7. SURVEY RESULTS FOR THE ISLAND OF BUTE

7.1 Based on the results of the field survey this section examines the findings relating to the erosion record of the Island of Bute.

7.1.1 The total length of the coastline is based on the digital measurement of each coastal unit mapped on each of the coloured 1:25, 000 map sheets (Bute Maps 1-10 above). The combined length of all units is 82.1km. This figure was used to establish the percentage frequency of each erosion class.

Erosion Classifications (Fig 3 & 4)

7.1.2 Erosion classes used are as defined in the Historic Scotland procedure document. Analysiss of the results are shown in a series of histograms and summarised in Table 2 below.

Erosion Class	Number of units	Total length (km)	Total length (%)
Eroding or Stable	9	27.5	33
Definitely Eroding	9	16.9	20.4
Accreting/Eroding	11	27.5	33
Accreting/Stable	10	10.6	12.8

Table 2: Summary statistics of the erosion class lengths of Bute

7.1.3 Both the *Eroding or Stable* and the *Accreting and Eroding* classifications attain a combined length of 27km and 10.6km respectively representing 33% of the survey area. The *Definitely Eroding* class attains a combined length of 16.9km, representing 20.4% of the survey area. The *Accreting or Stable* classification has the shortest combined distance at 10.6km, representing 12.8% of the survey area.

Period Categories of archaeological sites and monuments (Figs 5 & 6)

7.1.4 The results for the period categories for all the sites and monuments examined show a bi-modal distribution with 110 sites (59%) of unknown date. Typically sites which were assigned to this category include possible intertidal fish-trap sites, boat landing places, building platforms and poorly preserved settlement remains that are difficult to date without further investigation. Forty-five sites (25%) were assigned to the 18th and 20th century. This group is rich in industrial remains such as harbours, piers and jetties as well as the numerous listed buildings along the east coast of the island (mainly in and around Rothesay). Nine sites representing (8%) of the total number of sites (n= 180) are dated to the 4th millenium BC-1st century BC. This broad date range includes the later prehistoric monuments and features associated with Dunagoil promontory fort.

7.1.5 There are no Late 20th century, 11th-14th century and pre-4th millenium sites within the study area. The survey recorded only two WW2 sites and these are represented by a ruined look-out station and a system of posts to prevent planes landing in Scalpsie Bay on the west coast. These remains are poor and it is suggested that the origional number of WW2 sites must have been greater,

especially given the strategic importance of the Firth of Clyde during the Second World War.

Condition classifications of all site and monuments (Figs 7 & 8)

7.1.6 The classifications *Good*, *Fair* and *Poor* have been assigned to the general condition of all sites and monuments seen within the study area. The data shows that 62 sites and monuments were observed as Poor (29%). The other two condition classes attained 10 and 12% of the total number of archaeological sites recorded respectively. Sites within the intertidal area were found to be in a poor state of preservation. For example, possible fish-traps sites survived as nothing more than a low line of eroding posts or boulders. Similarly piers and jetties were generally found to be in a poor state. Sites within the hinterland are markedly better preserved. The prehistoric sites and monuments on the west coast of Bute associated with promontory forts and duns, were generally in a good condition.

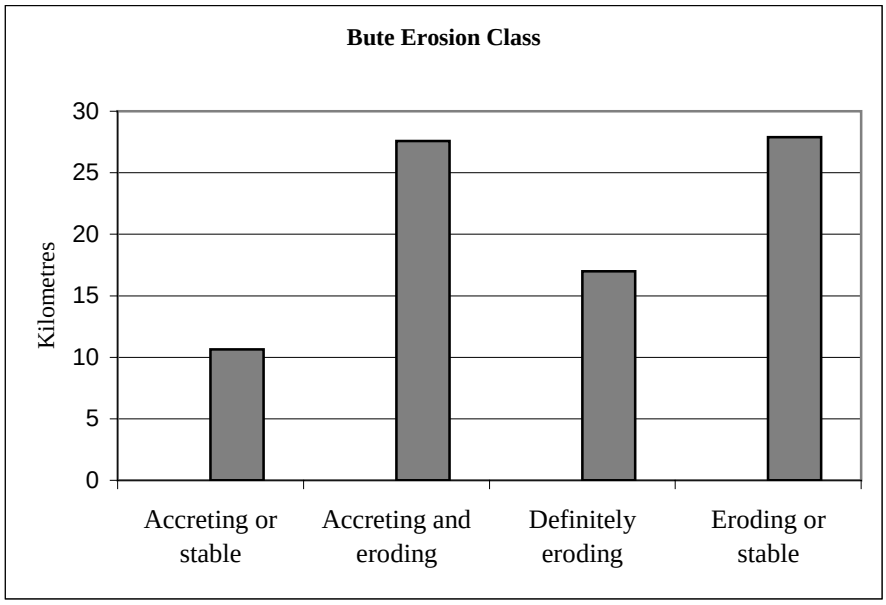

Figure 3 Bute distance versus erosion/stability classification

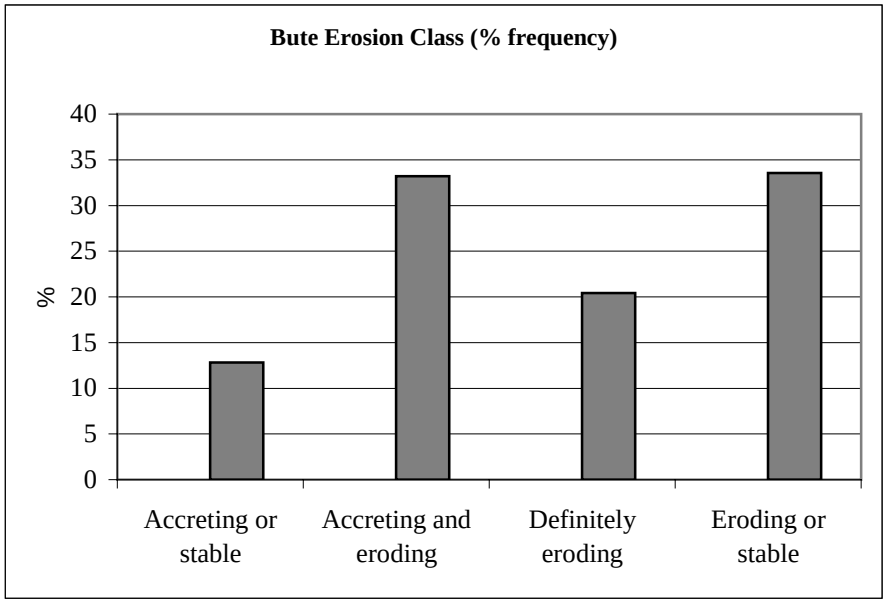

Figure 4 Bute percentage frequency of distance versus erosion/stability classification

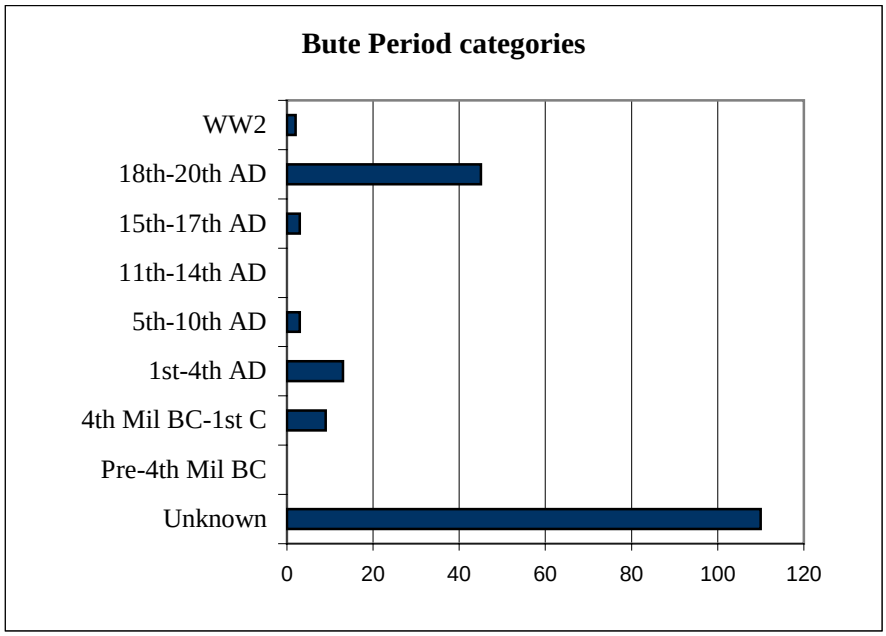

Figure 5 Bute period categories of all sites and monuments

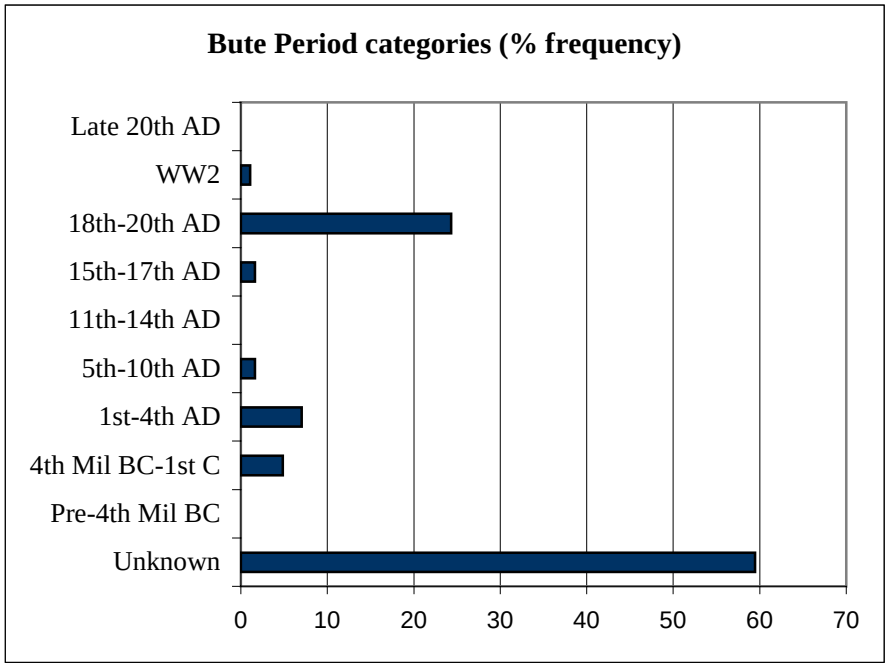

Figure 6 Bute percentage freqency period categories of all sites and monuments

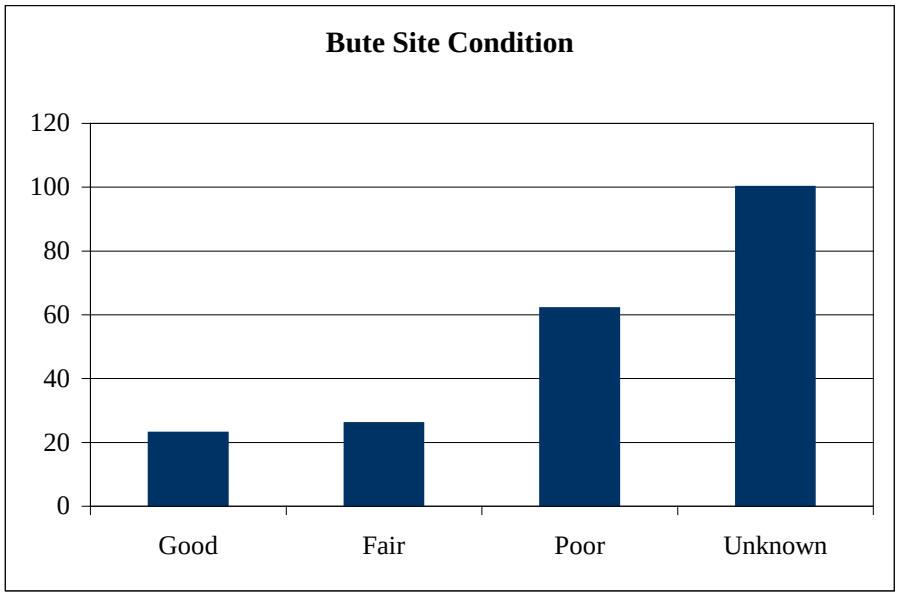

Figure 7 Bute frequency and condition of all archaeological sites

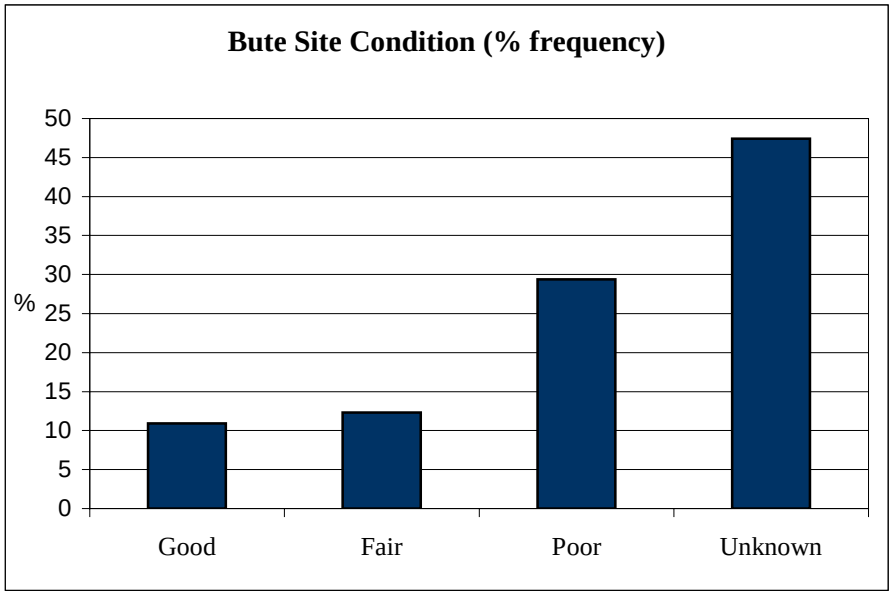

Figure 8 Bute percentage frequency and condition of all archaeological sites

8. SURVEY RESULTS FOR THE RIVER CLYDE

8.1 Based on the results of the field survey this section examines the findings relating to the erosion record of the River Clyde.

8.1.1 The total length of the coastline is based on the digital measurement of each coastal unit mapped on each of the coloured 1:25, 000 map sheets (Clyde Maps 1-10 above). The combined length of all units is 58 km. This figure was used to establish the percentage frequency of each erosion class.

Erosion Classes for the Clyde (Figs 9 & 10)

8.1.2 The River Clyde survey area has produced three types of erosion class. These include *Accreting or Stable, Accreting and eroding* and the *Definitely Eroding* classes. Seventeen kilometres of coastline is classified as *Definitely Eroding* representing 30% of the survey area.). The *Accreting and eroding* class represents 19km or 35% of the survey area. The *Accreting or stable* class has attained the greatest distance at just over 20km (c.40% of the survey area).

Erosion Class	Number of units	Total length (km)	Total length (%)
Definitely eroding	5	17	25
Both Accreting/eroding	7	19	35
Accreting/stable	7	22	40

Table 3 Summary statistics of the erosion class lengths of the Clyde

8.1.3 The results demonstrate that sediment accretion is geographically extensive and that active erosion is also occurring for at least 25% of the coastline within the survey area. Most of the active erosion appears to be confined to areas including Hill of Ardmore, Cardross and Dumbuck on the north side of the river where both 'soft' cliff sections and saltmarsh are eroding (see Figure 3 and 4). On the south side of the river, the cliff fronting Newshot Island is eroding, with up to 4-5m of saltmarsh lost behind the cobble revetment walls. 75% of the study area is currently affected by sediment accretion. The moderate tidal range in the Firth of Clyde results in weak currents. Firth and Collins (ibid) note that the primary source of sediment entering the Clyde area is from glacigenic and marine derived material situated on the margins of the estuary which will include erosion of both the coastline and nearshore sediment within the wider Firth of Clyde. There are no specific figures for fluvial born sediment derived from the River Leven and Black and White Cart Water or the upper reaches of the River Clyde. Dredging operations along the River Clyde have now virtually ceased (John Macdonald pers comm). This is mainly due to the decline in trade and shipbuilding that in the recent past required deep water shipping lanes.

Period categories of archaeological sites and monuments (Figs 11 & 12)

8.1.4 Over 100 sites and monuments were dated to between the 18th and 20th century (62%). The rest of the sites and monument attain values of below 10%.

Twenty-one sites (13%) were classified as unknown and include features that were difficult to classify without further investigation.

8.1.5 WW2 features are very rare (4%) and where these were found to survive, they were generally found to be in a poor state of preservation. Given the strategic importance of the River Clyde during the war it is very surprising that features from this period category were not more frequent. As we have seen, this pattern was observed for Bute and possibly demonstrating the vulnerability of WW2 monuments.

8.1.6 The large number of 18th-20th century sites include fish-traps on the northern shore. On the southern shore timber ponds, possible fish-traps and wooden piers and the numerous sea walls and harbours erected as part of the industrialisation of the River Clyde.

8.1.7 Roman, Dark Age and Earlier medieval and sites and monuments are low in frequency. Isolated findspots include urns and a finger ring. Sites such as the Dunglass Roman forts, Dumbarton Castles with its associated chapel contributes to these particular period categories.

8.1.8 Prehistoric features assigned to the 4th millennium BC –1st Century AD include the presence of inter-tidal crannogs, several logboats and prehistoric findspots. No Mesolithic sites or related finds are represented within the study area. The only cave with associated shell midden (NMRS NS37 NW6) is that recorded on the Hill of Ardmore (see Site 18 in Map 1). Although such a site might have been considered to be a typical coastal site of the Mesolithic period, excavation showed that the site contained only Iron Age finds.

8.1.7 The hinterland is dominated by built heritage features, most of which are listed. These buildings are depicted on Maps 1-10 as grouped entries and listed in Appendix 2. The largest numbers of listed buildings were present in the coastal towns of Helensburgh and Dumbarton.

Status classes of all site and monuments (Figs 13 & 14)

8.1.8 The results for the condition category of sites and monuments show that the majority of the sites (32%) recorded are in a good condition. Approximately 25% of these sites were in a poor condition and the rest were considered to be in a fair condition (7%). The consideration of the condition of the sites has potentially been skewed by the numerous listed buildings at Helensburgh and Dumbarton and the various sites classified as find-spots and log-boats whose condition is not known.

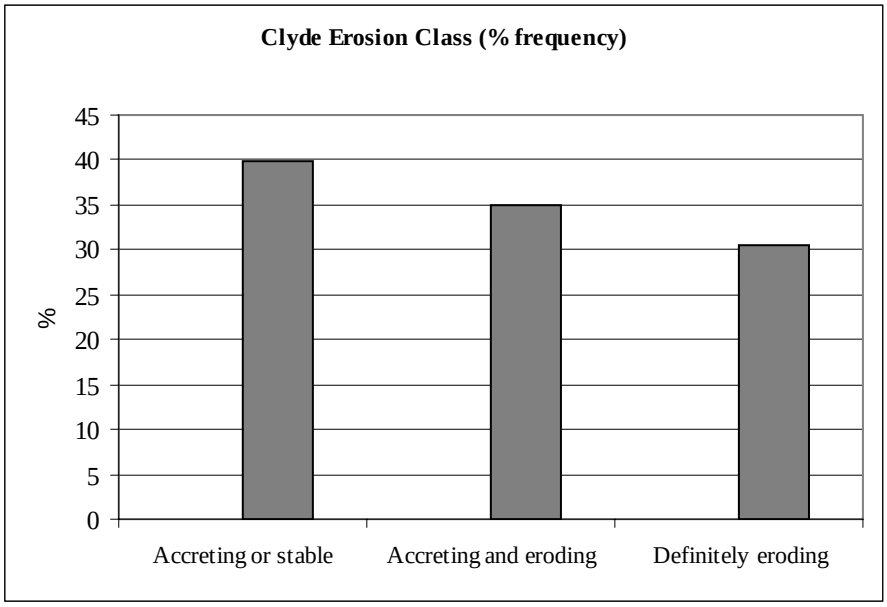

Figure 9 Clyde distance versus erosion/stability classification.

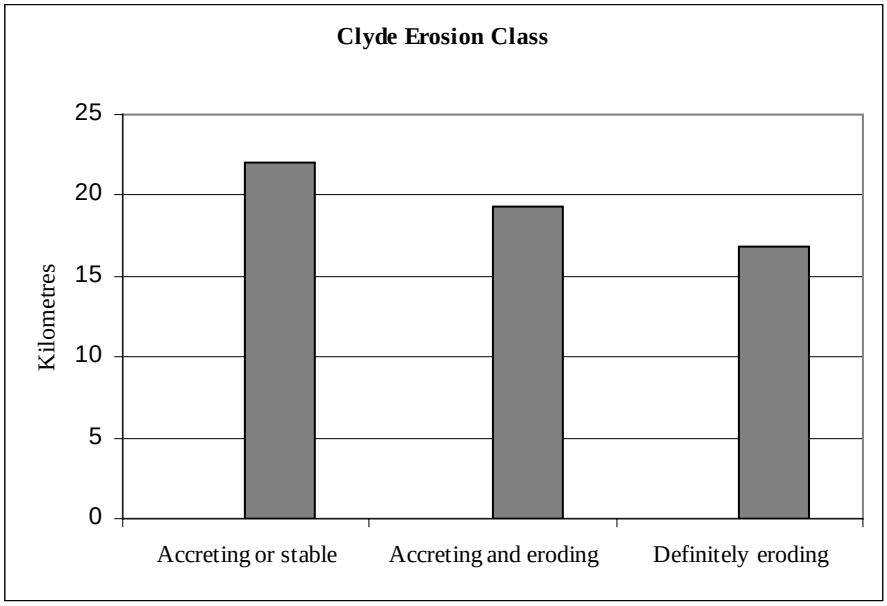

Figure 10 Clyde percentage frequency of distance versus erosion/stability classification.

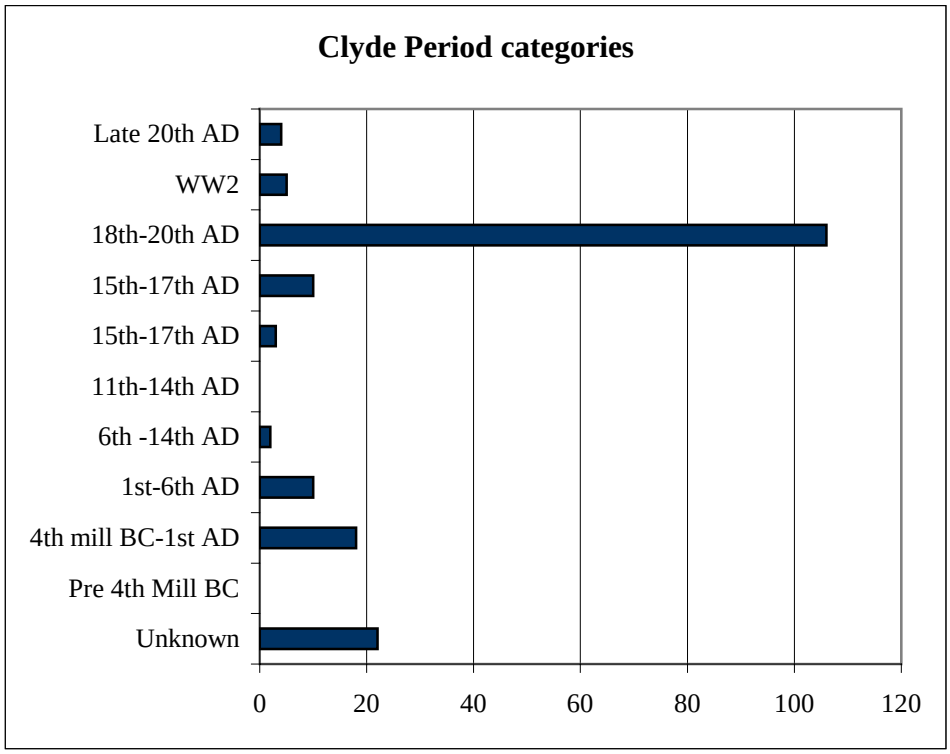

Figure 11 Clyde period categories of all sites and monuments.

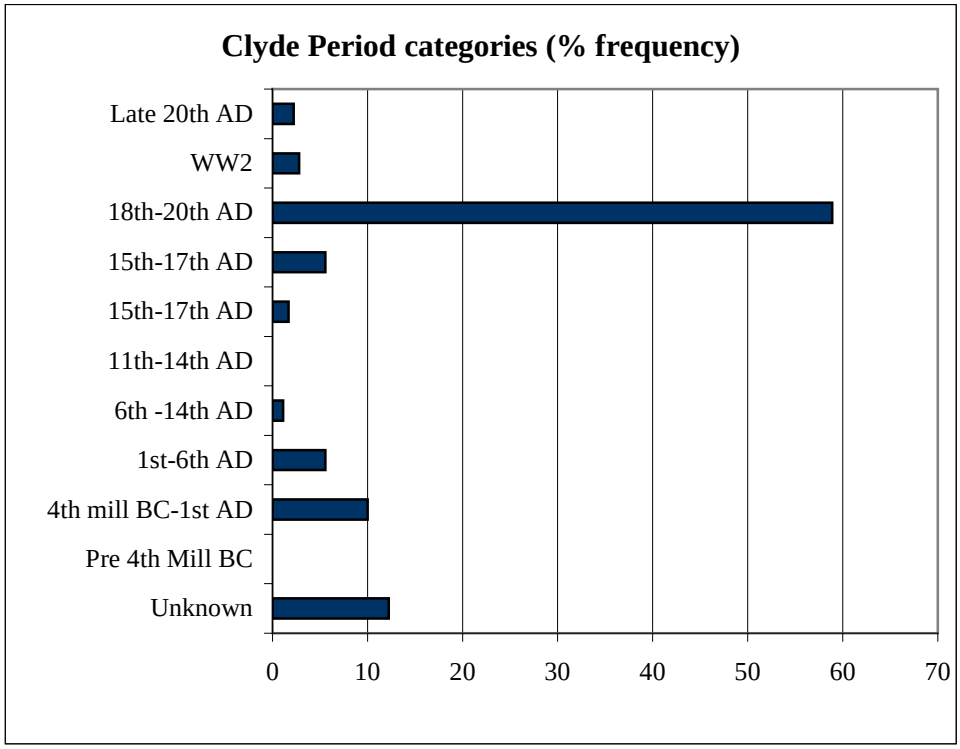

Figure 12 Clyde percentage frequency period categories of all sites and monuments.

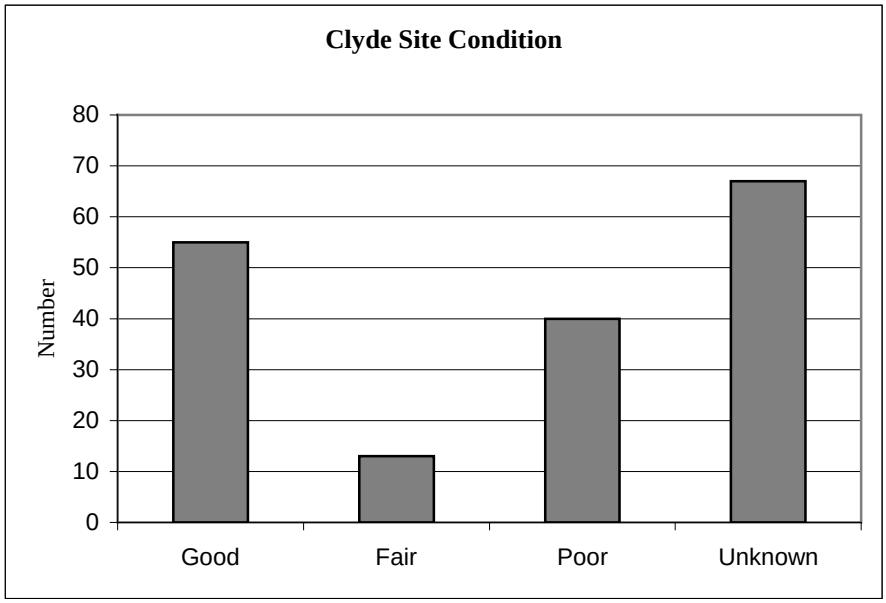

Figure 13 Clyde frequency and condition of all archaeological sites.

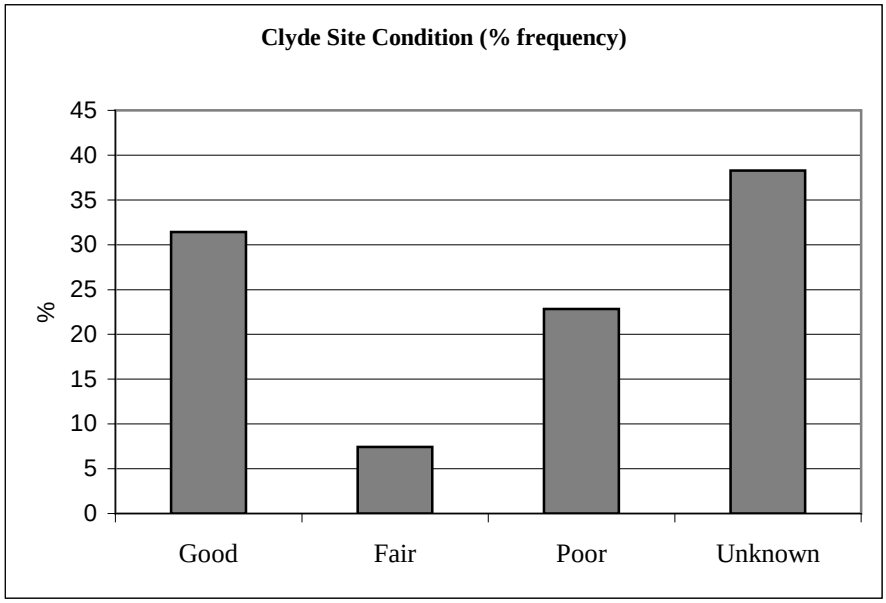

Figure 14 Clyde percentage frequency and condition of all archaeological sites.

9. CASE STUDIES: FISH-TRAPS & CRANNOGS

9.1 Fish-traps

9.1.1 The importance of fish-traps within the study areas will now be examined. These features appear to have been much more numerous within the Firth of Clyde than the archaeological record would suggest.

9.1.2 In a recent reappraisal of Scottish fish-traps based on historical accounts and field survey, Hale (2003) showed that estuarine fish-traps were built in a variety of forms, utilising different construction materials and often situated in particular places within estuaries and referred using colloquial terminology, such as 'yairs'. Invariably they are set at right angles to the coastline or at least at an angle that provides a barrier against which fish cannot swim and are subsequently forced into traps by receding tidal waters. In other cases the structures could be situated across ebb and flow channels to exploit migrating fish during the local tidal cycle. There are a number of different designs ranging from simple alignments of boulders to more complex traps including elaborate systems combining wattle-work forming stake and bag nets. There are still good examples of this type of net surviving on the Solway Firth that have only been abandoned in recent times.

9.1.3 Other Scottish coastal zone assessments have highlighted the frequency of fish-traps. In Cressey and Hale (1998), 62 fish-traps were recorded within the Beauly and Cromarty Firths. Here, calmer estuarine conditions favoured placing stake nets close to the confluence of freshwater river channels to trap migratory fish such as salmon and sea trout. It was demonstrated that fish-trap sites were also once numerous on the North Sea coastline but these did not survive owing to coastal erosion. Hale (2003) has also demonstrated that historical maps and documentary accounts provide evidence of other types of fish-traps known as 'weirs' and 'cruives' and these can be found in the lower and tidal reaches of Scottish rivers. These tended to be smaller structures than their maritime cousins and were generally tailored to fit the topography of the local riverbed. The archaeological record for such sites is poor due to the erosive nature of Highland rivers, especially in times of spate. Hale (2003) notes that today we see the remains of more recently built cruives that can comprise modern bonding materials such as concrete.

9.2 Bute fish traps

9.2.1 Ferrier (1969) considered that at least nine fish-traps were visible on the intertidal areas of Bute. During the course of his survey, he recorded only one on the east coast of Bute. This was located in the relatively sheltered East Kyle towards the north-east end of the island. The rest of the traps, eight in all, were confined to the west side of the island and found to be closely associated with fresh water streams. Of the traps that he recorded, only the one found at Glecknabae (NGR: NS 0030 6830) was rectangular in shape and consisted of lines of boulders. The rest of the traps were found to comprise lines of boulders forming short walls built across a natural inlet. In most cases the walls were buried in sea weed anchored to the foundation stones. He made

a very interesting point that it was useless to look for fish traps at high water, and that at low water, the stones may be buried in weed and that half-tide on the ebb presented in general the most suitable period for their recognition. It seems likely then that Ferrier was identifying the areas of ponding that occurred for brief periods of time when sea water is still retained behind the rock barriers. On a cautionary note, he further explained that it was very easy to confuse fish-traps with landing jetties, broken volcanic dykes or even old boundary walls running into the sea. The scarcity of fish-traps on the east coast was explained by lack of formal survey, the exposure to heavy wave action in storms, and to the presence of the Mount Stuart Estate, the Burgh of Rothesay and the other main centres of settlement. With regard to heavy wave action, it is argued by this author that wave action would not limit the presence of fish-traps and it is more likely to be either estate control or possibly tidal range factors that limited their use. It seems likely that fish was plentiful and certainly more productive as a result of boat fishing within the Kyle of Bute.

9.3 Clyde fish-traps

9.3.1 The north side of the Inner Firth of Clyde has a collection of fish-traps that fall into the category of yairs. Two are depicted on the 1864 First Edition Ordnance Survey (Fig 15) map as '*Old Fish Yair*' and are highly visible on aerial photographs (Plate 14). The largest fish-trap is situated to the north of Ardmore Hill at NGR NS 3170 8010 and is rectangular in shape and at least 300m in length. The structure consists of a line of boulders approximately 3m wide. An inlet channel is present approximately in the middle of the feature. There has been a great deal of accretion of estuarine mud within the fish-trap and during a recent Shorewatch survey it was found that sea water was still retained within the feature for quite some time after the tide had receded. This is demonstrated in Plate 2 that clearly shows rapid flowing water running out of the entrance of the trap. It seems logical that a gill net could be placed across the entrance just before the turn of the tide. Fish trapped within the stone enclosure would naturally swim with the greatest flow of water through the central channel and into the net (Hale pers comm). It is estimated that the trap walls would have stood to a height of about half a metre, and these were certainly of sufficient height for a person to walk along and draw a net across the entrance by hand. It is further surmised that migrating Spring and Autumn salmon running up to the Rivers Clyde and Leven were the main fish exploited. Dabs and flounders were also likely to have been caught.

9.3.2 On the north side of Hill of Ardmore (NGR: NS 3160 7920) another fish-trap was recorded during the recent survey (Fig 15). This survives as a long curvilinear mound of boulders. At its terminus a line of small wooden stakes was found strongly suggesting that these were associated with a stake net that was positioned well within the sheltered bay. Again, as with the previously mentioned fish-traps, this one appeared to also hold water to a depth of about 0.4m well after the tide had receded. Accretion of estuarine sediment and the displaced nature of the boulders do not allow for a true estimate of the actual depth of water that would have been trapped behind the walls when the trap was in operation.

Fig.15 - 1864 First Edition Ordnance Survey map showing the positions of three fishtraps, disused in the case study.

9.3.3 A third fish-trap was also identified during the Shorewatch field visit to the south of the Hill of Ardmore (NGR: NS 3579 7610). This fish-trap survives as a crescent-shaped line of boulders approximately 25m long and about 2m wide. Interestingly, this feature is shown on the 1864 First Edition Ordnance Survey map as an "*old fish yair*" and it is situated running at right angles to a sinuous river channel located between the foreshore and the Piller Bank. It seems plausible that migrating fish running up the channel on a flood tide could have run into the barrier wall and then funnelled into a stake net positioned towards the shore. Migratory fish running down the River Clyde on the ebb tide could also have been trapped. The current 1:25,000 Ordnance Survey map no longer shows the channel which clearly demonstrates how river channels on tidal flats can radically alter over time

9.3.4 This case study has demonstrated that there is a wealth of information to be gleaned on the fish-traps within the study area. It is hoped that further research will be carried out on these features in the near future.

9.4 Marine Crannogs

9.4.1 Section 4.2.1 above mentioned the presence of five known marine crannogs within the Firth of Clyde. These sites are currently being re-examined by the newly formed Clyde Shorewatch groups as part of their long-term monitoring projects. The significance of these sites has been illustrated by Hale 2000. This case study will focus only on the three crannog sites on the southern shore – Erskine, Langbank East and Langbank West (Fig 14). The Dumbuck crannog has been investigated in great detail as it has been the subject of several seasons fieldwork by Alex Hale and Rob Sands and forms the basis of the Dumbuck Research Project (Hale 2000). Table 4 below lists the radiocarbon dates for the Dumbuck and Erskine crannogs.

Lab code	Site	Material dated	Years BP uncal
GU-7472	Dumbuck 1	Oak pile	2090 ± 50
GU-7471	Dumbuck 2	Alder flooring timber	1910 ± 50
GU-7472	Dumbuck 3	Oak Pile	2040 ± 50
GU -7473	Dumbuck 4	Alder flooring timber	2060 ± 50
GU-2328	Erskine	Oak timber	1950 ± 50
GU-2187	Erskine	Oak timber	1970 ± 50
GU-2383	Erskine	Oak timber	2170 ± 60
GU-2186	Erskine	Alder timber	2210 ± 50

Table 4 Radiocarbon dates from marine crannogs in the Firth of Clyde (Hale 2000)

Erskine Crannog

9.4.2 Erskine Crannog (NGR: NS 4555 7288) is exposed for approximately four hours during low tide. In 1997, Hale (2000) confirmed that the upstanding remains consist of a mass of timbers and stones, 100m from the southern shore of the Firth on the edge of a large sandbank. Hale (2000) investigated what changes if any had occurred in the geomorphology of the structure since a previous photogrammetric site survey was carried out in 1984 (Hanson and McDonald 1985). Hale noted that a number of timbers, especially on the north

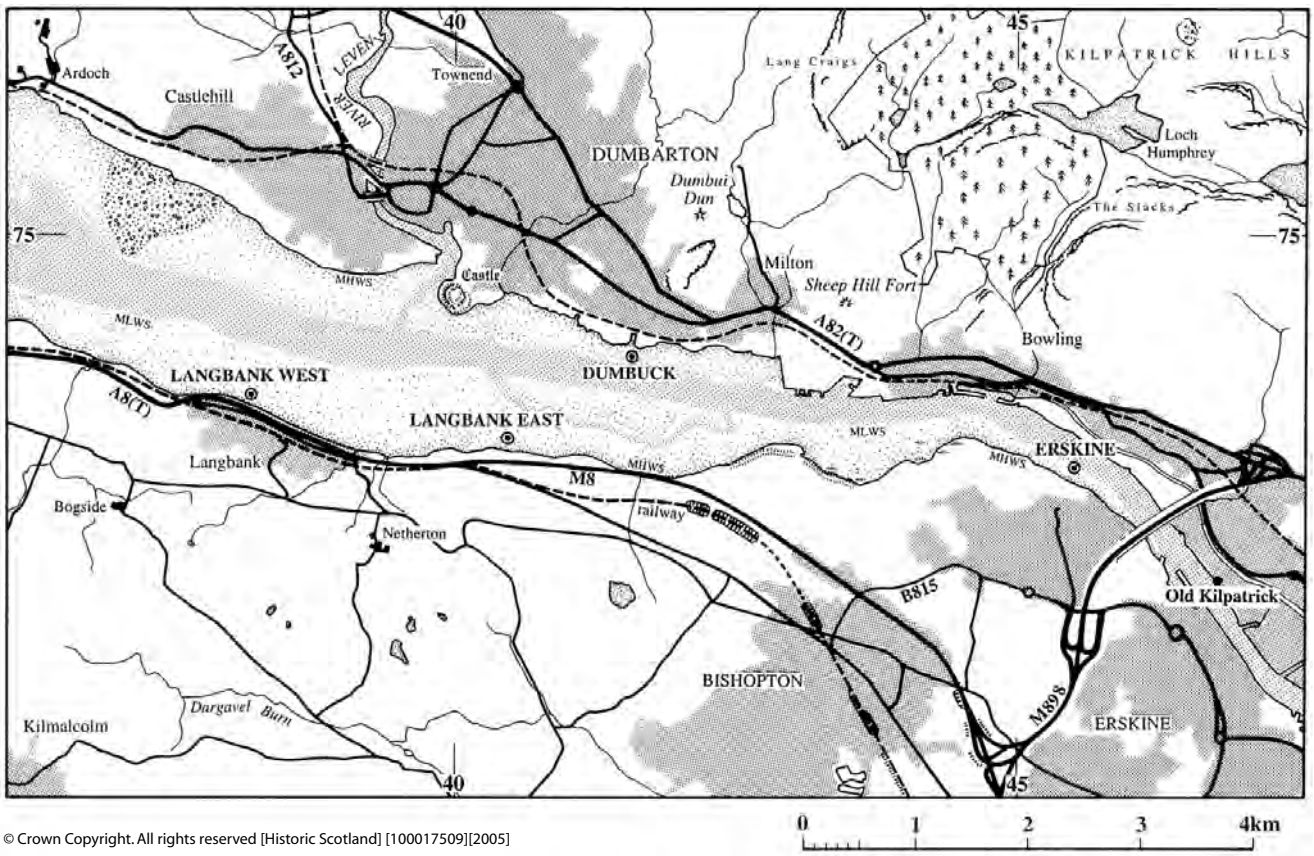

Fig. 16- Distribution map of inter-tidal crannogs within the River Clyde (after Hale 2000)

9.4.3 and north-east side of the site had disappeared, probably as a result of tidal scour. Timbers on the south and south-east of the site were also found to be absent and it seemed probable that these timbers had been re-buried by sediments as a result of accretion.

9.4.4 Visits to the site by the Shorewatch group carried out on 15 March 2004 have shown that there has been a great deal of sediment accretion. Many of the timbers are now partially buried. Mr John McDonald suggests that dredging operations along the river Clyde have virtually ceased. This was confirmed by Mr Douglas Hoad the Clydeport Hydrographer who stated that dredging operations have been reduced in recent times. The reduction of dredging and the fact that the Erskine crannog is situated on the inner radius of a bend in the river might explain why the sitye is accreting at the MLWM. However the situation is likely to change in this very dynamic environment.

9.5 Langbank East Crannog

9.5.1 Langbank East (NGR: NS 4050 7336) is 95m offshore from the southern HWMST and 300m from the LWMST which allows an extended exposure period of six hours during each low tide (Hale 2000). The site is 45m east/west and 30m north/south at its widest point and forms an irregular shaped stone structure, one course high, 20m long and 15m wide. Two parallel lines of stone between the site and the shoreline were considered to be the remains of a causeway. After carrying out a contour survey, Hale concluded that these features may have been demarcating the route of a later ford and that the crannog itself sat on a break of slope that may have been the possible remains of a buried palaeo-shoreline. No radiocarbon dates are available for this site.

9.6 Langbank West Crannog

9.6.1 Langbank West (NGR: NS 3822 7365) is situated near the southern shore, north of the village of Langbank. The site is exposed for approximately five hours during low tide. The site comprises an raised oval mound of stones and estuarine sediments, 30m in length and 20m wide. The margin of the site is clearly visible from the surrounding stone-strewn, gravel foreshore. In 1997 Hale (2000) noted the presence of three small wooden piles protruding from the intertidal sediment. No radiocarbon dates are available for this site. In the near future the Shorewatch group are going to investigate if these piles can still be seen and assess the general state of the site as part of a longer term monitoring programme.

9.6.2 The case studies have summarised the character of two contrasting archaeological sites in the intertidal zone. A common link between these sites is their vulnerability to coastal erosion processes in an extremely dynamic environment. These sites are continually at risk from tidal scour. Another threat to submerged timber is biological attack by marine plant and organism colonisation, in particular the boring mollusc of the Teredinidae family known as the shipworm (Hale 1997). It is clear that exposed timbers associated with both marine crannogs and fish-traps are at risk while exposed to the elements.

10. SUMMARY AND RECOMMENDATIONS

10.1 Summary

10.1.1 Three hundred and sixty five sites and monuments have been subjected to analyses during the rapid coastal assessment on the island of Bute and within the River Clyde. Of this number 101 were newly discovered sites. It has been demonstrated that a range of archaeological sites within the intertidal areas is being affected by a range of coastal erosion processes. The impact of this can be seen generally to correspond to different groups of chronologically distinct archaeological sites and monuments and remains, within varying topographical locations. Briefly the results have revealed that on the Island of Bute, just under 30% of all the sites examined are in a poor state. Within the Clyde estuary, a slightly different picture emerges with over 40% of the sites classified as in a poor state of preservation. It seems likely that the industrial development of the Firth of Clyde has to a large extent effected many sites and monuments. Importantly more intertidal sites were recorded in the Firth of Clyde due to the concentration of sites and monuments within this type of environment. The largest group of sites, comprising monuments and remains of an industrial and maritime nature from the post-mediaeval and industrial periods, are adversely affected primarily by wave impact and general erosion.

10.1.2 This survey represents a snapshot of the condition of the archaeological remains that were visible in late 2003. It is clear, that in addition to the rapid nature of the survey, there are a number of other biases inherent in the results. Chief amongst these large number of listed buildings which tend to fall within the 18th-20th centuries. During the Inner Clyde survey the tidal conditions were at their neap cycle which is not the optimum period in the tidal cycle to fully examine these sites. Fortunately the Shorewatch monitoring programme has now subsequently visited areas that could not be seen during late 2003 and their results have been integrated into this report.

10.1.3 The nature of the intertidal deposits is another factor in the recognition of sites. Where such sediments are still mobile, it is likely that a different array of archaeological remains may become visible from time to time. As this process is relatively constant and fluid, any time-limited survey is going to reflect only on the character and range of remains that may globally be present in such environments. It was recognised in 1996 (Cressey and Toolis 1996) that the only way to off-set the inherent bias from a single site visit was to develop a system of local monitoring. Thankfully the establishment of new Shorewatch groups within Scotland is now achieving this aim.

10.2 Recommendations

10.2.1 The following recommendations are proposed and all will involve the members of the Shorewatch teams:

- All the fish-traps located on the north shore of the River Clyde should be subjected to a detailed EDM and contour survey. This would allow a better understanding of their local geomorphological setting.

- The fish-traps should be subjected to a documentary study and include estate papers and any other historical documents that may shed light on their ownership. Such information may produce statistics on the type and frequency of fish being caught which is an aspect that is so far lacking in their understanding. Other aspects of ownership, tenure and repair history should also be investigated.

- A set of new radiocarbon dates on the Langbank East and Langbank West crannogs should be undertaken. The two sites are of great importance in terms of the history and use of the intertidal zone within the Firth of Clyde during the Later Prehistory. A new set of radiocarbon dates would help establish if the Langbank sites are contemporary with the Dumbuck and Erskine crannogs.

- A programme of incremental monitoring should be carried out based on the method devised by Hale (1997) on the Erskine crannog in order to establish how much sediment is now being lost or accreted on the site over a period of 12 months. This would see the implementation of fixed monitoring points placed at certain points across the site. The measurements could be tabulated at the end of the 12 months and a report made on the findings. The results would be useful in assessing whether a longer-term management strategy would be desirable.

- A detailed photographic survey should be carried out in order to provide the SMR and NMRS with a comprehensive photographic record of the present state of the crannogs and fish-traps. This will provide a record of their current state of preservation in the early 21st century providing bench-mark criteria for future research.

11. BIBLIOGRAPHY

Bruce, J. 1900 'Notes on the Discovery and Exploration of a Pile Structure on the River Clyde, East from Dumbarton Rock', *Proc. Soc. Antiq. Scot* 34, 437-62.

Bruce, J. 1908 'Report and Investigations upon Langbank Pile Dwelling' *Trans Glasgow Archaeol Soc*, 5 1908, 43-53.

Cressey, M. and Toolis, R. 1997 Solway Coastal Assessment: Solway North Coast. CFA Report 312, commissioned by Historic Scotland.

Cressey, M. Bunting, M.J., Dawsan, A., Dawson, S., Long, D. and Milburn, P 2001 'Relative sea-level changes at Newbie Cottages, near Annan, Upper Solway Firth, SW Scotland' *in* Raftery, B. and Hickey, J. 2001 (eds) *Recent Developments in Wetland Research* WARP (Wetland Archaeology Research Project) Occasional Paper 14 Vol 2.23, 257-270.

Cressey, M and Hale, A. 1998 Moray, Beulay and Cromarty Firth Coastal Assessment CFA Report 446, commissioned by Historic Scotland.

Ferrier, J. 1969 'Tidal Fish-Traps in Bute'. *Transactions of the Buteshire Natural History Society* Vol 17

Firth, C. R. and Collins, P.E.F 2002 'Coastal Processes and management of Scottish estuaries' Vol. 1 The Firth of Clyde. Scottish Natural Heritage Review No. 108.

Fraser, M. Gilmore, S. and Dawson, T. 2003 'Shorewatch: Monitoring Scotland's Coastal Archaeology', 21, 197-202 in Dawson (ed) *Coastal Archaeology and Erosion in Scotland.* Historic Scotland Conference Proceedings Publication.

Hale, A. 2000 'Marine Crannogs: previous work and recent surveys'. *Proc Soc Antiq Scot*, 130, 537-558.

Hill, J and Buist, D. 1995 'A Geological Field Guide to the Island of Bute, Scotland'. *Geologists' Association Guide No. 51.*

Hale, A. 1997 'The Intertidal Crannogs in the Beauly Firth: A Survey and Sampling Project with Special Attention to their Future Research and Management'. Historic Scotland Report.

Hale, A 2004 'Fish-traps in Scotland: construction, supply, demand and destruction'. RURALIA Conference Proceedings 2003 (in press).

Hanson, W.S. & Macdonald, J. 1985 'Erskine' *Discovery and Excavation in Scotland* 1985, 50.

Harding, D.W., Ralston I.B.M and Burgess, C 1994 'Little Dunagoil' (Kingarth parish) Discovery and Excavation, Scotland, 1994, 57.

Jardine, W. G. (ed) 1980 *Quaternary Research Association Field Guide.* Glasgow Region

Lavery, B. 2001 *Maritime Scotland*. Historic Scotland, Batsford.

Leask, C. 1996 *Sea level variation and coastal sand movements in Scotland: their inclusion in the Statistical Accounts of Scotland*. Historic Scotland.

Maclagan, I. 1995 'Harbour quays and ferry ports, (North Bute, Rothesay & Kingarth parish), sea communications', *Discovery and Excavation in Scotland*, 1995, 67.

Marshall, D.N. 1964 'Report on the excavations at Little Dunagoil', *Transactions of the Buteshire Natural History Society* 16, 3-64.

Maynard, A. 1969 '*Stumps in the Sand; the story of the old timber ponds of Port Glasgow*'. Scotlands Magazine, 45-46.

Mowat, R.J.C. 1966 *The Logboats of Scotland.* Oxbow Monograph.68 Oxford

Mudie, G. 2001 *Kingarth Quarry, Isle of Bute Watching Brief/Controlled Topsoil Strip*. CFA Data Structure Report 689.

Notes from the Island of Bute by D.C. Glen. 1873-76 " *On a Tract of Columnar Sandstone and a Perched Boulder, near Kilchattan*". *Trans Geol Soc of Glasgow* Vol 5.

Pethnick, J. 1984 An ntroduction to coastal geomorphology. Arnold, London.

Pugh, D.T. 1987 '*Tides, Surges and mean sea-level*': A handbook for engineers and scientists . John Wiley & Sons, Chichester.

Rees, A. 2001 *Kingarth Quarry, Kingarth, Isle of Bute Archaeological Evaluation.* CFA Data Structure Report 660.

Riddell, J. 2000 *The Clyde: The making of a River.* Edinburgh, John Donald.

Ritchie, W. 1975 *Beaches of Cowal, Bute and Arran*. Report commissioned by the Countryside Commission for Scotland, University of Aberdeen, Aberdeen.

Wallingford, HR 1996 *Saltcoats to Troon Coastal processes and development*. Report EX3327. Walingford, Oxford.

11.1 Cartographic sources

1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 17 6" to 1 mile
1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 21 6" to 1 mile
1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 22 6" to 1 mile
1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 28 6" to 1 mile

1861 First Edition Ordnance Survey *Renfrewshire* Sheet 2 6" to 1 mile
1861 First Edition Ordnance Survey *Renfrewshire* Sheet 3 6" to 1 mile
1861 First Edition Ordnance Survey *Renfrewshire* Sheet 4 6" to 1 mile

11.1 Cartographic sources

1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 17 6” to 1 mile
1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 21 6” to 1 mile
1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 22 6” to 1 mile
1864 First Edition Ordnance Survey *Dumbartonshire* Sheet 28 6” to 1 mile

1861 First Edition Ordnance Survey *Renfrewshire* Sheet 2 6” to 1 mile
1861 First Edition Ordnance Survey *Renfrewshire* Sheet 3 6” to 1 mile
1861 First Edition Ordnance Survey *Renfrewshire* Sheet 4 6” to 1 mile
1861 First Edition Ordnance Survey *Renfrewshire* Sheet 8 6” to 1 mile

1868 First Edition Ordnance Survey *Bute* Sheet 111 6” to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 173 6” to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 194 6”to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 203 6” to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 204 6” to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 214 6” to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 215 6” to 1 mile
1868 First Edition Ordnance Survey *Bute* Sheet 232 6” to 1 mile

11.2 Historical maps

Admiralty Chart 1856 *The Clyde and Loch Fyne: Hydrographic Office London*

Blaeu, J. 1654 *Levinia The Province of Lennox*

Cowley, J. 1734 *Map of the Duke of Argyll’s Heritable Dukedom*

Dorret, J. 1750 *A general map of Scotland and the Islands*

Hogg, A. 1786 *A new and correct map of the counties of Argyll, Bute and Dumbarton.*

Langland, G. 1803 *This map of Argyllshire*

Ross, C. 1777 *A Map of the Shire of Dumbarton*

Scott, R. 1799 *The county of Argyll*

Thompson, J. 1823 *Dumbartonshire*

Thomson, J. 1824 *South part of Argyllshire*

11.3 Aerial Photographic Record

The Inner Clyde (Helensburgh-Erskine Bridge)

Sortie	Frames	Date	Scale	NMRS Lib
CPE/Scot/UK312	5198-5201	23.2.48	1:10000	B215
106G/Scot/UK	3273-3275	15.5.46	1:10000	B97
106G/Scot/UK	4263-4267	15.5.46	1:10000	B97
CPE/Scot/UK256	5154-5161	11.8.47	1:10000	B175
CPE/Scot/UK256	5014-5009	11.8.47	1:10000	B175
CPE/ScotUK 276	5175-5173	23.8.47	1:10000	B182
Fairey 7345/12	333-330	11.9.73	1:10000	B749
Fairey 7345/12	328-320	11.9.73	1:10000	B749
Fairy7343/44	533-545	9.6.75	1:10000	B783

The Inner Clyde (Port Glasgow to White Cart River)

Sortie	Frames	Date	Scale	NMRS Lib
106G/Scot/UK92	3024-3029	15.5.46	1:10000	B97
CPE/Scot/UK265A	5080-5088	14.8.47	1:10000	B169
CPE/Scot/UK276	5249-5261	23.8.47	1:10000	B182
CPE/Scot/UK277	5143-5144	24.8.47	1:10000	B193
Fairey 7343/12	311-313	11.9.73	1:10000	B749
Fairey 7343/30	382-371	16.5.75	1:10000	B768
Fairey 7343/45	559-568	9.6.75	1:10000	B784

The Isle of Bute

Sortie	Frames	Date	Scale	NMRS Lib
CPE/Scot/UK325	5001-5053	26.3.1948	1:10000	B218
106G/Scot/UK94	3001-3116	15.5.1946	1:10000	B42
106G/Scot/Uk161	4001-4125	21.8.1946	1.10000	B141
51588	049-051	10.6.1988	1:24000	C275
51588	120-117	10.6.1988	1:24000	C275
51588	126-130	10.6.1988	1:24000	C275
51588	226-222	10.6.1988	1:24000	C275
51388	011-016	10.6.1988	1:24000	C273