



Impact of Bait Digging on Archaeology

*Chichester Harbour Pilot Project
Project Report*



**March
2015**



Impact of Bait Digging on Archaeology:

Chichester Harbour Pilot Project

Project Report



Prepared by

The Maritime Archaeology Trust

National Oceanography Centre, Southampton

On behalf of

**Chichester Harbour Sustainable Development Fund & Interreg IVA
Arch-Manche**

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1. Introduction

The Maritime Archaeology Trust (MAT, formerly the Hampshire & Wight Trust for Maritime Archaeology) developed this pilot project to better understand the impact of bait digging on archaeological artefacts and deposits within Chichester Harbour. Bait digging activity had been noted within the harbour during fieldwork at the southern end on the Wadeway Medieval crossing from Langstone village to Hayling Island.

The action of bait diggers involves digging through the intertidal sediment and turning it over, which leaves a hole where the material was from and a small mound of sediment with the previously buried material now exposed on top. As fine sediments are washed from the top of the mound of material it often leaves artefacts exposed. At the southern end of the Wadeway there were worked and burnt flints frequently seen on these bait digging mounds.

The disturbance of deposits also has the potential to create localised changes to the sediment regime, which may increase erosion and have a small scale impact on coastal and intertidal change.

There is a clear need to increase understanding of the impact of bait digging on intertidal deposits in relation to the historic environment in order to best manage heritage assets and bait digging activity. Bait digging occurs nationally in areas of suitable environment for the various species of bait targeted for fishing activities. While there is a wider need to understand the potential impacts on a national scale, this initial pilot project has been undertaken in Chichester Harbour and has enabled a greater understanding of the scale, rate and impact of bait digging activities. This information can now be used to aid future management of bait digging in relation to heritage features within the Area of Outstanding Natural Beauty (AONB), and also acts as a demonstration project to apply on a larger scale.

1.1 Project Aims and Objectives

Project Aim: To undertake a pilot study on the impact of bait digging on archaeological sites, features and deposits within Chichester Harbour, to use the results to develop management recommendations for the Harbour and demonstrate the need for a national study.

The broad objectives of this project were to:

- I. Review knowledge of sites, features and deposits where bait digging has impacted archaeology.
- II. Undertake research to determine other areas where bait digging is thought to coincide with heritage features.
- III. Understand the patterns and management of bait digging within Chichester Harbour.
- IV. Undertake a range of surveys to quantify the extent of the damage to heritage features.
- V. Review relationship between bait digging and movement of intertidal sediments.
- VI. Develop recommendations for management of bait digging within the harbour to minimise impact to heritage.
- VII. Identify opportunities for using the results of this study to develop a national assessment of the impact of bait digging.

This project has been generously funded through the Chichester Harbour Sustainability Fund, further match-funding has been provided through the European Regional Development Fund Interreg IVA Archaeology, Art and Coastal Heritage - Tools to Support Coastal Management and Climate Change Planning Across the Channel Regional Sea (Arch-Manche) project.

2. Methods

The project employed a range of methods to enable delivery of the aims and objectives, these ranged from desk based research, through fieldwork and analysis.

2.1 Desk Based Research

Prior to planning fieldwork a range of available sources were consulted to ensure the archaeological resource of the area was understood, in addition to any previous evidence of bait digging. Data relating to bait digging methods and species targeted were investigated alongside current environmental and management sources.

Archive and Archaeological Data Review

The archive of data gathered during the survey work on the Wadeway was reviewed to identify any information on the position, extent and impact of bait digging encountered during these surveys.

A review of databases of archaeological site information within Chichester Harbour was undertaken to identify where archaeological sites, features and deposits are located which could be threatened by bait digging activity. This included a review of the Historic Environment Record (HER), the National Record of the Historic Environment (NRHE) and a review of previous archaeological fieldwork in the area undertaken by Maritime Archaeology Ltd (MA Ltd, 2006).

Bait Digging Review

Desk based research was undertaken to:

- Determine information on the nature of bait digging in Chichester Harbour – where undertaken, density of activity, any seasonal patterning of activity, species targeted and physical impact required to gather bait.
- Briefly review habitats required by different bait species and where this may exist within the Harbour.
- Determine how bait digging is managed by Chichester Harbour Conservancy.
- Determine any relevant by-laws and guidelines which govern bait digging.
- Review 'bait digging code' produced as part of Solent Marine Environmental Sites initiative.

GIS data of bait digging areas was received from Chichester Harbour Conservancy, this was overlapped with archaeological data and if known sites existed in an area of bait digging activity these were then selected for the fieldwork.

Environmental and Management Review

This assessment focused on information pertinent for the physical preservation of heritage sites, features and deposits, relevant nature designations and harbour management frameworks.

Environmental information – geological and geomorphological sources, modern seabed conditions, and hydrological regime amongst others.

Designation information – current nature designations – Ramsar, Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), to review how they may contribute to management of bait digging activity.

Management framework – Review of how Chichester Harbour Conservancy currently manage bait digging activity.

Survey Data Review

Desk based research utilised available data from satellite and remote survey sources, to review whether known areas of bait digging disturbance can be identified. Data held by the Channel Coastal Observatory were reviewed, including:

- Ortho-rectified aerial photography captured in 2005 (CCO).
- Lidar collected in 2005 (CCO).
- Habitat mapping 2008, includes the type of habitat, location and extent (CCO – see http://www.channelcoast.org/southwest/survey_techniques/airborne_remote_sensing_topo_surveys/?link=habitat_mapping.html).

Other survey data sources reviewed included:

- Google Earth, Bing maps.
- Relevant SCOPAC datasets.
- Solent Forum Data Catalogue sources.
- Relevant Natural England and Wildlife Trust surveys.
- Relevant data held by Chichester Harbour Conservancy.

2.2 Field Investigation

Based on the results of the desk based research plans were developed for archaeological survey. Intertidal fieldwork was undertaken at suitable low tide periods and at intervals to review potential damage from bait digging at different times of the season, and how deposits in areas identified as being damaged change or move over time.

The following areas were selected for fieldwork and were investigated in June 2014 and again in January 2015:

- The Wadeway
- Prinsted
- Chidham
- Dell Quay to Copperas Point

Figure 1 shows the location of these areas, which contain known archaeological sites and features and were also highlighted as areas of bait digging activity in data received from CHC.

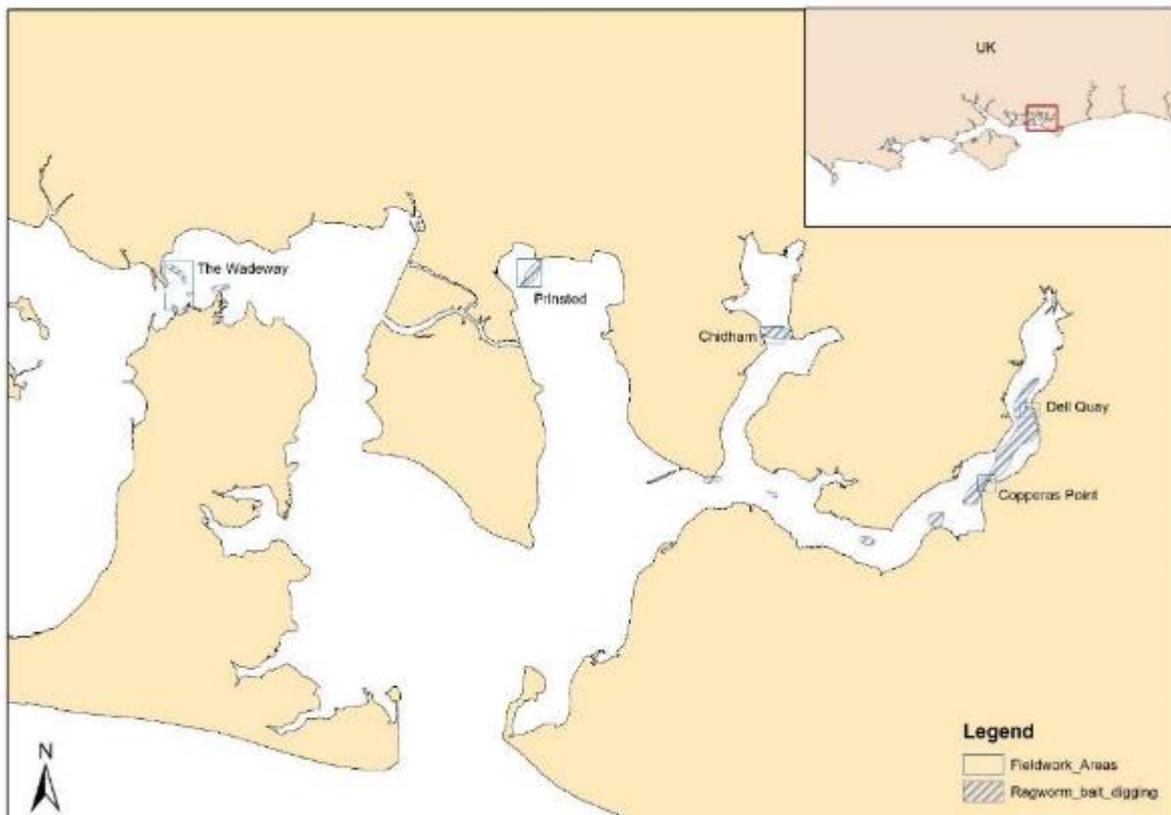


Figure 1. Overview map of key areas investigated. Areas known to be affected by bait digging are also depicted (data courtesy of CHC).

Volunteers and students were involved in both sessions of fieldwork, this included members of the Chichester District Archaeology Society and staff and students from the University of Southampton.

Fieldwork Planning, Equipment and Paperwork

MAT staff assessed the tide times, undertook a site risk assessment, developed the daily plans and obtained necessary permissions prior to fieldwork. All necessary equipment was checked and provided by MAT.

MAT staff, volunteers and students were provided with a detailed archaeological project plan prior to fieldwork, this included logistical information as well as background information on the sites visited.

Fieldwork Methods

Two sessions of fieldwork were carried out, one in the summer (June 2014) and one in the winter (January 2015). The same sites were re-visited in order to determine change over time. A number of these sites were also subject to previous archaeological fieldwork and were reported to have been affected by bait digging, these previous surveys provided more comparable data to assess change over time.

Each site was subject to an initial walkover survey. Areas of bait digging activity were then recorded, this included a position and photographic survey. Any potential artefacts that had been exposed due to bait digging were recorded in-situ and then recovered. Each site was given a code and the artefacts were bagged and labelled.

Post Fieldwork Tasks

After the fieldwork all records were checked, consolidated and assessed ensuring that all the data was processed to recognised archaeological standards.

2.3 Assessment and Analysis

This phase of work included:

Interpretation

All data and information gathered from desk based research and fieldwork was integrated to allow a comprehensive review of the scale and impact of bait digging on sites, features and deposits. All digital data was incorporated into the project GIS for analysis.

Assessment of Risks from Bait Digging

Based on the acquired data and its interpretation an assessment was made of the extent to which bait digging is causing risk to heritage features. Where possible this considered past bait digging, survey data on current bait digging and potential future bait digging.

The assessment particularly considered the location of known archaeological sites, features and deposits and where these correspond with habitat for bait.

Review of Current Management and Recommendations

The results of the desk based assessment, fieldwork, interpretation and assessment were then utilised to inform appropriate future management, monitoring and potential protection measures.

3. Bait Digging and Chichester Harbour

Understanding of bait species, their habitats and issues related to bait digging have drawn on the results of studies undertaken by Fowler (1999) as part of the EU Life Funded project 'UK Marine Special Areas of Conservation', which was completed in 2001 (<http://www.ukmarinesac.org.uk/bait-collection.htm>). Further research has focused more specifically on Chichester Harbour.

3.1 Bait and its Habitats

Most bait digging around the Solent area is targeting ragworm and lugworm which are commonly used for fishing bait. The two species prefer slightly differing habitats, with ragworms being most common within the muddy environments of Chichester Harbour.

Ragworms

These worms favour muddy environments. They live in 'U' shaped burrows between the high and low water marks. They are used for fishing from the shore or from small boats. They are popular as they are effective for catching a wide range of sea and estuarine fish species. These worms will grow to up to 1 metre in length, but are usually much smaller when used as bait, often 12 – 15cm long (<http://britishseafishing.co.uk/ragworm/>). Ragworms are frequently used for fishing in the summer months.

Lugworms

These worms favour a more sandy environment. They are smaller than ragworms and rarely exceed 20cm in length. There are several species of lugworm with 'blow lugworm' being most popular for fishing (<http://britishseafishing.co.uk/blow-lugworm/>). Lugworms also live in 'U' shaped burrows, larger worms live closer to the low tide mark, with smaller ones higher in the tidal range. These worms create a 'cast' of material from their burrow on the surface of the sand, making them more easily detectable by bait diggers.

Chichester Harbour Habitats

Surface sediments within the harbour are mainly mudflat, a study by Thomas in 1987 indicated over two thirds of the harbour intertidal area was covered by mudflats consisting of silt and clay mixed. Thomas also noted that sandflats were present in almost 10% of the intertidal area, but these are mostly situated near the harbour entrance. Due to this sediment regime it is likely that the 'mud-loving' ragworms are most frequently targeted within the Harbour.

3.2 Bait Digging Techniques and Impacts on Archaeology

Both ragworms and lugworms are traditionally collected by using a fork or spade to hand-dig areas of the lower shore where worms are resident. If bait is numerous then many holes may be dug across an area, but if fewer worms are present then it is likely that the collector will look for the individual worm hole and then target a specific burrow. This leaves fewer holes in an area, however, the holes are rarely back-filled leaving the foreshore 'pock-marked' with small holes and adjacent mounds of sediment that have been removed from them.

Fowler 1999 outlined that "Digging for bait disturbs the sediment, which is removed from its original position, overturned and exposed to air and wave or current action. Transport of fine sediment and previously buried contaminants takes place at the sediment surface. Stones and shell buried in the sediment are exposed" (http://www.ukmarinesac.org.uk/activities/bait-collection/bc2_3_2.htm). More detailed work to analyse the precise constituents of sediments where bait are present and changes to these sediments following digging have been undertaken in the Solent region by Watson et al (2007).

The impact of bait digging is most often discussed in terms of the effects on 'habitats', with particular emphasis on the speed at which the foreshore surface recovers to its previous form, and impacts on other biological species. Other impacts frequently cited include disturbance to birds and potential conflicts with other shore users (See http://www.ukmarinesac.org.uk/activities/bait-collection/bc2_3_2.htm).

Evidence of bait digging was initially noticed on the Wadeway site within Chichester Harbour where the mounds of sediment from the single spade or fork holes had left flint material exposed. Inevitably where bait digging activity corresponds with the presence of archaeological sites and deposits there is a threat of direct impact to historic environment features.

Most bait collection is thought to be undertaken for personal use rather than commercial, however, there is a larger market for fishing bait which is serviced by professional bait collectors. Commercial collectors are likely to work by digging a series of adjacent trenches which are back-filled as they proceed across an area of foreshore. Although this method is efficient for the bait diggers as it collects the majority of worms in an area, it leads to the depletion of worm populations. Although these trenches may be 'back-filled' and hence do not leave as much trace on the foreshore surface, in terms of heritage sites, features and deposits it could mean that large areas are disturbed, destroying archaeological contextual information. The back-filling process then fills holes with mixed deposits which could involve not only physical damage but also changes in the chemical composition of the sediments which could impact long term preservation.

Fowlers report (1999) in support of the UK Special Areas of Conservation project did recognise that heritage can be effected, the section 'Impacts on other shore users' includes the text "Bait digging can damage or destroy archaeological remains on the lower shore". While in the 'Conclusions and gaps in knowledge' it is outlined that: "Habitat damage and alteration may also be incompatible with some recreational uses, harbour operations and archaeological heritage. Problems caused include deterioration in the aesthetic appearance of dug shore and crab shelters, human safety, and physical damage to vessels and structures".

While the potential for impacting the historic environment has been recognised (e.g in Tomalin et al 2012 as a management issue), there have been no specific studies to attempt to identify sites where this is occurring and gauge the extent of the impact. The work undertaken within Chichester Harbour is an initial step in seeking to address this issue.

3.3 Bait Digging Activity within Chichester Harbour

The potential impacts of bait digging in Chichester Harbour were highlighted in the 1990s in terms of larger scale commercial exploitation of king ragworm and the effects of the activity on the population size of a range of species inhabiting the intertidal zone. Studies were undertaken by Farrell over a three year period (Farrell 1996 & 1998) to assess these impacts, the results helped support the case for the introduction of the bylaw on bait digging.

A further study was undertaken between 2004 and 2006 to review longer-term impacts on different species and the physical changes to the foreshore. This involved five sites within the Solent area, one of which was at Dell Quay (Watson et al 2007), which interestingly corresponds with one of the areas within the archaeological study area. The results demonstrated that some large, long-lived species do not recover for a number of years when they have been subjected to bait digging.

In support of the study of impacts of bait digging on archaeology CHC were able to provide a GIS Shape file showing the areas of known activity, these areas are shown in Figure 1,

which includes the whole harbour, and in more detail below in Figure 2. Most of the bait digging is towards the northern extremes of the Harbour areas, which corresponds to mud dominated environments.

The areas shown in Figure 1 as being impacted by bait digging were reviewed against known archaeology and heritage features. This demonstrated that four areas (shown in Figure 2), the Wadeway, Prinsted, Chidham and Dell Quay to Copperas Point, all contained heritage features and were targeted for archaeological survey. One other area to the south of Chidham was identified as being impacted by bait digging, however, the area contained no known archaeological material and was not assessed as part of the fieldwork element of the project.

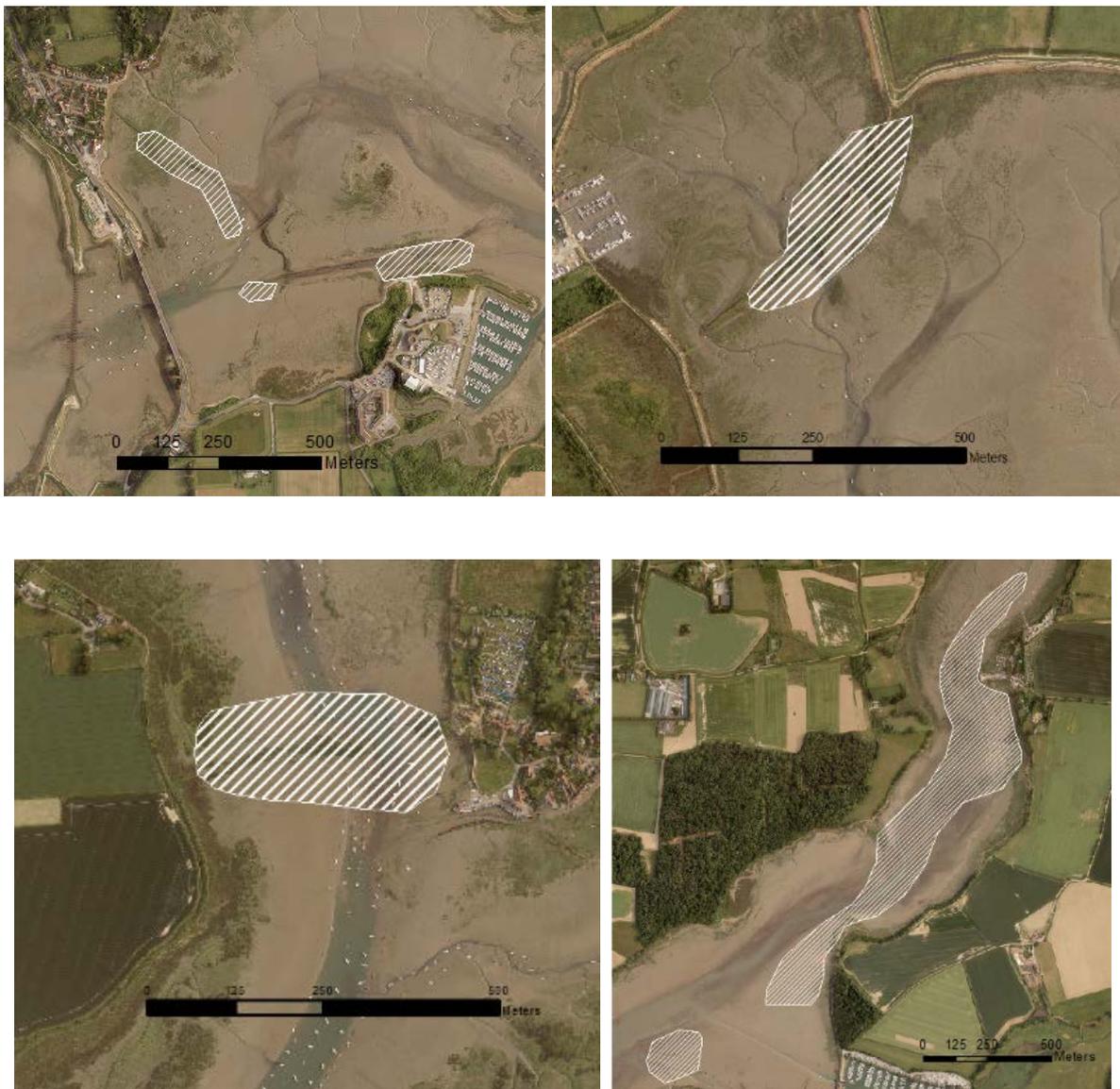


Figure 2. Detailed view of known bait digging areas in Chichester Harbour, from top left to bottom right: the Wadeway, Prinsted, Chidham and Dell Quay to Copperas Point. (Data courtesy of CHC, aerial photographs courtesy of the CCO).

3.4 Management of Bait Digging Activity

At present bait digging activity within Chichester Harbour is primarily managed through a specific bylaw, it is also covered through a voluntary code developed in support of the Solent Estuary Marine Sites.

Chichester Harbour Conservancy Management

As outlined on the Chichester Harbour Conservancy website (<http://www.conservancy.co.uk/page/angling/315/>), "Digging for bait in the Harbour is controlled by a bylaw and restricts the areas that are available. Over-digging has depleted the colony of harbour ragworms so please - only take what you intend to use and fill in the holes you have dug".

The relevant harbour bylaw is: **Bylaw no. 28.** (Digging of bait) No person shall in any part of the harbour dig for lugworm, ragworm, or any form of fishing bait within 50 ft. of any mooring, or within 20 ft. of any pile, beacon, mark, hard, causeway, jetty, quay, wharf or similar structure (Chichester Harbour Conservancy, 1996).

However, within the Harbour Management Plan for 2014 – 2019 the need to review the impacts of bait digging is recognised "Amateur anglers fish in the Harbour during the year from the shore and boats.....This means that bait digging also is a common activity in the Harbour, which is, to a degree only, controlled by bylaws and requires close monitoring and control" (page 38). And that "Closer scrutiny of the impact of activities such as oyster dredging and bait digging on the subtidal and intertidal biodiversity within the AONB may be required in the future to determine the impact on favourable conservation status" (Page 39). As a result a specific management issue identified is: "The impact of bait digging on intertidal habitats and collection of bait for commercial purposes".

Recognition that the bylaw only controls bait digging 'to a degree' and there is cause for concern in terms of potential impacts underlines the importance of the current project to review bait digging in relation to historic environment impacts.

The SEMS Bait Digging Code

In addition to the specific management approaches for bait digging by Chichester Harbour Conservancy there is a Solent wide voluntary Bait Digging Code which was developed in support of the management of the Solent European Marine Sites (SEMS). A review of this code revealed there is very little consideration of archaeological and heritage aspects that could be impacted by the activity. The code is primarily concerned with habitat and species protection. Section 5 of the code states 'Avoid disturbing wildlife and marine heritage wherever possible', however, the bullet points which expand on the specifics of this element of the code are all related to wildlife.

At present there is no recognition of the impact that the physical process of bait digging on archaeological sites, buried landscapes or deposits. There are no references to heritage sites with legal protection such as Scheduled Ancient Monuments and Protected Historic Wreck sites.

While the code may be helping reduce the wider impacts of bait digging, its voluntary status and a wider lack of regular monitoring of bait digging activity, mean its effectiveness is difficult to measure.

4. Survey of Impact of Bait Digging on Archaeology

As a result of the desk based research four sites were selected for the survey: the Wadeway, Prinstead, Chidham and Dell Quay to Copperas Point (Figure 1 & 2). These areas all contain potentially vulnerable archaeological sites, features and deposits and are in areas known to be impacted by bait digging.

In order to gauge whether there were difference in bait digging activity between seasons and to review how the foreshore recovers from previous activity the sites were visited in summer 2014 and winter 2015. As a number of these sites had also been included within previous fieldwork within the Harbour, particularly a 2006 Survey of Foreshore Structure (MALtd 2006) and the Wadeway surveys it was also possible to compare the fieldwork results with conditions encountered almost ten years ago.

This report section provides background information on each of the areas assessed and outlines the results of the survey of bait digging activity, including comparison with previous work.

4.1 The Wadeway

Introduction to the area

The Wadeway runs from the village of Langstone southwards to Hayling Island. This tidal causeway is exposed at low water and was once, the main crossing point to the Island until a bridge was constructed in 1817. It was long thought likely that the Wadeway dated from as early as the Bronze Age, when there was significant activity in the area. The first documentary reference to the Wadeway dates to 1552 and the toll for crossing the feature is mentioned. Later references mention the costs of maintenance. The first cartographic evidence of the Wadeway is found on Taylor's 1759 map. The decline of the Wadeway was inevitable after 1821 when it was cut through by the Portsmouth to Arundel canal.

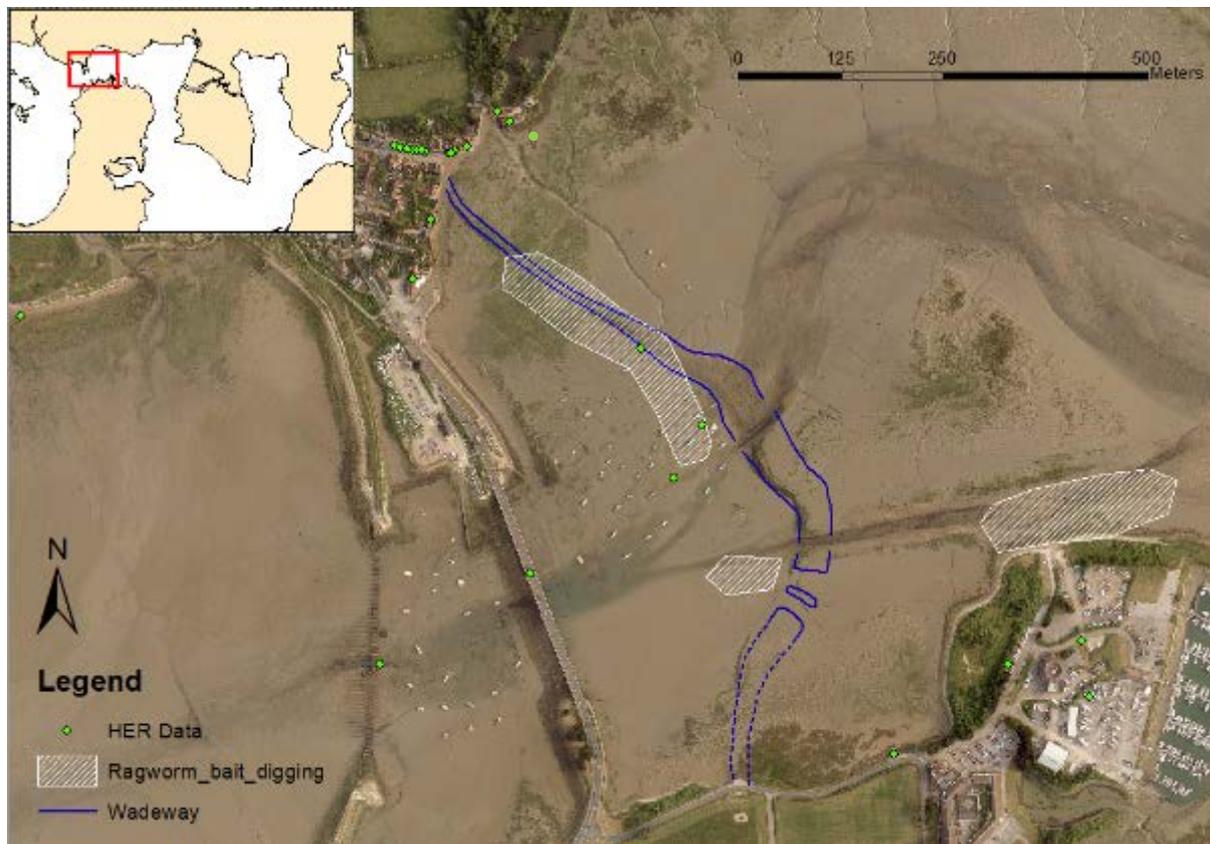


Figure 3. The Wadeway, north of Hayling Island, the blue line shows the remains of the feature, the hashes represent areas known for bait digging and the green dots represent HER data (aerial photo courtesy of CCO).

Known sites in relation to bait digging

The green dots in Figure 3 represent the County Historic Environment Record (HER) data, all three dots which overlap with the area of known bait digging activity represent the Wadeway structure (the plan of the site is depicted in blue courtesy of MA Ltd). Other nearby archaeological sites include the remains of a Langstone barge (located east of the northern section of the Wadeway), this site is situated in extremely soft mud and is unlikely to be targeted by bait diggers.

At the southern end of the Wadeway the HER records several timbers which were discovered during the construction of the seawall, one of which was dated to the Bronze Age. However, if any of these remains still survive they are unlikely to be impacted by bait digging as they are located on harder sediment near the high water mark.

Previous archaeological survey

A topographical survey and recording of features on the Wadeway was carried out in 2000 in conjunction with local volunteers. Ten timber structures were recorded, which appeared to provide structural support for the causeway. A more detailed survey in 2008 included excavation work and auger surveys to analyse the composition of the structure and seek artefacts to help in dating the structure. No significant artefacts were discovered, however a combination of radio-carbon dating, palaeoenvironmental analysis and other techniques indicated that the area was terrestrial in nature until at least the Post Roman period, and the causeway is most likely to have been constructed in the 13th or 14th century AD.

The negative impact of bait digging on the site was reported in 2008, particularly on the southern section, with the project report stating:

“During the walkover survey bait digging was observed in the southern segment [of the Wadeway]. This had left the area heavily truncated and damaged with one post split and removed by the activities. The physical evidence on site suggests that bait digging has been on-going for an extended period of time and may have had a detrimental effect on any potentially buried remains relating to the Wadeway in this area. Also within the southern segment a number of worked flints were located, these included a core and five pieces of worked flint. These provide further indication of prehistoric use of the area to the north of Hayling Island, but also demonstrates how bait digging is disturbing sediments containing archaeological material.” (Satchell, 2014).

The location of worked flints from the southern area of the site is further evidence of prehistoric activity, which clearly spreads beyond the shoreline into the intertidal zone.

Bait digging survey results

The Wadeway was first investigated as part of the bait digging impact project on the 9th June 2014 at low tide (Figure 4). Initial inspection was on the southern section and a walkover survey was carried out to determine whether any bait digging was evident. The site was then re-visited on the 15th January 2015 (Figure 5). There were no signs of any recent disturbance to the site and no notable damage. Although the incoming tide generally smooths over the evidence of bait digging this appears to take a considerable time to fully reinstate the sediments, so it was determined unlikely that the Wadeway area had been targeted for bait very recently. The northern section of the site was also investigated and a walkover survey carried out the length of the section until the channel which makes the structure impassable. Again there were no signs of recent disturbance.



Figure 4. The southern section of the Wadeway looking north. Left: June 2014. Right: January 2015



Figure 5. The northern section of the Wadeway looking south. Left: June 2014. Right: January 2015.



Figure 6. Timber remains on the Wadeway. Left: June 2014. Right: January 2015.

Discussions with local residents suggest that this is no longer an area targeted by bait diggers, whether the area was previously exhausted or whether this is due to other environmental changes is unknown. The timber remains appear relatively stable (as shown in Figure 6).

Comparison of bait digging over time

Although no evidence of bait digging activity was seen in the 2014 – 2015 survey it was still possible to compare images of the site with the previous survey:



Figure 7. Timber features on the northern section of the Wadeway. Left: 2005, Right: 2015.

Although the photographs in Figure 7 were taken at different times of year they show the timber remains on the northern section of the Wadeway, this appears to have changed very little in the ten years between surveys.

4.2 Prinsted

Introduction to the area

The intertidal area around Prinsted contains the remains of oyster beds and walkways, this consists of several circular and rectangular features which are clearly visible on aerial photography. The site is similar to the oyster beds found at Bosham, although larger in scale, the complex remains demonstrate the importance that this industry once played within the local economy. The remains are thought to be one of the largest oyster bed complexes in the harbour.

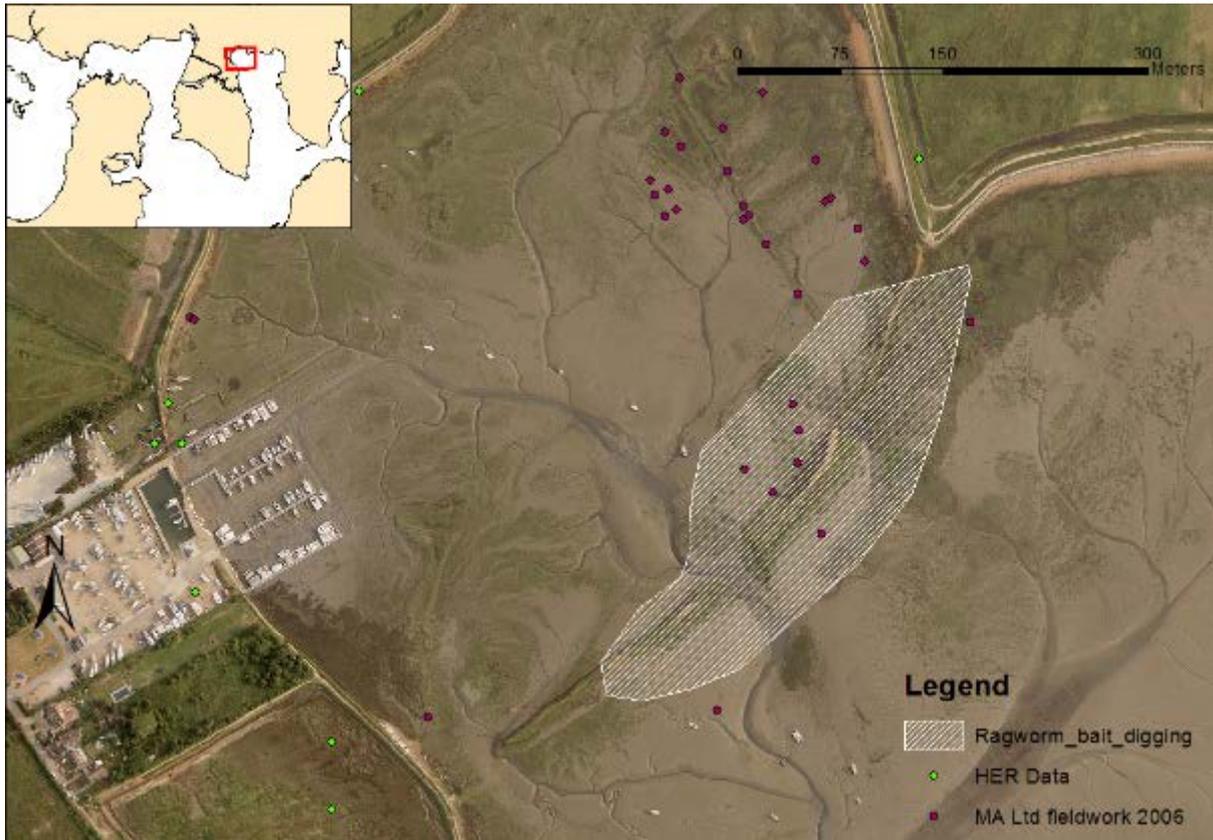


Figure 8. Prinsted, the hash represents the area known for bait digging, the green dots represent HER data and the red dots represent data collected by MA Ltd (aerial photo courtesy of CCO).

Known sites in relation to bait digging

Figure 8 shows known sites in relation to the area of bait digging activity. The main sites affected are those investigated in 2006 by MA Ltd which are the remains of the oyster beds and walkways. Nearby sites identified in the HER include finds of Iron Age and Roman Pottery as well as Neolithic sites, although these are all above high water and should not be impacted by bait digging, they are an indication of past human activity in the area.

Previous archaeological survey

The site at Printhead was investigated in 2006 as part of the Chichester Harbour Survey of Foreshore Structures project (MA Ltd, 2006:29-31). Features were initially identified on aerial photographs, closer inspection revealed that these were part of a large complex of oyster beds. The site was described as containing highly compacted gravel linears, bordering silty-clay rectangular beds of varying sizes. A break was noted on one of the linears and is thought to have once held a sluice that would have allowed control of the water (Figure 13). In some sections of the linears small amounts of timber revetment remains were recorded, as well as dense areas of oyster shells. Slight differences in at least three distinct areas of the complex suggests that this may be the result of several phases of construction.

During the 2006 survey it was reported that evidence of bait digging was visible in the area and could be damaging to buried elements of the features.

Bait digging survey results

Initial investigation of the site on the 9th June 2014 involved a walkover survey along the remains of the oyster bed then south-west along the hard (Figure 10: left). The remains of the oyster beds and several timber structures could clearly be seen, although there was quite extensive weed growth which made it difficult to view areas of intertidal sediment. There was no apparent evidence of recent disturbance from bait digging visible.

The site was re-visited on the 16th January 2015 (Figure 10: right), when the tides were slightly lower allowing the team to walk across the hard s and around the oyster bed remains. The weed growth present in the summer had died back making it possible to view large areas of intertidal sediment. There were clear signs of bait digging in the softer sediment in between the lines of hard s or walls between the oyster beds (Figures 9 & 11). The ‘classic’ evidence of hand digging for bait was seen where holes had been dug and the spoil left on the foreshore. Figure 11 shows a clear mound and corresponding hole in the foreground, areas of adjacent foreshore appear to show evidence of older bait digging with less pronounced ‘mounds’ where the tidal forces have begun to wash them away.

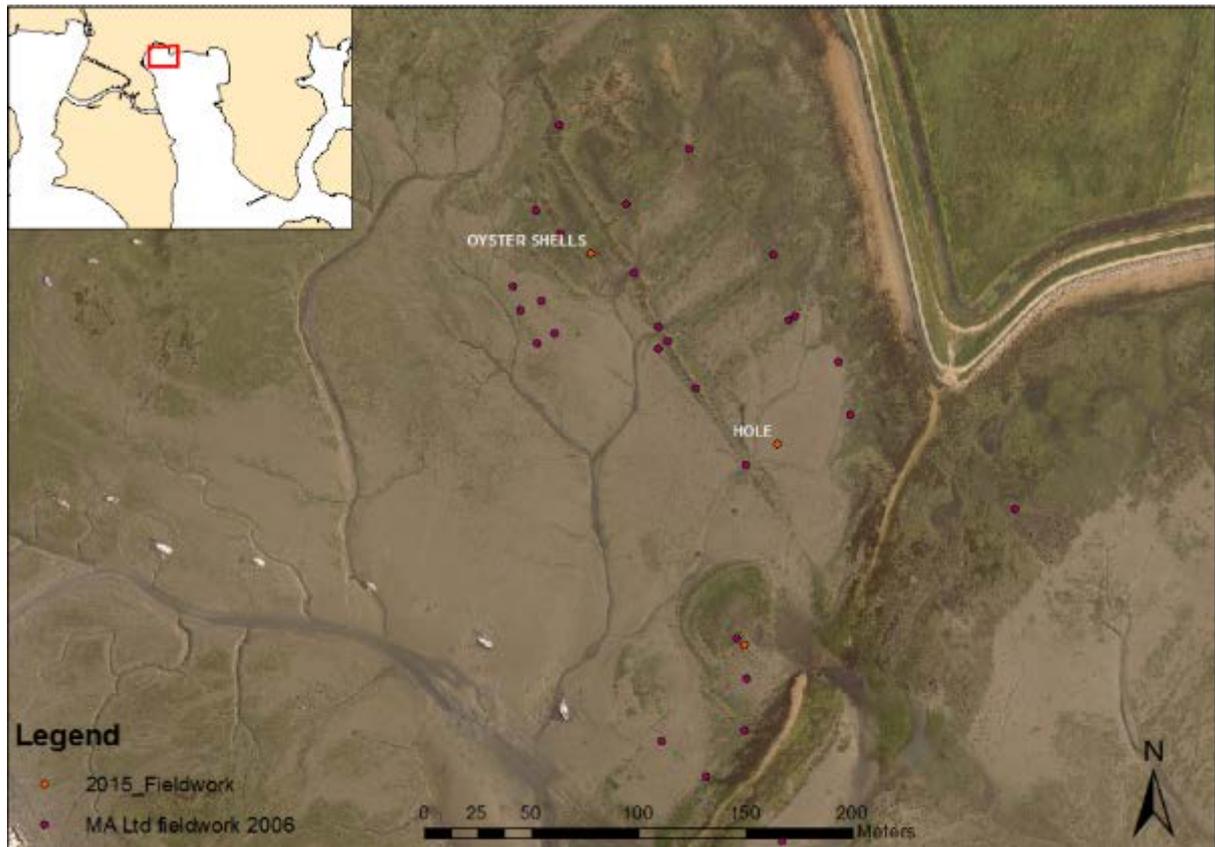


Figure 9. Location of bait digging evidence (hole) and fieldwork results in Prinsted (aerial photography courtesy CCO).



Figure 10. Remains of the oyster beds at Prinsted. Left: June 2014. Right: January 2015.



Figure 11. Evidence of bait digging at Prinsted on the softer sediment inside the oyster bed features



Figure 12. Dense areas of oyster shells were visible at the site in Prinsted

Comparison of bait digging over time



Figure 13. One of the gravel walkways with a sluice feature in the middle,, left: 2006, Right: 2015

Although the images shown in Figure 13 are facing different directions they are of the same gravel hard at Prinsted, with a sluice type feature in the middle. More depressions are visible in the 2015 images showing that the walkway may be deteriorating due to the impact of bait digging activity.

4.3 Chidham

Introduction to the area

Between Chidham and Bosham sailing club are the remains of a possible jetty or wharf structure, some sources suggest that this was a seawall built with the intention of reclaiming land (CHC website) or the remains of an attempt to construct a road from Chidham to Bosham (Francis, 2004:75). The feature is made up of various materials including shingle, rubble, flint nodules as well as timber. The timber components include stakes, posts, bracing timbers, revetment, beams and piles (MA Ltd, 2006). The visible aggregate makeup of the feature is somewhat wider than the timber elements, in some sections covering an area almost twice the width. Although shorter the structure on the Bosham side mirrors that found at Chidham, the Bosham side was not visited as part of this project.

Alongside the structure are the remains of a vessel, possibly late 19th century to early 20th century in date, although very little of the vessel survives.

Known sites in relation to bait digging

The area impacted by bait digging encompasses the entire feature from Chidham to Bosham. Nearby archaeological features (green dots in Figure 14) include findspots, fire cracked flints, and a Neolithic flint working site. The only other site from the HER which is within the area impacted by bait digging is the remains of a vessel (Monument number 911264), for which no further details were available, it is located on the edge of the channel in soft sediment which made it difficult for access preventing further investigation. It is possible this site is referring to the vessel remains located on the seawall feature mentioned above and has been recorded with position showing slightly differently in the HER.

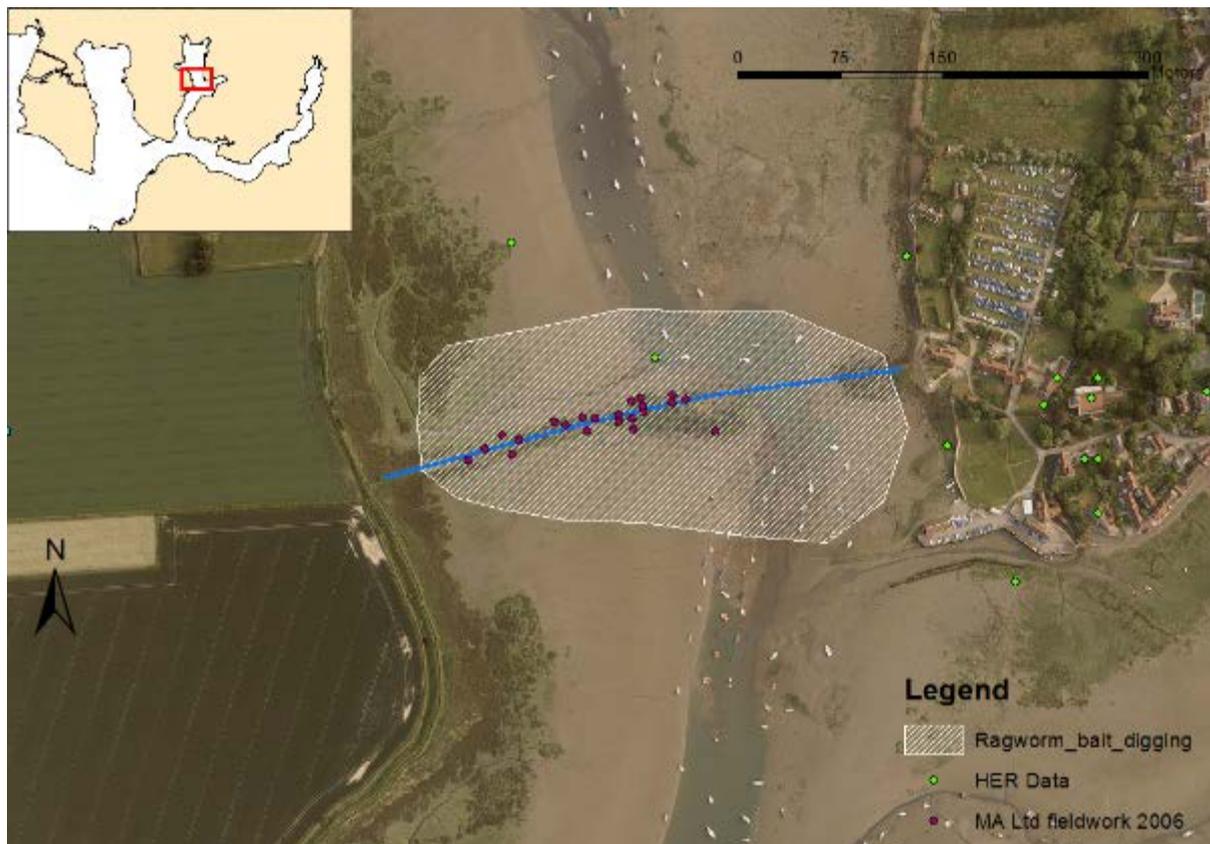


Figure 14. Chidham to Bosham. The hash demonstrates the area known to be impacted by bait digging, the red dots represent features within the walkway identified in the 2006 survey, the blue line and green dots represent HER data (aerial photo courtesy CCO).

Previous archaeological survey

The site was initially referred to as being a mud wall by the CHC, it was later investigated by MA Ltd in 2006 as part of the Chichester Harbour Survey of Foreshore Structures project. During the project the timber remains, the extent of the hard and the hulk remains were recorded (shown as red dots in Figure 14). As a result it was proposed that this feature is the remains of a jetty and wharf structure which may have acted as a kind of mole, creating a harbour near Bosham. As a result of the 2006 survey the site was recorded as having high archaeological potential and would add to our knowledge of the past economic infrastructure of Chichester Harbour (MA Ltd, 2006:44).

Bait digging survey results

The Chidham side of the feature was investigated on the 10th June 2014 and again on the 15th January 2015. This involved a walkover survey of the site and photographic recording of features and evidence of bait digging activity. During the fieldwork there was a range of evidence that bait digging has taken place in the past with holes and adjacent mounds of material (Figure 15), and even a fork abandoned on the foreshore. Talks with a local resident confirmed that this is an area frequently targeted by bait diggers, and it is the mud around the timber remains most frequently dug as there seems to be more worms in these areas.

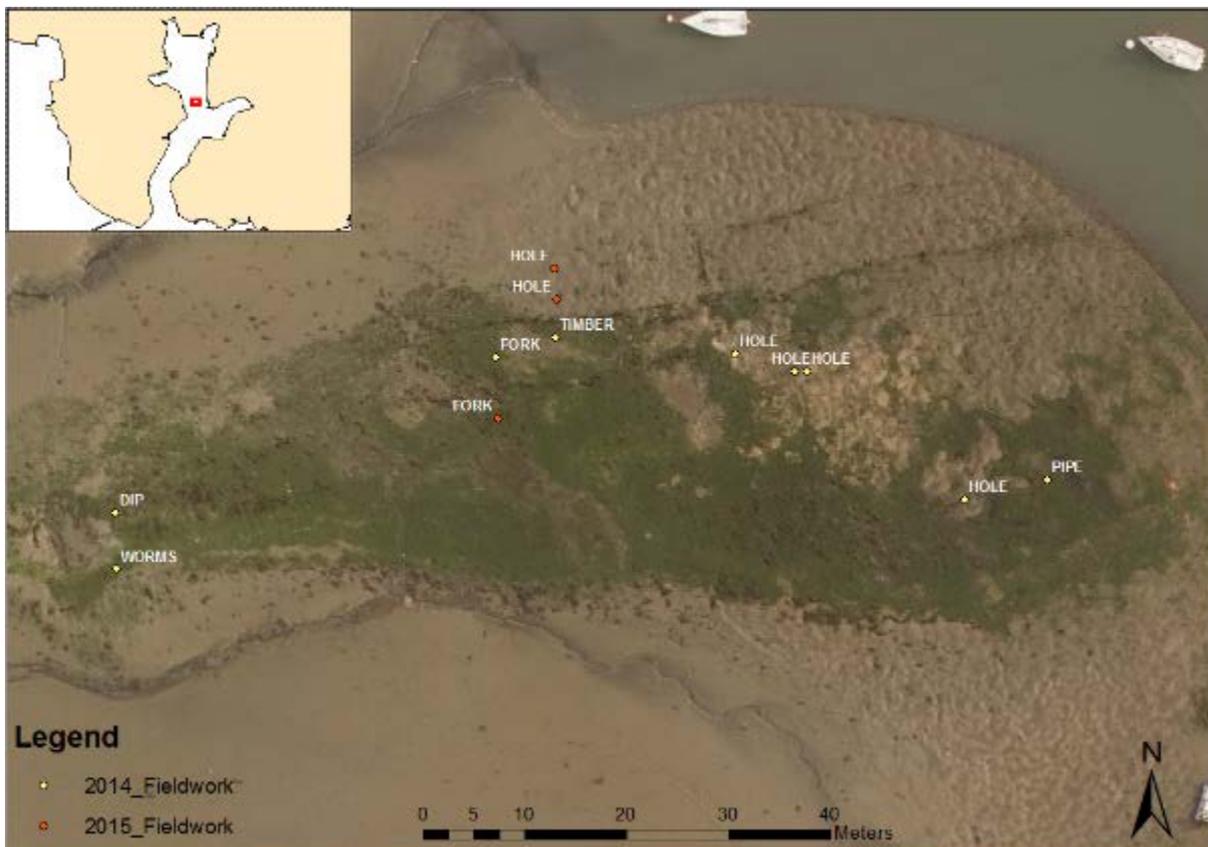


Figure 15. Location of bait digging evidence (hole) and fieldwork results in Chidham (aerial photography courtesy CCO).

Several depressions were noted in the mud around the timber structures with corresponding areas of debris where mounds had been and the tide had washed the fine sediment away to leave a range of stones and flints (Figure 16 – particularly top right & bottom left). Evidence of rag worm was also noted. A broken fork used for bait digging was also found between the timbers. These areas are shown in Figure 16.



Figure 16. Evidence of bait digging around the site at Chidham. The image in the top left shows a discarded fork.

Comparison of bait digging over time

Photographs from the 2014 and 2015 fieldwork have been compared to images taken in 2006 as part of the Chichester Harbour Survey of Foreshore structures project (MA Ltd, 2006). A large depression (labelled dip in Figure 15) was noted, within this area it was possible to see signs of ragworm and the depression appeared to be getting larger from 2006 to 2014/15, it is unclear whether this is natural or a result of bait digging (Figure 17).



Figure 17. The site at Chidham showing the large 'depression'. Top Left: from the 2006 survey (MA Ltd). Top Right: from the 2014 survey. Bottom Left: from the 2015 survey. Bottom Right: Close up of the 'depression from the 2015 survey'.

It is clear from the survey results that the Chidham area is frequently targeted by bait diggers, with additional activity noted between the June 2014 and January 2015 seasons of work.

4.4 Dell Quay to Copperas Point

Introduction to the area

A large stretch of the intertidal zone from north of Dell Quay to just south of Copperas Point is affected by bait digging (Figure 18). The area contains numerous archaeological sites and features which could be impacted by bait digging activity.

Dell Quay area was used as a study site to review the impacts of bait collection on other biological species in a study published in 2007 (Watson et al). The paper outlines that "Bait collection at Dell Quay covers an area of approximately 0.25km² and covers both sides of the Fishbourne Channel.....Bait collection can be heavy, but patchy at this site, and is dug regularly by many collectors resulting in many mounds and troughs"(pg 706).

Known sites in relation to bait digging

Several archaeological sites, features and deposits exist in this area, including a Roman tile kiln, a Neolithic site, remains of a possible groyne, and a number of partially buried trees that may mark the extent of the former shoreline. The Roman tile kiln is on the edge of the area impacted by bait digging just south of Dell Quay, closer inspection showed this was too high up the coastal zone to be directly impacted. Similarly the Neolithic site on the opposite bank is also above high water and unlikely to be impacted by bait digging, although there is potential for prehistoric material to be buried within sediments closer to or within the intertidal zone.

The groyne feature consists of a row of timbers extending from the current high water mark for around 13m into the intertidal zone, around twenty metres to the northwest are the remains of a number of partially buried trees, it is probable that this marks the extent of the former shoreline and demonstrates the scale of erosion along this stretch of coast. Both sites are situated in the softer sediment of the intertidal zone and are likely to be impacted by bait digging.

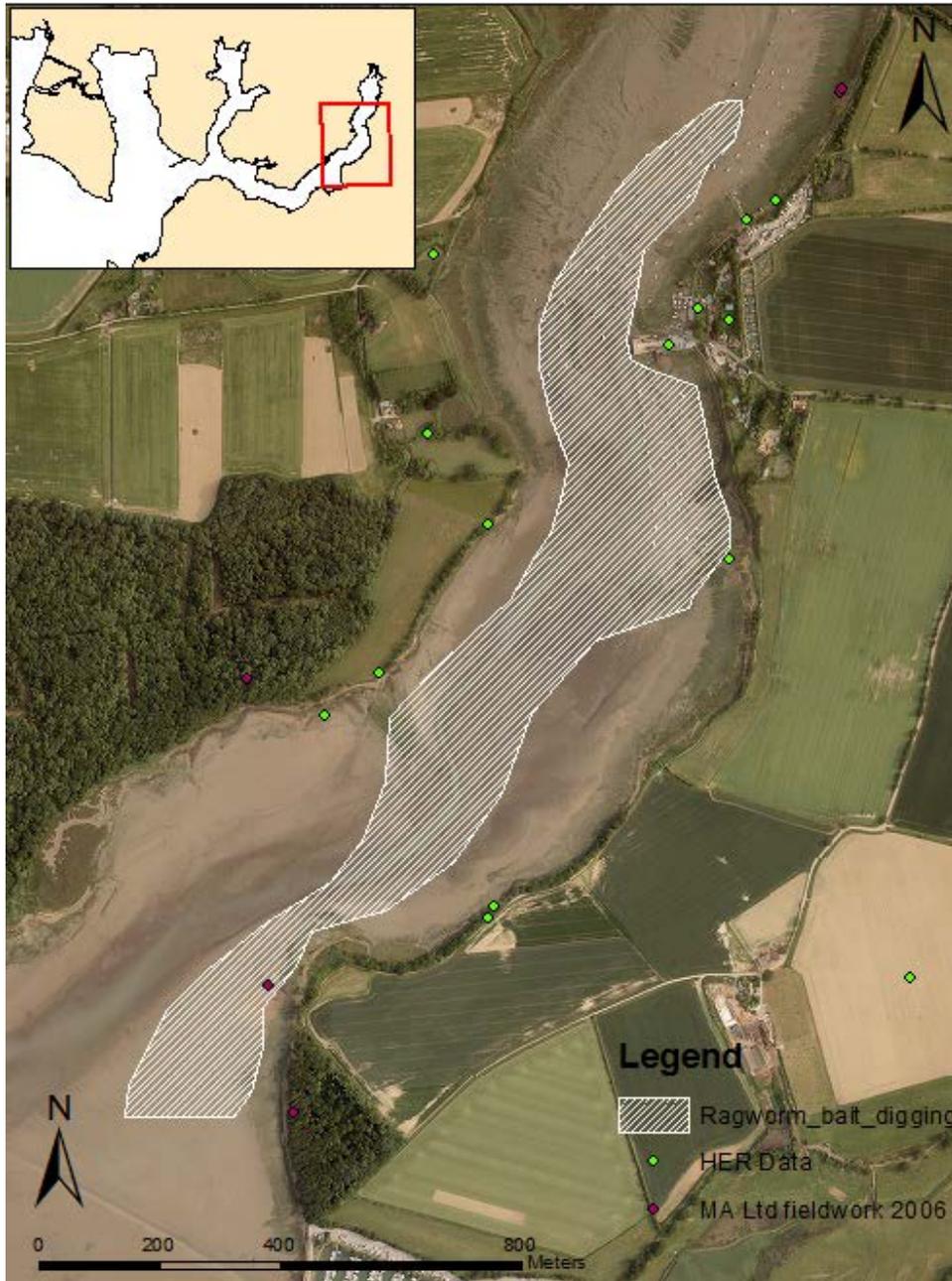


Figure 18. Dell Quay to Copperas Point, The hash demonstrates the area known to be impacted by bait digging, the red dots represent features identified in the 2006 survey by MA Ltd and the green dots represent HER data (aerial photo courtesy CCO).

Previous archaeological survey

The groyne feature and partially buried trees were first recorded in 2006 as part of the Chichester Harbour Survey of Foreshore Structures project (MA Ltd). During the survey the groyne feature was recorded as consisting of six timber posts, five were thought to be of the groyne itself with the sixth being a possible bracing timber. The area of partially buried trees was also subject to a photographic survey.

During the survey it was reported that the area was being affected by bait digging as well as coastal erosion. It was noted that little of this feature remains and it is continually being affected by erosion as well as the effects of human activity due to bait digging (MA Ltd, 2006:27).

Bait digging survey results

The site was first investigated on the 11th June 2014 and again on the 16th January 2015. The team began fieldwalking at Dell Quay, however there were no signs of bait digging activity so continued south to Copperas Point to the area containing known archaeological material.

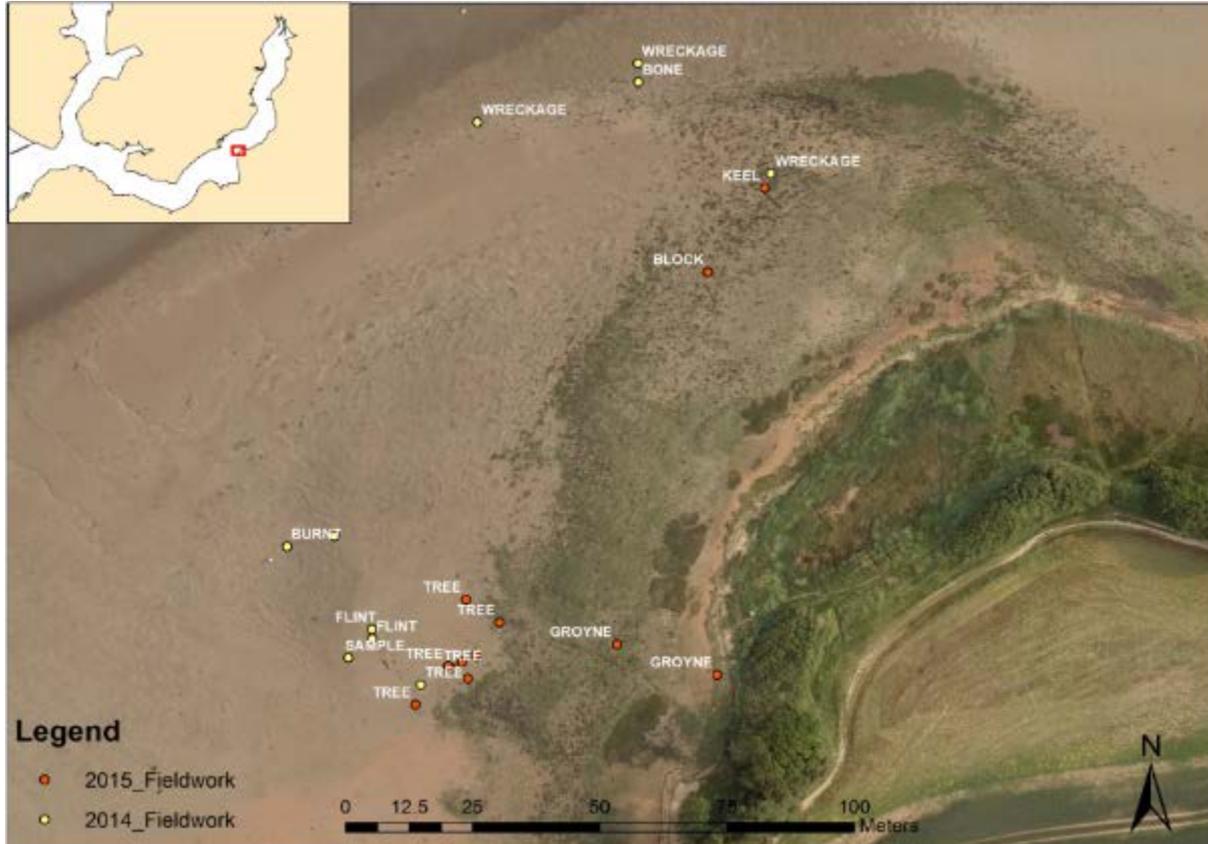


Figure 19. Results of the fieldwork off Copperas Point, bait digging activity was mainly around the area of trees (aerial photography courtesy CCO).

In both 2014 and 2015 it was possible to see clear evidence of bait digging activity around Copperas Point and on the other side of the channel. A photographic survey of the site was taken, the team then investigated the mounds of material dug up by bait diggers in order to record potential artefacts. Several possible worked flints were found, along with an animal bone. A sample of the dark organic sediment which has now been exposed was also taken, this will allow for future environmental analysis. This area has been heavily impacted by bait digging, a bait digger was seen during the 2014 fieldwork on the other side of the channel.



Figure 20. Evidence of bait digging around the trees off Copperas Point.

Much of the sediment around the exposed trees has been dug up which may have a detrimental effect on the site. The location of artefacts and the position of the sample were taken using handheld GPS (these are shown in Figure 19).

Only a sample of the bait digging holes were investigated, it is therefore likely that much more archaeological material has been exposed on this site. Further work is required in order to assess the flints, sample and animal bone. Figure 20 shows some of the possible worked flints recovered from the site. Previous survey work in the area recorded the tree remains but no archaeological material was found associated with the site, the exposure of worked flints in the 2014/15 survey demonstrates that this site has much higher archaeological potential than previously thought and should be subject to further investigation.



Figure 21. Possible worked flints found in bait digging holes off Copperas Point

Slightly to the north of the buried trees several ships timbers were noted, the position was recorded using the GPS and photographs taken. The fragmentary remains of a wooden vessel (Figure 23) were also located on the foreshore, the remains comprise a section of the keel, floor timber chocks and some lower planking from one end of the vessel, probably the bow (the site is marked as 'keel' in Figure 19). It is assumed that the vessel was hulked in its present location and has slowly broken up in-situ, either through natural or human processes. There is no evidence from the observed remains of any bait-digger impact to the timbers. The vessel was briefly inspected and on the basis of the extant remains would appear to be relatively recent in date and therefore of limited archaeological significance.

The wooden groyne-type feature was also assessed, although this was further up the intertidal zone where the sediment is more compacted and hasn't been targeted by bait digging. The team also noted evidence of coastal erosion and a brief survey of the cliffs was undertaken in order to see whether any archaeological material had been exposed (Figure 22).



Figure 22. Recent erosion was noted on the foreshore off Copperas Point.

Comparison of bait digging over time

There was not a noticeable difference in the area of partially buried trees from 2014 to 2015 (Figure 24), however, the area where vessel remains were observed had changed, with more of the site exposed in January 2015 compared to June 2014 (Figure 23). As mentioned above the area around the vessel remains does not appear to be targeted by bait diggers, so the increased exposure of the site is not thought to be due to bait digging activity. This site has not been recorded on any previous surveys.



Figure 23. Remains of a vessel off Copperas Point in June 2014 (left) and January 2015 (right)



Figure 24. Partially buried trees off Copperas Point. Left: 2014. Right: 2015.

The photographs were also compared with images taken during the 2006 survey (Figure 25). It is clear that bait digging has been an ongoing activity in this area, exposing archaeological material, much of which may have since been washed away.



Figure 25. Evidence of bait digging off Copperas Point, Left: 2006, Right: 2014

5. Assessment of Impact of Bait Digging and Management Recommendations

The following sections summarise the findings from the study, and put forward suggestions for consideration for management options.

5.1 Impact of Bait Digging on Archaeology

The impacts of bait digging on or near archaeological sites have been recorded during past fieldwork projects and during the current targeted fieldwork as part of this study. In summary, those sites where particular impact has been recorded include:

The Wadeway – bait digging noted and photographed in 2008 at the southern end of the Wadeway. Mounds left by digging had revealed worked and burnt flints. No evidence was seen of active bait digging during either the 2014 or 2015 fieldwork. This appears to indicate that the area is not targeted frequently for bait digging, so potentially smaller scale activities of local collectors here. The discovery of prehistoric flint remains demonstrates that bait digging activities are disturbing sediments with archaeological potential. The other archaeological evidence present at the northern shore of Hayling Island may suggest that Bronze Age landsurfaces are buried within this area.

Prinstead – bait digging was noted during a 2006 survey of the oyster beds. Further evidence was recorded during fieldwork in 2015 showing the softer sediment within the oyster beds being targeted. This is clearly a popular area for bait collection with survey results suggesting it is used regularly. The oyster beds themselves are historic features within the harbour, so are vulnerable to physical changes to the foreshore. Although the bait digging generally targets the areas within the old oyster beds rather than the structures themselves, continued changes to the sediment has the potential to increase erosion around the structures.

Chidham – bait digging evidence was recorded during both the June 2014 and January 2015 field surveys. Recording the position of the holes and the remains of abandoned bait digging forks on the foreshore provides detailed data spanning six months of specific areas of impact. It appears that the ‘mole’ feature provides suitable access out into areas of the harbour to enable access to soft mud where the bait live. Digging close to the timber elements of the ‘mole’ clearly has the potential for physical impact from changes to the sediment levels. There is also the potential for bait digging to have added to the size of a depression or ‘dip’ in the mole feature, where bait appear to be resident.

Copperas Point – this area is heavily used by bait diggers. Extensive impact was noted in 2006 survey and in both 2014 and 2015. There are a range of features exposed on this foreshore including tree remains and a hulked vessel. The recovery of worked flints from the spoil of bait digging holes demonstrates the likely presence of buried archaeological deposits which represent prehistoric landscapes with the potential for associated human occupation evidence. Further bait digging was visible on the opposite side of the Fishbourne Channel, but this area was not investigated as part of this survey.

These results clearly demonstrate that bait digging is occurring around a number of potentially sensitive archaeological sites, features and areas within the harbour. The actions of bait digging have the potential to impact through a range of changes including:

Physical – this can include the removal of, or damage to, archaeological remains. This could include archaeological features, such as timber structures, or deposits such as buried prehistoric occupation material. Key physical damage from bait digging includes the digging of holes and the creation of mounds of material from the spoil. This changes the topography, but also mixes the deposits as the mounds gradually erode down. Digging directly adjacent or within archaeological features can create small scale changes to the movement of water around the structures, which over time can alter sedimentation patterns.

Chemical – The digging of bait holes and the mixing of sediments from the mounds has the potential to change the chemical properties of the sediments close to any archaeological features. The exposure of previously buried areas to changes in

chemical properties could impact the archaeological material, particularly organics which can be fragile.

Biological – The creation of bait digging holes may make archaeological sites at risk from increased biological attack. While completely buried in waterlogged deposits an anaerobic environment means there is little biological activity from any species. Once the protective covering of deposits are removed water logged materials, mostly organic remains are then open to attack from a range of macro and micro species.

The field studies undertaken as part of this pilot project have clearly demonstrated the impact that bait digging is having within or close to a number of different archaeological sites, features and deposits. Records and photographs of the position and impact of specific bait digging activity can now be used in the future to assess any changes to features and provide monitoring data.

5.2 Management Recommendations

The results of the project have demonstrated there are clear impacts on known heritage sites and features within the harbour from bait digging activity. While this study has not been exhaustive as there are other areas of the harbour which may be used for bait digging which have not been surveyed, it has shown there is a need to carefully consider how to manage the impact of the activity on heritage.

5.2.1 Further Quantification of Impact

The study used data on known areas of bait digging to cross reference with archaeological site to target areas for study. It is possible that other areas of the harbour are now being used for bait digging, or that areas currently recorded within management GIS software may need to be extended. One example of this was seen opposite Copperas Point where a bait digger was out on the foreshore on the other side of the channel during the field survey. It may be useful to gain a more detailed understanding of areas currently used for bait digging around the harbour to aid understanding of the potential impact. This could be achieved through a combination of foreshore walking and talking to local bait diggers.

The current study reviewed bait digging in four key locations. The visual survey of the mounds left by bait diggers revealed artefacts of interest from Copperas Point, and also showed how an organic sediment layer was being impacted. The number of bait holes at Copperas Point that it was possible to survey was only a small proportion of those visible, it would be beneficial in the future to undertake further survey at this location to enable more of the mounds to be surveyed. This would allow further quantification of the scale of impact on archaeological deposits, and reveal more about their archaeological potential.

A repeat visit to the four sites in a year's time would allow further understanding of the wider impact of bait digging and whether there are changes in the areas targeted. The lack of evidence of bait digging activity at the southern end of the Wadeway during this survey has shown that areas may fall out of favour with bait diggers, or they may be so over-used that the amount of bait available declines too much.

5.2.2 Impact in relation to CHC Management Plan

In terms of the current management of bait digging activity, the Harbour Byelaw is in place and the potential impacts are recognised within the Management Plan (see section 3.4). The results of the current study provide evidence on which to assess this area of harbour management. The Management Plan states that "Closer scrutiny of the impact of activities such as oyster dredging and bait digging on the subtidal and intertidal biodiversity within the AONB may be required in the future to determine the impact on favourable conservation

status” (page 39). As a result a specific management issue identified is: “The impact of bait digging on intertidal habitats and collection of bait for commercial purposes”.

While this management issue is targeted at the biodiversity of the AONB, it would be useful to recognise the potential impacts on the historic environment here as well. Sections of the Management Plan related to heritage include:

- Policies HE1: *‘Ensure that the historic and archaeological resource of the AONB both on land and below the water is recorded, monitored, conserved and where possible enhanced’.*
- Policies HE2: *‘To continue to strengthen partnerships and contribute to the knowledge base for the management of the cultural heritage of the AONB’.*

The project has provided results relevant to both of the above policies. The field survey has provided results to monitor the archaeological resource, and can be used as baseline data for future studies. The ability to identify sites and areas under threat enables management responses to be developed.

5.2.3 Mitigating Impact

The project has developed understanding of bait digging impact at a number of sites around the harbour. It is important to consider how this data could be used to develop management responses to help reduce or prevent future impacts on heritage sites.

Looking at the current mechanisms for managing bait digging the harbour byelaw no. 228 ‘Digging of bait’ states “No person shall in any part of the harbour dig for lugworm, ragworm, or any form of fishing bait within 50 ft. of any mooring, or within 20 ft. of any pile, beacon, mark, hard, causeway, jetty, quay, wharf or similar structure (Chichester Harbour Conservancy, 1996)”. It could be argued that the Wadeway feature and the feature at Chidham could be considered as either a ‘hard’ or ‘causeway’, however, those using the harbour for bait digging are unlikely to recognise these as this type of feature as they are unused. An additional issue would be that the distance of 20ft (around 7 metres) is unlikely to be an adequate distance from recognisable parts of the feature/s to ensure there is no impact to buried remains. It may be possible to amend the byelaw by adding text to prevent bait digging within a certain distance of known archaeological sites/ features, however, this is likely to require the development of a map of known sites and features as some can be difficult to recognise within the intertidal mud.

At both the southern end of the Wadeway and at Copperas Point, there are buried sediments being impacted that contain prehistoric worked flints. It would be impossible for bait diggers to know these deposits are present as there are no surface indications, so consideration is needed for ways to either raise awareness directly adjacent to the sites, or look at prohibiting bait digging in the area.

The voluntary bait digging code for the Solent Estuary Marine Sites is in place. While this recommends that bait holes are backfilled and notes that digging can impact heritage sites, there is little evidence that the code is being applied within Chichester Harbour.

The UK SAC report of 2001 suggests that ‘zoning’ of bait collection areas could be used as a management approach. This is largely aimed at managing bird disturbance, conflict between shore users and to help avoid structures and vessels. The development of ‘heritage zones’ where bait digging is prohibited could be considered, however, this approach would require further baseline data from areas of the foreshore, a program of awareness raising and a means to monitor the zones.

6. Assessment of Potential for National Project

The results from the study of bait digging in Chichester Harbour have provided evidence of the types of impacts on heritage features, sites and deposits that are likely to be present in the intertidal zone. The evidence from just one harbour on the south coast shows how this activity could be impacting heritage much more widely. The MAT have witnessed bait digging in other areas of the Solent which are known to have a high potential for archaeology, one recent example is on the Weston Shore near Southampton (Figure 26), where significant numbers of bait holes are visible in an area where prehistoric flint tools have been recovered. There is clearly a need to better understand the threats from bait digging activity to heritage on a national scale.



Figure 26: Bait digging holes on the Weston Shore, Southampton

The approach taken in Chichester Harbour should be applied on a national scale. The development of such a project would provide important data on which to base heritage management decisions. There is also considerable potential for working with other disciplines which are interested in the impacts of bait digging on habitats, species, user groups etc. A national study should consider:

Desk based research:

- Mapping of areas of known bait digging
- Mapping of archaeological sites, features and deposits within the intertidal zone
- Review of any current management of bait digging activity
- Use of research data to identify sites where the presence of archaeology and bait digging make the potential threats high

Field study:

Undertake field studies in a range of intertidal locations to represent:

- Different sediment types
- Areas used for a range of bait species
- Range of archaeological site, feature and deposit types

Analysis:

- Based on collected research and fieldwork highlight areas where bait digging is impacting archaeology
- Put forward management options and recommendations to reduce impact

Increased understanding of the impact of bait digging on heritage would enhance management approaches and support the implementation of obligations through management plans and designations.

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- Promote archaeological awareness and competence.
- Promote public awareness, enjoyment, education and participation in the maritime archaeological heritage.
- Support the publication of the results of maritime archaeological investigations, surveys and research.
- Liaise with other regional, national and international organisations involved in maritime archaeology and related disciplines.
- Provide maritime archaeological services to heritage agencies, local authorities and a wide range of marine operators.
- Support regional, national and international initiatives for improvements to the legislation regarding the preservation and management of the maritime archaeological heritage.
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Images (top to bottom): Inspecting a gun on the stern section of the SS *Serrana*, disseminating maritime archaeology to the next generation, augering to recover samples of Bronze Age palaeochannels in Langstone harbour, representing the Trust at the INTERREG annual event in Rotterdam.

