



Scottish Coastal Archaeology and the Problem of Erosion



University of
St Andrews

Coastal Zone Assessment Survey Highland: Inverness to Culbin



Sarah Boyd, Joanna Hambly

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Key Findings

The Inverness to Culbin coastline is soft and low-lying, being composed of gravel and sandy beaches, with areas of salt marsh and mud flats. As such, the entire coastline was identified as being at least of moderate priority for survey due to the inherent susceptibility to erosion of softer coastlines and the highly dynamic nature of sections of the coast.

Areas of notable erosion include eroding soft sediment banks along the coast edge at Milton of Cullogen and evidence of sediment loss around both the northern and southern periphery of Fort George, however accumulations of gravel are also noted around other sections of the fort. Accretion is the dominant coastal process noted at Ardersier, Whiteness Head and at Culbin.

The prominent character of sites along this stretch of coastline reflects the maritime heritage of the Inner Moray Firth. Sites relating to maritime infrastructure and fishing activity make up 50% of all of the sites surveyed with 28% being directly related to fishing and 8% representing informal landing places. World War 2 defences are also a significant category of sites, with 12% of records being from this period.

Ten of the surveyed sites have been identified as a priority for monitoring and in some cases further investigation and recording, due to a combination of their vulnerability to coastal erosion and their archaeological significance. They include eight sites relating to maritime infrastructure and fishing between Allanfearn and Ardersier (five fish traps, two crafts and a jetty), one industry site at Scottack (tide mill), and an area of World War 2 anti-glider coastal defences at Whiteness Head. All of these sites are situated within the intertidal zone and are vulnerable to coastal erosion and deterioration. It is recommended that all ten sites are regularly monitored at three-year intervals or following extreme weather events.

1. Introduction

This report presents the results of a Community Coastal Zone Assessment Survey (CCZAS) of the Inner Moray Firth Highland coast, from Milton of Culloden to the Highland-Moray council boundary at Culbin (Figure 1). This stretch of coastline is predominantly soft and low-lying and was not included in previous coastal zone assessment surveys of the Inner Moray Firth in the Highland region (CfA 1998a, 1998b). The aim of the survey was to characterise and assess the condition and vulnerability of the coastal archaeological resource along stretches of coastline identified as being at moderate to high risk of erosion by 2030. The surveys were designed to involve volunteers and most of the accessible coastline was walked by SCAPE officers and volunteers over six days in April 2022. The surveys benefited from information from volunteers about local heritage and recent coastline change.

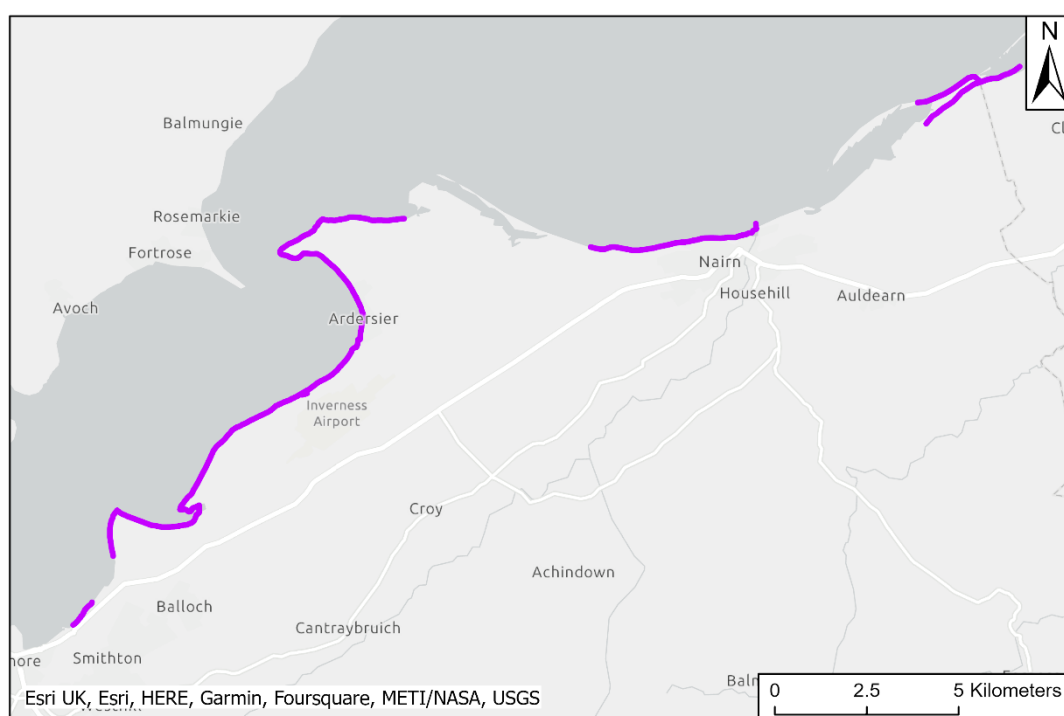


Figure 1. Survey area with stretches walked highlighted.

2. Project aims and objectives

The overarching aim of the survey was to identify and characterise archaeological sites and places that are likely to be impacted by coastal erosion and other threats in the short to medium term.

Survey objectives were to:

- Identify the most vulnerable sections of coastline through desk-based assessment to target fieldwork to coastlines experiencing erosion,
- Involve volunteers from local communities and societies in the field surveys,
- Locate and record archaeological sites at the coast edge and intertidal zone,

- Assess the condition and vulnerability of the sites,
- Assess the field evidence for coastline change during the walkover survey,
- Share data with Highland Council and Historic Environment Scotland.

3. Methodology

3.1. Prioritisation of field walkover survey areas

In advance of the walkover surveys, desk-based analysis of models of national coastal susceptibility and national coastal change were undertaken to understand the vulnerability of the coastline and target areas for walkover survey. Two models were combined; a coastal erosion susceptibility model (Fitton et al. 2016) and a model of projected coastal erosion rates by 2030 (Dynamic Coast, Hurst et al. 2021). The coastline was divided into 0.5 km² grid cells and each cell assigned a score based on the combined results from each model. Grid cells modelled to experience erosion by 2030 were coloured yellow, orange and red. The methodology used to combine the models is outlined in a short methodology report, available at: <https://scapetrust.org/wp-content/uploads/2023/02/CCZAS-prioritisation-methodology.pdf>.

The resolution of 0.5 km² grid cells was chosen to give a broad overview of the nature of the coastline for walkover planning purposes. Within a moderate-high priority grid cell there may be areas of accretion or no erosion, however the cell will also contain coastline with moderate to high susceptibility of erosion by 2030.

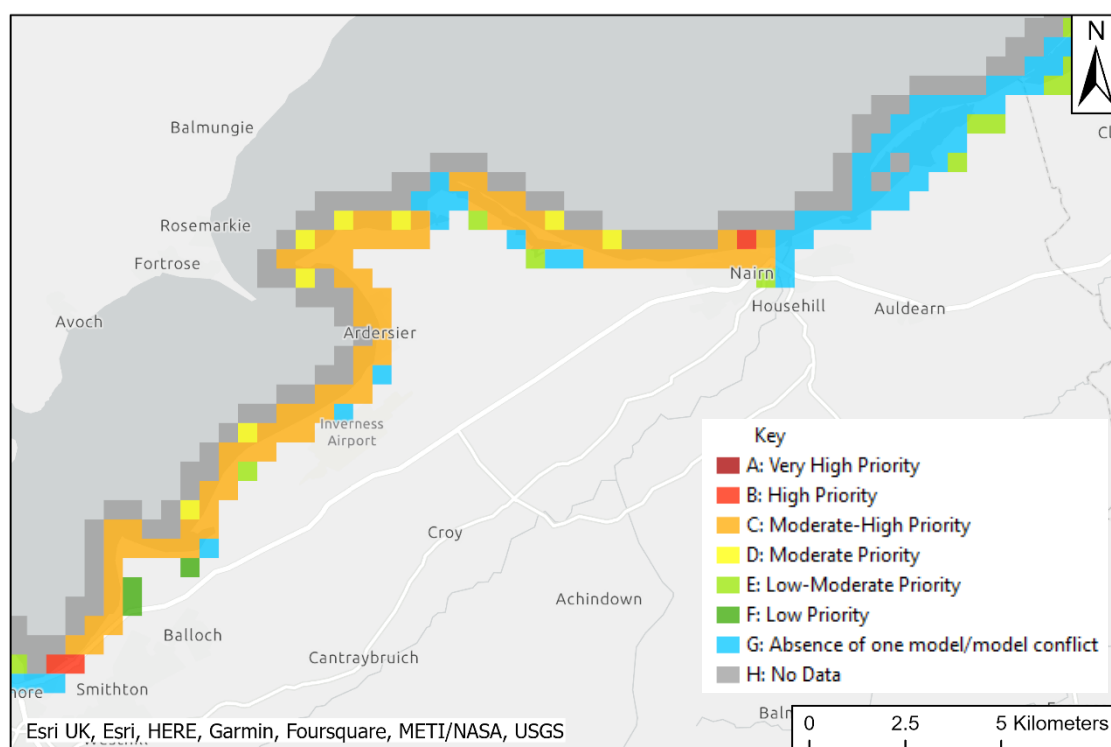


Figure 2. Desk-based prioritisation of the Highland coastline from Inverness to Culbin Forest.

3.2. Preparation of coastal heritage baseline

Highland Council and Historic Environment Scotland provided information and point data of all existing known heritage sites within a coastal strip extending 500m either side of the mean high-water springs. This data was integrated into a single database and imported into ArcGIS 10.7. The point data was buffered by 25 m and sites falling within 100m landward and 500m seaward of the mean high-water springs were selected except where Dynamic Coast 2100 erosion projections extend landward greater than 100m, in which case the zone was widened. The selected sites were then refined to screen out sites not relevant to the surveys. Table 1 presents information on main categories of sites removed from the coastal heritage baseline.

Site Category	Reasoning
Shipwrecks and other poorly located sites	<p>Site records with only approximate coordinates (e.g. bottom left corner of a km grid square) were removed from the database due to the inability to accurately locate during fieldwork.</p> <p>Shipwreck records are often poorly located with multiple wrecks plotted in the same grid square corner.</p> <p>When wrecks were noted on our surveys, these were checked against the shipwreck database and linked to the correct record where identifiable.</p>
Urban records	Records which are not at threat from coastal processes in urban coastal areas. This includes listed buildings, market squares, plaques, and memorials.
Findspots and relocated heritage	Site records where finds were discovered and are no longer there or sites recording the original locations of objects which are now held in museums.
Miscellaneous	Golf courses and general location records e.g. General Views

Table 1. Categories of sites removed from database.

The resulting sites were uploaded to SCAPE's interactive Sites at Risk web map and published to the linked SCAPE Coastal Archaeology Recording App. This app was developed for the project. It allows users to access the location and summary information about known sites, update existing site information and create new site records, including photographs and point and polygon location information. Satellite imagery and historic map layers provide additional information for users in the field. All features of the app are fully functional offline.

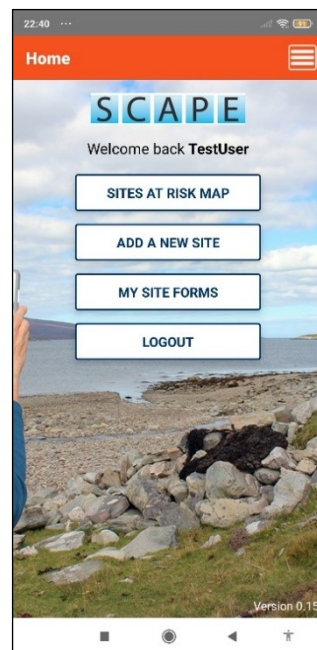


Figure 3A. App Home Screen

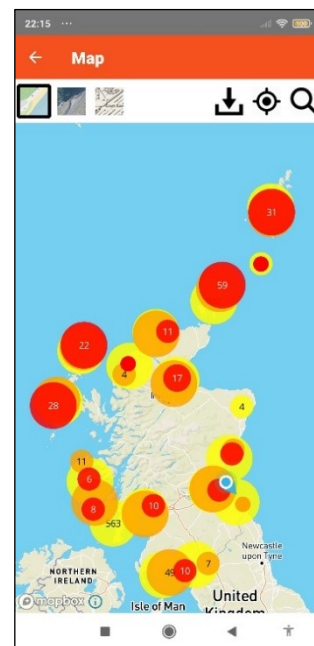


Figure 3B. Interactive Sites at Risk Map

Site markers are initially coloured green to indicate that they have not yet been visited and updated during the CCZA survey. Once visited and moderated, a colour code is assigned to each marker to reflect the priority status of the site based on archaeological significance and physical vulnerability (see section 3.4).

3.3. Field survey

The entire coastline in the survey area was selected for walkover survey due to the soft nature of the coastline and its susceptibility to erosion. Surveys were timetabled during periods of each month with the lowest tides and each walk was undertaken three hours either side of that day's low tide to gain the most visible exposure of the intertidal zone. SCAPE officers and volunteers generally walked along the coast edge with good views over the intertidal zone and hinterland, deviating to visit known sites and to check features and anomalies. Drone aerial photography was taken of as many selected sites and areas as was practical and possible, particularly of intertidal sites such as fish traps which are much better understood from the air.



Figure 4. A typical example of low-lying soft coastline at Brecknish/Allanfearn, at the western end of survey area. Large boulder-built fish traps extend into the intertidal muds of the Moray Firth.

3.4. Moderation of records

After each walkover, the data collected using the app was submitted to the website and moderated by SCAPE officers. Moderation ensures that data is consistent and meets the standard required by Canmore and Highland HER. During moderation, the significance, condition, and vulnerability of each site was also assessed, and a priority based upon site significance and threat from erosion assigned. SCAPE applies a colour code to denote priority for action. Yellow indicates no action and is applied to sites of low archaeological significance, generally not threatened by erosion. Orange indicates monitor and is applied to sites of medium to high significance, or potential significance, under threat from coastal erosion. Red denotes action required and is applied to sites of high archaeological significance or potential significance which are observed as being impacted by coastal erosion (Hambly 2017, p. 11). These categories are not fixed and updated information, either not available during the survey, or as a result of monitoring or further investigation may result in the priority status of a site changing. Moderated sites are then published and information publicly available on the SCAPE coastal heritage Sites at Risk web map. Sites not visited in the surveys retain their green marker and are visible only to registered users.

4. Results

4.1. RESULTS: Coastal Change

The desk-based analysis identified almost all the coastline between Inverness and Culbin as being at least of moderate priority for survey due to its susceptibility to erosion and projected erosion models. The exception was the Culbin area which is so dynamic that it is not possible to calculate reliable models of coastal change (Figure 2). We therefore included the Culbin coastline in our walkover survey. The following section highlights areas of notable erosion, accretion, and sediment movement along this dynamic coastline. It is understood that coastal change is a continuous process and the conditions described are as seen during the survey.

4.1.1. Areas of net erosion

Milton of Culloden

The coast edge at Milton of Culloden has seen recent erosion, with damage to stone and concrete sea walls (Figure 5). Anecdotal evidence from a local resident in the area estimated around two acres of land had been lost from the coast edge of their property over the past two decades due to storm damage and coastal erosion.



Figure 5. Damaged stone and concrete embankment at Milton of Culloden protecting soft sediment coastline behind



Figure 6. Eroding coast edge along the coastal stretch at Milton of Culloden.

Fort George

The location of Fort George at the end of a gravel spit, and the unusual architecture of the Fort itself creates complex sediment movement and dynamic zones of erosion and accretion.

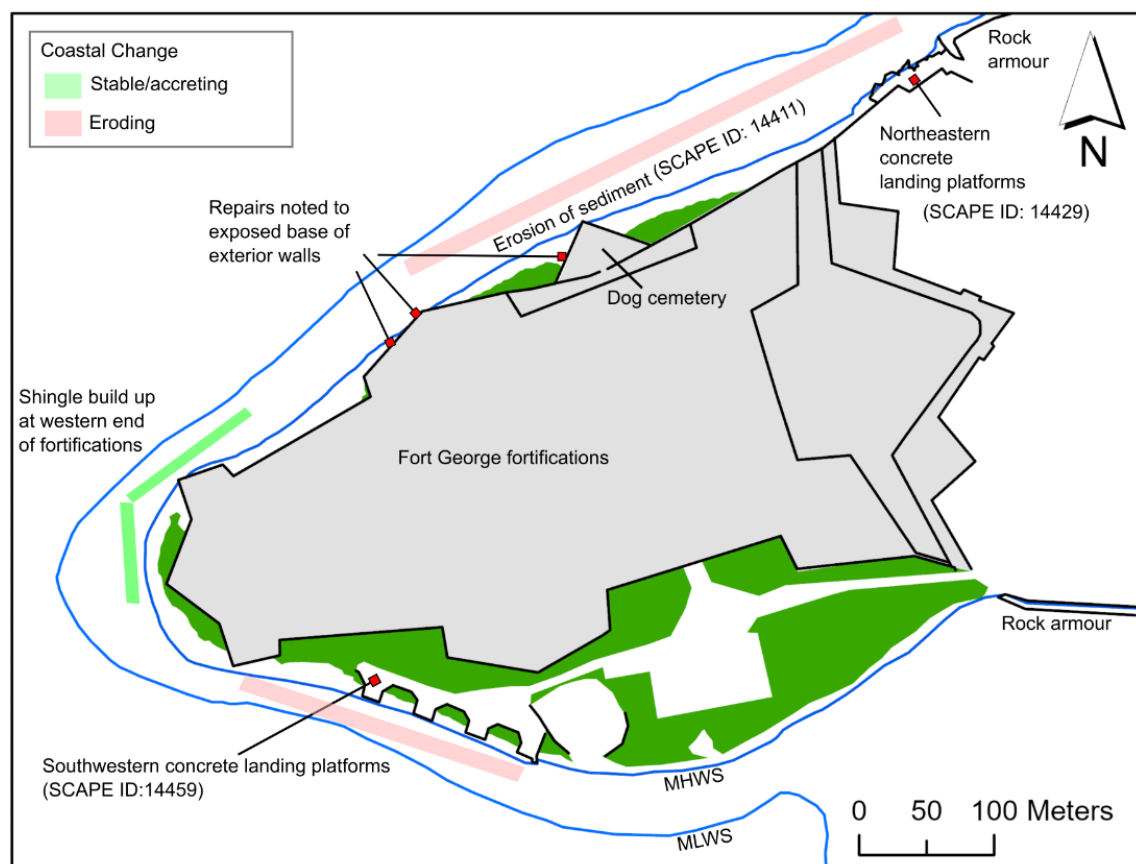


Figure 7. Annotated plan.

Evidence of recent erosion is noted around the external boundary of the Fort George fortifications. Sediment which has previously built up along the northern facing outer walls of Fort George on either side of the dog cemetery is showing signs of recent erosion wave action and scouring (Figure 8); also noted in 2010 (Kirkdale Archaeology, 2010a).



Figure 8. Active erosion of previously stabilised and vegetated gravel which had built up around the northern flank of the Fort George outer fortifications, on the eastern side of the dog cemetery.

Stained masonry at the base of the walls indicated where there has been recent removal of sediment. (Figure 9A). Repairs to the base of the outer wall of the fortifications were also noted where damage has occurred, perhaps exacerbated due to a lack of sediment build-up to act as a buffer to protect these sections of wall (Figure 9C, D).



Figure 9. (A) Level of previous level of sediment is noted by colour variation in stonework, northern side of Fort George outer walls. Cherry-cocking dressed stone below sediment level suggests that wall has been exposed before. (B) Active erosion and undermining of sediment, on northern side of Fort George, to the west of the dog cemetery. (C) Repairs that have been made to base of outer wall. (D) Repairs to outer wall and damage at current gravel beach level. Wooden posts suggest past attempts of sediment stabilisation.

Further evidence of erosion affecting the northern side of Fort George can be seen in the heavily deteriorated Second World War landing platforms which have cracked and fragmented, revealing the wooden supporting posts beneath (Figure 10A). Landing platforms to the southwest of Fort George (Figure 10B) are also being affected by erosion, albeit to a lesser extent, (see also Kirkdale Archaeology 2010b).



Figure 10A. Concrete landing platforms on northern side of Fort George showing heavy deterioration due to coastal erosion, revealing wooden supporting posts underneath.



Figure 10B. Concrete landing platforms on the southwestern side of Fort George which are showing signs of deterioration.

Conversely, sediment is accumulating along some sections of Fort George, for example against the western nose of the outer wall (Figure 11).



Figure 11. Gravel accumulated around the western nose of Fort George outer walls.

4.1.2. Areas of net accretion

Ardersier beach

Ardersier beach is situated immediately to the south of the gravel spit on which Fort George is situated. Gravel has accumulated in the form of high shingle storm beaches. An Ardersier resident informed us that the slipway has been rebuilt at least twice in recent years because of the increasing elevation of the gravel on the back beach.

Whiteness Head

A very large expanse of sand has built up in the intertidal zone west of the gravel bar of Whiteness Head. The Dynamic Coast model predicts erosion of the outer edge of the Whiteness bar, but this was not walked because access is restricted and because the bar has mostly developed since the late 19th century and so has limited heritage interest.

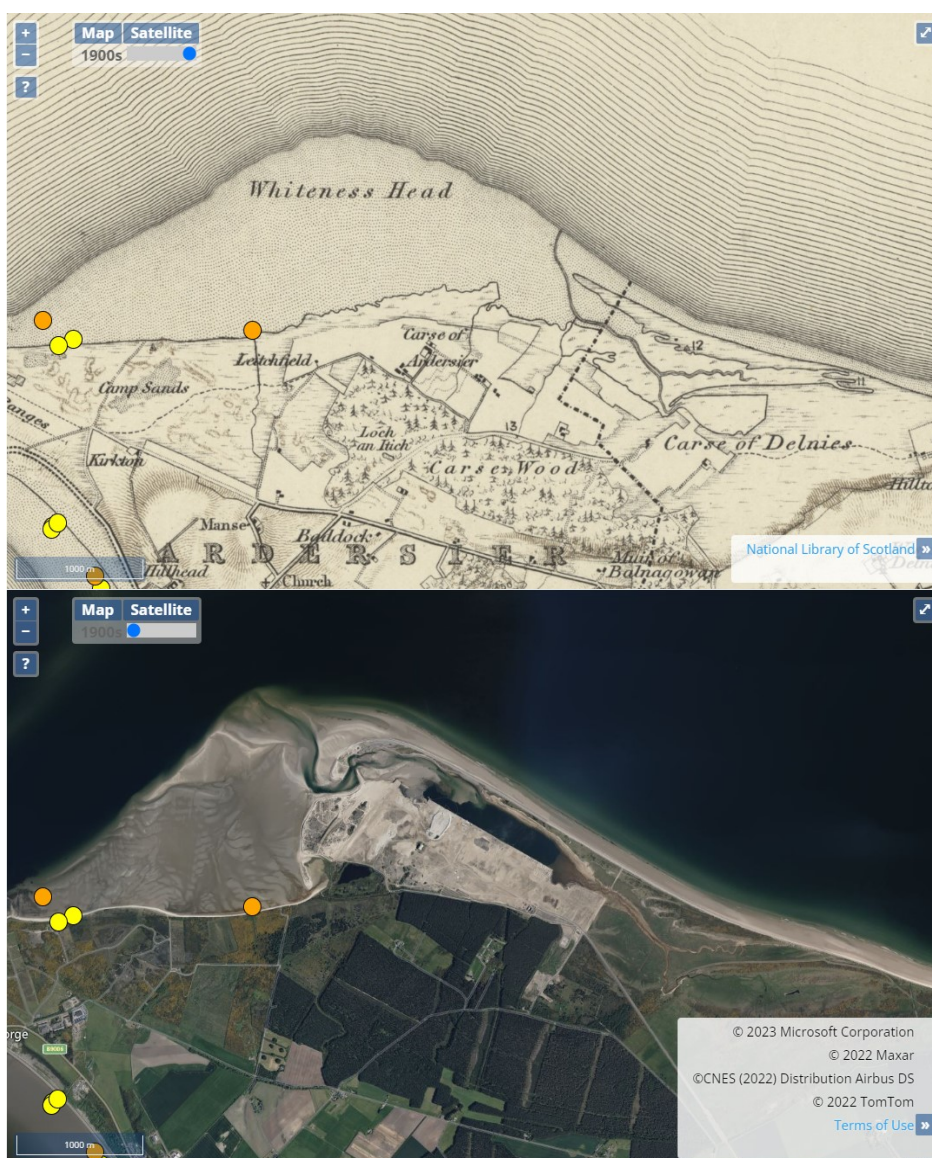


Figure 13. Progradation of the gravel spit at Whiteness Head over last ~120 years using OS One Inch 1885-1903 and modern satellite imagery.

Culbin, the Bar

The Culbin area is highly dynamic with sediment accreting on The Bar, a large sand and gravel bar growing from west to east along the coastline. Sheltered by the bar is an expanse of developing saltmarsh, much of which is inundated at high tide (Figure 14).



Figure 14. View of saltmarsh looking towards the sand and gravel bar to the north. Numerous anti-landing posts across saltmarsh.

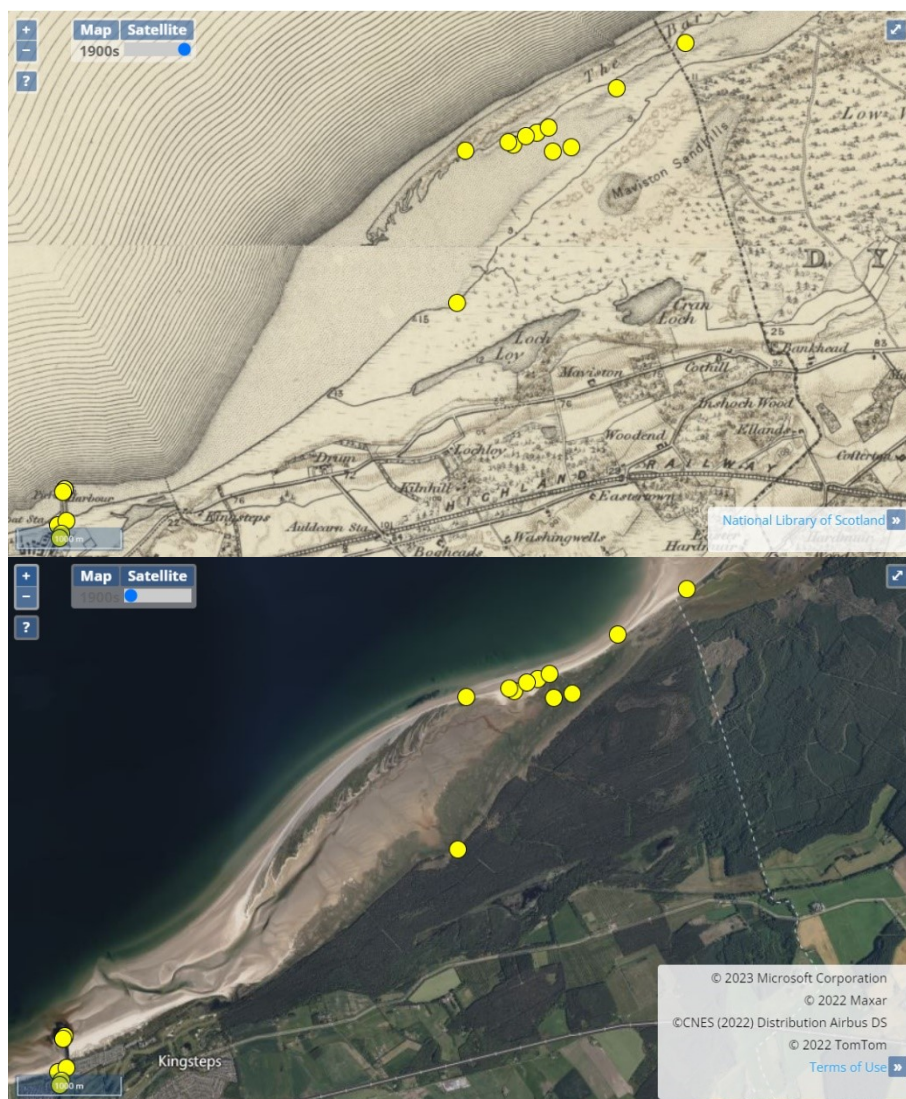


Figure 15. Progradation of The Bar at Culbin over last ~120 years. OS One Inch 1885-1903 and modern satellite imagery.

4.1.3. Summary of coastal change

The whole of the Highland coastline east of Inverness is soft and therefore could be vulnerable to future coastal processes such as coastal erosion. Erosion of the sea wall and coast edge was noted at Milton of Culloden along with anecdotal evidence suggesting that the coastline in this area is actively eroding.

Active erosion of sediment build-up around the northern perimeter wall of Fort George is taking place.

Accretion is the dominant coastal process between Ardersier and Fort George, as well as at Whiteness Head and behind the sand and gravel bar at Culbin. Whiteness Head and Culbin are very dynamic.

The coastal stretch from Hilton of Delnies to Nairn is largely defended along the perimeter of the Nairn golf course, with the coast edge around Nairn town also protected by sea walls.

Our observations agree with the general trends identified by the Dynamic Coast modelling, which projects this coastline to generally be affected by low-moderate erosion rates by 2030, but also stretches of accretion at Ardersier and Whiteness Head. Dynamic Coast projects the northern side of Fort George to experience accretion by 2030 (and erosion in the successive decades) however, we observed erosion of sediments along the northern flank of the fort. The unusual architecture of Fort George shelters some areas of the coast whilst exposing others, and contributes to the complex coastal processes at work here.

Along this whole stretch of coastline, pockets of accretion interspersed with stretches of erosion demonstrate natural dynamic processes of sediment erosion and deposition.

4.2. RESULTS: Built heritage and archaeology

One hundred and ten sites were visited and documented in the walkover survey. Forty-five of these were already recorded either within Canmore or the Highland Historic Environment Record and information about them was updated. Forty sites were previously recorded in a fish trap survey (FTS) of the inner Moray Firth (Dawson, 2004) but these records had not been integrated into Canmore or the HER. The survey identified 25 sites not previously documented.

Sites were categorised into broad site types to aid discussion (Table 2). An overview of the main findings is given below followed by a short section highlighting notable site types and examples.

Site Type	Definition
Maritime Fishing	Fixed sites or objects with a direct link to fishing industry e.g. fish traps, fishing stations, bothies, boat houses, icehouses, winches.
Maritime Craft	Craft, ballast mounds, components of crafts such as timbers, boilers, capstans.
Maritime Harbours	Formal harbour structures associated with and serving settlements, e.g., built harbours, piers, jetties, breakwaters, docks.
Maritime Landing Places	Informal and small-scale, landing areas or structures, e.g. cleared slipways, piers, jetties, breakwaters.
Maritime Navigation	Infrastructure related to navigation e.g. lighthouses, beacons.
Industry Factories and Works	Industry not directly related to fishing, e.g. rope works, brick works, tide mills, lime kilns, salt pans.
Industry Extractive	Extractive industries, e.g. coal mining, quarrying.
Settlement & Agriculture Buildings	Buildings related to settlements and agriculture.
Settlement & Agriculture Boundaries	Boundary stones, fences and walls demarking property or land boundaries.
Settlement & Agriculture Other	Sites other than buildings linked to settlement and agriculture.
Castles and Forts	Remains of castles and promontory forts.
Religious	Churches, burial sites, holy wells, crosses.
Military WW2	Military sites constructed as part of Second World War coastal defences e.g. pillboxes, observation posts, gun emplacements, anti-tank cubes, anti-glider posts or roadblocks.
Military Other	Military sites which are not solely Second World War, e.g. Napoleonic or WW1 targets and rifle ranges or military bases and airfields.
Natural Features	Geologic or geomorphologic features e.g. sea stacks, mounds, intertidal peat, unmodified caves, unmodified springs.
Miscellaneous	Sites out with the outlined site types.

Table 2. Site type categories and definitions

Fifty per cent of all sites were related to maritime infrastructure and activity. The majority of these, 28%, associated with fishing. The next most commonly occurring site type were World War 2 defences which accounted for 12% of all records (Figure 16).

Sites were overwhelmingly post-medieval and modern in date, reflective of the main site types which are mostly related to post-medieval maritime activities, and military defences. Even where it was not possible to assign a period, most sites categorised as 'period unknown' will be post-medieval or later. The only site where earlier remains are known to exist, but not identifiable during the survey, is the archaeological landscape around Culbin Sands. The majority of the coastline of mainland Scotland has experienced an overall trend of relative sea-level fall over the last ~6 ka, which is in contrast to peripheral areas such as the Western and Northern Islands which have experienced an overall trend of relative sea-level rise over that same time frame (Ramsay & Brampton, 2000). These differences in longer-term relative sea level change are reflected in the types of heritage sites found around the Scottish and the reason why earlier, prehistoric sites have not been found in the present-day intertidal zone of this survey area.

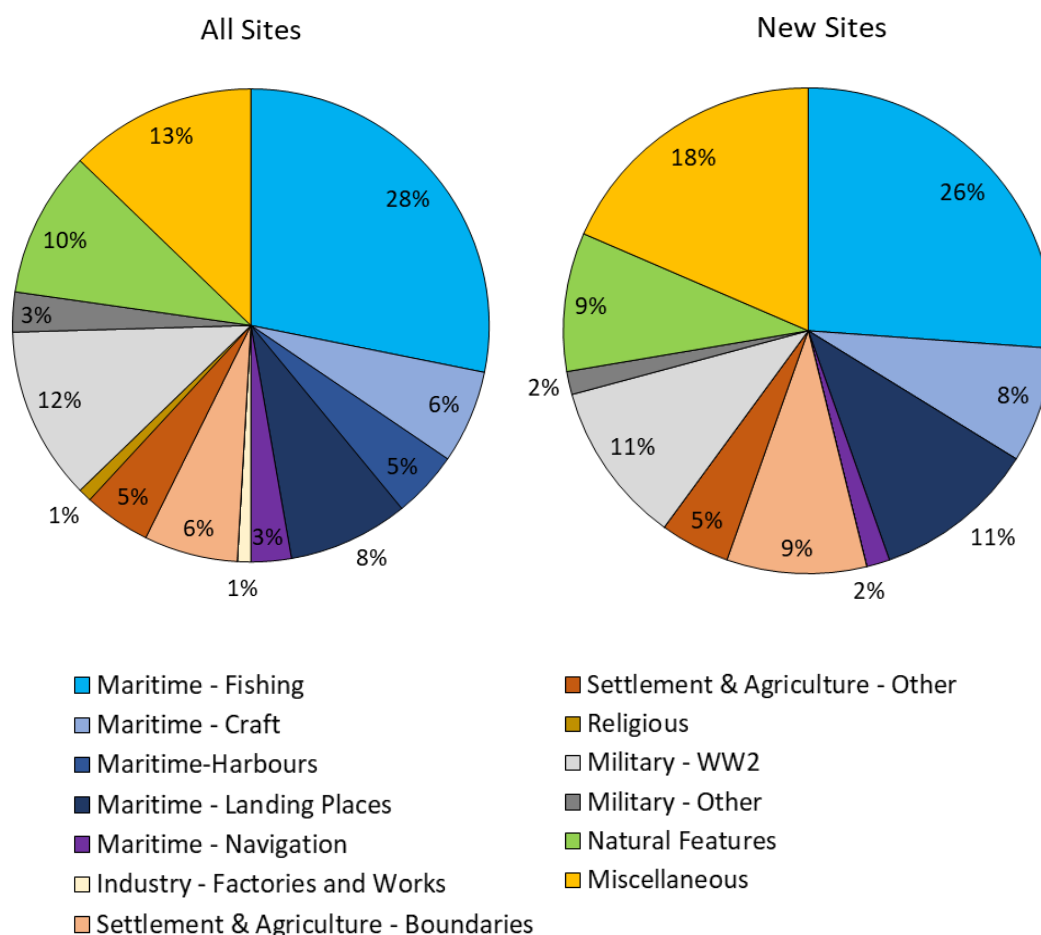


Figure 16. (A) All sites updated during survey, arranged by category (n=110); (B) New sites recorded during survey, arranged by category (n=65). 58 identified during 2022 survey and 7 sites identified during FTS survey but not visited in 2022 survey.

4.2.1. Maritime

Maritime - Fishing

The most common of the maritime sites are those directly related to fishing (31% of known sites and 26% of new sites). The intertidal zone is home to numerous large stone-built fish traps and alignments of wooden stakes and posts, which are the remains of salmon stake nets. Most of the stake nets only survive as stumps visible at low tide (Figure 17).



Figure 17. The remains of a salmon stake net in the intertidal zone at Ardersier (<https://scapetrust.org/sites-at-risk/site/15367>).

Stone-built fish traps are found in low-energy intertidal areas along the coast between Milton of Culloden and Ardersier and take a variety of forms (Figure 18; Figure 19). The majority (13) of new sites related to fishing were first identified in the Inner Moray Fish Trap survey (Dawson, 2004) and an additional four were identified during the April 2022 CCZAS survey.

The stone remains of fish traps of Brecknish, Allanfearn, Lonnie, Castle Stuart and Ardersier are a significant grouping and reflect the strong fishing heritage of the Inner Moray Firth communities. Some timber elements preserved within the stonework were observed at Brecknish. The structures have deteriorated to a point where they are fairly stable in the low energy intertidal zone. However, their location and relative invisibility from the shore makes them vulnerable to unintended disturbance or construction along these stretches of coast. The group of three fish traps between Allanfearn and Brecknish are the most complete.

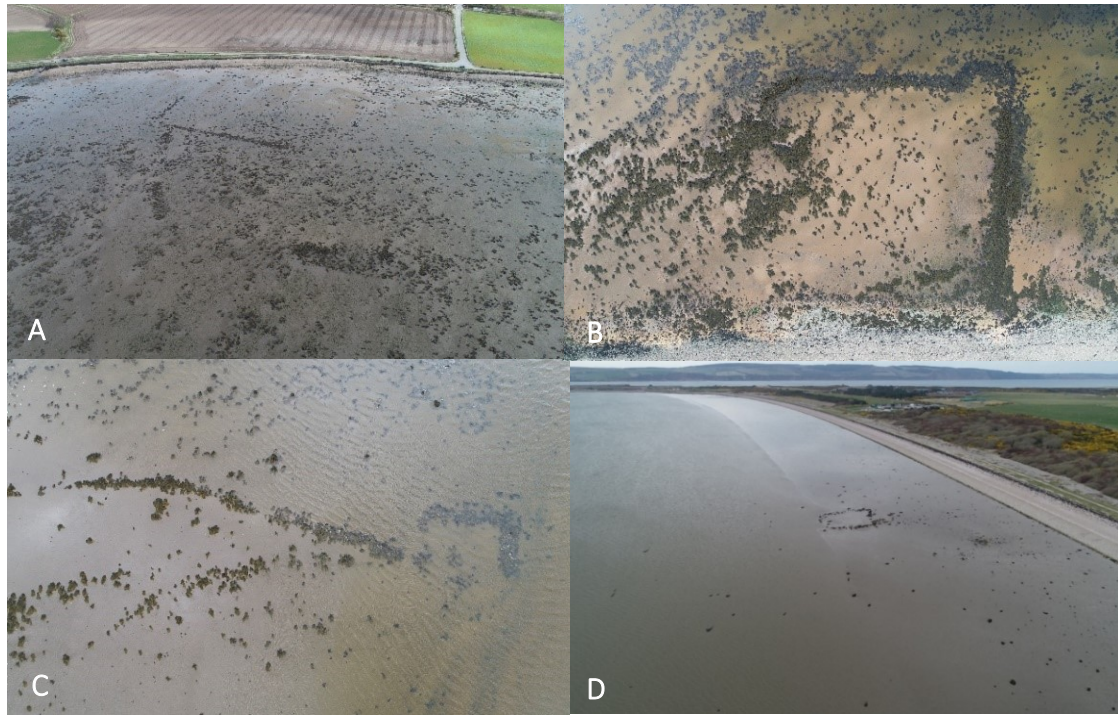


Figure 18. Examples of stone-built fish traps in the intertidal zone of (A) Allanfearn (<https://scapetrust.org/sites-at-risk/site/15311>); (B) Brecknish (<https://scapetrust.org/sites-at-risk/site/15308>); (C) Lonnie, Castle Stuart (<https://scapetrust.org/sites-at-risk/site/15437>) and (D) Ardersier (<https://scapetrust.org/sites-at-risk/site/15371>). Also see report cover image.



Figure 19. Local information identified these two sets of intertidal walls on either side of a cleared area at Mains of Connage as fish traps for flat fish. (<https://scapetrust.org/sites-at-risk/site/15426>).

Maritime - Boats and wrecks

Two known site records relating to a metal wreck, just offshore at Whiteness Head were updated and five new records relating to boats and wrecks were added. These sites included the remains of three wooden crafts, a boiler and up to six ballast mounds at Lonnie (Figure 20). Additionally, patches of tar were noted which suggests the area has been used to haul up and maintain boats. When taken together, the evidence points to a possible dispersed boat graveyard at Lonnie. Intertidal wrecks and boat graveyards are under recorded in Historic Environment Records. Their location in the intertidal zone, and the sensitivity of the heritage assets, mostly dating to the late 19th and early 20th centuries, constructed of perishable wood and metal, makes them a vulnerable site type and an increasingly rare feature of Scotland's coastline.



Figure 20. (A) Stem post of a large wooden vessel Lonnie (<https://scapetrust.org/sites-at-risk/site/15463>); (B) Ballast mound with probable buried keel at Newton of Petty (<https://scapetrust.org/sites-at-risk/site/15459>); (C) Wooden fishing boat wreck at Lonnie (<https://scapetrust.org/sites-at-risk/site/15464>); (D) Metal boat wreck at Whiteness Head (<https://scapetrust.org/sites-at-risk/site/15488>).

Maritime – Landing places

An under-recorded feature of the whole of the Scottish coastline are informal and small-scale boat landing places, and the survey area was no exception. Seven new landing place sites were recorded, including small piers, jetties and cleared slipways.

Notable among these is an unusual timber and tile jetty recorded at Brecknish (Figure 21). The jetty is constructed upon tree-trunk sleepers with a brick and tile top. It once served the short-lived Culloden Brick and Tile Works (established 1846, closed 1891) situated on the Fiddlers Burn at Lower Cullernie, which specialised in drainage tiles and large bricks. The jetty and associated building are shown on the 1st edition OS surveyed in 1869, but the jetty had gone and the building unroofed by the 2nd edition OS in 1903. Further detail about the site can be found in the North of Scotland Archaeology blog on Petty Industry (Ruscoe, 2019). This is an interesting and unusual site of local historic significance.



Figure 21. Remains of jetty constructed from wood and red brick, Brecknish (<https://scapetrust.org/sites-at-risk/site/15422>).

4.2.2. Military

Military – WW2

Most of the military sites visited relate to the Second World War. These include concrete gun emplacements, anti-tank cubes and concrete landing platforms around Fort George (Figure 10). Elsewhere, the well-preserved remains of expansive landscapes of anti-landing posts can be found across the intertidal sands of Whiteness Head and stretching

across the saltmarsh at Culbin (Figure 22). The posts at Whiteness Head are set into ceramic pipes which is unusual, and possibly the only extant example.



Figure 22. Anti-glider posts at (A) Whiteness Head (<https://scapetrust.org/sites-at-risk/site/15479>); (B) Culbin (<https://scapetrust.org/sites-at-risk/site/15319>).

Military – Other

Non WW2 military sites are all related to Fort George fortifications. Other than its associated coastal features and the condition of parts of the outer walls, Fort George itself was not recorded in detail in this survey as it is a Property in Care.

4.2.3. Industry

Industry – Factories and Works

The tide mill at Scottack, Newton of Petty comprises the remains of a dike which dams the Rough Burn and hidden within vegetation to the northwest, the stone footings of a narrow rectangular building constructed on a slight platform just behind the coast edge. The dike is the most visible feature and can be traced for approximately 200 m. The dike consists of three parallel boulder walls filled with mud and shingle (Figure 23).

The mill was in use in the late 17th century and given up around 1824.

Extract of the minute of kirk-session:

‘17th September 1682, P.F. and M. English, millers of the salt water mill, charged by the officer for setting it, and grinding on the Lord’s day.’

The New Statistical Account (1839) describes the mill:

‘The salt water mill, which was double, had two wheels. Its ruins still stand towards the entrance of the bay near the church. Across this bay a dike was erected, and the keeping in repair of so many feet of dike was assigned to each tenant on the Earl of Moray’s estate. A considerable supply of water for this mill was obtained from a burn which flows into the bay; but the object of the dike was not merely to dam up the waters of this burn,

but, first to exclude and then to admit the flow-tide at sluices so constructed, as that the mill might be turned both by the flow and the ebb-tide. This mill was given up fifteen years ago.'

The tide mill at Scottack is a good example of a tide mill which are rare sites around the Scottish coast. It would benefit from an updated survey.



Figure 23. Remains of tide mill, Scottack (<https://scapetrust.org/sites-at-risk/site/14458>).

4.2.4. Natural

Natural features in this survey were generally re-classifications of stone alignments and mounds in previous surveys, mis-interpreted as archaeological features. One new exposure of intertidal peat at Culbin was recorded.

One notable natural feature with an historic association is the Clach an Abain, or the Abbot's Stone (Figure 24), the story of which is told in the Ordnance Survey name book:

'This name is applied to a large black stone, lying in the sandy beach about 200 yards within the high water line, and north west of Lonnie farm house; "on the south side of the bay, an immense stone, weighing at least 8 tons, which marked the boundary between the estate of Lord Moray and Culloden, was, on the night of Saturday 20th February 1799, carried forward into the sea 260 yards, some suppose that nothing short of an earthquake could have moved such a mass; but the more probable opinion is, that a large sheet of ice, which had collected to the thickness of 18 inches round the stone, had been raised by the tide, lifting the stone with it, and that their motion forward was aided and increased by a tremendous hurricane which blew from the land"



Figure 24. The Abbot's Stone, (<https://scapetrust.org/sites-at-risk/site/15489>).

5. Priority sites and recommendations

Ten sites have been assigned a priority 3 status based on their vulnerability to coastal erosion and archaeological significance. Seven of these have an existing Canmore or HER record associated with them and three are new sites. All are located in the intertidal zone and are vulnerable to coastal processes.

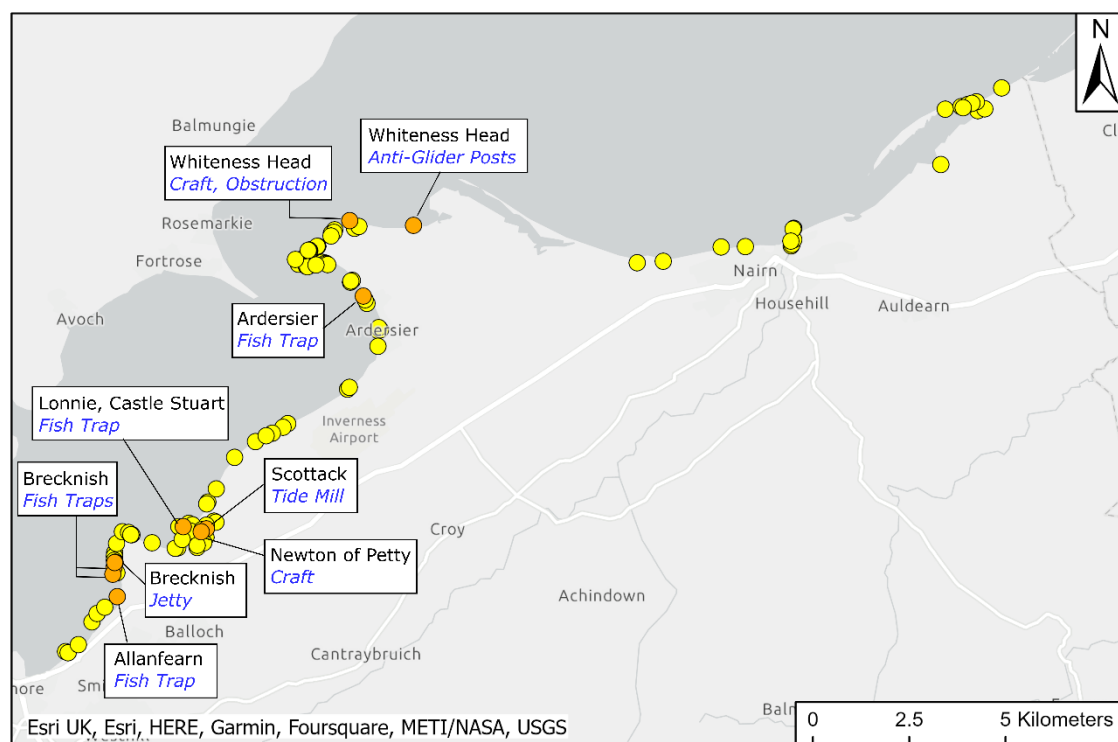


Figure 25. All updated sites within the survey area. Yellow sites are low priority and orange sites are moderate priority sites.

It is recommended that all ten sites are regularly monitored at three-year intervals or following an extreme weather event. It is most practical to monitor the intertidal fish traps using a drone.

The Whiteness Head wreck [[SCAPE ID: 15488](#)] is submerged except for upper parts and only properly visible at extreme low tides.

The individual sites of Brecknish Jetty [[SCAPE ID: 15422](#)], Scottack Tide mill [[SCAPE ID: 14458](#)], and the possible remains of a wooden vessel associated with a ballast mound at Newton of Petty [[SCAPE ID: 15459](#)], would benefit from detailed survey and recording. Following the survey, NoSAS have undertaken a detailed survey and recording of Brecknish jetty in 2022.

All three fish traps located between Allanfearn and Brecknish [[SCAPE ID: 15308](#)], [[SCAPE ID: 15309](#)], [[SCAPE ID: 15311](#)], would benefit from detailed survey and historical research. To our knowledge there are no scheduled fish traps in the Moray Firth area and these could make good candidates.

A summary of vulnerability and recommended action for each site is given in Table 4.

Scape ID	Canmore ID	HER ID	Site Name	Site Type	Summary of vulnerability	Recommended Action
<i>Maritime - Fishing</i>						
15308	346352	MHG14261	Brecknish	Fish Traps	Intertidal	Monitor, drone, walkover. Detailed survey and historical research.
15309	346352	MHG14260	Brecknish	Fish Traps	Intertidal	Monitor, drone, walkover. Detailed survey and historical research.
15311	34711	MHG14259	Allanfearn	Fish Trap	Intertidal	Monitor, drone. Detailed survey and historical research.
15371	347130	MHG29244	Ardersier	Fish Trap	Intertidal	Monitor, drone, walkover.
15437	347132	-	Lonnie, Castle Stuart	Fish Trap?	Intertidal	Monitor, drone.
<i>Maritime - Boats and Wrecks</i>						
15459	-	-	Newton of Petty	Craft	Intertidal	Monitor, walkover.
15488	324546	-	Whiteness Head	Craft, Obstruction	Intertidal, wave erosion	Monitor, drone or from shore. Research to identify wreck.
<i>Maritime - Landing Places</i>						
15422	-	-	Brecknish	Jetty	Intertidal, wave erosion	Monitor, drone, walkover. The NoSAS survey of the jetty is currently being written up.
<i>Industry - Factories and Works</i>						
14458	173951	MHG36425	Scottack	Tide Mill	Intertidal, low-lying coast edge	Monitor, drone, walkover. Detailed survey and historical research.
<i>Military – WW2</i>						
15479	-	-	Whiteness Head	Anti-Glider Posts	Intertidal	Monitor, walkover.

Table 4. Summary of the ten priority 3 sites.

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7. References

Centre for Archaeology, 1998a. Coastal Assessment Survey: Inner Moray Firth, Volume 1, Inverness to Dingwall. Unpublished report. <https://scapetrust.org/wp-content/uploads/reports/moray1.pdf> [Accessed 31 Jan 2023].

Centre for Archaeology, 1998b. Coastal Assessment Survey: Inner Moray Firth, Volume 2, Dingwall to Tarbat Ness. Unpublished report. <https://scapetrust.org/wp-content/uploads/reports/InnermorayfirthVol2.pdf> [Accessed 31 Jan 2023].

Dawson, T. D. 2004. Locating Fishtraps on the Moray and the Forth. Available online at: <https://scapetrust.org/wp-content/uploads/reports/fishtraps.pdf>.

Fitton, J. M., Hansom, J. D. and Rennie, A. F. 2016. A national coastal erosion susceptibility model for Scotland. *Ocean & Coastal Management*, 132, 80-89.

Hambly, J. 2017. A review of heritage at risk from coastal processes in Scotland: Results from the Scotland's Coastal Heritage at Risk Project 2012-2016. Available online at: <https://scapetrust.org/wp-content/uploads/reports/SCHARP-CoastalHeritage-REVIEW.pdf> [Accessed 27 Jan 2023].

Hurst, M. D., Muir, F. M. E., Rennie, A. F. and Hansom, J. D. 2021. Dynamic Coast: Future Coastal Erosion. CRW2017_08. Scotland's Centre of Expertise for Waters (CREW). Available online at: <https://www.dynamiccoast.com/reports> [Accessed 9 Feb 2023].

Kirkdale Archaeology. 2010a. Fort George: Coastal Erosion Recording May 2010. HS PIC Index Number: 90146, Project Code: HSCO-90146-2010-02. Available online at: <https://her.highland.gov.uk/monument/MHG15618> [Accessed 27 Jan 2023].

Kirkdale Archaeology. 2010b. Fort George: DUKW Platforms May 2010. HS PIC Index Number: 90146, Project Code: HSCO-90146-2010-01. Available online at: <https://her.highland.gov.uk/monument/MHG15618> [Accessed 27 Jan 2023].

Ordnance Survey Name Book, Inverness-shire County, Parish of Petty, 1876-1878, volume 55, OS1/17/55/34.

Ramsay, D. L. and Brampton, A. H. 2000. Coastal Cells in Scotland: Cell 3 – Cairnbulg Point to Duncansby Head. Scottish Natural Heritage. Available online at:
<https://www.dynamiccoast.com/resources> [Accessed 27 Jan 2023].

Ruscoe, M. 2019. Petty Industry: The Evidence for Industry in a Highland Parish. [Blog] NOSAS Archaeology Blog. Available at:
<https://nosasblog.wordpress.com/2019/08/17/petty-industry-the-evidence-for-industry-in-a-highland-parish/> [Accessed 26 Jan 2023].

Appendix 1. Known sites visited on 2022 survey

SCAPE ID	Site name	Site type	Periods	Easting	Northing	Canmore ID	HER ID
<i>Maritime - Fishing</i>							
14416	Nairn, Harbour Street, Old Salmon Bothy	Bothy		288820	857030	110118	MHG23130
15308	Brecknish	Fish trap(s)	Period Unknown	271230	848666	346352	MHG14261
15309	Brecknish	Fish trap(s)	Period Unknown	271206	848489	346352	MHG14260
15311	Allanfearn	Fish trap	Period Unknown	271312	847910	34711	MHG14259
15314	Icehouse, Easter Delnies	Icehouse	Post-Medieval	285500	856630		MHG29575
15366	Fort George	Fish trap, stake net	Period Unknown	276759	856558	347129	
15367	Fort George	Stake net	Period Unknown	276780	856544	347129	
15368	Ardersier, fish traps	Stake net	Period Unknown	277424	856135		MHG30499
15371	Ardersier	Fish trap	Post-Medieval	277711	855717	347130	MHG29244
15417	Brecknish	Breakwater, fish trap?	Period Unknown	271255	848783	346352	MHG14262
15426	Mains of Connage	Wall, fish trap?, cleared slipway?	Post-Medieval	277298	853303	347131	
15429	Mains of Connage	Wall, cleared slipway?, fish trap?	Post-Medieval	277346	853353	347131	
15437	Lonnie, Castle Stuart	Fish trap?	Period Unknown	273032	849726	347132	
15495	Icehouse, Delnies	Icehouse	Post-Medieval	284821	856589	15158	MHG43690
<i>Maritime - Craft</i>							
15473	Whiteness Head	Craft, Obstruction	Period Unknown	277594	857533	324546	
15488	Whiteness Head	Craft, Obstruction	Period Unknown	277353	857680	324546	
<i>Maritime - Harbours</i>							
14417	Nairn Harbour, West Pier	Pier	Post-Medieval	288868	857463	110254	MHG23166

SCAPE ID	Site name	Site type	Periods	Easting	Northing	Canmore ID	HER ID
14418	Nairn Harbour, Wharf	Wharf		288839	857065	279926	MHG49457
14427	Nairn Harbour, East Pier	Pier		288886	857488	279924	MHG49455
14435	Nairn, Harbour	Harbour	Modern	288889	857185	113789	MHG25661
14448	Nairn Harbour, Dock	Dock	Modern	288813	857149	279925	MHG49456
<i>Maritime - Landing Places</i>							
15361	Fort George	Jetty/pier	Modern	276229	856492		MHG30497
15362	Fort George	Pier	Post-Medieval	276255	856481	348276	
<i>Maritime - Navigation</i>							
14436	Nairn Harbour, East Pier, Beacon	Beacon		288887	857487	279928	MHG49459
14441	Nairn Harbour, West Pier, Beacon	Beacon	Modern	288867	857462	279927	MHG49458
<i>Industry - Factories and Works</i>							
14458	Scottack	Tide Mill	Post-Medieval	273634	849671	173951	MHG36425
<i>Settlement - Boundaries</i>							
15322	Ardersier, boundary markers	Boundary marker	Post-Medieval	277475	857485		MHG30498
<i>Settlement - Other</i>							
15317	Culbin Sands	Archaeological landscape	Multi-Period	293667	860542		MHG55366
14421	Lonnie	Well, Sunken floored building(s)	Period Unknown	273390	849190	347080	
<i>Religious</i>							
14426	Petty, Parish Church of Scotland, Watch House	Watch House	Post-Medieval	273882	849849	101173	MHG24175
<i>Military - WW2</i>							
14429	Fort George	Concrete Platform	Second World War	276524	857018	312466	

SCAPE ID	Site name	Site type	Periods	Easting	Northing	Canmore ID	HER ID
14457	Fort George	Coastal Battery	Second World War	276966	857444	173653	MHG36383
15318	WWII Battery, Fort George	Battery	Second World War	276877	857351		MHG30322
15319	Anti-landing obstacle, Nairn Beach	Anti glider posts	Second World War	293848	860584		MHG30372
15521	Culbin Sands, The Bar	Post	Second World War	293410	860700		MHG30372
15522	Culbin Sands, The Bar	Post	Second World War	293632	860769		MHG30372
<i>Military - Other</i>							
14455	Fort George	Artillery fortification, barracks, hospital, prisoner of war camp, war memorial		276079	856674	14317	MHG15618
14459	Fort George Seaplane Base	Seaplane base	First World War	276200	856520	331289	MHG58929
<i>Natural Features</i>							
14404	Old Petty, Glebe Cottage	Motte, Natural Feature	Period Unknown	273830	849870	14218	MHG14254
14411	Fort George	No class	Nil Antiquity	276260	856840	312459	
14425	Nairn, Fairy Hillock	Mound	Period Unknown	287630	857010	15144	MHG7306
15313	Old Petty	Mound	Period Unknown	273630	849770		MHG39332
15489	Boundary Marker, The Abbot's Stone	Boundary marker	Period Unknown	273000	849400		MHG14258
<i>Miscellaneous</i>							
14405	Nairn 'Castle'	Castle, Harbour	Period Unknown	287000	857000	15106	MHG6950
14430	Loch Loy	Coastal defence site, Sea defences		292710	859140	314426	

Appendix 2. New sites

SCAPE ID	FTS ID	Site name	Site type	Periods	Easting	Northing
<i>Maritime - Fishing</i>						
15369	044	Ardersier	Stake Net	Period Unknown	277375	856087
15370	045	Ardersier	Stake net	Period Unknown	277381	856111
15388	064	Brecknish	Post	Period Unknown	271303	848526
15406	087, 086, 088, 089	Ardersier	Stake	Period Unknown	277806	855534
15408	090	Ardersier	Fish trap, Stake net	Period Unknown	277756	855624
15412	094	Brecknish	Stone alignment	Period Unknown	271250	849052
15413	095	Brecknish	Stone alignment	Period Unknown	271247	848961
15414	096	Brecknish	Stone alignment, Fish trap	Period Unknown	271243	848961
15415	097	Brecknish	Fish trap	Period Unknown	271239	848857
15416	098	Brecknish	Breakwater, Fish trap?	Period Unknown	271261	848808
15440	141	Fisherton	Stone alignment	Period Unknown	273640	850324
15478		Fort George	Fish trap, Stake net	Period Unknown	276480	856531
15603		Culbin Sands, The Bar	Post	Period Unknown	293517	860729
15604		Culbin Sands, The Bar	Post	Period Unknown	293286	860617
15605		Culbin Sands, The Bar	Fishing Bothy	Post-Medieval, Modern	292826	860579
15348*	023, 024, 025, 051, 052, 053, 059	Allanfearn	Post	Period Unknown	270795	847474
15403*	085	Ardersier	Fish trap, Stake net	Period Unknown	278105	854905
<i>Maritime - Craft</i>						
15459		Newton of Petty	Craft	Post-Medieval	273494	849599
15463		Lonnie	Craft	Post-Medieval	273621	849455

SCAPE ID	FTS ID	Site name	Site type	Periods	Easting	Northing
15464		Castle Stuart, Lonnie	Craft	Modern	273566	849307
15465		Castle Stuart, Lonnie	Boiler	Modern	273389	849243
15466		Alturlie, Clattach	Maritime Craft?, Ballast Mounds	Period Unknown	272889	849175
<i>Maritime - Landing Places</i>						
15363	039	Fort George	Post alignment	Period Unknown	276599	856606
15402	084	Ardersier	Pier	Post-Medieval	278158	854842
15422	104	Brecknish	Jetty	Post-Medieval	271245	848798
15433	134	Alturlie Point	Stone alignment, Cleared slipway?	Period Unknown	271694	849518
15439	140	Fisherton	Stone alignment, Cleared slipway?, Fish trap	Period Unknown	273666	850367
15455		Newton of Petty	Pier, Posts, Fishing structures	Period Unknown	273515	849653
15487		Clattach	Jetty	Post-Medieval	272218	849309
<i>Maritime – Navigation</i>						
15448	049	Castle Stuart	Post	Post-Medieval	273209	849617
<i>Settlement & Agriculture - Boundaries</i>						
15442	142, 143	Wester Fisherton	Stone alignment	Period Unknown	274360	851531
15443	144	Easter Fisherton	Stone alignment, Wall	Period Unknown	274904	851938
15460		Wester Kerrogair	Wall	Period Unknown	275619	852308
15462		Easter Fisherton	Boundary	Period Unknown	275180	852095
15335*	011	Cairnlaw, Scretan Bridge	Wall	Period Unknown	270038	846452
15329*	005	Cairnlaw, Scretan Bridge	Stone alignment	Period Unknown	269969	846481
<i>Settlement & Agriculture - Other</i>						
15447	148	Castle Stuart	Sheepfold	Period Unknown	273270	849782

SCAPE ID	FTS ID	Site name	Site type	Periods	Easting	Northing
15446	147	Balnaglack	Sheepfold	Period Unknown	273885	850711
15461		Easter Fisherton	Sheep dip, Well	Period Unknown	275343	852161
<i>Military - WW2</i>						
15364	040	Fort George	Post alignment	Period Unknown	276643	856602
15467		Alturlie	Concrete structure	Modern	272823	849168
15470		Fort George	Defence	Second World War	276942	857381
15471		Fort George	Posts	Period Unknown	276502	857021
15479		Whiteness Head	Anti Glider Posts	Second World War	279009	857558
15519		Culbin Sands, The Bar	Posts	Second World War	294292	861128
15524*	001-004, 006-010, 012-018, 026-034, 057, 058, 060-062, 065-073	Milton of Culloden	Anti Glider Posts	Second World War	270309	846664
<i>Military - Other</i>						
15476		Fort George	Wall	Post-Medieval	276317	856907
<i>Natural Features</i>						
15430	131	Alturlie Point	Stone alignment, Natural?	Nil Antiquity	271293	849297
15431	132	Alturlie Point	Stone alignment, Natural?	Nil Antiquity	271452	849599
15432	133	Alturlie Point	Stone alignment, Fish trap?	Nil Antiquity	271615	849579
15434	135	Alturlie Point	Mound, Natural?	Nil Antiquity	271665	849523
15436	137	Castle Stuart	Stone alignment, Natural?	Nil Antiquity	272911	849729
15520		Culbin Sands, The Bar	Intertidal peat	Nil Antiquity	293237	860644
<i>Miscellaneous</i>						
15344*	019, 020, 021, 022	Milton of Culloden	Post	Period Unknown	270659	847256

SCAPE ID	FTS ID	Site name	Site type	Periods	Easting	Northing
15360	035, 036	Fort George	Post alignment, Groyne?	Period Unknown	276017	856552
15365	040A	Fort George	Post alignment	Period Unknown	276729	856580
15401	083	Ardersier	Post alignment	Period Unknown	278088	854830
15410	092	Ardersier	Groyne	Period Unknown	278088	854421
15438	139	Castle Stuart	Post, metal	Post-Medieval	273171	849816
15445	146	Wester Kerrowgair	Pole	Period Unknown	275741	852411
15477		Fort George	Linear feature, stone structure	Period Unknown	275943	856671
15483		Fort George	Sea defences, Groyne?	Post-Medieval	276301	856924
15484		Fort George	Sea defences	Post-Medieval	276279	856916
15485		Fort George	Posts	Period Unknown	276868	857285
15379*	047, 048, 049, 050, 054, 055, 056	Allanfearn	Post	Period Unknown	270990	847632

*Sites with an asterisk denote new sites identified in the Inner Moray Firth Fish Trap Survey (FTS) conducted in 2003/04 and which are not currently recorded within Canmore or local HERs. These sites were not revisited during the 2022 CZAS survey but have been included in analysis for completeness.