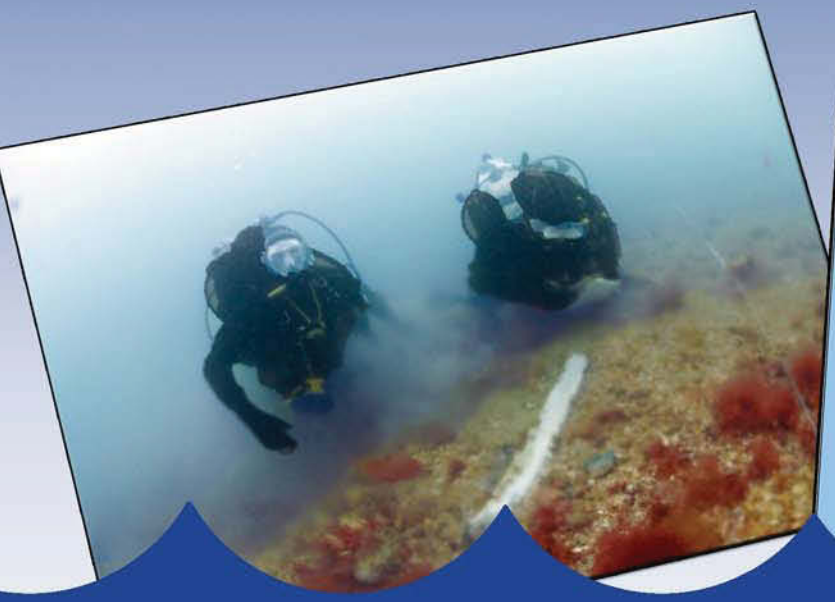
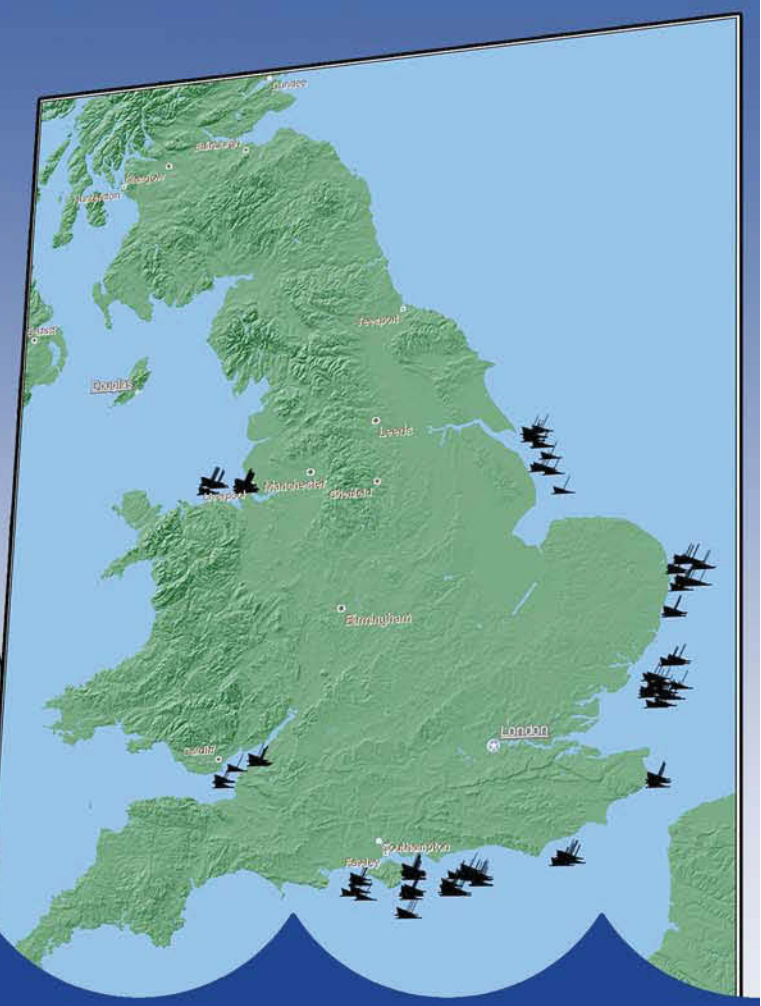
1808 Our Marine Historic Environment: Enhancing the National Monuments Record.

Phase One – Identifying the Scale of the Problem

Final Report

November 2010





Maritime Archaeology Ltd.

Our Marine Historic Environment: Enhancing the National Monuments Record

Phase 1: Identifying the Scale of the Problem

Final Report

Submitted by: Maritime Archaeology Ltd
In collaboration with: SeaZone Solutions Ltd

On behalf of English Heritage

Principle Contact: Dr Vir Dellino-Musgrave

023 8023 7300
vdm@hwtma.org.uk

Contents

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V. PROJECT SUMMARY

The Hampshire and Wight Trust for Maritime Archaeology (HWTMA)/Maritime Archaeology Ltd (MA Ltd) have been commissioned by English Heritage through the Aggregates Levy Sustainability Fund (ALSF) to undertake a project entitled 'Our Marine Historic Environment: Enhancing the National Monuments Record'. The overall aim of this project is to compare the wreck data maintained by the National Monuments Record (NMR) and United Kingdom Hydrographic Office (UKHO) datasets and, where applicable, suggest solutions as to how any discrepancies should be overcome. Continuous communication with the NMR and UKHO and SeaZone Solutions Ltd (hereafter SeaZone) will ensure detailed understanding of both datasets.

This project involves three phases of work:

- Phase One: identify the scale of the problem and make recommendations (this report).
- Phase Two: test and implement the recommendations based on Phase One results.
- Phase Three: production of guidance notes.

Phase One, the identification of the scale of the issue, was completed in September 2010 and consisted of:

- Undertaking a pilot study by reviewing NMR and UKHO datasets in and around all existing aggregates extraction areas;
- Undertaking a pilot study by reviewing NMR and UKHO datasets in the Thames Estuary and Humber areas since these are areas of potential aggregate extraction;
- Reviewing NMR and UKHO datasets for all Protected Wreck Sites in England as a comparative tool;
- Comparing the results of the three pilots; and
- Making recommendations for possible solutions.

This Phase One Report analyses the maritime NMR and UKHO data in areas that are currently subject to marine aggregate dredging as well as areas of potential marine dredging. This will support the work undertaken by the NMR in relation to finds reported through the EH-British Marine Aggregate Producers Association (BMAPA) Protocol for Reporting Finds of Archaeological Interest. It will enable better informed licencing processes and facilitate a greater understanding of the data required to support UK Government priorities such as marine spatial planning.

The usability within a spatial context, the format and the method of bringing both datasets together has been assessed and challenges identified. Phase 1 results have shown that:

- The assessment of data format demonstrated the challenges of converting large scale databases from paper format to a digital and spatial output.

- Attribute data fields and their content need some basic common standardisation to allow matching further records in the future.
- There is considerable scope for matching further records by addressing some of the contradictions identified. However, further index fields would be needed from both databases if records were to be matched beyond the use of known matching identifiers.
- Spatial discrepancies were identified in all pilot areas undertaken as part of this Phase One of work. Spatial discrepancies occurred in both distance and direction.
- The data attribute assessment illustrated that there are several fields in both datasets with equivalent data but presentation and use of this data is not always consistent.

Due to the nature of the UKHO and NMR datasets, this phase included cross referencing both datasets to enable consistency and to achieve the standards and protocols required for the marine sector (http://www.oceannet.org/). Consequently, this approach will enable the essential delivery of effective evidence to allow management decisions within the marine environment. Any issues regarding UKHO data are outside the framework of this project but, if they arise, they would be fed back to UKHO and SeaZone.

1. Project Description

1.1 INTRODUCTION

In February 2009, English Heritage (EH) invited Maritime Archaeology Ltd (MA Ltd), the trading company of the Hampshire and Wight Trust for Maritime Archaeology (HWTMA), to tender for a project, funded through the Aggregates Levy Sustainability Fund (ALSF), to develop an understanding of the perceived discrepancies between the National Monuments Record (NMR) and the United Kingdom Hydrographic Office (UKHO) datasets and where appropriate, suggest solutions. Some of these discrepancies were highlighted by the ALSF project *Refining Areas of Maritime Archaeological Potential (AMAPs) for Shipwrecks* (Project 5083) undertaken by Bournemouth University in 2007. This project subsequently formed the basis of the proposal *Refining Areas of Maritime Archaeological Potential* (AMAP) 2 (Project 5653) submitted to English Heritage by SeaZone and also inspired the proposal *Our Marine Historic Environment: Enhancing the National Monument Record* (Project 5553) submitted to English Heritage by the HWTMA in February 2008.

Following the *Management of Research Projects in the Historic Environment* (English Heritage 2006a), a phased approach to enhance the maritime NMR has been adopted, consisting of:

- Phase One: identify the scale of the problem and make recommendations
- Phase Two: test and implement the recommendations based on Phase One results.

- Phase Three: production of guidance notes.

This report focuses on the identification of the scale of the problem (Phase One) which consisted of:

- Undertaking a pilot study by reviewing NMR and UKHO datasets in and around all existing aggregates extraction areas;
- Undertaking a pilot study by reviewing NMR and UKHO datasets in the Thames Estuary and Humber areas since these are areas of potential aggregate extraction;
- Reviewing NMR and UKHO datasets for all Protected Wreck Sites in England as a comparative tool;
- Comparing the results of the three pilot dataset assessments.
- Making recommendations for possible solutions.

This project involves continuous communication with the NMR and SeaZone, who distribute UKHO data in a spatial format, to ensure a detailed understanding of both datasets.

Phase One analysed the maritime NMR and the UKHO data in areas that are currently subject to marine aggregate dredging as well as areas of potential marine dredging. This supports the work undertaken by the NMR in relation to finds reported through the EH-British Marine Aggregate Producers Association (BMAPA) Protocol for Reporting Finds of Archaeological Interest. Importantly, it enables better informed licencing processes and facilitates a greater understanding of the data required to support UK Government priorities such as marine spatial planning. Such work also facilitates '*a positive approach to managing the marine historic environment, which will be transparent, inclusive, effective and sustainable and central to social, environmental and economic agendas at a local as well as national level*' (DCMS 2005: 4).

Due to the nature of the UKHO and NMR datasets, this phase included cross referencing both datasets to enable consistency and to achieve the standards and protocols required for the marine sector (http://www.oceannet.org/). Consequently, this approach will enable the essential delivery of effective evidence to allow management decisions within the marine environment. Any issues regarding UKHO data are outside the framework of this project but, when they arose, they were fed back to the UKHO via SeaZone.

This report also serves as a summary for Phase One of the scheme of work clarifying how many matching and non-matching records have been identified within both databases, how all the matching records are related to each other and if any inconsistencies in information, spatial position or name exist. This report also provides the basis for Phase Two work.

1.2 CONTEXT

In 1990s, the NMR initiated the recording of sites and structures of archaeological and historic interest in England's Territorial Waters to complement its existing record of terrestrial sites. The NMR dataset is held in its Archive Monuments Information England (AMIE) in the form of an Oracle dataset and a Geographical Information System (GIS) depiction. The NMR AMIE database now has a maritime record of circa 48,000 monuments encompassing wrecks, reported casualties, crashed aircraft, fishermen's fastenings, isolated finds and submerged landscapes.

One of the resources used to create the NMR's maritime record during its initial compilation as part of the *Taking to the Water* (Roberts & Trow 2002) was a set of printouts provided by the UKHO. This data was supplied as a one off exercise. From this point in time, both the UKHO and NMR datasets have continued to develop independently due to differing remits: the NMR's remit is to record the historical and archaeological dimension of the marine environment whereas the UKHO is primarily concerned with gathering and supplying data for navigational safety purposes.

In 2007, the NMR acquired SeaZone Hydrospatial for inclusion in its GIS system known as deskGIS. Through using this data, it became apparent that there were perceived discrepancies between the NMR maritime data for located wrecks and the UKHO data supplied via SeaZone Hydrospatial. This issue was exacerbated when third parties undertaking maritime projects on behalf of English Heritage tried to work with both the NMR and UKHO data resulting in questions being raised as to which dataset was accurate, reliable and authoritative. Uncertainty arose over the extent to which apparently spatially separate records in the respective databases may be duplicates. This has caused challenges producing reliable density mapping for several ALSF-EH commissioned projects such as Refining Areas of Maritime Archaeological Potential for Shipwrecks – AMAP 1 (Project 5083MAIN), Identifying Shipwrecks of Historic Importance lying within Deposits of Marine Aggregate by Bournemouth University (Project 3916MAIN), Enhancing our Understanding: Navigational Hazards by Bournemouth University (Project 3917MAIN) and England's Historic Seascapes: Liverpool Bay Pilot by Wessex Archaeology (Project 3783MAIN).

In a SeaZone training course held at the NMR offices at the end of January 2007, the inconsistency issue was again raised and the relevance of enhancing the maritime NMR in conjunction with the UKHO dataset was clear. The main perceived inconsistencies between the NMR and UKHO datasets are summarised in **Section 1.2.1**. Furthermore, Martin Newman at the NMR (English Heritage) has discussed this issue with SeaZone and it was agreed the crucial necessity to undertake such exercise for both organisations (Newman *pers. comm.* February 2007). SeaZone is supportive of seeing such work done due to its relevance regarding the improvement of marine data quality and development of data standards at a national level (see

http://www.dnf.org/Pages/home/default.asp). In a workshop hosted by SeaZone in July 2007, the inconsistency issue in different datasets was discussed and it was clear that there is an urgent need in the marine sector of accessing accurate data to inform decisions on marine planning, marine licensing, case work delivery, and historic and natural environment management related issues.

1.2.1 Perceived Inconsistencies

The following list provides a summary of the perceived inconsistencies:

- The UKHO and NMR datasets do not correlate with one another when viewed spatially on a GI system. Any issues identified related to the UKHO were not part of this project but they were fed back into the UKHO/SeaZone.
- The lack of spatial correlation between the UKHO and NMR datasets is due to data projection issues (i.e. UKHO dataset is delivered in WGS84 coordinate system and NMR dataset GI depiction is delivered in OSGB36). Projection issues were dealt with by utilising the Ordnance Survey transformation method OSTN02. Variations in the distance between both datasets were assessed after OSTN02 was applied.
- Any repetition of wreck names within the NMR dataset was discussed with the NMR.
- There are differences in the spelling of wreck names between the UKHO and NMR datasets (although the NMR records alternative names which are not available in the GIS dataset). It is recognised that the recording of monument names has always been somewhat problematic in that names change over time as do variations in their spelling, etc. The NMR records alternative names although this field is not one of those available as an attribute in the monuments layer on GIS. The NMR recording rules specify that the primary name should be the name at the time of sinking and former names are recorded as alternatives. Where the name is unknown, however, a more modern descriptive name has, where appropriate, been used (e.g. The *Studland Bay* Wreck). The NMR has also suggested that there are more detailed recording rules concerning serial numbers and foreign names that can be supplied once the project commences. The proposed project looked at ensuring that the name recorded in the UKHO dataset for a wreck is one of those recorded by the NMR, if not the primary name, and assessing how often the NMRs primary name is not the one given in UKHO wreck data.
- There are also issues relating to the following as a result of the differing evolution of the two datasets since the original data supply to the NMR;
    - Locational accuracy of wrecks recorded by the UKHO and NMR: variations in distances between both datasets were assessed after OSTN02 was applied.
    - Up-to-date information on newly discovered wrecks by UKHO, which may be recorded as casualties by the NMR (i.e. a shipping loss for which the location is unknown). This project looked at how many cases there are where the NMR has a location for a loss but no location for physical remains on the seabed and compare this to the UKHO dataset

where a record has been created of a definite real physical location which has not yet been fed back into AMIE.
- Wrecks in the same location for which one dataset gives a name and the other does not or gives an alternative name. A possible solution to this issue could be through regular updates. The NMR will feed back into this providing advice as to how the NMR would like to receive the updates and how often.

It is important to note that the UKHO compiles data to provide information to facilitate safe navigation. The NMR, however, compiles data to enable a better understanding of the historic environment. These issues were taken into consideration during the duration of this project since this can affect levels of accuracy and degrees of bias. These levels of accuracy and degrees of bias are dependent on the method used to gather the data and purpose for which the data was gathered.

1.3 AIMS AND OBJECTIVES

1.3.1 General Aim

The overall aim of this project is to examine the perceived inconsistencies between the NMR and UKHO datasets and, where applicable, suggest solutions as to how these discrepancies should be overcome.

1.3.2 General Objectives

- Undertake a pilot study on the following selected trial areas: 1) all existing licensed aggregate extraction areas, extending their size to a buffer of 2,000 metres to obtain a better catchment of wrecks; 2) Thames Estuary and Humber areas as these are areas of potential marine aggregate extraction; 3) all Protected Wreck Sites in England as a comparative tool. This will allow an informed assessment of the scale and complexity of the issue posed by discrepancies between UKHO and NMR wreck datasets.
- Make recommendations on addressing the discrepancies to ensure data consistency noting the resources required to achieve them.

1.3.3 Specific Objectives

The specific objectives for the overall project are as follows:

1. To produce recommendations for the NMR with regard to best practice as to how the marine historic environment is recorded for projection on a GI system. At present, NMR remit is limited to 12nm and NMR current AMIE database does not facilitate recording in the WGS84 Datum. Possible solutions to this issue will also consider maintaining terrestrial and marine compatibility by looking at for example online NMR resources.

2. To identify ways in which the NMR can enhance its existing record with complementary and supplementary elements in the UKHO database with

an estimated time-scale as to how long this will take and what resources will be required.

3. To produce recommendations for the NMR as to how an effective flowline can be established with the UKHO to maintain the ongoing accuracy of both datasets so that the discrepancies and their consequences addressed by this project will not recur in the future.

4. To identify how SeaZone and the NMR could work together with an integrated approach.

5. To include appraisal of marine historic environment data acquisition (including online NMR resources), management and access issues from such current and upcoming initiatives such as marine aggregate initiatives underway acquiring data (e.g. Regional Environmental Characterisations), as well as Government-led developments such as Marine Environmental Data and Information Network (MEDIN) (see http://www.oceannet.org/) and Infrastructure for Spatial Information in Europe (INSPIRE) (see http://inspire.jrc.ec.europa.eu/index.cfm).

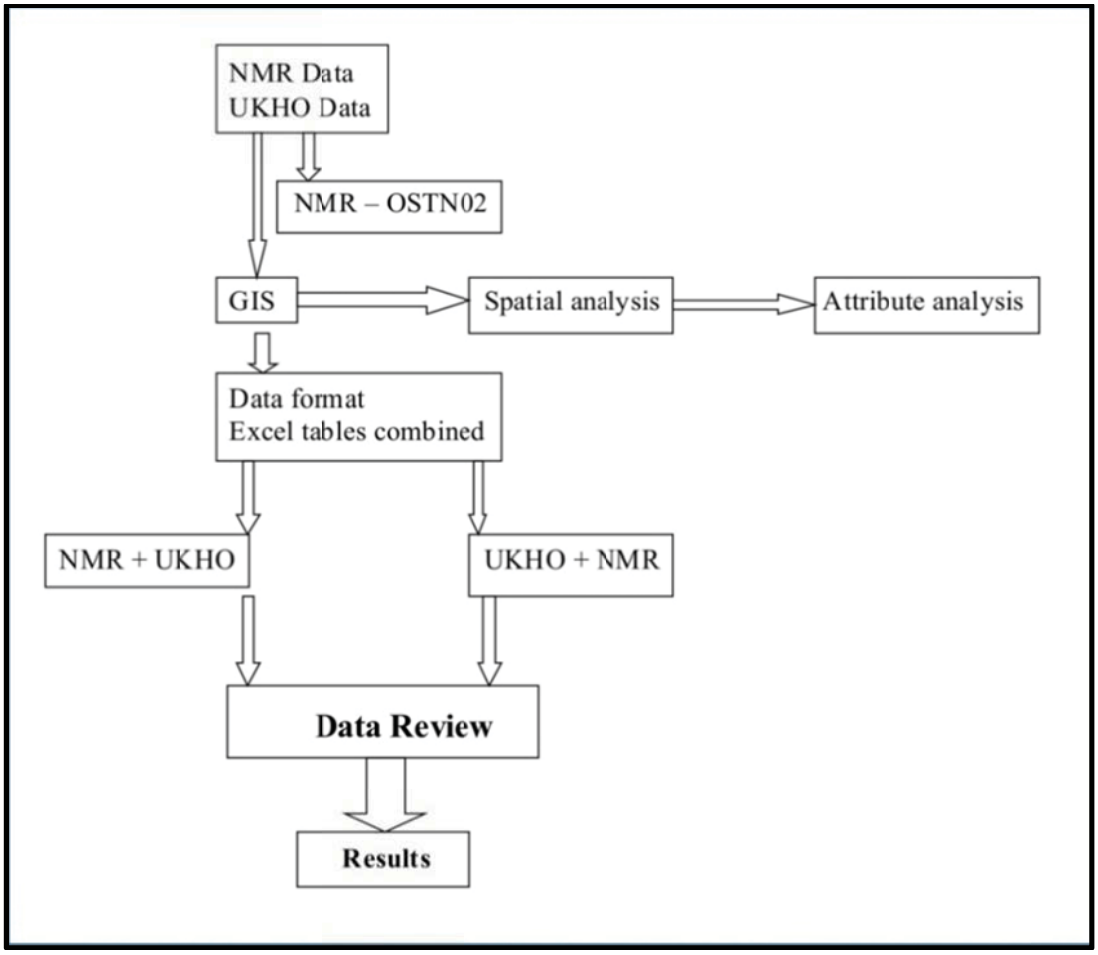
2. Methodology

The project has been carried out in line with the project management guidance set out in MoRPHE (English Heritage 2006a).

Following the methods developed during the AMAP1 project (see Merritt 2007, 2008), the methodological development of this Phase One of the project was undertaken by primarily reviewing shipwreck datasets available from:

- AMIE, including known wrecks and casualty records or named locations.
- UKHO (via SeaZone), including wrecks and obstructions.

This is summarised in the following graph and further discussed within this section:



The review was undertaken utilising a GIS platform and by accessing AMIE data through remote access provided by the NMR.

Close communication with English Heritage NMR staff was maintained throughout the duration of this project as well as ongoing liaison with SeaZone staff.

The *Guidelines for English Heritage Projects Involving GIS* (Froggatt 2004), and UK Gemini and GIgateway™ standards (http://www.gigateway.org.uk/metadata/standards.html) were considered throughout the duration of this Phase One project.

Due to the nature of UKHO and NMR datasets, this Phase One Study included cross referencing both datasets to enable future consistency according to standards and protocols for the marine sector (http://www.oceannet.org/). Consequently, this approach will enable the essential delivery of effective evidence to allow management decisions within the marine environment.

2.1 FAMILIARISATION

Familiarisation with the nature of both the NMR and UKHO datasets was undertaken by reviewing the following projects:

Project title	Completion date	Outputs to use in the proposed research
ALFM 3767MAIN. On the Importance of Shipwrecks	March 2006	• final report • MS Access database
ALFM 3916MAIN. Identifying Shipwrecks of Historic Importance lying within Deposits of Marine Aggregate	March 2007	• final report • MS Access database
ALFM 3916 (2nd phase). Identifying Shipwrecks of Historic Importance lying within Deposits of Marine Aggregate	March 2008	• final report • MS Access database
ALFM 3917MAIN. Enhancing our Understanding: Navigational Hazards	February 2007	• final report • GIS component
ALFM 5083PD. Refining Areas of Maritime Archaeological Potential for Shipwrecks – AMAP 1	March 2008	• Wreck data review report (Pilot: Solent) • Final project report • GIS component
ALFM 3783MAIN. England's Historic Seascapes: Liverpool Bay Pilot	March 2006	• final report • method statement • GIS component
ALFM 4728MAIN. England's Historic Seascapes: Solent Pilot	March 2007	• final report • GIS component
ALFM 4729MAIN. Southwold to Clacton	March 2007	• final report • GIS component
ALFM 4730MAIN. Whithernsea to Skegness	March 2007	• final report • GIS component
ALFM 4731MAIN. Scarborough to Hartlepool	March 2007	• final report • GIS component

This quick review enabled an introduction to the perceived inconsistencies between NMR and UKHO datasets previously mentioned in **Section 1.**

During this familiarisation stage, information regarding some aspects as far as the maritime NMR dataset is concerned was gathered. For example, how the locational information from the maritime NMR dataset was derived, the source of the location and any transformations undertaken.

Marine historic environment data acquisition (including online NMR resources), management and access issues from current and upcoming initiatives such as marine aggregate initiatives underway acquiring data (e.g. Regional Environmental Characterisations), as well as Government-led developments

such as Marine Environmental Data and Information Network (MEDIN) (see http://www.oceannet.org/) and Infrastructure for Spatial Information in Europe (INSPIRE) (see http://inspire.jrc.ec.europa.eu/index.cfm) was also appraised as part of this stage. These were taken into account when making recommendations to further enhance the NMR discussed in **Section 5**.

2.2 Pilot Studies

Phase One focused on identifying the scale of the problem. This was achieved by undertaking three pilot studies which comprised:

Pilot Study One: All Aggregate Extraction Areas in England

This pilot was undertaken in and around all existing aggregate extraction areas in England. NMR and UKHO datasets were reviewed in all existing aggregate extraction areas. The size of the current aggregate extraction areas were extended with a buffer of 2,000 metres (**Figure 1**). This buffer enabled a better catchment of wrecks around these aggregate areas to allow a better informed assessment to identify the scale of the problem, considering it is not expected to find many wrecks in current aggregate extraction areas.

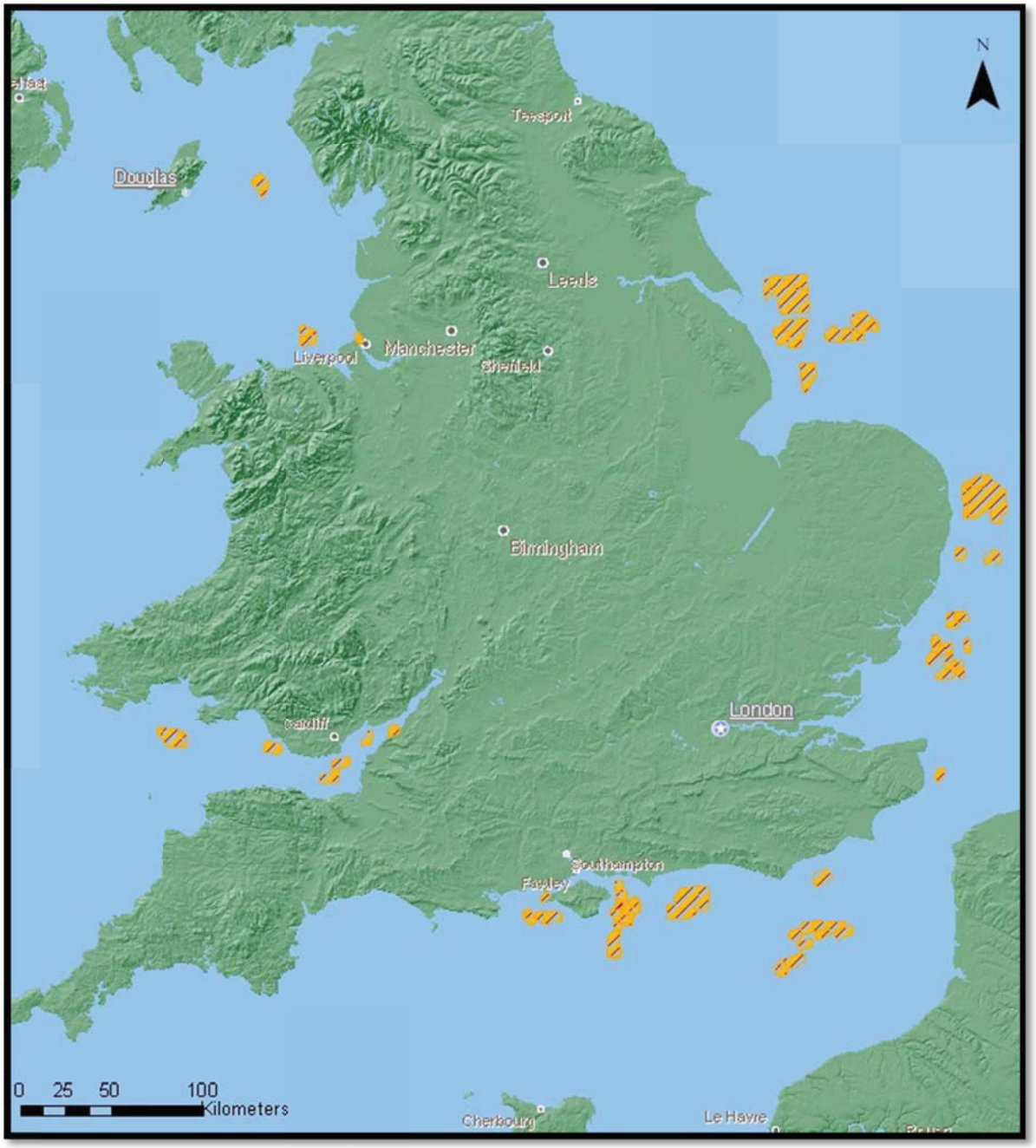


Figure 1. All aggregate extraction areas around England represented with a buffer of 2,000 meters for the purposes of this project

Pilot Study Two: Thames Estuary & Humber

Due to current offshore development pressures, this pilot study focused on two areas: Thames Estuary (North boundary: Southwold, South boundary: Clacton-on-Sea to the limit of UK Controlled Waters) and Humber (North boundary: Humber Estuary, South boundary: The Wash to the limit of the UK Controlled

Waters) as illustrated in the **figures 2** and **3** respectively. The NMR and UKHO datasets were reviewed within these areas to assess and quantify the issues within these two datasets.

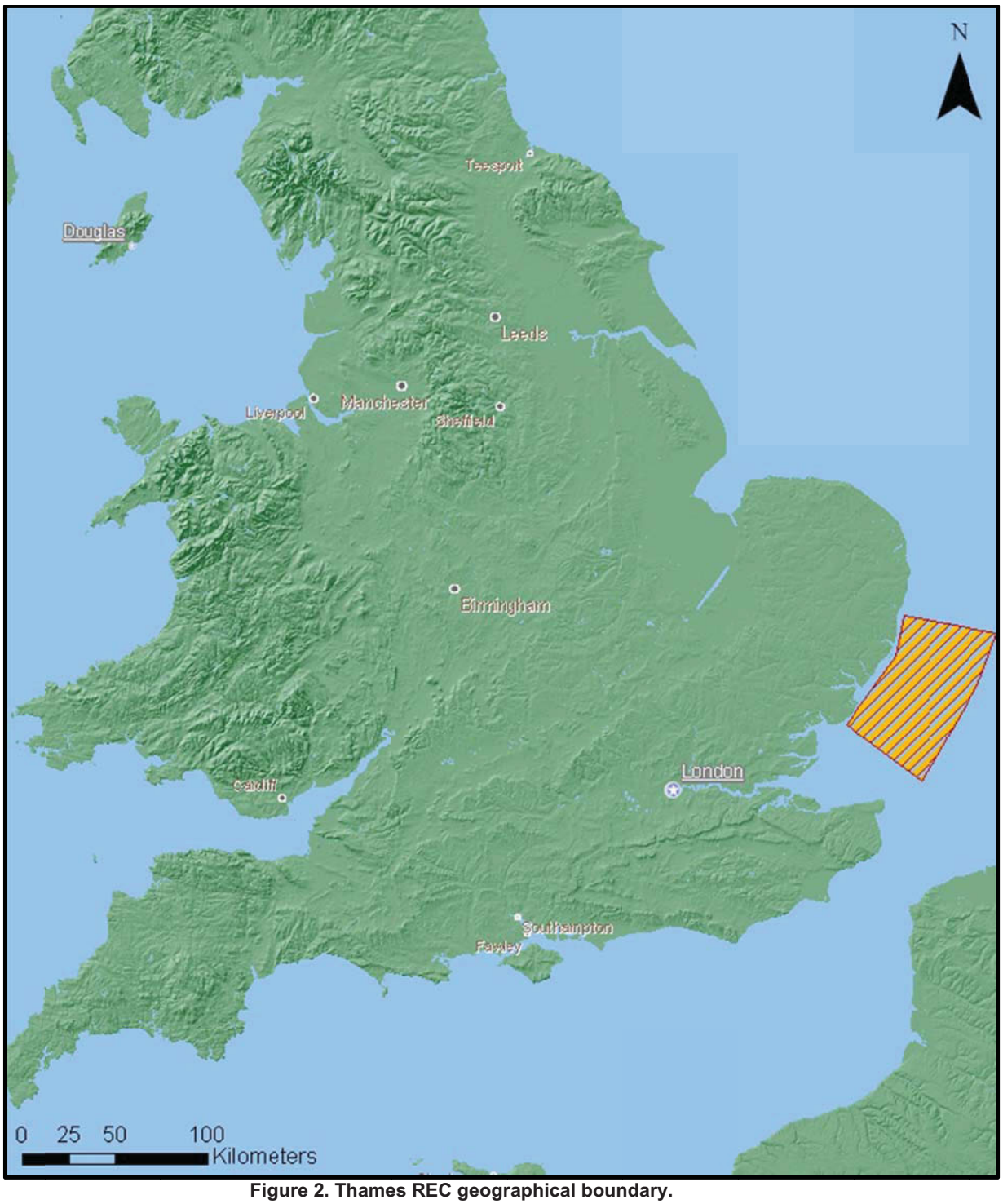


Figure 2. Thames REC geographical boundary.

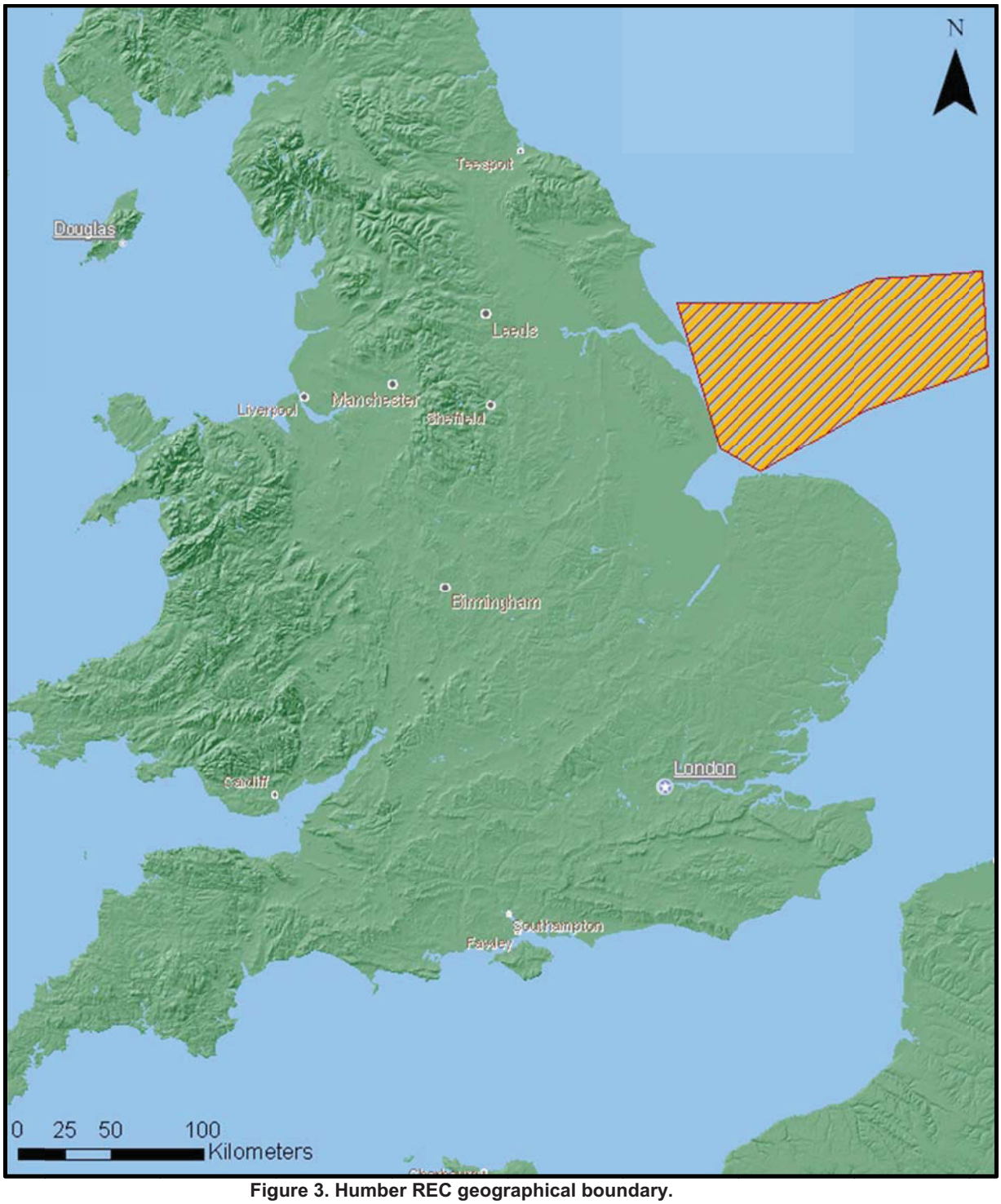


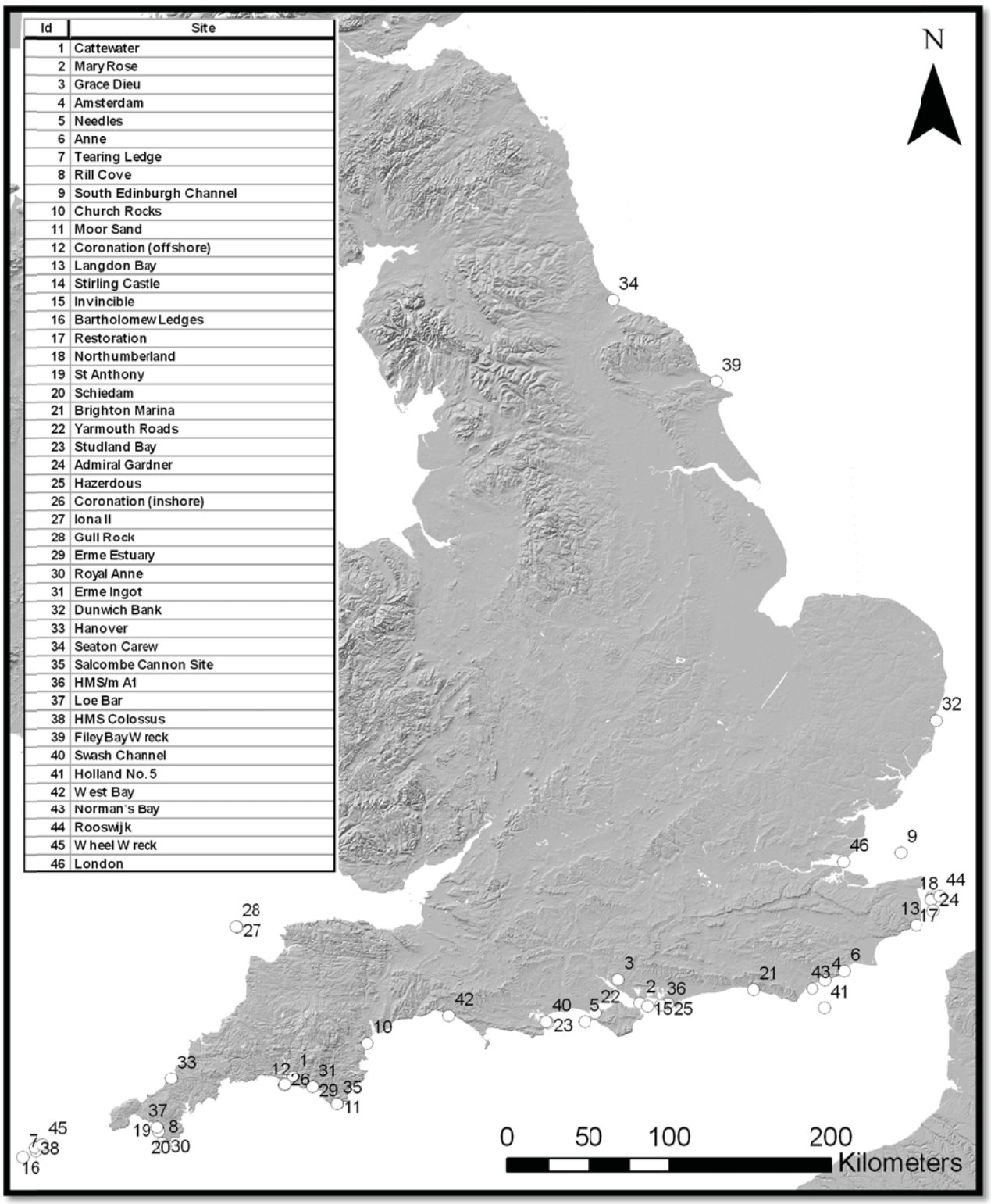
Figure 3. Humber REC geographical boundary.

Pilot Study Three: Protected Wreck Sites in England

A review of the NMR and UKHO datasets of all Protected Wreck Sites in England was undertaken as a comparative tool (**Figure 4**). It is worth noting that this report utilises examples of wrecks protected under both Sections 1 and 2 of the Protection of Wrecks Act 1973.

These three pilots allowed a varied catchment area of wrecks to enable an informed assessment to identify, qualify and quantify the scale of the problem. This was achieved by:

- Assessing data format,
- Assessing NMR and UKHO datasets within a GIS platform,
- Assessing data coverage,
- Assessing data attribute contents,
- Identifying data conflicts, and
- Updating data in AMIE.



Id	Site
1	Cattewater
2	Mary Rose
3	Grace Dieu
4	Amsterdam
5	Needles
6	Anne
7	Tearing Ledge
8	Rill Cove
9	South Edinburgh Channel
10	Church Rocks
11	Moor Sand
12	Coronation (offshore)
13	Langdon Bay
14	Stirling Castle
15	Invincible
16	Bartholomew Ledges
17	Restoration
18	Northumberland
19	St Anthony
20	Schiedam
21	Brighton Marina
22	Yarmouth Roads
23	Studland Bay
24	Admiral Gardner
25	Hazerdous
26	Coronation (inshore)
27	Iona II
28	Gull Rock
29	Erme Estuary
30	Royal Anne
31	Erme Ingot
32	Dunwich Bank
33	Hanover
34	Seaton Carew
35	Salcombe Cannon Site
36	HMS/m A1
37	Loe Bar
38	HMS Colossus
39	Filey Bay Wreck
40	Swash Channel
41	Holland No. 5
42	West Bay
43	Norman's Bay
44	Rooswijk
45	Wheel Wreck
46	London

Figure 4. Protected Wreck Sites in England.

2.3 Assessing Data Format

The format of both the NMR and UKHO datasets have been undertaken to achieve the objectives outlined in **Section 1.4**, in particular, to produce recommendations for the NMR with regard to best practice as to how the marine historic environment is recorded for projection on a GIS system. Importantly, the format in which a dataset is provided determines how easily that dataset is used.

The data assessment was undertaken on the basis that the data for the three pilot areas was requested for use in a GIS format. Once the data was delivered, metadata, file formats, supporting information and additional data was assessed as well as the ease of integrating the data into a GIS platform.

Any provision of supporting documentation, such as instructions of use and metadata to aid the user in utilising such datasets, was also assessed.

2.4 The UKHO and AMIE Records in GIS

The NMR AMIE database has a maritime record of circa 48,000 monuments encompassing wrecks, reported casualties (i.e. shipping losses for which the location is unknown), crashed aircraft, fishermen's fastenings, isolated finds and submerged landscapes. For the purposes of this project, only wrecks and casualties were assessed.

The UKHO database contains wrecks and obstructions. Wrecks are defined as 'the ruined remains of a stranded or sunken vessel which has been rendered useless' (IHO Dictionary, S-32, 5th Edition, 6027). Obstruction, in marine navigation, is defined as 'anything that hinders or prevents movement, particularly anything that endangers or prevents passage of a vessel'. The term is usually used to refer to an isolated danger to navigation (IHO Dictionary, S-32, 5th Edition, 3503). Often obstructions contain information about wrecks and therefore these were assessed within the scope of Phase One of this project.

The UKHO dataset is delivered using a globally applicable Coordinate Reference System (CRS) known as the World Geodetic System of 1984 (WGS84). The NMR dataset GI depiction is delivered using the British National Grid, the national standard CRS used for land mapping in the British Isles (http://www.seazone.com/uploads/refzone-Introduction_to_CoordinateReferenceSystems.pdf). The OSGB36 is a plane coordinate system for use on land within Britain. The projection is a based on a modification of the Transverse Mercator projection, based on the OSGB36 datum and the Airy 1830 Ellipsoid. World Geodetic System, WGS84 is a geocentric reference Ellipsoid and a geodetic datum. It defines the centre of mass of the Earth as its origin, and the direction of the Earth's axis as the minor axis of the reference ellipsoid. WGS84 does not specify a projection, which must be defined as appropriate by the user. When dealing with data from different sources it is crucial to know the projection. A single physical location on the Earth can have different coordinates depending on the datum used. Therefore, if data is loaded

with a datum other than that used in its capture then the dataset will be displayed in an incorrect spatial location (for further details see SeaZone 2006). Hence, to reduce average variation in distance, the geographic transformation to 'OSGB_1936_to_WGS_1984_Petroleum' (Ordnance Survey transformation method OSTN02) was utilised as part of this project. However, non-consistent spatial variations were still identified which are further discussed in **Section 3**.

From a methodological point of view, the NMR and UKHO datasets were delivered as two separate databases. To allow comparisons of the extent and content of the NMR and UKHO shipwreck data, these two databases were joined together via the UKHO UID (field name: HOID) recorded within the MS Excel table (**identifier data.xls**) provided by the NMR. This allowed viewing the data in a single table, forming the basis on which to match both datasets. All the matching records could then be reviewed and compared. This is further discussed in **Section 3**.

The UKHO Obstructions and NMR casualty records were compared throughout the pilot study areas one and two. This enabled a more comprehensive understanding of the extent of the data and identification of inconsistencies. The UKHO Obstructions data was compared to the NMR known wreck point data. The NMR casualty records data was compared to the UKHO known wreck data. Due to time constraints, ten case studies were selected and analysed across pilot study areas one and two and are presented in **Section 3**.

The difference in data management for the three pilots areas are described in detail below.

Pilot Study One (All Aggregate Areas in England) and Pilot Study Two (Thames Estuary & Humber)
The data for both pilot studies came in the same shapefile. Hence, the methods followed for both pilots are discussed together.

For organisational purposes, both pilot studies were assessed in two separate shapefiles. No duplicates within the UKHO wrecks upgrade database and NMR dataset were encountered. All wrecks identified that lie outside the 12 nautical mile extent were excluded. The reasons as why the 12 nautical mile limit was chosen are explained in **Section 2.5**. Both datasets were then joined utilising the method explained above.

A copy of a new shapefile was generated in MS Excel to use as a working document. Unnecessary fields that were not used and data that was gathered during the review and comparison process were recorded into this working document.

Pilot Study Three (Protected Wreck Sites in England)
Pilot study three includes all the protected wrecks in England. Data from the NMR was received both as points and polygon data, with a total number of 49 entries. Data included wrecks protected under both Section 1 and Section 2 of the Protection of Wrecks Act 1973. When matching those entries to only those wrecks protected under Section 2 of the Protection of Wrecks Act 1973 (i.e those wrecks which are managed by English Heritage) a total of 46 entries were identified at the time of undertaking this pilot study. NMR and UKHO datasets for this pilot were also joined via the UKHO UID (field name: HOID) recorded within the MS Excel table (**identifier data.xls**) provided by the NMR. This enabled comparison of both datasets in a GIS platform allowing spatial and attribute analysis in a time and cost effective way.

Queries were run in GIS to compare location and attribute contents. The distance between the polygon data provided by the UKHO and the point data provided by NMR was also recorded. Inconsistencies identified during the data review were recorded in a MS Excel 'working document' spreadsheet. Results of this process are discussed in **Section 3**.

2.5 Assessing Data Coverage

As noted in **Section 1.2**, this project recognises that both the NMR and UKHO gather data for different purposes and both organisations have different remits. Hence, the data coverage differs between both datasets. It was also previously explained that both organisations record shipwrecks in their datasets. However, for the shipwrecks present in both datasets, consistency is needed in order to maintain interoperability between them.

Under the National Heritage Act 2002, the territorial sea pertaining to England marks the extent to which English Heritage has statutory curatorial responsibility for the marine historic environment. Therefore, the NMR dataset primarily extends up to the 12 nautical miles. On the contrary, the remit of the UKHO extends beyond the UK continental shelf. Hence, to ensure appropriate representation when comparing both datasets, only those records identified within English Territorial Waters (i.e. within the 12 nautical mile limit) were analysed for the three pilots undertaken as part of this project.

2.6 Assessing Data Attribute Contents

Data attributes were assessed to compare the information linked to each record. This exercise provided an overall knowledge of what information was made available across both datasets.

The aim of the assessment is to identify where the information is missing or contains errors or inconsistencies between both datasets. Overlaps and duplication, especially in cases where data is independently updated by different data providers, were also identified. For example, the NMR and UKHO update their datasets independently which can cause inconsistencies and errors

between records. Records were therefore assessed individually and any inconsistencies or errors were recorded on a MS Excel 'working document'. This enabled a direct attribute assessment when working with AMIE, allowing changes to be made where appropriate. The results of queries of attribute contents run in GIS are presented and discussed in **Section 3.2**.

2.7 Comparing the Results

The results of the three pilot dataset assessments were compared to enable the identification of any perceived inconsistencies and identify any new ones. The comparison was undertaken in GIS to enable the scale of the problem to be quantified.

2.8 Identifying Data Conflicts

Following the method employed for AMAP 1 (see Merritt 2007), queries were run in GIS to identify records where information of wrecks differed between the two databases. This was undertaken by adding a field on the matching UIDs table recording whether the data record is the same, null or contradictory. Performed on all records where UIDs were matched, this process allowed the contents of the UKHO name field (field name: SZLABEL) to be compared with the AMIE name field (field name: NAME). Because of variations in the spelling of wreck names, the identification of matching records was done manually since only a very limited number of records could be matched through queries. The full .pdf records from the AMIE database were also used to ensure thorough assessment of all the information available.

Results of the AMAP1 project were also used as a comparative tool where project areas overlapped in the Eastern English Channel (see Merritt 2008).

2.9 Updating Data in AMIE

AMIE data was updated live, where appropriate, through remote access. This was achieved through training and ongoing support from the NMR.

For practical purposes as well as quality control, once the matching records were identified, these were searched in AMIE and data was exported and saved as a .pdf file (original record .pdf). The information in the UKHO data field (field name: INFORM) was compared to the existing data in the AMIE. AMIE records were missing information on the following fields:

- Long text field (93 records were missing information on this field)
- Destination (32 records were missing information on this field)
- Departure (36 records were missing information on this field)
- Vessel name: for these cases the AMIE recording standard guidelines (English Heritage 2005, 2006b) were followed and the additional name was added as possible referencing the UKHO as the source (6 records were missing information on this field)
- Alternative monument names (4 records were missing information on this field)

- Cargo (11 records were missing information on this field)
- Manner of loss (7 records were missing information on this field)
- Propulsion (3 records were missing information on this field)
- Maritime craft type (3 records were missing information on this field)
- Main building material (3 records were missing information on this field)
- Sources (102 records were missing information on this field)

In those cases, the information gathered through the UKHO data field (field name: INFORM) was added to AMIE and the data source was also updated referring back to the UKHO. After the amendments were made the updated AMIE record was exported and saved as a .pdf file (enhanced record.pdf) to enable a comparison between the original and amended AMIE record. The original records are presented in **Appendix 1** and the amended records are available in **Appendix 2** with changes made highlighted. Both appendices are enclosed on a CD within this report. A total of 107 AMIE records (Pilot One: 16 records; Pilot Two: 91; Pilot Three: none) were amended enabling the enhancement of AMIE data.

3. Data Review Results

This section discusses the results of the review based on the methodology described in **Section 2**, allowing the assessment of the NMR and UKHO shipwreck datasets.

The distribution and attributes of the UKHO and NMR wreck databases have been compared. The data was compared on a pilot by pilot area basis (see **Section 2.2**). To ensure the results provided an objective representation of the data issues identified, the same queries were then run across the three pilot areas enabling identification of trends in the data. Only data identified within England's Territorial Waters (12 nautical miles) was assessed due to the reasons presented in **Section 2.5**.

3.1 Assessing Data Format

3.1.1 NMR Shipwreck Data

The NMR shipwreck data is available as individual paper records or in digital format, and delivered by the National Monuments Record office (Swindon).

Through this project, full access to the AMIE database was obtained via remote access. AMIE holds a wealth of information regarding maritime historic assets in England, with shipwreck data containing the following fields:

Field name	Description
HOB UID - automatically generated	It is the Heritage Object Unique Identifier, a unique number automatically generated by the system when a new record is committed.
NMR NUMBER – mandatory	It is automatically generated once the grid reference or latitude and longitude fields have been populated.

Field name	Description
CHILDREN	This field indicates whether the monument record being viewed is part of a child/parent relationship. This facility allows the creation of a hierarchical relationship between two or more monuments. It is most commonly used to help define a complex of monuments.
PARENT	If the record is a child, the HOB UID of the appropriate parent will be recorded and the NMR number of the parent UID is automatically populated. The hierarchical association is then made automatically between the two records.
SUMMARY – mandatory	Free text field to provide further information of the monument, building or wreck, as currently and previously interpreted. Where available, the summary field generally includes some of the following information: **Monument/Building Type/Vessel/Aircraft type** - list present and previous type if a change of use has occurred or if there is a conflict of interpretation **Date of structure, monument, or vessel** - date of build and date of loss (absolute or period) **Function** - give present and previous functions where known, or a brief history of the vessel for maritime records **Material** - e.g. building and covering materials for a building, and construction material for a maritime vessel **Style/culture** - e.g. Viking cemetery **Phasing** - main phases in the construction of a building, monument or vessel **Layout** - basic shape of a monument or plan of a building **Associated people** - people of note associated with the site e.g. "Wheeler first dug here", "Emily Bronte wrote Wuthering Heights in this house" **Historical events** - any historical events associated with the monument/ vessel **Survey** - date of survey for any monument/building, and Hydrographic Office records for maritime **Nationality of vessel** (maritime) **Departure/Destination** (maritime) **Cargo** (maritime) **Status of monument** – whether scheduled, listed or a protected wreck.
DATE OF LOSS - maritime	For maritime records, the **precision/minimum date/maximum date** is used to indicate the most precise date recorded for the loss of a vessel. This information should also be recorded, along with the build date of the vessel, where known.
MONUMENT STATUS – maritime	Refers to whether a wreck has been identified as having physical remains. Some wrecks are only known from documentary sources, in this instance CAS [Casualty] is the relevant selection. SIT [Identified Site] is only used where physical remains have been located.
ROLE - automatically generated	Populated with the role used by the recorder to create the record.
STANDARD	Refers to the Recording Standard and is automatically populated.
COORDINATE SYSTEM - mandatory	Both NGR (National Grid Reference/100km) or LAT/LONG can be entered into AMIE.
COUNTY/UNITARY AUTHORITY (CODE & FULL) - mandatory	The county/unitary authority where the monument is located. Can be added by code or name.
DISTRICT (CODE &	District where the monument is located. This is not applicable for

Field name	Description
FULL) - mandatory (except if unitary authority)	monuments within a unitary authority.
PARISH OR NON PARISH AREA - mandatory	Maritime recorders do not use this field. Sites which fall below MLWS (Mean Low Water Springs) do not have a parish.
AREA	Optional, but important, field which allows for the recording of a local non-administrative area in which a monument is situated.
NAME	This field is not core data, so should only be populated where an established or published name specific to a monument, building or maritime vessel is known. For maritime records, the primary name should be the name at the time of sinking and former names are recorded as alternatives. The name of the vessel is the monument name, e.g. Mary Rose. Where the actual name is not known, names by which the wreck or wreck site is commonly known are permissible, e.g. Seaton Carew wreck.
PERIOD (CODE & FULL) - mandatory	The Period/Date area of the monument record is mandatory, and records details of the monument chronology; it should reflect the chronology that has been expressed in free text in the summary.
CLASS SCHEME - mandatory	This area records the classifications of the monument, building or vessel. The core classification schemes used here for ALL monument records are MONUMENT TYPE and EVIDENCE. Maritime records should contain MARITIME CRAFT TYPE, MANNER OF LOSS, PROPULSION and OBJECT MATERIAL. Other types such as CARGO, CONSTRUCTION, DEPARTURE, DESTINATION, NATIONALITY and REGISTRATION PLACE can be entered where known.
BACKGROUND MENU OPTIONS	These are used to record additional information to that recorded in the main monument form. These include amongst others: 'long text' representing a cumulative history of the site and its interpretation, copyright, and sources or general archive references
MONUMENT CONDITION / STATUS AND MONUMENT IDENTIFIERS IN OTHER NUMBERING SCHEMES	Monument Condition is not core data for Heritage Data, but it is core data for EH survey projects started after June 1997. This option includes: area status which allows the recorder to indicate that the monument has statutory protection, materials, monument identifiers in other numbering schemes, associated monuments such as the collision of two aircrafts
ASSOCIATED NAMED LOCATIONS AND ASSOCIATED DIMENSIONS FOR MARITIME RECORDS	The Named Location is a standardised set of co-ordinates in latitude and longitude, relating to a particular place or group of places, which is used when no precise co-ordinates are available for a position of loss. It may be named after one feature, but also cover other, nearby, features. Associated Dimensions allows the principal dimensions of a vessel to be recorded, whether these were established by survey or in documentary sources. The definition of the dimensions is as follows: • **Length:** The distance from the bow to the stern of a vessel. • **Breadth:** The measure of a vessel from side to side at its broadest point. • **Depth:** Depth of Hold; The height between the floor of the hold and the lower deck. • **Tonnage:** Tonnage can vary in meaning depending on the vessel and can be established in a number of different ways. It can refer to the weight of a fully loaded or empty vessel, or to its volume or its cargo volume.

Table 1. List of data fields in AMIE

There is a relationship between the AMIE textual database and the spatial component of the dataset. Following the creation of an AMIE record, GIS automatically generates a spatial record at the location of the monument National Grid Reference (NGR). AMIE only allows the recorder to enter one set of coordinates, and the AMIE shape code needs to be used correctly to depict the monument record spatially. The codes and depictions are as follows:

AMIE SHAPE CODE	AMIE SHAPE	GIS DEPICTION
1	Point	Point
2	Linear	Point
3	Position Approximate	Circle polygon 250m diameter
4	Named Location	Circle polygon 1000m diameter
5	Locality	Circle polygon 20m diameter
6	Area	Diamond polygon 20m x 20m

Table 2. AMIE codes and GI depictions.

When an AMIE record is created a selection of the data is migrated from AMIE to GIS metadata. These are as follows:

AMIE Process	Action	GIS Event
AMIE Monument record created	→NGR and textual data sent to GIS database	GIS record created with: - Shape (default) − HOB UID − Monument Name − Description − Monument precision − Capture − Easting/Northing

Table 3. Selection of data from AMIE to GIS

When an existing AMIE record is updated a small number of AMIE text fields are updated on the GIS platform. This is an automatic process and happens in real time within deskGIS. However, the monument location details cannot be updated through AMIE once a record has been created. This is because AMIE spatial data is controlled by GIS and any changes are undertaken through GIS using the appropriate guidelines (English Heritage 2006b).

For the purposes of this project, AMIE shipwreck data was delivered as three separate shapefiles containing line, point and polygon data respectively. This data accompanied by a complete monument record extract in the form of a .pdf file and four MS Excel spreadsheets (**condition data.xls; core data.xls; enhancing the NMR period and class data.xls; identifier data.xls**) containing additional fields illustrated in the table below. The UK GEMINI metadata for the AMIE Monument dataset was contained in a file delivered as

EH_AMIE_monuments.xml. The AMIE data received and the contents description are summarised as follows:

File Name	Description	Fields
Enhancing NMR AMIE Data_AMIEMonumentLine.shp	Contains mapped records of known shipwreck data.	HOB_UID, Name, Description, Mon_precis, Capture_sc, Easting, Northing
Enhancing NMR AMIE Data_AMIEMonumentPoint.shp	Contains mapped records of known shipwreck data.	HOB_UID, Name, Description, Mon_precis, Capture_sc, Easting, Northing
Enhancing NMR AMIE Data_AMIEMonumentPolygon.shp	Contains mapped records of known shipwreck data.	HOB_UID, Name, Description, Mon_precis, Capture_sc, Easting, Northing, Area_ha
NamedLocations_NMR.shp	Contains mapped records of ship losses.	HOB_UID, Name, Description, Mon_precis, Capture_sc, Easting, Northing, Area_ha
condition data.xls	Contains data on the nature of the evidence on which the record is based. There is also information as whether the record is in the intertidal, marine or terrestrial zone	HOB_UID, Condition scheme, Term
core data.xls	Contains core data including unique identifier which enabled the core point data to be plotted including the text description and location details	HOB_UID, NMR No, Description, Name, St Number Start, Street, Parish, District, County, X, Y
enhancing the NMR period and class data.xls	Contains details of each monument period, where known, as well as feature type classifications	HOB_UID, Period, Min Date, Max Date, Display date, Class scheme, Term
identifier data.xls	Contains the identifiers for other records including the current UKHO HOIDs.	HOB_UID, Identifier, Value

Table 4. AMIE data received from the NMR as part of this project.

These data files required varying degrees of processing, depending on the fields, to enable integration within the project GIS platform. For example, the GIS data provided contains basic core data. However, to enable a representative assessment, the associated MS Excel files were joined using the UIDs for each record represented in all MS Excel files as HOB_UID. Each field had to be filtered into a separate table to enable the data to be linked. When performing a

joint, in those cases where there were more than one record per UID, some data was loss.

3.1.2 UKHO Shipwreck Data

The wrecks and obstructions data is held by the UKHO and is available in two forms. Records can be requested in paper form stating the parameters that are of interest for the client such as date, location, and name for example. This is a viable process when requesting a limit number of records and is a service available from the UKHO Wrecks Service.

The UKHO data can also be ordered in a digital form. Inputting data manually would be prohibitively expensive, therefore the acquisition of digital data is more practical and cost-effective especially when working with large GIS based projects. The UKHO digital data is provided by Seazone through one of the Hydrospatial datasets. To receive the data with the original data structure supplied by the UKHO the Wrecks Upgrade dataset is required in addition to SeaZone Hydrospatial.

For the purposes of this project, English Heritage has a licence agreement with SeaZone regarding GIS based projects funded by English Heritage. Hydrospatial data was received as four different shape files: **wreck1.shp**, **obstruction1.shp**, **obstruction2.shp** and **wreck-areas1.shp**. The **wreck-areas1.shp** contains seven areas, all labelled as dangerous wreck areas, which have not been considered since do not contain relevant information for the scope of this project. The UKHO Wrecks Upgrade database was not delivered by English Heritage. Hence, it was received via SeaZone for each pilot study area as a shapefile.

The UKHO data received included a total of 2168 records which extend beyond the 12 nautical mile limit. No duplicates were identified in the UKHO wrecks upgrade database. For the purposes of this project and to enable the assessment of the full set of attributes provided by the UKHO, in addition to SeaZone Hydrospatial, the wrecks upgrade database is required. Therefore, the latter was used as the main database to enable representative comparisons with the NMR dataset.

SeaZone Hydrospatial UKHO shipwreck data is provided as unprojected and referenced to WGS84 compliant datum below Mean Low Water (MLW), which is an international recognised global reference system for marine GIS data.

3.1.3 Discussion

As discussed in **Section 3.1.1**, the .xls files delivered by the NMR required a degree of processing to enable integration within a GIS platform. Instructions on how to integrate these files into GIS were not provided as part of the data delivery. However, the same methodology applied as part of the AMAP1 project (see Merritt 2007) was followed and discussed in **Section 2** within this report.

The UKHO dataset provided via Hydrospatial also needed a degree of manipulation to enable a representative comparison with the NMR dataset. Because of this, the UKHO wrecks upgrade was used as the main database to enable comparisons with the NMR dataset since it did not require further manipulation. The original number of records received and total number of records within 12 nautical miles used for comparative purposes are summarised in the following table:

Description	NMR	UKHO	
	Wrecks	Wrecks	Obstructions
Original amount of records			
Pilot 1 (all aggregate extraction areas in England)	612	516	202
Pilot 2 (Thames Estuary & Humber)	559	1039	365
Pilot 3 (Protected Wreck Sites)	49	46	n/a
TOTAL	*1220*	*1601*	*567*
Number of records within 12 nautical miles			
Pilot 1 (all aggregate extraction areas in England)	570	443	190
Pilot 2 (Thames Estuary & Humber)	557	675	231
Pilot 3 (Protected Wreck Sites)	49	46	n/a
TOTAL	*1176*	*1164*	*421*

Table 5. Original number of records received from the NMR and UKHO and number of records within 12 nautical miles.

Regarding coordinate systems, the UKHO dataset is delivered using a WGS84 coordinate reference system and NMR dataset GI depiction is delivered in OSGB36. To reduce average variation in distance, the geographic transformation to 'OSGB_1936_to_WGS_1984_Petroleum' (Ordnance Survey transformation method OSTN02) was utilised. Offsets could have been caused by errors in transformation between the two coordinate reference systems. However, non-consistent spatial variations were still identified which are further discussed in **Section 3.2**.

3.2 Assessing Data Coverage

The shipwreck data coverage was assessed within a GIS platform. The assessment was undertaken by joining both datasets in order to quantify the number of matching and non-matching records. The method on how both datasets were joined was discussed in **Section 2.4**.

For organisational purposes, the assessment of the results regarding data coverage is discussed as follows:

- Attribute analysis
- Spatial analysis
- Obstructions and named location analysis
- Discussion summarising key points

3.2.1 Attribute Analysis

For some of the NMR records, this database contains unique identifiers for the Hydrographic Office records. The system of UIDs for UKHO wreck data was changed in the 1990s, after the transfer of UKHO data was made to the NMR. Therefore, the IDs held in the AMIE record attributes were out of date. However, recently, the NMR updated the UKHO IDs in their records, which were provided as part of this project in the **identifier data.xls** spreadsheet. Consequently, as explained in **Section 2.4**, both datasets were combined using the UKHO UID (field name: HOID) recorded within the MS Excel table (**identifier data.xls**) provided by the NMR. Once both datasets were joined, the following relationships were assessed through querying the attributes within the joined data:

- UKHO records (wrecks and obstructions) with matching NMR records
- UKHO records (wrecks and obstructions) with non-matching NMR records
- UKHO records (wrecks and obstructions) with NMR named locations
- NMR records with matching UKHO records (wrecks and obstructions)
- NMR records with non-matching UKHO records (wrecks and obstructions)

The comparison of the data relies on the presence of matching UKHO UIDs in the NMR dataset. During the AMAP1 project, it was found that matching records vary with the direction of the join (Merritt 2007, 2008). Similarly, during this project, matching records varied with the direction of the join and results are presented on the following table:

Direction of join	Number of matching records	
	Pilot 1	Pilot 2
UKHO → NMR	320	530
NMR → UKHO	324	531

Table 6. Variation of matching records depending on direction of join

This variation is occurring due to one-to-many relationships in both datasets. For example, the NMR Excel spreadsheet **enhancing the NMR period and class data.xls** contains data from more than one attribute field within different rows registering different phases within a monument. This generates duplicate rows which are referring to the same record but recorded with the same HOB_UID. Hence, when joining the data, it creates duplicates in identifiers and produces one-to-many relationships with individual sites. The UKHO wrecks upgrade contains information about the same wreck which is broken in two or more sections. These wrecks are recorded with the same wreck name but registered under different UIDs generating one-to-many relationships.

The table below illustrates the number of records received from the NMR and UKHO wrecks and obstructions and the number of matching records via the UIDs.

Description	NMR → UKHO		UKHO →NMR	
	P1	P2	P1	P2
Records within 12 nautical miles	570	557	633	906
Records after joining with **identifier data.xls**	330	537	320	530
Matching records via UIDs	324	531	320	530
Non-matching records via UIDs	246	26	313	376

Table 7. Number of NMR and UKHO matching and non-matching records via UIDs illustrating variations in direction of the join

The difference of non-matching records via UIDs (direction of join: NMR→UKHO) when looking across the pilot study areas could be attributable to 176 records recorded as obstructions reported by fishermen, 29 as possible wrecks, 4 as craft, and 63 as finds and other structures. The number of matching UIDs records between the UKHO and the NMR differs slightly when looking across the pilot study areas. This difference could be related to the methods and purposes for which the data was gathered. It also indicates that no predictable pattern can be expected in matching records between the NMR and UKHO across England.

Attribute queries showed that approximately half of the NMR and UKHO records were joined using the UKHO UIDs. There could potentially be a larger number of matching records. If field names are standardised in both datasets errors could then be minimised by enabling field names to be rapidly and effectively identified.

Regarding pilot study three (Protected Wreck Sites), records were joined manually (see **Section 2**). One of the records, *SS Richard Montgomery* (HOB_UID 904735), was not found in the UKHO wreck dataset. This issue was raised with SeaZone and MA Ltd was informed that this site is recorded, with a restricted area around it, under ADMIN_REGULATION in Hydrospatial. No further action was taken as part of this project.

3.2.2 Spatial Analysis

Spatial analysis was undertaken to test the results of the attribute analysis and assess spatial discrepancies between matching records, allowing the identification of any potential spatial issues related to the shipwreck data.

Spatial discrepancies between the NMR and UKHO datasets was recognised and discussed between English Heritage and SeaZone since 2007 (see Dellino-Musgrave 2007). It was first thought that the offset between both datasets was probably in part to projection issues. Following AMAP1 methodology, the geographic transformation to 'OSGB_1936_to_WGS_1984_Petroleum' (also known as Ordnance Survey transformation method OSTN02) was utilised which helped to reduce considerably the average of the offset. However, variations in distance and direction were still identified during the three pilot studies as part of this project.

Initial queries show that there are no records that are completely overlapping to each other. Variations in distance and direction were not equidistant from each other, indicating that this issue is not solely due to the result of different projections. The UKHO responsibility is to ensure safe navigation and therefore the location of wrecks and obstructions are updated on a regular basis through surveys. The NMR compiles data to enable a better understanding of the historic environment and therefore approximate spatial location for some cases may suffice. This could of course contribute to some of the spatial inconsistencies identified as part of this Phase One of work. For example, in the case of *SS Harlington, SS Thyra* and *SS Old Charlton* (HOB_UID: 912651, 912638, 912644) one of the reasons for the spatial inconstancy in distance and direction is that the UKHO data was entered into the NMR in 1993. The UKHO preformed a new survey of the area in September 2006 after the area had been swept by wire. The NMR has not been amending these records to reflect the updated UKHO position (David Hilton *pers. comm*. May 2010). Therefore, this is illustrating that some inconsistencies could be the result of independent updates between both data providers.

An assessment of the variability between known wrecks with matching UIDs, names and date sunk from both datasets was undertaken. Following AMAP1 methodology, the join by location tool within GIS was used to join the NMR points to the closest UKHO point. The overall results across all pilot areas is summarised in the following table:

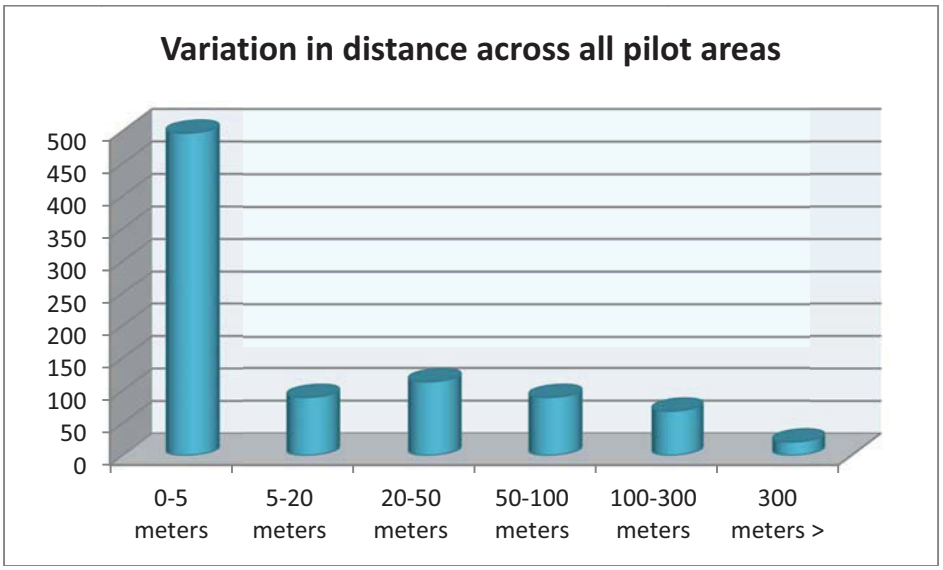
NMR → UKHO			
	Matching IDs	**Matching IDs & Names**	**Matching IDs & Date Sunk**
Pilot 1 (all aggregate extraction areas in England)	324	108	97
Pilot 2 (Thames Estuary & Humber)	531	109	158
Pilot 3 (Protected Wreck Sites)	49	48	48
Total	*904*	*265*	*303*

UKHO → NMR			
	Matching IDs	**Matching IDs & Names**	**Matching IDs & Date Sunk**
Pilot 1 (all aggregate extraction areas in England)	320	140	140
Pilot 2 (Thames Estuary & Humber)	530	248	256
Pilot 3 (Protected Wreck Sites)	46	46	46
Total	*896*	*434*	*442*

Table 8. Summary of NMR and UKHO matching UIDs records where NAME and DATE SUNK also match, illustrating variations depending on the direction of the join.

The attributes of the shapefiles resulting from the joins contain a field which records the distances between the points joined. This was undertaken by joining

the NMR as the base layer to the UKHO. All records where the HOB_UIDs are the same were kept. By joining by location, a distance field is automatically generated within a GIS platform Queries regarding variation in distance were applied using different scale buffers. The results across all pilot studies are represented in the following graph and table:



Variation in distance across all pilot areas	
Distance between NMR and UKHO	**Number of records**
0-5 meters	497
5-20 meters	89
20-50 meters	113
50-100 meters	89
100-300 meters	68
300 meters >	21

Table 9. Variation in distance across all pilot areas

The analysis of this variation in distance between matching records indicate that they are not equidistant and there is no recognisable trends across them. However, significant variation in distance concentrates between 20 to 300+ meters. The reasons as to why these variable offsets are still unclear but they

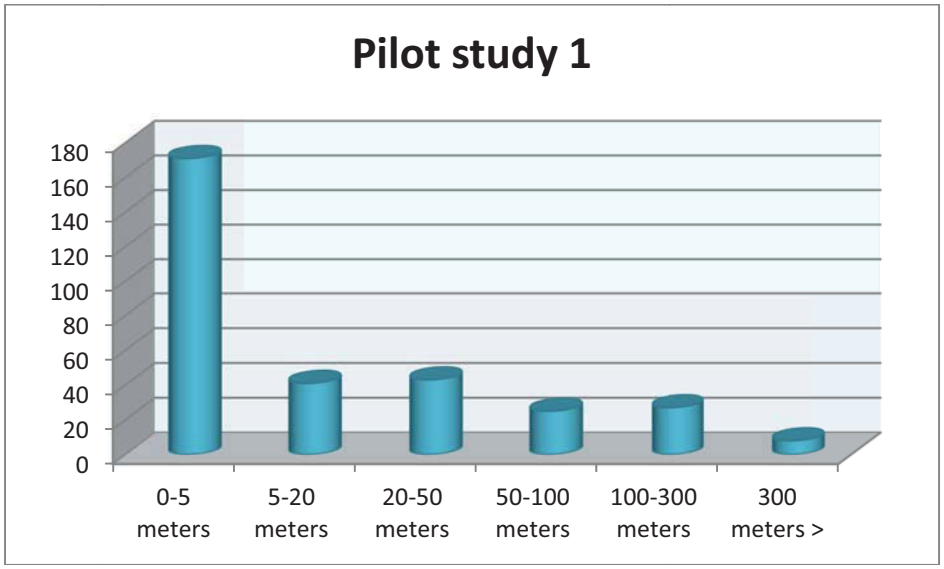
could be due to a combination of projection issues and mapping of data from a wide range of sources (see Merritt 2007).

For the purpose of clarity, results are presented on a pilot by pilot basis in the next sub-sections.

3.2.2.1 Pilot Study One: All Aggregate Extraction Areas in England

The pilot study one dataset contains 324 entries of matching records between the NMR and UKHO. Only those records containing matching IDs, names and dates were assessed. If the name or date was missing but the ID was matched the record was also assessed.

The table illustrates inconsistencies in distance between the two datasets. The majority of the points are shown within a five meter distance from each other. However, further assessment is needed regarding those wrecks between 20 and 300+ meters.



Pilot study 1	
Distance between NMR and UKHO data	**Number of records**
0-5 meters	171
5-20 meters	41
20-50 meters	43
50-100 meters	25
100-300 meters	27
300 meters +	8

Table 10. Variation in distance across the pilot study area one (all aggregate extraction areas in England).

For example, *SS Begona No 5* is believed to be a Spanish merchant steamer from 1923 (HOB_UID: 907423). In this case, the inconsistency between the two datasets is 34 meters and the inconsistency in direction stretches from the NMR to UKHO in a westerly direction (**Figure 5**).

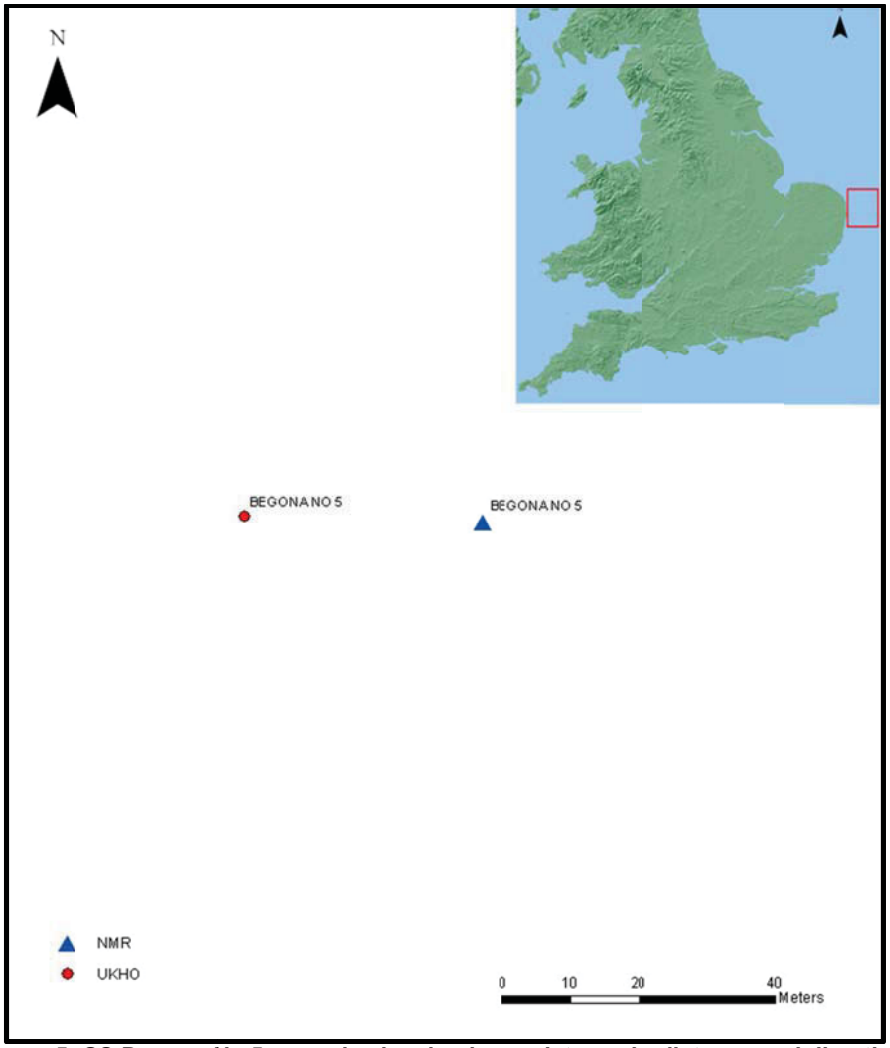


Figure 5. *SS Begona No 5* example showing inconsistency in distance and direction.

Another example is the German Submarine *U1195* (HOB_UID:804910). In this case, the spatial inconsistency between both datasets is 149 meters. The inconsistency in direction stretches from the NMR to UKHO in a north westerly direction (**Figure 6**).

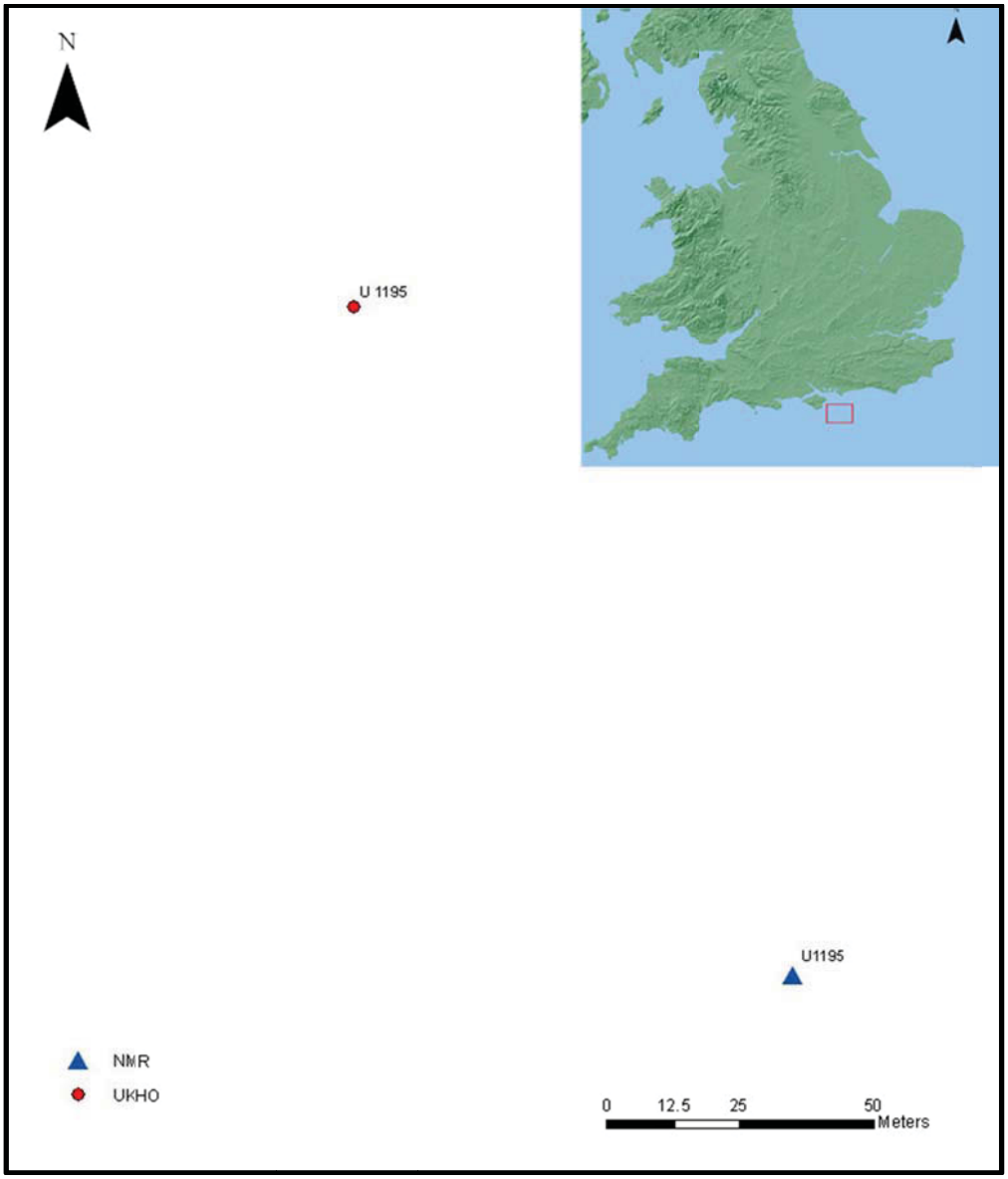
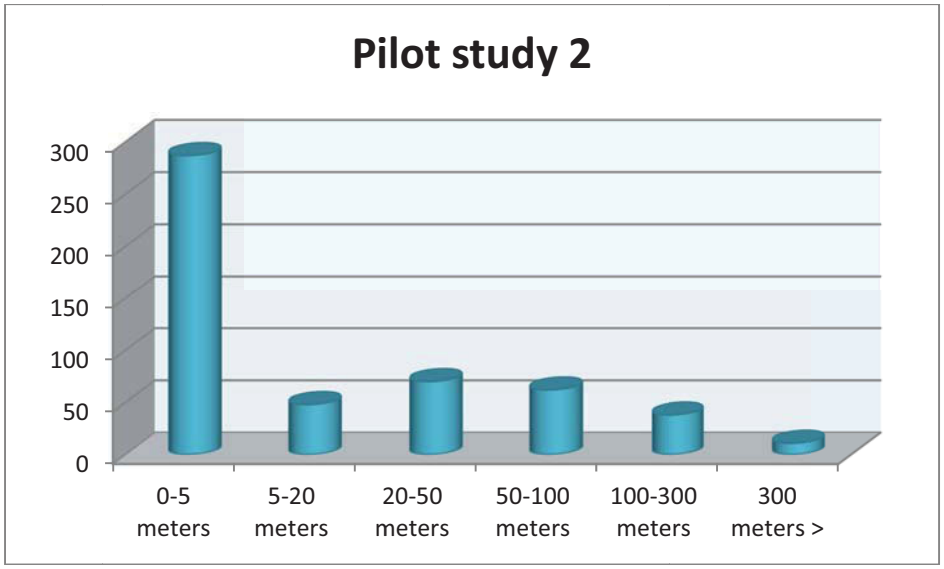


Figure 6. *U1195* example showing inconsistency in distance and direction.

3.2.2.2 Pilot Study Two: Thames Estuary & Humber

The pilot study two dataset contains 531 entries of matching records between the NMR and UKHO. Only those records containing matching IDs, names and dates were assessed. If the name or date was missing but the ID was matched the record was also assessed. Results of the spatial analysis are presented in the graph and table below.



Pilot study 2	
Distance between NMR and UKHO data	**Number of records**
0-5 meters	287
5-20 meters	48
20-50 meters	70
50-100 meters	62
100-300 meters	38
300 meters +	11

Table 11. Variation in distance across the pilot study area two (Humber & Thames Estuary).

A significant spatial inconsistency was identified for the case of *SS Fane,* a Norwegian cargo vessel mined in 1917 (HOB_UID; 1459776). The spatial variation between both two datasets is 546 meters. The inconsistency in direction stretches from the NMR to UKHO in a north easterly direction (**Figure 7**).

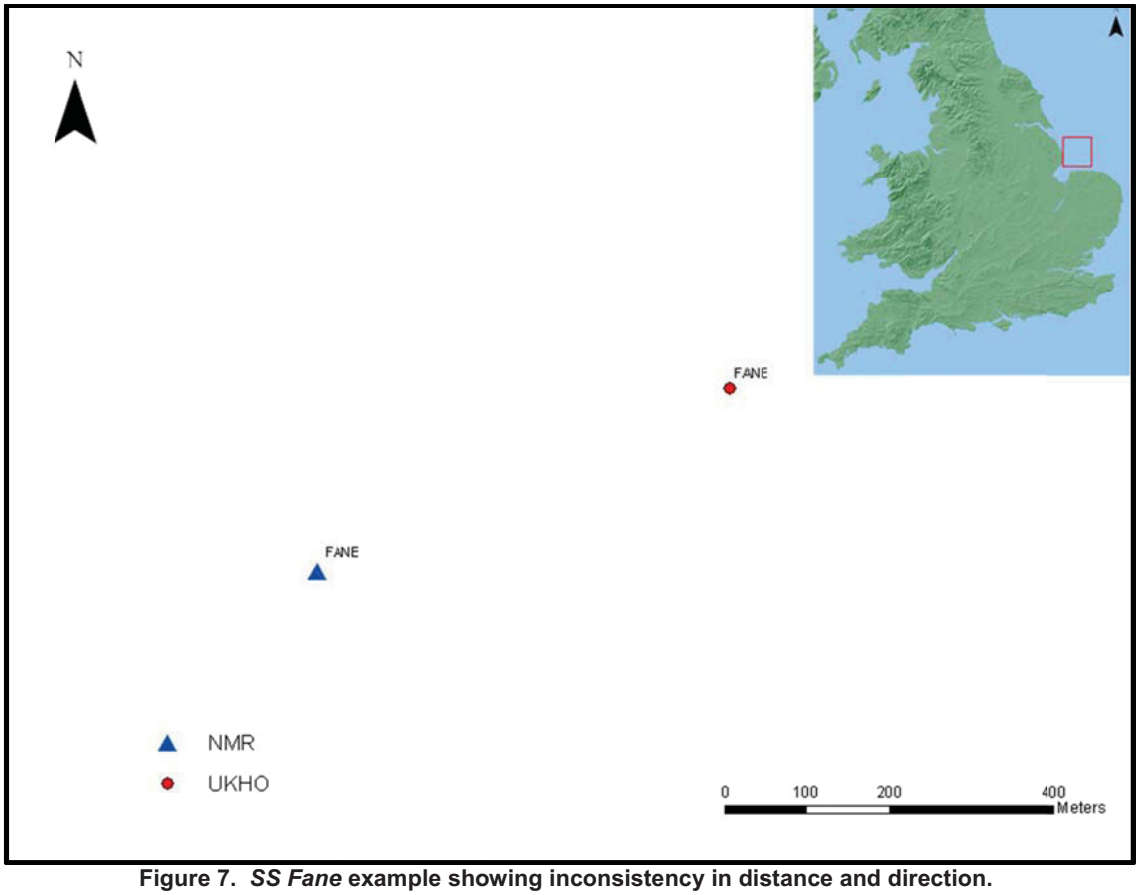


Figure 7. *SS Fane* example showing inconsistency in distance and direction.

Conversely, *SS Eerna Boldt* (HOB_UID: 908138*)* spatial variation is merely 1.2 meters between both datasets. The inconsistency in direction stretches from the NMR to UKHO in a north westerly direction (**Figure 8**).

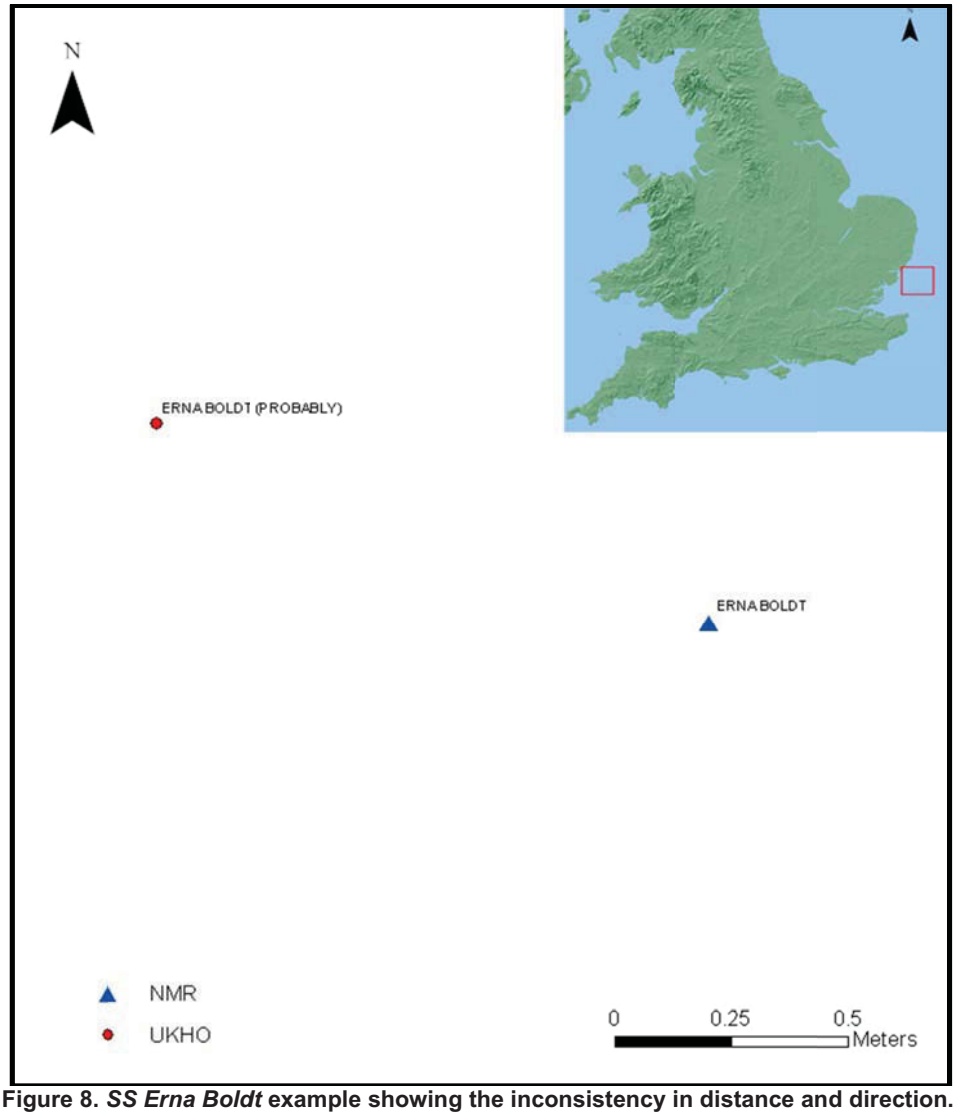
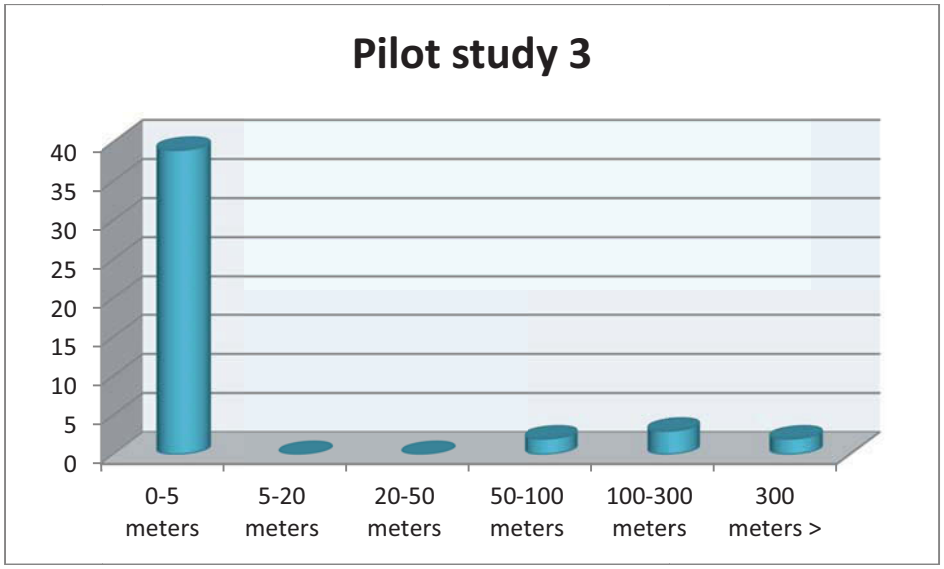


Figure 8. *SS Erna Boldt* example showing the inconsistency in distance and direction.

3.2.2.3 Pilot Study Three: Protected Wreck Sites

The third pilot study contains all the Protected Wreck Sites in England. It is worth noting that the UKHO dataset for Protected Wrecks is delivered only as a polygon layer. The NMR, however, originates the Protected Wreck Sites controlled area data as a GIS layer separate to the AMIE and supplies this externally. Therefore, delivery of the NMR data for Protected Wreck Sites is both as polygon and point layers. The NMR Protected Wrecks polygon data overlaps exactly with the UKHO dataset. However, inconsistencies were identified when comparing the NMR point data with the UKHO polygon data. The graph and table below illustrates the inconsistencies in distance identified as part of this dataset.



Pilot study 3	
Distance between NMR and UKHO data	**Number of records**
0-5 meters	39
5-20 meters	0
20-50 meters	0
50-100 meters	2
100-300 meters	3
300 meters +	2

Table 12. Variation in distance between protected wrecks NMR point layer and UKHO polygon layer.

A significant spatial variation in distance was identified in the case of the *Amsterdam* where the spatial inconsistency between the NMR point data with the UKHO polygon data is about 200 meters (**Figure 9**).

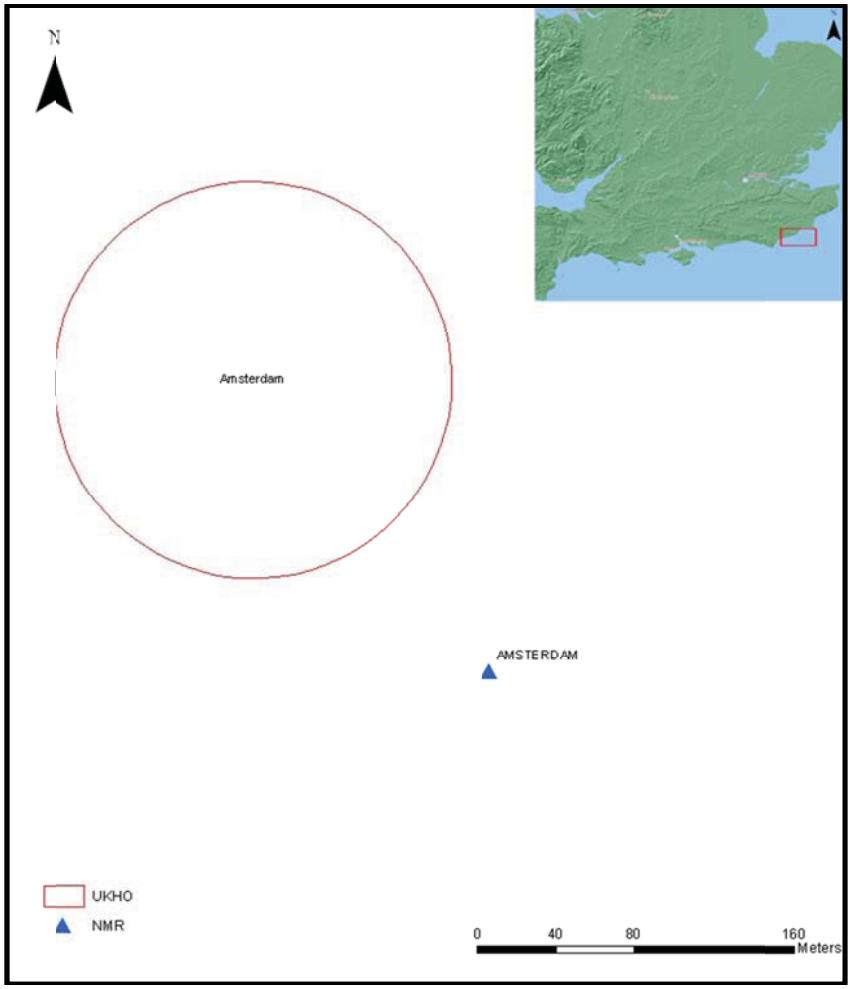


Figure 9. *Amsterdam* example showing the inconsistency in distance and direction between UKHO polygon layer and NMR point layer.

HMS Stirling Castle, HMS Restoration and *HMS Nothumberland* illustrates that most of the Protected Wreck Sites point data from the NMR are within the polygons provided by the UKHO (**Figure 10**).

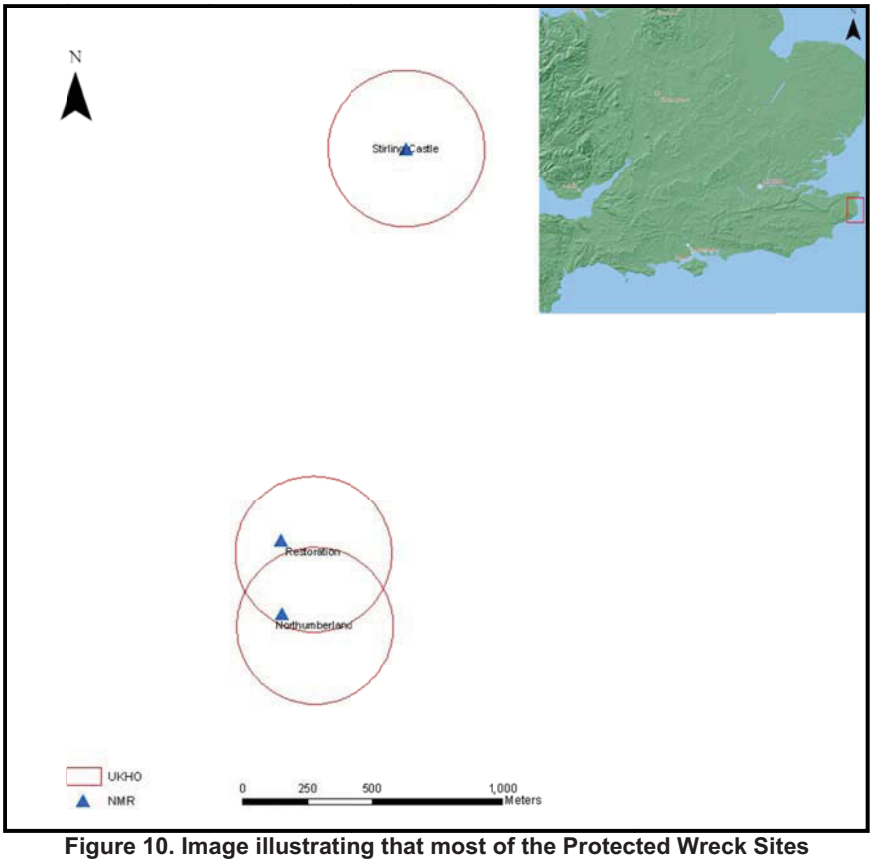


Figure 10. Image illustrating that most of the Protected Wreck Sites provided by NMR as a point layer are within the polygons provided by the UKHO.

3.2.3 Analysing Obstructions and Casualty Records

The UKHO Obstructions often contain information about shipwreck data. Due to the amount of records and time constraints, the UKHO obstructions were compared to the NMR wreck data by undertaking a total of ten case studies.

The NMR casualty records data is delivered as polygons (named locations (NLOs)), which contain multiple casualty records within those polygons. The number of casualty records within the NLOs are summarised in the table below. Due to the number of records, the casualty records were compared to the UKHO wreck data by undertaking ten case studies.

NMR Casualty Records		
Description	**Pilot 1**	**Pilot 2**
Total number of casualty records received	1000	1577
Total number of casualty records after records on land were removed	989	1544
Total number of casualty records within 12 nautical miles	793	1445

NMR Casualty Records		
Description	**Pilot 1**	**Pilot 2**
Total number of casualty records within 12 nautical miles recorded as potential wrecks	706	1433
Total number of casualty records within 12 nautical miles recorded as obstructions	97	12
Total number of casualty records within 12 nautical miles that match to UKHO wrecks via UIDs & wreck name	0	36
Total number of casualty records within 12 nautical miles that match to UKHO obstructions via UIDs	0	8

Table 13. Summary of NMR casualty records.

The eight casualty records that matched with the UKHO obstructions via UIDs are presented in the following table:

HOB_UID (NMR)	NAME (NMR)	Description (NMR)	SZLABLE (UKHO)	DATE_SUNK (UKHO)	CIRCUMSTAN (UKHO)
913208		Possible remains of 1917 wreck of sailing vessel (…)	Foul	??/04/1917	
879921		Net fastener	Foul		
907570	*Blackburn*	Remains of British steamer, 1910	*Blackburn* (possibly)	08/12/1910	Built by Earl's Co Ltd, hull owned at time of loss by the Great Central Railway Co. Two boilers, triple expansion engine of 309HP, single shaft. Passage Grimsby for Antwerp. General cargo. Sunk following collision with SS Rock.
879930		Fouls stated to be wreck	Foul		
879928		Fouls stated to be wreck	Foul		
879925		Net fastener	Foul		
904846	*HMS Kale*	Possibly remains of British destroyer, 1918	*HMS Kale*	27/03/1918	Mined
892347		Unidentified seabed obstruction	Obstruction		

HOB_UID (NMR)	NAME (NMR)	Description (NMR)	SZLABLE (UKHO)	DATE_SUNK (UKHO)	CIRCUMSTAN (UKHO)
		reported by fishermen. Possibly indicative of wreckage or a submerged feature.			

Table 14. Eight NMR casualty records that matched with UKHO obstructions.

Based on these results, the casualty records HOB_UID 907570 and HOB_UID 904846 could therefore be upgraded to wrecks.

Due to significant variability in the results (both spatially and in attribute fields), ten casualty records and UKHO obstructions through pilot areas one and two were selected as case studies. Similarly to the method used for the ALSF Mystery Wreck Stage One project (see HWTMA 2009), the case studies were analysed by running buffers between 1,000, 5,000 and 10,000 meters to record the amount of UKHO known wrecks. The attributes of the selected UKHO known wrecks were then manually compared to the NMR casualty records to enable the identification of any matching features within the buffers. The results are presented in the following table:

Casualty Records Case Studies				
Case study no.	HOB_UID	No of matches to UKHO known wrecks		
		Buffer 10,000 mts	Buffer 5,000 mts	Buffer 1,000 mts
1	1337536, 1343112, 1341781,1348638, 1348637, 1357567, 1337550	71	22	1
2	912997	151	48	1
3	1243773, 1240504, 1243746	22	15	1
4	1341702, 1337799, 1343887, 1382580, 1382199, 1364861, 1382394, 1450182, 1325491, 1337820, 1324195, 1357687, 1349136, 1357924	11	9	0
5	1331967, 1350835, 1331985, 1337916, 1331443, 1331452, 1336417, 1336371, 1331641, 1327568, 1359071, 1359910, 1340700	0	0	0
6	1338301, 1338771, 1339003, 1351244, 1358731, 1338327, 1317608, 1338363	110	108	54

Casualty Records Case Studies				
Case study no.	HOB_UID	No of matches to UKHO known wrecks		
		Buffer 10,000 mts	Buffer 5,000 mts	Buffer 1,000 mts
7	1369078	54	18	0
8	881563, 904404, 1256716	11	7	1
9	1457719, 1252193, 1457920, 1259565, 1260933, 1254021, 1259542, 1259540, 1260045	182	36	5
10	1352083	26	22	4

Table 15. Summary of casualty records compared to UKHO wrecks.

The results of the case studies show that three records could be upgraded to known wrecks due to matches by name, which are summarised in the table below:

Wreck name	HOB_UID	HOID	Upgrade from	Distance
HMS Cortina	913084	8764	Obstruction to known wreck	43 meters
(HMS) Numitor	912997	10255	NLO to known wreck	15 meters
Durdam	1003011	12465	Obstruction to known wreck	0.3 meters

Table 16. Summary of records that can be upgraded to known wrecks for both NMR and UKHO.

As part of the Solent Heritage Assets English Heritage funded project, currently undertaken by the HWTMA, duplicate geometries between NMR casualty records and known wrecks were identified. For example, the wreck *Fenna* has two entries in the NMR dataset: one as a wreck (HOB_UID 901153) and one as a casualty record (HOB_UID 832528).

These results also demonstrate that resources need to be invested on a site by site basis to reliably identify casualty records and match them to known wrecks. It also demonstrates that the combined use of the NMR and UKHO datasets is beneficial to enable data enhancement on both databases respectively.

3.2.4 Discussion

The attribute analysis has shown that attributes fields such as name and date often present variations in information when comparing both NMR and UKHO datasets. Further desk based research on the case by case basis will be required to verify the nature of the information on these datasets. It would also be useful to undertake comparisons on other fields such as vessel type, for example. This information is available through the NMR dataset but not directly available through AMIE GIS depiction. Therefore, due to time constraints, it is proposed to undertake this task as part of Phase Two of this project following discussion with the NMR staff.

The results from the spatial analysis show that there is inconsistent variation in distance within both NMR and UKHO wreck datasets. For example, most wrecks which have been matched through identifiers and vessel name lay within 5 meters distance of each other, which is generally considered insignificant when referring to wreck data. However, there is also a considerable concentration of wrecks with variation in distance that ranges from 20 to 300+ meters (see **Section 3.2.2**). This spatial inconsistency needs to be addressed since there could be potential reference to different wrecks. In this sense, the same location for the same wrecks irrespective of projection and coordinates systems should be expected in both datasets.

The spatial analysis also illustrated irregularities not only in distance by also in direction. This offset in direction was inconsistent throughout the datasets (see **Section 3.2.2**). Therefore, this offset goes beyond the result of the transfer between the OSGB36 and the WGS84 coordinate systems.

The obstructions and casualty records were also assessed and analysed. Due to the size of the datasets, the selection of ten UKHO obstructions and ten casualty records were assessed as case studies. The result of the analysis showed that assessing casualty records and obstructions are a time consuming process and that it is very likely that a great amount of records need upgrading from named location/obstructions to known wreck sites. Furthermore, duplicate geometries between casualty records and known wrecks needs addressing.

3.3 Assessing Data Attribute Contents

The structure of the data with the NMR and UKHO datasets reflects how the data between both databases can be joined and compared and how the data can be queried to extract meaningful trends for research, management or amenity purposes where applicable. Hence, assessing the data structure will contribute to identify ways in which the NMR can enhance its existing record with complementary and supplementary elements in the UKHO database, which is discussed in this section.

Data fields and their contents have been compared to identify areas where data may coincide, contradict or complement each other or does not exist. These are summarised in the following table (also see Merritt 2007):

Information about:	NMR GIS depiction field name	UKHO field name
Location	Easting / northing (core data) County (core data) District (core data) Parish (core data) Land use	Lat / long

Information about:	NMR GIS depiction field name	UKHO field name
Wreck name	Name (core data)	SZ label Object_name
Description of remains	Description (core data) Class scheme	SZ_feature_description (SZFEATDESC) Inform Wreck_type (TYPWK)
Status	Condition scheme Term	Status
Period	Period Max date Min date Display date	Date_sank (DATSNK)

Table 17. Data fields and their content that has been compared, where data may coincide, contradict or complement each other.

Assessment of data coverage was only undertaken on records that were matched via UIDs. The standardisation of attribute structure would be beneficial to enable further identification of matching records. For example, DATE and NAME fields were assessed manually on the case by case basis due considerable variations in how the data is recorded. Hence, to enable effective queries within a GIS platform, extra fields were created (field name: date_match; name_match) and yes/no entries were recorded. Null records were not modified at this stage due to the lack of information available and further desk based research would also be needed. The following table presents the number of matching and non-matching records via DATE and NAME fields (direction of the join: NMR → UKHO):

Field	Description	Pilot Study 1	Pilot Study 2
DATE	Matching records	144	256
	Non-matching records	20	33
	Null records	159	242
NAME	Matching records	140	246
	Non-matching records	28	49
	Null records	156	236

Table 18. Number of matching and non-matching records via DATE and NAME fields.

By assessing the records across all pilot study areas, there are 454 records where the date field does not match or is null and 474 records where the name field does not match or is null. Unknown shipwreck identity is generally linked to those cases where name field is null and often the same applies to the date field. In those cases where there is some information, the results across all pilot areas have shown the following:

- NMR records with no date but UKHO date is present: 40

- UKHO records with no date but NMR date is present: 5
- Different date between both datasets: 8
- NMR records with no name but UKHO name is present: 29
- UKHO records with no name but NMR name is present: 16
- Typos in name recording (including any differences in recording from 'possibly', 'probably' to spaces between characters): 25
- Different name between both datasets: 7

Consequently, further desk based research on the case by case basis is required to enable clarification of these records which goes beyond the Phase One of this project.

The UKHO dataset often contains the word 'possibly', 'possible' or 'probable' in the SZ label or object name fields. This limits the use of queries in an effective manner and might confuse the end user. Due to this issue going beyond of the scope of this project, no further action was undertaken.

Both the NMR and UKHO databases contain long descriptive text fields due to the original format in which the data was gathered (NMR field name: DESCRIPTION; UKHO field name: INFORM). Long text fields are limited within a GIS platform and queries are not practical due to lack of consistency on how long text fields are written. Furthermore, when converted into GIS compatible format files, text fields have a limited number of characters which can be entered. Therefore, information is often viewed incomplete or truncated. Useful fields for research, education and amenity purposes are available within AMIE (see **Section 3.1.1**). Some of this information is often contained in the long text fields (e.g. vessel type, cargo, nationality, when and where built and by who, etc). A possible solution would be to separate the information contained in the long text fields to populate other fields or provide the data in a separate table which can then be appended to the GIS data related to it. The extraction of the data contained in these long text fields was not possible within the scope of this Phase One of work. However, it may be something that could be considered as part of Phase Two and undertaken in collaboration with SeaZone.

The wreck type field would have been a useful comparison between both datasets. This field, although available in the NMR dataset, could not be extracted in a cost and time effective manner to be used within a GIS platform. Therefore, information from the UKHO (field name: TYPEWK), which refers to vessel type or obstruction, was used when enhancing data directly into AMIE (see **Section 3.5**).

3.4 COMPARING THE RESULTS

The comparison of the data relied on the presence of matching UKHO UIDs in the NMR dataset (see **Section 3.2.1**). Results have shown that across all the pilot study areas 24% of the NMR records received within 12 nautical miles do not match with the UKHO UIDs and 45% of the UKHO records (wrecks and obstructions) received within 12 nautical miles do not match with the NMR UIDs.

However, for the Pilot One (all aggregate extraction areas in England) 43% of the NMR records received within 12 nautical miles do not match with the UKHO UIDs and 49% of the UKHO records (wrecks and obstructions) received within 12 nautical miles do not match with the NMR UIDs . For the Pilot Two (Thames and Humber Estuary) 5% of the originally received NMR records do not match with the UKHO UIDs and 41% of the originally received UKHO records (wrecks and obstructions) do not match with the NMR UIDs. These percentages demonstrate the variability in the results and that there are still cases where UIDs do not match. The reasons as why the UIDs do not match can be related to:

- The potential transfer of errors due to changes between old and new UIDs
- Missing new UIDs in some cases
- The identification and incorporation of new records that have not received the same update
- Lack of effective communication between the NMR and UKHO

When comparing both the NMR and UKHO datasets, a lack of spatial correlation (both in location and direction) was identified and discussed in **Section 3.2.2**.

As a result of the data attribute contents assessment, the number of known wreck sites with no matching names or dates, despite matching identifiers, was due to the conflicts in the identification of the site, lack of information on the field or because records are recognised as obstructions. Further conflicting information could be related to separate updates undertaken by the data holders and lack of consistency on how the data is presented. For example, all attribute fields in both the NMR GIS depiction and UKHO contain similar types of data with potential conflicting contents discussed in **Section 3.3**. For consistency purposes, it would be useful to have basic agreed common fields and terminology to populate those attribute fields (for further details see **Section 5**). Regarding terminology, the NMR uses the NMR online thesauri which could be used as a common starting point (see http://thesaurus.english-heritage.org.uk/) between both data providers.

The NMR also contains 97 obstructions and features identified within all the matched UIDs records assessed. The historical significance of these records would require further desk based research to identify whether these obstructions and features can be upgraded as wrecks.

3.5 Updating Data in AMIE

To enable further enhancement of AMIE, the information contained in the UKHO INFORM field was manually compared to all the NMR records obtained within this Phase One of the project. The NMR records that were modified in AMIE were saved as .pdf files before any changes were made. These original records are presented in **Appendix 1**. A total number of 107 records were modified in AMIE: 16 records were amended as part of the pilot area one (all aggregate extraction

areas in England) and 91 records were amended as part of the pilot area two (Thames and Humber Estuary).

Records were compared to the UKHO field INFORM. In those cases where there was missing information, AMIE entries were directly added into the NMR dataset through remote access. Overall, the amendments were made due to:

- some records were identified with no name,
- difference in wreck names, which was further investigated since the NMR recording rules specify that the primary name should be the name at the time of sinking and former names are recorded as alternatives
- further information was provided in the INFORM UKHO field which was not available within the NMR
- information regarding destination, place of departure, name of the company building the vessel, owner at the time of loss, cargo and former names was available on the UKHO INFORM field but lacking in the NMR.

Those amended records in AMIE were also saved as a .pdf complete monument record file. All amended records are presented in **Appendix 2**.

In AMIE, the new information was added to the monument period, type, summary field as well as the long text field. No information was removed from AMIE even if the information was in some cases inconsistent. For example, the *Waalstroom* site (HOB_UID 912680) shows the date of loss as 27-Jun-1916 but in the summary it appears as August 1916. The *Rhiannon* (HOB_UID 802214) appears with no name in the NMR GIS depiction and in the AMIE summary field it is referred as possibly *HMS Rhiannon* whilst in the UKHO is referenced as the *Rhiannon* (HOID 14433). Some of these inconsistencies can only be clarified through further desk based research which was outside the scope of this Phase One of work.

The example below illustrates the INFORM field from the UKHO data and the complete NMR monument record before any amendments were made.

SZLABEL (UKHO)	INFORM (UKHO)	OBJNAM (UKHO)	TYPEWK (UKHO)	HOID (UKHO)
BEGONA NO 5	CIRCUMSTANCES OF LOSS:**EX-TEODORE, EX-VINCENTE, EX-CARISE, EX-CARMEN ROCA, EX-EMMA K, EX-GAMBIA, EX-SHIEIK. BUILT IN 1880 BY C MITCHESS & CO, NEWCASTLE-UPON-TYNE. OWNED AT TIME OF LOSS BY J M & G A DE URQUIJO. TWO BOILERS, COMPOUND EXPANSION ENGINE OF 2	*BEGONA NO 5*	SS	907423

Table 19. UKHO Inform field for the *Begona No 5* wreck.

NMR COMPLETE MONUMENT REPORT

BEGONA NO 5
Unique Identifier: 907423 **NMR Number:** TG 70 NW 4

Recording Role: Inventory
Location: **Address Status:** Primary

Great Yarmouth (District)
Norfolk

Associated Named Locations: Coastal Waters **Date Of Loss:** 15-JUL-1923 - 15-JUL-1923
OSGB Grid Reference: 70726 08011

Latitude:	Longitude:		Depth:	
N 52 36.116	E 001 59.917	(centre / point)	-24	UNI

Alternate Monument Names:

Summary
REMAINS OF VESSEL, POSSIBLY SPANISH MERCHANT STEAMER, 1923

Monument Periods And Types

20TH CENTURY	1923 to 1923	PROPULSION	STEAM
		NATIONALITY	SPANISH
		MONUMENT TYPE	WRECK
		MARITIME CRAFT TYPE	CARGO VESSEL
		MANNER OF LOSS	COLLISION
		MANNER OF LOSS	BURNT
		DESTINATION	MARSEILLE
		DEPARTURE	BLYTH
		CARGO	COAL

Parent Monument There is no parent monument associated with this record

Child Monuments There are no child monuments associated with this record

Associated Monuments

929135	TG 60 NE 52	BEGONA NO 5	GAS
929135	TG 60 NE 52	CARMEN ROCA	GAS
929135	TG 60 NE 52	CARSIE	GAS
929135	TG 60 NE 52	EMMA K	GAS
929135	TG 60 NE 52	GAMBIA	GAS
929135	TG 60 NE 52	SHEIKH	GAS
929135	TG 60 NE 52	TEODORE	GAS
929135	TG 60 NE 52	VICENTE	GAS

Other Identifiers: Hydrographic Office Number - 011003534
Admiralty Chart - 1504 11-02-77
Admiralty Chart - 1543 18-10-74
Hydrographic Office Number - 10491

Condition:

EVIDENCE	VESSEL STRUCTURE
EVIDENCE	SIDE SCAN SONAR CONTACT
LAND USE	COASTLAND 1 (MARINE)

Monument Dimensions:

LENGTH	91	METRES	LER
BREADTH	13	METRES	BER

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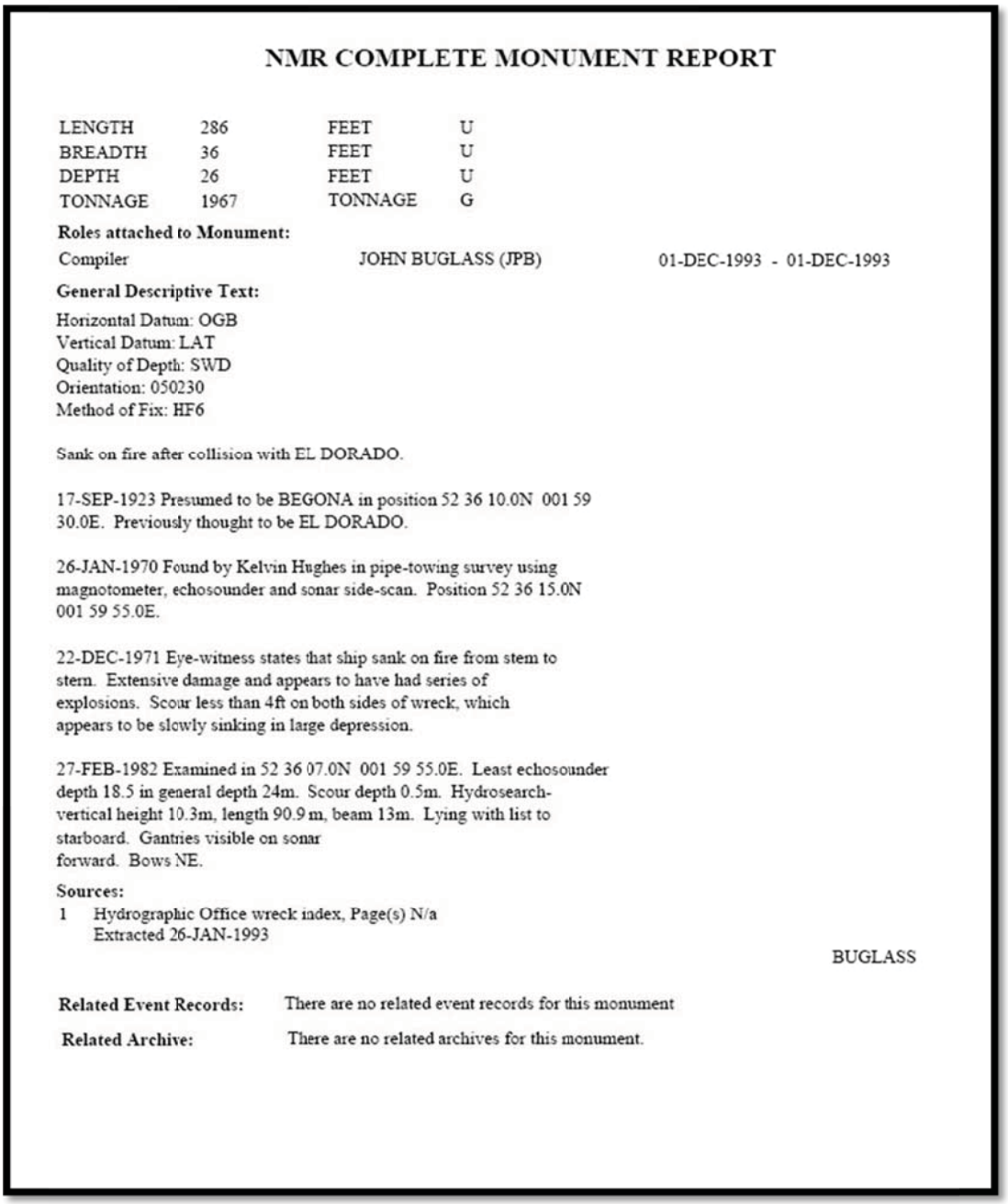

NMR COMPLETE MONUMENT REPORT

LENGTH	286	FEET	U
BREADTH	36	FEET	U
DEPTH	26	FEET	U
TONNAGE	1967	TONNAGE	G

Roles attached to Monument:

Compiler JOHN BUGLASS (JPB) 01-DEC-1993 - 01-DEC-1993

General Descriptive Text:

Horizontal Datum: OGB
Vertical Datum: LAT
Quality of Depth: SWD
Orientation: 050230
Method of Fix: HF6

Sank on fire after collision with EL DORADO.

17-SEP-1923 Presumed to be BEGONA in position 52 36 10.0N 001 59 30.0E. Previously thought to be EL DORADO.

26-JAN-1970 Found by Kelvin Hughes in pipe-towing survey using magnotometer, echosounder and sonar side-scan. Position 52 36 15.0N 001 59 55.0E.

22-DEC-1971 Eye-witness states that ship sank on fire from stem to stern. Extensive damage and appears to have had series of explosions. Scour less than 4ft on both sides of wreck, which appears to be slowly sinking in large depression.

27-FEB-1982 Examined in 52 36 07.0N 001 59 55.0E. Least echosounder depth 18.5 in general depth 24m. Scour depth 0.5m. Hydrosearch-vertical height 10.3m, length 90.9 m, beam 13m. Lying with list to starboard. Gantries visible on sonar forward. Bows NE.

Sources:

1 Hydrographic Office wreck index, Page(s) N/a
Extracted 26-JAN-1993

BUGLASS

Related Event Records: There are no related event records for this monument

Related Archive: There are no related archives for this monument.

Figure 11. NMR complete monument report for the *Begona No 5* wreck.

Only a few cases within the NMR dataset did not have a name but the UKHO did provide a name of the vessel. In those cases, the NMR record has been updated according to the data from UKHO and the name has been added with a note stating that it is possible the wreck in question (e.g. HOB_UID 879920/HOID 10304: recorded in the NMR as 'unidentified contact' but identified in the UKHO as *Rhenas*). An example is shown below.

SZLABEL (UKHO)	INFORM (UKHO)	OBJNAM (UKHO)	TYPEWK (UKHHO)	HOID (UKHO)
COALGAS	CIRCUMSTANCES OF LOSS:**MINED AND SANK WHILST EN-ROUTE LONDON TO THE TYNE. FORMERLY NAMED THE `GEORGE ALLEN'.\n; nnSURVEYING DETAILS:**H4139/76 22.12.76 LOCATED 7.8.76 IN 515745.6N, 014254.6E [OGB] USING HIFIX/6 [2 LOP]. SWEPT CLEAR AT 18.8, FOUL AT 19.2	*COALGAS*	COLLIER	879852

HOB_UID (NMR)	NAME (NMR)	DESCRIPTIO (NMR)	Easting (NMR)	Northing (NMR)
879852		LARGE WRECK, PROBABLY PARTIALLY BROKEN-UP	655193	235922

Table 20. Example of a record where there is no wreck name on the NMR dataset but the UKHO dataset provides a vessel name.

Some changes were made regarding place of departure and destination, the owner of the ship, when built and time of loss as well as former names and details of the cargo. One example is the *HMS Hirose* (HOB_UID: 912705) former name *Onze* which sank 1916. Another example is illustrated in the table below:

SZLABEL (UKHO)	INFORM (UKHO)	OBJNAM (UKHO)	TYPEWK (UKHHO)	HOID (UKHO)
LINCAIRN (POSSIBLY)	CIRCUMSTANCES OF LOSS:**BUILT IN 1904 BY FURNESS, WITHY & CO LTD, WEST HARTLEPOOL. OWNED AT TIME OF LOSS BY HOPESIDE STEAM SHIPPING CO LTD. TWO BOILERS, TRIPLE EXPANSION ENGINE OF 292HP, SINGLE SHAFT. PASSAGE THE TYNE FOR GIBRALTAR. CARGO 5300 TONS COAL.	*LINCAIRN* (POSSIBLY)	SS	10286

HOB_UID (NMR)	NAME (NMR)	DESCRIPTIO (NMR)	Easting (NMR)	Northing (NMR)
912703	*LINCAIRN*	REMAINS OF BRITISH MERCHANT STEAMSHIP, 1916	653897	255434

Table 21. Example where changes on place of departure and destination have been made.

Regarding Protected Wreck Sites, no amendments were made in AMIE. However, some missing information was identified in some cases. For example, the *Grace Dieu* (HOB_ID: 1082121) where the latest information about the excavation that took place during 2008 is missing. This is highlighting possible delays in updating records, which the NMR has already been notified as part of this project. It also demonstrates the need for the 'event' record in AMIE to be developed to cover maritime recording, an issue that the NMR is aware of (Martin Newman *pers. comm.* September 2010).

3.5.1 Issues with AMIE

AMIE was updated using remote access. During this process, a number of issues were encountered, especially regarding remote access often being slow. It is important to acknowledge that English Heritage staff provided ongoing support to minimise disruption although AMIE was down a few times, causing delays in the updating process. During this phase of the project, the AMIE support team was contacted 8 times regarding remote connection issues.

When updating a record, AMIE often crashed. The session could not be reset remotely. Therefore, a member of the AMIE team had to be contacted to reset the session to enable work to be resumed. Although remote access was certainly useful and positive for this project, it was also time consuming and challenging to plan workload.

Another important issue encountered was related to the fact that remote access only works in Internet Explorer. When Internet Explorer was updated several access issues were experienced and it was noticed that there was no compatibility with Explorer 8. This could not be resolved remotely despite having trial various tests. Therefore, to complete the work, MA Ltd staff organised two visits to Fort Cumberland (Portsmouth) enabling access to AMIE.

4. Conclusions

'Our Marine Historic Environment: Enhancing the NMR' Phase One project was successful in assessing various aspects of the digital data provided by both the NMR and UKHO. The usability within a spatial context, the format and the method of bringing both datasets together has been assessed and challenges identified.

The assessment of data format demonstrated the challenges of converting large scale databases from paper format to a digital and spatial output. SeaZone and the UKHO have invested time and resources in creating the UKHO shipwreck data, as well as other UKHO datasets, available in a ready to use spatial format. Similarly, 'Our Marine Historic Environment: Enhancing the NMR' Phase One project demonstrates the starting point of the NMR acknowledging and looking for means to resolve the issues identified within this project. For example, it has been very positive and useful the incorporation of the new UKHO IDs into the

NMR dataset. However, attribute data fields and their content need some basic common standardisation to allow matching further records in the future.

The data coverage assessment demonstrated that a total of 77% of the NMR dataset received for the pilot areas within 12 nautical miles matched the UKHO UIDs (i.e. NMR →UKHO) and 54% of the UKHO dataset matched the NMR UIDs (i.e. UKHO→NMR) with the remaining percentage referring to non-matching records.

There is considerable scope for matching further records by addressing some of the contradictions identified within this review (further details were discussed in **Section 3.2**). However, further indexable fields would be needed from both databases if records were to be matched beyond the use of known matching identifiers.

Spatial discrepancies were identified in all pilot areas undertaken as part of this Phase One of work. Spatial discrepancies were both in distance and direction. Suggestions explaining why these spatial discrepancies occurred would go beyond different coordinate systems between both datasets. This is due to the lack of consistent variability in distance and direction between records (see **Section 3.2.2**).

The data attribute assessment illustrated that there are several fields in both datasets with equivalent data but presentation and use of this data is not in a user friendly format. It also contains numerous empty fields which can cause confusion when comparing both datasets. Therefore, there is scope for both datasets to complement each other through an exchange of information via regular updates (e.g. every quarter). This would represent a 'win-win' situation for both data holders allowing reconciliation of contradictory fields and populating empty ones in other to improve their coverage and future matching records. This would be effective if a joined up approach between the NMR and UKHO is undertaken.

In those cases where differing attribute contents were identified, a live update of the AMIE records were undertaken through remote access. Although indeed very useful, remote access to the NMR AMIE database showed some technical issues partly slowing down the enhancement process. Instead, accessing AMIE directly from English Heritage Fort Cumberland (Portsmouth) offices was an alternative solution which proved to be effective.

This Phase One of work highlighted some major constrains when using two national shipwreck datasets together. A joined approach between the NMR and UKHO is needed mainly agreeing some common data standards to enable easy discovery and use of data. The presence of overlapping and potentially conflicting data highlights the need for spatial analysis. Lack of common basic attribute fields and conflicting attribute data within a GIS platform shows that the

incorporation of basic attribute fields needs to be considered. Besides, regarding data attribute content, further research for conflicting cases is needed on the case by case basis. Resolving these issues would allow the delivery of a spatially ready to use and user friendly dataset saving time and resources for the data holders as well as the end users undertaking commissioned work.

5. Recommendations to Enhancing the NMR

As a result of the work undertaken, recommendation as part of this Phase One of work can be summarised as follows:

	NMR	UKHO	Joined issues
Spatial analysis	Spatial conflicts		
	Duplicate geometries (casualty records & known wrecks)	Duplicate geometries (S57 & UKHO)	Duplicate geometries (all data suppliers)
	Geometric offsets		
Attribute analysis	Attribute conflicts		
	Remove NMR obstructions with no recognised historical meaning from AMIE (e.g. fishermen fastenings)		
Data attribute contents	Data field content	Data field content	Common data standards for recording attributes
	Wreck name	Wreck name	
	Date field	Date field	
	Vessel type field	Vessel type field	
Format	Delivery format		Common data standards
	Feature IDs		
	Inform the requirements for the system that will replace AMIE		
Communication			Communication through regular updates (i.e. every quarter)

Table 22. Summary of proposed recommendations as part of Phase One.

Consequently, the following recommendations are proposed:

- Develop ‘event’ record in AMIE to cover maritime recording.

- Use of IDs and common attribute fields to identify further potential matches. Generally, information is available in the AMIE long text but this information is not indexed. Therefore, it is suggested to undertake some data cleaning to ensure these records meet current data standards.

- Useful fields for research, education and amenity purposes are available within AMIE (see **Section 3.1.1**). Some of this information is often contained in the long text fields (e.g. vessel type, cargo, nationality, when and where built and by who, etc). A possible solution would be to separate the information contained in the long text fields to populate other fields or provide the data in a separate table which can then be appended to the GIS data related to it. The extraction of the data contained in these long text fields was not possible within the scope of this Phase One of work. However, it may be something that could be considered as part of Phase Two and undertaken in collaboration with SeaZone.

- Standardise the format for wreck names and create fields that facilitate fit for purpose queries and enable further matches. However, this would require the analysis of contents of supporting fields.

- Agree on common fields to be recorded within the NMR GIS depiction and the UKHO to ensure fit for purpose fields that can be queried, further cross referenced and can increase matching records. Some suggested basic common fields are:

  UID
  NMR UID/ HOB_UID
  UKHO UID/HOID (where applicable)
  Monument
  Monument Type
  Monument Name
  Nationality
  Date wrecked/sunk (inc aircraft). It is worth mentioning that the NMR currently records minimum date and maximum date. Although useful, to enable GIS queries date of sinking or loss would be preferable where known. Recording of year of loss would be sufficed where known and available. An extra field to record 'date range or period' would be useful especially for those cases where exact date of loss is unknown.
  Vessel (inc aircraft)
  From port
  To port
  Vessel Type (vessel class)
  Vessel Construction (wood, steel, etc)
  Cargo
  Other information
  Update Date (date of last record update)

- For consistency purposes and facilitate future matching records, common terminology to populate common attribute fields would be desirable. The NMR uses the NMR online thesauri which could be used as a common starting point (see http://thesaurus.english-heritage.org.uk/).

- Further enhancement of data for matched records where empty or conflicting fields have been identified. This could be undertaken in first instance utilising data existing in other available databases such as the ALSF Enhancing Our Understanding: Shipwreck Importance database undertaken by Bournemouth University.

- The NMR also contains obstructions and fishermen fastenings identified within its record. The historical significance of these records would require further desk based research on the case by case basis. This will allow identifying whether these records can be upgraded as wrecks. It would be recommended to remove NMR records only for those cases identified with no recognised historical meaning. This could facilitate the matching records in the future as well as reduce management requirements of the data.

- Spatial correlation needs to be addressed by resolving data geometries in collaboration with SeaZone due to their experience in dealing with data geometries.

- Undertake a case by case basis desk based research to upgrade targeted casualty records to wrecks

- Agreeing on a definitive set of coordinates for matching records.

- Development of guidance notes on how to integrate further AMIE information delivered as MS Excel files into GIS

- Ongoing communication between the NMR and UKHO and vice-versa through regular updates (e.g. every quarter) would be beneficial to prevent these issues recurring in the future.

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Maritime Archaeology Ltd.

Room W1/95, National Oceaonography Centre,
Empress Dock, Southampton, Hampshire SO14 3ZH
Tel: 02380 237300 or 02380 593290
enquiries@maritimearchaeology.co.uk
www.maritimearchaeology.co.uk