along its many

[19] Connolly and Holden 2001; Atkinson & Dutton 2004; Atkinson 2005; Atkinson 2006

[20] http://www.worldcanals.com/vev/uk/projet.htm

[21] http://www.scottishcanals.co.uk

[22] http://www.thewaterwaystrust.org.uk/

[23] http://canalrivertrust.org.uk/

canals and to collecting oral history on the canal that would then be available to the local community in order to promote tourism but also, along with other community actions, to focus the local communities' attention on the canal. British Waterways also dedicated a strong focus on the careful integration of modern architecture and structures with the historic heritage of the canal; particularly in relation to the Falkirk Wheel. Projects included the description and reorganisation of the Scottish canal archives, part of the Virtual Waterways Archive Catalogue project which is an electronic catalogue of records relating to the canals[24] and the Caledonian Canal music and stories, research and production project[25]. Canal archives can be found in the National Archives of Scotland, Mitchell Library and the Highland Archive Centre and British Waterways also made contributions to SCRAN.

Canal Assessments have been undertaken in specific regions to help quantify the resource through conservation and management initiatives, often in connection with planning and development such as the Forth & Clyde Cultural Heritage Assessment[26] carried out for Glasgow City Council. Further afield, Waterways Ireland has undertaken a national assessment of the architectural and cultural heritage aspects of all the canals and navigations – perhaps a good model to augment the national and regional sites and monuments records and quantify the available research resource.

Focused research initiatives

Research initiatives covering aspects of specific canals tend to be conducted in isolation and without reference to a wider research strategy. While interpretative documents cover a number of canals, there is a lack of 'current' research. Examples include the RCAHMS fold out booklets of the Forth & Clyde and Union canals; and at a more localised level, booklets such as the one for the Dingwall Canal by the Dingwall Museum Trust as part of a series of local studies papers. Other initiatives have included the Wild Over Waterways website[27] for schools, although no recent research has been carried out.

Comment [EO2]: Do you happen to have a contact for this? If not I was going to give someone there a bell.

[24] http://www.virtualwaterways.co.uk

[25] http://www.thecaledoniancanal.org.uk

[26] http://www.glasgow.gov.uk/en/Business/CityPlan/Part3_DevPol_DesGuide/Design/DES05

[27] http://www.wow4water.net/

The Union Canal at Leamington Wharf, Fountainbridge, Edinburgh

Archaeological investigations were carried out at Leamington Wharf on the Union Canal in Fountainbridge, Edinburgh. The remains of a stone quay, wooden platforms and staging, a ropewalk and a canal vessel were investigated prior to redevelopment of the site for housing. The combination of archaeological excavation and historical research illuminated the development of this former canal basin at the terminus of the Union Can*al.* and provided a rare opportunity to study the remains of a canal vessel likely to date from the early to mid 19th century.

The investigation of the historic quay structures and buildings enabled a much better understanding of the nature of Leamington Wharf and the development of part of the busy terminus of the Union Canal in Edinburgh from the early 19th century until the beginnings of decline in its latter years. The investigations also increased our understanding of the subsequent changes in the function of the basin into the 20th century and the changing fortunes of the can*al.* from essentially a commercial use to one of a recreational nature.

The unexpected discovery of the remains of the wooden canal vessel in particular provided a hitherto rare and valuable insight into the nature and characteristics of an early to mid 19th century canal vessel operating on the Scottish Canals. The results of the investigations have made it possible to suggest the age, type and possible provenance of the vessel thus revealing an understudied and little known resource in connection with boatbuilding on the Scottish Canals. A scale model of the canal vessel was created as part of the project, developed from the archaeological evidence and the use of state of the art modelling software. The model will be submitted to the local museum service as a record demonstrating a distinct and wide-ranging research potential for further study.

Figure 24: Excavation of the Leamington Scow on the Union canal in Edinburgh. An indication of how rare and unexpected discoveries through developer-funded work can contribute to cross-sector research opportunities and the capability in dealing with important archaeological discoveries within commercial constraints, © Headland Archaeology.

Interest Groups such as the various Canal Societies have tended to concentrate on local matters and the outcome of this activity been published mainly in the Societies' magazines. The Linlithgow Canal Society has a small museum at Manse Basin in Linlithgow containing Canal artefacts. Contributors to the Railway & Canal Historical Society Journal and to the Newcomen Society have produced in-depth papers on a variety of topics. Articles on specific Scottish canals with a historical bent also appear from time to time in canal magazines such as Waterways World.

Notable publications include Lindsay's (1968) and Paterson's (2006) general works on Scottish canals and a number of popular publications on aspects of the canals by Guthrie Hutton (1994; 1998a; 1998b; 2002; 2003). John Hume's publications on Industrial archaeology (1976; 1977) also include canal related installations, and there are notable publications on specific canals, including work by Cameron (1972) on the Caledonian canal and Fleming (2000) on the Forth, Clyde and Union canals. In addition, British Waterways have produced over the years a series of pamphlets on some historical aspects of the Forth & Clyde and Union Canals. Assorted information on Scottish Canals also appears on the Internet, for example 'Lost Scottish Canals' on Secret Scotland wiki[28].

4.3.3 Gaps in knowledge & Future Areas of research

There is a need for the continued quantification of the current archaeological and documentary resource. The quantification of grey literature and bibliographic sources would help develop our understanding and subsequent identification of 'gaps' in knowledge and the development of research themes. This work could augment the current initiatives developed between Scottish Canals and RCHAMS to improve NMRS data (there are currently c.650 canal related records in the RCAHMS Canmore database) and the quantification of the archaeological resource. In addition, Scottish Canals is investigating ways that the data can be digitised and the resource made more accessible to researchers. Other aspects of an augmented digitised resource include moves to increase the pictorial resource on SCRAN[29]. Scottish Canals also hope to improve archiving protocols for future work, for example through the *Online AccesS to the Index of archaeological investigationS* project (OASIS[30]). In addition, specific research topics worthy of detailed study include ship and boatbuilding on the Scottish canals.

Future approaches required to address current research gaps should include the following:

- Research placing canals within their landscape context, incorporating initiatives to understand how the canals were utilised. Both desk-based research and fieldwork could identify heritage assets associated with the canals, including timber yards, quarries, mines, settlement, and support industries;
- Exploration of the interface between waterways, the coast, and non canalised navigations (e.g. the rivers and lochs associated with the Caledonian Canal among others);
- Greater quantification, understanding and study of relict waterways from both industrial and pre-industrial contexts; research into the development (and sometimes the demise) of canal ports, such as Grangemouth, Fort Augustus, Port Dundas, and Port McAdam;

[28] www.secretscotland.org.uk

[29] http://www.scran.ac.uk/

[30] http://www.oasis.ac.uk/

- Scotland-wide studies of boat and shipbuilding on inland waters;
- Reconstruction of the wider systems of inland waters, including settlement, transport, exploitation and trade.

Future areas of research remain difficult to define in the face of difficulties quantifying the resource as a whole. Initiatives are in the process of development such as those already mentioned above. However, in the light of our limited understanding of the exact state of the resource, some indications as to potential future avenues of research are presented above.

4.3.4 Capacity

One of the key issues is the lack of any academic focus currently available in Scottish Universities that concentrates upon teaching and research of industrial archaeology and the archaeology of Scottish rivers, canals and navigations. This concern is recognised by Scottish Canals who are developing links with universities. It is hoped that a well-developed research agenda could kick-start interest within higher education institutions.

4.4 Summary Research Recommendations

Potential projects or approaches that this framework deems appropriate to promote and pursue include:

- To focus study on crannog contexts within their wider landscape, particularly of the earliest (Neolithic or earlier) and latest (Medieval and post-Medieval) sites;

- To survey under-studied areas in Scotland such as the north Highlands, as well as the remaining parts of the better known areas. This should include underwater survey using remote sensing in order to obtain coverage of large areas and identify the full range of submerged structures to be found in Scotland's lochs

- To develop 'topical' research in areas such as Boat and shipbuilding;

- To foster partnership projects encompassing rivers and navigations and the mapping of the development of riverine, lacustrine and canal contexts, particularly in connection with arteries to more extensive settlements connected with the sea. This will allow understanding of how people exploited inland waterways and interacted with the coast in a 'Source to Sea' style approach.

5. Ships and Vessels

5.1 Introduction

Given the vast number of ship and vessel remains around Scotland coasts, it is useful to attempt to categorise them, define them and identify gaps in their research and some future approaches to these vital archaeological resources. Wreck sites and surviving vessels together provide an invaluable research resource which benefits from examination in a joined-up manner. This chapter outlines the range of archaeological potential of extant vessels, discusses the range and potential of early watercraft, such as log-boats, and defines the archaeologic*al.* historical and wider potential of shipwreck archaeology. Ships of potential archaeological interest fall into five general categories:

1. Vessels still afloat and in active use with origins and/or careers of historic significance. Such vessels may have undergone extensive rebuilding and restoration during their lifetimes. Attempts will often have been made to re-create their supposed original appearances. Only by identifying and recording what is origin*al.* and working out what changes have subsequently been made (including attempts to 'reverse' earlier ones), can valid archaeological information be derived from such survivals.

2. Vessels no longer in use, but which, because of perceived interest whether by virtue of technical innovation or historic significance, have been preserved afloat, ashore, or in a dock. As with the previous category they will often have undergone extensive modification, repair, and attempted reversal of deterioration during their careers. In this respect they are akin to standing historic buildings, and similar techniques of structural analysis and chronological phasing should be applied to their study. Comprehensive and accurate recording of such vessels is of prime importance. Laser scanning is a valuable tool for this purpose, and has been successfully applied to the recording of the emigrant clipper ship *City of Adelaide*[31]. It should be remembered that, unlike most buildings, ships are not constructed with permanence in mind, and are especially vulnerable to rot, corrosion, and mechanical stress when laid up ashore. The tasks of long-term preservation and maintenance are technically difficult, expensive, and constantly recur. Routine survey permits monitoring and the identification of problems as they arise. Should it become no longer practical or economic to preserve a vessel, the completion of as complete a record as possible recording the detail of all aspects of construction and the precise nature of all components is the only alternative.

3. Vessels abandoned on the foreshore or in the inter-tidal zone. Boats are frequently left drawn up in creeks or just clear of the beach, often with an owner's intention of doing something with them 'one day'. At what point good intention fades to abandonment is rarely clear, but many old vessels around our coast have progressed beyond hope of useful life and may be regarded as potential archaeological resources. The identification and recording of those deemed 'significant' would be a valuable exercise. Such vessels are likely to have been stripped of most of their contents and usable fittings, though they may still incorporate archaeologically relevant material other than structure. Ships grounded in the inter-tidal zone, though technically 'wrecks' rather than 'abandonments', can often be placed in the same general category, as they are likely to have been extensively salvaged to leave only a bare and often partly

[31] http://www.headlandarchaeology.com/Services/consultancy/maritime_case_studies/city_of_adelaide.html

disintegrated hull. Examples are the large wooden wreck on Fuday, Barra, believed to be of 16th or 17th century date, which appears occasionally when sand levels are low, and the remains of a 19th century smack in the beach near Montrose.

4. Shipwrecks deposited below low water mark. These are archaeologically the most 'pure', since they represent the reality of a ship and its contents at the time of wrecking, though natural forces will have dispersed and degraded its once highly-organised entity to a greater or lesser extent. Later human activity, notably salvage, may also have selectively removed further material or in other ways disturbed the site's coherence. An understanding of formation processes can often inform a hypothetical reconstuction of the ship and an understanding of its structural technicalities, while distribution patterns of artefacts and other material may reflect aspects of internal organisation. Evidence may bear on the purpose of the vessel, such as trade, resource exploitation, or warfare, and touch on related craft skills, domestic activities, and social division on board. Environmental evidence such as food remains may reflect aspects of diet and sources of supply, while human skeletal remains will often represent healthy young individuals from specialised backgrounds who would not otherwise have entered the archaeological record. A ship is in many ways a microcosm of its parent society on shore (though there are often significant differences, such as gender imbalance), so the study of a shipwreck assemblage often goes considerably beyond the immediacy of an individual vessel. The archaeology of shipwrecks should always be studied in their cultural contexts, and related to the wider history and archaeology of relevant periods and associations. In more general terms shipwrecks are often rich sources of artefact groups with unusually precise *termini post quem*, so their value in testing and refining typologies should not be overlooked. All these aspects are illustrated by the Duart Point wreck (see below), and it may be expected that shipwreck deposits elsewhere in our waters will offer similar opportunities for other periods and aspects of the past, maritime and terrestrial.

5. Isolated components from boatyard sites, timbers re-used in buildings, displaced relics from abandoned ships, or items deposited in wet environments for seasoning. Examples include boat timbers from medieval Perth and pieces perhaps associated with shipbuilding activities from Eigg and Rubh'an Dùnain, Skye (see boxed example below).

5.2 Early Watercraft

The current gaps in the archaeological record for early watercraft are a matter of long recognition (Piggott 1982, 7), particularly when compared to other European countries. Chronology is an issue - any surviving remains require to be dated in order to appreciate their significance and to integrate them within the broader context of their contemporary prehistoric society.

There is no recognisable concentration of early watercraft discoveries comparable to those seen in the Humber Basin or on the South Welsh coast. This must be considered surprising, given that Scotland is geographically distinguished by: relatively large size; deeply indented (and hence long) coastline; large areas of estuarine and coastal dunes; vast areas of peat bog (much of it along watercourses); and large numbers of inland lochs and (on occasion) lakes, both deep (glacial) and shallow (periglacial).

The historically-recorded pattern of maritime losses shows relatively few examples from Scottish waters. The RNLI map of published losses for 1876-7 (reproduced in *Underwater Archaeology*, the *NAS Guide to Principles and Practice*, 2008) shows their frequency distribution to follow an exponential decline away from the Straits of Dover (notably the

Goodwin Sands); Scottish losses are infrequent, and mainly in the major estuaries of the east coast, while Orkney and Shetland are not mapped at all.

5.2.1 Gaps in our knowledge

The geographical background renders maritime remains of extreme significance in understanding the prehistoric development of Scotland. Some key research areas are discussed below.

Early prehistoric settlement and use of islands, notably the Hebrides
Apart from initial colonisation and subsequent contact, there is also the question of the use of islands, notably for fishing. The value of the sea to Mesolithic populations is an important research topic (see Hardy and Wickham-Jones, 2002), although the absence of evidence for sea-craft is a significant challenge.

Neolithic and Bronze Age 'trade' in raw materials
This is a significant research topic, though with little primary evidence as such. Examples of the potential of work in this area include research into the pitchstone trade (Ballin 2009). It is worth noting that such heavy, durable and intrinsically valuable cargoes as roughouts and semi-manufactures are well suited to transport in early watercraft. The maritime role of early craftsmen is also a promising research area, with the Eigg metalworking deposit as an example (RCAHMS 2003).

Contact in the Late Bronze Age and Iron Age
The nature of contact between different groups on a local to international level is a key research area, some specific topics include: what was the mechanism by which Roman material found its way beyond the 'Empire'? (see Robertson 1983); what is the significance of the Broighter boat model, the Irish votive deposit that is said to be a skin boat? (see Farrell and Penny 1975); were 'Venetic' ships found around Scotland in the IA? Is there any evidence in Scotland for leather sails and/or chain rigging, or indeed chainwork of any type, such as that found in Llyn Cerrig Bach, Merioneth (see Macdonald 2007)?

Living and dying in the Early Historic and Norse periods
Connections between settlement and maritime aspects of society is an important research theme. This period is characterised in the North and West by an increasing conjunction between settlement and maritime use, epitomised by the development of Norse settlements in maritime situations (e.g. Brough of Birsay with its boathouse) and the move towards castles and fortifications in 'maritime' situations in the West, notably the range of forts studied by Alcock (e.g. Dunollie, Dumbarton). One example of a current research programme is the Papar project, which focuses on the place names of Papar and the archaeological remains, historical documentation and surviving ecclesiastical sculpture (see http://www.paparproject.org.uk/).

The connection between maritime and funerary/religious belief is another key research area, with boat burials, such as at Scar on Orkney (Owen & Dalland 1999), hinting at wider connections.

Logboats
Notwithstanding the Carpow discovery (Strachan, 2010), it must be stressed that the available body of evidence is currently minimal in quantity, and quality. The record is also potentially misleading in that is consists almost entirely of poorly-recorded oak examples - oak hardens and preserves remarkably well by self-induration when left in peat, giving it a remarkably high survival value which grossly exaggerates the importance of the use of this timber. The limited dimensions of the oak available in Scotland (on the edge of the distribution of

the species) must, realistically, have resulted in many (if not most) of the logboats used being made from softwood and/or paired examples or log rafts, which would allow the use of smaller timbers than would be required for the construction of 'conventional' examples. This may be one part of a research strand that could be pursued in the future;

It should also be noted that the logboat, as a type, is inherently cross-period. Individual examples have been recorded from the Bronze Age to the post-Medie*val.* though their placement within the *Department of Medieval and Later Antiquities* at the British Museum recognises a particular concentration of use. Their typological links with, and reuse as other categories of artefact (including cooking-troughs, log-coffins, industrial and salt troughs) has long been recognised and forms another potential research area (Mowat 1996, 137-148).

5.2.2 Current research projects and future approaches

The chronology of the recorded discoveries of early watercraft (including logboats) across the UK reveals an encouraging increasing frequency of such discoveries in recent years, with an implicit recognition that watercraft discoveries are a form of archaeological evidence which can, and should, be investigated by 'normal' units rather than specialist teams and institutions. Apart from the continuation of chance discoveries, and their investigation in the current manner, the potential of the following may be recognised:

Ship- and boat-remains in urban contexts
Excavation at London and elsewhere (York, Bergen, Trondheim, and Beverley) has revealed the coherent remains of early watercraft (in practice, Viking or Medieval) either retained or deposited behind harbour-walls (which inevitably develop forwards) or in re-use incorporated as coherent units into harbour- and river-walls. The logboats from Springfield and Clydehaugh, Glasgow presumably fall within this category, while the projected River Clyde canalisation works of the 1950s would have blocked in the Newshot Island ship graveyard and the Erskine logboats that were discovered by Helen Adamson. The discovery in a similar situation of the old harbour at Perth is also significant here, while the Dover boat falls within this category. The log-boat found at Dumbuck crannog, discovered in a wooden-lined dock adjacent to the crannog timber platform (see Hale & Sands 2005), is another example.

Areas within Scottish towns which appear significant in this respect would appear to include the following (Table 1):

Table 1: Areas within Scottish towns which appear significant for ship and boat remains

Aberdeen	The area between the present docks and also that to the west of Bridge Street (essentially the railway goods yard). Aberdeen docks have been constructed by the selective excavation of a braided river channel, the quays being the former banks between.
Dumfries	The Whitesands (bus station) area, east of the river. The presence of training walls around Glencaple and the Southernness lighthouse indicate the early significance of the port here.

Glasgow	Both banks of the river from about the Glasgow Green barrage at least as far Westwards as far as the West side of Partick.
Inverness	Both sides of the river throughout the whole extent of the town.
Leith & Newhaven (Edinburgh)	Both sides of the Water of Leith and the shore NE of Commercial Street, Bernard Street and Baltic Street, but not the present Leith Docks area which is built out to seawards from the old shoreline.

Perth boat timbers

What appears to have been a well-preserved boat was found at Perth in the 1830s, though it was not recorded or preserved. But the excavation of waterlogged medieval levels in Perth during the 1970s revealed several wooden boat components, some re-used in timber buildings of 12th century date. All belong to the clinker or overlapping-plank tradition. They include plank fragments edge-joined with distinctive iron rivet and rove fastenings, together with unused roves in strips with chisel-cuts defining each square washer, so they could be broken off as required like pieces of chocolate. These unused roves suggest that boats were being built or repaired in the locality.

Other timbers include frames notched for overlapped planking and tholes, to which oars were attached with rope grommets. These denote vessels low enough to allow oars to be placed directly atop the gunwale. That larger ships were also present is suggested by what appears to be an oar-port shutter, similar to those found on the Gokstad Viking ship of *c*. 850AD. These sealed ports cut for the oars when the vessel was under sail, as seen on the representation of a galley at Rodel in Harris dated 1528.

The Perth finds suggest that other urban deposits in riverine or maritime locations, especially where good organic preservation obtains, may contain boat-related material. Recent discoveries in Dublin illustrate the richness of what may be preserved.

Ship- and boat-remains in areas of major agricultural drainage

This same approach may be extended to rural contexts in such low-lying areas with developed artificial drainage systems as the Carse of Gowrie (Hodd 1975), which intrinsically present problems and possibilities similar to those long recognised in Eastern England, the English Fenland and the Somerset Levels. These are types of areas which deserve regular monitoring, notably by ditch-walking.

Sub-bottom sonar-based investigations

The relatively restricted use of sonar investigation in Scotland includes the illustration of deep water in the West (Sound of Mull) and North (Scapa Flow) Robertson 2007). However, the picture currently presented by the RCAHMS database is that of the greatest number of recorded losses lying within the mud estuaries of the East, notably the Rivers Esk (including Montrose basin), the outer Tay and parts of the Forth.

Ship- and boat-remains near early settlements in 'shore' situations

Vessels at the end of their life are commonly abandoned close to their area of use, and may be discovered if the area of interest and excavation is expanded to this end. The potential value of the trenching (or possibly geophysical survey) around the base of Dunadd (within the infilled area of the Crinan Moss) is a case in point (Lane and Campbell 2000).

There is considerable potential in the use of sub-bottom sonar systems to indicate the frequency of wreck remains across such areas as the Drum Sands (in the Forth) or Elbow End Bank (in the Tay), although most vessels so revealed would presumably date from beyond the period here covered. The remarkable number of wrecks revealed by pioneering works of this nature across the Goodwin Sands offers an encouraging example (Cloet 1954).

Loch as a research focus
There is much to be gained from the detailed multidisciplinary investigation (including excavation, natural history and sedimentology) of a small and shallow in-filled loch, most probably in the South-west, with the potential for a range of structures and finds including metalwork hoards, crannogs which have not been reduced to their substructures, and logboats.

5.3 Shipwrecks

Shipwrecks are quite distinct from surviving historic ships, and enjoy a similar relationship as that between terrestrial archaeological features and standing historic buildings. The nature of the evidence each can provide, and the processes by which it is obtained and analysed, are for the most part different, although (as on land) there is potential for integrated approaches. The recording of smaller vernacular craft above the low tide mark, whether still in use, abandoned, or partially decayed, in some respects straddles these categories, and requires consideration on its own terms.

Although shipwrecks are a stand-alone category, they should logically be seen as integral parts of the wider periods and historical processes with which they were associated. A primary characteristic of a shipwreck is that it is usually a secure closed find with a closely defined *terminus ante quem* for its loss. The circumstances of the loss, and the character of the environment, will determine the survival of various components, and an understanding of the formation processes involved will therefore inform the interpretation of its remains. They are likely to include aspects of the ship's structure, fittings, and gear; its contents and equipment; items relating to specialised activities such as navigation, medicine, trade, warfare, measurement-taking, and craft skills; provisioning and food preparation; and the domestic and personal possessions of those on board. A ship and its contents, moreover, is not just a random assemblage of unrelated objects and environmental materi*al.* but a self-contained and highly organised entity in which each part relates to the others. Its remains will therefore represent not only the focused purpose of a particular voyage but also, in many and often highly significant ways, reflect its parent society on shore. A shipwreck, if properly investigated, may have an archaeological potential on a par with Pompeii or an unopened Pharonic tomb.

Figure 25: The Fuday wreck located on a beach in the Sound of Barra. This potentially significant wreck provides all sections of the research community with the opportunity to study ship remains in a more accessible context than more traditional submerged wreck sites. Such remains provide often well-preserved subject material for multi-disciplinary investigation, © Headland Archaeology.

Rubh'an Dùnain, Skye

Figure 26: RCAHMS Aerial Photography Digital General oblique aerial view centred on Loch na h-Airde, the 'Viking Canal' and Rubh' an Dunain with the Cuillin Hills in the background, taken from the WSW. DP098284 ©RCAHMS

Parts of medieval boats, one of which has been dated to *c.*1100AD, have been found in Loch na h-Airde. This shallow and partly fresh-water loch is linked to the sea by a 100m-long canal. A blockage in the canal ensures that the loch level remains constant, and it is suggested that vessels entered and left at High Water via some kind of sluice. The remains of a now submerged stone-built quay has been identified inside the loch, and two boat nousts are situated on the northern edge of the can*al.* close to its seaward end. A promontary dun, probably of late prehistoric origin, stands nearby.

It is believed that this place was used for boatbuilding, repair, and secure winter harbourage, perhaps over a long period. The probability that the loch contains more boat components, and perhaps articulated pieces of structure, is high. It is paralleled at Laig on Eigg, only some 30 km distant from Rubh'an Dùnain, where boat timbers were found in the 19th century. Preliminary assessment suggests that there may be similar sites elsewhere in Scotland, some of which might also contain boat remains of medieval or earlier date, especially where waterlogged conditions still prevail.

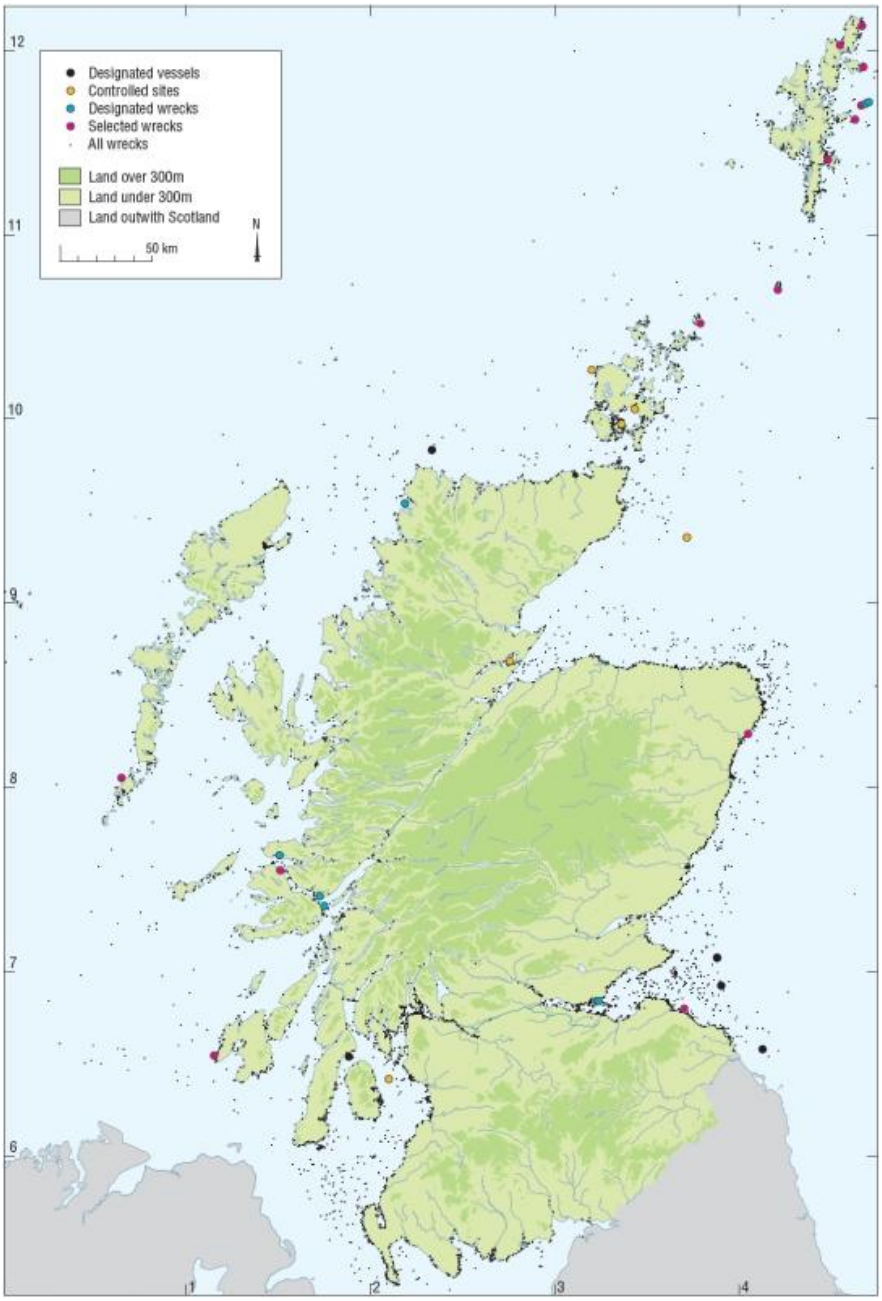


Figure 27: Location data of wrecks, losses and casualties. A comprehensive list of losses in Scottish Waters is available in Whittaker 1998 which is kept updated and the data also entered into CANMORE. © RCAHMS.

5.3.1 History of research

Scotland's first generation of shipwreck archaeology has been largely positive and in several respects innovative. As elsewhere, treasure hunting dominated activities in the '60s and early '70s, but this was mitigated in 1973 by the Protection of Wrecks Act and the establishment, in the same year, of an Institute of Maritime Archaeology (later the Scottish Institute of Maritime Studies) at the University of St Andrews. Active scholarly fieldwork has been practised in our waters since 1970, when the remains of the Armada ship *El Gran Grifón* were excavated off Fair Isle to conventional archaeological principles and standards (Martin, 1972). In 1972 and 1974 the Dutch East Indiaman *Adelaar* (1728) was investigated off Barra (Martin 1992 and 2005).

A milestone in the evolution of the discipline was the excavation of the *Kennemerland*, a Dutch East Indiaman lost off the Out Skerries of Shetland in 1664. Seven seasons of work were conducted on the wreck between 1971 and 1987 (various references cited in Martin, 1998: 122). Here the late Keith Muckelroy tested the theoretical approaches to wreck formation processes which led to his seminal book *Maritime Archaeology* (1978), which has done much to establish an internationally-recognised framework for the subject.

A key project undertaken by the St Andrews group between 1973 and 1975 was the excavation of the *Dartmouth*, a 5th-rate warship lost in the Sound of Mull in 1690 (Martin, 1978). This was the first site in Scotland to be protected under the 1973 Act. The National Museums of Scotland were involved from the outset, providing conservation services and acquiring the full collection for curation and study.

In 1991 it was noted that the wreck of the small Cromwellian warship *Swan* (see boxed example), lost off Mull in 1653, was under threat from erosion. Historic Scotland, which that year had taken responsibility for the country's shipwreck resource, designated the site. The project developed as a rescue intervention on which a research agenda was grafted, with funding from the annual round of competitive bidding supplemented by other sources. The NMS came in as an active partner and acquired the full collection of finds from a programme of limited excavation and site consolidation which ended in 2003. Several interim papers have been published and the final report is close to completion (see Martin 1997, 1998, 2005).

From 1986 to 2003 St Andrews University held a contract to operate the UK-wide Archaeological Diving Unit (ADU) in support of the historic shipwreck legislation. Though not specifically dedicated to Scottish waters, the unit's presence here has had a spin-off in terms of fostering interest and developing expertise in maritime archaeology. Its director (Martin Dean) was instrumental in establishing, in collaboration with the Nautical Archaeology Society, the Sound of Mull Archaeological Project (SOMAP), an initiative which has encouraged amateurs to develop and use skills in underwater archaeology. A monograph has recently been published (Robertson, 2007).

In 2002 Philip Robertson, who over the years coordinated the SOMAP programme, organised the investigation of an early 17th century ship with Iberian associations off Kinlochbervie. This project demonstrated the viability of combining amateur and professional input, and resulted in the recovery of a unique collection of Italian majolica of late 16th/early 17th century date (Robertson, 2004). This project, which was carried out in association with Historic Scotland and the NMS, was also noteworthy for the expert analysis conducted on an unusual and important ceramic group, demonstrating the still under-utilised potential of closed shipwreck finds within a

wider archaeological context (Brown and Curnow, 2004).

The ADU has now morphed into ADUS (ADU Survey), a collaborative venture involving the Universities of St Andrews and Dundee. This unit specialises in ultra-high definition multibeam sonar, which works especially well on upstanding metal wrecks, and has made an excellent record of the German ships in Scapa Flow as well as of the British battleship *Royal Oak*.

The *International Journal of Nautical Archaeology* is currently edited in Scotland, but there is currently no university programme or research group in Scotland dedicated to shipwreck archaeology, the St Andrews institute having closed in 2002. The lack of current research projects is an issue in that not maintaining a level of active fieldwork runs the risk of losing national capability to deal with resources under threat (such as the Duart Point shipwreck, see below).

The Duart Point shipwreck

The wreck of a small Cromwellian warship lost in 1653, probably the *Swan*, was discovered off Duart Point in 1979. In 1992 the site was found to be under threat from erosion. After a rescue and recovery operation by the University of St Andrews in collaboration with Historic Scotland and the National Museum of Scotland, work to consolidate and protect the wreck was conducted between 1993 and 2003 under Colin Martin's direction. This involved limited excavation and stabilisation with sandbags. Circumstances allowed the work, although rescue-driven, to be conducted to research standards. The site is designated under the 1973 Protection of Wrecks Act.

Detailed survey and environmental observations led to an understanding of formation processes, allowing an interpretation of the archaeological remains. Parts of the lower hull survive along its full length, while some of the upper works, particularly towards the stern, have collapsed in a relatively coherent manner. From this the vessel's dimensions and general proportions have been ascertained, and aspects of its internal layout established. Structural elements from the transom stern and pieces of carved decoration have informed a reconstruction of the ship's symbolic iconography.

Finds include furnishings and fittings from the stern cabin, where a sword hilt and pocket watch were found. Navigation is represented by the remains of a binnacle, mariner's compasses, and dividers. Parts of the ship's pumping system were identified. A patent iron gun - the first of its kind known to survive - was identified, together with its carriage and associated items. Domestic objects include pottery and clay pipes, and many wooden utensils. Weights and measures were found, including the oldest known examples of pewter 'tappit hens'. An assemblage of animal and fish bones, and a rotary quern, indicate that the vessel's provisioning was locally-based. A human skeleton provides evidence of physique, diet, and health, and shows work-related characteristics which suggest the individual was a seaman.

The University of St Andrews have been using XRF/XRD techniques (see also section 3.2.1 of the ScARF Science panel report) for rare Earth element analysis and geochemical fingerprinting of archaeological material from the Duart Point wreck. In particular this work has focussed on metal analysis of guns from the site.

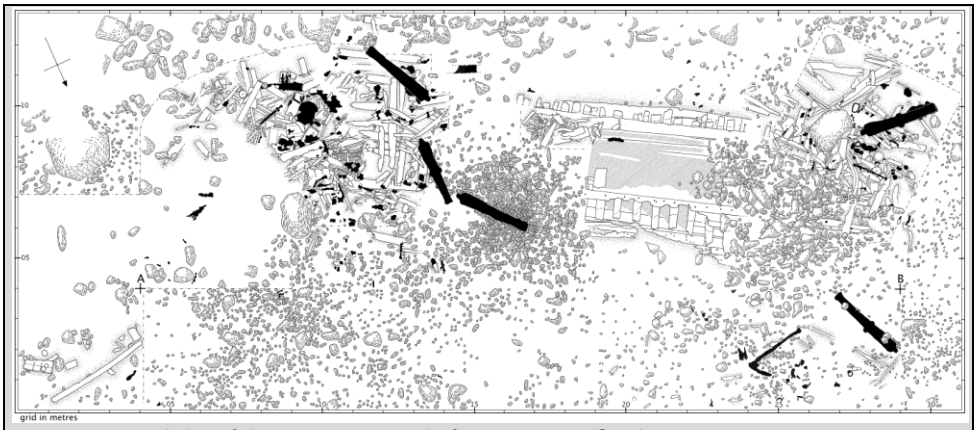


Figure 28: General plan of the Duart Point wreck after excavation, © Colin Martin.

Figure 29: Duart Point, Mull. The value of this shipwreck site goes far beyond the increase in knowledge about the maritime past of the wreck, and encompasses the capacity-building aspect of expertise and skills-development for current and future marine and maritime researchers, heritage professionals and archaeological divers, © RCAHMS DP018039.

5.4 Historic ships and Boats

Introduction: Surviving historic ships and boats offer a direct connection with the maritime past and can provide insights into the operations and experiences of sea-going life in former times. Despite this attraction they have hitherto not featured extensively in archaeological or antiquarian research and have until recently been largely excluded from cultural resource management and heritage protection legislation. This state of affairs had its origins in the perceived sense that historic ships are difficult and expensive to look after and that their potential mobility (in contrast with historical monuments on land) created problems for their care and protection. It also arose because of the specialised skills required to work with historic vessels, which skills were not to be found among those

working with other forms of archaeological and antiquarian resources.

This former position is rapidly undergoing change. The setting up of the National Historic Ships Project in 1995 led to the establishment in 2000 of the National Register of Historic Vessels (NRHV), originally managed by the independent NHSC but since 2007 by the centrally funded Advisory Committee on National Historic Ships (ACNHS; see ACNHS Annual Reports 2006-7 et sequ)[32].

The NRHV comprises detailed records of vessels located in Britain, above 33ft (10m) in length on deck that are over 50yrs old (a rolling age criterion), built in the UK or, if not, of demonstrable significance to UK maritime history, and substantially intact. A similar database, covering vessels less than 33ft long, the National Small Boat Register (NSBR) is maintained by the National Maritime Museum, Cornwall. The two registers together provide for complete coverage of surviving historic craft of all sizes, types and functions in the UK. Details of vessels on the registers which are transported overseas, or which are lost or broken up, are transferred to the NHS Archive. These three registers thus provide detailed records of all known vessels over 50 years old which are or were until recently surviving in the UK[33].

The registers are backed up by a large database, providing technical information about each vessel, its life-history and the changes in configuration it has undergone. This detailed information is used to evaluate systematically the heritage significance of each vessel, using a multi-variate scoring system, and as a result, the most significant surviving ships and boats in each functional category in the maritime economy can be identified. These vessels comprise together the National Historic Fleet (NHF)

The scale of the Scottish resource: There are currently 1,009 vessels on the NRHV (excluding vessels on the NSBR), of which 212 form the NHF. The Scottish contribution to these statistics is set out in the accompanying tables, showing the number of NHF vessels based in Scotland, both those built here and those originating elsewhere in the UK. There is also a table showing the number of Scottish-built vessels based elsewhere in the UK. (See Tables 2 – 4).

[32] Recent changes in H M Government policy towards NDPB's has brought about a change in name from *ACNHS* to *National Historic Ships*.

[33] The registers exclude historic wreck sites, which are listed separately on Sites and Monuments records and on the list of sites Designated under the Protection of Wrecks Act, 1973.

Table 2: Number of Scottish-built vessels in the NHF, Archive, and NRHV that are (or in the case of archived vessels, were) located in Scotland

Status group	Number of vessels
National Historic Fleet	18
National Historic Ships Archive	27
Register only vessels	24
Total number of vessels	69

Table 3: Number of Scottish-built vessels in the NHF, Archive, and NRHV that are (or were) located outwith Scotland.

Status group	Number of vessels
National Historic Fleet	21
National Historic Ships Archive	51
Register only vessels	51
Total number of vessels	123

Table 4: Number of vessels in the NHF Archive, and NRHV, built outwith Scotland, that are (or were) located in Scotland.

Status group	Number of vessels
National Historic Fleet	7
National Historic Ships Archive	11
Register only vessels	18
Total number of vessels	36

From the above tables it can be seen that there are (including archived vessels) 105 historic ships, regardless of origin, with present or recent locations in Scotland, representing 10.4% of the records in the National Registers. Of these ships, 25 (24%) are NHF members. Turning to Scottish-built vessels on the Registers, there are 192 UK-wide, representing 19% of all records; of these Scottish-built vessels, 39 (21%) are of sufficient heritage merit to be included in the NHF. The addition of records from the NSBR would considerably extend this source of information about Scottish-built ships and boats from the past.

These surviving vessels include examples from a variety of functions across the maritime economy, including warships, merchant ships, passenger carriers and ferries, fishing vessels, service craft such as ice-breakers, tugs, rescue boats and light-vessels, a research vessel, ceremonial craft and leisure craft. They form a reference collection against which ship structures from the archaeological record can be compared. They also present opportunities for experimental archaeology and for research into craft practices in the past. Together they comprise an educational and research resource whose potential is only just beginning to be appreciated. Above all they are inspirational.

Table 5 illustrates one aspect of the impact of these vessels by providing recent annual visitor statistics for six of the larger vessels in

the NHF in Scotland. A further dimension of significance might be derived from a bibliography of published works in which the NHF ships figure.

Table 5: Annual visitor figures for larger historic vessels in Scotland (to nearest 1,000; figures supplied by management).

Ship	Launch date	Construction & type	Visitors per annum (latest figures)
UNICORN	1824	Wood, sailing frigate (Seppings system)	7,000
GLENLEE	1896	steel barque, merchant, later sail training ship	28,000
DISCOVERY	1901	Wood, polar research vessel.(steam and sail)	53,000
REAPER	1902	Wood, fishing vessel (sail)	18,000
WAVERLEY	1947	Steel, passenger ship (steam, paddle-driven)	65,000
BRITANNIA	1953	Steel, Royal Yacht; hospital ship capability (steam turbine)	250,000

The research potential of the National Historic Fleet:

The educational and research opportunities presented by the collection of surviving historic ships and boats are numerous yet the potential of this fragile and diminishing resource is not thus far fully appreciated. The range of possibilities is illustrated by the examples below, some of them based on existing projects, others provided as pointers to future work:

- a test-bed for studies of ship-building techniques, in both vernacular (e.g. boats of the North Isles) and major industrial forms (e.g. shipwrights' race-marks on the frigate *Unicorn*);
- studies of technological evolution including the impact of new technologies on traditional designs (e.g. the introduction of steel ropes and steam capstans in Scottish sailing fishing-vessels such as the fifie *Reaper*);
- field experiments eg sailing studies of Scottish luggers; the design and operation of fishing gear such as drift-nets; craft-based studies of sail-making, rope-making, net-making (including machine-made nets - a special Scottish invention from the early 19th century); navigation and pilotage;
- science-based conservation studies, incorporating new recording techniques such as the use of laser-scan survey methods for intact ships and boats of all sizes (in fact, extending decent recording across the NHF would be a valuable research exercise in connection with this diminishing resource) and improved

methods for dealing with chlorides in wood and metals;

- Ethnological research into ship-board life and working practices

Figure 30: The City of Adelaide is a prime example of a Scottish maritime artefact that can be used to explore many research questions that permeate across the global maritime research community ©RCAHMS

Laser Scan Survey and Historic Vessels

In the last few years the development of hi-tech laser scanning techniques have highlighted the worth of the application in helping with the recording, conservation, and management of historic vessels of all sizes - from ocean going ships to smaller inshore craft. Two recent surveys in Scotland help to illustrate the benefits of the technique, both of which satisfied the differing nature of the project requirements.

The emigrant clipper ship *City of Adelaide*, currently slipped at Irvine under the care of the Scottish Maritime Museum, was earmarked for controlled deconstruction. As a Category A listed structure a condition required the full non-intrusive survey of the vessel prior to intervention to provide a complete and highly accurate archaeological record of the entire vessel. The laser scanner collected 3.5 billion points in a 'point cloud' which creates the 3D image of the object accurate to within 2mm. A photomontage is then 'stitched' to the 3D product to create a manipulative photographic model. In addition to the creation of a highly accurate archaeological record, the technique also enabled

data to help inform engineering strategies for possible deconstruction or removal of the vessel from the site and to guide the museum in the characteristics of sections of the bow and stern which were to be retained in the museum collections.

The second example involved the survey of the Zulu sailing herring drifter *Research* housed in the permanent collections of the Scottish Fisheries Museum. The vessel is displayed undercover in a museum gallery and has begun to show signs of hull movement and deterioration. The purpose of the survey was to create an accurate record of the vessel to establish a 'control' from which to monitor any subsequent movement or deterioration in the hull shape and integrity. In addition, the control element was provided by scanning the builder's half model of the *Carolina*, a Zulu drifter built at the same yard as the *Research*. The resultant survey data from the *Research* was then transposed onto the half model data and compared. The results were fascinating and showed quite clearly the parts of the hull of the *Research* that had altered in shape. The results will help to closely manage the conservation of the hull and fabric and ultimately inform aspects of a proposed Conservation Management Plan to secure the vessel's long term future.

Figure 31: The emigrant clipper ship City of Adelaide. The complicated management and conservation issues of an internationally significant vessel have resulted in innovative high-tech applications to provide a long-lasting archaeological record and management tool for the presentation and future prosperity of the vessel, © Headland Archaeology.

Model Ships

Model ships and boats were made for a variety of reasons (Roach, 2007; 2008), including for commemorative, leisure, decorative, religious, and training purposes, as well as aids for construction. They can therefore shed light on a range of aspects of past maritime and marine culture and

represent a considerable, though currently inadequately catalogued resource. Future areas of research would include the social aspects of model sailing (particularly in fishing communities such as at East Fife and Peterhead, the Peerie Sea, Kirkwall, or in Glasgow parks) as well as the interpretive potential in comparing models with extant and wrecked ships.

Figure 32: A model of the Leamington Scow which illustrates the potential for vessel reconstruction using direct archaeological data without the luxury of the builders plan, © Headland Archaeology.

5.5 Research recommendations

Potential projects or approaches that this framework deems appropriate to promote and pursue include:

- To develop a dating programme for the early vessels of Scotland in partnership with national and local strategies. Early watercraft provide a window into prehistoric settlement, exchange, communication, and belief and archaeological data should be integrated within this wider context.

- To match multi-disciplinary techniques of interpretation and synthesis with recent technological advances, particularly in the field of non-intrusive survey techniques. The application of such techniques to shipwrecks and extant vessels offers a remarkable opportunity to provide information on the economy of maritime communities.

- To promote and pursue, creative approaches to capture the public imagination and offer the opportunity to provide a context for involving wider communities in educational outreach. Extant vessels and shipwrecks as well as ship and boat-building sites can be seminal for raising awareness of the maritime historic environment generally and can be employed for engaging wider communities and disseminating research as well as providing a rich potential research resource for all periods.

- To promote collaboration between different individuals and institutions in order to ensure that the skills and relevant infrastructure are available to meet all future needs. Realising the potential of, what is almost always fortuitous, discovery requires enhanced archaeological capacity in survey, excavation, post-excavation and subsequent analysis and publication.

- To treat research and analysis into watercraft of any period holistically, well integrated within the wider maritime environment. This can be undertaken by applying the methodology, exemplified in the 'Source to Sea' approach.

6. Challenges and Future Directions

6.1 Introduction

This theme falls into two parts; the real and potential challenges that face the research community in Scotland and the potential future directions for research in the marine and maritime sphere. The first part of the theme looks at the individual challenges; ranging from research questions and methodologies to management structures within the wider heritage sector and the methods of communication amongst the constituent research individuals, institutions and networks. This theme recognises that the environment within which marine and maritime research takes place is a challenging one and asks how a research framework can address the issues posed by this environment. The issues of datasets, their origins, sources, data curation, storage, dissemination, use and ownership are identified and the challenges facing the practitioners who work in this arena are illustrated.

The second part of the theme outlines the potential future directions for research in the Scottish Marine and Maritime sphere. It looks at the need for collaboration across the heritage sector and beyond, into specific areas of industry, science and the arts. This section will address the issues of training, skills and building capacity within the sector, to enable the research to be undertaken and developed in the future. Part of this area of potential includes the way in which researchers and the wider public can work together within wider programmes and specific projects, and this is addressed in public engagement and outreach.

6.2 Key challenges

The key challenges identified in this research framework document are listed and discussed below as: Research, management and communication; Fieldwork specific issues; and Data issues

6.2.1 Research, management and communication

Much research in this field has to date been of an ad-hoc nature, with discoveries often occurring by chance. We should continue to embrace the fortuitous contribution that archaeology can make, especially when it comes to the discovery of new sites, landscape features and artefacts and their subsequent investigation. However, especially in the coming years when public sector resources will be severely constrained, there would be benefits in a more structured approach which maximises the contribution archaeological research can make to strategic priorities, government policy, and commercial interests. This approach has been adopted by the Scottish Marine Science Strategy 2010-2015[34] which seeks to focus marine scientific effort on supporting Scottish Government priorities for sustainable management of Scotland's coasts and seas. It also promotes effective collaboration across sectors to ensure the most efficient use of resources. Links with archaeological research interests are acknowledged and doors opened to collaborations with the heritage community. In England, research undertaken for the Aggregates Levy Sustainability Fund[35] has already involved fruitful cooperation between industry, the public sector and archaeological organisations. Fresh insights into the past have arisen together with a greater awareness about how to manage the marine aggregate resource sustainably. As we look to the future in Scotland, improved archiving of and access to important legacy marine data, better coordination of new seabed mapping and

[34] http://www.scotland.gov.uk/Resource/Doc/343328/0114215.pdf

[35] See http://cefas.defra.gov.uk/alsf.aspx

monitoring effort, and a major push for renewable energy offshore represent opportunities for the public and private sector to work effectively together towards common goals. In turn this should provide opportunities for researchers to address 'old' and 'new' questions alike and to communicate hitherto unseen aspects of the archaeological resource to the public in new and exciting ways.

6.2.2 Fieldwork specific issues

The two main areas where there are fieldwork issues are the intertidal zone and the submerged zone. Low tides bring diurnal opportunities which allow windows of investigation, ranging from many hours to very limited periods of exposure. Conversely, high tides bring submergence and the erosive power of in-rushing water, movement of suspended sediment in the water column, localised scouring around temporary research equipment, and the potential for the loss of data as a result of erosion and or deposition of sediments, deposits and artefacts.

Intertidal research is dependent on the tide and this is also true of the survey techniques that are appropriate. For example, the Fairey Coastal Colour aerial photographs (see Figure 34), which were taken at approximately 1:10,000 scale, were not all taken at low tide and hence some of their coverage for the intertidal zone is limited (see Dawson 2004 for a discussion on the use of aerial photographs for locating intertidal features). Recent intertidal surveys, such as those in the Severn Estuary (see SELRC papers[36]), the Shannon estuary (O'Sullivan et al 2001), Strangford Lough (McErlean, McConkey & Forsythe 2002) and site-specific work (for example Hale 2004) has enabled a corpus of intertidal survey and research techniques to be developed that largely deal with the broad range of sites, deposits and artefacts found in this environment.

The increase in use of coastal and near shore sites by both industry and leisure activities are placing ever greater pressure on the environment and heritage of these areas. Over the last decade, the archaeological community in concert with the offshore survey industry has responded to this by the development of a number of new technologies for very high resolution marine survey. Deciding on the particular technology to use will depend on the primary survey objectives: the resolution needed for the survey and what spatial sampling is therefore required; the logistics for deploying the equipment; and unfortunately, the cost of the survey. Further information is given in detail in the EH briefing note on the Use of Geophysics for Maritime Archaeology, and each survey method is briefly described and summarised and is available from the ScARF wiki[37].

The technologies can be divided into two basic types, namely those for measuring features that are on or above the seafloor and technologies for measuring features buried beneath the seafloor. Techniques for both categories are dominated by acoustic-based methods with a few techniques relaying on other physical properties such magnetic and electromagnetic signatures.

[36] http://www.selrc.org.uk/publications.html

[37] Note that this summary is not exhaustive and only gives examples of manufacturers plus examples of spacing/coverage/resolution issues

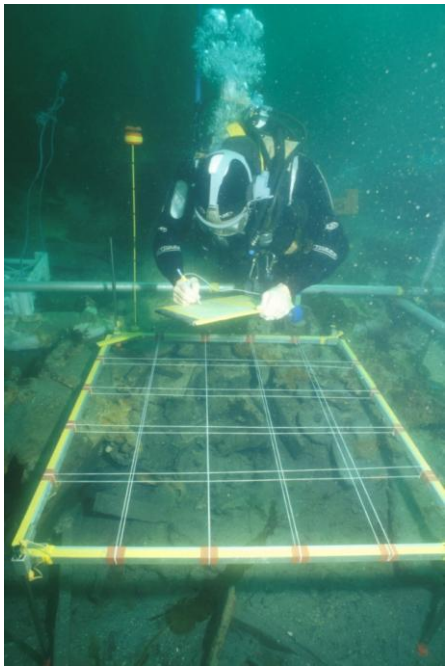


Figure 33: An archaeologist using a drawing-grid and plumbing-device on the Duart Point wreck. Archaeological features under water require assessment by appropriately qualified archaeologists who can dive, ©Colin Martin.

6.2.3 Data issues

The lack of visibility of datasets and especially the absence of cross-sector awareness of the existence of certain datasets appear to be re-occurring issues regarding marine and maritime data. Additional issues include the sizes of datasets, storage capacity, archive and curation problems, dissemination of data in appropriate formats, intellectual property rights issues and the sharing of data through appropriate knowledge dissemination networks.

The 'maritime' national dataset for Scotland currently includes disparate sources of information and it is difficult for the user to fully understand, interpret and engage with this fundamentally important resource. Project Adair[38], a partnership project between RCAHMS and HS, aims to identify these records by providing greater clarity and making subtle but important global changes. A first priority has been establishing a much clearly distinction between the c1600 wrecks that are recorded in Scottish waters (of which only a handful are designated), and around 18,000 losses of shipping that have been identified through desk-based assessments. The wrecks are a finite and crucial part of Scotland's unique heritage assets, while the latter is an indicator of the great potential of marine archaeology over the coming years.

RCAHMS and HS have teamed up to improve access to information about Scotland's shipwrecks and maritime cultural heritage. Project Adair has the central aims of a) updating, incorporating and disseminating important national datasets through Canmore, b) working in partnership with organisations and individuals to improve the quality of information, and c) reporting to the project partners on the best way forward. One of the most important longer term results of this project will be the introduction of clearer symbology, the introduction of 'discovery' polygons, and the development of density mapping. These approaches will combine to help the user more easily distinguish between known heritage assets and potential.

Additional mention should be made here of data availability and licensing issues. Data availability to marine and maritime community users is one area where the heritage sector can demonstrate that it is successfully listening to community needs, in the broadest sense. Data availability is a major priority for the heritage sector and one of the central tenets in working across the range of

[38] See http://www.rcahms.gov.uk/rcahms-projects/project-adair

communities of interest. Marine and maritime heritage information can be used across a broad range of spectrums, from interpretative information presented at sites of significance, to national historic environment archives that underpin planning, management and research bases for whole nations. Making archives relevant to the nation and enabling people to freely and easily interact with the data within archives, is fundamental in the process of historic environment engagement. If institutions charged with the responsibility to create, maintain, curate, promote and keep their archives relevant today and in the future are to achieve their potential usefulness, then they have to make their data freely and easily available. Archives are still sometimes perceived as bastions of knowledge where specialists maintain power and control over their resources by limiting access to information[39]. Although, sea changes in such attitudes are happening across the archive and museum sectors[40], there are still areas and institutions that are lagging behind. New business models have recently been developed that demonstrate good practice, which include the bare minimum of bureaucracy and few if any charges for use. People increasingly expect open, freely available data and resources that can be redistributed and not restricted through contracts and licensing agreements – a bureaucracy that can otherwise add to people's perceptions of poor engagement practices with marine and maritime historic environment sector institutions[41]. Policies initiated by UK government[42], in part developed as a result of groundswell organisations such as the Open Knowledge Foundation[43] which propose codes of practice and toolkits[44], are improving the ways that heritage institutions engage with a very broad range of community members, through facilitating their access to data.

Figure 34: Fairey Coastal Colour vertical aerial photography provides high quality imagery of parts of Scotland's coastline taken in the 1970s. This has considerable potential for further research. SC380355, © RCAHMS

39 For example see Mark Greene's 2008 address, as the president of the Society of American Archivists (2007-8) http://www.archivists.org/governance/presidential/GreeneAddressAug08.pdf

40 Merriman 2004

41 See the example of good practice from the British Museum: http://www.britishmuseum.org/join_in/using_digital_images/using_digital_images.aspx?asset_id=25365&objectId=808635&partId=1

42 http://data.gov.uk/

43 http://okfn.org/

44 http://opendatacommons.org/

Marine data comparison

This example is a comparison between RCAHMS data of maritime losses off Scotland and primary survey data derived from a British Geological Survey multibeam echosounder survey of Loch Eribol, Durness[45], undertaken in 2009. The RCAHMS data is derived from a UKHO data dump in 1992, which comprises wrecks and losses. The Canmore data includes the position of known wrecks (in part derived from UKHO data) and also the approximate position of casualties or losses i.e. potential losses of shipping identified from extensive desk-based research. Added to this, as part of the on-going maritime enhancement record project, are the locations of wrecks and losses, derived from both primary and secondary sources, including Whittaker's 'Off Scotland'.

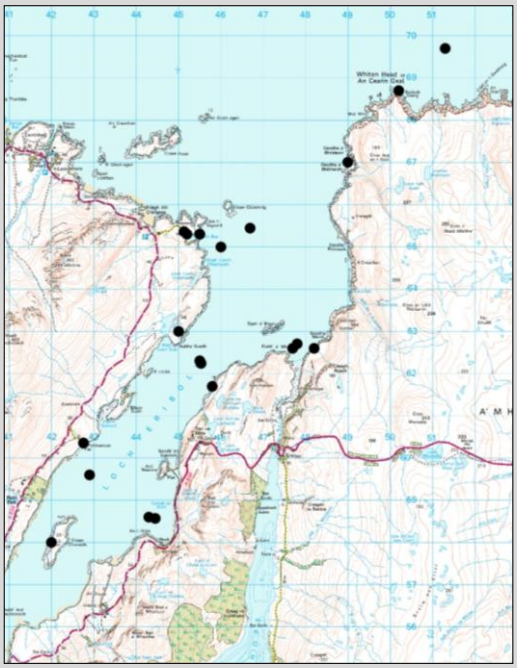


Figure 35: RCAHMS database locations of wrecks are derived from many datasets, both primary and secondary. Accuracy is therefore an issue, with some of the records only be located within a few kms, while others may be surveyed to an accuracy of 10m. RCAHMS uses colour coding to highlight the level of accuracy. © RCAHMS.

RCAHMS' database comprises a total of 20 records of wrecks and losses in Loch Eribol, compared with 4 known on the Seazone (UKHO derived) data. As a data cleansing exercise and as a pilot to develop different methods of presentation of RCAHMS marine data a series of polygons were placed around the site points, with the aim of demonstrating the accuracy of the site point geographical location. Some of the polygons were grid squares, ranging from 100m^2 to 1km^2, whilst others were

[45] see http://www.bgs.ac.uk/research/highlights/lochEriboll.html

'tailored' polygons. Note some polygons cover land and sea. This polygon approach is designed to address the issue of points being located on land as a result of low resolution national grid references and to provide clarity over the potential location, and, in the case of 'real' polygons, the size of the site.

Figure 36: RCAHMS database points with polygons overlaid, to demonstrate the potential location of the site, © RCAHMS.

The BGS 2010 survey was undertaken using the White Ribbon, this relatively shallow draft vessel could not however, reach some of the potential sites in very shallow waters. In addition the survey did not go north of Rispond harbour and hence a number of potential locations were not surveyed. As a result of the BGS multibeam survey two wrecks were identified and two possible sites recognised that reconcile with the RCAHMS locations. Obviously, this demonstrates that there is a disparity between the datasets. This disparity between primary derived survey data and using secondary sources to populate the RCAHMS Canmore database, is a challenge that RCAHMS can address with third party datasets such as the data from the BGS Loch Eribol survey.

Current projects

Listed and briefly described here are some of the current approaches to characterise the maritime historic environment resource. Audits of existing information and the provision of a platform on which to build future work are essential to research into Scottish marine and maritime heritage.

Scottish Marine Historic Environment Data Audit: Sources for the enhancement of the Coastal and Marine Historic Environment Record (Wessex Archaeology commissioned by Historic Scotland)

WA Coastal & Marine[46] was commissioned to provide a rapid study concerning the availability of data for enhancement of the Historic Environment Record (HER) with regard to the coastal and marine environment. The aim of the project was to identify significant existing datasets, assess their value for cultural heritage purposes and to make a series of recommendations for enhancement of the marine HER. The project is intended to inform and support both the work of Historic Scotland to safeguard the coastal and marine environment, and the role of the RCAHMS in the enhancement of its coastal and marine records. An important element of the project was the design and creation of a database listing the most significant organisations holding data of relevance to the coastal and marine historic environment with regard to possible future data mining. Where possible, the limits of the data sources which had a geographic extent were defined. The aims of the project were accomplished by contacting the most relevant external authorities, agencies and contractors and requesting general descriptions of holdings of potential relevance and extents of data coverage. Maps of organisations were created in some cases from the co-ordinates recorded in the Audit Database. The rapid study was commissioned in January and was concluded in March 2011. It was decided early on that it was vital to assess as wide a range of sources as possible. These included community sources such as divers and fishermen, written and cartographic sources and remote sensing datasets. Given the inherent limited scale of the project, the primary focus was a review of the large-scale geophysical surveys in the marine zone by various governmental organisations outside the heritage sector. Polygon extents representing the vast majority of historical geophysical surveys conducted within Scottish Waters have been brought together in a series of figures[47]. In a short space of time this study was able to quantify a vast amount of largely untapped existing data. It also included a detailed series of recommendations for the streamlining and enhancement of future data-gathering programmes (e.g. through closer cooperation on geophysical and geotechnical surveys by stakeholders).

Characterising Scotland's Marine Archaeological Resource
(Wessex Archaeology commissioned by Historic Scotland)
Although records existed for the known marine archaeological assets in Scottish waters, Historic Scotland decided that an overview of the dataset was required both as an aid to making planning policy and decisions, and to help in the change to a new system of protecting cultural heritage in the marine environment. Wessex Archaeology compiled a database from the sites with a 'maritime' classification in the RCAHMS Canmore database. Only assets with recorded locations, based on instrumental measurements, within Scottish waters were included. As such, a number of records that had been included in the Canmore database were removed from the project database as they did not conform to these criteria of selection. Different database tables were created for different classes of marine archaeological resource. The classes are: Shipwrecks; Aircraft wrecks; Spot finds; and Maritime Infrastructure (including navigational aids and mooring places).

[46] WA Coastal & Marine (located in Edinburgh) is a part of Wessex Archaeology, Registered Scottish Charity No. SC042630.

[47] For further details and the audit itself, see http://www.wessexarch.co.uk/projects/marine/scotland/historic-scotland-marine-data-audit

Information from published sources was used to make each entry in the database as complete as possible and to allow the archaeological resource to be characterised the data was broken down into categories. These categories were designed to allow thematic enquiries to be made reflecting the history of each asset, any associations it might have with named people or other archaeological materi*al.* whether there might be any respect issues, principally with regard for the potential for human remains to be associated with a site, what the state of survival of the asset is and what level of associated records there are for a site. This is referred to as the BULSI (Build, Use, Loss, Survi*val.* Investigation) approach and was based on the methodology for the study of shipwreck records undertaken by WA Coastal & Marine in England (Wessex Archaeology 2011). The records were examined by region, as well as at a national level.

More details on the broader scope of both the Scottish Marine Historic Environment Data Audit and Characterising Scotland's Marine Archaeological Resource and potential future directions have been set out in a recent paper (Lancaster *et al.* in press). Both of the above projects were undertaken within a restricted timescale and budget and should be viewed as the first steps in unlocking the potential of the marine resource to better understand Scotland's past[48].

Maritime and Intertidal Archaeology in Wales: A Research Agenda
(The Research Framework for the Archaeology of Wales)
This paper was produced in order to present suggestions for the direction of further study and to strengthen current weaknesses in the management of maritime heritage. The weaknesses highlighted in this paper are chiefly concerned with post-designation management of maritime sites. These include inadequacy in the national maritime database, lack of subtidal and intertidal survey by qualified archaeologists, lack of response and curation of surveys undertaken by developers, sports' divers, and the lack of curation and conservation of material declared to Receiver of Wreck and from excavated wrecks. The research agenda emphasises the need to examine methods of identifying areas of maritime importance, of identifying threats to these areas, of encouraging and training in fieldwork and raising awareness of the National Maritime Database and promotion of maritime projects. There are four candidate topics listed in the original review for future study: investigations on early sites; technological advancement in later sites; the Welsh dimension of maritime archaeology; and surveys on vulnerable areas of high potential. All the points highlighted in this paper are valuable and need to be considered for the management of the maritime heritage throughout the UK, though the paper primarily discusses general issues of managing maritime heritage rather than presenting a detailed research agenda. The original document has subsequently been reviewed in 2011[49] with more specific

[48] As a point of comparison, the USA's department of the interior (through the Bureau of Ocean Energy management) recently commissioned a study designed to analyse and inventory the marine archaeological resources on the Pacific Outer Continental Shelf (from 3 to 200 nautical mile offshore and excluding the nearshore waters 0 – 3 nm); a program designed as a two-year desk based study, with a budget of $650,000 USD. The two Scottish reports listed here were undertaken in under a (combined) half-year and at a cost <10% of the Pacific OCS study. http://www.boemre.gov/ooc/press/2011/press0803b.htm

[49] See http://www.archaeoleg.org.uk/documents2011.html

recommendations added that highlight several specific research topics.

Securing a Future for Maritime Archaeological Archives (MAA)
(A collaborative project in support of the aims of Archaeological Archives Forum - March 2009)
The recent work by the IFA Maritime Affairs Group (MAG) highlighted that the current state of maritime archives and the need for improvements. As a result the Archaeological Archives Forum instigated the project '*Securing a Future for Maritime Archaeological Archives (MAA)*' in 2009. The project provided baseline information on the scale and extent of the problem to inform future solutions to the current situation, by gathering data on three key areas:

- Current geographical remits of museums and archives in the offshore zone
- The extent of the current situation regarding maritime archives
- Gauge future demand for maritime archaeological archive capacity.

This included a survey questionnaire response on maritime archive collection, storage and policy from select museums located within proximity to the coast and major tidal rivers. The result was reported and displayed in distribution maps. While this research has produced valuable data, the investigations in Scotland appear to be limited. There is no mention of the archive that may be held at the regional SMRs/HERs or the National Archives and several museums that hold maritime archive were not included in the survey, i.e. Unst Boat Haven, Glasgow Museum of Transport and the National Museums Scotland. All phases of the project have now been reported[50]. The definition of maritime archaeology in this project did not cover inland waters.

Maritime and Marine Historic Environment Research Framework
(Southampton University commissioned by English Heritage)
Recently, English Heritage commissioned Southampton University to create a framework for archaeological research into the maritime and marine historic environment. This was designed to provide a coherent overview of previous research, and to set out shared research priorities for the future. The framework was put together through a series of specialist panels based around period themes, as well as panels that considered archaeological archives and collections. The report will be published in summer 2012, while some of the project archives are available through the Archaeology Data Service[51].

Seascape Characterisation
Characterisation initiatives have been used in terrestrial historic environment contexts, primarily utilising GIS platforms. Recently, marine and maritime environments have adopted similar methodologies in England[52]. The English Heritage sponsored Historic Seascape Characterisation approach has mapped cultural processes in coastal and marine environments, totalling around 60% of the coastline of England by March 2011. Much

[50] http://www.britarch.ac.uk/archives/Maritime%20Archives%20Element%20One%20Report_FINAL_April_09.pdf); http://www.britarch.ac.uk/archives/Maritime%20Archives%20Element%20Two%20Report_FINAL_Sept_09.pdf; http://www.britarch.ac.uk/archives/Maritime%20Archives%20Element%20Three%20Report_FINAL_Oct_09.pdf

[51] See http://www.soton.ac.uk/archaeology/research/projects/maritime_and_marine_historic_environment_research_framework.page

[52] http://www.english-heritage.org.uk/professional/research/landscapes-and-areas/characterisation/historic-seascape-character/ accessed 15th December 2011.

of this work was funded by the Aggregates Levy Sustainability Fund (ALSF). Recent reviews of the applicability of historic characterisation projects have taken place (Clark et al 2004) and the recent technical report for England's Historic Seascapes[53] identified a number of important challenges that this methodological approach presents to researchers undertaking the characterisation and to those users of the end products.

Scotland's Historic Environment Audit (SHEA)

As part of the panel deliberations, research[54] was commissioned to investigate the extent and locations of the Scottish Marine and Maritime archives, repositories and active research programmes. This should help inform any future attempt to characterise the nature of the information into Scotland's Marine and Maritime historic environment, as Scotland's Historic Environment Audit[55] is tasked with undertaking.

A list of organisations that hold maritime/marine collections[56], manage a database or conduct research, and their location, was created into an excel spreadsheet, with information sourced from the internet, Heal 1988 and Securing a Future for Maritime Archaeological Archives, Element One: Mapping Maritime Collection Areas. Details of the collections were listed when information was available, and the organisations were not contacted.

The organisations have been categorised by the geographic area they cover ('national' or 'regional'), or specified as a 'research group' or 'port authority'. 'National' includes Country-wide Museums, Institutes and Societies that hold collections from the whole of Scotland and/or UK (36 items). 'Regional' includes Local museums, SMRs/HERs, Online catalogues and databases (99 items). 'Research Groups' includes Universities or Trusts that promote and undertake research and produce archive, but do not typically hold or receive collections (18 items). 'Port Authorities' comprises a list of port authorities in Scotland (23 items). It was felt that the data would be best illustrated within a GIS, using a database that comprised the above categories. Ideally the regional organisations would be represented by a polygon to illustrate the area that the collection covers.

The information gathered during this research may help fill the gaps in maritime knowledge in association with Scotland's Historic Environment Audit (SHEA), and identifies future directions in which to gain additional information. Headline indicators might include: the number of organisations that hold maritime archives; the number of organisations that hold maritime records; and the number of organisations that are involved with maritime research and/or produce archive material (i.e. postgraduate research; underwater surveys).

If one of the end results of an audit of Scotland's Marine and Maritime Historic Environment Record is to quantify maritime collections for statistical purposes it should be noted that the term archive needs to be assessed. The number of sites with archive would be more meaningful than the number of maritime collections. For example, would 'archive' pertain to an organization (i.e. the ADU archive), which may include multiple sites, or the archive for a particular site, which may be part of a larger project/collection (i.e.

[53] http://ads.ahds.ac.uk/catalogue/adsdata/arch-767-1/dissemination/pdf/Solent_Seascapes_Technical_Report_V2_02_05_07.pdf accessed 15th December 2011

[54] This is available in full from the ScARF wiki

[55] http://www.heritageaudit.org.uk/

[56] The term 'collection' used in this paper covers both museum collections/exhibits/displays and archaeological archive.

the SoMAP archive)? Perhaps a more meaningful number would be the number of sites with associated archives and the number of archives associated with that particular site.

6.3 Future directions

Key future directions identified in this document are discussed and listed below as: Collaboration; Training capacity; and Public engagement and outreach.

6.3.1 Collaboration

A collaborative approach has to be considered as a fundamental tenant in Marine and Maritime research, given the nature of the archaeology. Partnership projects, between research institutions and the commercial sector have proven advantageous, for example the 'Mapping Doggerland' project (Gaffney, Thompson and Fitch 2007). Any 'Source to Sea' approach should consider an ambitious remit, drawing in multiple partners, who fulfil individual roles that contribute to the overall success of the programme. Examples of cross-sector co-operation highlights how essential this approach is, such as the close working relationship with the likes of the British Geological Survey (BGS) and Scottish Natural Heritage (SNH). In both cases the sharing of marine survey and geological data allow for increased opportunities to access and archaeologically assess extensive swathes of seabed not initially targeted for cultural heritage purposes.

The AHRC consider knowledge sharing networks as a fundamental approach to research, through their 'Knowledge Transfer' funding stream, which supports collaborative activities between academic and non-academic partners. This is one funding stream that is designed specifically for collaboration and could be applied to a future Marine and Maritime programme of work in Scotland.

6.3.2 Training capacity

Since the closure of the Scottish Institute of Maritime Studies at St Andrew's University in 2000, there has not been a dedicated university department or institution that has maintained capacity for researchers in Scotland. This is a lamentable state of affairs and one which should be addressed with some urgency. However, there are departments, schools and institutes which are involved with marine and maritime research, within and out with Scotland, which should be considered for capacity building. These include the Scottish Oceans Institute at St Andrews University[57], and the Universities of Nottingham, Southampton and Aberdeen. In addition, the more generic avocational training opportunities through the Nautical Archaeology Society (NAS) have also undergone a resurgence in Scotland since 2010 and there are now real opportunities for the amateur and professional alike to undertake training from regional centres based throughout Scotland. Scholarships to enable archaeologists (particularly at early career level) to obtain basic diving qualifications would pay rich dividends.

The commercial sector, which is burgeoning in Scotland, is also currently undertaking its own research capacity building, particularly through the increased training and Continuing Professional Development (CPD) opportunities developed by the Institute for Archaeologists, and current projects such as the Outer Hebrides Coastal Community Marine Archaeology Pilot Project OHCCMAPP[58], which reflect the broader European-scale capacity building programmes such as the SPLASHCOS initiative[59].

[57] http://www.st-andrews.ac.uk/tzp/rising_tides.html accessed 15th December 2011

[58] http://blogs.wessexarch.co.uk/ohccmapp/ accessed 15 December 2011

[59] http://www.splashcos.org/welcome accessed 15 December 2011

Training programmes should be tailored to specific projects, however more often the case is that training takes place during the actual implementation of the project. This is not necessarily a problem, but rather an opportunity, and if recognised as such can be adopted and adapted to future programmes and projects. By including a percentage of time and resource to training within each individual project - a percentage which is stipulated in the overall work programme - a positive outcome can be achieved. Incorporating training within work schedules allows qualified practitioners to mentor trainees and for trainees to undertake tasks in controlled environments with the appropriate supervision.

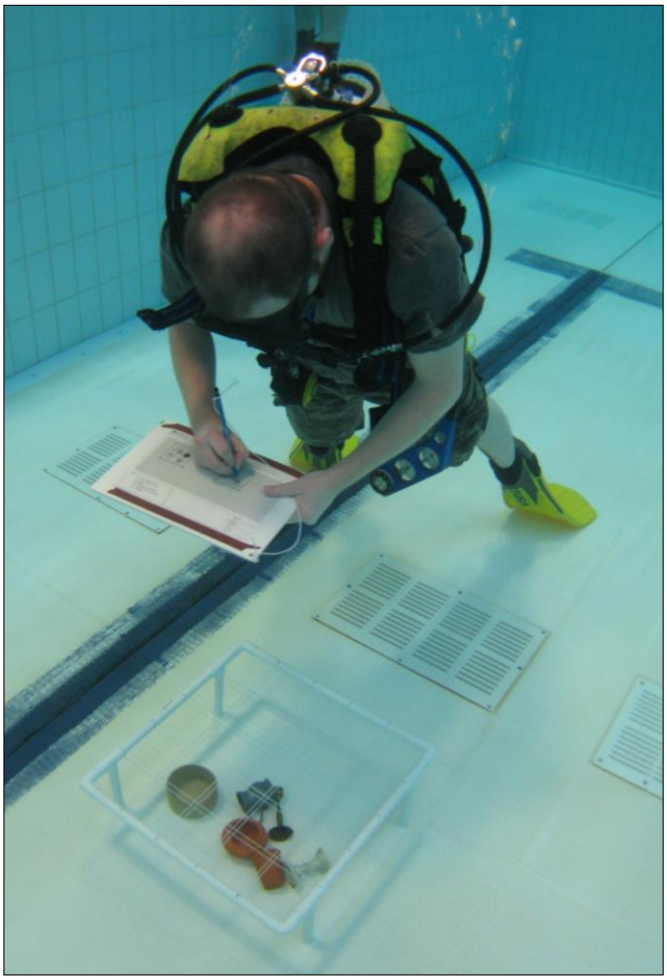


Figure 37: The Nautical Archaeology Society with the assistance of Historic Scotland have made great strides since 2010 with the re-introduction of training opportunities throughout Scotland; ranging from introductory courses to field schools run through regional training centres. The training allows for real hands on involvement such as pool sessions to practice newly acquired 2D survey skills © NAS.

6.3.3 Community engagement in the marine and maritime historic environment

Figure 38: Art students from Taigh Chearsabhagh, North Uist work with archaeologists to record the site, © SCAPE.

From a marine and maritime perspective it is important to consider public engagement as community groups are undertaking an increasing amount of research. There are several on-going projects that are engaging community participants in the marine and maritime historic environment. They include the SCAPE Trust Shorewatch initiatives[60], a national scheme to record eroding archaeological sites, and the recent OHCCMAP feasibility project, which focussed on the Outer Hebrides and community engagement[61]. SCAPE has also conducted site specific community excavations at eroding coastal sites, working in partnerships with commercial organisations and national bodies such as Archaeology Scotland (Unst[62]; Cruester[63]).

This work has included a significant training element, as well as providing opportunities for the wider community to get involved. For example, art students from a North Uist college visited the SCAPE community excavation at Baile Sear to gain inspiration for their art work.

Other community engagement projects, such as the Discover Bute Landscape Partnership Scheme[64] have incorporated coastal archaeology surveys with RCAHMS survey teams and members of ACFA and the local community[65]. Survey work conducted between 2002 and 2009 by members of NoSAS and other partners of the coast of Loch Hourn revealed hundreds of previously unrecorded sites (Wombell & Hooper, 2010). These highly-successful partnerships combine community members (aka people), national organisations, non-departmental public bodies, heritage professionals, charitable bodies and local heritage, archaeological and historical societies.

Figure 39: Local volunteers working on the community excavation at the eroding salt pans at Brora, Sutherland. This masonry, buried for hundreds of years in the dune, is the oldest that survives in the village, © SCAPE

Experiences in these projects are often extremely positive for all participants because often the local community participants are able to inform the professionals about local landscapes/seascapes and the professionals

[60] http://www.shorewatch.co.uk/index.htm accessed 15th December 2011
[61] http://blogs.wessexarch.co.uk/ohccmapp/ accessed 15th December 2011
[62] www.shorewatch.co.uk/unst accessed 17th January 2012
[63] www.shorewatch.co.uk/cruester accessed 17th January 2012
[64] http://www.discoverbute.com/Home.aspx accessed 15th December 2011
[65] http://www.acfabaseline.info/?page_id=76 accessed 15th December 2011

are able to bring technical expertise with broader knowledge of sites, features and archaeological remains. This form of 'symbiotic knowledge transfer' (Duffy 2010, vi) is a hugely valuable outcome, potentially beyond the socioeconomic measurables that often represent community engagement projects as statistics.

Figure 40: An archaeological survey of Dun Birgidale with community participants from the Discover Bute Landscape Partnership Scheme and the RCAHMS survey team, ©RCAHMS DP099962

Community engagement research

During a recent research review, funded by the AHRC, it was recognised that there is a paucity of research into community engagement, with specific reference to the historic environment and almost a complete absence of research into community engagement in the marine and maritime historic environment (Hale 2011). As part of the research a number of recommendations with regard to further community engagement research were proposed, which could be adapted to encompass the marine and maritime historic environment. Three key areas for future directions have been recognised as a result of this research review.

There is a clear need for more appropriately targeted research into the area of engagement with different constituencies of the (marine and maritime) historic environment community, ranging from heritage sector professionals to members of the public.

Using the technology available, it is incumbent upon the heritage sector to develop systems that enable it to communicate with, and especially listen to the needs of people who want to engage with the (marine and maritime) historic environment. This could be undertaken in collaboration with researchers and using research data from other aligned disciplines

The creation of effective partnerships, which are process-making rather than being project-focussed, is imperative, in order that the historic environment sector can demonstrate its ongoing relevance in today's world. Research into how the historic environment sector creates processes and then forms, sustains and undertakes partnerships appears to be minimal.

A recent funding call, as part of the AHRC Connected Communities, has begun to address the gap in heritage sector community-engagement research[66] and it is hoped that recent and future applications will include marine and maritime projects.

6.4 Summary

This theme has avoided becoming a handbook to marine and maritime working practices, but the broader area of methods and practices should be considered in all future research, as the methodological approaches taken define the end results. Metadata of this kind, in the form of detailed project method statements are a vital source for current and future researchers in order that they can assess datasets and understand the context by which the conclusions were derived.

66 http://www.ahrc.ac.uk/FundingOpportunities/Pages/connectedcommunities.aspx#14 accessed 15th December 2011.

6.5 Research Recommendations

Addressing the challenges and considering future directions will allow a holistic treatment of the rich legacy that the marine and maritime historic environment provides. A number of strategic recommendations are proposed:

- To raise the international profile of Scottish Maritime Heritage. Research into aspects of Scotland's marine and maritime heritage should be considered in terms of loc*al.* region*al.* national and international contexts. International synthesis should be encouraged in order to highlight the contribution that the Scottish evidence provides to broader understandings of marine and maritime landscapes.

- To broaden the basis of data retrieval to include every available and relevant source, technique and academic discipline. Due to the pervasive nature of the Marine and Maritime historic landscape, a holistic approach must be more fully adopted that incorporates evidence from a variety of sources, including, but not limited to: commercial and research archaeology; off-shore development; local and national societies; techniques including photography and geophysics; and disciplines including history; ethnology; cultural studies; folklore; and architecture.

- To explore collaboration beyond archaeology in order to ensure the capacity to meet research challenges while providing the experience and perspective to ensure research of the highest quality.

- To create a Research Focus that incorporates the complexity of the record and allow full and rich explorations of the past. By considering the areas of research highlighted throughout this document, and by addressing the challenges through collaboration, holistic 'Source to Sea' projects will provide a focus for research.

- To strengthen and broaden the marine and maritime research knowledge-base, which is created, maintained and promoted by and in partnership with regional and historic environment records organisations.

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Appendix 1 – List of legislative acts

- European Convention on the Protection of the Archaeological Heritage (Revised) 1992
- Marine (Scotland) Act 2010
- Protection of Wrecks Act 1973
- The Valletta Convention
- UK Marine and Coastal Access Act 2009
- UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001 http://unesdoc.unesco.org/images/0012/001260/126065e.pdf
- United Nations Convention on the Law of the Sea (UNCLOS) 1982 http://www.un.org/depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm