Wessex Archaeology

Assessing Boats and Ships 1860-1913

Archaeological Desk-based Assessment

Ref: 70861.01

February 2011

ASSESSING BOATS AND SHIPS
1860-1913

ARCHAEOLOGICAL DESK-BASED ASSESSMENT

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Summary

Wessex Archaeology (WA) has been funded by English Heritage (EH) through the Aggregates Levy Sustainability fund (ALSF) to provide a national stock-take of known wrecks in waters off England and review it in light of the framework for assessing special interest prepared in the *Marine Principles of Selection* project (ALSF 5383) and historical thematic studies.

The *Assessing Boats and Ships* project comprises a series of three desk-based studies of the special interest of wrecks from 1860 to 1950, split into the periods 1860-1913, 1914-1938 and 1939-1950. This report presents the first phase of study; the assessment of boats and ships lost between 1860 and 1913.

Through undertaking a national stock-take of wrecks dating to this period within English territorial waters, this project provides supplementary guidance on the key themes and interests represented by the known resource with the aim of enabling better informed decision-making in respect of wrecks of vessels lost between 1860 and 1950 that are encountered in the course of marine aggregate dredging. The principle benefit of the project thus accrues from a firmer evidence base for decisions relating to post-1860 wreck sites encountered in the course of aggregate licensing. It is intended that the results of the project are made available to project staff in EH, the marine aggregate industry, environmental consultancies, archaeological practices and the wider public.

The project addresses Theme 2.1 of English Heritage's funding priorities for the ALSF in 2008-11 through the identification and characterisation of wreck sites in relation to aggregate dredging. It addresses SHAPE sub-programme Strategic Designation Research (31111.110) by researching and synthesising current understanding of the national record of known wrecks from the most commonly encountered periods. It is also consistent with the priorities and commissioning principles of the MEPF Science and Information Strategy for the Marine ALSF. Furthermore the project is consistent with the research priorities set out by English Heritage in *Taking to the Water* (Roberts and Trow, 2002), insofar as it is intended to serve as a national evaluation study to characterise elements of the marine historic environment that are little understood relative to their prevalence.

As of May 2009, the NMR recorded 518 wrecks lost during the period 1860-1913. These records were collated in a GIS-linked project database. Due to the presence of relevant data in free text fields of the NMR records significant unanticipated enhancement was required.

The collated records were then interrogated in accordance with an attribute framework informed by Wessex Archaeology's 'BULSI' system of wreck assessment and by the integral and relative factors for assessing the special interest of boats and ships identified by the 2008 ALSF project on Marine Principles of Selection.

The results of this interrogation were then used to conduct a thematic review of the NMR dataset to provide a basis upon which special interest can be assessed. The following

classes of vessel use were reviewed, with particular emphasis upon the narratives of build, use and loss:

- Transport (cargo/passenger);
- Military;
- Fishing;
- Industrial;
- Law and government;
- Health and welfare;
- Commercial;
- Agriculture and subsistence;
- Domestic;
- Recreation.

Unlike earlier periods many vessels of 1860-1913 survive, either in use or as static displays. The existence of such vessel must be taken into consideration when assessing the special interest of boats and ships of this period that survive as wrecks. Information about 222 vessels on the National Small Boat Register and 401 vessels on the National Historic Ships Register has therefore been collated and integrated into the thematic review.

The period 1860-1913 was a period of revolutionary change when the full impact of the industrial revolution and Britain's commercial and colonial expansion was felt in the maritime world. In little more than fifty years sail gave way to steam and wooden hulls to those made of iron and then steel. The sailing navy of Nelson became the armoured dreadnoughts of Jutland and the jack of all trades sailing merchantman was replaced by specialist cargo carriers and the liner and tramp industries. This is therefore a period of crucial interest to both curators and archaeologists and the wrecks recorded by the NMR therefore have an inherently high potential for special interest.

The period is complicated. The report therefore concludes that the special interest of boats and ships of 1860-1913 is likely to be multi-faceted. For a wreck of this period to be of special interest it is likely to have to make a distinctive contribution in respect of one or more of the following:

- Illustrate a key narrative of the period, for example intermediate or final stages in important technological transitions;
- Represent a distinct and tangible link to significant persons or events;
- Be representative of significant loss of life or related responses in seafaring safety;
- Have made a distinct cultural contribution;
- Have a current relevance or parallels.

In addition, in order to have special interest a wreck must be considered to have relative merit in comparison to other wrecks or surviving vessels of the period. The factors used to express relative merit are likely to include the following:

- Rarity, for example military vessels or vessels propelled by both sail and steam;

- Representativeness, for example vessel types such as tramp steamers;
- Diversity, either examples of ‘the typical’ such as colliers or highly diverse types of vessel such as warships;
- Survival, in other words the relatively small number of wrecks of this period described as intact or well preserved;
- Setting and context, for example wrecks associated with the approaches to ports of particular significance for the period.

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Diana Donohue carried out the assessment and compiled the report with contributions by Graham Scott. Kitty Brandon prepared the illustrations. Graham Scott edited the report and managed the project for Wessex Archaeology. Dr Antony Firth carried out quality assurance.

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Cover Top: *HMS Warrior* (1860) (© Warrior Preservation Trust)
Bottom: *HMS Dreadnought* (1906) (Royal Naval Museum)

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1. INTRODUCTION

1.1.1. Wessex Archaeology (WA) has been funded by English Heritage (EH) through the Aggregates Levy Sustainability fund (ALSF) to provide a national stock-take of known wrecks in waters off England and review it in light of the framework for assessing special interest prepared in the *Marine Principles of Selection* project (ALSF 5383) and historical thematic studies.

1.1.2. The known maritime resource in waters off England is dominated by wrecks of the mid 19th to mid 20th centuries. Through a consideration of the known wrecks listed by the National Monuments Record (NMR), the *Marine Principles of Selection* project (ALSF 5383) revealed that a total of 96% of known and dated wrecks were lost in the period between 1860 and 1950. It therefore follows that wrecks from these periods are the most commonly encountered by the aggregates industry in the course of the licence application process.

1.1.3. Despite this abundance of known and dated wrecks of the period between 1860 and 1950, a consideration of the special interest of any particular wreck from this period is currently assessed in the wider national context of historic shipping activity and a national stock-take of comparable surviving examples. While this approach enables a particular wreck to be considered of special interest in respect of one factor or another, it does not enable the relative or absolute importance of a particular wreck to be ascertained. The difficulties in assessing wrecks dating between 1860 and 1950 therefore arise from the absence of any agreed corpus of work upon which the assessment of individual wrecks from this period can be based.

1.1.4. In the absence of a decision making framework which assists in determining the interest of a particular set of physical remains in respect to wrecks dating between 1860 and 1950, to date mitigation largely relies on the establishment of exclusion zones based on the physical extent of wrecks; an approach which is neither intellectually sustainable nor likely to remain viable as more wrecks are found. In consequence, there is a pressing need for a robust basis for discussions about wrecks implicated by aggregate dredging that addresses the special interest of wrecks from the periods most commonly encountered.

1.1.5. Through undertaking a national stock-take of wrecks dating to the period 1860-1950 within English territorial waters, this project provides supplementary guidance on the key themes and interests represented by the known resource with the aim of enabling better informed decision-making in respect of wrecks of vessels lost between 1860 and 1950 that are encountered in the course of marine aggregate dredging. It is intended that the results of the project will be made available to project staff in EH, the marine aggregate industry, environmental consultancies, archaeological practices and the wider public.

1.1.6. The project addresses Theme 2.1 of English Heritage's funding priorities for the ALSF in 2008-11. It addresses SHAPE sub-programme Strategic Designation

Research (31111.110). It is consistent with the priorities and commissioning principles of the MEPF Science and Information Strategy for the Marine ALSF. Furthermore the project is consistent with the research priorities set out by English Heritage in *Taking to the Water* (Roberts and Trow, 2002).

1.1.7. According to the Historic Ships Committee, a vessel below 40 tons and 40ft (*c.* 12m) is designated as a boat (http://www.nmm.ac.uk/explore/sea-and-ships/facts/faqs/ what-is-the-definition-of-a-boat-versus-a-ship). There are however, some exceptions, such as submarines and fishing vessels which are always referred to as boats regardless of their size. While this project includes the review of both boats and ships for the period 1860-1950, the wrecks within the known resource have not been divided as such within this review. In many cases, information relating to known wrecks is fragmentary and ambiguous, and an attempt to divide the wrecks on basis of this definition may prove to be more misleading than beneficial. As such, the project will consider known wrecks as a single entity; comprising both boats and ships.

1.1.8. The *Assessing Boats and Ships* project comprises a series of three desk-based studies of the special interest of wrecks from 1860 to 1950, split into the periods 1860-1913, 1914-1938 and 1939-1950. This report presents the first phase of study; the assessment of boats and ships lost between 1860 and 1913.

1.1.9. Discussions with the NMR have resulted in the requirement for a separate document dealing with methodology. This enables the project methodology and the issues that have arisen to be discussed without distracting from the core purpose of the project. It also avoids repetition. Project methodology is therefore discussed in a separate Methodology Report (70861.04) and is only summarised in this document.

2. ASSESSMENT AIMS AND OBJECTIVES

2.1. PROJECT AIMS

2.1.1. The aim of this project is to enable better-informed decision-making in respect of wrecks of vessels lost between 1860 and 1913 that are encountered in the course of marine aggregate dredging.

2.1.2. While wrecks of this period are the most commonly encountered during aggregate licence applications, their special interest is far from evident and there is currently effectively no guidance to which to turn. It is thus intended that the Assessing Boats and Ships project results provide a reference upon which the special interest of a wreck dating to the period 1860-1913 may be assessed within its historical and thematic context, informing decisions about mitigation during aggregate licensing processes. The principle benefit of the project will thus accrue from the much firmer evidence base for decisions relating to post-1860 wreck sites encountered in the course of aggregate licensing.

2.1.3. The aim of the project is not to enhance the NMR dataset nor to make recommendations as to what data the NMR should record and how it should be structured. Nevertheless, the project does provide useful practical experience with regard to the application of NMR data. This experience is therefore discussed in the Methodology Report.

2.2. PROJECT OBJECTIVES

2.2.1. The objectives of this project are as follows:

- For each period, to provide a national stock-take of known wrecks in waters off England, drawing on the framework for assessing special interest created as a result of the *Marine Principles of Selection* project (ALSF 5383);
- To review the national stock in light of a) the framework for assessing special interest and b) historical thematic studies, in order to provide guidance on assessing the special interest of any specific wreck;
- To make available the results of the project to staff in EH, the marine aggregate industry, environmental consultancies, archaeological practices, and the wider public.

2.2.2. The project addresses Theme 2.1 of English Heritage's funding priorities for the ALSF in 2008-11 through the identification and characterisation of wreck sites in relation to aggregate dredging. Specifically, the project is intended to break down the numbers of known wrecks to help identify special interest as it might apply to wrecks implicated by aggregate dredging, within the context of an overall stock take of the national record of known wrecks. As the project involves correlating data about known wrecks already held by the NMR with thematic historical information, it qualifies as a project that will derive added value from existing data.

2.2.3. The project addresses SHAPE sub-programme Strategic Designation Research (31111.110) by researching and synthesising current understanding of the national record of known wrecks from the most commonly encountered periods. As a result of the three studies, English Heritage (and others) is intended to have a firmer evidence base for decisions relating to special interest.

2.2.4. The project is consistent with the priorities and commissioning principles of the MEPF Science and Information Strategy for the Marine ALSF. The project aims to increase understanding of the significance of effects of aggregate dredging (Strategic Aim 2) by contributing to the understanding of receptor importance (i.e. special interest) of the most commonly encountered archaeological receptors.

2.2.5. The project is consistent with the research priorities set out by English Heritage in *Taking to the Water* (Roberts and Trow, 2002), insofar as it is intended to serve as a national evaluation study to characterise elements of the marine historic environment that are little understood relative to their prevalence.

3. METHODOLOGY AND DATA ACQUISITION

3.1.1. Details of the methodology and data acquisition for this project are described in the Methodology report. The following is a summary.

Overall Methodology

3.1.1. The following scheme of investigation has been adopted, as set out in the project design (Wessex Archaeology 2009):

- Relevant NMR records have been collated in a project database and interrogated to provide a national stock-take of wrecks in English territorial waters for the period 1860-1913.
- Selected additional records of vessels of the period and from other relevant national sources have been collated and compared with the NMR dataset in order to inform the stock-take.
- The collated data has been reviewed in the context of a number of historical themes set out in the project design to establish the

relationship between the archaeological record of known sites and current historical understanding of the period.

- The results of the stock-take and thematic review have been used produce a report that provides a summary of the evidential basis upon which the special interest of boats and ships of this period can be judged.

Data Sources

3.1.2. The principle source of data used to compile the stock-take for this report comprises known wrecks in the NMR Complete Monument Record dataset for the period 1914-1938 inclusive. Throughout the report, this dataset is referred to as the known resource. Wrecks are assigned in the NMR to the period 1860-1913 on basis of their date of loss.

3.1.3. Records relating to the potential resource, such as shipping casualties, are not considered as part of the project dataset. Shipping casualties refer to wrecking incidents and do not necessarily relate to the actual remains of wrecks on the seabed. Fundamental to the understanding of this project is the fact that the special interest of wrecks of this period is being examined on the basis of the actual physical evidence, i.e. the sites that are known to exist on the seabed, rather than the potential resource. Nevertheless the potential resource has been examined and discussed where relevant, for example where there are suspected gaps or biases in the known resource.

3.1.4. Examples of individual wrecks are included where relevant. However, this report is not an inventory or catalogue of the known resource.

3.1.5. The NMR is being used as a point-in-time source for the stock-take. As such the project is based on the record as of May 2009.

3.1.6. The national inventories relating to vessels in preservation were also considered throughout this report. The National Historic Ship Register (NHSR) provides a dataset of vessels over 10m in length overall, whereas the National Small Boat Register (NSBR) comprises vessels of less than 10m in length. The datasets acquired were based on the record as of January 2010. As the vessels concerned have not been lost, they have been selected on basis of their date of build.

Data Collation Overview

3.1.7. A Microsoft Access database linked to a GIS workspace was created to enable the project dataset to be subject to both simple and complex queries. The design of the database has been informed by WA's 'BULSI' system of wreck assessment; a system which uses five key subjects (build; use; loss; survival; investigation) to map the 'life cycle' of a boat or ship. The design has also been informed by the integral and relative factors for assessing the special interest of boats and ships in archaeological contexts identified by WA's 2008 ALSF project on *Marine Principles of Selection* (ALSF 5383). The 'BULSI' system and the relative and integral factors are further explained in the Methodology report.

3.1.8. While a proportion of the data contained within the NMR Complete Monument Records was entered automatically into the database, some of the data within the records that was required in order to produce and interrogate the stock-take was contained within the free text of the records. It was therefore necessary to manually search for and input this data into the project database.

Dataset interrogation

3.1.9. A series of both simple (a single attribute query) and complex queries (multiple attribute queries) have been used to interrogate the project database in order to

provide a national stock-take. The results of the queries have then been used to conduct a thematic review of the known resource to provide a basis upon which special interest can be judged. The project database was examined against the following classes of shipping use:

- Transport (Cargo/Passenger);
- Military;
- Fishing;
- Industrial;
- Law and Government;
- Health and Welfare;
- Commercial;
- Agriculture and Subsistence;
- Domestic;
- Recreation.

4. NATIONAL STOCK-TAKE OF WRECKS 1860-1913

4.1. INTRODUCTION

4.1.1. There are 518 records in the known resource relating to the remains of boats and ships which were lost in the period between 1860 and 1913 (**Figure 2**). In order to provide a stock-take of these sites the records were subject to a series of queries. In the first instance, the queries were conducted relating to key factors which outline the biography of a boat or ship.

4.1.2. In order to assess supplementary data relating to extant boats and ships, where possible the datasets of the NSBR and the NHSR have been incorporated alongside the NMR queries. The NSBR and NHSR list 233 and 399 vessels respectively for the period between 1860 and 1913. It is notable that ships and boats of this period in preservation outnumber those recorded in the known resource.

4.2. BUILD

4.2.1. The build of a vessel encompasses its construction, including its date and place of build, the object material from which it was constructed, its dimensions and tonnage, the means by which is was propelled and any fittings. Build can also encompass re-building or re-fitting, whether incremental or as a distinct event.

4.2.2. In the period between 1860 and 1913, a number of critical advances in naval engineering took place which changed the face of shipbuilding forever. While steam as a means of propulsion had been used in the period leading up to 1860, it was not until screw driven vessels were equipped with low consumption engines that steam could truly compete with sail. The increasing use of iron and thereafter steel in hull construction had further implications on the build of vessels in the period 1860-1913, with the onset of the period marked by the construction of the first iron-clad warship, the *HMS Warrior*.

Date of Build

4.2.3. A query conducted on the project dataset shows the temporal distribution of vessels according to their date of build (**Table 1** and **Figure 3**). Of the 518 records listed by the known resource to have been lost between 1860 and 1913, a total of 260 or just over half did not contain information relating to their date of build. Of those records which did contain a date of build, the largest number, 65 (25%), are recorded as having been built between 1870 and 1879. 51 (just under 20%) are listed as having been constructed in each of the periods 1860-1869 and 1880-1889. There are notably fewer vessels in the known resource that were built in 1890-1913.

Date Built	NMR	NSBR	NHSR
1810-1819	1	0	0
1820-1829	1	0	0
1830-1839	6	0	0
1840-1849	9	0	0
1850-1859	22	0	0
1860-1869	51	9	19
1870-1879	65	13	17
1880-1889	51	18	40
1890-1899	32	58	114

Date Built	NMR	NSBR	NHSR
1900-1913	19	135	209

Table 1: Records queried by Date of Build

4.2.4. The query results may be interpreted as suggesting an increase in shipbuilding from 1860 to 1889, with a decline in the number of vessels built after 1890. The shipbuilding industry was an important part of the Industrial Revolution and experienced great changes in scale during the 19th century (Slaven 1986:132). For example shipbuilding output increased six fold between 1820 and 1871, from 65,018 tons to 382,585 tons. From then until the turn of the century, shipbuilding output increased a further two and half times to 999,091 net tons (Slaven 1986:132). The vessels recorded by the registers of the NSBR and the NHSR suggest an increase in both ship and boat building in this period, with the highest proportion of vessels built between 1900 and 1913 (**Table 1**).

4.2.5. Notwithstanding increases in the tonnage of the average ship that occurred in this period, these historical figures do not support the decline in the numbers of ships being built from 1890 that is suggested by the known resource. The decline in the number of vessels built in the years which followed 1890 is more likely due to the sorting of records in the known resource by their date of loss than it is to suggest a national decline in shipbuilding during this period. In this manner, vessels built from 1890 onwards are likely to achieve better representation in the following phase of enquiry which considers vessels lost in 1914-1938. The drop in the numbers recorded may be accounted for to some extent by the greater survival rate of vessels with metal hulls. Testimony to this survivability is the *SS Great Britain* which went ashore in 1846 but remained in good condition and was still able to float when salvaged a year later (Ville 1993:54). Metal vessels were also less susceptible to fire and breaking up whilst at sea (Ville 1993:54).

Place of Build

4.2.6. Of the 518 vessels recorded by the known resource as having been lost between 1860 and 1913, only 167 (about 32%) contained information relating to their place of build. A total of 63 different places of build are given (**Appendix I**, **Table 1**). Most places are settlements such as towns and cities, but some places of build are given as regions or countries.

4.2.7. In order to identify any national trends in the distribution of shipbuilding the places of build have been grouped into countries. The total number of vessels built from each country, as represented by the known resource, is shown in **Table 2**. The results of this query show that 96 of these vessels (57%) were built in England.

Country Built	Total
England	96
Scotland	38
Northern Ireland	10
Canada	4
Wales	4
France	3
Germany	3
Netherlands	2
USA	2

Country Built	Total
Channel Islands	1
Isle of Man	1
Norway	1
Poland	1
Sweden	1

Table 2: NMR records queried by country of build

4.2.8. Of the vessels built in England, the greatest number was constructed in Sunderland, comprising a total of 18 records. The second greatest number of vessels built in England was constructed in Newcastle, totalling 13 records. A closer inspection of the regional distribution of shipbuilding as indicated by the known resource revealed that of the 167 records which contain information relating to their place of build, a total of 53 were built in the northeast of England. These records are marked with an asterisk (**Appendix I**, **Table 1**). This amounts to almost a third of the vessels listed with a place of build by the known resource.

4.2.9. The predominance of vessels being built in the northeast of England is not surprising. The northeast has long been an important centre for shipbuilding and throughout the 19th century was regarded as the most prolific shipbuilding region in the country (Ville 1993a:1-2). The bulk coal and timber trades generated a high demand for shipping in the northeast (Ville 1993a:1). The known resource is largely consistent with historical sources relating to the shipbuilding industry during this period. In a regional approach to the study of shipbuilding, a study on the northeast of England states that by the end of the 18th century, about one-third of British shipbuilding came from the Northeast. This grew to an average of 52% of the UK total between 1911 and 1913 (Ville 1993a:1).

4.2.10. This predominance of boats and ships built from the northeast of England as suggested by the known resource dataset is not reflected in the records for ships in preservation. The NSBR lists only 5 vessels (2%) built in the northeast out of 233 records. Similarly of the 399 vessels listed by the NHSR, only 50 (13%) are detailed to have been built in the north of England, a proportion of which are expected to derive from northwest England. Rather than representing the proportion of shipbuilding for each region in the period 1860-1913, the NSBR and the NHSR may be reflecting higher tendencies for particular regions to register vessels under the datasets. The known resource may therefore be seen as being more representative in this respect than the preserved record. Additionally the difference in location of build between the known resource and the record for vessels in preservation may also be accounted for by the predominance of certain types of vessels in the relevant datasets. For example, the most common type of vessel represented in the NHSR is narrow boats (25 records), of which the largest proportion (17 records) were constructed in the Heart of England. Similarly, the most represented vessel type in the NSBR, the Falmouth Quay Punt (16 records) were predominantly constructed in Falmouth (13 records).

4.2.11. The second most common country in which the vessels listed by the known resource were built is Scotland, comprising 38 records of the total 167 records containing references to their place of build. This is broadly consistent with historical sources relating to the shipbuilding industry during this period. Parliament papers entitled 'Annual Statement of the Navigation and Shipping of the United Kingdom' dating to 1911, show that in 1820, 16.5% of the total net

tonnage of vessels built in the UK were constructed in Scotland (Slaven 1993:154). This increased to 33.3% in 1871, and levelled off with 32.2% in 1911 (Slaven 1993:154).

4.2.12. Of the 38 Scottish-built vessels, 26 list areas of build which relate to the Clyde shipbuilding industry. These vessels are marked with a double asterisk on **Appendix I**, **Table 1**. This suggests that approximately two-thirds of all Scottish-built vessels listed by the known resource for this period were constructed on the Clyde. This high proportion of vessels is consistent with historical sources relating to this period. The 1911 'Annual Statement of the Navigation and Shipping of the United Kingdom' stated that in 1871, a total of 115,136 net tonnage was constructed on the Clyde, out of a total of 130,141 net tonnage constructed in Scotland as a whole (Slaven 1993:154). These figures thus demonstrate that out of the total net tonnage of Scottish-built vessels in 1871, a large proportion (88%) derived from the Clyde shipbuilding industry. By 1911, this had increased to a total of 93% (Slaven 1993:154). The predominance of vessels built in the Clyde during this period is largely due to its position on the forefront of iron shipbuilding in the late 19th century. By 1871 the Clyde built and launched one-third of all iron tonnage in the UK and was by far the most important iron shipbuilding river in Britain (Slaven 1993:160).

4.2.13. Steering away from a regional approach, the records relating to places of shipbuilding may also be used to infer broader trends. Of the 167 records containing references to their place of build and listed by the known resource, a total of 149 are detailed to have been built in the United Kingdom. This is approximately 89% of the vessels which are listed with a place of build.

4.2.14. While it may be argued that this high proportion of vessels built in the United Kingdom as represented by the known resource may be expected in a search area which encompasses English territorial waters, this predominance is also consistent with historical sources which relate to shipbuilding figures in the 19th and early 20th century, which state that in the two decades prior to WWI, UK shipbuilders accounted for sixty to eighty percent of world tonnage (Pollard and Robertson 1979:249; Slaven 1980:39). By 1870, the carrying power of the British merchant fleet was four-times that of the American foreign-going fleet, five times that of the French fleet, and six times that of the German or Italian fleets (Hope 1990:303). The modern shipbuilding industry, founded in engineering, steam and metal, was well established by the 1870s in Britain, and between 1870 and the end of WWI, British shipbuilders enjoyed a complete ascendency in world shipbuilding (Slaven 1992:4).

Object Material

4.2.15. The period 1860-1913 encompasses the main transition period in vessel construction from wood to iron and then steel. A query was therefore conducted on the records on the basis of their object material (**Tables 3** and **4** and **Figure 4**) to determine whether this transition is reflected in the known resource.

4.2.16. For the vessels lost between 1860 and 1913, there are six types of object material listed in the known resource, as shown in **Table 3**. In some instances, an individual wreck may be recorded as having duplicate entries for object material. For example, the vessel *Caduceus* (NMR **UID 767431**) has been assigned three types of object material, comprising copper, iron and wood. This reflects a tendency for NMR records to list all materials used in order to provide maximum retrievability of records for the user.

Building Material	Total

Building Material	Total
Iron	169
Wood	145
Steel	78
Metal	5
Copper	3
Pine	1

Table 3: NMR records queried by building material

4.2.17. This query highlights a predominance of iron-built vessels listed in the known resource for the period between 1860 and 1913. The predominance of boats and ships of a metal construction in the known archaeological record is not surprising and may be due to the higher potential for metal structures to be identified on the seabed using geophysical and hydrographical survey techniques. In addition to this, the more regular updating of charts took place in the late 19th century as metal wrecks were viewed to be more permanent structures posing greater hazards to navigation (Bournemouth University 2007:13).

4.2.18. The results of this query were further sub-divided by decade of build in order to highlight any changes in object material used over time (**Table 4**). The most common object material per decade is shaded.

Date Built	Wood	Iron	Steel
1810-1819	1	0	0
1820-1829	1	0	0
1830-1839	6	0	0
1840-1849	6	1	0
1850-1859	15	11	0
1860-1869	21	25	1
1870-1879	18	43	5
1880-1889	3	33	17
1890-1899	1	2	23
1900-1913	0	5	14

Table 4: NMR records queried by Date of Build and Object Material

4.2.19. The results of this sub-query show that for vessels built prior to 1859, wood was the most common material of construction. Between 1860 and 1889 it was iron and thereafter steel.

4.2.20. Although the use of iron in shipbuilding can be dated back until at least to the late 18th century, it did not displace wood as the primary construction material until the late 1860s and 1870s (Ville 1993:52). The benefits in using iron in shipbuilding not only released design from the physical limits of timber construction, but were also regarded as a providing a combination of greater safety, capacity, speed, durability and strength alongside lower construction and repair costs and often weight (Ville 1993:53). The improved survival rate of stranded iron vessels was a clear testimony to their greater strength (Ville 1993:54). This strength meant that iron vessels were less susceptible to foundering whilst at sea and evidence from the late 19th century also points to substantially improved carrying capacity (Ville 1993:54). The earliest iron-hulled vessel in the known resource for the period 1860-1913 is the *Ida* (NMR **UID 906913**), a screw propelled cargo steamship built in 1849.

4.2.21. Historical sources state that in 1850, 12,800 tons of iron ships were built in Britain. By 1870 this had increased to a vast 255,000 tons of iron shipping (Greenhill 1993:85-6). This increase is certainly represented in the known resource, which lists 11 records of vessels built using iron between 1850 and 1859 in comparison to 43 records built between 1870 and 1879.

4.2.22. Similar advantages which accounted for the superiority of iron over wood also serve to explain that of steel over iron, particularly with regards to strength, lightness, stowage capacity and safety. Additionally, the ability to work on steel while cold had advantages in the shipyard in that it saved on fuel and furnace costs and reduced the risk of heat brittle materials being incorporated in a vessel (Ville 1993:59). The main problems associated with the use of steel in ship construction was the inconsistent quality of Bessemer process steel in the late 1850s and the competition from the railways for the limited quantities initially available. The first problem was solved by the introduction of the Siemens-Martin process in the mid-1860s, and by the end of the next decade the process successfully reduced the level of impurities after which steel gradually superseded iron (Greenhill 1993:89; Ville 1993:52, 1993:60). The second was solved by greatly increased production in the late 19th century. This increase in the availability of suitable steel is reflected in the known resource, which shows that steel had become the dominant object material used in shipyard construction by 1890. The earliest steel-hulled vessel in the known resource for the period 1860-1913 is the *RTC No. 9* (NMR **UID 805671**) dredger, built in 1863.

4.2.23. The introduction of metal in shipbuilding practices enabled much larger vessels to be constructed in the period 1860-1913. However, a query on the length of vessels listed in the known resource reveals that while larger vessels may be directly related to the technological advances of the period, there is a poor representation of smaller vessels. A query conducted on the known resource for vessels with a length of 10m or less resulted in only four records; less than 1% of the total records listed in the known resource for this period. This is largely due difficulties encountered in identifying the remains of smaller vessels in hydrographic and geophysical surveys alongside the recording biases of shipping casualties in this period, which predominantly focussed on vessels of a larger tonnage. The 233 vessels listed in the NSBR thus attain an even greater importance in providing the greatest representation of small vessels for this period.

4.2.24. One such factor which is essential to a consideration to object material in the period 1860-1913 is the development of the composite hull. Composite hulls were patented by John Jordan of Liverpool in 1850 and were iron framed and timber planked, with copper sheathing. They were intended to combine strength, sleekness and resistance to rot and fouling (Slaven 1992:2).

4.2.25. Although viewed as a possible solution to the problems of marine fouling, the idea of building vessels hulls in both wood and metal eventually proved to be an unsatisfactory compromise, minimising the efficiency gains of iron in terms of carrying capacity, strength, durability, repair costs and design potential (Ville 1993:59). Nevertheless the design was in vogue in the mid-late 19th century, particularly for clipper ships, other ‘fast’ merchant ships, and composite yachts. The latter continued to be built until the beginning of the 20th century (Kemp 1969:191).

4.2.26. The introduction of composite hulls also helped rejuvenate the shipbuilding industry, helping Britain re-establish itself as a leading builder of sailing ships, in the 1860s (Slaven 1992:2). The use of vessels built with a composite hull is not reflected in the known resource. Due to the limited information provided in

contemporary source material upon which the known resource is based, there are no references to composite hulls in the NMR Complete Monument Records. Additionally, only four and three records respectively are described as having both wood and iron and wood and steel as object materials. The NHSR lists five vessels of composite construction, comprising the *City of Adelaide* (NHSR **ID 433**), the *Cutty Sark* (NHSR **ID 438**), the *FMC 138* (NHSR **ID 2063**) the *Monarch* (NHSR **ID 484**) and the *Viceroy* (NHSR **ID 693**). These vessels may be regarded of being of even greater importance given the lack of any conclusively identified composite vessels in the known archaeological resource.

4.2.27. The dataset for vessels in preservation shows a marked contrast to the known resource with regards to object material (**Tables 5 and 6**). Of the 233 records listed by the NSBR, a significant 191 records (82%) are listed as wooden constructed vessels. Conversely, only three records (less than 1%) are listed to have been constructed of metal, comprising two vessels listed as metal and riveted, and another as steel and riveted.

Material	Total
Wood, Carvel	92
Wood, Clinker	63
Wood	32
Wood, Double Diagonal	2
Wood, Chine	2
Metal, Riveted	2
Steel, Riveted	1
Skin	1
Birch bark Skin	1

Table 5: NSBR records queried by Object Material

Material	Total
Wood	86
Iron	44
Pine	40
Steel	39
Teak	28
Oak	22
Timber	22
Larch	21
Mahogany	10
Elm	8
Cedar	4
Iroko	2
Copper	1
Greenheart	1

Table 6: NHSR records queried by Object Material

4.2.28. Similarly, there are a significant 244 records relating to wooden hulled vessels in the NHSR, accounting to 61% of the total number of records for this period. Iron is the most commonly represented metal utilised in hull construction, totalling 44 records, followed by steel with 39 records.

4.2.29. There are a number of explanations for this. Firstly, the predominance of wooden-hulled vessels is likely to reflect the higher tendencies for vessels to be registered which are perceived to be traditional boats or ships to which there is attached an element of nostalgia. Another possibility is that in accommodating vessels less than 10m in length, the NSBR query results may imply that smaller vessels of the period are likely to have been subject to the more traditional methods of construction for a longer period of time than larger vessels upon which British primacy at sea relied. However, the significant proportion of wooden hulled vessels in the NHSR certainly suggests the continued incorporation of wood in the construction of larger vessels of this period. On this basis, whilst the known resource represents the transition from wood to iron and then later steel well, the most likely explanation for the differences between the known resource and the records of vessels in preservation is the lower potential for vessels of wooden construction to be identified or to survive on the seabed to the same extent as their metal counterparts.

Propulsion

4.2.30. Another category queried was propulsion (**Figure 5**). The known resource lists four types of propulsion for wrecks dating to this period, as illustrated in **Table 7**: engine; sail, steam and 'towed'. Sail and steam predictably predominate, comprising 45 and 51% respectively of the 474 records for which propulsion is listed.

Propulsion	Total
Steam	242
Sail	211
Engine	14
Towed	7

Table 7: NMR records queried by propulsion

4.2.31. A number of records in the known resource display duplicate entries for propulsion. For example, the *Loanda* (NMR **UID 901835**) is listed as having been propelled by both steam and sail and is also recorded to have been towed. As such the results presented in **Table 7** above do not represent absolute values in this respect.

4.2.32. The results of this query were sub-queried by decade of build, the results of which are presented in **Table 8**. The most common means of propulsion within each decade is shaded. Vessels which are recorded to have been towed have been omitted from these results as it is not a primary means of propulsion and the number of records concerned is not significant. The provision of both sail and steam propulsion for a single vessel was common until the very late 19th century and therefore this query has been refined by listing records with duplicate entries for propulsion as a separate category.

Date Built	Sail	Steam	Sail and Steam	Engine
1810-1819	1	0	0	0
1820-1829	1	0	0	0
1830-1839	6	0	0	0
1840-1849	6	1	0	0
1850-1859	15	10	2	0
1860-1869	31	19	4	0
1870-1879	29	41	8	0

Date Built	Sail	Steam	Sail and Steam	Engine
1880-1889	13	38	3	3
1890-1899	5	23	1	1
1900-1913	4	10	1	6

Table 8: NMR records queried by Date of Build and Propulsion

4.2.33. The results of the query show that vessels recorded by the known resource as having been constructed prior to 1870 were predominantly propelled by sail. Vessels built between 1870 and 1913 employed steam as their primary means of propulsion. The number of vessels recorded as employing both steam and sail represent only a small proportion of the total. The greatest number fall within the date range 1870 to 1879, although even within that decade they represent only about 10% of the total. In many cases the information available for wrecks listed in the known resource is limited, and contemporary source material relating to a wreck can often be fragmentary. As such, while every effort has been made to include a depth of information in the NMR Complete Monument records for each wreck site, there are often factors such as vessels incorporating both sail and steam which are unavoidably underrepresented. It is with regards to elements such as this when the NSBR and NHSR datasets become important. For the period 1860-1913, the NSBR and NHSR list 42 and five vessels respectively which are recorded to have been equipped with both sail and engine. The survival of such vessels would have a direct bearing on the special interest of vessels on basis of their representation of the transition from sail to steam.

4.2.34. The predominance of sailing vessels in the known resource prior to 1870 is consistent with historical sources which state that the peak tonnage of the sailing fleet came in 1865 at 4.9 million net tons (Hope 1990:298). By 1868 the tonnage of steam-propelled vessels being built in Britain exceeded that of sail tonnage built (Hope 1990:303). The increasing use of steam engines from 1870 is further supported by figures which display steam tonnage as a percentage of total tonnage on a decadal base and encompassing vessels which entered and cleared in the foreign trade at UK ports. The figures show that in 1860, 30.1% of the total tonnage of British ships was steam propelled, but by 1870 this had increased to just over half of the total tonnage (Fayle 1933:247; Hope 1990:302).

4.2.35. While a number of advances in naval engineering enabled the potential of steam propulsion to be better recognised, steam continued to be regarded as auxiliary to sail in the 1860s. However, as engines became more reliable and economical and ships grew bigger, it became too expensive to pay for the extra crew and for the extra maintenance required to carry sail (Hope 1990:299).

4.2.36. Changes in warship design and armament led to experimental designs that could be unstable as well poor fighting platforms. The stability problems of using both steam and sail in the new generation of warship became apparent, particularly after the loss of the *Captain* in 1870. Eventually the use of sail was also recognised as seriously impairing the fighting efficiency of the new designs (Watts 1994:38). As a result, in 1873 the *Devastation* was completed as the first vessel without sails and rigging and has since been described as the most radical design to emerge in the 19th century, marking the end of the era of the sailing warship (Watts 1994:41). Although these advances occurred in a military setting, the success of the first solely steam-propelled vessel had significant implications for the shipbuilding industry as a whole and may

account for the greater number of steam-only propelled vessels in relation to sail from 1870 onwards.

4.2.37. The records of vessels in preservation differ to the known resource in respect of propulsion. Whereas there is a high representation of steam propelled vessels in the known resource for the period 1860-1913, the most commonly represented means of propulsion in the NSBR and the NHSR is sail, comprising 66 and 161 records respectively (**Tables 9** and **10**). The arrival of steam technology did not hasten the demise of sailing ships in the 19th century. In 1879 sailing vessels accounted for 82% of ships registered in the UK and during the mid-19th century there was a rush of investment in wooden sailing vessels which were cheaper and easier to build. In addition to this the majority of vessels utilising sail as a means of propulsion as listed by the NSBR and NHSR are of wooden construction (comprising 58 and 129 records respectively). As such it is possible that a large proportion of sailing vessels remains are unidentified or have a poor level of preservation on the seabed, thus accounting for the lower number of sailing vessels in the known resource for this period.

4.2.38. However, the low quantity of steam propelled vessels of the period 1860-1913 in the NSBR and NHSR is nonetheless notable, totalling only 11 and 45 records respectively. There are a comparably higher proportion of vessels equipped with motor or internal combustion engines in this period. This is most likely due to the refitting of steamers to incorporate different methods of propulsion as new technologies became available in later periods. For example, the narrow boat *Empress* (NHSR **ID 1662**) which is listed to have been equipped with an engine was built in 1887 as a steam fly-boat but was converted to a semi-diesel engine in 1919. In this respect, these query results must be regarded with caution as they may represent technologies which became more prominent in the years which followed 1913 and are thus not relevant to a discussion of the period 1860-1913.

Propulsion	Total
Sail	66
Sail/Engine	42
Oar	24
Oar/Sail	19
Engine	12
Paddle	11
Steam	11
Towed	3
Engine/oar	1
Engine/Sail/Oar	1

Table 9: NSBR records queried by propulsion

Propulsion	Total
Sail	161
Motor	59
Engine	52
Engine Steam	45
Towed	23
Auxiliary Sail	11
Oar/Sail	8
Manpower	6
Sail/Engine	5

Propulsion	Total
Gaff Sail	4
Oar	3
Auxiliary Steam	1
Steam	1

Table 10: NHSR records queried by propulsion

4.2.39. In the period between 1860 and 1913, steam propulsion was achieved by combining a steam engine with either the paddle wheel or the screw propeller. The known resource was queried on this basis and of the 148 relevant records, 138 of the steamships (93%) were screw driven (**Table 11** and **Figure 6)**.

Propulsion Specifics	Total
Paddle	10
Screw	138
Simple	3
Compound	88
Triple Expansion	56

Table 11: NMR records queried by Propulsion Specifics

4.2.40. Further advances in engine technology had significant implications for naval engineering in the 19th and early 20th century. The known resource dataset for the period between 1860 and 1913 was queried according to the three main types of engines used in vessels for which steam provided a means of propulsion; comprising simple engines, compound engines and triple expansion engines (**Table 11**). This query was further sub-divided by date of build, the results of which are shown in **Table 12**. The engine type most commonly represented in the known resource for each period is highlighted. Vessels for which the date of build is unknown have been omitted from this table.

Date Built	Simple	Compound	Triple Expansion
1840-1849	0	1	0
1850-1859	0	5	0
1860-1869	3	13	0
1870-1879	0	28	4
1880-1889	0	19	18
1890-1899	0	2	19
1900-1913	0	0	9

Table 12: NMR records queried by Date of Build and Propulsion Specifics

4.2.41. These results show a gradual shift from compound to triple expansion engines during the period 1860-1913. There are no steam propelled vessels whose construction predates 1840 in the known resource for the period 1860-1913. The earliest steamship in the known resource for this period is recorded to have been fitted with a compound engine (the *Ida* NMR **UID 906913**).The lack of a significant number of vessels equipped with simple engines in this period appears to show that the move from simple engines to compound had taken place earlier. This broadly reflects the established historical narrative.

4.2.42. There are often duplicate entries for propulsion. For example, the *Grappler* (NMR **UID 906684**) is listed as having been both screw and paddle driven, and the *Coniston Fell* (NMR **UID 906803**) is detailed to have been equipped with

both a compound and triple expansion engine. The presence of these differing propulsion attributes may be due to the refitting of vessels in the period 1960-1913; a practice which was common given the regular advances in naval engineering which quickly outdated vessels utilising earlier methods of propulsion. The presence of these duplications must be borne in mind when assessing the results of the queries.

4.2.43. The results of these queries show few vessels equipped with either paddle wheels or simple engines. The rarity of such vessels is likely to enhance their special interest.

4.2.44. The predominance of screw driven vessels or those equipped with compound or triple expansion engines in the known resource is unsurprising. While steam propelled vessels date back to the early 19th century, it was not until the introduction of screw driven vessels equipped with compound engines that the full potential of steamers could be recognised. Early steamers using paddle wheels as a means of propulsion and equipped with single cylinder engines and low pressure boilers had high coal consumption, thus limiting their range and competitiveness (Thomas 1992:11).

4.2.45. The introduction of screw propulsion in the 1830s provided an alternative and more efficient means of propulsion. Its adoption and the development of the compound engine in 1854 led to average coal consumption being halved. This led to a reduction in running costs and enabled either a larger volume of cargo to be carried or doubled the range for a given bunker capacity (Thomas 1992:11). As a result paddle steamers were gradually superseded by screw driven vessels, although the use of the paddle as a means of propulsion continued amongst some vessels working in shallow water and specialist harbour tugs (Allington and Greenhill 1997:5; Body 1971:87).

4.2.46. Only two screw driven vessels listed in the known resource are recorded as having been built prior to 1850. From 1850 onwards these figures increase, from five records between 1850 and 1859 to a peak of 37 between 1870 and 1879. The known resource suggests a predominance of vessels equipped with compound engines until 1890, from which point they are superseded by those equipped with the triple expansion engine.

4.2.47. The earliest vessel equipped with a triple expansion engines in the known resource for the period 1860-1913 was constructed in 1865 (*Delaware* NMR **UID 858298**). Triple expansion engines were introduced in boats and ships in the 1870s and 1880s and thus it is likely that the *Delaware* was refitted with a triple expansion engine at a later date. If this is the case then the earliest vessel equipped with a triple expansion engine construction was the *Ponce* (NMR **UID 906893**), built in 1873. Between 1900 and 1913, triple expansion engines are the only form of propulsion represented in the known resource. This reflects historical sources which state that by the beginning of the 1880s the construction of high pressure steel boilers at competitive costs and the consequent application of the triple expansion engine led to the production of vessels which could be operated with a much greater efficiency and that were more economical than sailing vessels (Allington and Greenhill 1997:6).

Summary

4.2.48. This assessment of the national stock-take of the known resource with regards to the build of vessels raises a number of factors which may be considered to contribute to an understanding of the special interest of vessels from the period 1860-1913.

4.2.49. The industrialisation of Britain had significant implications for shipbuilding in the period 1860-1913. Shipbuilding migrated to areas which could best meet its

changing technological demands in engineering and metallurgy. Thus a number of formerly less important ports and regions with industrialising hinterlands emerged as important shipbuilding areas (Jackson 1986:102; Ville 1993b: xi). The North East provides an example of one such area which benefited from the products and skilled labour force of local heavy industries (Ville 1993b: xii). A further area which benefited during this period was the Clyde in Scotland, which became home to the vertically-integrated shipbuilding industries of metallurgy and engineering (Ville 1993b: xii).

4.2.50. Vessels built in these and similar regions are thus likely to be of special interest on the basis of their context and setting. This is through their association with key places in the late 19th and early 20th century industrialisation of Britain and consequent changes in naval engineering. Whilst vessels from the North East and the Clyde are unlikely to be considered of special interest on basis of rarity, the fact that they are so commonly encountered in the known resource is of special interest in itself as it represents the growing shipbuilding dominance of these regions.

4.2.51. Changes in hull construction are a major factor to consider with regards to special interest. Wrecks with wooden hulls dating to this period may be considered to be potentially of special interest on the basis that they are representative of what was in effect 'sail's last century' (Gardiner 1993) and because the second half of the 19th century was the last period in which wooden vessels existed in greater numbers than those with metal hulls. However, given that nearly a third of the records in the known resource are of wooden hulled vessels, this special interest is likely to have a group rather than an individual wreck basis.

4.2.52. Iron hulled vessels may also be regarded as being of special interest on the basis of their representative qualities. The period 1860-1913 was the age of iron. Ships constructed with iron hulls both superseded wood as the dominant material and were themselves superseded by steel in this period. Examples of iron-hulled vessels outside of this period are likely to be far fewer in relation to the total number of wrecks. For example, the period 1914-1938 contains 1358 records of which only 70 list iron as their building material. The period 1939-1950 contains only three out of a total of 898. Consequently, iron-hulled wrecks within the 1860-1913 dataset are likely to be of special interest because they represent this short lived but enormously important period of iron shipbuilding. Again because they are common this special interest is likely to be group based.

4.2.53. With less than 1% of the total records listed by the known resource for the period 1860-1913, vessels under 10m length are likely to be regarded of special interest due to their rarity in the national stock. However, the level of special interest assigned to such a vessel would not be based on this rarity alone, and would depend on the representation of such vessels in preservation as listed by the NSBR.

4.2.54. There is no wreck within the known resource for this period which has been conclusively identified as having a composite hull. Therefore the wrecks of composite vessels will almost certainly be of special interest because of their rarity. However, the fact that composite vessels are not listed in the known resource for this period does not mean that they are not there. Their absence may rather be due to the constraints imposed by the often fragmentary nature of the source material upon which the known resource is based and to a lesser extent by the scope of the NMR Thesaurus (which does not include the term 'composite').

4.2.55. The radical changes which affected the means by which vessels were propelled are of paramount importance in understanding the changes that occurred in the design of ships between 1860 and 1913. Vessels recorded as having been propelled by sail may be of special interest as they are representative of the last period in which sailing ships were seen in any great numbers in relation to steamships. For the period 1914-1938 only 69 of the 1358 records refer to sail, and for the period which follows, 1939-1950, only 14 records contain references to sail.

4.2.56. The period 1860-1913 is thus characterised by the transition from sail to steam. Any vessel which is recorded as having both methods of propulsion is likely to be regarded as of special interest on the basis that it is representative of this transition. Of the 518 records listed by the known resource for this period, only 22 or about 4% are listed to be both sail and steam propelled. On that basis these vessels may be regarded as being of special interest because of their rarity.

4.2.57. It should be noted that this period is also characterised by important changes in the way that sailing rigs were equipped and handled. Wire rigging and cables became common and powered machinery greatly assisted the handling of rigging and anchors in larger sailing ships. Information of this nature is often not detailed in the relevant source material and therefore does not appear to be represented in the known resource data.

4.2.58. Steamships might also be regarded as of special interest. Early steamships, particularly those equipped with simple engines and/or paddle wheels are so few in the national stock-take (representing only three and ten records respectively of the total 518 records listed in the known resource) that they may be assigned special interest on the basis of their rarity. These early steamships are also important because they represent a period of technological trials and innovations that led to the development of the economical and practical steamship designs that finally supplanted sail.

4.2.59. Screw driven and compound or triple expansion engine vessels are far more common in the national stock for 1860-1913. Of the 518 wrecks listed in the known resource, 77 are recorded as having been screw driven and equipped with compound engines, and a further 51 are recorded as having been screw driven and equipped with triple expansion engines. These vessels represent the mature steamship design that facilitated the dramatic trade expansion in the late 19th and early 20th century. However, due to their common occurrence they are individually unlikely to be of any particular special interest in the absence of other factors.

4.3. USE

4.3.1. The technological innovations of the late 19th century had huge implications for the use of vessels in the period 1860-1913. New technology opened up a plethora of opportunities, allowing naval architects to create specialised designs for specific functions to a far greater extent than had previously been possible (Lambert 1992:8). This ultimately led to the construction of purpose-built specialist vessels, intended to perform specific functions and thus meet particular objectives.

4.3.2. The use of a vessel relates to its use as a particular type of vessel. Use also relates to themes which address issues of distribution, and may refer to the registration of a vessel, its nationality, departure or destination.

Vessel Type

4.3.3. There are 50 NMR vessel types recorded in the known resource for the period 1860-1913 (**Table 2**). The NHSR and the NSBR list eight and six vessel functions respectively and adopt consistent terminology (**Table 13**). The function types represented comprise 'cargo vessels', 'fighting vessels', 'fishing vessels', 'leisure craft', 'service vessels', 'experimental craft' and 'research vessels'. With regards to vessel type or class, the NHSR and NSBR list 145 and 83 different vessel types respectively. The NSBR further lists 96 vessels for which the vessel type is unknown or where such vessels may represent one of a kind. This demonstrates the wide variety of specialist boats and ships developed during this period.

Function	NHSR	NSBR
Leisure	110	126
Cargo	102	1
Fishing	76	70
Service Vessel	61	28
Passenger	35	3
Fighting	13	3
Experimental Craft	1	-
Research vessel	1	-

Table 13: NSBR and NHSR queried by function type

4.3.4. Of the 518 records listed by the known resource dating to the period between 1860 and 1913, 332 (64%) are listed as cargo vessels. The dramatic growth in sea trade which took place during the 19th century lies behind this. Between 1876 and 1913, the tonnage entering or clearing UK ports increased from 117 million tons per annum to 295 million tons and trade voyages will have accounted for most shipping movements by larger vessels (Simper 1982:61).

4.3.5. Of these 332 cargo vessels, 119 are recorded as being English, 30 as Scottish and 7 as Welsh. A further 68 vessels are listed as being British in nationality. In some cases British vessels are listed with more than one nationality. For example, the *Strathclyde* (NMR **UID 813607**) is listed as being both British and Scottish. Of the 68 vessels recorded as British, two contained duplicate nationalities relating to Scottish and English nationality. Having omitted these duplications, it becomes apparent that out of the 332 cargo vessels, a total of 222 (66%) are listed as being English, British, Scottish or Welsh in nationality. This high volume of cargo shipping from the UK is largely consistent with historical sources. Britain was at the forefront of 19th century trade expansion, and in the 1870s British merchant tonnage was larger than the combined tonnage of the next three major European maritime nations (Simper 1982:61).

4.3.6. The vessel function type most commonly represented by the NHSR and NSBR are leisure vessels, comprising 110 (28%) and 126 (39%) vessels respectively **(Table 13**). The high representation of this vessel function is likely to be due to the higher tendency for people to register vessels to which they have a personal and nostalgic attachment. It is unsurprising that the NSBR lists only one cargo vessel, as vessels under 10m in length would generally be too small to transport cargo as their primary function. Approximately one quarter (102 records) of the vessels registered under the NHSR are listed as cargo vessels. This significant proportion is also likely to relate to the growth of seaborne trade in the period as discussed above.

Departure, Destination and Registration

4.3.7. In order to best document wreck sites and ensure maximum retrievability for the user, the known resource often lists duplicate entries for the fields of Departure, Destination and Registration. Duplicate entries with regards to departure and destination may be due to conflicting source material relating to the final journey of a particular vessel, or may be incorporated to represent the various ports of call relevant to a particular vessel. Duplicate places of registration may also be due to conflicting source material, although it was not unusual for an individual vessel to have been sold and thus have more than one place of registration in its life cycle.

4.3.8. As such, where places for departure, destination and registration have been grouped by country, the results should not be considered as absolute totals. For example, a single vessel may be listed as departing from both the Tyne and Newcastle, and would thus arise as the result of two separate queries, contributing two counts towards vessels departing from England. Consequently, these results should be regarded with caution and should be viewed as providing broad qualitative representations of the place from which a vessel cleared, was due to enter and was registered to at its time of loss on a country by country basis.

4.3.9. The known resource was queried by Departure (**Table 3**). A total of 170 individual places of departure are listed within the known resource dataset for vessels lost between 1860 and 1913. In order to identify broad trends and distributions, these records were grouped by country, the results of which are shown in **Table 4** and **Figure 7**. The ten most represented countries of departure are shown in **Table 14**.

Country of Departure	Total
England	188
Wales	39
Spain	25
USA	24
France	15
Channel Islands	9
Chile	7
Belgium	6
Scotland	6
Australia	5

Table 14: NMR records queried by country of departure (top ten)

4.3.10. The known resource was further queried on basis of destination. The known resource lists 152 individual destinations, as shown in **Table 5**. These were grouped by country, the results of which are shown in **Table 6** and **Figure 7**. The ten most commonly represented countries of destination are shown in **Table 15**.

Country of Destination	Total
England	138

Country of Destination	Total
France	23
Wales	23
Australia	13
Netherlands	13
Germany	12
Scotland	12
USA	12
Italy	8
Republic of Ireland	8

Table 15: NMR records queried by country of destination (top ten)

4.3.11. The results of the query based on vessel departure show that the majority of vessels with a point of departure recorded by the known resource departed from England before sinking. Of these, the greatest number (57 or 30%) departed from Liverpool. The second greatest number of vessels departing from England left from London, with a total of 19 vessels or 10%.

4.3.12. Similar figures are noted with regards to vessel destination. The query results for vessel departure show that the majority of vessels listed places in England as their destination. Of these, the majority (36 vessels or 22%) were bound for Liverpool. The second most common English destination was London.

4.3.13. A further query was conducted on the known resource on the basis of place of vessel registration (**Table 7**). There are 85 places of registration listed in the known resource for vessels lost between 1860 and 1913. This has been sub-queried by country, the results of which are shown in **Table 8** and **Figure 7.** The top ten most represented countries of registration are shown in **Table 16.**

Country Registered	NMR
England	150
Scotland	32
Germany	9
Norway	9
Spain	9
Wales	9
France	6
Netherlands	6
Republic of Ireland	6
USA	4

Table 16: NMR records queried by country of registration (top ten)

4.3.14. The results of the query show that the largest number of vessels is recorded as having been registered in England. Of this total, the greatest number was registered in Liverpool (47) followed by London (23).

4.3.15. The query results based on the departure, destination and registration of vessels listed in the known resource for the period 1860-1913 suggest a predominance of shipping activity registered to, clearing and entering the ports of Liverpool and London. This is certainly consistent with historical sources, which state that in the period between 1870/4 and 1910/13, London and Liverpool accounted for 27.6% of the total national growth in tonnage (Jackson 1983:119).

4.3.16. Liverpool was at the forefront of dock building in the late 19th century, and was subject to a series of alterations intended to expand and refurbish the docks. Work began under an Act of 1891 and by 1909 the Mersey Docks and Harbour Board had added some one hundred acres of new deep docks to their estate, accommodating the rising number of medium-to-large ships (Jackson 1983:121). Part of Liverpool's advance was undoubtedly attributable to the great transatlantic liners.

4.3.17. The port of London was also subject to a series of alterations to cater for large steamships. At the start of the 19th century, London was the world's largest port, the centre of international finance and was at the heart of the expanding British Empire. Throughout the century, a large dock-building programme expanded the port, which by 1886 comprised seven enclosed dock systems (http://www.portcities.org.uk).

4.3.18. The data shows that with the exception of vessels departing from the Mersey or the Thames, the vessels listed by the known resource predominantly departed from Cardiff (11 vessels) or the River Tyne (8 vessels). The pre-war period was the age of the coal trade, and as the two major exporters of coal it is hardly surprising that Cardiff and the Tyne are well represented in the known resource for this period.

4.3.19. The departure query results also reveal that the known resource contains 189 references to vessels with places of departure in England, of which 71 were also destined for a region within the UK (**Table 9**). The query results for the destination of vessels were assessed in a similar manner, revealing that of the 158 vessels with a place of destination in England, a total of 86 had departed from a place in the UK (**Table 10**). This suggests that a large proportion of the vessels both entering and clearing ports in England were predominantly involved in coastal trade around Britain. The construction of the railways had greatly aided coastal traffic which grew considerably from the 1840s onwards (Jackson 1986:100). Coastal trade was the most important by volume and a large number of places were involved with local produce being shipped and coal and foreign foods received (Jackson 1986:98). By WWI coastal trade was largely a coal trade (Jackson 1986:102).

Nationality

4.3.20. The known resource was queried on the basis of vessel nationality, the results of which are presented in **Table 17** and **Figure 7**.

Nationality	Total
British	150
English	143
Scottish	32
Norwegian	15
German	14

Nationality	Total
French	11
Spanish	11
Welsh	11
Irish	8
Dutch	5
Danish	4
Manx	4
American	3
Canadian	3
Greek	3
Swedish	3
Russian	2
Austrian	1
Belgian	1
Channel Island	1
Croatian	1
Finnish	1
Hungarian	1
New Zealand	1
Uruguayan	1

Table 17: NMR records queried by Nationality

4.3.21. The results of the query show that of the vessels listed by the known resource for this period, the majority were British (comprising 150 records or 35%) or English (comprising 143 records). Scottish was the third most common nationality, with 32 vessels or 7%). These figures support the dominance of the United Kingdom in seafaring activities in the later 19th and early 20th centuries.

Summary

4.3.22. The vast array of vessel types as represented in the known resource brings to light a theme which is central to the use of vessels in the period 1860-1913; that of the growing emergence of purpose-built vessels. Consequently it might be argued that at least one example of each type of vessel may be regarded as being of special interest on basis of diversity. However, the special interest of vessels judged in this way must take into account surviving boats and ships in the inventories of the NSBR, the NHSR and elsewhere.

4.3.23. With regards to the use of vessels, wrecks may also be of special interest through their association, setting and context. This is particularly relevant to wrecks associated with ports which played a key role in facilitating both the changing requirements brought about by advances in naval engineering and the growing sea trade which occurred during this period. An example of one such port is Liverpool. Liverpool had a geographical advantage which enabled it to capture a substantial share of transatlantic commerce and passenger transport. The heavy concentration of shipping activity and the growing size of boats and ships placed immense strain on the major ports, a strain which was met in Liverpool by harbour development on a grand scale. Wrecks associated with ports which were directly related to the industrialisation of Britain, such as the northern coal ports, may also be regarded as of special interest due to their

association, context, setting and representation of this period of industrialisation.

4.3.24. The growth of coastal traffic, particularly with regards to the transport of coal, is a key factor in the use of boats and ships in the period 1860-1913. Wrecks which operated as part of this coastal traffic may be regarded as having special interest because they are representative of a trade which was directly related to the industrialisation of Britain in the late 19th century. However, due to the large number such wrecks, in order for an individual wreck to be considered as being of special interest additional contributory factors would probably be required.

4.3.25. With regards to nationality, a wreck may be regarded to be of special interest on the basis that it is unique or representative of a significant group, for example a dominant nationality such as Britain. Where that group is very large, as in the case of British vessels, the extent of an individual vessel's special interest may depend upon additional factors.

4.4. Loss

4.4.1. Loss explores the numerous different circumstances in which a boat or ship may be lost. It therefore encompasses its date of loss, place of loss and reason for loss. Loss may result in loss of life, which undoubtedly plays an important factor when considering the special interest of a particular vessel.

Date of Loss

4.4.2. A query was conducted based on date of loss by decade, the results of which are shown in **Table 18** and **Figure 8**. Of the 518 records, there are six records for which the precise year of loss is unknown. The date of loss for these records has been presented in the NMR Complete Monument Records as a date range and still falls within the period of 1860-1913. For example, the vessel Bernardo (NMR **UID 1483591**) is listed as having been lost between 1870 and 1890.

Date Lost	Total
1860-1869	25
1870-1879	75
1880-1889	125
1890-1899	132
1900-1913	155
Exact Year Unknown	6
Total	**518**

Table 18: NMR records queried by date of loss

4.4.3. The results show that the greatest number of losses in this period occurred between 1900 and 1913. The figures also reveal a gradual increase in shipping losses from 1860 to 1879, a big jump in the decade 1880-9 and a gradual increase to a peak in 1900-1913. However, this peak may be due to the period being one of 13 years rather than the previous decadal divisions.

4.4.4. There is a strong possibility that the dramatic rise in the number of recorded wrecks in the decade 1880-9 is due to the widespread adoption of more durable and significantly larger metal hulls rather than a greater propensity for vessels to sink in that decade. Not only are vessels with such hulls likely to survive as wrecks in a more intact condition, at least in the short to medium term, they are often easier to identify in geophysical and hydrographical

surveys and because of their greater potential to survive relatively intact are more likely to be searched for as navigational hazards.

4.4.5. Whilst the survival of wood in marine contexts is often far greater than in a terrestrial environment, wooden wrecks often collapse and disperse quickly. Substantial remains may survive in buried contexts but only the more durable wreck-related debris such as metal hull supports and ballast are likely to be detectable on the surface. These are less likely to be searched for as potential hazards or to be discovered during routine hydrographic survey.

4.4.6. The known resource appears to support this. Of the 25 vessels lost between 1860 and 1869, nearly half are listed to have wood as their object material, a total of 11 records. Of these vessels, eight have information relating to their date of build, five of which predate 1860 when wood was utilised as a primary construction material. Conversely, of the 155 vessels lost between 1900 and 1913, only 22 records list wood as an object material for the vessel.

4.4.7. This analysis must however be treated with considerable caution. There are good grounds to believe that the number of losses recorded and therefore the number of losses recorded per decade is unrepresentative. For example the official records of losses compiled by the Board of Trade indicate that 1973 merchant vessels were lost by stranding alone in English waters between 1860 and 1869. Whilst these figures represent losses as opposed to wrecks and a significant proportion may only have resulted in a partial loss, the contrast with the number of wreck sites in the known resource this decade, 25, is notable and does point to there being the potential for the presence of many more wrecks of this period on the seabed than are currently represented in the known resource. It is expected that a significant proportion of the vessels lost, as recorded in the Board of Trade shipping returns for this period, are documented as shipping casualties by the NMR, and thus comprise part of the potential resource. A consideration of the potential resource alongside the known resource is thus likely to further highlight the potential for additional uncharted and unknown wrecks to be present in the waters off England dating to this period.

Manner of Loss

4.4.8. The known resource was also queried by manner of loss (**Table 19** and **Figure 8**). A total of 18 types of loss are recorded.

Manner of Loss	Total
Foundered	247
Collision	187
Stranded	142
Dispersed	120
Grounded	46
Capsized	14
Burnt	5
Beached	4
Broken Up	4
Wrecked	4
Explosion	3
Scuttled	3
Bilged	2
Gun Action	2
Leaked	2
Lost	2

Manner of Loss	Total
Recovered	2
Abandoned	1

Table 19: NMR records queried by manner of loss

4.4.9. There are a number of factors which must be borne in mind before assessing the results of the database query in relation to manner of loss. One such factor is the presence of multiple values within this field. In order to provide a thorough documentation of a wrecking incident and the circumstances that led up to it and to provide maximum retrievability of this data to the user, the NMR often lists more than one manner of loss for a particular wreck site. This terminology is non-hierarchical and whilst there are only 518 wrecks in the datasets, 790 manners of loss are recorded

4.4.10. The record for the wreck of *HMS A1* (NMR **UID 911782**) is a good example of this. The *A1* was a British submarine which tragically sank after a collision with the SS *Berwick Castle* during an attack exercise in 1904. It was raised by the Neptun Salvage Company of Stockholm and put back into service after repairs, but following an explosion in 1910 in which seven men were injured, it was used as a target and accidentally sank whilst running under autopilot. The manner of loss for the vessel is listed in the known resource as 'explosion', 'scuttled' and 'foundered'. However, whilst it was clearly a significant event in the life cycle of the *HMS A1,* the explosion described did not result directly in the final loss of the vessel. Whilst it may be said to be linked to the decision to use the vessel as an expendable target and therefore indirectly to the final loss, this term does not relate to the primary cause of final loss. Similarly, whilst the use of the term scuttling helps to describe the circumstances of loss, it was not the direct cause of loss.

4.4.11. Taking this into account, the results of the query show that foundering is the most common cause of loss recorded between 1860 and 1913 (**Table 19**). It is likely that the majority of the 247 vessels recorded as lost in this way (47% of the total number of wrecks) were on a voyage that was otherwise typical of many previous voyages. Their remains may thus have considerable potential to provide insight into 'normal' maritime activity (Wessex Archaeology 2008:6).

4.4.12. The second most common cause of loss listed is collision, comprising 187 records. Whilst according to the known resource shipping losses generally increase in the period between 1860 and 1913 on a decadal basis, the number of vessels lost by collision is recorded in the known resource as decreasing slightly in 1890-1899 and then levelling off until the end of the period. This may be due to the increasing emphasis placed on safety at sea and the considerable effort made by governments to regulate and standardise the practice of navigation. These efforts led to the introduction of internationally recognised anti-collision regulations in the 1860s. These were revised on a regular basis throughout the period and quickly gained world-wide acceptance (Cockroft *et al*., 2003: xiv-xvi).

4.4.13. The late 19th century is marked by a period of continuous government legislation to improve the merchant shipping industry and steady reforming pressure was applied (Greenhill 1993:85). From 1850 to 1906, scarcely a year passed in which a committee or a commission enquiring into some aspect of maritime activity was not sitting or an Act of Parliament was not in course of preparation (Greenhill 1993:85). In 1862 the Merchant Shipping Act confirmed the general regulations then existing for preventing collisions at sea (Hope 1990:290). The process came to a climax with the Merchant Shipping Act of 1894.

4.4.14. It is also possible for some vessels to have been lost in this period in circumstances that were highly specific, relating to a particular event (Wessex Archaeology 2008:6). Whilst the Royal Navy was involved in a great deal of fighting associated with colonial expansion and trade protection during this period, in English territorial waters it was a period of unbroken peace. It is therefore highly unlikely that any vessels in British waters lost during this period relate to a specific and hostile naval encounter. However, vessels may be lost in a circumstance which is related to military endeavours that are not in the face of an enemy. The submarine *A1* (NMR **UID 911782**) provides a very rare example of one such wreck.

4.4.15. This particular event may also relate to vessels lost in a single storm. For example, the known wreck *Bay of Panama* (NMR **UID 919184**) is recorded as having stranded near Penare Point in a snow storm while on passage from Calcutta to Dundee on the 10th March 1891. This same snow storm also claimed the *Catherine* (NMR **UID 924309**), the *Acquilon* (NMR **UID 924310**) and the *Dove* (NMR **UID 924308**) in the same vicinity. The latter vessels are listed as Recorded Losses and are not present within the known resource dataset.

Place of Loss

4.4.16. In order to identify and assess patterns of distribution, a 20km grid square was incorporated into the project GIS and joined with a point shapefile containing all of the wrecks listed in the known resource for this period (**Figure 8**). The count of wrecks within each grid square was calculated to highlight areas of high shipwreck density.

4.4.17. This assessment revealed that the greatest number of shipwrecks were present in the entrance to the Liverpool docks. In this area, one 20km square was seen to contain the greatest number of wrecks, comprising 114 records. The 20km square containing the second greatest number of wrecks (87) was adjacent.

4.4.18. A large proportion of the wrecks located towards the entrance to the Liverpool docks were dispersed intentionally by explosives. The dispersal of these wrecks, which may otherwise have presented navigational hazards, may have been associated with the large scale port enhancement which took place during this period to cater for the increasing number and size of vessels entering and clearing the docks.

4.4.19. The third highest count of wrecks within a 20km square was noted off Cornwall and the Isles of Scilly.

4.4.20. Somewhat remarkably, virtually no known wrecks are recorded for the Thames Estuary and its near approaches in this period. This is quite surprising given that London was the greatest port of the era and possessed many navigational hazards in its approaches. Historical records such as Board of Trade returns document many losses to have taken place in this area in the period. For example 74 strandings are recorded by the Board of Trade at Gunfleet Sands at the mouth of the Thames between 1860 and 1869 and yet there are no known wrecks of that decade in the known resource in this area. Additionally a review of the shipping casualties documented by the NMR as part of the Thames Estuary Dredging Association Regional Environmental Assessment (TEDA REA) revealed that the largest proportion of shipping causalities to take place in the TEDA study area (encompassing the northern approaches to the Thames Estuary off the coasts of Essex and Suffolk) took place in the period 1816-1913 comprising 1087 records (Wessex Archaeology 2010:53, Figure 14). The comparative scarcity of known wrecks therefore suggests that the wreck distribution recorded in the known resource does not accurately reflect

the number and distribution of wrecks that have occurred within the Thames Estuary.

4.4.21. Similarly other locations frequently mentioned in Board of Trade returns are not fully represented in the known resource. This is particularly true of the east coast in Essex, Suffolk and Norfolk. For example Hasborough Sands in Norfolk was the scene of 92 strandings recorded by the Board of Trade in 1860-9 alone and yet there are no known wrecks at this location which were lost at this time. There are numerous other examples of high loss locations in this region without comparable known wrecks, for example Cross Sand at Yarmouth and Corton Sand off Suffolk.

4.4.22. Where a discrepancy occurs in any particular area between the number of wrecks and the number of vessels known from historical sources to have been lost, this may have been caused by the recording of these losses as shipping casualties rather than wrecks. They thus comprise part of the potential resource rather than the known resource.

4.4.23. The distribution of known wrecks correlates only moderately well with the areas identified as having high potential hazard to navigation in the EH Navigational Hazards Project (BU 2007: Map 9). The Thames Estuary, the Wash, Morecambe Bay and the Bristol Channel are all assessed as being high hazard areas but the results of this project do not appear to correlate with this.

Lives Lost

4.4.24. The known resource for the period between 1860 and 1913 was queried on the basis of whether any loss of life was associated with the loss of each vessel. The query results are presented in **Table 20**.

Casualties	Total
Loss of Life	93
No Casualties	425

Table 20: NMR records queried by loss of life

4.4.25. The results of the query show that of the 518 vessels listed in the known resource, 93 contain information relating to loss of life. It must be noted that whilst these figures indicate that 422 (81%) of the wrecks are not recorded in the known resource as being associated with loss of life, this is very unlikely to be the case. Of the wrecks, only 15 (3%) were found to specifically state no loss of life. It may reasonably be assumed that a substantial proportion of the other 407, if not a majority, are likely to be associated with loss of life. The record of lives lost in the known resource depends upon contemporary source material relating to the wrecking incident. These sources are often fragmentary in nature and there may be cases in which casualties were not recorded.

4.4.26. Seafaring activity around the British Isles intensified with the rapid growth of British trade during the 19th century, and the number of boats and ships wrecked each year was regarded with increasing concern. Losses amongst cargo vessels were the most common as shipowners were often tempted to risk overloading their vessels because of the huge profits that could be made when large cargoes were sold abroad (http://www.nmm.ac.uk/explore/sea-and-ships/facts/ships-and-seafarers/load -lines). Even if a vessel were lost, shipowners would not suffer financially as they could claim back insurance money for the loss. Overloading and poor repair made some ships so dangerous that they became known as ‘coffin ships’, and many lives were lost at sea. In the year 1873-74, 411 ships sank around the coastline of the UK with

the loss of 506 lives (http://www.nmm.ac.uk/explore/sea-and-ships/facts/ships-and-seafarers/load-lines).

4.4.27. In the mid 19th century, aware of the perils of the 'coffin ships', many sailors refused to go to sea. In one case in 1866, several whole crews were jailed one after the other when the refused to set sail with the *Harkaway,* a cargo vessel which they claimed took in more than a metre of water at anchor on a calm sea (http://www.nmm.ac.uk/explore/sea-and-ships/facts/ships-and-seafarers/load-lines). Although the Merchant Shipping Act of 1876 made load lines compulsory, the position of the mark was not fixed by law until 1894. For much of the period in question the related loss of cargo vessels at sea continued to occur, resulting in the loss of many lives.

Summary

4.4.28. Wrecks may attain special interest due to their manner of loss. For example, vessels lost by collision may be of special interest due to their association with the numerous shipping regulations which characterise the period. Of the vessels lost by collision, 20% had associated loss of life. These wrecks may thus be of special interest due to their association with loss of life and consequent responses in seafaring safety. Furthermore, as the period 1860-1913 represents a period of peace in British territorial waters, any vessel lost as a result of a military event is likely to be of special interest on the basis of rarity.

4.4.29. In terms of loss location, wrecks may be regarded to be of special interest because they are representative of navigational hazards and busy shipping routes. This is particularly true for locations of high recorded losses but where actual wrecks are rare. In the same way they may thus be attributed special interest on the basis of their association, setting and context.

4.4.30. Vessels associated with loss of life may attain special interest with regards to their respect.

4.5. SURVIVAL

4.5.1. The special interest of a boat or ship, discussed in the summary sections above, will be affected by the degree to which the physical remains giving rise to that interest have survived (Wessex Archaeology 2008:9). The completeness of survival may therefore be fundamental to special interest, although it must be noted that in some cases, an interest of an asset may be so great that even fragmentary remains are considered to be of 'special' interest (Wessex Archaeology 2008:9).

4.5.2. For example, if the wreck of only one paddle steamer of this period was recorded, then even if its remains were extremely fragmentary it would nevertheless be regarded as being of special interest on the basis of rarity alone. Conversely, a screw driven vessel, for which there are many examples, might need to have more coherent remains if it was to be considered to be of special interest. Of the screw driven vessels listed in the known resource for this period, only five are recorded as having intact vessel structure. To this end, the special interest of a vessel must take into account the degree of its survival on the seabed.

Evidence on the Seabed and Seabed Survival

4.5.3. The known resource was queried on basis of evidence type, the results of which are shown in **Table 21**. It must be noted that in many cases, records contain duplicate entries for their evidence type. For example, the *Deutschland* (NMR **UID 801951**) is listed to have coherent vessel structure, side scan sonar contact and finds providing evidence for the site.

Evidence	Sub-Type	Total
Documentary Evidence	Documentary Evidence	213
Geophysical	Magnetometer Reading	2
	Echo Sounder Trace	3
	Sonar Contact	4
	Side Scan Sonar Contact	13
	Geophysical Evidence	8
	Multi-beam Survey	2
Vessel Structure	Intact Vessel Structure	9
	Coherent Vessel Structure	15
	Collapsed Vessel Structure	6
	Scattered Vessel Structure	47
	Buried Vessel Structure	8
	Vessel Structure	371
	Conjectural Evidence	2
	Uncertain Evidence	17
Find	Find	61

Table 21: NMR records queried by evidence on the seabed

4.5.4. The results of the query suggest that the evidence most commonly associated with the known resource is vessel structure, being present in 371 or over 70% of the 518 records. Second to vessel structure is documentary evidence, present in 213 or 41% of records. Of the records for which there is documentary evidence, 13 are listed to contain no other type of evidence.

4.5.5. The records were further queried on basis of their seabed survival, the results of which are shown in**Table 22**. Nine distinct descriptions of seabed survival were used. Where no reference was made to the condition of the wreck, its seabed survival is classed as unknown.

Seabed Survival	Total
Unknown	198
Dispersed	184
Broken Up	73
Mainly Intact	22
Poor	19
Partially Buried	7
Buried	6
Partially Intact	5
Flattened	4

Table 22: NMR records queried by seabed survival

4.5.6. A total of 198 wrecks, over one third, had no reference to the condition of the site on the seabed and are thus assigned as unknown. A further 184 records are recorded as dispersed and 73 broken up. Only 22, or 7% or the wrecks for which information is available, are described as mainly intact and only five as partially intact. Thus notwithstanding the introduction of iron and steel hulls during this period, fewer than one in twenty of the wrecks recorded in the known resource are believed to be intact. Whilst further investigation of wrecks of this period may add to these numbers, wrecks of this period that are intact or partially intact can currently be described as very rare.

4.5.7. Vessels which are described as dispersed encompass both sites where the remains of the wreck have been dispersed by natural processes and also wrecks which were dispersed intentionally by the use of explosives or other means. The vast majority of these records represent vessels which were intentionally dispersed by explosives by the Merseyside Docks and Harbours Board. They may have been dispersed during the refurbishment of the port of Liverpool which took place during the late 19th and early 20th century. A large proportion of the vessels (73 records) are also reported to be broken up.

4.6. INVESTIGATION

4.6.1. Assessment of the NMR Complete Monument Records suggests that very few wrecks dating between 1860 and 1913 have been subject to documented archaeological investigation. This in turn suggests that very little shipwreck archaeology for this period has been undertaken in the territorial waters of England.

4.6.2. The known resource records that just three wrecks of the period 1860-1913 have been subject to archaeological investigation, just over 0.5% of the total. These are also the wrecks of this period which have been afforded protection under Section 1 of the Protection of Wrecks Act 1973, namely: *HMS A1* (NMR **UID 911513**), the *Iona II* (NMR **UID 1082110**) and the *HMS Holland No.5* (NMR **UID 1397999**). A further vessel, the *Thomas Lawrence* (NMR **UID 911513**) was investigated by both the Archaeological Diving Unit (ADU) and WA (Wessex Archaeology 2007) although the NMR does not yet record the investigations undertaken by WA for this site.

4.6.3. Although some survey work has been carried out for the purposes of aiding recreational dive visits (for example *Diver* magazine's 'Wreck Tours' series) and unpublished survey work may have been undertaken, this apparent lack of archaeological investigation suggests that archaeology has contributed very little to date to the study of vessels of this period.

4.6.4. The majority of investigations detailed for the remaining wreck sites are incidental, arising from hydrographical or geophysical surveys, and the discovery of wreck-related debris or salvage works.

5. THEMATIC REVIEW

5.1.1. In order to provide a context for the assessment of special interest, the known resource for the period 1860-1913 been reviewed in the light of published historical thematic studies. This review seeks to identify key trends, events and changes relating to the following classes of shipping use, each of which will be considered in turn:

- Transport (Cargo/Passenger);
- Military;
- Industrial;
- Fishing;
- Law and Government;
- Health and Welfare;
- Commercial;
- Agriculture and Subsistence;
- Domestic;
- Recreation.

5.2. TRANSPORT

5.2.1. The revolutionary technological advances in naval engineering which occurred in the period 1860-1913 had significant implications for the transport of cargoes and passengers. The use of steam, particularly in the form of screw driven vessels equipped with low consumption engines and high pressure boilers, provided a more economic and cost effective means of transport, enabling faster journeys to be undertaken which were no longer restricted by adverse weather. The increasingly widespread use of steam led to the development of steam winches and cranes which increased the speed of cargo handling and the capacity of ports. Changes in hull construction saw an increase in the use of iron and later steel and enabled larger and safer vessels to be constructed with a greater cargo capacity. These changes in ship design in the late 19th and early 20th century and the changes in ship management that they and other key technological advances enabled also led to the introduction of purpose-built vessels, from which emerged specialised tramp and liner shipping industries.

5.2.2. The records for the period 1860-1913 are dominated by cargo vessels. In addition to the 332 records (64%) recorded as cargo vessels, there are further 20 vessel types which may also fall into this category, marked by an asterisks in **Table 2** (**Figure 10**). To have included these vessel types within the queries which form the basis of this discussion would have been complex and potentially misleading, especially given that wreck sites are often attributed in excess of a single craft type, incorporating both broad and narrow terms and documenting the various roles a single vessel may have performed throughout its life cycle.. As a result, the queries in this section were confined to vessels specifically termed as cargo vessels in the known resource. Therefore the figures discussed below provide the minimum representation of cargo vessels for this period.

5.2.3. As there were fewer vessels relating to the transport of passengers, it was possible to comprise a conclusive list of passenger vessels for the period 1860-1913. The assignment of vessels under this theme was based on craft type

and included those listed as passenger vessels, liners, emigrant ships and ferries. A total of 22 passenger vessels are listed in the known resource for this period (**Table 11**). The NHSR and NSBR list 35 and three passenger vessels respectively.

Build

5.2.4. During the 19th century, many of the critical advances in naval engineering were pioneered by the mercantile community, where potential profit provided an incentive for progress (Lambert 1992:12). In a period in which there was limited conflict, developments in naval science were not driven by the necessities of war, but largely by the social and economic pressures and challenges that arose from the Industrial Revolution (Lyon and Winfield 2004a:28).

5.2.5. Boats and ships are central to the transport of goods and passengers. Regardless of whether it is the primary function of a vessel to transport goods or people over short or long distances, every boat and ship must have the capacity to be able to sustain themselves with stores and provisions. Consequently, the volume of cargo and the number of crew and passengers that a boat or ship can carry is an integral factor in its construction and operation.

Propulsion

5.2.6. With the advent of steam came the introduction of vessels propelled by the paddle wheel. Paddle steamers are few in the known resource (**Table 11**). Of the 518 vessels lost between 1860 and 1913, only ten or less than 2% are recorded as paddle steamers (**Tables 8** and **9**). Of these ten records, three (the *Grappler* NMR **UID 906684**, the *Hercules* NMR **UID 906809** and the *Earl of Jersey* NMR **UID 1240244**) are recorded as having operated as tugs, with the first two working in the entrance to the Merseyside docks, and the latter in Cardiff. These vessels were built in 1862, 1861 and 1886 respectively.

NMR UID	Name	Date Built
906639	*United States*	Unknown
906662	*Lylie*	Unknown
906725	Unknown	Unknown
906817	*John W Elliot*	Unknown
906809	*Hercules*	1861
906684	*Grappler*	1862
1082110	*Iona II*	1863
904664	*South of Ireland*	1867
904624	*Bournemouth*	1884
1240244	*Earl of Jersey*	1886

Table 23: Paddle steamers in the known resource for the period 1860-1913

5.2.7. By comparison, of the 399 vessels in the NHSR register, there is only one paddle driven transport vessel listed; a 1907 paddle tug (NHSR **ID 2250**). There are no paddle tugs present in the NSBR for this period.

5.2.8. Following the advent of steam propulsion in shipbuilding practices, transport vessels which relied on the paddle wheel were first limited to river boats, harbour tugs and ferries operating in sheltered waters (Allington and Greenhill 1997:3). The use of paddle steamers working in shallow water and as specialist harbour tugs continued after the introduction of screw driven vessels (Allington and Greenhill 1997:5; Body 1971:87). Paddle tugs as they were

known were highly manoeuvrable and therefore very well suited to bringing vessels, particularly sailing vessels, into port.

5.2.9. A further two paddle driven vessels are recorded as passenger vessels. The *Bournemouth* (NMR **UID 904624**) was carrying 180 passengers when she stranded on an excursion from Bournemouth to Torquay. The *Iona II* (NMR **UID 1082110**) was initially built in the 1860s as a passenger and mail boat for the Clyde, but was lost in the Bristol Channel off Lundy at the start of an ill-fated attempt to sail across the Atlantic as an American Civil War blockade runner.

5.2.10. Although paddle steamers were known to be uneconomical in comparison to sail, their benefits were recognised with regards to the short sea transport of passengers, where reliable quick passages were more important than cost (MacRae and Waine 1990:11). As well as being used in river crossings, coastal routes and cross-channel voyages, paddle steamers were utilised as 'sail assist' (part steam and part sail powered) ocean-going passenger vessels from the 1820s, a mode of transport which had reached fruition in 1838 with the establishment of a regular transatlantic service by the *Great Western* (Allington and Greenhill 1997:5).

5.2.11. With the growth of the holiday and excursion habit in the second half of the 19th century, tug-owners also saw an opportunity to supplement their income by using their paddle tugs for pleasure cruises in the summer months (Body 1971:146). This was accompanied by the development of dedicated excursion paddle steamers such as the *Iona II* (NMR **UID 1082110**) and the 1884 *Bournemouth* (NMR **UID 904624**). These were able to operate economically throughout the period as specialist vessels, even long after the relatively low cost and efficiency of screw driven vessels had been proven.

5.2.12. Of the ten paddle steamers in the known resource, only two were intended solely for the purpose of cargo transport. The *South of Ireland* (NMR **UID 904664**) was *en route* across the Channel from Cherbourg (France) to Weymouth, laden with general cargo when she was stranded. The vessel was built in 1867. A further unidentified vessel (NMR **UID 906725**) is described as a British cargo vessel or tanker and was lost whilst *en route* from Liverpool to Bermuda in 1865.

5.2.13. Paddle steamers did not provide the most efficient means of transporting cargo. Not only were the engines of the paddle steamers large and inefficient in proportion to the size of the vessel, but the paddles had to be immersed at a constant depth in order for them to work efficiently. This was clearly not an advantageous characteristic for a cargo steamer which necessarily sailed on different draughts between fully loaded and in ballast (Thomas 1992:24).

5.2.14. The inefficiency of early steamers in the transport of cargo is further illustrated by the lack of any cargo vessel, paddle or screw, equipped with a simple engine within the known resource for this period.

5.2.15. Almost half of the paddle steamers listed in the known resource for the period 1860-1913 were built in the 1860s (**Table 24**). Paddle steamers were gradually superseded by screw driven vessels, which provided an alternative and more efficient means of propulsion. However, although introduced in the 1830s, it was not until the development of the compound engine in 1854 that vessels equipped with screw propulsion could truly compete with the sail.

Propulsion and Engine	Total	Cargo Vessels	Passenger Vessels
Screw Driven	138	111	15

Propulsion and Engine	Total	Cargo Vessels	Passenger Vessels
Compound	88	67	9
Screw Driven AND Compound	77	64	8
Triple Expansion	56	48	7
Screw Driven AND Triple Expansion	**51**	**45**	**7**

Table 24: Propulsion and Engine results for cargo and passenger vessels

5.2.16. Of the 138 vessels which are recorded as having been screw driven, 111 or 80% are listed as cargo vessels. Further to this, of the total 88 vessels equipped with a compound engine, 67 or 76% are recorded to have been cargo vessels. Of the total 77 wrecks recorded as having been screw driven and equipped with a compound engine, 64 or 83% were cargo vessels.

5.2.17. The introduction of the triple expansion engine in the 1880s had further implications for the transport of cargo, enabling vessels to operate with greater efficiency in a manner which was far more economical than that provided by sail power.

5.2.18. The known resource lists 56 vessels equipped with a triple expansion engine, 48 (86%) of which are further listed to be cargo vessels. Of the cargo vessels equipped with a triple expansion engines, 45 are listed to have also been screw driven.

5.2.19. These figures clearly demonstrate that the competitive speed and costs offered by screw driven vessels equipped with compound or triple expansion engines were of great benefit to the transport of cargo. However, despite the advantages afforded by these technological advances, sailing cargo vessels continue to be well represented in the known record for this period. Of the 332 cargo vessels listed by the known resource to have been lost between 1860 and 1913, just over half were steam propelled (184 records), whereas just under half utilised sail as a means of propulsion (143 records). Of these vessels, only 20 cargo vessels are listed to have utilised both sail and steam as a means of propulsion.

5.2.20. Of the 138 vessels which are detailed to have been screw driven in the known resource (**Table 24**) only 15 records are listed to have been passenger vessels. Further to this, of the 88 vessels equipped with a compound engine, nine are recorded as passenger vessels. Of the 77 vessels which combined the technologies of screw propulsion and compound engines, eight were passenger vessels. Similarly, of the 56 screw driven vessels equipped with triple expansion engines, seven were passenger vessels.

5.2.21. On first inspection, these figures indicate that screw driven passenger vessels equipped with compound or triple expansion engines were few in relation to cargo vessels (**Table 24**). However, with only 19 records in the known resource which have been assigned as passenger vessels, there is a relatively high number of either screw driven passenger vessels or those equipped with a compound or triple expansion engine, thus indicating a tendency for vessels which transported passengers during this period to adopt such means of propulsion. By the 1880s, screw-driven steam propulsion had been completely proven for reliability and fuel economy, and sister ships *Umbria* and *Etruria* which were launched in 1885 were the last two transatlantic liners completed with auxiliary sails (Batchelor and Chant 2007:11).

5.2.22. The records for vessels in preservation differ to the known resource in respect to the propulsion of transport vessels. Of the 102 cargo vessels listed by the NHSR for this period, only six are detailed to have utilised steam as a means of propulsion (the *Monarch* NHSR **ID 484**, the *Raven* NHSR **ID 57**, the *SS Robin* NHSR **ID 1794**, the *Adamant* NHSR **ID 6**, the *Basuto* NHSR **ID 11** and the *President* NHSR **ID 55**). The majority of cargo vessels are detailed to have been sailing vessels (41 records) although a significant proportion is also listed as having employed motor or engines as a means of propulsion (32 records). The engine type most commonly represented in the NHSR with regards to cargo vessels is the diesel engine, comprising 52 records.

5.2.23. Similarly, of the 35 passenger vessels listed by the NHSR for this period, the majority are motor (18 records) or engine (9 records) propelled, with only five utilising a steam engine (the *King* NHSR **ID 682***, Alaska* NHSR **ID 7***, Sir Walter Scott* NHSR **ID 67***, Resolute* NHSR **ID 1551** *and Streatley* NHSR **ID 279**). The most commonly represented engine amongst passenger vessels as listed by the NHSR is again the diesel engine, comprising 24 of the total 35 passenger vessels for this period. The records relating to passenger and cargo vessels in the NSBR are so few and specialised (comprising three vessels described as 'one off's and two coracles) that their comparison against the known resource in respect of propulsion is unrepresentative and will not be considered here.

5.2.24. The predominance of diesel engines in transport vessels listed by the NHSR should not be regarded as representative of the period 1860-1913. The use of the diesel engine became far more widespread during and after WWI and thus it is likely that the majority of vessels listed by the NHSR to utilise this method of propulsion were refitted at a later stage. The *Lady of the Lake* (NHSR **ID 375**) provides an example of one such vessel, which was constructed in 1877 as a steamship until 1935 when she was fitted with diesel engines. This arguably enhances the importance of both the few steam propelled vessels in preservation which have not been subject to an engine refit and the remains of steam propelled vessels on the seabed.

Hull Construction

5.2.25. The period 1860-1913 encompasses great changes in hull construction. At the onset of the period in 1862, a vote in Parliament took place on a motion for an end to the construction of wooden capital ships, which effectively ended the era of the wooden battle fleet. Queen Victoria's 1867 Pearl Jubilee Fleet Review at Spithead witnessed the last occasion on which a wooden battleship officiated as the flagship (Lyon and Winfield 2004:13).

Object Material	No. of Cargo Vessels
Iron	132
Wood	87
Steel	59
Copper	3
Metal	2
Pine	1

Table 25: Cargo vessels queried by object material

5.2.26. The cargo vessels listed in the known resource were queried on the basis of their object material, the results of which are shown in **Table 25**. Of the 332 cargo vessels listed in the known resource, the majority are iron in construction, comprising 132 records or 40%. The second most common object material amongst the cargo vessels is wood, totalling 87 records or 26%. Iron had

advantages over wood for the construction of steamers, in providing stronger and more durable material which could cope with heavy vibrating engines that steam propulsion necessitated (Ville 1993:62). Comprising 55 of the 102 cargo vessels listed by the NHSR, the most commonly represented object material is wood, followed by iron with 29 records. The higher representation of wooden vessels in the NHSR may be accounted for by the factors outlined in **Section 4.4.29**.

Object Material	No. of Passenger Vessels
Iron	14
Steel	5
Wood	1

Table 26: Passenger vessels queried by object material

5.2.27. Iron is also the most commonly represented material with regards to passenger vessels listed in the known resource for this period, comprising 14 records of a total 22 (**Table 26**). The NHSR lists only one iron passenger vessel for the period (the *Lake* NHSR **ID 375**), with the majority of vessels steel in construction (13 records). A proportion of passenger vessels listed by the NHSR are also of wooden construction (9 records). The steel vessels listed by the NHSR date from the late 1880s, when the advantages of using steel over iron in the construction was becoming more widely recognised. Conversely, the *Lake* was constructed in 1877, a period in which iron largely predominated. The low number of iron hulled passenger vessels dating to this period arguably enhances the importance of such vessels which exist on the seabed.

5.2.28. Changes in hull material and the increasing use of iron and steel in the construction of boats and ships had significant implications for the transport of cargo and passengers. The use of metal in shipbuilding ultimately enabled the construction of more durable vessels with larger cargo capacity than that provided by wooden vessels (Ville 1993:73). Further advantages provided by metal hulls included strength, lightness and safety.

5.2.29. However, early iron cargo vessels were not without their shortcomings. Iron hulls were not only more susceptible to fowling; they also developed a permanent and complex magnetic field resulting in a serious deviation of compass readings in early iron vessels (Ville 1993:57). Another problem was the effects of 'sweating' and bilge water effluvia upon cargoes such as coffee and tea (Ville 1993:57). It was conversely feared that cargoes such as sugar might damage and corrode iron plates (Ville 1993:57). As a consequence, the construction of wooden cargo vessels continued, despite the increasing use of iron in shipbuilding. They are represented in the known resource, albeit at a decreasing rate, up until the turn of the 20th century (**Table 27**).

Date Built	Wood	Iron	Steel
1810-1819	1	0	0
1820-1829	1	0	0
1830-1839	6	0	0
1840-1849	6	1	0
1850-1859	15	9	0
1860-1869	18	20	0
1870-1879	14	39	4

Date Built	Wood	Iron	Steel
1880-1889	3	30	16
1890-1899	0	1	19
1900-1913	0	0	8

Table 27: Cargo vessels queried by object material and date of build

Date Built	Wood	Iron	Steel
1850-1859	1	1	0
1860-1869	0	2	0
1870-1879	0	7	0
1880-1889	0	2	1
1890-1899	0	1	2
1900-1913	0	0	1

Table 28: Passenger vessels queried by object material and date of build

5.2.30. While the adoption of iron as the primary building material occurred much earlier in steam than in sail, the two technologies did not necessarily go hand-in-hand. While the combination and steam and metal ultimately proved the best mix of technologies, naval architects and shipbuilders also focussed on the construction of the metal sailing vessel (Ville 1993:53).

5.2.31. There are records of 23 cargo vessels in the known resource dataset listing iron as an object material and sail as the sole means of propulsion. One of these records, the English barque *Caduceus* (NMR **UID 767431**), refers to a vessel which was primarily wooden in construction but incorporated iron fastening in its design. However, the remaining 22 examples comprise examples of vessels which were primarily constructed of iron, such is the case with the Scottish schooner *Irex* (NMR **UID 805267**) built in 1889 or the English cargo vessel *Underley* (NMR **UID 1166275**) built in 1866. Although iron sailing vessels had the same loading and discharging rates as wooden sailing vessels, they benefitted from a reduced amount of repair work and were thus cheaper in terms of both cost and time (Ville 1993:56).

Use

5.2.32. There are a number of themes which come to light when considering the context of use for both cargo and passenger vessels in the period between 1860 and 1913.

5.2.33. In the 19th century there was a dramatic growth in sea trade. This partly occurred as a result of the Industrial Revolution, which saw an increase in the demand for raw materials, the import of which into Britain guaranteed a continuing high level of trade and for access to export markets (Jackson 1983:113). From 1870 to the outbreak of WWI, the British merchant marine grew from *c.*8.5 million grt to *c.*19 million grt (Slaven 1992:5).

5.2.34. The introduction of the steamship enabled long-distance trades to grow rapidly and also saw the introduction of steam driven winches which rapidly increased the loading and discharging rates of cargo vessels (Campbell 1974:15). The opening of the Suez Canal in 1869 had further implications for long-distance trades, removing the need for vessels to pass around the Cape of Good Hope and providing a route which cut several thousand miles from passages to the Orient.

5.2.35. The increasing use of the steamship alongside the introduction of the railway further stimulated trade with Continental Europe. Coastal traffic around Britain also continued to grow, though at a diminishing rate, up to 1913, experiencing the largest coastal tonnages on record (Jackson 1983:114). It was not until 1880 that the tonnage of vessels carrying goods out of the country regularly exceeded that clearing coastwise (Jackson 1983:114).

5.2.36. The laying of the trans-ocean telegraph cables further revolutionised trading patterns, making it possible for up-to-the-minute data on the availability and movements of cargoes and ships around the globe, greatly decreasing the time that vessels spent waiting for cargoes (Dawson 2005:39).

5.2.37. A combination of these factors saw a noticeable change in the volume, direction and composition of British trade during the second half of the 19th century (Saul 1960). There was a large increase in the size, range and economy of screw steamers during this period (Jackson 1986:100).

5.2.38. The technological innovations in propulsion and hull construction of the late 19th century further enabled the regularly scheduled services of larger ships with high standards of accommodation and onboard comfort, thus stimulating the growth of passenger trade (Dawson 2005:10). The passenger trade was further stimulated by the large scale migration of people from the British Isles, largely resulting from the industrialisation and urban development of Britain.

Tramp Shipping

5.2.39. The 19th century saw the introduction of the tramp steamer, a type of vessel normally designed to carry bulk goods. The propelling machinery integrated into tramp steamers had to be completely reliable as the vessels could be away from the UK for up to 24 months (Thomas 1992:10). Following the introduction of screw propulsion, tramp steamers gradually displaced the sailing ship, offering lower operating costs and faster passages (Thomas 1992:11). The higher costs of steam were offset by the need to hold lower stocks of goods as the quicker passages enabled deliveries to occur on a more regular basis (Thomas 1992:11).

5.2.40. The tramp steamer was arguably the most important freight vessel operating during the 19th century and thus the emergence of tramp shipping in the period between 1860 and 1913 is paramount in understanding the context of use for cargo vessels. However, the term tramp steamer is not included in the NMR terminology for the field 'craft type'. As a result a vessel type which is central to an understanding of the transport of cargo in the period 1860-1913 is not recorded explicitly as such in the known resource. This low representation is further affected by the lack of any vessels termed as tramp steamers in the NHSR.

5.2.41. With regards to craft type, the transport of bulk commodities is represented in the known resource by Dry Bulk Cargo Carriers. Out of the 518 records listed in the known resource, only one has been assigned as a Dry Bulk Cargo Carrier, the *Preussen* (NMR **UID 901826**). However, this vessel is recorded to have been carrying general cargo, pianos and cement; possibly unlikely cargoes for a tramp steamer.

5.2.42. The cargo carried by tramp steamers generally consisted of only one type of material, the quantity of which was sufficient to load the vessel either to its load line or to its cubic capacity (Thomas 1992:9). Rather than running a liner service on a fixed route in accordance with a regular shipping schedule, the tramp steamer sailed only when the owner had obtained a cargo, i.e. on a more *ad hoc* basis (Dawson 2005:40). For the outward charter, tramp steamers would mainly be concerned with deadweight cargo, consisting of commodities

such as coal, iron, steel, phosphates, salt and other 'rough' merchandise. On the homeward run the variety would be much greater (Thomas 1992:9).

5.2.43. A rise in demand for commodities comprising imports of grain and iron ore and the exports of coal marked a turning point for the British tramp shipping industry, with the carrying trade reaching its climax in 1913 (Thomas 1992:11).

5.2.44. A query conducted on cargo type for vessels which sank between 1860 and 1913 revealed that the most commonly carried cargo was coal. Of the 518 records for this period, 74 are recorded as having been carrying coal. Of this total, 69 records relate to vessels which carried coal and no other material. This is not surprising as coal was not usually part of a mixed or general cargo. Despite this, there are only eight wrecks out of 518 which are documented as colliers in the known resource for the period 1860-1913. This is unlikely to be representative given the quantity of coal which is known to have been traded coastally and exported abroad. In 1900 alone, 44,089,197 tons of coal is recorded to have been exported from the United Kingdom. It is likely that the great majority of the vessels which carried this coal were involved in the tramp shipping system.

Cargo liners

5.2.45. The age of the liner trade began when steam propulsion allowed voyage duration and arrival times to be much more precisely scheduled. This enabled shipowners and managers to operate their ships according to a regular schedule, on scheduled routes and sailing at advertised times (Dawson 2005:13).

5.2.46. Of the 518 records listed in the known resource, nine are referred to as liners, all of which are detailed to have been transporting either general cargo or a selection of more specialist commodities at their time of sinking. Of these liners, eight also carried passengers, ranging in number from 49 (the *Edam II* NMR **UID 832248**) to 383 (the *Suevic* NMR **UID 918674**). Cargo liners, or liner traders, often had cabins for small number of passengers. It is likely that the liners which carried a large number of passengers such as the *Suevic* (NMR **UID 918674**) were primarily passenger liners. No cargo vessels referred to as liners were present in the NHSR.

5.2.47. The drastic reduction in cargo shipping rates brought about by the effects of steam tramping forced liner traders to compete with the tramp operators for their share of the cargoes and the revenues to be earned from carrying them (Dawson 2005:40). The liner traders were able to offer the advantage for larger and faster ships and regular sailings, putting them in good stead to compete for the government mail contracts (Dawson 2005:40).

Clippers

5.2.48. There are three vessels within the known resource attributed the vessel type 'clipper' in the period between 1860 and 1913 (the *Smyrna* NMR **UID 1479436**, the *Glenbervie* NMR **UID 918805** and the *Polynesia* NMR **UID 911980**). The destinations of these clippers varied, with one destined for Belgium (the *Polynesia* NMR **UID 911980**), one for South Africa (the *Glenbervie* NMR **UID 918805**) and the other Australia (the *Smyrna* NMR **UID 1479436**). All of these vessels employed sail as a means of propulsion, although the *Polynesia* (NMR **UID 911980**) is listed to also have been steam propelled.

5.2.49. With only three records, there is a poor representation of the sailing clipper amongst known wrecks in the period 1860-1913. The tea races of the 19th century form a prominent element of the transport of cargo during this period, and the use of the sailing clipper in the important tea trade reached its peak in the 1860s with the increasing use of composite clippers (Campbell 1974:14).

Each of the clippers detailed to have been constructed of iron and thus there is no record in the known resource for composite clippers in the period 1860-1913. There are two clippers listed in the NHSR for the period 1860-1913; the *Cutty Sark* (NHSR **ID 438**) and the *City of Adelaide* (NHSR **ID 433**). These vessels were built in the 1860s (1869 and 1864 respectively) and were each composite in construction.

5.2.50. Of the three clippers listed in the known resource, only one is detailed to have been built as a tea clipper in 1866, although it later became engaged in the timber and cod fish trade (*Glenbervie* NMR **UID 918805**). Despite the steady increase in the number of steamers with greater efficiency being launched, clipper ships were still being built as the 1860s drew to a close, with no less than 132 ocean-going sailing ships being launched in Britain in 1869 (MacGregor 1979:115). While the construction of the three clippers between 1866 and 1876 indicates a continuing demand for such vessels, the records are so few that they do not provide a realistic representation of the volume of sailing clippers which operated in English waters during this period.

5.2.51. Prior to 1860, the steamship did not constitute a real threat to sailing clippers on long voyages like the 'China run', owing to the need to refuel frequently at coaling stations off the direct route (Campbell 1974:15). However, following the introduction of screw driven vessels equipped with compound engines and the opening of the Suez Canal the sailing clipper was gradually rendered obsolete. The Suez Canal cut several thousand miles from passages to the Orient. A journey from Liverpool to Shanghai via the Suez Canal was 10,387 miles, in comparison to a passage via the Cape which was 13,717 miles (Allington and Greenhill 1997:50).

5.2.52. The first real challenger to the sailing clippers was the *Agamemnon,* the first vessel of the Ocean Steam Ship Company established by Alfred Holt in 1866. Unlike earlier steamships, the *Agamemnon* was equipped with a more economical compound engine and was later joined by two sister ships, the *Ajax* and the *Achilles,* inaugurating a service of modern steamships to the Far East (Campbell 1974:15).

5.2.53. By the mid 1870s, sailing tea clippers had slowly vanished from the tea trade in racing form (Campbell 1974:15). The only vessel recorded in the known resource for the period between 1860 and 1913 as having carried tea as a cargo is the *Mahratta I* (NMR **UID 904862**), a steamship which was transporting tea from Calcutta to Britain at the time of her loss. The construction of this vessel in 1892 suggests a new found preference for steamships to be employed in the transportation of tea. However, iron clippers continued to be used in trade routes to Australia which did not fit in with steamer schedules until boilers and engines became more efficient later in the century and coal consumption could be reduced (MacGregor 1979:142). The continued attraction of iron sailing clippers for lengthy voyages is reflected in the presence of the *Smyrna* (NMR **UID 1479436**) in the known resource. Destined for Australia at the time of loss, this vessel was constructed in 1876 at a time which the benefits of the steam propulsion had already been proved.

5.2.54. In the late 19th century, the volume of tea trade was immense. However, of the 518 known wrecks in the period 1860-1913, only one is listed to have carried tea as cargo. This suggests that sailing clippers are under-represented in the known resource and indicates that a degree of special interest will attach to wrecks such as that of the *Mahratta I* (NMR **UID 904862**).

Passenger Liners

5.2.55. The passenger vessels listed in the known resource for the period 1860-1913 were queried by their date of build. A further query conducted on the records considered liners by their date of build, the results of which are shown in **Table 27**.

Date of Build	Total	Liners
1850-1859	2	0
1860-1869	2	0
1870-1879	7	3
1880-1889	3	1
1890-1899	4	2
1900-1913	1	1
Unknown	3	2

Table 27: Total Passenger Vessels and liners queried by date of build

5.2.56. The results of the query indicate that passenger liners are not recorded in the known resource prior to the 1870s. The appearance of passenger liners in the 1870s may be attributed to the technological advances in hull construction and propulsion. The advances in mechanical propulsion and the introduction of iron and steel hulls made possible the construction of larger ships and high standards of accommodation and onboard comfort (Dawson 2005:10). The development of ocean going steamships brought regular scheduled services to all of the world's great oceans, changing perceptions of distance and ultimately enabling sea travel to be available for millions rather than the privileged few (Dawson 2005:13).

5.2.57. In 1870 the White Star Line's *Oceanic* pioneered a new era in the comfort of ocean travel, with first-class accommodation amidships (Batchelor and Chant 2007:11). The accommodation also included large portholes, running water and electrical lighting (Batchelor and Chant 2007:11).

5.2.58. The concept of 'hotels at sea' started to appear in the 1880s, when the hospitality available on land as an accessory to rail started to be introduced as an integral part of the passenger's life at sea. It is not until the following decade that passenger vessels appear in any significant numbers in the NHSR dataset. By the end of the 19th century, sea travel was being enjoyed for its own pleasures (Dawson 2005:54). In the last two decades of the 19th century, the size of ocean liners increased steadily and growing numbers of large passenger liners were built to satisfy this increasing demand for international travel by the affluent (Batchelor and Chant 2007:8). The beginning of the 20th century therefore saw the dawn of the 'golden age' of the ocean liner, with shipping lines vying strongly with each other with emphasis on the size, capacity, luxury and speed (Batchelor and Chant 2007:12). Just under two thirds of the total passenger vessels listed by the NHSR were built between 1900 and 1913, indicative of this growth in passenger transport.

5.2.59. Of the eight liners in the known resource, seven were lost during long distance voyages. Six of these were Transatlantic, travelling between New York and Europe. One vessel was lost during a voyage from Australia to Britain, while the remaining liner was lost *en route* from Britain to Portugal. The high proportion of liners involved in long-distance routes from Europe to the United States is representative of one of the most routes of the passenger liner (Jackson 1986:102). The busiest route for liners was across the North Atlantic,

which was plied by ships travelling between Europe and North America (Batchelor and Chant 2007:10).

Migration

5.2.60. With the Industrial Revolution and the subsequent growth of the modern metropolis, many people were unable to find a place for themselves within the new urban economies (Dawson 2005:29). The industrialisation and urban development of Britain thus ultimately led to large scale migration from the British Isles.

5.2.61. Of the 518 records listed by the known resource, only one vessel is described as an emigrant ship, the *Brest* (NMR **UID 918720**). A single record for an emigrant ship is unlikely to be representative of the volume of migration that took place between 1860 and 1913. While dedicated emigrant ships operated in the period 1860-1913, emigrants were also in some cases steerage passengers onboard passenger and cargo vessels where they were effectively carried as cargo, occupying the same holds on the outward passages that were used to carry cargo on the homebound leg of the voyage (Dawson 2005:28). Consequently, it's likely that any number of the 21 vessels listed to carry passengers as cargo carried emigrants.

5.2.62. Between 1846 and 1932 more than 60 million people migrated from the British Isles, Europe, Scandinavia and Russia, with the greatest numbers migrating to the United States (Dawson 2005:29). British emigrants also settled in Canada, Australia and the other dominions of the Empire (Dawson 2005:29). The United States and Canada imposed no restriction on immigration of English-speaking settlers at this time, and this alongside the industrialisation and development of the United States created opportunities for people of the British Isles to use their valuable skills and trades to create a new life for themselves in the Americas (Dawson 2005:29). The emigrant market to the U.S. and Canada provided the economic base forming the foundation for the dawn of the 'golden age' of the ocean liner at the turn of the 20th century (Batchelor and Chant 2007:12).

5.2.63. Of the 21 vessels listed to carry passengers as cargo, only one is recorded to have departed from Britain on a transatlantic voyage to the United States (the *Mohegan* NMR **UID 919160**). No records are present for vessels carrying passengers as cargo from Britain to Canada or Australia.

Loss

5.2.64. As a period of peace, the cargo vessels listed in the known resource between 1860 and 1913 are likely to have been lost as a result of accidental factors, including unfavourable weather conditions, navigational hazards and human error. As such it is likely that the majority of transport vessels were lost on a voyage that was otherwise typical of many previous voyages, whereby their remains may have considerable potential to provide insight into the routine patterns of transport during this period.

5.2.65. A review of the known resource dataset reveals that there appears to be no circumstances of loss that are specific and unique to transport vessels during this period, and as such this theme has already been considered in detail in **Section 4.4**.

5.2.66. Most notable with regards to cargo vessels is the low number of known wrecks in the Thames estuary and off the coasts of Essex and Suffolk. London in particular was a hub for British commerce during this period and dominated foreign trade, both by providing a transhipment point for foreign and colonial goods, and by attracting a huge coastal traffic which catered for the capital's demand for foodstuffs, fuel and building material (Jackson 1986:96). As such

the greater Thames estuary and its approaches are likely to have been subject to a significant concentration of shipping activity. In travelling across areas subject to a high level of shipping, a great number of cargo vessels are likely to have been lost due to collision. This is demonstrated by the fact that over one third (121 records) of cargo vessels were lost due to a collision. The majority of these (54 records) occurred in 1880-1889 (**Table 22**). The number of cargo vessels lost by collision decrease and level-off towards the end of the period in question, which may be due to the continuous government legislation to improve the merchant shipping industry discussed in **Section 4.4**.

5.2.67. While it is possible that a great number of wrecks that were lost in this area are recorded as shipping casualties rather than known wreck sites, the lack of known wrecks in any significant number of this stretch of coastline in comparison to other areas around the coast is notable given the high potential for wrecks to exist within this area.

Summary

5.2.68. The late 19th and early 20th century was a period of dramatic increase in sea trade, both overseas and coastal. This stimulated and was in turn stimulated by technological innovations. On the basis of their representation and grouping, cargo vessels may thus be regarded of special interest both by their association and by their quantity, signifying this economically prosperous period. However, due to their large numbers, it is expected that cargo vessels would require further contributory factors in order for them to be considered as of special interest.

5.2.69. The advent of mass emigration and the consequent growth of passenger traffic at sea is a key feature of this period. Any passenger vessel may therefore have special interest on the basis of its representation of this key theme. The passenger vessels within the national stock-take for the period 1860-1913 are relatively few, and thus such wrecks may also be regarded of special interest on basis of their rarity. The wrecks of passenger vessels might also be regarded of special interest on the basis of their association with prominent shipping companies which operated in the late 19th and early 20th century, particularly in relation to the White Star Line or the Cunard Line. The known resource lists two passenger vessels which were owned by the White Star Line and the Cunard Line respectively, comprising the *Suevic* (NMR **UID 918674**) and the *Brest* (NMR **UID 918720**).

5.2.70. Due to their rarity in the national stock-take and the fact that they are representative of a particular stage in the evolution of steam technology, cargo paddle steamers are likely to be considered of special interest. Conversely, cargo screw driven vessels equipped with either compound or triple expansion engines are abundant, and thus may be regarded of special interest on basis of being representative of a technological advance which, through providing competitive speed and economy, stimulated the growth of trade during this period.

5.2.71. Although sailing vessels are fairly well represented in the known resource for the period 1860-1913, cargo sailing vessels may be regarded of special interest on the basis that they are representative of a transitional period in cargo carrying and the final development of commercial sail. However, due to their quantity such wrecks would probably need to have other significant characteristics in order to be of special interest. Special interest in this respect should also take into account the survival and preservation of 41 cargo vessels which utilised sail as a means of propulsion, as listed by the NHSR. Particular special interest may be attributed to the 23 iron-built cargo vessels relying

solely on sail as propulsion in the known resource as these vessels represent a significant transitory period relating both to propulsion and hull construction.

5.2.72. The technological changes which took place in this period saw the rapid introduction of purpose-built vessels. In 1852 the first bulk carrier, the *John Bowes*, was built. In 1866 the first modern cargo liner was constructed, the *Agamemnon*. In 1880 the SS *Strathleven*, the first reefer cargo ship, was launched and in 1886 the first oil tanker, the *Glückauf*. These were all highly significant events and the vessel types have continued in widespread use to the present day. The known resource records one dry bulk cargo carrier (*Preussen* NMR **UID 901826**), nine liners (*Deutschland* NMR **UID 801951**, *Patria* NMR **UID 831711**, *Edam II* NMR **UID 832248**, *Schiller* NMR **UID 858537**, *Pomerania* NMR **UID 883110**, *Argonaut* NMR **UID 901719**, *W A Scholten* NMR **UID 901801**, *Suevic* NMR **UID 918674** and *Mohegan* NMR **UID 919160**) and three tankers (*Blesk* NMR **UID 832177**, *Thomas W Lawson* NMR **UID 859029** and an unnamed vessel NMR **UID 906725**) but no reefers.

5.2.73. With regards to cargo vessels, no less than 21 individual vessel types are recorded in the known resource. Consequently, it may be argued that an example of each vessel type may be considered of special interest on basis of conserving the diversity of vessels which operated during the late 19th and early 20th trading systems.

5.2.74. The emergence of the tramp and liner shipping industries is characteristic of the period 1860-1913. Any wreck associated with these trading systems may be regarded of special interest on the basis of being representative of this key theme.

5.2.75. Other rare vessel types including clippers are likely to be regarded as being of special interest. The low representation of clippers in the known resource arguably enhances the importance of the *Cutty Sark* (NHSR **ID 438**) and the *City of Adelaide* (NHSR **ID 433**), the only clippers listed by the NHSR for the period 1860-1913.

5.3. MILITARY

5.3.1. The period 1860-1913 is one of revolutionary changes in naval warfare. An English sailor of the navy of Henry VIII transported 300 years into the future would have found a different but very recognisable world in the navy of Nelson. Transported just 100 years further to the brink of the First World War, the same sailor would have found an utterly unrecognisable and alien world of huge dreadnoughts and submarines.

5.3.2. The transformation of the Royal Navy from a sailing fleet to a fleet of iron- and steel-clad warships and submersibles depended upon a number of technological advances. The use of steam propulsion freed warships from their dependence upon the wind. Advances in the construction of weaponry saw the introduction of shell projectiles, breech-loaded rifled guns, barbettes, gun turrets and torpedoes. Changes in hull construction and the development of armoured hulls provided more durable vessels more capable of withstanding the effects of such armaments. Further advances in technology saw the construction of submersibles and underwater weaponry.

5.3.3. A query conducted for vessel types likely to be military in origin revealed there are only 12 military vessels in the known resource for this period (one of two records for the *Grosser Kurfurst,* NMR UID **901765**; **901781** has been omitted). This represents just over 2% of the 518 wrecks recorded for this period (**Figure 12**). The military vessels listed in the known resource for the period 1860-1913

are shown in **Table 30**. The NHSR and NSBR list 13 and two records respectively with the function type 'fighting vessel' (**Table 28**).

5.3.4. The limited representation of military vessels in this period is unsurprising. The lack of any significant naval conflicts in British territorial waters in the period 1860-1913 means that any vessels constructed in this period are more likely to have been lost in the major naval conflicts of WWI and will thus be considered in the second phase of this project.

ID	Name	Type	Built	Source
501	*HMS Warrior*	Ironclad	1860	NHSR
505	*HMS Gannet*	Cruiser	1878	NHSR
16	*Demon (HMS Dandy)*		1882	NHSR
2173	*Collie*	Pinnace	1890	NHSR
31	*Janet*	Admiral's Barge	1892	NHSR
1666	*Osborne*	Royal Naval Steam Cutter	1896	NSBR
1028	*Mischief*	Royal Naval Steam Cutter	1897	NSBR
2238	*Caretta*	Sailing Pinnace	1898	NHSR
427	*Holland I*	Submersible	1901	NHSR
415	*Vere*	Naval Pinnace	1905	NHSR
2126	*Condorline*	Admiralty Pinnace	1909	NHSR
40	*199*	Naval Pinnace	1911	NHSR
96	*Sundowner*	Naval Pinnace	1912	NHSR
1935	*Fat Old Sun*	Admiralty Pinnace	1912	NHSR
2098	*Hospital Boat No. 67*	Hospital Boat	1912	NHSR

Table 28: NHSR and NSBR Military Vessels

Build

5.3.5. The period 1860-1913 was a period of dramatic change for navies all over the world. The introduction of new technologies and materials from which new weapons were developed demanded radical changes in ship design (Watts 1994:6).

5.3.6. At the beginning of Queen Victoria's reign in 1837, a battleship was a wooden and unarmoured structure, propelled either entirely or primarily by the wind and armed with a large number of light short range hand-served weapons that usually fired solid shot. By the 1860s the introduction of steam, iron and shell guns technology resulted in the development of steam powered armoured ships. By the end of the period the battleship had become an all-metal armoured structure, propelled by engines and armed with a small number of very large long range guns firing armour piercing shells.

5.3.7. The period was also one of experimentation. The absence of any major naval warfare and competing theories about the future of naval design resulted in uncertainty and a seemingly endless array of designs with widely differing capabilities (Roberts 1992:105; Watts 1994:44). Warships were ordered and designed to meet each specific situation as it arose, incorporating the latest technological developments as they became available (Watts 1994:44-45). For the first time practical submersible warships were built.

Propulsion

5.3.8. Of the ten paddle steamers listed in the known resource between 1860 and 1913, none are military vessels. As discussed in **Section 5.2** paddle steamers

are poorly represented in the known resource. Similarly there are no military paddle steamers in the records for vessels in preservation which performed a military function. Early use of paddle steamers in the Royal Navy was largely confined to vessels operating as tugs which were to tow warships in unfavourable winds and as dredgers, although from the 1830s onwards larger paddle frigates were constructed with a powerful armament (Brown 1993:6).

5.3.9. Despite their use within this period, the lack of paddle steamers of a military nature for the period 1860-1913 is not surprising. Paddle steamers had limitations which imposed constraints upon their use for military purposes. Early paddle steamers depended on frequent supplies of coal and were unable to make long ocean passages under steam alone (Brown 1993:6). Alongside the more general concerns associated with early steam vessels, such as reliability, paddle wheels prevented vessels from carrying full broadside batteries and the paddles were hard to protect and therefore very vulnerable when the vessel was in action (Watts 1994:15).

5.3.10. Consequently, it was only when the screw propeller was introduced that steam could achieve naval primacy at sea (Lambert 1992:8). It allowed vessels to regain their full broadside armament and the position of the screw underwater at the stern of the vessel overcame the vulnerability issue (Watts 1994:15). The coming of screw propulsion therefore put an end to the prospects of the paddle in the Royal Navy, although a few special service paddlers continued to be built, largely for work overseas (Body 1971:113).

5.3.11. Of the 138 vessels listed in the known resource as having been screw driven only seven, or 5%, are military vessels (*HMS Empress of India* NMR **UID 1891** *HMS Blackwater* NMR **UID 901743** *HMS A3* NMR **UID 1904** *HMS Landrail* NMR **UID 904640** *HMS Clarence* NMR **UID 906643** *HMS C11* NMR **UID 907529** *HMS A1* NMR **UID 911782**) (**Appendix I**; **Table 12**). With the exception of *HMS Clarence* (NMR **UID 906643**), each of these vessels were built from the mid 1880s onwards.

5.3.12. The dearth of military screw driven vessels built prior to the mid-1880s is largely consistent with what is known from historical sources. In the 1840s a number of ships of the line were converted to screw propulsion and in 1849 the *Agamemnon* was built, a vessel designed from the outset with screw propulsion.

5.3.13. The *HMS Clarence* (NMR **UID 906643**) provides an example of a military vessel converted to screw propulsion. It was built in 1833 as a First Rate ship of the line and rebuilt in 1860 as a screw ship. However, despite the potentially decisive freedom of movement advantages provided by screw propulsion, there were reservations that it would have an adverse effect on the sailing quality of ships (Watts 1994:16).

5.3.14. The *HMS Clarence* is the only military vessel in the known resource dataset within this period to have been recorded as employing sail as a means of propulsion. Prior to the 1870s, despite its advantages, steam continued to be regarded as auxiliary to sail. It was not until the loss of the *Captain* in 1870 that the fundamental problems of installing both systems in the new generation of warship were fully acknowledged (Watts 1994:38).

5.3.15. The steam turbine first went to sea in *Turbinia* in 1897 and by 1906 was virtually universal in the Royal Navy (Brown 1992:7). There are no examples in the known resource for this period but the *Turbinia* still exists in preservation (**NHSR ID 138**). Examples of early 20th century military vessels equipped with steam turbines are more likely to be represented in the period 1914-1938.

5.3.16. Only one military vessel listed in the known resource was built after 1906 (the *HMS C11* NMR **UID 907529**). This vessel is listed to be screw driven.

5.3.17. Of the 12 military vessels in the known resource only seven records contain information relating to their engine type. Only one was equipped with a compound engine. This was *HMS Clarence*, which was refitted with steam propulsion in 1860. This type of engine was introduced in 1854 and five cargo vessels listed in the known resource are recorded as having been equipped with a compound engine prior to its use in the *Clarence* in 1860. This appears to reflect the initial reluctance of the military to fully embrace steam propulsion and the natural conservatism of the Admiralty during peacetime. It also reflects the pioneering role played by mercantile vessels with regards to naval engineering.

5.3.18. Amongst the mercantile community the potential for profit provided an incentive for technological innovation and progress (Lambert 1992:12). Of the 15 records for military vessels in preservation, four are recorded to have utilised a compound engine (*Demon* NHSR **ID 16***, Janet* NHSR **ID 31***, 199* NHSR **ID 40** and *Osborne* NSBR **ID 1666**).

5.3.19. Similar naval conservatism may be evident in the adoption of triple expansion engines, an improved type of engine introduced in 1880s. A total of 48 cargo vessels are listed in the known resource as having this type of engine from the 1880s, but only two military vessels built in 1891 and 1901 (*HMS Empress of India* NMR **UID 832223** and *HMS Montagu* NMR **UID 1033924** respectively) were so fitted. There are no military vessels in the preserved record which are recorded to have been equipped with triple expansion engines.

5.3.20. The remaining four military vessels which contain information relating to their engine type were equipped with oil or petrol engines, one of which had an electric motor (*HMS Holland N. 5* NMR **UID 1397999**). Each of these vessels was a submersible. No non-military vessels are listed in the known resource as having been equipped with oil or petrol engines during this period. One vessel recorded by the NHSR is documented to have used a petrol and electric engine, the *Holland I* (NHSR **ID 427**).

5.3.21. Additionally, six military vessels are recorded by the NHSR to utilise diesel engines (*Sundowner* NHSR **ID 96***, Fat Old Sun* NHSR **ID 1935***. Hospital Boat No. 67* NHSR **ID 2098***, Condorline* NHSR **ID 2126***, Collie* NHSR **ID 2173** and *Vere* NHSR **ID 415**). Diesel engines were introduced to ship propulsion in the early 20th century and thus the vessels listed by the NHSR which predate 1900 such as the *Collie* are likely to have been subject to a refit in later years. This may also be the case for those vessels built in the early 20th century, as it was not until WWI and the years which followed that the use of the diesel engine became more widespread. A case in point here is the *Condorline* which was refitted in 1983 with a Honda diesel engine.

Armament

5.3.22. A limitation in the source material upon which the known resource is based has been observed with regards to the armaments for vessels lost between 1860 and 1913. The period between 1860 and 1913 is marked by a number of technological innovations in armaments, with the development of the breech-loaded rifled gun, the introduction of turrets and barbettes and the construction of the first torpedo. Despite these advances, contemporary records relating to military vessels of this period often record the bore of a gun rather than its loading mechanism or method of mounting and as such there is little reference to these armament methods in the known resource.

5.3.23. Of the 12 military vessels listed in the known resource, seven contain references to armament. These references consist of a basic description of the type of gun onboard e.g. '3 x 6 pounder guns' or '3 x 15 inch guns'. There is no reference in the source material relating to the method of loading or mounting employed.

5.3.24. Understanding technological advances in armament is fundamental to understanding the design of military boats and ships between 1860 and 1913. Until the late 1850s, naval gunnery was dominated by the smooth-bore, muzzle-loaded cast iron guns (commonly called 'cannons'). The known resource dataset for the period 1860-1913 contains no references to these weapons.

5.3.25. Development of the breech-loading rifled gun began in 1855. The rifled gun imparted a spin to the projectile which offered a much straighter and more accurately defined trajectory (Watts 1994:25). Despite this a number of serious faults in early breech-loading mechanisms resulted in the Royal Navy reverting to muzzle-loading guns. However, breech loading became necessary for the increasing length of gun barrels. The use of steel in gun manufacture and slow burning powder therefore eventually resulted in its reintroduction. By the end of the period breach loading had become universal (Watts 1994:28).

5.3.26. Development of the rifled gun also led to the development of a new shell, which was elongated in shape with a pointed nose and thus could be packed with a heavier weight of explosives. The new form of shell projectile was able to maintain a more constant speed for a greater length of time in flight, giving it greater range and far greater accuracy than the conventional spherical projectile (Watts 1994:25).

5.3.27. The only reference to breech loading guns is in the descriptive text for the *HMS Montagu* (NMR **UID 1033924**). It refers to the salvage of four 12 inch breech guns. Launched in 1901, *HMS Montagu* was built at a time when the increasing length of gun barrels necessitated the use of the breech-loading guns (Watts 1994:28). The *HMS Empress of India* (NMR **UID 832223**) is also expected to have been armed with breech-loaders, on the basis of its identification of a Royal Sovereign Class vessel; a type principally armed with four 13.5in 67 ton breech-loaders (Lyon and Winfield 2004:319).

5.3.28. The lack of information in the source material relating to military vessels of this period arguably enhances the importance of vessels such as the *HMS Warrior* (NHSR **ID 501**), which represents the transition of old and new technology, incorporating both muzzle and breech loading guns.

5.3.29. The Union warship *Monitor* of 1862 pioneered the armoured revolving gun. The turret protected the gun, its crew and the reloading operation from enemy fire and enabling the gun to fire in any direction irrespective of the position or course of the ship (Watts 1994:33). However, doubts existed as to whether mounting turrets in seagoing ships carrying a full sailing rig was practical or safe, largely because the turrets and their guns were so heavy and could easily compromise stability. The loss of the *Captain* in 1870 was seen as confirming these fears.

5.3.30. It was not until the construction of the *Devastation* in 1873 that vessel design allowed the full potential of the turret to be demonstrated. Without masts, sails and rigging, the *Devastation* had a central battery which achieved far better arcs of fire, including full end-on fire from the turrets mounted on the centreline without compromising the stability of the vessel (Watts 1994:41).

5.3.31. The known resource records for 1860-1913 contain one reference to turret mounting. The reference is within the descriptive text for the *Grosser Kurfurst* (NMR **UID 901765**, **901781**), which refers part of a gun turret bearing block being raised from the wreck. At least one additional military vessel, the *HMS Montagu* (NMR **UID 1397999**) is recorded as having been equipped with large calibre guns in turrets.

5.3.32. The perceived threat posed by France saw the development of the barbette, in which a gun was trained on a turntable inside an armoured but unroofed breastwork (Watts 1994:44). At the time that they were developed, barbettes could be advantageously mounted higher above the waterline than a turret because they were lighter (Watts 1994:44). The known resource records contain no reference to the barbette for military vessels lost between 1860 and 1913. However, the principal armament of Royal Sovereign Class battleships was four breech-loaders mounted in twin barbettes fore and aft. The Royal Sovereign Class *HMS Empress of India* (NMR **UID 832223**) was therefore equipped with barbettes (Lyon and Winfield 2004:319).

5.3.33. Of the 12 military vessels listed in the known resource, seven contain references to torpedo tubes. These vessels date between 1886 and 1904. Although Robert Whitehead built the first torpedo in 1866, it was not until 1871 that the Admiralty bought the manufacturing rights to the torpedo (Watts 1994:54). Most major warships were soon fitted with launching equipment. With the exception of the *HMS Clarence*, which was built prior to the introduction of the torpedo, it is therefore likely that the lack of reference to torpedoes on the five remaining vessels is due to lack of information available in the contemporary source material rather than the absence of torpedoes onboard.

Hull Construction and Armour

5.3.34. Although there were significant advances in hull construction in the 19th century, with the introduction of iron and later steel in shipbuilding practices, these were initially dominated by the commercial sector. The earliest vessel listed in the known resource to have iron as an object material was the *Ida* (NMR **UID 906913**), a cargo vessel built in 1849. By the early 1840s, a number of commercial yards had developed the facilities needed to build in iron (Lambert 1992a:48).

5.3.35. The only military vessel listing iron as an object material is the *Grosser Kurfurst* (NMR **UID 901765**, **901781**). While its date of build is not recorded in the known resource, it must have been built no later than 1878 which is the year in which it was lost. In comparison 65 cargo vessels are recorded as being built of iron prior to 1878. Iron did not displace wood as the primary construction material until the late 1860s and 1870s, at which point its use in ship construction was dominated by the commercial sector (Ville 1993:52). The NHSR lists two iron-hulled military vessels for the period 1860-1913; the *HMS Warrior* (NHSR **ID 501**) and the *Demon* (NHSR **ID 16**).

5.3.36. This low representation of iron-built warships is more likely to be due to the limited use of military vessels in this period characterised by a lack of large scale naval warfare, where fewer circumstances were present in which the loss of military vessels would be expected.

5.3.37. The late 19th century is marked by the development of the armoured 'ironclad'. After the introduction of the shell projectile in 1827 it became necessary to armour warships in order to provide an effective form of defence against this type of projectile. In particular, the use of the shell in the Crimean War had a profound effect on warship design by proving that wooden sailing ships were no

longer viable, which in turn led to the development of wrought iron plating (Watts 1994:19). This led to the construction of vessels of composite construction with a wooden hull protected by an iron belt, and ultimately to the construction of iron hulled and then steel hulled vessels.

5.3.38. Although not the first ironclad, the launch of the famous iron hulled and armoured *Warrior* (NHSR **ID 501**) in 1860 signified the entry of the Royal Navy into the 19th century arms race. At the time, the *Warrior* was widely regarded as having rendered all previous designs obsolete. Following the completion of the *Warrior,* a number of smaller vessels were developed using the concept of the *Warrior* as a basis for their design (Watts 1994:31). This led to the development of the central protected battery. While new ironclads were under construction, efforts were made to build up the effective strength of the Royal Navy by converting wooden ships of the line into ironclads (Watts 1994:32).

5.3.39. There is better representation of steel constructed military vessels in the known resource dataset. Steel was introduced into the Royal Navy with the vessels *Iris* and *Mercury* in 1875. Of the 12 military vessels listed in the known resource, eight are listed as being steel in construction. A further two records list metal as their object and as they are post 1900 in date it is likely that these too are steel. The earliest of the steel-built military vessels in the known resource for 1860-1913, the *HMS Landrail* (NMR **UID 904640**), was built in 1886. This date corresponds approximately with the superseding of iron by steel following the development of the Siemens processes in the mid 1880s (Greenhill 1993:89; Ville 1993:52).

5.3.40. The greater quantity of steel military vessels in comparison to those constructed from iron may be due to the increasing perceived threat from Europe and the subsequent spur to the development of the Royal Navy. Little was done to increase the navy's material strength during the early 1880s, and the naval fleet continued to comprise a motley collection of hybrid vessels, very few of which could operate together as a homogenous squadron (Watts 1994:48).

5.3.41. However, in 1884, a series of articles entitled 'The Truth about the Navy' were published in the Liberal newspaper the *Pall Mall Gazette*. This aroused the concerns of the public and urged the government to reform the navy. This led to the 1884 "Northbrook Programme" and the 1889 Naval Defence Act.

5.3.42. Between 1900 and 1914, the Royal Navy underwent another rapid change which effectively resulted in the total replacement of the frontline ships of the fleet with vessels that were larger, more powerful, and more capable to the conditions of naval war (Roberts 1997:7). The reformation of the Royal Navy from the mid 1880s to the end of the period in question may explain the greater representation of military vessels in the known resource for this period, with nine of the twelve vessels built between 1886 and 1907.

5.3.43. Conversely, the records for vessels in preservation list only a single record of a steel-hulled military vessel, the submersible *Holland I* (NHSR **ID 427**). With the exception of the *HMS Warrior,* the remaining vessels are of wooden construction, with date of builds ranging from 1878 to 1912 (**Table 28**). These results suggest the increasing use of wood as a building material amongst small and auxiliary warships as late as 1912.

Submersibles

5.3.44. The known resource lists five submersibles for the period between 1860 and 1913, namely *HMS B2* (NMR **UID 901840**), *HMS A3* (NMR **UID 904626**), *HMS C11* (NMR **UID 907529**), *HMS A1* (NMR **UID 911782**) and *HMS Holland No. 5* (NMR **UID 1397999**). Four of these records contain information relating to date

of build, which range between 1902 and 1907. A further submarine, the *HMS Holland I* (NHSR **ID 427**) is listed by the NHSR, built in 1901.

5.3.45. Comprising five out of 12 military vessels listed between 1860 and 1913, the known resource provides a relatively good representation of submersibles for this period. Indeed they are represented out of all proportion to their relative numbers or importance. This is perhaps not surprising as early submarines were both experimental and dangerous.

5.3.46. The rapid change which took place in the Royal Navy between 1900 and 1914 and which saw the development of the dreadnought, also resulted in the construction or purchase of a significant number of submersibles. By the outbreak of WWI the Royal Navy had more submersibles than any other navy (Brown 1999:86).

5.3.47. In 1900, the Admiralty agreed that the firm of Vickers Son and Maxim Ltd would be asked to build submersibles for the Royal Navy and an order of five *Holland*-type boats was placed. Regarded as experimental boats, the *Hollands* were used for evaluation, training and instructional purposes. The construction of these vessels was followed by that of the *'A'* class submarines. These were the first submersibles designed and built for the Royal Navy, four of which were ordered in 1902 and a further nine in 1903 (Watts 1994:70).

5.3.48. Thereafter, development of the submarine proceeded rapidly. In service, the '*A'* class submarines were seen as only slight improvements on the *Hollands*, but the '*B'* class and '*C'* class submarines which followed were thought to be fully capable warships (Brown 1999:80). Further technological advances led to the construction of the '*D*' class and '*E*' class submarines capable of overseas patrols (Brown 1999:82).

Use

5.3.49. The military vessels listed by in the known resource for the period 1860-1913 represent 11 distinct vessel types. These vessel types are listed below in alphabetical order, alongside their description as defined by the NMR Maritime Craft Type Thesaurus.

- **Admiralty Vessel**: Any vessel which has been hired or impressed for use by the Admiralty;
- **Battleship**: A capital warship, often steam driven, heavily armoured with armament of large calibre guns deployed in turrets;
- **Destroyer**: A very fast, small warship. Armed with small calibre guns and torpedoes. Used for attacking enemy vessels, escort duties and anti-submarine duties;
- **Hulk**: An old ship converted for a variety of uses for which it is not required to move under its own power;
- **Motor Torpedo Boat**: A small warship powered by petrol or diesel engines and armed with torpedo tubes and small guns. Used for coastal anti-shipping patrols and warfare in coastal waters;
- **Submarine**: A vessel designed to operate below the surface of the sea;
- **Target Craft**: An obsolete vessel used as a weapons target;
- **Torpedo Boat Destroyer**: A small fast warship developed in the late 19th century. Armed principally with quick firing guns to destroy enemy torpedo boats;

- **Training Ship**: Vessels of various types used specifically for providing an initial training in seamanship;
- **Warship**: A ship that is built and primarily intended for war.

5.3.50. In incorporating both broad and narrow terms relating to the type of a particular vessel, in most cases an individual record is attributed in excess of a single vessel type. While each term recorded in the known resource is important in documenting the life cycle of these vessels, there are a number of craft types which can be disregarded for the purposes of this discussion.

5.3.51. With regards to the vessel types listed above, three provide generic terms relating to military vessels, consisting of Admiralty Vessel, Hulk and Warship. These vessel types are marked with a single asterisk in **Table 12**. A further two terms relate to the later use of the vessel rather than the initial function for which it was constructed, comprising the Training Ship and Target Craft. These vessel types are marked with double asterisks in **Table 12**. If these vessel types are omitted, each record is assigned with no more than a single assigned vessel type, as illustrated by the bold text in **Table 12**. The remaining vessel types listed provide the foundation upon which a discussion of the use of military vessels of 1860-1913 will be based.

5.3.52. Of the 12 military vessels listed in the known resource for the period between 1860 and 1913, three are listed as battleships (*HMS Empress of India* NMR **UID 832223**, *Grosser Kurfurst* NMR **UID 901765**, **901781** and *HMS Montagu* NMR **UID 1033924**). The development of the battleship is a significant factor in considering military vessels in the period between 1860 and 1913. The term battleship came into formal use in the late 19th century with the introduction of the ironclad warship. However, despite the launch of *HMS Warrior* in 1860 as the first British sea-going ironclad made wholly out of iron, the superiority of sea-going ironclads remained undemonstrated in the years which followed. As late as 1871, the Controller of the Navy Captain Robert Hall envisioned a continuing role for the wooden battle fleet (Beeler 2004:30).

5.3.53. Only two of the battleships listed in the known resource for this period contain information relating to their date of build, both of which are British, comprising the *HMS Empress of India* (NMR **UID 832223**) and the *HMS Montagu* (NMR **UID 1033924**), built in 1891 and 1901 respectively. The *Empress of India* represents a Royal Sovereign class battleship, seven of which were built during the building programme which followed the Naval Defence Act of 1889 (Brown 1997:125). The *HMS Montagu* is described as a Duncan class battleship, a type built between 1901 and 1906 in response to the perceived threat of French and Russian building programmes. Both the Royal Sovereign and Duncan Class battleships were built as part of the building programme which followed the Act, with the ultimate aim of raising the size of the British battle fleet to a number greater than that possessed by the French.

5.3.54. Each of these vessels was constructed prior to the *HMS Dreadnought* in 1906 which heralded a revolution in battleship design. They thus represent a particular type of battleship collectively referred to as pre-Dreadnought battleships, comprising the only such examples listed in the known resource for the period 1860-1913.

5.3.55. From the introduction of the torpedo in 1866 there emerged two lines of development: the torpedo boat and the torpedo boat destroyer. The Royal Navy's first torpedo boat was the *Vesuvius* constructed in 1874. At this time the emphasis was on torpedo attack rather than the need to protect Britain's maritime strength and battle fleet against torpedo attack.

5.3.56. By the mid-1880s the growth of the French torpedo flotilla and the possibility of war with Russia saw necessary the construction of both specialised seagoing torpedo craft and fast light torpedo launches for inshore and coastal work (Lyon 2001:13). These two lines of development culminated in the design of the torpedo boat destroyer (TBD).

5.3.57. The building programme which followed the Naval Defence Act of 1889, alongside the steady developments of marine engineering, saw the construction of the Royal Navy's first TBDs in the early 1890s. The first four TBDs were ordered in 1892, followed by another pair in 1893 (Lyon and Winfield 2004:319). Between 1893-1894 36 more TBDs were built, followed by a further 72 in the 1900s, demonstrating their increasing role in naval duties (Lyon and Winfield 2004:319).

5.3.58. There is one motor torpedo boat listed in the known resource for this period, *HMS Landrail* (NMR **UID 904640**) built in 1886. The known resource also lists one torpedo boat destroyer (*HMS Decoy* NMR **UID 859019**) and one destroyer (*HMS Blackwater* NMR **UID 901743**), built in 1894 and 1903 respectively.

5.3.59. As noted above, five submarines are listed in the known resource, comprising the *HMS B2* (NMR **UID 901840**), the *HMS A3* (NMR **UID 904626**), the *HMS C11* (NMR **UID 907529**), the *HMS A1* (NMR **UID 911782**) and the *HMS Holland No. 5* (NMR **UID 1397999**). These are considered in **Section 5.3** 'Build'.

5.3.60. The discussion above is based on an assessment of the use of military vessels based on their initial intended function. However, in many cases vessels from this period were later re-used to fulfil other functions. The *HMS Clarence* (NMR **UID 906643**) provides an example of one such vessel. The *HMS Clarence* was built in 1833 as the *Royal William,* a 120-gun First Rate Man o'War. However, the vessel undocked in February 1860 as a screw ship of 72 guns. In 1885 the vessel was renamed the *HMS Clarence* and converted to a training vessel until its loss in 1899. The use of the *HMS Clarence* is thus multi-dimensional during its 66 years of service under the Admiralty. It's conversion to a screw-driven vessel equipped with a compound engine signifies the military's recognition of the advantages offered by the use of steam in the 1860s and is thus resonant of the period 1860-1913 which is characterised by technological innovation and trial and error with regards to marine engineering.

5.3.61. Four further vessels listed in the known resource for the period 1860-1913 were re-used as target craft, comprising the *HMS Empress of India* (NMR **UID 832223**), the *HMS A3* (NMR **UID 904626**), the *HMS Landrail* (NMR **UID 904640**) and the *HMS A1* (NMR **UID 911782**). During the period between 1860 and 1913, vessels were being constructed at such a rate that by their completion, they were quickly rendered obsolete by changing technology and tactical considerations. Shipbuilding programmes in the late 19th century thus sought to replace and re-fit the existing collection or over-age ships; a significant factor in considering the use of military vessels for the period 1860-1913.

Loss

5.3.62. Of the 12 military vessels listed by the known resource for the period between 1860 and 1913, none were lost as the result of enemy action. Two of the vessels, the *HMS Empress of India* (NMR **UID 832223**) and the *HMS A3* (NMR **UID 904626**) list 'Gun Action' as a cause of loss. However, these vessels were each being used as target craft at their time of loss. A further vessel, the *HMS A1* (NMR **UID 911782**) lists 'Explosion' as a cause of loss. However, this explosion occurred due to a build-up of gases on the vessel and was not the result of enemy action.

5.3.63. The cause of loss as listed in the known resource for the 12 military vessels is consistent with historical sources, which state that the period between 1860 and 1913 was recognised as a period with a shortage of significant battles, where the only real actions during this period were minor skirmishes in the Far East and on the continent of Africa where British interests came into conflict with other European powers (Watts 1994:46). Vessels lost as a result of such skirmishes would not have taken place in British territorial waters and thus their remains would not be listed by the NMR for this period.

Summary

5.3.64. The factors from which the special interest of military vessels from this period can be gauged are multi-faceted. Each of the 12 military vessels listed for the period 1860-1913 may be of special interest on the basis of their rarity in the archaeological record. This perspective arguably gives rise to the importance of military vessels for this period which are currently in preservation, such as the *HMS Warrior* (NHSR **ID 501**) at Portsmouth Historic Dockyards and the 1878 *HMS Gannet* (NHSR **ID 505**) at the Chatham Historic Dockyard, two of the total 13 military vessels listed by the NHSR for the period 1860-1913. It is notable that most of the vessels listed by the NHSR and NSBR are small and are auxiliary vessels rather than front line warships (**Table 28**).

5.3.65. Additionally, the array of military vessel types serves to represent this revolutionary period for the Royal Navy, whereby special interest is drawn from the ability of each vessel collectively to reflect the diversity of military boats and ships operating in English territorial waters in the period 1860-1913. In this manner, the military vessels may be assigned special interest on the basis of their grouping and diversity.

5.3.66. The military vessels may also be considered of special interest on the basis of their representation. For example, the *HMS Empress of India* and the *HMS Montagu* may attain special interest through their representation of a type of pre-Dreadnought battleship; a type characteristic and unique to the period in question. Built after the 1889 Naval Defence Act building programme which sought to raise the number of the battle fleet above that possessed by the French, they thus represent attempts to sustain British naval dominance in this period.

5.3.67. Similarly, the five submarines (*HMS B2, HMS A3, HMS C11, HMS A1* and *HMS Holland No. 5*) may be regarded of special interest through their representation of the earliest forms of submarine, the development of which is a key theme in a consideration of the period 1860-1913.

5.3.68. The advances in naval engineering and weaponry in this period which ultimately led to the construction of torpedo boats and the subsequent torpedo boat destroyers are developments which are essential in understanding the changes in naval engineering and warfare which took place during this period. Consequently, wrecks which represent these vessel types, such as the *HMS Decoy,* the *HMS Landrail* and the *HMS Blackwater,* may also be regarded of special interest on the basis of their representation in this manner.

5.3.69. Alternatively, the *HMS Clarence* may attain special interest on the basis of its representation of the re-fitting and re-build of vessels which took place in numerous occasions during this period to meet the demands of the radical changes in naval engineering. The re-fitting of vessels in this manner may account for the low number of military vessels listed in the known resource for this period. With no major naval warfare during this period, few military vessels were lost by hostile activity and vessels which did not suffer any alternative

manner of loss are likely to have been continually re-fitted with new technologies.

5.3.70. Some military vessels may also be regarded of special interest on the basis of their association. For example, the five submarines may attain special interest on basis of their association with the firm Vickers Son and Maxim Ltd which built the first British submarines for the Royal Navy.

5.4. FISHING

5.4.1. Of the 518 records listed in the known resource to have been lost between 1860 and 1913, only seven have been assigned as fishing vessels with regards to their vessel type. A further eight vessels are listed to be trawlers. The known resource also lists a single smack (NMR **UID 906680**); a vessel type defined in the NMR Maritime Craft Type Thesaurus as a small fishing craft, cutter of ketch rigged. Two vessels listed within the known resource are assigned as both fishing vessels and trawlers. Taking into consideration this duplication, there is thus a total of 14 vessels listed in the known resource which functioned as fishing vessels (**Appendix I, Table 13** and **Figure 12**).

5.4.2. With only 14 known wrecks, the known resource provides a poor representation of fishing vessels operating in the period between 1860 and 1913. Historical sources suggest a much greater volume of fishing activities than that represented by the known resource, whereby in 1913, the British fishing industry as a whole launched more than 800,000 tons of fish, caught by a fleet of nearly 9,500 boats (Wilcox 2009:78). Conversely the NHSR and the NSBR provide a good representation of fishing vessels for the period 1860-1913, comprising 76 and 70 vessels respectively.

5.4.3. There are a number of factors which contribute towards the low representation of fishing vessels in the known resource for the period 1860-1913. By the end of the period in question, most steam trawlers were still relatively small in size (250-500 tons) and are as such, not easily identifiable in hydrographic and geophysical surveys. The advent of steam further enabled fishing vessels to venture further afield, and those which were lost may have been wrecked beyond English territorial waters. Further factors contributing towards the low representation of fishing vessels in the known resource relate to recording biases and the often inaccurate nature of those records that do exist. A fishing vessel would have been predominantly perceived to operate as part of working-class activities, and is thus likely not to have been considered in the same regards as larger vessels such as cargo or military vessels, resulting in the presence of fewer records relating to known wrecks of this period. Additionally, many fishermen in this period navigated by instinct and thus the position of loss recorded by survivors, where present, may not have translated into a meaningful position fix to enable the remains to be located. The records of such losses would thus comprise part of the potential resource.

Build

Propulsion

5.4.4. Of the 14 fishing vessels listed in the known resource, eight are listed to be steam propelled. A further vessel, the *Queen* (NMR **UID 906892**) lists both sail and steam as a means of propulsion. This is due to two conflicting sources relating to the vessel, one of which describes it as a wooden sailing ketch, and the other as a steel steam craft. The *Queen,* built in 1876, was both entering and clearing Liverpool on her final voyage and may have been operating inshore. Prior to 1880, steam propelled fishing vessels were largely limited to converted paddle steamers working inshore from 1877. It is possible that the *Queen* (NMR **UID 906892**) provides an example of one such vessel which was

converted to steam in the late 1870s, thus providing an explanation for the conflicting sources. A further vessel, the *Gwydir* (NMR **UID 906680**) was a sailing vessel built in 1859, a time in which the British tonnage of sailing vessels exceeded that of steam. The remaining vessels listed in the known resource do not contain information relating to their method of propulsion.

5.4.5. Only three of the steam propelled vessels list their date of build; the *Dayrian* (NMR **UID 913083**), the *Retriever* (NMR **UID 913089**) and the *Magdeleine* (NMR **UID 859021**), which were built in 1906, 1891 and 1899 respectively. The period 1885-1900 saw a drive towards mechanisation in the fishing fleet and the replacement of sailing trawlers with steam-driven ones (Friel 2003: 221) and it is possible that these vessels represent purpose built steam trawlers.

5.4.6. The *Dayrian* (NMR **UID 913083**) and the *Retriever* (NMR **UID 913089**) are listed to have been registered, clearing and entering from Grimsby and Kingston-upon-Hull respectively. The *Magdeleine* (NMR **UID 859021**) is listed as a French fishing vessel operating across the North Sea which was lost whilst *en route* from the Isle of Scilly to France. The North Sea was home to a high concentration of fishing activity in the late 19th century. The great North Sea fishing industry was in full swing by 1880, and by 1890 there were some 20,000 men working on the North Sea (Simper 1982:184).

5.4.7. However, the success of purpose built steam trawlers resulted in the opening up of fishing grounds away from the North Sea. Icelandic grounds were trawled from 1891 and thereafter the Bay of Biscay and the Barents Sea were explored (Wilcox 2009:77). The introduction of steam trawlers with greater range led to a focus on more distant ground (Simper 1982:221). Evidence for steam propelled fishing vessels enduring long-distance journeys is provided by the *Maxwell* (NMR **UID 911968**) which sank whilst *en route* from San Francisco to Kingston-upon-Hull.

Hull Construction

5.4.8. Of the 13 fishing vessels listed in the known resource for the period between 1860 and 1913, six provide information relating to their object material. Of these six records, three list wood as their object material (*Crux* NMR **UID 907874**, *Retriever* NMR **UID 913089** and *Gwydir* NMR **UID 906680**), one lists steel (*Dayrian* NMR **UID 913083**), one lists both wood and steel (*Queen* NMR **UID 906892**) and the remaining vessel is listed to be iron in construction (*Magdeleine* NMR **UID 859021**)

5.4.9. With limited information relating to the date of build of the fishing vessels in the known resource, it is difficult to assess the affect of the changes in hull construction upon the vessels operating as part of the fishing industry. Trawling underwent a variety of technological change in the 19th century. Trawlers got larger in size and were thus able to use larger nets, making them more efficient (Friel 2003:221). What the record of known wrecks from this period does suggest is that as late as the 1890s, wooden trawlers were still being built as demonstrated by the *Retriever* (NMR **UID 913089**). Despite this, advances in metallurgical processes certainly played an effect on trawler construction in the late 19th century, as evidenced by the use of iron and later steel in the construction of the *Magdeleine* (NMR **UID 859021**) and the *Dayrain* (NMR **UID 913083**) respectively.

Use

Trawl and Line Fisheries

5.4.10. The practice of 'fleeting' was pioneered by the firm Hewett & Co. of Barking, whereby trawlers were sent to sea in fleets for up to eight weeks where they were serviced daily with a fast cutter that took out supplies and brought the fish

to market (Wilcox 2009:70). Hewett and Co. are also credited with pioneering the use of ice to keep the fish cool at sea. Between them, ice and fleeting ensured a more regular supply of fish to market, which arrived in better condition and fetched higher prices (Wilcox 2009:70). The introduction of the railway further enhanced the fishing industry, by providing a mode of transport which enabled fresh fish to be transported to towns and cities inland (Wilcox 2009:70). Between 1840 and 1880, the trawl and line fisheries around the UK grew at an unprecedented rate (Wilcox 2009:73).

5.4.11. Through an assessment of the known resource records alone, it is not possible to ascertain which of the fishing vessels operated as part of the trawl and line fisheries. However, of the eight fishing vessels listed, four contain information relating to their place of Registration (*Queen* NMR **UID 906892**, *Dayrain* NMR **UID 913083**, *Retriever* NMR **UID 913089** and *Magdeleine* NMR **UID 859021**). These vessels were registered to Liverpool, Grimsby, Kingston-upon-Hull and Boulogne respectively.

5.4.12. The vessels registered or operating out of Kingston-upon-Hull and Grimsby may have been operating as part of the trawl and line fisheries. In 1857, the Manchester, Sheffield and Lincolnshire Railway (MS&LR) built the first dedicated fish dock at Grimsby, which developed from a small isolated town into the largest whitefish port in the country by the 1890s (Wilcox 2009:71). This development was influenced by the opening of the new trawling grounds around Dogger Bank, which further stimulated the fishing industry in the Humber ports. This boom is demonstrated by the growth of trawlers which had increased from less than 50 on the Humber in the mid 1840s to over 1000 between Grimsby and Humber by the mid 1880s (Wilcox 2009:73).

Herring and Inshore Fisheries

5.4.13. Inshore fishery is largely confined to fishermen who go out for a day or night from their own boat of limited dimensions and without steam power, fishing within sight of land. As larger fishing vessels ventured further afield for expanding markets, smaller coastal communities continued to fish in inshore tidal waters using traditional open boats. Inshore fishery is often seasonal, and is often produced for a very local market. The introduction of the railway enabled fish to be sent to market further afield and as such the period between 1850 and 1913 was a relatively prosperous time for inshore fisheries. There are no known wrecks dating to the period 1860-1913 which can be conclusively associated with the inshore fisheries during this period. Inshore and local fishing industries are less visible in the archaeological record due to their ephemeral nature.

5.4.14. The size of shoals in the late 19th century encouraged the rapid expansion of the British herring fishery. Until the end of the 19th century, herring fishery relied on sailing boats, whereby drifters were relatively small and mainly open-decked. In the late 19th century, drifters became much larger and were more seaworthy, enabling them to operate further offshore. Steam propulsion was first used by drifters in 1897, and by enabling fishermen to catch more fish and reach fishing grounds at a faster rate than sailing vessels which were affected by adverse weather conditions, they rapidly replaced sailing drifters in major fishing ports. By the end of the 19th century, drifters were fishing up to 50 miles out from the coast.

5.4.15. The period 1860-1913 is regarded as one of prosperity with regards to herring fishery which reached its peak in 1913. During the autumn season of 1913, 1,776 drifters were working from Lowestoft and Great Yarmouth alone (Wilcox 2009). Despite this prosperity, there are no drifters represented in the known resource for the period between 1860 and 1913.

Summary

5.4.16. The discrepancy between the national stock and the potential resource as suggested by historical sources in relation to the fishing industry is impressive. The number of fishing boats active within and passing through British territorial waters is likely to have been huge in the period 1860-1913, with advances in naval engineering stimulating the fishing industry, enabling more distant grounds to be accessed. The 14 fishing vessels within the known resource are not representative of this volume of activity.

5.4.17. The low representation of fishing vessels in the known resource may be accounted for by the absence of purpose-built trawlers prior to the 1880s. This may be supported by the *Gwydir* (NMR **UID 906680**), which is neither detailed as a trawler nor a fishing vessel, but is by definition of the basis of the vessel type 'smack' likely to have been involved with fishing activities. It is possible that a great deal more records listed in the known resource were involved with the fishing industry although due to paucity of information in source material relating to a wreck site, if available, its use as such may not be immediately apparent on the basis of their vessel type alone. This is particularly relevant for those wrecks assigned the vessel type 'craft' which encompasses all vessels.

5.4.18. In direct contrast to the known wreck resource, fishing vessels of this period are well represented in terms of numbers in the preserved record, with a total of 146 vessels recorded by the NHSR and NSBR. However, there are some key gaps and steam driven trawlers in particular are poorly represented, possibly because older trawlers are unlikely to have survived without being converted from steam to internal combustion engines in the 20th century.

5.4.19. While it could be argued that special interest be granted for fishing vessels on basis of their rarity in the national stock for the period 1860-1913 or the presence of original steam equipment, due the abundance of fishing vessels in the preserved record it is likely in the majority of cases that such vessels would need to be regarded as of special interest on the basis of additional factors. For example, if a wreck can be confirmed to have operated as part of the trawl and line, herring or inshore fisheries they would be regarded of particular special interest on basis of their representation, as there are currently no references to these industries, which played a key role in the late 19th and early 20th centuries, in the known resource records. Further special interest may be ascertained from the association of a given wreck with an area or region that prospered due to the fishing industry during this period, such as Grimsby.

5.5. OTHER THEMES

5.5.1. There are so few records relating to the following themes listed in the known resource for the period 1860-1913 that little can be said of any statistical validity on the basis of the queries conducted. As such, this section will present an overall discussion for each theme and the wrecks which relate to it (where applicable) and will not be considered according to the format outlined in **Sections 5.2**-**5.4**, under the sub-headings of build, use and loss.

Industrial

5.5.2. Industrial vessels include those which are adapted to specific maritime industries and tasks, including dredgers, hoppers and sheer hulks (Wessex Archaeology 2008:17).

5.5.3. The known resource lists two vessels with the vessel type 'Hopper Dredger' or 'Dredger' in the period between 1860 and 1913 (*RTC No. 9* NMR **UID 805671** and *Hopper No. 6* NMR **UID 906673**) (**Figure 12**). A Hopper Dredger is defined in the NMR Maritime Craft Type Thesaurus as a dredger which can act

as its own hopper and can thus transport the mud it picks up to dump it at the desired place.

5.5.4. The *RTC No. 9* (NMR **UID 805671**) was a steel screw driven steam propelled dredger built in 1863 which was lost whilst returning to Southampton having been to sea to dump dredged spoil. The specific dredging activities carried out by the *RTC No. 9* are unknown. The *Hopper No. 6* was an iron screw driven steam propelled dredger built in 1865 which was lost near the entrance to Brunswick Dock. The vessel is listed as both clearing and entering Liverpool and thus may have been involved in dredging the harbour rather than fulfilling dredging as part of maritime industrial work. Dredgers were frequently used by large harbours such as Liverpool to work in areas of the docks where there was no current and silt could build up (Waine 2003:112). A further dredger, the *No. 1 Dredger* (NHSR **ID 2100**) is also listed by the NHSR although this vessel is detailed as having carried out maintenance on the Birmingham Canal and is unlikely to have undertaken industrial work.

5.5.5. Whaling forms a further aspect of maritime industry that may be considered with regards to industrial vessels. The period 1860-1913 encompasses the dawn of the modern whaling industry. In the late 19th century, whaling was dominated by the catching of rorquals, an exceedingly powerful and fast whale which would sink having been killed (Tønnessen and Johnsen 1982:6). The capture of this type of whale necessitated a new method of whaling, which utilised steam-driven whale catchers with a harpoon gun mounted on the bow, the development of which began in the 1860s. The modern whaling industry was almost exclusively based on the extraction of oil, the demand for which had increased in the 19th century, which was used for a number of purposes including lighting, lubrication and the production of margarine (Tønnessen and Johnsen 1982:7). At the turn of the 20th century, whaling was dominated by Antarctic whaling, an industry in which Britain alongside Norway exercised a near-monopoly into the mid-20th century (Tønnessen and Johnsen 1982:9). Whaling took place at a distance from Britain and therefore whaling ships were only present in territorial waters for the purposes of clearing and entering home ports such as Hull.

5.5.6. Of the 518 records listed by the known resource, there are no whalers. The NSBR lists two boats which may be associated with the whaling industry in the period between 1860 and 1913. One such boat is the *James Caird* (NSBR **ID 478**); a whaler built in 1912 for use on the Endurance expedition. The other vessel listed by the NSBR to be associated with the whaling industry is the *Selina* (NSBR **ID 891**), a whaleboat built in 1905. While the *Selina* may have operated as part of the whaling industry, the term whaleboat is the name given to an open rowing boat and were often utilised to perform a variety of coastal work.

Law and Government

5.5.7. Amongst non-military craft associated with law and government are vessels operated to enforce customs and revenue (Wessex Archaeology 2008:17). Examples include a Revenue Cutter, a single masted cutter built specifically for the prevention of smuggling and the enforcement of customs regulations, or Customs Boats, comprising small vessels used as transport for customs officers. The known resource contains no information to suggest that a specialised customs and revenue vessel exists in the known archaeological record for the period 1860-1913.

5.5.8. The NSBR lists one vessel described as a Customs Gig, the *Klondike* (NSBR **ID 429**) for the period 1860-1913. The *Klondike* was built in 1877 for the Customs Officers based at St Marys, Isles of Scilly as No. 37, but was sold in

1897, renamed *Klondike* and operated for lighthouse relief and pilot work. The NHSR lists a further vessel relating to law and government – a Customs Cruiser called the *HMCC Vigilant* which was built in 1901 (NHSR **ID 500**).

5.5.9. In the early 19th century, the Customs and Excise services operated a varying number of preventative cruisers, usually in the form of 'cutters' (Lyon and Winfield 2004:339). From 1824, a mixed collection of naval and revenue vessels were transferred to the Coastguard, which was formed in 1822 under the control of the Customs Board and became exclusively naval from 1831 (Lyon and Winfield 2004:339). The naval vessels involved comprised an assortment of vessels, ranging from elderly brigs to surplus Crimean War mortar vessels. By the 1850s, steam launches had begun to replace the cutter rigged sailing-craft (Lyon and Winfield 2004:339).

Health and Welfare

5.5.10. Vessels which might fall under the category of health and welfare include hospital boats, quarantine hulks, floating chapels and missions (Wessex Archaeology 2008:17).

5.5.11. The period 1860-1913 encompasses the establishment of the Port Sanitary Authorities, which were introduced in 1872 as a means of port prophylaxis (Maglen 2002:413). Quarantine continued to play a central role in the day-to-day operation of British ports, whereby dual authority was maintained by the Quarantine Service and the Port Sanitary Authorities until 1896 (Maglen 2002:413).

5.5.12. Based on the information provided in the known resource, there are no vessels listed for the period between 1860 and 1913 which are specialised to provide a function relating to health and welfare. However, it would be expected that the large proportion of hospital boats would have been lost in hostile circumstances and would thus be represented in the following period 1914-1938. The NHSR lists one record assigned as a Hospital Boat for the period 1860-1913, *Hospital Boat No. 67* (NHSR **ID 2098**) which was built in 1912.

Commercial

5.5.13. Examples of commercial vessels used for face-to-face selling might be limited to small boats selling victuals and stores within ports, lighters and fuel barges (Wessex Archaeology 2008:17). No victualling vessels are listed in the known resource, the NHSR and the NSBR for the period between 1860 and 1913. There is one lighter in the known resource for this period, the *Devonshire* (NMR **UID 919222**), which may be considered in this category. The *Devonshire* was wrecked whilst on a regular run to replenish naval depots at Pembroke Dock and Cork. There are also three lighters in the NHSR register (*Herons* NHSR **ID 1852,** *Elswick II* NHSR **ID 445** and *River Thames Visitor Centre* NHSR **ID 2109**). No literature and historical sources relating to this theme were found throughout the project to supplement an understanding of any vessels which may be considered as commercial in the period 1860-1913.

Agricultural and Subsistence

5.5.14. Craft involved in agriculture and subsistence are largely addressed in **Section 5.2** which considers the transport of cargo. This section focuses on vessels which may have been specifically adapted to cultivation, hunting or gathering.

5.5.15. One such example of a vessel adapted to meet agricultural and subsistence needs is the duck punt – a low, narrow double ended punt which was rowed or sailed in pursuit of wildfowl (Greenhill 1997:80). The duck punt developed from the concept of the gun punt introduced in *c.*1820, a punt on which a gun was mounted at the bow with the gunner laying behind the gun and using hand paddles to move quietly to a flock of wildfowl (Greenhill 1997:80). In the late

19th century, duck punts were open but by 1920 were predominantly decked (Greenhill 1997:80).

5.5.16. The NSBR lists one gun punt dating between 1860 and 1913 (NSBR **ID 689**). The name of the vessel is unknown. The vessel was a two-man gun punt built *c.*1900 and was used to shoot ducks on the mud flats of Foryd Bay, Caernarfonshire.

5.5.17. A boat adapted for specific needs relating to agriculture and subsistence may also include a ferry used to transport animals. One example of such a craft is the Irish curraghs; a type of lightly built open boat used for a variety of purposes, including the towing of heavy livestock, the conveyance of smaller animals to grazing grounds on offshore islands and the transport of turf (Greenhill 1997:222). While providing an example of a vessel type associated with agriculture and subsistence, it must be noted that these vessels operated within Irish waterways and would not expected to be discovered in English territorial waters.

5.5.18. No vessels associated with agriculture and subsistence are listed in the known resource for the period 1860-1913, other than cargo vessels carrying agricultural produce which are considered in **Section 5.2**.

Domestic

5.5.19. There is a wide range of craft adapted for domestic use in the form of houseboats (Wessex Archaeology 2008:17). Houseboats in the United Kingdom predominantly comprise canal narrow boats, which in the period between 1860 and 1913 were largely used for the bulk transport of raw materials. While it is possible that a number of narrow boats were adapted for domestic needs, such vessels are expected to be quite rare.

5.5.20. There is no vessel listed in the known resource that can be conclusively identified as a vessel fulfilling a domestic function. The NHSR lists two vessels which have been assigned the vessel type 'Houseboat', the *Astoria* (NHSR **ID 1863**) which was built in 1911 and the *Riverdream* (NHSR **ID 1864**) which was built in 1896. The NSBR lists a further vessel which falls in this category, the *Heather* (NSBR **ID 1440**), a barge built in the late 19th century which may have been used for painting vessels in the docks in Holland, but was later converted to a pleasure houseboat.

Recreation

5.5.21. Craft involved in recreation activities in relation to cruise liners has already been considered in **Section 5.2** and will not be repeated here. This section considers the use of watercraft in relation to recreational boating, predominantly focussing on smaller craft used for cruising and racing (Wessex Archaeology 2008:17).

5.5.22. The rise of steam technology in the 19th century brought better transport links which resulted in a rise in leisure uses of the coast (Brodie and Winter 2007). By 1900, sailing was already a well-established worldwide pastime for he moneyed classes and yacht clubs were in place around the coastline, catering for both those who wished to race their small keel day boats and those who cruised or raced in larger yachts (Dear 2000:135). Despite the increasingly widespread nature of recreation activities in the waters around England, it is a topic which receives relatively low attention in archaeological and historical narratives of the period, and understanding of the recreational use of boats and ships in this manner remains somewhat fragmentary.

5.5.23. Of the 518 records listed in the known resource for the period between 1860 and 1913, one vessel has been assigned the vessel type 'leisure craft' (the

New Moss Rose NMR **UID 767418**). The vessel is also assigned as a yacht. The *New Moss Rose* is detailed as having been a sailing vessel constructed of wood, although the date of build is unknown.

5.5.24. One further yacht is listed in the known resource (the *Argonaut* NMR **UID 901719**). The *Argonaut* (NMR **UID 901719**) is listed as a vessel constructed of iron in 1879, utilising both sail and steam as a means of propulsion. The vessel is detailed as having been screw driven and equipped with a triple expansion engine. The *Argonaut* is described as a small liner lost while on a pleasure cruise from London to Lisbon. No other vessel type listed in the known resource may be considered to confirm the recreational use of a particular vessel.

5.5.25. Recreational craft of the period are frequent survivors. The NHSR and the NSBR record 110 and 126 leisure craft respectively and dominate the preserved record with regards to function and type.

Summary

5.5.26. With the exception of recreation craft which are frequent survivors, on the basis of their rarity and the lack of good representation in the preserved records, wrecks associated with the themes discussed above are likely to be considered of special interest.

5.5.27. Further factors contributing to the special interest of these wrecks may also be considered. For example, due to the direct effects of the industrialisation of Britain in the 19th century and the consequent emergence of the modern whaling industry in the 1860s, vessels which relate to the whaling industry are likely to be of special interest on the basis of their representation. Wrecks associated with the Antarctic whaling industry may be regarded of particular special interest in this manner, on basis of their association with an industry almost monopolised by Britain from the late 19th century to the mid 20th century.

5.5.28. In many cases, the research undertaken within the remits of this project indicated that historical literature relating to boats and ships associated with these themes is quite limited. In order to provide an indication of the volume of boats and ships operating within or passing through English territorial waters which relate to these themes, further research would be required.

6. THE SPECIAL INTEREST OF BOATS AND SHIPS 1860-1913

6.1.1. The importance of shipping in the period 1860-1913 should not be underestimated. The effects of the Industrial Revolution on shipbuilding practices and naval engineering and the growth of trade, fishing and naval activity saw the dawn of a new maritime era and the development of the foundations of the modern shipping industry.

6.1.2. In the late 19th and early 20th century, the shipping industry was dominated by the transport of cargo. Technological innovation led by British engineers and the demands of a rapidly increasing worldwide market resulted in the transformation, in a mere 50 years, of a wooden merchant sailing fleet to a steam powered metal fleet, often carrying specialised cargoes in much larger hulls.

6.1.3. By 1890, Britain owned half of the world's tonnage of merchant ships and the demands of the British import and export markets meant that many thousands of voyages were undertaken in the seas around England each year. Cargo vessels passed through English territorial waters, entering and clearing English ports as part of this coastal, home and worldwide trade.

6.1.4. This was also the era of the 'Pax Britannica'. Although there was limited conflict in the period 1860-1913, and wars in which Britain was involved were fought at a great distance from the UK, the Royal Navy continued to act as a deterrent to threat of invasion or interference with trade. The technological innovation that characterised this period led to experimentation that utterly transformed the navies of Europe, turning fleets of wooden sailing ships into fleets of armoured dreadnoughts and encouraging the development of entirely new weapons of war such as submarines and torpedoes.

6.1.5. The technological innovations which underscored the changes in naval design in the 19th and 20th centuries ultimately affected every aspect of the shipping industry in the period 1860-1913. The development of liners propelled by steam enabled the growth of passenger trade. The emergence of the steam trawler enabled fishing activities to occur in distant grounds beyond the inshore and North Sea fisheries and to occur more safely, and the introduction of steam-propelled whale catchers provided the foundation upon which emerged the modern whaling industry.

6.1.6. For a boat or ship to be considered to be of special interest, the remains must be capable of making such a distinctive contribution to our understanding or awareness of people's actions in the past that the remains themselves should be protected from uncontrolled damage (Wessex Archaeology 2008:5).

6.1.7. The vessels listed in the national stock for the period 1860-1913 may relate to any number of the inter-relating themes discussed above, and as such, the basis upon which special interest may be granted for a particular wreck in the period 1860-1913 is likely to be multi-faceted. Due to the great number of wrecks dating to this period, a framework from which the special interest of a wreck can be ascertained in relation to the national stock is necessary.

6.1.8. The Selection Guide for Boats and Ships in Archaeological Contexts (Wessex Archaeology 2008) underpins a number of factors in the consideration of the special interest of a boat or ship. The factors are divided into two distinct sections: integral factors and relative factors.

Integral Factors

6.1.9. This section considers the integral factors that any boat or ship must exhibit if it is to be considered of special interest.

6.1.10. Integral factors enable a boat or ship to be considered of special interest on the basis of its own merit. As this project arises from a holistic assessment of the national stock, analysis of individual wreck sites has been minimal. The discussion of the integral factors therefore outlines particular themes relating to the period 1860-1913 and, where applicable, provides examples of wrecks which may be considered of special interest in this respect.

Key Narratives

6.1.11. A boat or ship will be of special interest where it makes a distinct contribution to understanding overall historical processes relating to England or to the globe. The special interest of a boat or ship may arise from its relation to a turning point in history or an overall situation or trend that is important.

6.1.12. The period 1860-1913 encompasses a plethora of narratives represented variously by the remains of boats and ships, which may be social, economic, political, cultural or technological in context. In light of the main themes considered for the period 1860-1913, narratives which relate to technological aspects are likely to form a key consideration. Vessels which thus contribute to an understanding of the transition between practices in naval engineering may be regarded of particular special interest.

6.1.13. For example, a vessel equipped with both sail and steam propulsion may be regarded as potentially important in understanding the transition which is characteristic of the period 1860-1913. One example of the 22 records listed by the known resource to adopt both sail and steam propulsion is the English vessel the *Iduna* (NMR **UID 767271**), which was built in 1868 with a single boiler, a screw driven 2 cylinder compound engine and three masts. Vessels which contribute to an understanding of the changes in hull construction which took place in this period are also likely to be of special interest. This will include relatively short-lived technologies, such as composite hulls.

6.1.14. Where a boat or ship is related to another country, its special interest depends on its ability to be identified as historically significant to the people of that country. For example, the German ironclad *Grosser Kurfurst* (NMR UID **901765**, **901781**) is the only non-British military vessel for the period 1860-1913, and may be assigned special interest as one of the first armoured ships with gun turrets built in Germany as the Imperial Navy sought independence from foreign shipbuilders.

Associations

6.1.15. A boat or ship will be of special interest where it presents a distinct tangible link to a person or event. Such special interest will be all the greater where the boat or ship had a distinct role in shaping the person or event.

6.1.16. The fields relating to the association of vessels in the Boats and Ships database arose from the free text within the NMR Complete Monument Records and are non-queriable. The review of the themes brought to light as part of the assessment of the national stock for 1860-1913 did however, highlight a number of examples. One such example of vessels which may attain special interest on basis of their association with a particular person may be provided by the four military submarines listed in the known resource as having been built by the firm Vickers Son and Maxim Ltd which built the first British submarines for the Royal Navy (*HMS A3* NMR **UID 904626**, *HMS C11* NMR **UID 907529**, *HMS A1* NMR **UID 911782** and *HMS Holland No. 5* NMR **UID 1397999**). A further example was considered in light of passenger vessels, whereby vessels may be regarded of special interest on the basis of their association with prominent shipping companies which operated in the late 19th and early 20th century, particularly in relation to the White Star Line or the Cunard Line. The *Suevic* (NMR **UID 918674**) and the *Brest* (NMR **UID 918720**) provide examples of such vessels.

6.1.17. One example of a type of event with which vessels may be associated is military episodes. In the period 1860-1913, no naval conflicts of any significance took place in British territorial waters. However, special interest may arise from the association of a wreck to an event which took place in an event further afield, such as the American Civil War 1861-5. The *Iona II* (NMR **UID 1082110**) is suspected to have been engaged as a Confederate blockade runner in the American Civil War and may thus attain special interest on this basis.

6.1.18. Other examples of event types with which vessels may be associated are storms and collisions which in each case saw the loss of multiple vessels.

Loss of Life and Related Responses in Seafaring Safety

6.1.19. A boat or ship will be of special interest where it was the site of major or otherwise tragic loss of life. While casualties must be noted when taking into account decisions regarding the investigation or management of a particular site, as many shipwrecks involved some loss of life, it will probably not in itself generate special interest. Special interest may arise where large numbers of

people were killed, if famous persons were lost, if notable acts of bravery occurred or when the circumstances of loss were otherwise very significant.

6.1.20. Shipwrecks where loss of life may be seen to relate to responses in seafaring safety may be of particular special interest. The upsurge of sea trade in the mid 19th century saw an increase in the losses of merchant ships and the period 1860-1913 is marked by a series of government reforms which sought to regulate the merchant shipping industry. For example, the increase of trade led to old rotten vessels, commonly referred to as 'coffin ships', which were continually being excessively overloaded. A campaign to introduce a maximum load line by Samuel Plimsoll came to a successful conclusion in 1876 with the passing of the Merchant Shipping Act. Merchantmen lost in the late 19th century which may relate to these responses in seafaring safety are thus likely to be of special interest. The *Delaware* (NMR **UID 858298**, a cargo vessel which sank in 1871 may provide an example of one such vessel. The *Delaware* was caught in a gale and sank after cargo in one of its holds shifted. More than 40 people are recorded to have lost their lives.

Aesthetic context and literary, artistic and other associations

6.1.21. A boat or ship will be of special interest where it made a distinct cultural contribution either directly through its build, or indirectly through being represented in other artistic media. In order for the aesthetics to give rise to special interest, the surviving remains should be expected to provide a tangible, evidential link between the boat or ship and the artistry. One such example is the *HMS Empress of India* (NMR **UID 832223**), which is depicted having foundered off Portland in a watercolour painting by MacKenzie Thomson. The date of the painting is unknown. The painting is currently held at the National Maritime Museum. A further example is provided by the *HMS Landrail* (NMR **UID 904640**), which is depicted in a watercolour painting by William Lionel Wyllie. This painting is also held at the National Maritime Museum and its date is unknown.

Parallels with current shipping themes and events

6.1.22. A boat or ship will be of special interest on account of its current relevance if it embodies distinctive attributes that are also practices or applied today. Current relevance is likely to give rise to special interest in relation to technological innovations in the past that are being developed or re-examined for current use.

Relative Factors

6.1.23. This section considers the factors that enable boats and ships to be sorted relative to each other. Having established that a boat or ship is capable of making a distinctive contribution in terms of the integral factors discussed above, consideration should be given to the relative factors in comparing it to other similar assets.

6.1.24. The queries which form the basis of an assessment of the national stock (**Appendix I**) lend themselves directly to a review of the relative factors which may be considered for the period 1860-1913, the results of which should be consulted when assessing the special interest of wrecks as part of an aggregate licence application proposal.

Rarity

6.1.25. Rarity is considered as reflecting the difference between historic activity and the record of known wrecks. Additionally, where there are very few other examples of comparable boats or ships, rarity will add to the special interest of a special asset.

6.1.26. There are a number of cases in which the national stock for 1860-1913 did not necessarily reflect historical literature relating to the period. Types of vessels

containing very few (if any) examples in the national stock are considered in the summary section for each theme. Particular rarity has been noted in relation to the following examples:

- Wood and metal constructed hulls;
- Composite vessels;
- Vessels propelled by sail and steam;
- Paddle Steamers;
- Vessel equipped with simple engines;
- Clippers.

6.1.27. The rarity of wrecks that represent these types of craft is based on the description listed in the NMR Complete Monuments Record and must be regarded with caution. The detail for a particular wreck provided to the NMR may be fragmentary or may be based on conflicting sources. Issues inevitably arise in data entry, for example the current lack of 'composite' as an object material.

6.1.28. Rarity in the national stock for the period 1860-1913 was also noted in respect of examples relating to the following themes:

- Transport (People);
- Military;
- Fishing;
- Industrial;
- Law and Government;
- Health and Welfare;
- Commercial;
- Agricultural and Subsistence;
- Domestic;
- Recreation.

6.1.29. The results of the review suggest that a number of vessel types and themes are rare or have limited representation in the known resource. However, special interest may not depend on rarity alone. In order for a vessel to be regarded of special interest, there must also be a tangible link between the material remains and the integral factors discussed above.

Representativeness

6.1.30. Representiveness is considered in terms of the key themes that the conserved archaeological record needs to reflect. There are many themes which may be represented variously by wrecks in the national stock for 1860-1913, examples of which are considered within the summary sections for each theme. For example a wreck may be regarded of special interest on the basis of its representation of the revolutionary changes in naval engineering which characterise the period 1860-1913. Wrecks which relate to these changes in shipbuilding practices thus contribute to an understanding of the technological innovations of the late 19th and early 20th century.

6.1.31. Consideration should also be given to the value of what was typical and representative of overall patterns of activity in this period. For example, vessels which represent the tramp or liner shipping industries which emerged and became commonplace in this period may be regarded as of special interest. Where special interest arises in respect of a class of boats or ships, decisions about mitigation should consider which examples most comprehensively represent the attributes from which their special interest arises.

Diversity

6.1.32. Diversity is considered in respect of the range of features or sub-themes that should be reflected in the conserved archaeological record within a particular theme. Attention should be paid as to what was 'typical', to avoid accumulating examples of the unusual at the expense of what might have been most important day-to-day.

6.1.33. The technological advances in naval engineering which revolutionised the shipping industry in the late 19th and early 20th century saw the emergence of a variety of purpose-built vessels. In order to retain a record of this diversity, records which represent this array of vessel types and designs (particularly those poorly represented in the national stock) are likely to be regarded of special interest. For example, while there are abundant cargo vessels in the national stock, care must be taken to ensure the survival for the varying types of cargo vessels in this period, from the coastal colliers to the long distance tramp steamers.

6.1.34. Diversity is particularly relevant with regards to military vessels. In the late 19th century these were in a transitional process of developing towards a more homogenous fleet. This fleet encompassed a combination of various technologies arising from both the early Victorian wooden wind propelled battle fleet and the late Victorian all-metal steam and engine driven battle fleet.

Survival

6.1.35. It is imperative that consideration of special interest is evidence-based, and is related directly to the surviving fabric of the asset. Survival is considered as reflecting the degree to which wrecks in the archaeological record are intact and coherent. Survival can therefore be gauged in terms of completeness.

6.1.36. Of the 518 records for the period 1860-1913, based on the most recent information listed in the NMR Complete Monument Records, only 22 wrecks are listed as mainly intact with regards to their seabed survival. To provide an example, the *Alster* (NMR **UID 907479**), a British iron schooner which is listed to be mainly intact, may be regarded of greater special interest than a British iron schooner which has fragmentary remains. However, it must be noted that in some instances, the interest of an asset may be so great that even fragmentary remains might be considered 'special'.

6.1.37. Additional interest may arise where the survival of the asset can shed light on the processes that cause sites to be preserved or deteriorate. This is case specific and must be considered on a wreck by wreck basis.

Setting and Context

6.1.38. Setting and context considers places that are particularly associated with themes highlighted in the review that are represented or associated with known wrecks. With regards the period 1860-1913, this is particularly relevant to areas or regions which prospered and played key roles in the industrialisation of Britain and the shipping industries. Examples drawn out through the review include vessels which were built in the north-east of England or on Clydeside; areas which owed their success to the industrialisation of their hinterlands.

6.1.39. Special interest on the basis of setting and context may also derive from the location of a wreck site that adds to its understanding or appreciation. The remains of boats and ships can generate interest by evoking patterns of activity that have left no visible trace on the surface of the sea. An assessment of the distribution of shipping losses highlighted the entrance to the Merseyside docks as the most concentrated area of shipwrecks in the period 1860-1913. A large number of these wrecks were dispersed by explosives, and may be associated with the extension of the Liverpool docks – one of the largest dock building programmes to occur in the late 19th century.

Grouping

6.1.40. Grouping is considered in terms of associations between known wrecks that reflect themes or events highlighted by the review. The special interest of a boat or ship may thus be increased by its being grouped by other assets.

6.1.41. In the review for the period 1860-1913, there are a number of cases in which vessels may be regarded of special interest on the basis of their grouping, particularly in relation to wrecks which provide good representation of particular themes. For example, the abundant cargo vessels for the period 1860-1913 collectively signify the growth of sea trade within this period, and the dominance of British cargo vessels may attain greater special interest in representing the leading position played by Britain in this economic climate.

Exceptional

6.1.42. This factor provides for the special interest of wrecks which stand outside the main themes and trends. In this manner, the special interest of some assets may be all the greater because it is 'exceptional' and does not bear comparison. This must be considered on a wreck by wreck basis and cannot be considered in relation to the holistic study of the national stock which forms the basis of this discussion.

7. CONCLUSIONS

7.1.1. The period from 1860 to 1913 was arguably the most important in British maritime history. Rapid technological innovation fuelled by the Industrial Revolution and the demands of an expanding worldwide merchant marine and navy revolutionised the design and use of ships.

7.1.2. By the end of this period, on the brink of world war, British shipping stood transformed. British shipyards built most of the world's ships. The sailing navy had been replaced by the dreadnought navy and small wooden merchant ships powered by sail had been largely supplanted by larger, specialised steam ships built of iron or steel. The tonnage entering and clearing British ports had increased vastly and yet travel by sea had become safer. Furthermore, the foundations of Britain's 20th century maritime history had been laid.

7.1.3. The wrecks of boats and ships of this period in territorial waters off England therefore have an inherently high potential for special interest. England was a major destination for vessels from all over the world and the resource is therefore likely to be important both nationally and internationally.

7.1.4. This first stage of the Assessing Boats and Ships project has demonstrated that although there are a large number of wrecks of this period in territorial waters off England, some types of boats and ships, including warships and smaller vessels, are not well represented in the known resource. Whilst these apparent biases may be corrected in the second stage of this project, when the known resource for the losses sustained in the First World War are examined, in the meantime these types of vessel appear to be of particular interest in terms of their inherent special interest.

7.1.5. Large numbers of boats and ships of this period exist in preservation. The project has demonstrated that these need to be taken into consideration when considering the special interest of wrecks on the seabed off England. Notwithstanding their numbers, there are biases within the preserved record, for example in respect of warships. Where this record is lacking, the special interest of wrecks will be enhanced.

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8.2. WEB SOURCES

EHKOS

http://www.ehkos.org

PortCities

http://www.portcities.org.uk/london/server/show/nav.001003003

The National Maritime Museum

http://www.nmm.ac.uk/explore/sea-and-ships/facts/ships-and-seafarers/load-lines

9. ARCHIVE

9.1.1. The project archive consisting of WA Access databases, digital photographs and other computer records, together with miscellaneous hardcopy documents are currently stored at WA under project code 70861.

APPENDIX I : RESULTS OF DATABASE QUERIES

Table 1: Records queried by place of build

Place Built	Country	Total NMR
Montrose	Canada	1
Nova Scotia		1
Quebec		2
Jersey	Channel Islands	1
Barrow in Furness	England	6
Birkenhead		2
Bristol		1
Chatham		1
Cheshire		4
Goole		1
Hartlepool*		1
Hull		4
Jarrow*		3
Liverpool		7
London		5
Merseyside		1
Middlesbrough*		3
Milford Haven		1
Newcastle*		13
Norfolk (England)		1
North Shields*		2
Northfleet		1
Poole		1
Portland (Dorset)		1
Preston		1
Runcorn		1
Shoreham by Sea		1
South Shields*		1
Stockton on Tees*		7
Sunderland*		18
Ulverston		1
Wallsend*		1
West Hartlepool*		2
Whitby*		2
Widnes		1
Workington		1
Dieppe	France	1
Le Havre		1
Rouen		1
Germany	Germany	2
Kiel		1
Ramsey	Isle of Man	1
Belfast	N. Ireland	10
Amsterdam	Netherlands	1
Rotterdam		1
Bergen	Norway	1
Stettin	Poland	1
Aberdeen	Scotland	2

Place Built	Country	Total NMR
Campbeltown**		1
Dumbarton**		3
Dundee		2
Glasgow**		17
Greenock**		3
Kincardine on Forth		1
Leith		2
Scotland		5
Troon**		2
Lulea	Sweden	1
Massachusetts	USA	1
New Brunswick		1
Bangor	Wales	1
Pembroke		2
Rhyl		1
		167

Table 2: NMR records queried by vessel type

Vessel Type	NMR Total
Admiralty Vessel	5
Barge*	53
Barque*	33
Barquentine*	1
Battleship	4
Brig*	4
Brigantine*	2
Cargo Vessel	332
Clipper*	3
Coaster*	4
Collier*	8
Craft*	99
Dandy*	2
Destroyer	2
Dredger	1
Dry Bulk Cargo Carrier*	1
East Indiaman*	1
Emigrant Ship	1
Ferry	2
Fishing Vessel	7
Flat*	10
Frigate (sail)	1
Full Rigged Ship*	17
Hopper Dredger	2
Hulk	1
Ketch*	7
Leisure Craft	1
Lighter	1
Lightship	1
Liner	9
Torpedo Motor Boat	1
Packet*	4
Paddle Steamer	8
Passenger Vessel	19
Pilot Vessel	2
Schooner*	40
Sloop	2
Smack	1
Snow*	1
Square Rigged Vessel*	1
Submarine	5
Tanker*	3
Target Craft	4
Tender	1
Torpedo Boat Destroyer	1
Training Ship	1
Trawler	8
Tug	6
Warship	6
Yacht	2

Table 3:NMR records queried by place of Departure

Departure	Country	Total NMR
Algeria	Algeria	1
Algiers		1
Annaba		1
Beni Saf		1
Buenos Aires	Argentina	2
Junin		1
Villa Constitucion		1
Adelaide	Australia	1
Australia		2
Melbourne		1
St Marys		1
Antwerp	Belgium	6
Varna	Bulgaria	1
Montreal	Canada	1
Guernsey	Channel Islands	1
Hamburg		7
Jersey		1
Chile	Chile	3
Iquique		2
Mejillones		1
Taltal		1
Rijeka	Croatia	1
Caleta Buena	Cuba	1
Esmeraldas	Ecuador	1
Alexandria	Egypt	2
Amble	England	1
Barrow in Furness	England	1
Birkenhead		4
Blyth		2
Bournemouth		1
Bristol		3
Castletown		1
Cornwall		1
Dartmouth		1
Dover		2
England		3
Falmouth		5
Fowey		3
Gainsborough		1
Garston		6
Goole		1
Grimsby		3
Hartlepool		1
Isles of Scilly		2
Kingston upon Hull		4
Liverpool		57
London		19
Manchester		1
Middlesbrough		2
Newcastle upon Tyne		4
Newhaven		1

Departure	Country	Total NMR
Newlyn		1
North Shields		2
Padstow		1
Par		1
Pentewan		1
Penzance		1
Piel		1
Plymouth		2
Portland (Dorset)		2
Portsmouth (Hampshire)		2
River Mersey		13
River Thames		1
River Tyne		8
Runcorn		3
Seaham		1
Shields		1
South Shields		2
St Michaels		1
Sunderland		5
Swanscombe		1
Teignmouth		2
Tilbury		1
Ulverston		1
Wallsend		1
Weston Point		1
Weymouth		1
Woolwich		1
Porvoo	Finland	1
Caen	France	1
Calais		1
Cherbourg		1
Dunkirk		1
France		1
Granville		1
Le Havre		4
Lorient		2
Rouen		1
St Valery en Caux		1
St Valery Sur Somme		1
Gabon	Gabon	1
Bremer Lehe	Germany	1
Bremerhaven		1
Wilhelmshaven		2
Piraeus	Greece	1
Calcutta	India	4
Jakarta	Indonesia	1
Semarang		2
Douglas	Isle of Man	1
Ramsey		1
Venice	Italy	1
Savanna La Mar	Jamaica	1
Pinang	Malaysia	1

Departure	Country	Total NMR
Mexico	Mexico	1
Annalong	N. Ireland	2
Belfast		1
Rotterdam	Netherlands	1
Maasluis		1
Bluff Harbour	New Zealand	1
New Zealand		1
Bergen	Norway	1
Callao	Peru	1
Szczecin	Poland	1
Novorossisk	Russia	1
Aberdeen	Scotland	1
Dundee		1
Glasgow		2
Granton		1
River Clyde		1
Senegal	Senegal	1
South America	South America	1
Almeria	Spain	1
Bilbao		8
Burriana		1
Cadiz		2
Cartagena		1
Dicido		1
Huelva		3
Las Palmas de Gran Canaria		1
Malaga		1
Portman		1
Sagunto		1
Seville		1
Spain		2
Villaricos		1
Gothenburg	Sweden	1
Sundsvall		1
Bangkok	Thailand	1
Thailand		1
Izmir	Turkey	1
Nikolayev	Ukraine	1
Odessa		2
Montevideo	Uruguay	1
Baltimore (Maryland)	USA	3
Boston (Massachusetts)		2
Coosaw River		1
Galveston		2
New Orleans		1
New York		6
Philadelphia		1
Puget Sound		1
San Francisco		1
Tacoma		2
USA		4

Departure	Country	Total NMR
Anglesey	Wales	1
Barry		1
Caernarvon		1
Cardiff		11
Holyhead		1
Llandulas		2
Llanelli		1
Mostyn		3
Newport (Gwent)		4
Penarth		1
Port Dinorwic		2
Pwllheli		1
Rhyl		1
Swansea		7
Wales		2
West Africa	West Africa	1

Table 4: Records queried by country of departure

Country of Departure	Total NMR
England	188
Wales	39
Spain	25
USA	24
France	15
Channel Islands	9
Chile	7
Belgium	6
Scotland	6
Australia	5
Algeria	4
Argentina	4
Germany	4
India	4
Indonesia	3
Northern Ireland	3
Ukraine	3
Egypt	2
Isle of Man	2
Netherlands	2
New Zealand	2
Sweden	2
Thailand	2
Bulgaria	1
Canada	1
Croatia	1
Cuba	1
Ecuador	1
Finland	1
Gabon	1
Greece	1
Italy	1
Jamaica	1

Country of Departure	Total NMR
Malaysia	1
Mexico	1
Norway	1
Peru	1
Poland	1
Russia	1
Senegal	1
South America	1
Turkey	1
Uruguay	1
West Africa	1

Table 5: Records queried by place of destination

Destination	Country	Total NMR
Argentina	Argentina	1
Devonport	Australia	1
Hobart		1
Melbourne		4
St Marys		1
Sydney (New South Wales)		6
Nassau	Bahamas	1
Antwerp	Belgium	6
Bermuda	Bermuda	1
Rio de Janeiro	Brazil	2
Malahide	Canada	1
Iquique	Chile	1
Valparaiso (Chile)		3
Havana	Cuba	3
Alexandria	Egypt	1
Port Said		1
Berwick upon Tweed	England	1
Blyth		1
Bristol		3
Dartmouth		1
Deptford		1
Dover		2
Ellesmere Port		2
England		9
English Channel		1
Falmouth		8
Fleetwood		2
Fowey		1
Garston		6
Gateshead		1
Grimsby		2
Isles of Scilly		2
Kingston		1
Kingston Upon Hull		4
Leeds		1
Liverpool		36
London		20

Destination	Country	Total NMR
Lowestoft		1
Manchester		1
Maryport		1
Middlesbrough		2
Mistley		1
Newcastle upon Tyne		3
Newlyn		1
North Shields		1
Pentewan		1
Penzance		1
Plymouth (Devon)		4
Poole		1
Portishead		1
Portsmouth		3
Preston		1
River Tyne		3
Runcorn		10
Seaham		1
Solent		1
Southampton		3
Stockton on Tees		1
Sunderland		2
Torquay		1
Tranmere		1
Warrington		1
Weymouth		1
Widnes		4
Workington		1
Boulogne	France	1
Calais		1
Cherbourg		3
Dieppe		4
Dunkirk		2
France		4
Le Havre		2
Lorient		1
Marseille		1
Nantes		1
St Nazaire		3
Bremen	Germany	1
Germany		1
Hamburg		10
Piraeus	Greece	1
Cap Haitien	Haiti	1
Bombay	India	2
Calcutta		2
Douglas	Isle of Man	1
Genoa	Italy	2
Italy		1
Livorno		1
Naples		2
Palermo		1

Destination	Country	Total NMR
Savona		1
Japan	Japan	2
Malta	Malta	2
Rostrevor	N. Ireland	1
Amsterdam	Netherlands	3
Netherlands		1
Rotterdam		9
New Zealand	New Zealand	1
Brass River	Nigeria	1
Calabar		1
Bergen	Norway	1
Trondheim		1
Szczecin	Poland	1
Lisbon	Portugal	1
Madeira		1
Puerto Rico	Puerto Rico	1
Cork	Republic of Ireland	3
Dublin		3
Waterford		2
Kronshtadt	Russia	1
Russia		1
Aberdeen	Scotland	1
Annan		1
Ardrossan		1
Bowling		1
Dundee		3
Firth of Forth		1
Glasgow		1
Grangemouth		1
Leith		1
Scotland		1
Table Bay	South Africa	1
Cape Town		1
Port Elizabeth		1
Bilbao	Spain	1
Cartegena		1
Malaga		1
Santander		1
Seville		2
Colombo	Sri Lanka	1
Turkey	Turkey	2
Odessa	Ukraine	2
Baltimore (Maryland)	USA	1
Brunswick (Georgia)		1
Brunswick(Maine)		1
New Orleans		1
New York		5
San Diego		1
Sapelo Island		1
Savannah		1
Anglesey	Wales	1
Barry		1

Destination	Country	Total NMR
Barry Roads		1
Beaumaris		1
Cardiff		8
Llanelli		1
Mostyn		1
Newport (Gwent)		5
Pembroke		1
Swansea		1
Wales		2
West Africa	West Africa	1
Aden	Yemen	1

Table 6: Records queried by country of destination

Country of Destination	Total NMR
England	158
France	23
Wales	23
Australia	13
Netherlands	13
Germany	12
Scotland	12
USA	12
Italy	8
Republic of Ireland	8
Belgium	6
Spain	6
Chile	4
India	4
Cuba	3
South Africa	3
Brazil	2
Egypt	2
Japan	2
Malta	2
Nigeria	2
Norway	2
Portugal	2
Russia	2
Turkey	2
Ukraine	2
Argentina	1
Bahamas	1
Bermuda	1
Canada	1
Greece	1
Haiti	1
Isle of Man	1
Northern Ireland	1
New Zealand	1
Poland	1
Puerto Rico	1
Sri Lanka	1

Country of Destination	Total NMR
West Africa	1
Yemen	1

Table 7: NMR records queried by Registration

Registration	Country	Total NMR
Ostend	Belgium	1
Montrose	Canada	1
Jersey	Channel Islands	1
Rijeka	Croatia	1
Copenhagen	Denmark	1
Nordby		1
Barrow-in-Furness	England	7
Bristol		2
Castletown		1
Chester		2
Garston		1
Grimsby		1
Kingsbridge		1
Kingston-upon-Hull		7
Lancaster		4
Liverpool		47
London		23
Middlesbrough		1
Milford Haven		2
Newcastle		11
Newhaven		1
Newry		1
North Shields		3
Padstow		2
Penzance		1
Plymouth		1
Poole		1
Preston		2
Ramsey		1
Rochester		1
Runcorn		9
Scarborough		2
Shields		1
South Shields		1
Stockton-on-Tees		1
Sunderland		8
West Hartlepool		1
Whitby		1
Wigtown		1
Yarmouth		1
Bordeux	France	1
Boulogne		2
Dunkirk		1
Lorient		1
Nantes		1
Bremen	Germany	1
Bremerhaven		1

Registration	Country	Total NMR
Hamburg		6
Stralsund		1
Andros	Greece	1
Argostoli		1
Douglas	Isle of Man	2
Amsterdam	Netherlands	3
Dordrecht		1
Puttershoek		1
Rotterdam		1
Belfast	Northern Ireland	1
Bergen	Norway	3
Egersund		1
Farsund		2
Lillesand		1
Mandal		1
Trondheim		1
Cork	Republic of Ireland	4
Dublin		1
Youghal		1
Aberdeen	Scotland	4
Dumfries		1
Dundee		4
Glasgow		18
Greenock		3
Leith		2
Bilbao	Spain	8
Seville		1
Brevik	Sweden	1
Odessa	Ukraine	1
Montevideo	Uruguay	1
Boston	USA	1
New Brunswick		1
New York		1
Virginia		1
Beaumaris	Wales	1
Caernarvon		2
Cardiff		4
Swansea		2

Table 8: Records queried by country of Registration

Country Registered	Total NMR
England	150
Scotland	32
Germany	9
Norway	9
Spain	9
Wales	9
France	6
Netherlands	6
Republic of Ireland	6
USA	4
Denmark	2

Country Registered	Total NMR
Greece	2
Isle of Man	2
Belgium	1
Canada	1
Channel Islands	1
Croatia	1
Northern Ireland	1
Sweden	1
Ukraine	1
Uruguay	1

Table 9: NMR records queried by place of departure and sorted by those destined for the UK and Europe

Place of Departure	Total	Destined for UK	Destined for Europe
Amble	1	1	0
Barrow in Furness	1	1	0
Birkenhead	4	4	0
Blyth	2	1	1
Bournemouth	1	1	0
Bristol	3	1	1
Castletown	1	1	0
Cornwall	1	0	1
Dartmouth	1	1	0
Dover	2	1	0
England	3	2	1
Falmouth	5	3	2
Fowey	3	2	1
Gainsborough	1	1	0
Garston	6	4	1
Goole	1	0	0
Grimsby	3	2	1
Hartlepool	1	1	0
Isles of Scilly	2	1	1
Kingston upon Hull	4	2	1
Liverpool	57	9	8
London	19	5	1
Manchester	1	1	0
Middlesbrough	2	0	1
Newcastle upon Tyne	4	1	3
Newhaven	1	0	1
Newlyn	1	1	0
North Shields	2	1	1
Padstow	1	1	1
Par	1	1	1
Pentewan	1	1	1
Penzance	1	1	1
Piel	1	1	1
Plymouth	2	0	0
Portland (Dorset)	2	1	1
Portsmouth (Hampshire)	2	2	2
River Mersey	13	1	1

Place of Departure	Total	Destined for UK	Destined for Europe
River Thames	1	0	0
River Tyne	8	3	3
Runcorn	3	1	1
Seaham	1	0	0
Shields	1	0	0
South Shields	2	0	0
St Michaels	1	1	1
Sunderland	5	2	2
Swanscombe	1	1	1
Teignmouth	2	2	2
Tilbury	1	0	0
Ulverston	1	1	1
Wallsend	1	0	0
Weston Point	1	1	1
Weymouth	1	1	1
Woolwich	1	1	1
TOTAL	189	71	49

Table 10: NMR records queried by place of destination and sorted by those which departed from the UK and Europe

Place of Destination	Total	Departed from UK	Departed from Europe
Berwick upon Tweed	1	0	0
Blyth	1	0	1
Bristol	3	1	0
Dartmouth	1	1	0
Deptford	1	0	0
Dover	2	1	0
Ellesmere Port	2	1	0
England	9	4	1
English Channel	1	1	0
Falmouth	8	2	0
Fleetwood	2	1	1
Fowey	1	0	0
Garston	6	4	2
Gateshead	1	1	0
Grimsby	2	1	1
Isles of Scilly	2	1	0
Kingston	1	1	0
Kingston Upon Hull	4	2	0
Leeds	1	1	0
Liverpool	36	20	8
London	20	10	1
Lowestoft	1	1	0
Manchester	1	0	1
Maryport	1	0	1
Middlesbrough	2	0	2
Mistley	1	1	0
Newcastle upon Tyne	3	1	1
Newlyn	1	1	0
North Shields	1	1	0

Place of Destination	Total	Departed from UK	Departed from Europe
Pentewan	1	1	0
Penzance	1	1	0
Plymouth (Devon)	4	0	0
Poole	1	1	0
Portishead	1	0	0
Portsmouth	3	3	0
Preston	1	0	0
River Tyne	3	0	2
Runcorn	10	9	1
Seaham	1	1	0
Solent	1	1	0
Southampton	3	0	1
Stockton on Tees	1	1	0
Sunderland	2	2	0
Torquay	1	1	0
Tranmere	1	1	0
Warrington	1	1	0
Weymouth	1	0	1
Widnes	4	4	0
Workington	1	1	0
TOTAL	158	86	25

Table 11: Passenger Vessels 1860-1913

NMR UID	Name	Year Built	Vessel Type	Propulsion	Specs	Material	Loss
813607	Strathclyde	1871	Cargo Vessel Passenger Vessel	Steam	Screw Driven Compound	Iron	1876
831711	Patria	1894	Cargo Vessel Liner Passenger Vessel	Steam	Screw Driven Triple Expansion	Iron	1899
832178	Jebba	1896	Cargo Vessel Passenger Vessel	Steam	Screw Driven Triple Expansion	Steel	1907
832248	Edam II	1883	Cargo Vessel Passenger Vessel Liner	Steam	Screw Driven Triple Expansion Compound	Steel	1895
858537	Schiller	1873	Cargo Vessel Passenger Vessel Liner	Sail Steam	Screw Driven Compound	Iron	1875
858678	Castleford	1883	Passenger Vessel Cargo Vessel	Steam	-	Iron	1887
883110	Pomerania	1873	Packet Passenger Vessel Liner	Steam	Screw Driven Compound	Iron	1878
901719	Argonaut	1879	Cargo Vessel Barquentine Yacht Passenger Vessel Liner	Sail Steam	Screw Driven Triple Expansion	Iron	1908
901749	Northfleet	1853	Full Rigged Ship Frigate (Sail) Cargo Vessel Passenger Vessel	Sail	-	Wood	1873
901801	W A Scholten	Unknown	Passenger Vessel Cargo Vessel Liner	Steam	-	Steel	1887
904624	Bournemouth	1884	Passenger Vessel Paddle Steamer	Steam	Paddle Driven Compound	Iron	1886

NMR UID	Name	Year Built	Vessel Type	Propulsion	Specs	Material	Loss
906936	Mona	1878	Packet Cargo Vessel Passenger Vessel	Steam	Screw Driven Inverted Compound	Iron	1883
911512	Pontos	1895	Passenger Vessel Cargo Vessel	-	Screw Driven Triple Expansion	-	1899
918674	Suevic	1900	Liner Cargo Vessel Passenger Vessel	Steam	Screw Driven Quadruple Expansion	Steel	1907
918702	Mosel	1872	Passenger Vessel Barque Cargo Vessel	Sail Steam	Screw Driven Compound	Iron	1882
918720	Brest	1873	Emigrant Ship Passenger Vessel Cargo Vessel	Steam	Screw Driven Compound	Iron	1879
918735	Stromboli	1856	Passenger Vessel Cargo Vessel	Steam	Screw Driven Compound	Iron	1878
919160	Mohegan	1898	Passenger Vessel Cargo Vessel Liner	Steam	Screw Driven Triple Expansion	Steel	1898
1452055	General Havelock	1868	Passenger Vessel Cargo Vessel	Steam	Screw Driven Triple Expansion Compound	Iron	1894
801951	Deutschland	Unknown	Liner Cargo Vessel	-	-	-	1875
1082110	Iona II	1863	Ferry Paddle Steamer Cargo Vessel	Sail Steam	Paddle Driven Compound	Iron	1864
1478270	Seaford	Unknown	Ferry	Steam	-	Iron	1895

Table 12: Military Vessels 1860-1913

NMR UID	Name	Year Built	Vessel Type	Propulsion	Specs	Material	Armament	Loss
832223	HMS Empress of India	1891	Battleship Target Craft** Warship*	Engine	Screw Driven Triple Expansion	Steel	-	Gun Action Capsized Foundered
859019	HMS Decoy	1894	Torpedo Boat Destroyer	-	-	Steel	1 x 12pdr 3 x 6pdr 3 x TT	Foundered Collision
901743	HMS Blackwater	1903	Destroyer Admiralty Vessel*	Engine	Screw	Steel	4 x 12pdr 5 x 6pdr 2 x TT	Collision Foundered
901765	Grosser Kurfurst	-	Warship* Battleship	Steam	-	Iron	-	Collision Foundered
901781	Grosser Kurfurst	-	Warship* Battleship	Steam	-	Iron	-	Collision Foundered
901840	HMS B2	-	Submarine Warship*	Engine	-	Steel	-	Collision Foundered
904626	HMS A3	1904	Submarine Target Craft**	Engine	Screw Oil Engine	Metal	2 x 18in TT	Collision Gun Action Scuttled Foundered
904640	HMS Landrail	1886	Motor Torpedo Boat Target Craft** Admiralty Vessel*	Engine	Screw	Steel	1 x 16in 3 x 5in 3 x TT	Scuttled
906643	HMS Clarence	1833	Training Ship** Warship* Admiralty Vessel* Hulk*	Sail	Screw Compound	Wood	-	Burnt Foundered Dispersed
907529	HMS C11	1907	Submarine Admiralty Vessel*	Engine	Screw Petrol Engine	Steel	-	Collision Foundered
911782	HMS A1	1902	Target Craft** Submarine	Engine	Screw Petrol Engine	Metal	2 x 18in TT	Explosion Scuttled Foundered

NMR UID	Name	Year Built	Vessel Type	Propulsion	Specs	Material	Armament	Loss
1033924	HMS Montagu	1901	Battleship Warship*	Steam	Triple Expansion	Steel	4 x 12in 12 x 6in 12 x 12pdr 2 maxim machine guns 4 x 18in submerged TT	Stranded
1397999	HMS Holland No. 5	1903	Submarine	Engine Towed	Petrol Engine with Electric Motor	Steel	Plate 1 x 18in TT	Foundered

Table 13: Fishing Vessels

NMR UID	Name	Year Built	Vessel Type	Propulsion	Material	Nationality	Departure	Destination	Registration	Loss
906892	Queen	1876	Fishing Vessel Ketch	Steam Sail	Steel Wood	British	Liverpool	Liverpool	Liverpool	Collision Foundered Dispersed
907874	Crux	-	Fishing Vessel	-	Wood	British	-	-	-	-
908710	Orion	-	Fishing Vessel	-	-	-	-	-	-	-
911968	Maxwell	-	Fishing Vessel	Steam	-	British	San Francisco	Kingston upon Hull	-	Collision Foundered
913083	Dayrian	1906	Fishing Vessel Trawler	Steam	Steel	British	Grimsby	Grimsby	Grimsby	Collision Foundered
913089	Retriever	1891	Trawler Fishing Vessel	Steam	Wood	English	Kingston upon Hull	Kingston upon Hull	Kingston upon Hull	Collision Foundered
913210	-	-	Coaster Fishing Vessel	-	-	-	-	-	-	-
859021	Magdeleine	1899	Trawler	-	Iron	French	Isle of Scilly	Boulogne	Boulogne	Stranded
907550	Ayrshire	-	Trawler	Steam	-	British	-	-	-	Foundered
907955	Artic	-	Trawler	Steam	-	British	-	-	-	-
908841	Victory	-	Trawler	Steam	-	British	-	-	-	-
909164	Laconia	-	Trawler	Steam	-	British	-	-	-	Collision
1109419	Goldfinder	-	Trawler	Steam	-	British	-	-	-	Foundered

NMR UID	Name	Year Built	Vessel Type	Propulsion	Material	Nationality	Departure	Destination	Registration	Loss
906680	Gwydir	1858	Barge Smack Cargo Vessel	Sail	Wood	British	-	-	-	Foundered

APPENDIX II: 'BULLSEYE' SYSTEM

The 'BULSI system' is used by Wessex Archaeology to assess the 'career' or 'life cycle' of a wrecked vessel, from its building through its use and loss and then through its subsequent history as a wreck. The system has been proved on a wide variety of projects, including regional environmental characterisations and the assessment of individual wrecks.

The system breaks the description of any wreck down into the following consistent categories:

B – Build

This category provides information concerning the building of the vessel, including the date of construction, the place of construction and the companies and individuals involved. It also includes information concerning the design of the vessel, including the dimensions and tonnage, the materials used, and propulsion and other engineering details.

U – Use

This category provides information on what the vessel was used for, including changes of use during its career. Registration and nationality information is recorded here, together with details of companies and individuals associated with the vessel, such as owners, managers and crew. For merchant ships, details of the type of cargo can be recorded, together with information about ports of call and therefore routes.

L – Loss

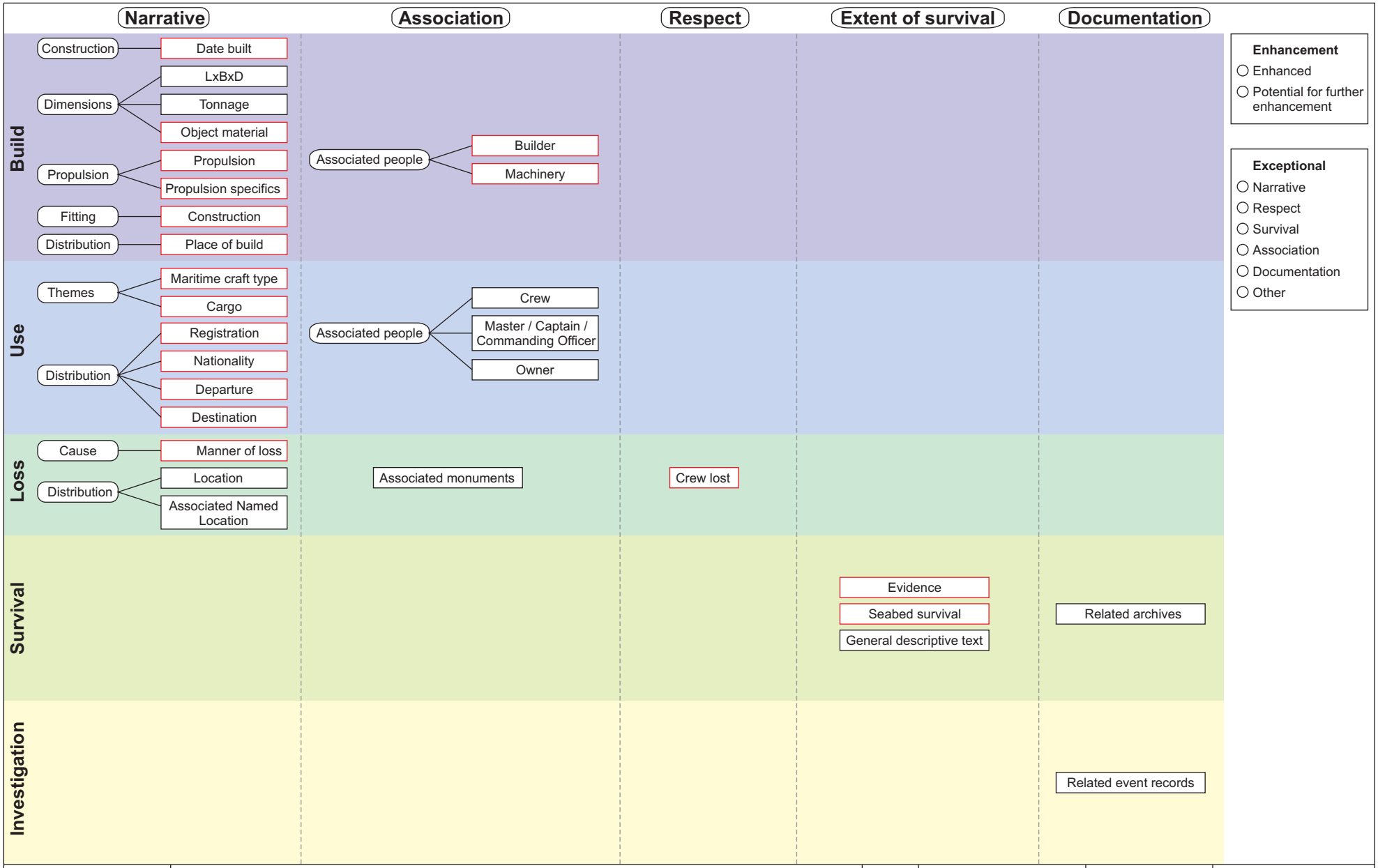
This category records information about how the vessel came to be lost, including date and circumstances of loss, location and associated vessels and people. Fatalities can be recorded as well as commemorative monuments subsequently erected.

S – Survival

This category describes the evidence for the history and survival of the vessel as a wreck and can include information from a wide variety of sources including diver descriptions and geophysical and hydrographic surveys.

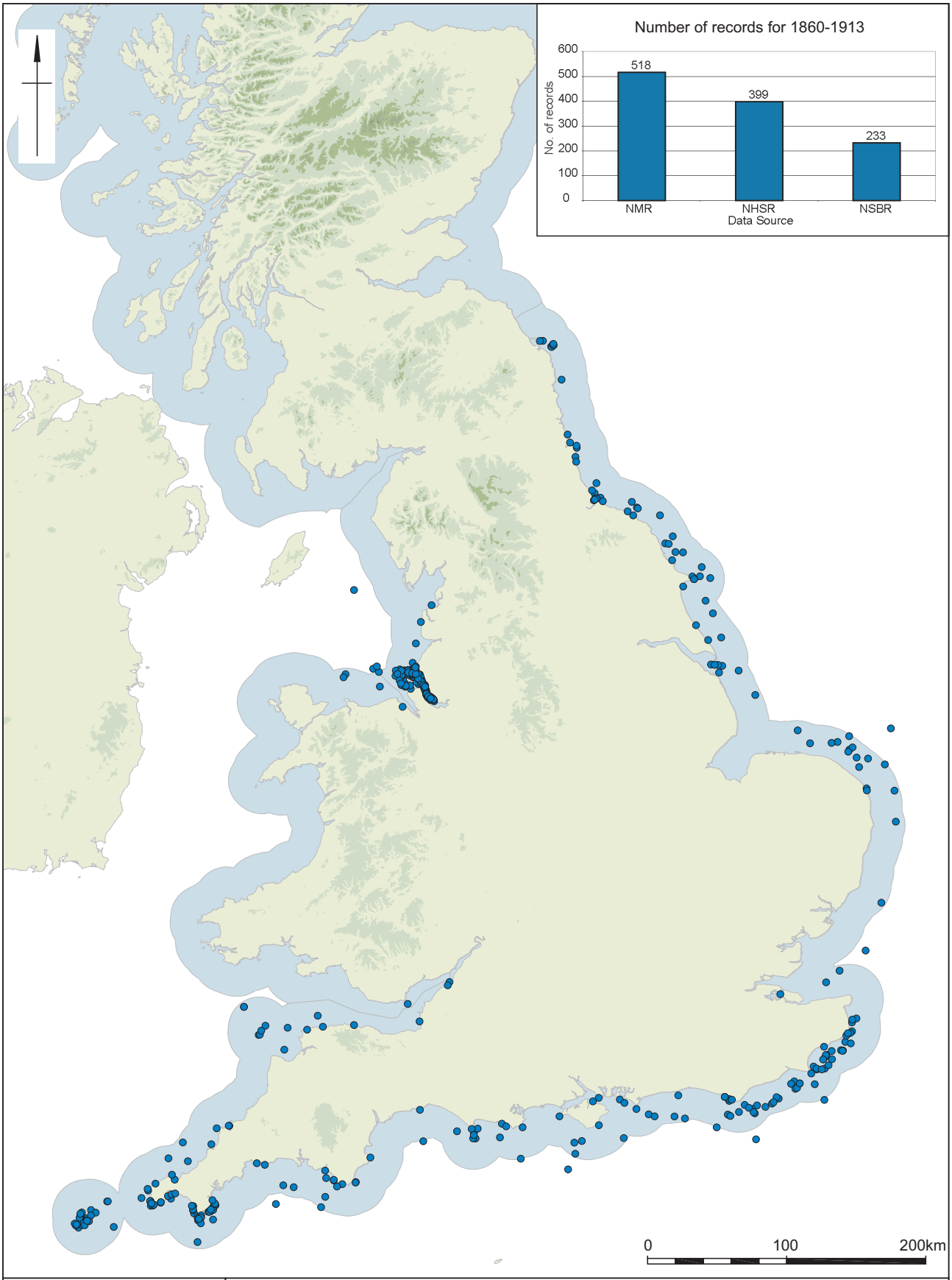
I – Investigation

This category describes the history of investigation of the wreck and can include interventions by archaeologists, salvors and others.



A schematic diagram of the Boats and Ships database

Figure 1

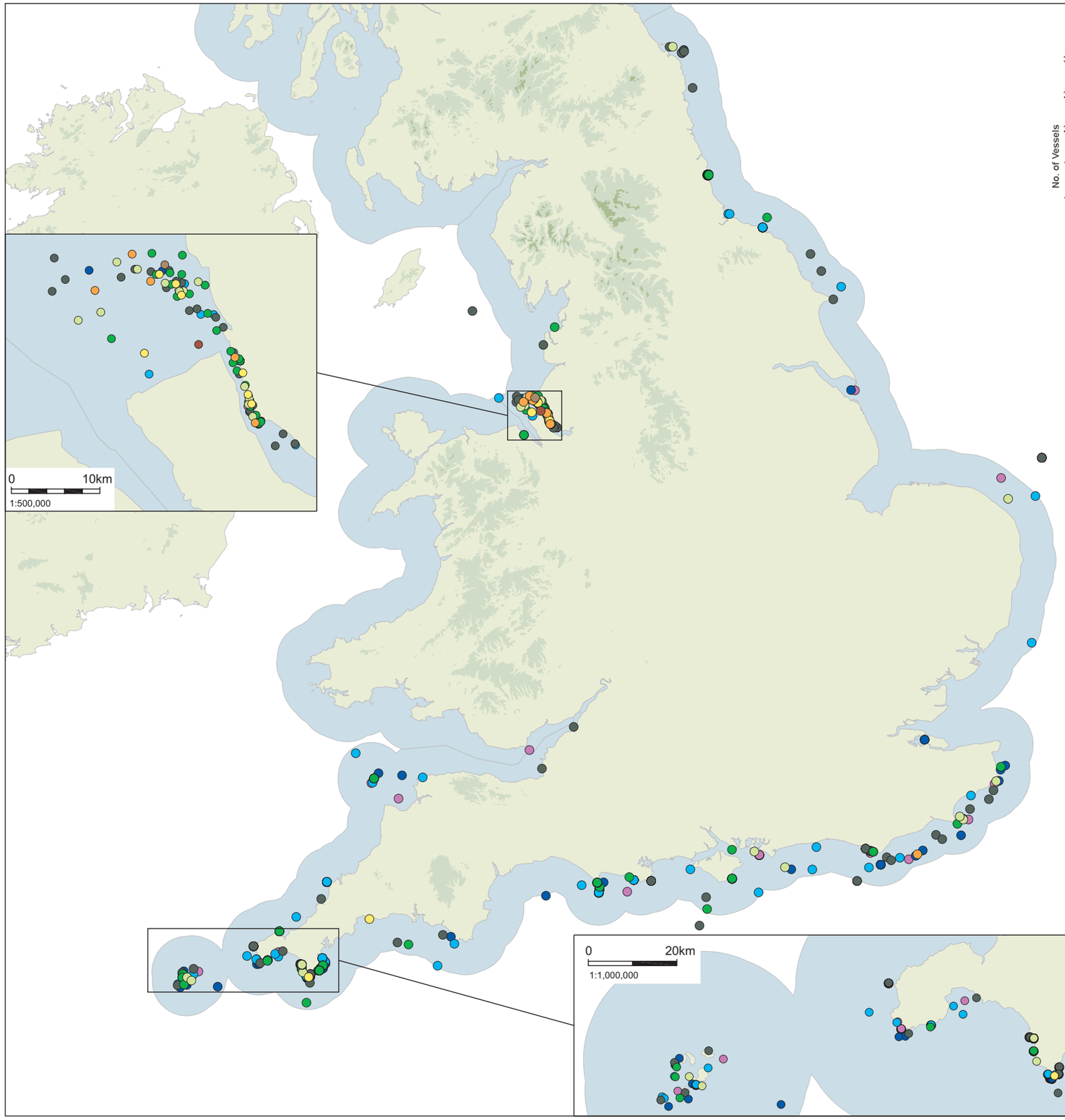


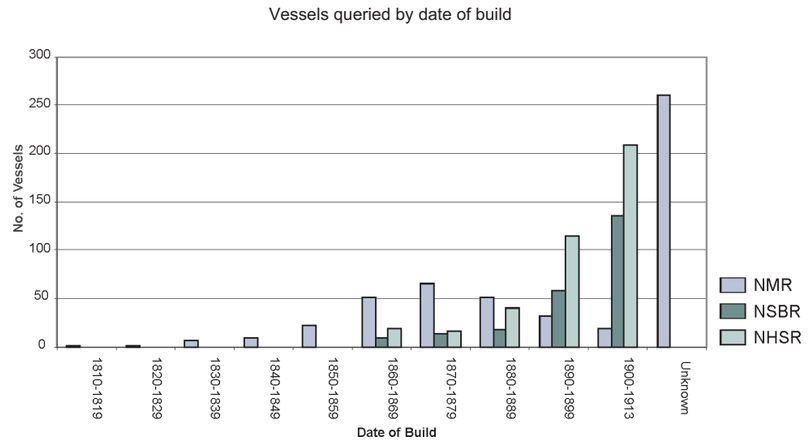
12 Nautical mile limit
NMR records

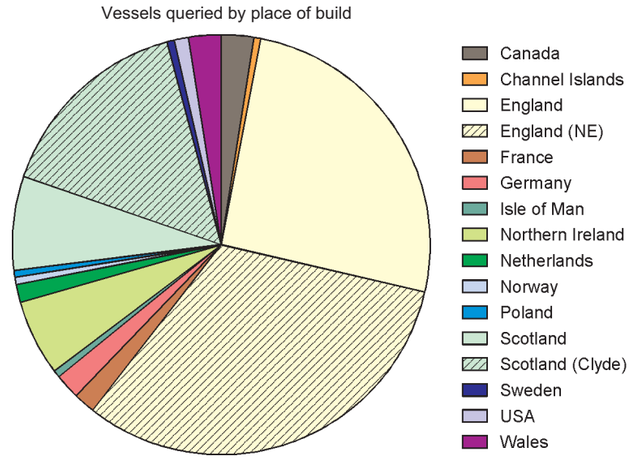
Wessex Archaeology

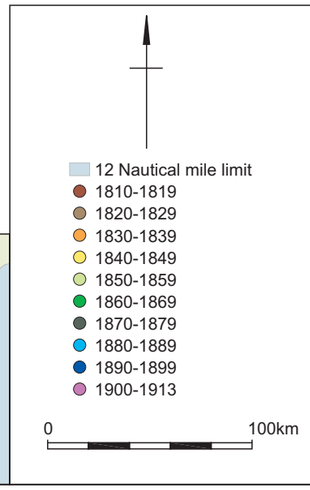
Date:	18/12/09	Revision Number:	0
Scale:	1:4,000,000 @A4	Illustrator:	KJB
Path:	W:\Projects\70861\Drawing Office\Report Figs\DBA\09-12-18		

Distribution of NMR records for the period 1860-1913 Figure 2









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Revision Number:	1
Illustrator:	KJB
Date:	13/10/10
Scale:	1:3,000,000 @A3
Path:	W:\Projects\70861\Drawing Office\
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NMR records queried by date of build

Figure 3

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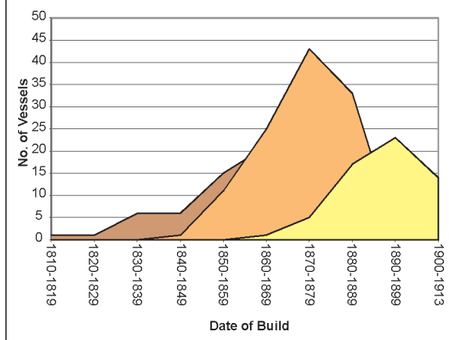
NMR records queried by object material and date of build



12 Nautical mile limit
Wood
Steel
Pine
Copper
Metal
Iron

0 100km

Revision Number:	0
Illustrator:	KJB
Date:	18/12/09
Scale:	1:3,000,000 @A3
Path:	W:\Projects\70861\Drawing Office\
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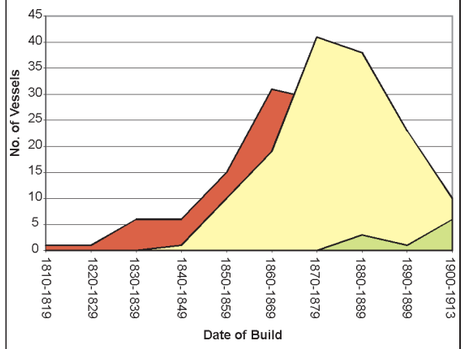
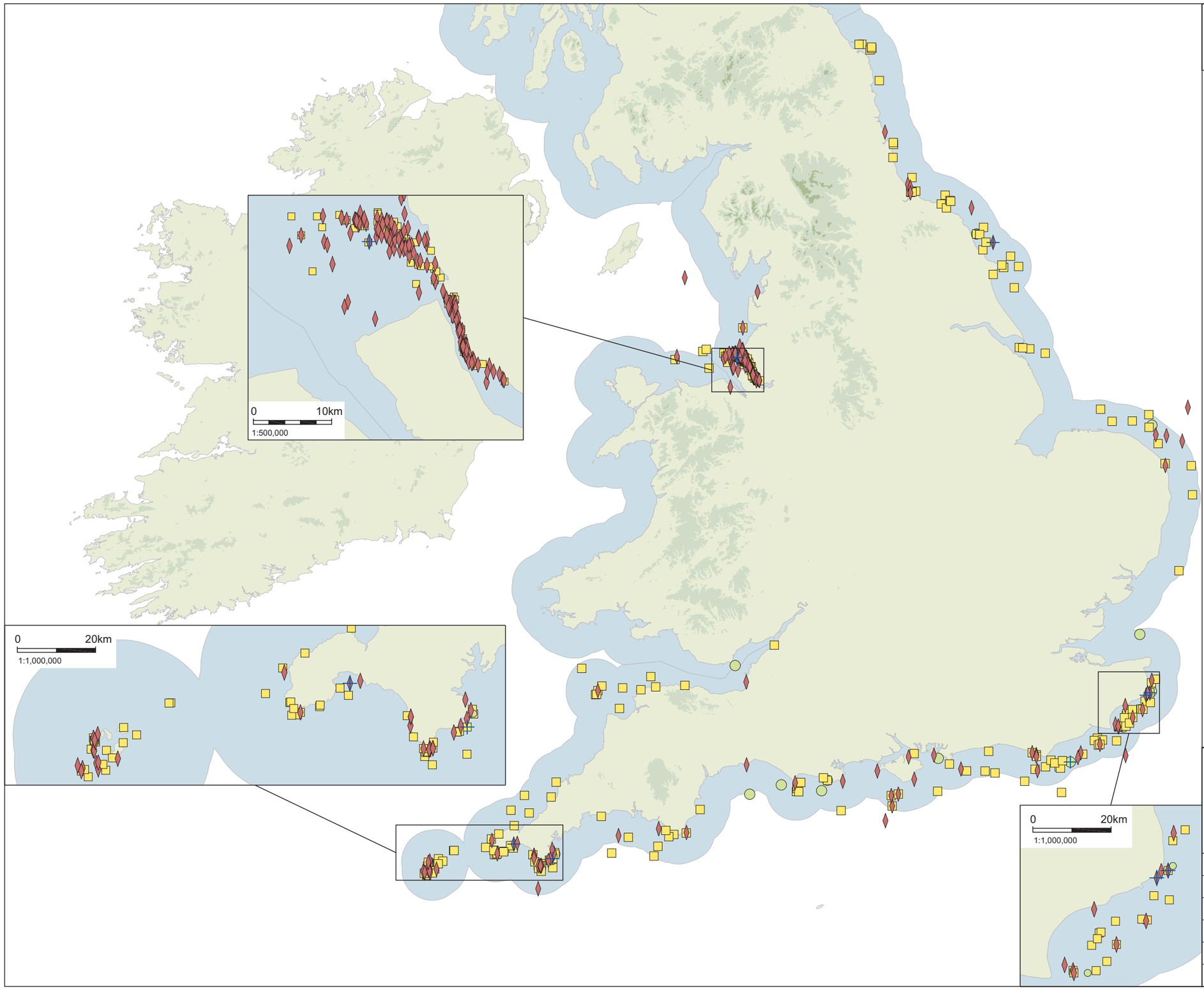
NMR records queried by object material

Figure 4

Wessex Archaeology

NMR Records queried by propulsion and date of build





12 Nautical mile limit
Towed
Sail
Steam
Engine

0 100km

Revision Number:	0
Illustrator:	KJB
Date:	21/12/09
Scale:	1:3,000,000 @A3
Path:	W:\Projects\70861\Drawing Office\
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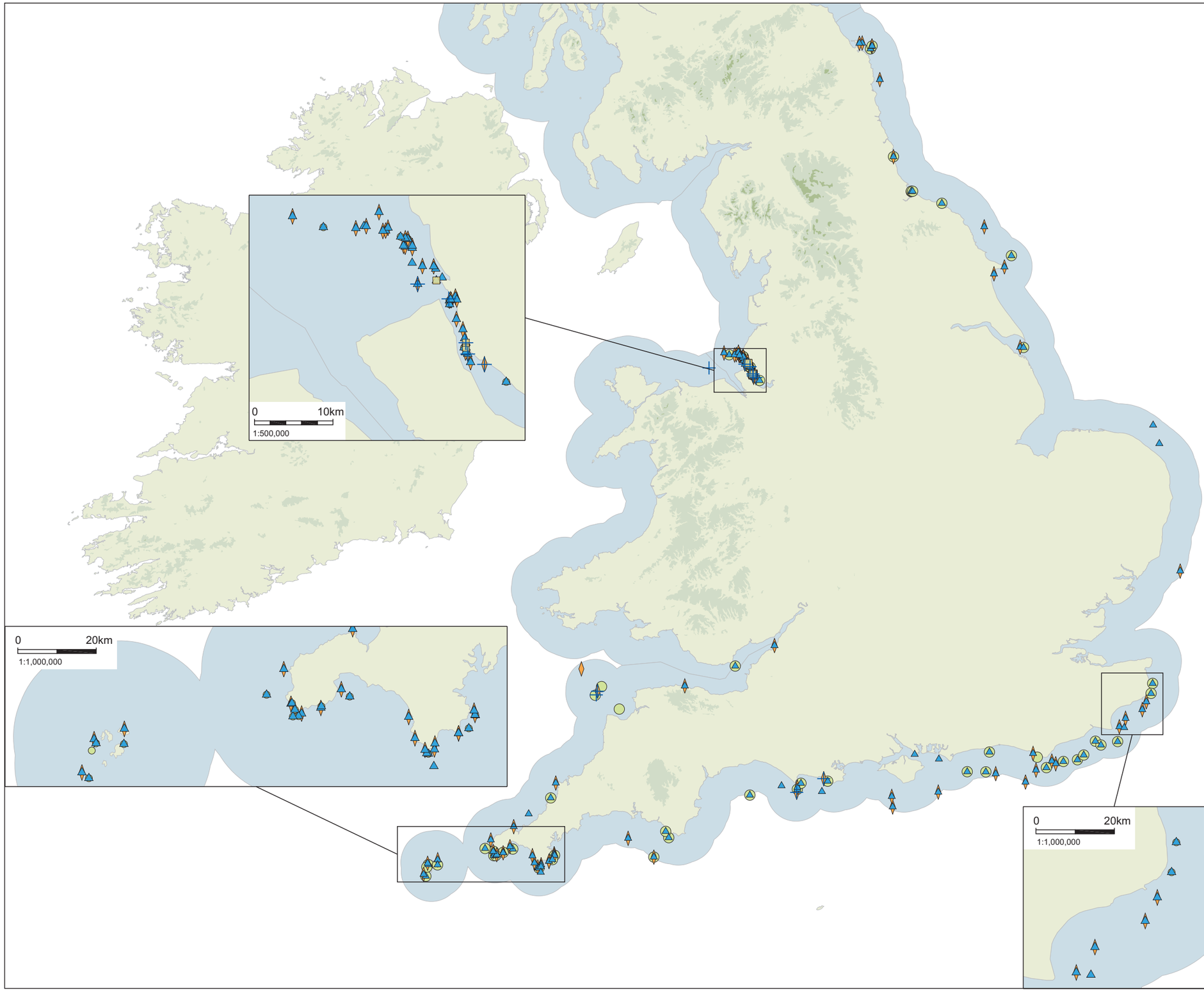
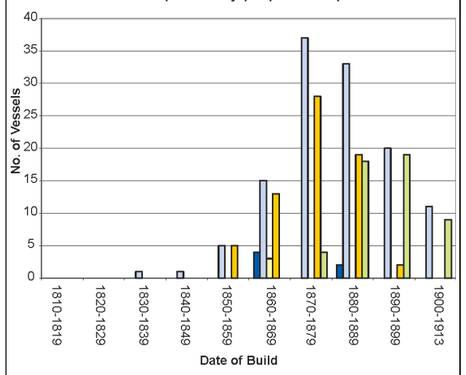
NMR Records queried by propulsion

Figure 5

Wessex Archaeology



NMR Records queried by propulsion specifics



- Paddle
- Screw
- Simple Engine
- Compound Engine
- Triple Expansion Engine

- 12 Nautical mile limit
- Paddle driven
- Screw driven
- Compound engine
- Simple engine
- Triple expansion engine

0 100km

Revision Number:	0
Illustrator:	KJB
Date:	22/12/09
Scale:	1:3,000,000 @A3
Path:	W:\Projects\70861\Drawing Office\
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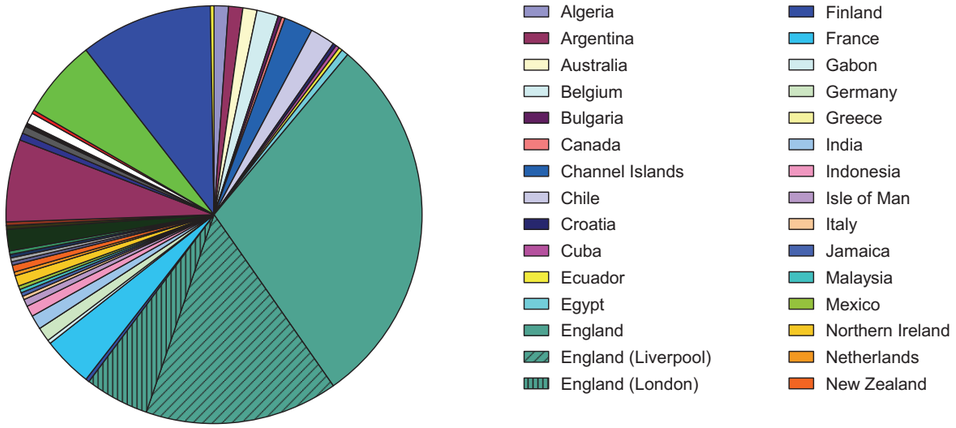
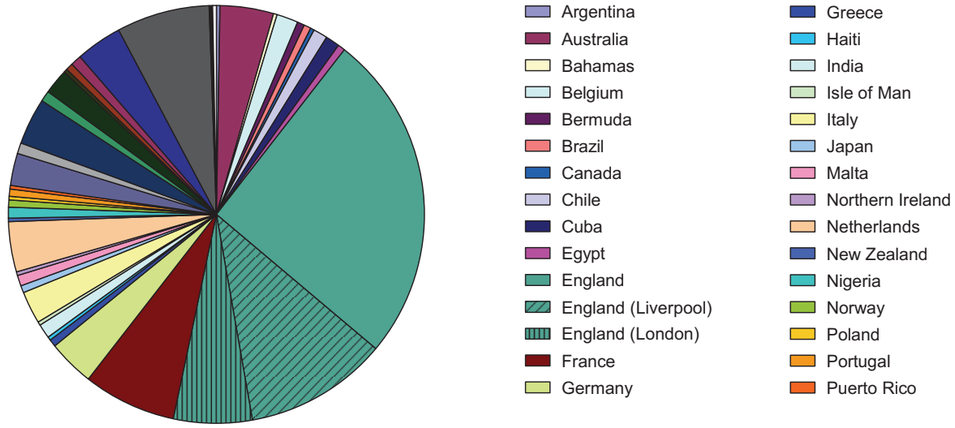
NMR Records queried by propulsion specifics

Figure 6

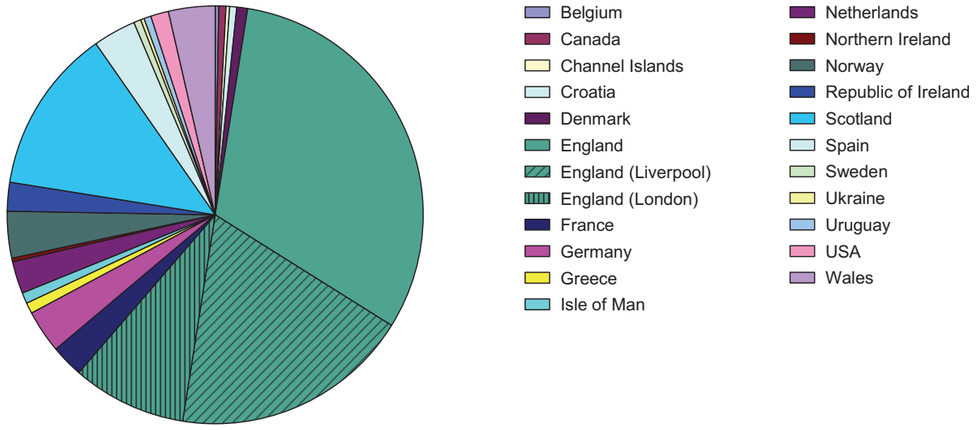
NMR Records queried by Country of Departure



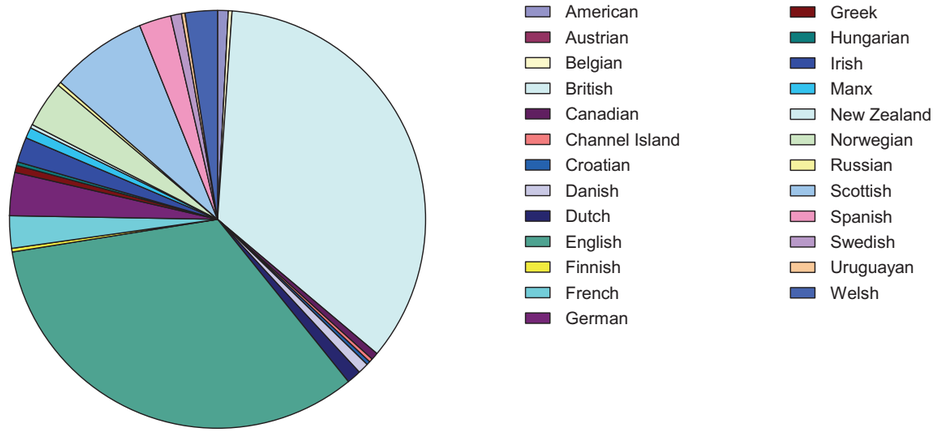
NMR Records queried by Country of Destination



NMR Records queried by Country of Registration



NMR Records queried by Nationality



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Date:	21/12/09	Revision Number:	0
Scale:	n/a	Illustrator:	KJB
Path:	W:\Projects\70861\Drawing Office\Report Figs\DBA\09-12-18		

NMR records queried by country of departure, destination, registration and nationality

Figure 7

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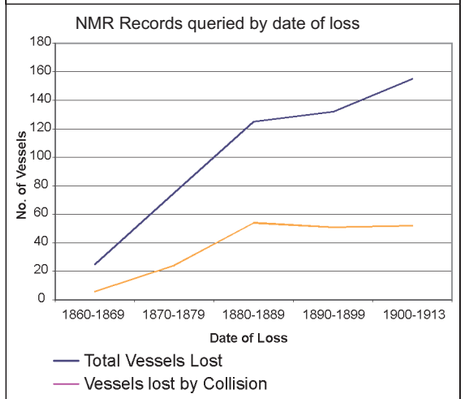

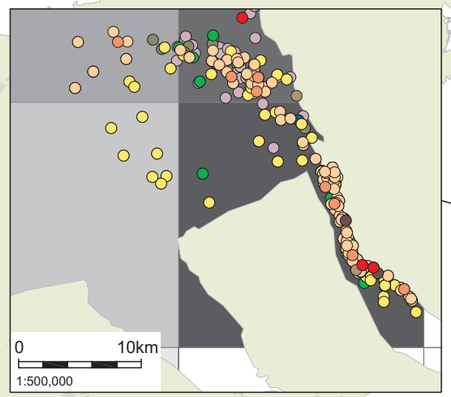

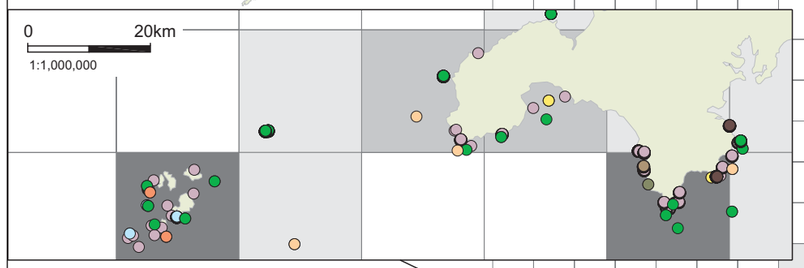

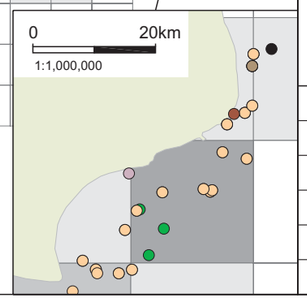

- Abandoned
- Beached
- Bilged
- Broken up
- Burnt
- Capsized
- Collision
- Dispersed
- Explosion
- Foundered
- Grounded
- Gun action
- Leaked
- Lost
- Recovered
- Scuttled
- Stranded
- Wrecked

Density of wrecks per 20km²:

- 0
- 1-5
- 6-10
- 11-20
- 21-30
- 80-90
- 100-114

0 100km

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Illustrator:	KJB
Date:	22/12/09
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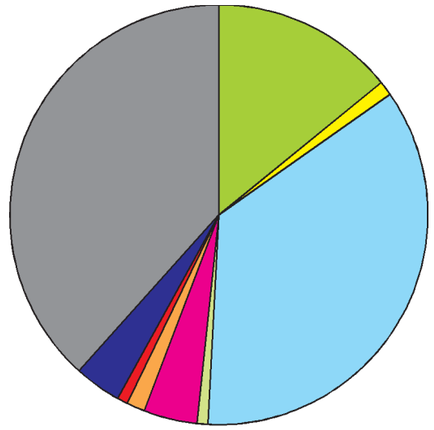
NMR records queried by date of loss, manner and location of loss

Figure 8

Wessex Archaeology

NMR Records queried by seabed survival



Mainly Intact
Partially Intact
Partially Buried
Buried
Flattened
Broken Up
Dispersed
Poor
Unknown

0 10km
1:500,000

0 20km
1:1,000,000

0 20km
1:1,000,000

12 Nautical mile limit
Mainly intact
Partially intact
Partially buried
Buried
Flattened
Broken up
Dispersed
Poor
Unknown

0 100km

Revision Number:	0
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Date:	22/12/09
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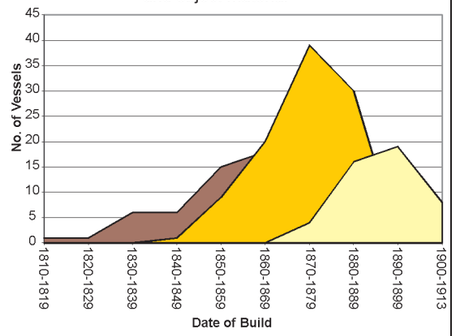
NMR records queried by seabed survival

Figure 9

Wessex Archaeology

Cargo vessels (NMR) queried by date of build and object material



Wood
Iron
Steel

12 Nautical mile limit
Barge
Barque
Barquentine
Brig
Brigantine
Cargo vessel
Clipper
Coaster
Collier
Craft
Dandy
Dry bulk cargo carrier
East Indiaman
Flat
Full rigged ship
Ketch
Liner
Packet
Paddle steamer
Schooner
Sloop
Smack
Snow
Square rigged vessel
Tanker

0 100km

0 10km
1:500,000

0 20km
1:1,000,000

0 20km
1:1,000,000

Revision Number:	0
Illustrator:	KJB
Date:	22/12/09
Scale:	1:3,000,000 @A3
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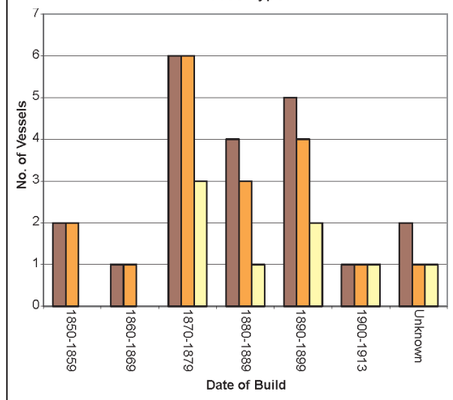
NMR records relating to the transport of cargo

Figure 10

Wessex Archaeology



12 Nautical mile limit
Vessels with passenger cargo
Passenger vessels with passenger cargo
Liners with passenger cargo

0 100km

Revision Number:	0
Illustrator:	KJB
Date:	22/12/09
Scale:	1:3,000,000 @A3
Path:	W:\Projects\70861\Drawing Office\
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NMR records relating to the transport of passengers

Figure 11

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12 Nautical mile limit
Military
Fishing
Industrial

0 100km

Revision Number:	0
Illustrator:	KJB
Date:	22/12/09
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Distribution of military, fishing and industrial vessels listed by the NMR

Figure 12

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