

Some effects of disturbance to waterfowl from bait-digging and wildfowling at Lindisfarne National Nature Reserve, north-east England

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Lindisfarne National Nature Reserve is a largely unspoilt estuary of international importance for wintering waterfowl. In the mid-1980s large numbers of bait-diggers operating in a wildfowl refuge area greatly reduced the extent of use by several waterfowl species, apparently largely through direct effects of disturbance. At the same time a decline in the population size and period of stay of Wigeon, the main quarry species, was related to the number of consecutive days and periods of punt-gunning. The decline may have been made worse by the unavailability of refuge areas with food because of the presence of bait-diggers. Practical management solutions designed to limit the effects of these sources of disturbance are described.

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INTRODUCTION

This paper describes the observed effects of two separate sources of disturbance, bait-digging and wildfowling, to migrant and wintering waterfowl at Lindisfarne National Nature Reserve in north-east England. The paper illustrates the practical implications of different and potentially conflicting human activities for the successful management of estuarine systems for waterfowl.

Lindisfarne is an area of some 3,540 ha of estuarine habitats on the north-east coast of England (Figure 1a). Much of the tidal flat area has formed in the shelter of Holy Island and its tail of sand dunes, and there is a separate muddy embayment to the south, Budle Bay, formed behind a further area of sand dunes. Lindisfarne is unusual in that it has very little freshwater inflow apart from a few small streams so that it is chiefly marine in character. It is unusual in England also in that it is a large rural estuary and one of the few that has been subjected to very little of the industrial and pollutant degradation that has affected many other parts of the country's estuarine resource.

Much of Lindisfarne is a National Nature Reserve (NNR). English Nature has management responsibilities covering almost the whole of the estuary and its surrounding sand-dunes, unlike the situation for other estuarine NNRs which cover only part of an estuary. The NNR was declared in 1964 following concerns over the

extent of uncontrolled wildfowling. The reserve was established through agreement between local naturalists, wildfowlers and the then Nature Conservancy and so wildfowling has always been an integral part of the management of the reserve.

As part of this reserve management, wildfowling is permitted over the main area of tidal flats and salt-marshes but is not permitted in refuge areas established on the sandy areas in the northern part of the reserve, on the sandy shore of Ross Back Sands and over the whole of Budle Bay (Figure 1b). Budle Bay is thus the only refuge area with substantial areas of productive inter-tidal mudflats.

The main quarry species at Lindisfarne is Wigeon *Anas penelope* which is hunted by both shoulder-gunning and punt-gunning. Lindisfarne supports internationally important numbers of this species and several other species of waders and wildfowl, and is the main British wintering area for the small and endangered Svalbard breeding population of Light-bellied Brent Geese *Branta bernicla hrota*. In recognition of this major importance Lindisfarne has been designated as a wetland of international importance under the Ramsar Convention, and is designated as a Special Protection Area under the EC Directive on the conservation of wild birds. Numbers of waterfowl using different parts of the NNR are routinely censused during each winter, and

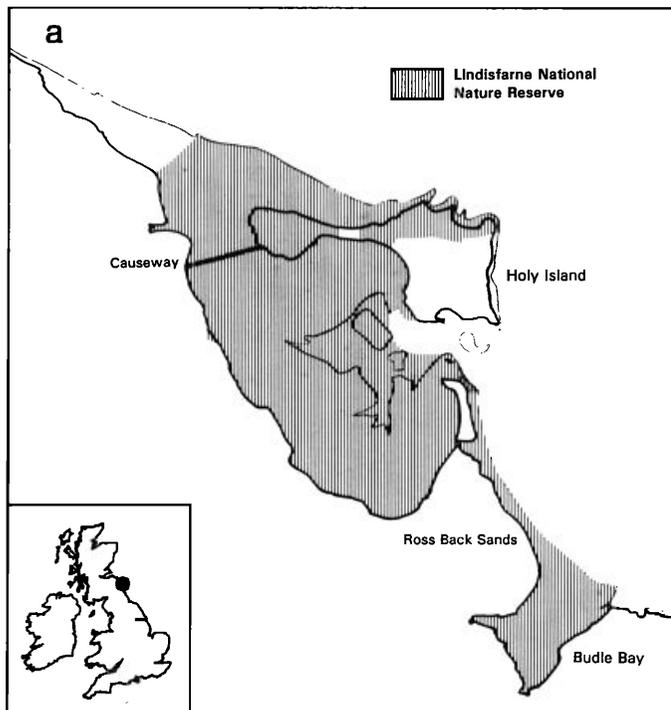


Figure 1. a). The location of Lindisfarne National Nature Reserve and places mentioned in the text.

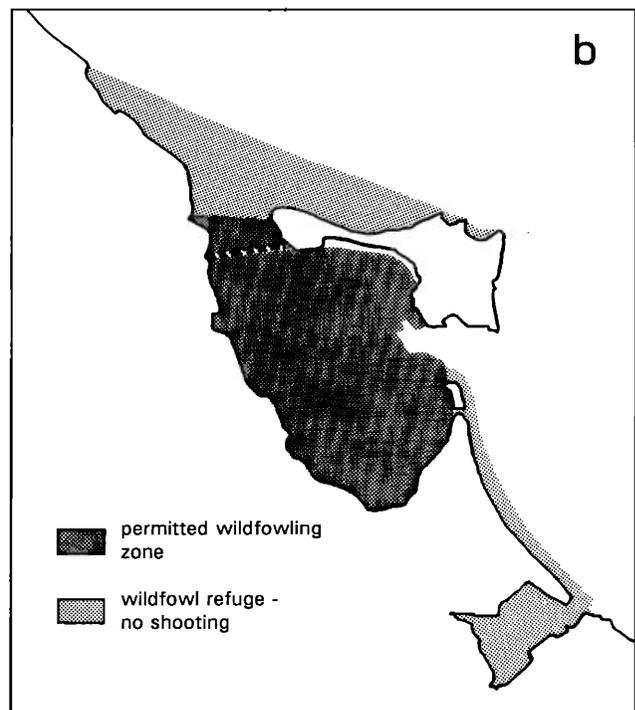


Figure 1. b). Permitted wildfowling areas and refuge areas at Lindisfarne.

particular attention has been paid to counting birds on Budle Bay during the period of concern about bait-digging during the 1980s. As part of the licensing of wildfowling in the NNR we collect information about punt-gunning using a proforma. This records features of each punt-gunning excursion including the number of hours afloat, the number of shots fired and the success of these shots. We have analysed the numbers and distribution of waterfowl, especially those of Wigeon, in relation to features of bait-digging and punt-gunning in an attempt to assess the nature and extent of the disturbance effects of these activities.

BAIT-DIGGING

Bait-digging, mostly for lugworms, has taken place at Lindisfarne for many years. Budle Bay has been a favoured area since there are both close road access and dense populations of lugworms there. During the 1970s there were generally fewer than 10 bait-diggers using the Bay at any one time, but even with that intensity, the Joint Advisory Committee to the NNR was expressing concern about the effects of this bait-digging.

By the early 1980s the numbers of bait-diggers using Budle Bay had increased ten-fold, with up to 120 people digging at a time in an area less than 300 ha. As a consequence of major concern about the effects of this intensity of bait-digging in disturbing waterfowl from the refuge area, in depleting lugworm populations and

disturbance to the sediments and other parts of the benthic fauna, Budle Bay was closed to bait-digging for the winters of 1982/83 and 1983/84, under NNR byelaws.

After further discussions with anglers and their representative bodies, a compromise agreement was reached in which the southern part of Budle Bay was re-opened to bait-digging (Figure 2), for the years 1984/85-1986/87. This re-opening of part of Budle Bay coincided, however, with a national miners' strike, a time when many people from the north-eastern coalfields had spare time and little income. This resulted in large numbers of bait-diggers using Budle Bay. During this time the adult lugworm population was completely removed from the permitted bait-digging area with an estimated four million worms taken. Subsequently recolonisation of the area occurred, apparently by immigration of juveniles from adjacent areas (P. Olive, unpubl. report).

This intensity of bait-digging is known to have increased the release of toxic pollutants such as cadmium and mercury from disturbed sediments (Howell 1985), as well as leading to an overall decrease in the density of lugworms in the dug area (P. Olive, unpubl. report). The major conservation concern during this period was, however, the effects of the presence of large numbers of people spread across the tidal flats of Budle Bay and their disturbance to waterfowl attempting to use the wildfowl refuge area. This problem was exacerbated by bait-diggers moving outside the permitted digging area

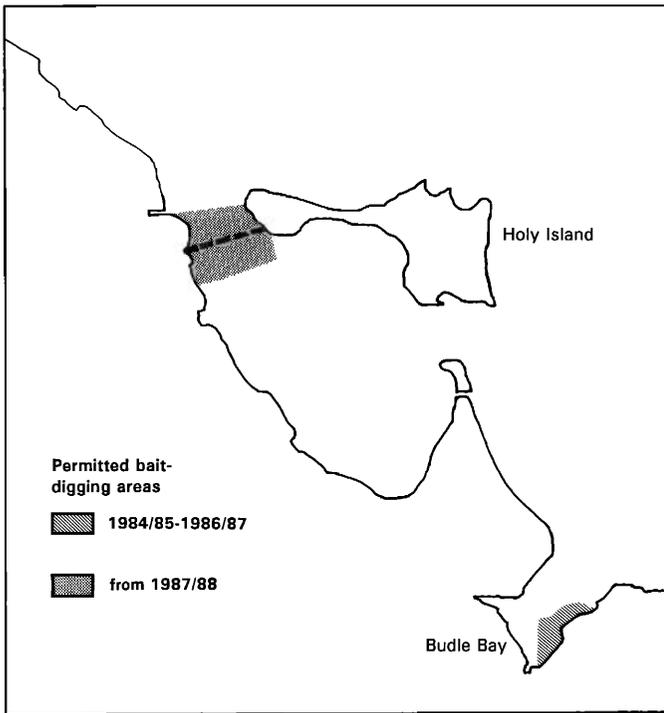


Figure 2. Permitted bait-digging areas in Budle Bay during 1984/85 - 1986/87, and the alternative area subsequently provided adjacent to Holy Island Causeway from 1987/88.

as lugworm stocks became progressively depleted. This led to the successful prosecution under the NNR byelaws of three bait-diggers for digging outside the agreed area.

Subsequently bait-digging was permanently prohibited in Budle Bay from 1987/88, and an alternative area alongside the Holy Island Causeway allocated for bait-digging (Figure 2).

Table 1 shows the average peak winter numbers of the main quarry species, Wigeon, and two of the main wader species, Bar-tailed Godwit *Limosa lapponica* and Redshank *Tringa totanus* using Budle Bay before,

Table 1. Average peak numbers of three species of waterfowl in early winter (October-December) using the sanctuary area of Budle Bay, Lindisfarne before, during and after periods when bait-digging was permitted.

Species	Bait-digging			
	1980/81 & 1981/82	1982/83 & 1983/84	1984/85, 1985/86 & 1986/87	1987/88
	unrestricted	none permitted	permitted in restricted zone	none permitted
Wigeon	1,535	6,900	497	5,400
Bar-tailed Godwit	210	480	353	2,010
Redshank	222	385	201	1,750

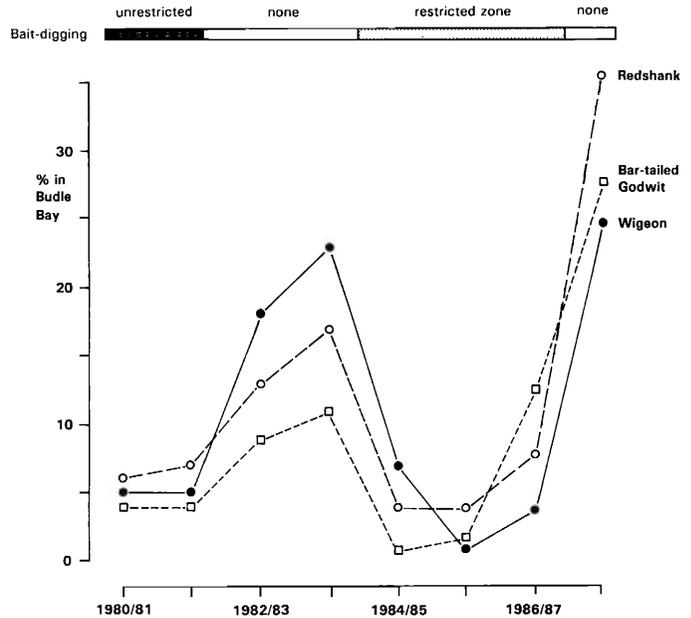


Figure 3. The percentages of the total Lindisfarne populations of Wigeon, Bar-tailed Godwit and Redshank that were present on the Budle Bay refuge area between 1980/81 and 1987/88. Values are calculated as the peak Budle Bay count in early winter (October-December) expressed as a percentage of the peak Lindisfarne count in that year. The status of bait-digging in Budle Bay is also shown.

during and after the restrictions to bait-digging. Table 1 shows that in years when bait-digging took place on all or part of Budle Bay numbers of all three species were substantially lower than in years when no bait-digging took place. The difference was most marked for Wigeon, for which the Bay acts as a refuge for birds moving from other tidal flats.

It is possible that annual differences in numbers of birds using Budle Bay shown in Table 1 could arise through between-year differences in the total Lindisfarne populations. Figure 3 shows, however, that in years with no bait-digging, much larger proportions of the Lindisfarne populations of Wigeon, Bar-tailed Godwit and Redshank used Budle Bay. This implies that Budle

Table 2. Peak early winter (October-December) counts of seven species of waterfowl in Budle Bay in the winter prior to a ban on bait-digging (1986) and in the two winters after the ban (1987 & 1988).

Species	1986	1987	% change (1986-87)	1988
Redshank	382	1,750	+358	1,140
Bar-tailed Godwit	860	2,010	+134	2,000
Wigeon	640	5,400	+744	10,000
Shelduck	114	250	+119	560
Teal	94	800	+751	340
Mallard	180	800	+344	780
Eider	73	211	+189	375

Bay may be a preferred area for these species and that birds which would otherwise have fed there were prevented from doing so by the presence of bait-diggers.

Substantial increases in the populations of four other species of wildfowl using Budle Bay were also recorded in the year following prohibition of bait-digging from the Bay (Table 2). Increases varied from 119% for Shelduck *Tadorna tadorna* to over 700% for Wigeon. Indeed in the following year (1988) the Wigeon population using Budle Bay underwent a further doubling, with up to 10,000 birds present and numbers of the other species using the bay remained high (Table 2).

Thus there appears to be a strong link between the extent of bait-digging in the refuge area of Budle Bay and the numbers of waterfowl able to use the Bay. This seems largely to be a consequence of the disturbing effect of the presence of people scattered over large parts of the Bay during the low-water period.

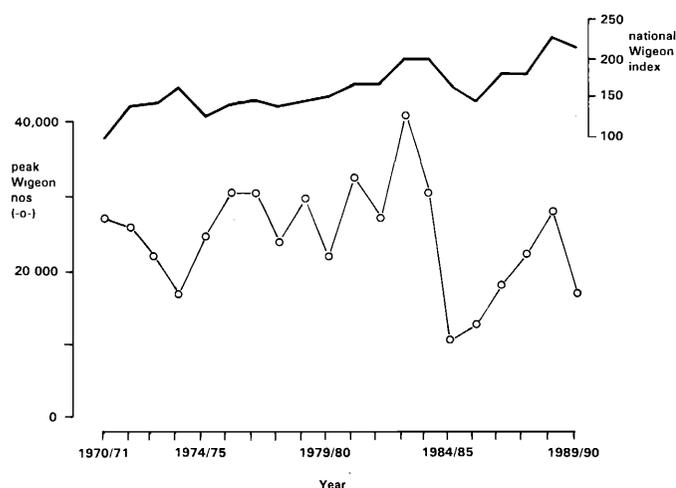


Figure 4. The winter peak count of Wigeon at Lindisfarne between 1970/71 and 1989/90 and the national index for the British Wigeon population over the same period (derived from Kirby *et al.* 1991, and earlier reports).

WILDFOWLING

As described above, wildfowling is a traditional use of Lindisfarne and wildfowling interests were instrumental in establishing the National Nature Reserve. Wildfowling at Lindisfarne is practised in two ways: shoulder-gunning and punt-gunning. A brief history of punt-gunning in the area is given in Appendix 1.

We began examination of the possible effects of punt-gunning after the annual peak numbers of Wigeon using Lindisfarne declined rapidly during the mid-1980s from populations often exceeding 30,000 birds to populations of less than 20,000 birds, and in one year only 10,000 birds. This substantial decrease in the Lindisfarne population took place at a time when the national population index of Wigeon was increasing (Figure 4). We found also that during the early 1980s, when the population was high, most Wigeon stayed at Lindisfarne until after early December (Figure 5a) whereas during the years of low populations (1984/85 - 1986/87) birds generally left much earlier in the winter - usually during November (Figure 5b). In only one recent year (1987/88) did a large population remain at Lindisfarne until as late as December (Figure 5c). Hence the overall Wigeon usage of Lindisfarne during the late 1980s has been even lower than the peak numbers alone suggest.

Figure 6 compares the phenology of the Wigeon population in one year, 1989/90, with the frequency of punt-gunning. 1989/90 was, like most other years in the late 1980s, a year in which the Wigeon population was small and most birds had left by early November. Most punt-gunning takes place during late autumn/early winter when most Wigeon are present, and there was only one visit (by a visiting team) after November.

For the five-winter seasons 1985/86 - 1989/90 we have examined various features reflecting the intensity of punt-gunning in relation to the peak monthly count of Wigeon using Lindisfarne in that year. There were no correlations between either the total number of hours

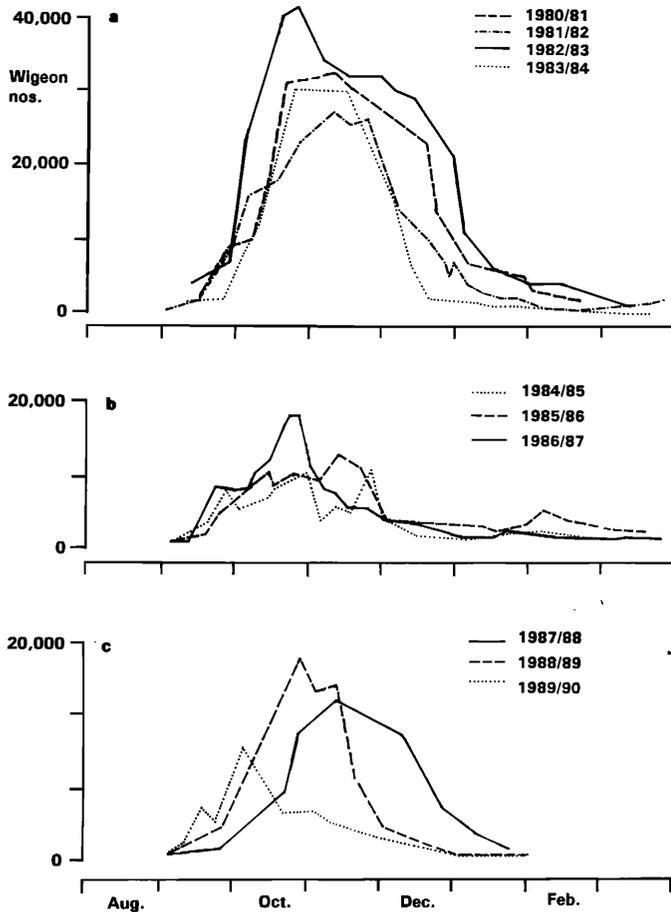


Figure 5. Seasonal patterns of the use of Lindisfarne by Wigeon, a) 1980/81-1983/84; b) 1984/85-1986/87; and c) 1987/88-1989/90.

afloat, the number of punting visits or the total number of shots fired and the peak monthly Wigeon count.

There were, however, significantly fewer Wigeon

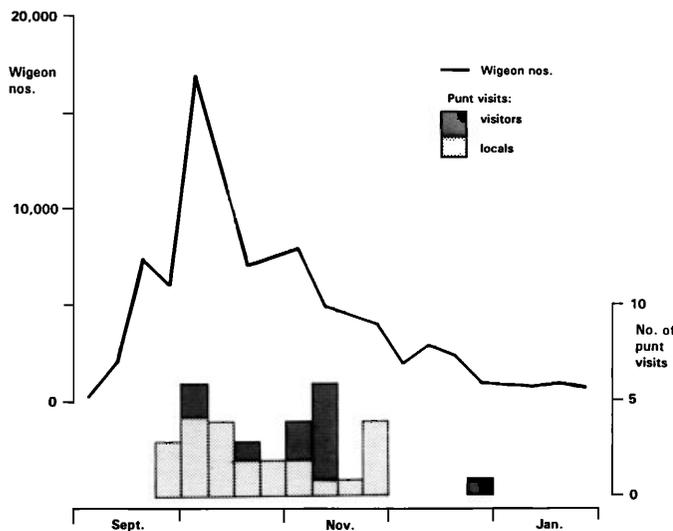


Figure 6. The number of punt-gunning visits to Lindisfarne in 1989/90 and the population phenology of Wigeon, the main quarry species, in that year.

present at Lindisfarne in years when the total number of consecutive days of punting was high ($r = -0.98$, $p = 0.002$; Figure 7). There was a similar relationship between the number of periods of consecutive punting days and Wigeon numbers ($r = -0.89$; $p = 0.044$; Figure 7). This suggests that periods of continuous disturbance early in the winter may lead to fewer Wigeon using Lindisfarne and these birds staying a shorter time. Indeed the slopes of the regression lines for the relationships shown in Figure 7 imply that very few Wigeon would use Lindisfarne if there were more than about 15 periods and/or 30 days of consecutive punt-gunning.

Punt-gunning was formerly permitted on each day of the week. As a consequence of these analyses the permitted periods of punt-gunning have, with the agreement of the local wildfowlers, been rearranged so as to avoid days of consecutive punt-gunning: punt-gunning is now permitted only on alternate days of the week. Wigeon numbers in relation to the intensity of punt-gunning are continuing to be monitored to establish if Wigeon numbers do increase again with the removal of consecutive days of disturbance.

The picture of disturbance from punt-gunning may not, however, always be so straightforward. It is noticeable that in two of the years with high punt-gunning intensity (1985/86 and 1986/87) there was also excessive bait-digging in Budle Bay which severely limited the use of this area as a wildfowl refuge (see Figure 3). It may be

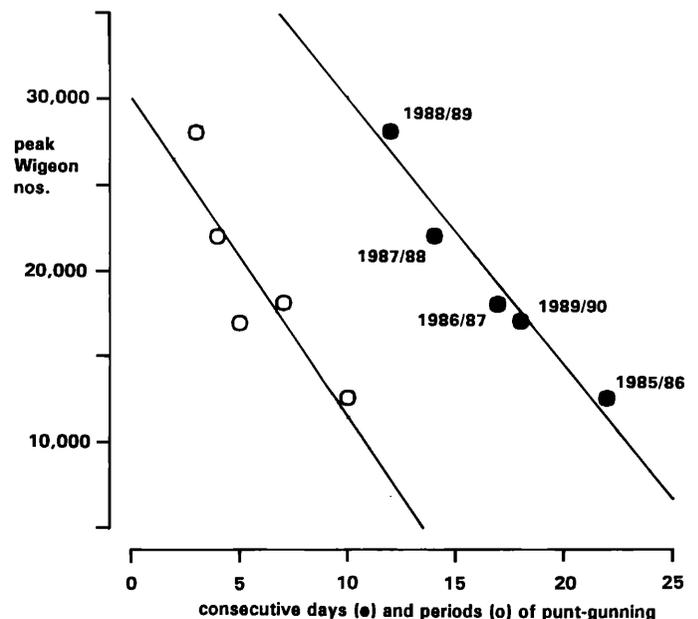


Figure 7. The relationships between the number of consecutive days (D) and periods (P) of punt-gunning and the peak Wigeon population (W) at Lindisfarne. Regressions are: $W = 45,558 - 1,555D$, $r = -0.98$, $p = 0.002$; $W = 30,328 - 1,887P$, $r = -0.89$, $p = 0.044$.

that Wigeon at Lindisfarne are able to tolerate high levels of continuous disturbance from punt-gunning provided that there are adequate undisturbed refuge areas available, perhaps because this provided the necessary alternative feeding areas. This stresses the likely importance of large enough undisturbed refuge areas on estuaries with both internationally important waterfowl populations and extensive wildfowling. Our experience at Lindisfarne also emphasises the importance of understanding all the simultaneous sources of human disturbance to migrant and wintering waterfowl if appropriate integrated management of our estuaries is to be effective.

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APPENDIX 1. SOME FEATURES OF PUNT-GUNNING AT LINDISFARNE

Punt-gunning at Lindisfarne seems to have started in the mid-1800s when famous hunter-collectors like Abel Chapman visited Holy Island during the autumn and winter. Chapman has written eloquently about the excitements and privations of punt-gunning at Lindisfarne in *Bird Life of the Borders* (Gurney & Jackson, London. 1889). Once the punts were brought to the island they were left in the care of professional fisherman-guides who, when the gentry were not out punting and collecting, used punt-gunning to supplement their income. These people were fishermen during the summer and punters during the winter.

In those days a train stopped on the mainland close to the island and large quantities of wildfowl were shipped for sale in Newcastle and London. In the late 19th and early 20th centuries punt-gunning was very widespread on British estuaries and may have led to artificially depressed waterfowl populations (Tubbs 1992, *Wader Study Group Bull.* 65: 46-54). Punt-gunning continues today on many British estuaries and there are nationally some 50-60 working outfits.

Most of the punts at Lindisfarne are two-man outfits. The average double punt is about 6.7 m long and mounted along the bow is a gun up to 3 m long. The gun weighs some 64 kg and has a maximum bore of 45 mm. When fired it discharges over 700 g of shot, which is more than 2,500 lead pellets if the most favoured shot, number one shot, is used. The propellant is black powder, which produces a lot of smoke and a long, loud bang. At Lindisfarne such a discharge often causes birds to move away from the inter-tidal area and onto the sea, or into the Budle Bay refuge to the south. The range of the gun is 70-80 m and on firing not all the birds hit are killed outright. The first action after firing the puntsmen take is to leap out of the punt and recover all the injured birds. This can take 30-40 minutes depending on the number of birds brought down, so this picking up operation after the shot may cause as much as or, on occasion, more disturbance than the shot itself.

Punting at Lindisfarne occurs during the daylight hours and the most suitable tides for punt-gunning are those leading up to the full moon period. The full moon period itself is when much of the night shooting (using shoulder-guns) takes place at Lindisfarne.

More than one punt can be active on a tide, and pre-war there were six punts operating from Holy Island. There was often a race in the morning to get the best position and it was unusual for more than three punts to be active on a tide. It was generally considered best if no more than two punts were out at any one time.

Eight authorised punting outfits are permitted currently at Lindisfarne. Four are local and four are visitors. The local punt-gunners are in the fisherman/punter tradition and tend to be most active early in the season. They tend to launch the punt only if they see the potential for a shot and so do not spend a great deal of time afloat looking for a shot.

In contrast, when visiting puntsmen launch and go in search of resting Wigeon they are afloat for 5-7 hours. Local punters are seldom out for more than three hours. Visitors launch their punts on the ebb tide from the Holy Island Causeway so they are unable to recover their punt from the inter-tidal zone until the tide returns several hours later. Whether or not a shot is fired the presence of the punt and its occupants in the low water zone can disrupt the feeding and resting patterns of the waterfowl.