

3 STATUS AND DECLINE

3.1 INTRODUCTION

In order to understand the comparative scarcity of the Chough in Britain, and help its conservation, we need to know why previous declines occurred (Darke 1971, Coombs 1978, Monaghan 1989). Data which might shed light on the Chough's past status and decline are scattered throughout a wide range and variety of historic sources. Although they may not be quantitatively assessed in critical detail, it would be foolish to overlook potentially valuable information where it does occur and where the source is reliable. This chapter, therefore, reviews the historical evidence which relates both directly to the demise of the Chough, principally in southern Britain but also to the French zoogeographic region to the south (Figure 3.1), and to those environmental factors which might have influenced it.

The historical literature, examined previously by Bullock *et al.* (1983b) and Owen (1985), shows that the Chough was once widespread on the southern coast of Britain, and also bred at east coast locations. Fossil evidence, from 130,000BC, testifies to occurrence in Yorkshire and inland in Derbyshire (Owen 1985), and in Europe it was widespread when steppe conditions prevailed (Guillou 1981); Guillou suggests that when steppe was succeeded by forest, the Chough became dependent on montane and coastal regions, and, subsequently, on primitive farming practices. Historical evidence from the Isle of Man dates back to AD90 (Cullen & Jennings 1986). Supportive evidence from inland or eastern sites in England is sparse but breeding currently occurs in Snowdonia and at a few locations in mid-Wales (Bullock *et al.* 1985). Artefact sites are unknown from historic England, and very rare in Wales; one pair used to nest in a castle at Llangollen in the early 1800s (Forrest 1907), and "in former days" (Mathew 1894) the Chough was said to nest in a ruin at St Davids (Pembrokeshire) 1km from the coast. In Scotland, until the early C19, it "was comparatively abundantly distributed in many inland districts" (Buchanan 1882, and see Warnes 1983). The west of Ireland is the stronghold for the Chough but unfortunately lies beyond the scope of this study. It has declined sharply in Northern Ireland (Bullock *et al.* 1983). There is a real need for a full ecological study of Irish Choughs, and this has begun with the formation of the Northern Ireland Chough Habitat Enquiry (BTO 1990). The first all-Ireland census (Ussher & Warren 1900) was updated by Cabot (1965) and Bullock *et al.* (1983b).

In Great Britain, a general decline is suggested by all accounts post-C18. Dixon (1888) wrote:

"From causes that baffle all conjecture to explain them, this handsome rock-bird is gradually becoming rarer and rarer in this country. Formerly it had its noisy colonies on many an inland cliff, but at the present day it only frequents a few favoured localities on the rock-bound coasts. It may be that the Jackdaw is slowly driving out the Chough, or the spread of C19 civilisation is too much opposed to its retiring habits and love of solitude. Whatever be the cause of its disappearance, we have now to repair to the wildest and most inaccessible parts of the rock-bound coasts if we wish to see the handsome Chough at home."

Malan (1891) remarked: "Considering their former plentitude, their present scarcity is not an altogether easy matter to account for." Causes given were: "(1) Jackdaws swarming round the cliffs, harming and usurping their nesting places; (2) trapping and shooting in former days; and (3) robbing nests and taking young and eggs" (quoted in Palmer, 1950s undated pamphlet, *The Old Cornwall Society*) (3.4).

Without quantitative data it is impossible to assess pre-decline status and distribution accurately. That the Chough was a familiar species is suggested by the frequency with which it appears in

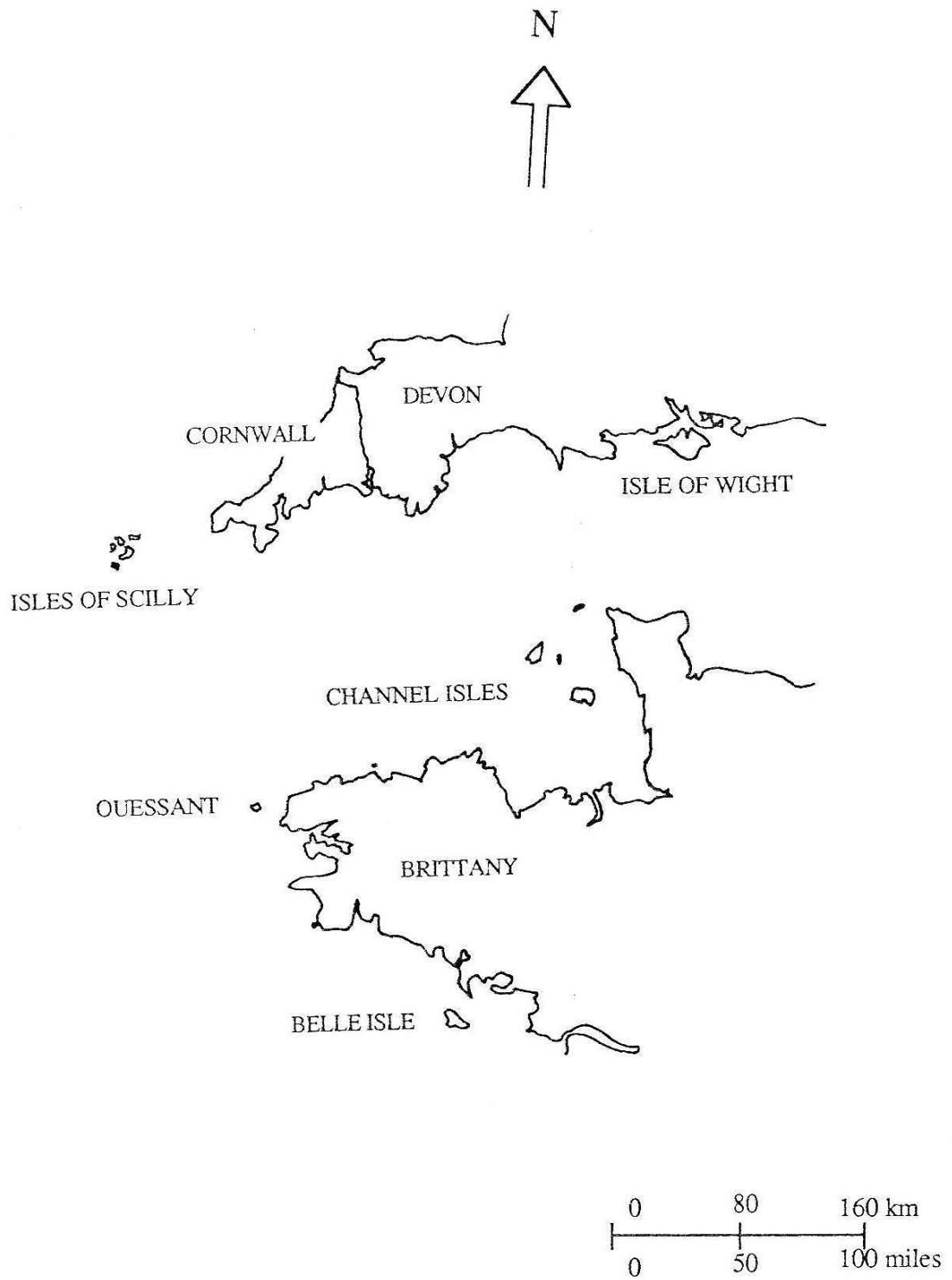


Figure 3.1
Locations of south-west England, North France (Brittany) and the Channel Islands.

Welsh and English heraldry, on insignia and family crests etc., but its striking looks could have made it popular as an heraldic device on the edge of its range. Rarity itself attracts attention and would increase the esteem in which it was held. Upton (*ante*1446, trans. from the Latin *ca.* 1500, publ. 1651) comments:

"some of their (Cornwall's) most ancient families bore these birds in their coat-armour. Now to shew that these gentlemen made no contemptable choice of their 'bearing', it must be remembered that the Cornish Chough is the most graceful, slender and genteel of the crow kind" (quoted in Darke 1971).

Carew (1602) stated "I mean, not the common daw, but one peculiar to Cornwall." That the Jackdaw and Chough merited such splitting further suggests that the latter was not some little known oddity though it was clearly far less common. Upton states: "Ther be dyverse kyndes of thes byrdes for some be blacke in ther bylles and legges, wherof ther is great abundance; and some be rede in ther bylles and fete, which be smaller than the other and but few in number. They be most in cornwall..."

Rarity did ensure a fairly reliable recording of actual disappearance. In mainland Scotland, the historic status of the Chough will repay fresh examination. Baxter & Rintoul (1953) assembled much of the data and remarked on the "parallel decrease" in England. It would be interesting to see how Scottish data correlate with bioclimatic, socioeconomic, geographic and other independent variables, and this is currently underway (McKay in prep.).

The Chough operates within a narrow ecological niche (Bullock *et al.* 1985). It is likely that human activity "where it (the Chough) is at the mercy of changes in land use" (Curtis *et al.* 1989), has had a substantial effect (see Chapter 4).

3.2 BACKGROUND TO STUDIES IN SOUTHERN BRITAIN

In ancient natural histories and travel journals the Chough received more attention in Cornwall than anywhere else. This was due, in part, to the belief promulgated by Carew (1602), mentioned above, that the species was "peculiar to Cornwall ... there-through termed a *Cornish chough*"; "deservedly so-named among the moderns" according to Borlase (1758).

Owen (1985) concisely explains the etymology of the name 'chough':

"Until 1402, forms of the word Chough were the only words used in English to describe the Jackdaw. The emergence of the word daw in the 15th century meant that until the 17th century, both Chough and daw were used to describe the Jackdaws. ...from c1449 Choughs were described by the form Cornish Chough."

Penhallurick (1978) provides a good review of the early records. He claims that Cornwall was the type locality of the Chough since Linnaeus obtained his specimens from England and also received mineral specimens from Cornwall "where was there more natural for him to obtain a specimen?". If so, there is some justification for Cornwall's claim to the nominate race, which found expression throughout Britain. Linnaeus related the Chough to the Hoopoe (see Section 1.3.1). Tunstall, in his *Ornithologia Britannica* of 1771, elevated *Pyrrhocorax* to generic status, and subscribed to the vernacular 'Cornish Chough'. In Wales, it was (and still is) occasionally known as '*bran Cernyw*'; in Scotland, '*Cornwall kae*' (Sibbald 1684) or 'Cornish Chough' persisted until at least as recently as the 'New Statistical Account' of 1839 (Baxter & Rintoul 1953). The practice has been adopted even by the authors of *The Birds of the Soviet Union* (Dementiev & Gladkov 1954)!

Taxonomic confusion existed regarding *Pyrrhocorax pyrrhocorax* and its Alpine congener. Turner (1544), who is not known to have visited Cornwall, and spent many years on the Continent, possibly began the confusion when he wrote his "succinct account of the principal birds mentioned by Pliny and Aristotle". Turner would certainly have been more familiar with Pliny's bird 'of *luteo rostra* (yellow beak)'. Belon (1555) described the species correctly but his accurate account was overshadowed by a major work, published in the same year by Gesner, which was to become the standard work of reference throughout Europe. Gesner (1555) obtained his information about Choughs from Turner and Belon. Possibly influenced by his personal knowledge of *graculus* alone, he accepted Turner's account and additionally repeated the myth that the bill changes colour from red in summer to yellow in winter. In Section 1.3.1, I mentioned the possibility of confusion, between immature Red-billed choughs and adult Alpines due to the colour of bill and legs; although this would be more likely to cause a confusion the other way. "Such was the influence of Turner and Gesner that it was possible for an indiscriminating writer to become hopelessly confused long after Bellon and Carew had described the Cornish chough correctly" (Penhallurick 1978). For example, in the *Itinerarium Mundi* (Mundy 1654) is found the following description:

"The Cornish Daw, breeding in shafts of Tynne [tin mines] seldom seine elsewhere; it hath long yellow legs and a yellow bill; the body black, it hath a note like a chough [Jackdaw] but pleasanter".

Penhallurick wryly points out that Mundy was "a Cornishman to boot". He is doubtful that Choughs nested in mine shafts in Cornwall, and yet Darke (1971) gives documentary evidence that this did occur. Stewart (1928) reports that pairs "in two widely separated and remote parts of Lanarkshire [were seen] emerging from old pit shafts", they certainly use such sites in Wales (*e.g.* Breeze-Jones 1959, Roberts 1978, and pers. obs.), and a variety of natural shafts (*e.g.* 'blowholes').

Mundy's passage highlights the 3-way confusion which now besets historical review concerning the two *Pyrrhocorax* species and the Jackdaw. Camden (1610) was more discriminating: while not knowing the British distribution of the Chough, he recognised that it was "not, as Plinie thought, proper to the Alps only." Camden (1610) believed the Chough was confined to Cornwall: "in the rocks underneath (St Michael's Mount), as also along the shore everywhere, breedeth the *Pyrrhocorax*, a kind of crow, with bill and feet red." However, earlier, in the mid-C15 (publ.1651), Upton reported: "but few in number ... *most* [my italics] in Cornwall". Merrett (1666) reported the Chough's presence "on all the sea coasts from Cornwall to Dover". He was the first to give a realistic account of its distribution in Britain. In 1662, Francis Willoughby (1676) and John Ray (1678) (quoted in Penhallurick 1978) saw "great flocks" near Padstow (see Figure 2.10, Table 3.1), and followed Merrett *viz* "not only in Cornwall but also in Wales and all along the western coast of England about the cliffs and near the sea."

A century later, Gilbert White wrote to two correspondents, Barrington (1770) and Pennant (1771), "the Cornish Chough builds I know all along the chalky cliffs of the Sussex shore" and they "abound and breed on Beachey-Head and on all the cliffs of the Sussex coast". These are the first references to the Chough in Sussex, and yet Montagu (1802) was to describe it as "chiefly confined to Devonshire, Cornwall and Wales". These are reliable records: White is famous for the accuracy of his observations, and Montagu, who knew the south of England well, claimed that the Chough was "lost" from Kent and Sussex by 1802. That it was a familiar bird in the south-east is testified by the fact that it appears frequently on coats-of-arms etc., especially in Kent. Outlying remnant populations might have been overlooked but it seems certain that the Chough was extinct in these counties by 1810 (Owen 1985). This points to a dramatic decline in the last half of the C18, although, Montagu (1798, quoted in Loyd 1929) reported that it was "frequent" in S Devon "where the cliffs were high." Consistent breeding in Devon and Dorset ended pre-C20. A fairly reliable late (*ca.* 1910) record exists for S Devon (Hurrell 1965), and regular breeding ceased then in N Devon

(Owen 1985). Excepting Montagu's work in Devonshire and a review by Mansell-Pleydell in Dorset in 1888 (in loc. cit.), there are few reliable accounts for the remaining southern English counties. A range of books published approximately a century later, all testify to the Chough's increasing rarity (e.g. see Dixon 1888, Bonhote 1907, Johns 1909).

3.3 DEMOGRAPHIC TRENDS

3.3.1 CORNWALL

The Chough is now extinct in Cornwall. In Section 3.2, the background of study within the region was described; it was explained why and how this was more complete for Cornwall than elsewhere. This is now examined in a little more detail.

Owen (1985) reviewed much of the evidence. His attempt at "systematically recreating the extent and size of a bird's population, to an acceptable degree of detail over two hundred years" relied, inevitably, on isolated and largely unquantified accounts. Many secondary sources were identified and excluded, nevertheless a high error potential remains when attempting to correlate vague estimates of bird numbers over several centuries with parameters such as age structure (admitted by Owen to be inadequately known), "potentially suitable coastline" and so-called "'ideal' conditions".

Owen attempted "To examine the geographical patterns of distributional changes against time". He constructed a population estimate based on unofficial trapping returns using a formula devised by Richford (1978) for Jackdaws. It is doubtful, however, that the data warrant such faith. The source was a remark by Bullmore (1866) that "they (Choughs) were caught in large numbers on Perran Sands .. several dozen .. annually .. throughout the game season. I have seen as many as five lying dead at one time". Owen, probably with good cause, attributes depletion of the Chough population by the 1870s to such "large-scale trapping" but assumes that from 1830 through 1850 "this level of cropping must have been a sustainable loss". This is a non-sequitor if Bullmore's discussion of animals "procured during the last six years" (in this case from one location) is not a reliable source for general application throughout Cornwall for a period of four decades (3.4.6.a-b).

Applying Bullmore's data and Richford's formula, Owen estimated a breeding density in Cornwall of 2.43prs/1 mile of coast: nearly 75% more than that suggested for coastal Wales (1.79prs), and nearly double that for Ireland (1.31prs). Bardsey was estimated at 3.44prs. Converting these data to a population estimate, Owen gives:

| | |
|------------------------|-------------------|
| Bardsey Island | 720.5 individuals |
| Cornwall | 508.8 " |
| Wales (mainland coast) | 375.9 " |
| Ireland | 274.6 " |

Of these, on current census returns, only the Welsh value looks at all possible but even so the modern estimate of 381-390 individuals for Wales includes both inland and Bardsey data (Bullock *et al.* 1985).

Owen graphs the decline in Cornwall by 20 year isobars for the period 1750-1960. Cornwall receives individual attention because of the better quality of available data and geographic position: a peninsula at the toe of the country with southern and northern aspects and a long coastline (>200 miles) relative to land mass (see Section 7.3.2).

Table 3.1 The historical record of Choughs in Cornwall. Key to localities in Figure 3.2

| Period | Locality | Record | Source |
|-----------|--|---|-------------------|
| 1600-1700 | 13 | present | Owen (1985) |
| 1607 | 13 | 'all along coast' | Camden (1610) |
| 1662 | 31 | 'great flocks' | Ray (16??) |
| 1724 | 17 | 'great numbers' | Defoe (1768) |
| ca.1813 | 2 | gone | VCH/CBRU |
| 1816 | 7 | 'frequents', 'plentiful' | Polwhele (1816) |
| 1816-49 | 14 | very common | Paris (1816) |
| -1820 | 4 | gone | VCH/CBRU |
| 1832 | 9 | gone | VCH/CBRU |
| 1853 | 14 | 'former nest site' | Rodd (1880) |
| 1848 | 6 | breeding site | Johns (1848) |
| -1848 | 8 | breeding site | Johns (1848) |
| -1849 | 16 | gone | VCH/CBRU |
| 1852 | 20 | eggs collected | Rodd (1853) |
| 1853 | 15 | 'disappeared' | Rodd (1880) |
| 1854 | 12 | 1 nest | Clark/VCH/CBRU |
| 1856 | 5 | 'tolerable abundance - declining to east' | Jenkins (1856) |
| -1856 | 7,10,11,14, 19,21,22,26, 31,32,34,40 | 'tolerable abundance' | Jenkins (1856) |
| 1861 | 15 | 'rarely seen ... eggs much sought after' | Blight (1861) |
| 1862-5 | 3 | unconfirmed reports | anon. |
| -1863 | 6 | extinct due to collecting | Hill (in Johns 18 |
| 1863 | 8 | 'much sought after ... eggs so prized, they will soon be extinct' | Hill (in Johns 18 |
| 1865 | 8 | bred, robbed - 1 of 3 taken | L'Estrange (1865) |
| 1866 | 23 | 'caught in large numbers' | Bullmore (1866) |
| -1870s | 20 | disappeared | Pk (1978) |
| 1880 | 31 | 'impending extinction' | Rodd (1880) |
| 1883 | 31 | 2 shot | Gatcombe (in Pk 1 |
| 1885 | 34 | none seen | Smith (in Pk 1978 |
| 1899 | 18 | 1 shot | CBRU |
| 1900 | 17 | absent | Hudson (1908) |
| 1901 | 28-40 | 7 nests recorded | Clark/VCH |
| 1904 | 28-40 | 10 nests recorded | Pk (1978) |
| 1905 | 28-40 | 12 nests recorded | Pk (1978) |
| -1920-36 | 29 | bred most years | Ryves (1948) |
| 1924 | 36,38 | breeding site | Cox (in Pk 1978) |
| -1928 | 25 | breeding site | Pk (1978) |
| -1930 | 35 | breeding site | Pk (1978) |
| -1930 | 37 | breeding site | Pk (1978) |
| -1930 | 39 | breeding site | Pk (1978) |
| 1930-38 | 31 | bred most years | Pk (1978) |
| 1930-44 | 31 | breeding site | Ryves (1948) |

continued ...

Table 3.1
The historical record of Choughs in Cornwall. Key to localities in Figure 3.2

Table 3.1 continued

| Period | Locality | Record | Source |
|---------|----------|--|--------------------|
| -1931 | 32 | breeding site | Ryves (in Pk 1978) |
| -1931 | 34 | breeding site | Pk (1978) |
| 1931 | 39 | deserted | Cox (in Pk 1978) |
| 1931 | 1-40 | <7 pairs - all 26-33 | Ryves (in Pk 1978) |
| -1932 | 38 | gone | Cox (in Pk 1978) |
| 1932-47 | 33 | bred most years | Pk (1978) |
| 1937-38 | 29 | did not breed | Ryves (1948) |
| 1938-47 | 28 | young reared most years | Ryves (1948) |
| 1939-40 | 24 | (attempted) breeding | Ryves (1948) |
| 1939-40 | 31 | failed | Pk (1978) |
| 1939-47 | 29 | young probably reared annually | Ryves (1948) |
| 1940 | 24 | pair, 1 caught in trap, released with broken leg | CBRU |
| 1941 | 13 | ca.11 (3prs, 2 bred) | CBRU |
| 1941 | 27 | 15 | Hawken/CBRU |
| 1943 | 31 | 'male (?) killed' | Pk (1978) |
| 1944 | 31 | 3 young reared - never seen here again | Pk (1978) |
| -1945 | 25 | deserted | Ryves (1948) |
| 1945 | 31 | 'bred successfully' | CBRU |
| 1946 | 27 | 10 (? broods) | Darke (1971) |
| 1947 | 27-30 | 3/4 broods | Darke (1971) |
| 1948-51 | 27-30 | 4 birds seen | Darke (1971) |
| 1954 | 27-30 | 3 birds seen | Darke (1971) |
| 1957 | 29 | bred, young hatched? | Pk (1978) |
| 1968 | 28 | 1 found dead | Darke (1971) |
| 1968-73 | 28-29 | last bird alive | various |
| 1987 | 1 | 2 birds present | Meyer (1990) |
| 1988 | 1 | 1 died, 1 departed | Meyer (1990) |

CBRU Cornwall Biological Records Unit
Pk Penhallurick
VCH Victoria History of the County of Cornwall

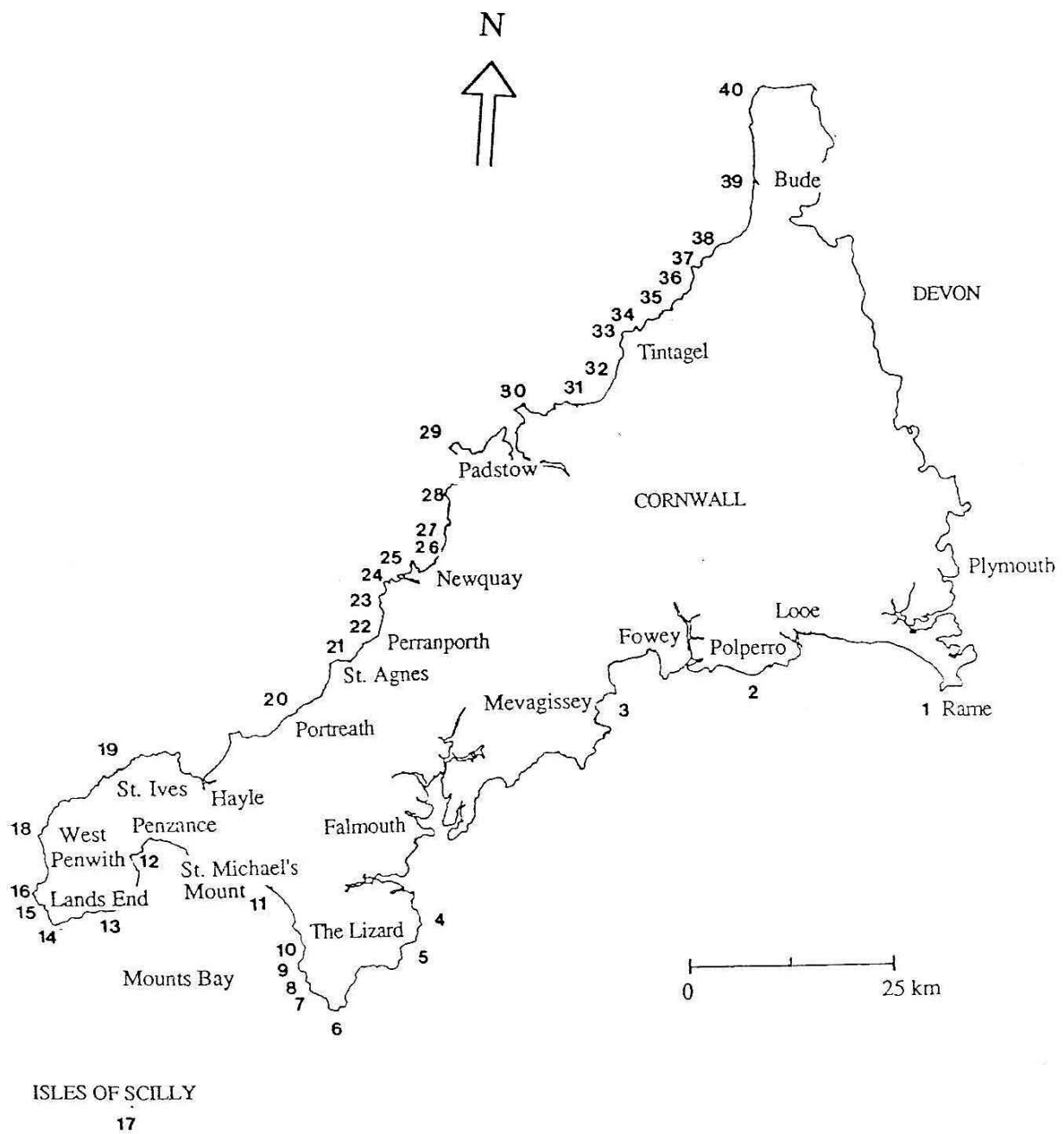


Figure 3.2
Locations of areas of disappearance of the Chough in Cornwall (see Table 3.1)

There is a pattern of linear clockwise decline (3.4.2). A Lizard record post-dating extinction farther west might be explained by the contemporary poor communications in that region; transport systems by-passed the Lizard *en route* Lands End and it remained relatively isolated with a low human population (Hopkins 1983, Bristol University 1987). If so, this strengthens the theory that the impact of human presence, influenced by outside market forces, was an important decline factor (3.4.6d-f). Prior to the Industrial Revolution (1760-1840), agriculture was a major and generally positive influence on wildlife (3.4.6e). At the turn of the C18 Cornwall, was still considered coastal and "primitive" compared to other areas of Britain, where the agricultural revolution was gaining momentum (Fraser 1794). The Cornish literature gives an impression of Chough status within the county since the C19. Table 3.1 and Figure 3.2 tabulate the chronology of all the known reliable records that I have been able to locate. Although no earlier record suggests rarity, by 1813 it was reported to have disappeared from SE Cornwall, heralding, it seems, the final decline.

Tin mining was a dominant industry until the 1860s but many workers in the industry were really miner-farmers and had been so probably since Celtic times (Bullock *et al.* 1983e). They were responsible for the patchwork of small coastal fields. Cornwall was enclosed earlier than the rest of England (Roberson & Stamp 1941), however until the early C19, dairy farming was unimportant and unenclosed sheep pasture abundant (Worgan 1811). Later in the C19, the price of tin slumped, the railway arrived and the pattern of Cornish agriculture changed radically with an increase in corn growing. Many miners emigrated and crofts, shepherding and grazed cliff pastures were abandoned. Some of the more fertile ones were amalgamated and converted to dairy farming, which the railways promoted and which boomed from 1860 onwards (Roberson & Stamp 1941).

The decline of the Chough appears to be linked in part at least to the decline in sheep-farming and the growth of dairy-farming charted by Roberson (*ibid.*). An observer, Harting, writing in 1880, believed that a rapid decline began in the 1860s and continued through the 1870s; Hart (1953) largely concurs. The profound land-use changes, in association with burgeoning human pressures, must have seriously affected the Chough. Island sanctuaries with agrarian economies, equivalent to Bardsey, Ramsey and Skomer in Wales, which might have provided valuable sanctuaries, were missing off the Cornish coast (see below and Section 7.3.2).

3.3.2 WEST WALES

The decline evident in Scotland and England (3.1.1) was apparently repeated (or continued) elsewhere in Britain. "There can be no doubt that 50 years ago [*i.e.* in the 1840s] the Chough was a common bird on the (Pembrokeshire) coast... It is now rapidly becoming scarce", so said M.A. Mathew in 1894, without unfortunately revealing his historic source. Persecution was one obvious cause, for Mathew's account largely concentrates on oological exploits (3.4.6.d); he concludes: "Apart from the persecution they meet with, the Choughs appear to be dying out in Pembrokeshire just as they are in Cornwall and Devonshire, where in former years they were equally numerous."

There is much less historical evidence than for England (=Cornwall). The lighthouse island of Caldey might encapsulate the general picture. Ebben (in loc. cit.) wrote in 1881: "The Chough breeds upon the island, and never goes away." It was 'believed' they still bred there in 1894, "they certainly did some four or five years ago", but Donovan (1972) stated "they are not proven to breed in recent years on Caldey. They are usually present there however". Bullock *et al.* (1983d) gave "possibly 1 pair", more recently, the above mentioned author and county bird recorder, Jack Donovan, has reports of two pairs of Choughs using the island in 1990 "but that only one pair is thought to have bred" (pers. comm.).

Bullock (1985) believed that the position in Pembrokeshire generally had "remained stable since 1971" and might even have slightly increased. Choughs ringed on Bardsey Island in North Wales have been reported in Ceredigion and Pembrokeshire, 100km and 160km south respectively (Roberts 1985). Ramsey Island, with as many as 9 pairs and flocks of 42 and 62 (Donovan 1972), might at times be a recruitment centre. At the time of a brief visit in July 1989, a breeding population of 3-5 pairs was estimated, a figure in line with estimates for the island during periods of low grazing pressure (Bullock *et al.* 1985; see Appendix V).

3.3.3 NORTHERN FRANCE AND THE CHANNEL ISLANDS

The Channel Islands come within French zoogeographic influence (Figure 3.1), also, because the human population is islandic with very different traditions and cultures from mainland Britain, the islands were omitted from Section 3.2. On Sark, the final nest was robbed in 1906, causing extinction; the culprit commenting that he did not understand why they were not more numerous... "I am inclined to think the Jackdaws ... may drive them away(!)" (quoted in Dobson 1952). Probable periods of actual extinction on the other islands were: Alderney 1875, Jersey ante1900 and Guernsey 1929 (*ibid.*).

Guermeur & Monnat (1980) and Thomas (1989) have provided good reviews of the historic Breton status. The first reference is Belon (1555). Many subsequent records in C17-20 suggest long tenure of present sites but a retraction from others. Earlier authors might have over-estimated populations due to a misunderstanding of flock structure, with sub-adults sometimes being regarded as breeding birds (Guermeur & Monnat 1980). The decline began in *ca.* 1820 with "a sharp fall" occurring over the following 60 years with the species finally disappearing from Cotentin a1870 and Pays de Caux in 1870-80 (*ibid.*, Yeatman 1976) in west and east Normandy respectively. Vagrants were occasionally seen or captured at Cotentin until 1913 (Guermeur & Monnat 1980). In southern Brittany, on two islands located either side of Belle Ile, a nest site identified on Houat in 1850 (Delalande 1850 in loc. cit.) was unused by 1868 (Mayaud 1933 in loc. cit.), and on Groix, where it was common in 1636 (Dubuisson-Aubenay 1898) it had gone a1872 (Mayaud 1933). Similarly, on the island of Ouessant, Clarke saw none in 9 days of 'careful observation' in 1898, whereas *ca.* 40 had been seen 18 years before; they returned in 1933 (Guermeur & Monnat 1980). Indeed, a revival seemed to occur: in the 1950s, they were reported as being "numerous in all their traditional haunts", however it is possible that the underlying trend was still downwards (*ibid.*).

On Belle-Ile, "formerly the best haunt" (Thomas 1989) of Breton Choughs, in the mid-1950s, Kowalaski (in Guermeur & Monnat 1980) twice estimated the number of pairs at *ca.* 40, but in 1973 and 1974 only 10-15 pairs are recorded (Thomas 1989) and the maximum flock size had reduced from 56 in 1949 (Moreau & Moreau 1959, in Guermeur & Monnat 1980), 80-100 in 1952 (Burnier & Burnier 1969 in loc. cit.) and 50 in 1957 (Kowalski 1957 in loc. cit.) to 36 in 1970 and 22 in 1971. On Cap Sizun and the Crozon peninsula, the same pattern applied: on 25km of the Leon coast, 6 pairs in 1965-69 declined to only one in 1975 (*ibid.*). Only on Ouessant did the situation show any improvement: 6 pairs in 1969 (A. Thomas unpubl. data) increased to 10 pairs in 1973. Flock sizes fluctuated from 10 (1948) to 65 (1966) to 17 (1971); they then showed some increase: to 29 in 1973 (Guermeur & Monnat 1980).

In conclusion, the total breeding population for Brittany was estimated at 30-45 pairs in 1973 (*ibid.*). Synchronously with the major British and Irish survey in 1982 (Bullock *et al.* 1983a), the *Societe pour l'Etude et la Protection de la Nature en Bretagne* (SEPNB) surveyed Brittany and estimated 23-35 pairs, with some previously occupied territories vacant. Subsequent work in 1987-88 gave an estimate of 28-37 pairs, suggesting either that the earlier estimate was low or that the

decline has been arrested (Thomas 1989).

3.4 FACTORS CONTRIBUTING TO DECLINE

3.4.1 INTRODUCTION

Rolfe (1966), in one of the first assessments of the decline, stated: "There seems to have been several causes, not one of which stands out as generally applicable". He identified *human persecution, natural predators, jackdaws, climatic influences, inbreeding and disease, and toxic chemicals*. In this study, five major parameters have been identified (Table 3.2); all Rolfe's criteria are covered within these, the last mentioned under 'Changes in land use'. This chapter takes each of these variables in turn, and building on Rolfe's conclusions, reviews their possible effects during C19-20 on the present status and distribution. Table 3.1 clearly shows that the decline was gradual, and not the result of sudden events, although these might have affected on-going trends.

Table 3.2 Possible factors influencing decline of the Chough

- 1 CLIMATIC
- 2 GENETIC DEPRESSION
- 3 DISEASE
- 4 PREDATION
- 5 INTERSPECIFIC COMPETITION
- 6 HUMAN INTERFERENCE:
 - a) Shooting and intentional killing
 - b) Trapping for captivity
 - c) Accidental trapping
 - d) Egg collecting
 - e) Changes in land use
 - f) Impact of presence – repercussive disturbance etc.

3.4.2 CLIMATIC EFFECTS

Rolfe (1966), Bullock *et al.* (1983a) and Monaghan *et al.* (1989) discussed broad weather patterns. Mean annual temperatures in Britain decrease from SW to NE; areas exposed to the Atlantic oceanic influence have the highest annual means (a result of mild winters) as opposed to those more affected by the continental influence (Chandler & Gregory 1976). The southern coastal parts of Ireland, Dyfed and the West Country are the only areas with a mean January temperature of $>5^{\circ}$, which may be regarded as the threshold temperature over which accelerated growth of vegetation occurs (*ibid.*). The 4° January isotherm shows that the extreme west of Scotland is as warm as the south coast of England eastwards from the Isle of Wight (*ibid.*). Cullen & Jennings (1986) demonstrated the high correlation of Chough distribution and the equivalent Fahrenheit isotherm (38°).

Bullock *et al.* (1983a) plotted the chronology of the Chough's decline by region. Owen (1985) reviewed the historical record more critically and rejected secondary and unreliable sources. These data are reassessed, some additional records included, and plotted against longitude (Figure 3.3). A progressive E > W retraction is shown, which was not apparent from Bullock's review or revealed by Owen. The correlation responds largely to western oceanicity, and disregards other bioclimatic variables. Mean temperature declines ---> N E in Britain, and if this is taken as a more meaningful basis on which to assess habitat suitability for Choughs, north-easterly inland districts would be less suitable than the eastern coast, and sub-optimality for the Chough in Britain would begin here

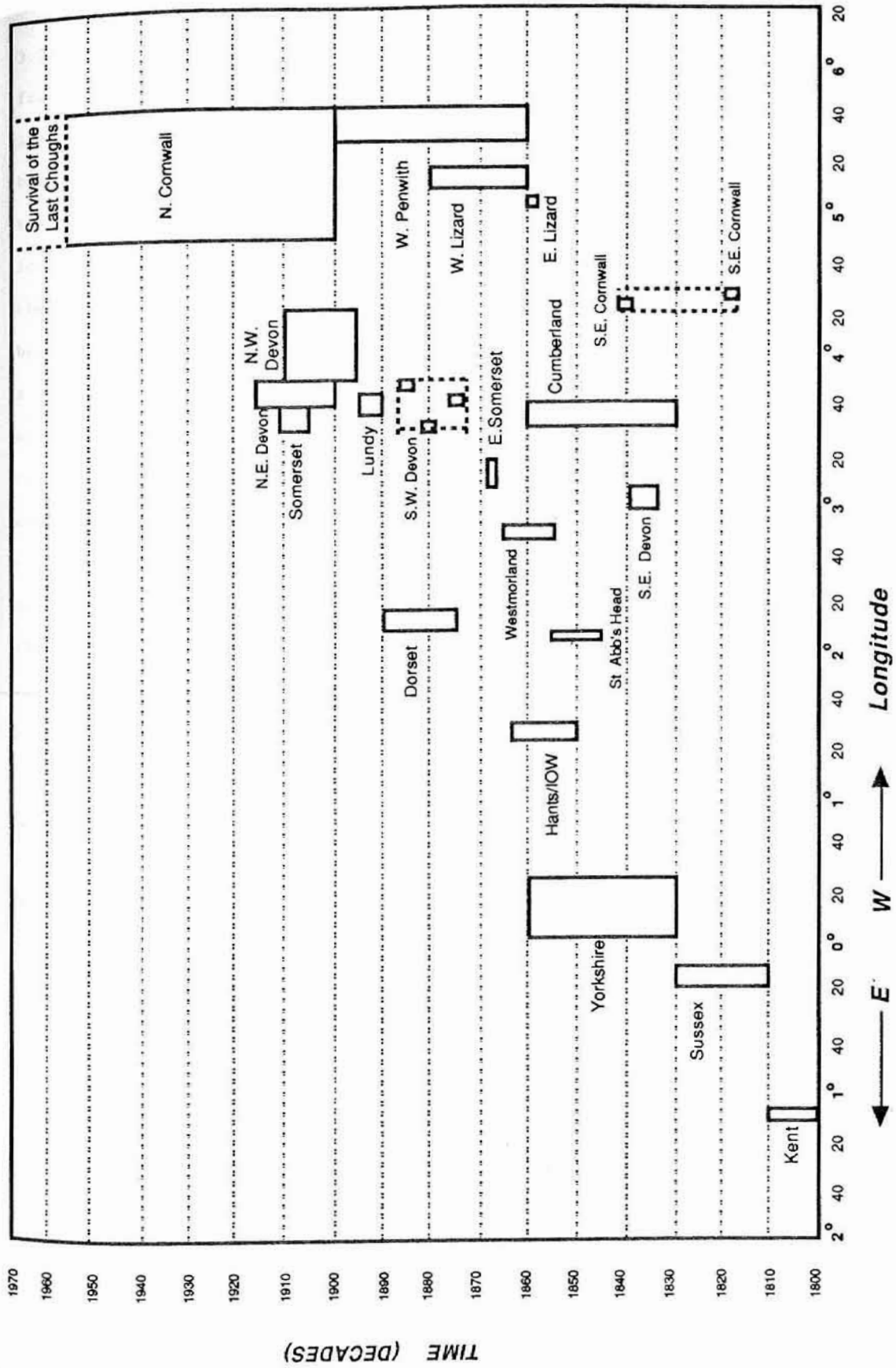


Figure 3.3

The decline of the Chough in England measured by longitude. X axis: length of the coastline in degrees longitude; Y axis: known dates of last records.

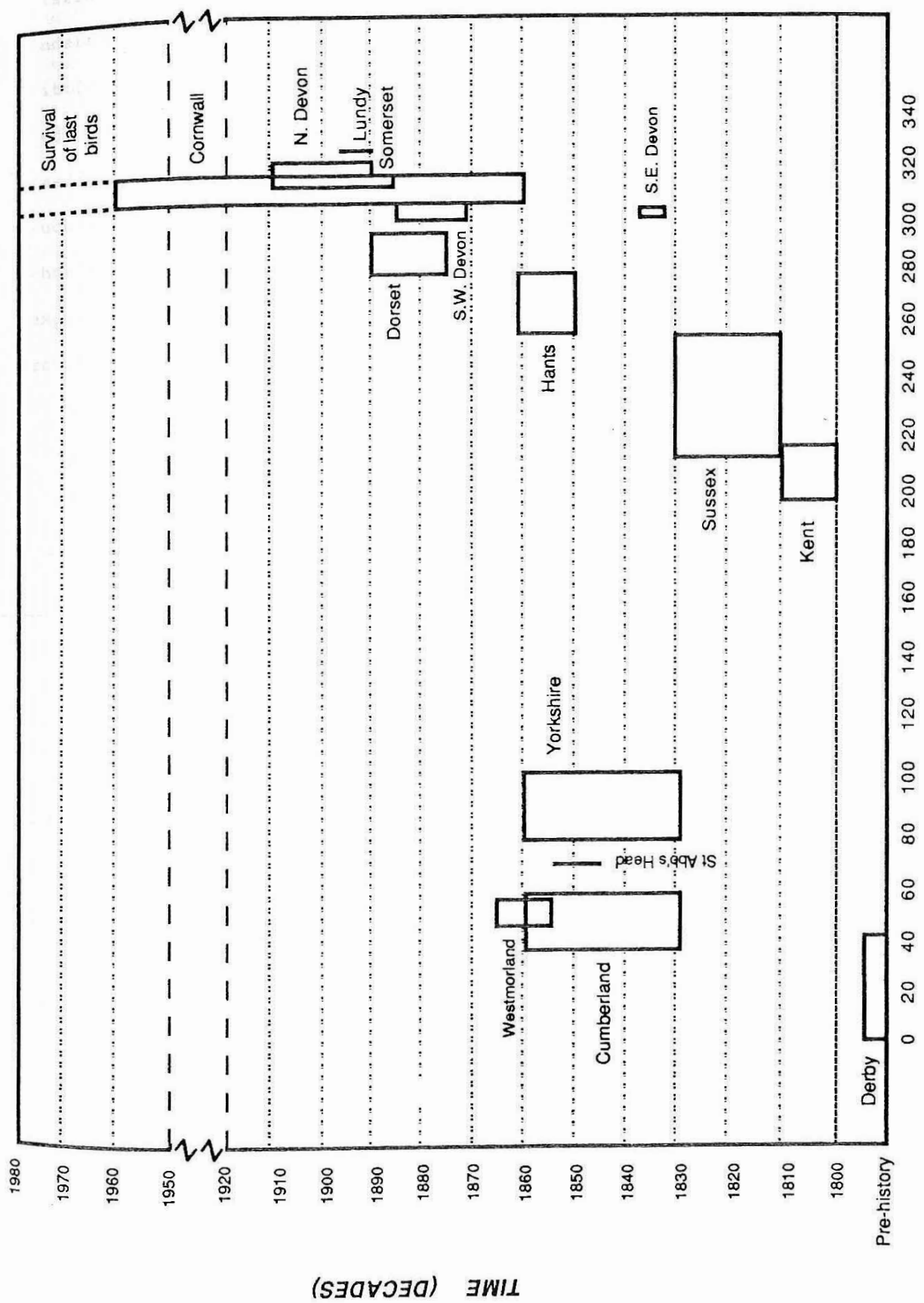


Figure 3.4

The decline of the Chough in England measured by clockwise radial linearity (see text). X axis: length of coastline as represented by R_0 from a theorised central point within the British landmass (*i.e.* Northampton); Y axis: known dates of last records

and radiate progressively 'clockwise' around the coast. Thus, a retraction, if one were to be induced by a general climatic change, might have been expected to have begun in central (*i.e.* away from the coast) northern districts of the Chough's known range (Derbyshire or central Scotland?) and spread southwards round the east coast of Britain, then westwards to Cornwall. Figure 3.4 re-plots the decline data by such a R° index, which uses a theoretical central point in Britain (Northampton) as the base from which the final disappearances on County coastlines are measured in radial degrees: the 180° midline running approximately NNW through the spine of Britain.

Presumably, any effect to be identified as affecting Chough status must agree with a regional and sequential pattern of decline similar to this. Global phenomena would show national effects or exacerbate prevailing regional ones. For example, a strengthening westerly wind pattern from 1880>1920 (Rolfe 1966, Chandler & Gregory 1976) cannot be a root cause of a decline that began in eastern districts early in C19 (Figure 3.3). A series of cold winters, with temperature *minima* mainly during 1837-55 and 1878-98, could have affected status, either by affecting food supply or increasing susceptibility to human persecution (3.4.6), but by then Chough decline was already in progress. Until 1940, the pattern ameliorated, with a warming of *ca.* 2.8°: an improvement in Chough numbers might have been expected but no such improvement is evident, unless by this time other factors had taken effect. The period 1740-1810 gave a consistently high level of summer temperatures (*ibid.*). Rolfe's 1963 survey, undertaken immediately after the severest winter in living memory, found little evidence to suggest a consequential decline. There was certainly individual hardship and some deaths, evidenced by distressed Choughs feeding in streets and gardens but no widespread mortality. However, such observations and a recent study (Meyer 1990, see Appendix IV), show that severe weather does change behaviour patterns. An account from an experienced naturalist-farmer in West Wales suggests possible longer-term results:

"We had 2 particularly severe winters, consecutively, 4 or 5 years ago, the low temperatures made worse by almost continuously northerly winds. This killed the exposed Gorse bushes, and I think must have penetrated so deeply as to kill most of the ants. It has certainly changed the summer feeding of the Choughs at Ceibwr [adjacent and S of Study Area W1 (2.3.2, see Figure 2.6c)]. One could almost guarantee them feeding on the rough meadow ... covered with ant mounds, - now they are seldom there, though close grazing by ponies and rabbits is maintained" (M. Patterson 1988, pers. comm. to NCC, Dyfed-Powys).

3.4.3 GENETIC DEPRESSION

The Chough is a sparsely distributed sedentary species which breeds in isolated pairs within isolated (or patchy) communities (Rolfe 1966, Coombs 1978, Monaghan 1989). If outbreeding maintains genetic variability, which is valuable when adaptability to a changing environment is needed (O'Connor 1985), it would appear, at first sight, to be a candidate for inbreeding depression through high homozygosity. Malan (1891) was possibly the first to discuss inbreeding in reference to Choughs, stating "there would be fewer opportunities for the survivors to find fresh alliances in the way of mates..." after numbers had been reduced by human persecution and competition from Jackdaws. Malan advocated the introduction of new blood, and as a result, one JP Woods, a Fellow of the Zoological Society and manager of zinc mines in Spain, offered to catch "any number of red-legged choughs, entirely free of cost, to turn loose on the Cornish cliffs". Fortunately (or unfortunately) the promise was not fulfilled due to problems encountered in keeping adult birds alive and, afterwards, the hand-reared nestlings died during Mr Woods' absence.

There is no evidence to suggest that the species has ever been densely distributed in Britain, and the expectation would be that when populations are chronically reduced and isolated, inbreeding depression would occur (Frankel & Soule, 1981); however, this, could not *ipso facto* be a primary

cause of decline but rather a consequence of it. In Brittany, where the Chough has been isolated at a low level since at least the 1940s and possibly much longer, there is no evidence that any diminished heterozygosity has affected reproductive success (3.3.3). Examination of isoenzyme variation on Islay suggests that the genetic variation on this island is in the middle to upper range of values when compared to a large number of bird species, and that the Chough on Islay has not suffered a loss of genetic variability (Monaghan 1989). Elsewhere, the rate of decline might well have outpaced genetic effects.

3.4.4 DISEASE

There are insufficient data to assess the role of disease as a limiting factor on Chough status (Bullock 1980). Two diseases have been recorded: pseudotuberculosis and gapeworm. The former is a bacteriological disease caused by the pathogen *Yersinia pseudotuberculosis*, and is seen mainly in the winter when animals are in sub-optimum condition due to climatic and environmental effects (Petraik 1969) although Cowdy (1962) reports a female Chough dying on her nest from the disease on Bardsey in 1958; she also refers to other recent deaths of nestlings and fledglings from unknown causes. Rolfe (1966) quotes similar evidence from Merionethshire. Pseudotuberculosis is seen in predators which have eaten infected prey, and in all animals which have taken contaminated food (Petraik 1969).

The Gapeworm is a blood-sucking nematode *Syngamus trachea* that infects the trachea of many species of birds. The worms cause considerable irritation to the lining of the trachea, and can obstruct the airways. Eggs are coughed up, swallowed, and are voided. Usually the eggs hatch to produce larvae which are ingested by invertebrates such as earthworms (Lumbricidae), where they become encysted and can remain for months or years (Meyer & Simpson 1988, see Appendix VII). Birds which eat the infected prey (or the eggs themselves (Cox 1968)) can then become infected.

It is likely that the lame birds occasionally reported, including from Cornwall (Ryves 1948) are suffering from the *Yersinia* bacterium. Recently there has been more discussion about gapeworm, but a century ago, in 1891, Malan remarked of Choughs in captivity needing 'absolute liberty and full exercise of wings; if not, they generally developed asthma in their first year, which usually proved fatal.' 'Asthma' might well have been gapeworm since the wheezing symptoms could easily be confused; gapeworm is a common disease of many captive birds, especially juveniles (Wilkinson 1987). It has been recorded in wild Choughs from the Isle of Man (Haycock 1975), Scotland (Bignal *et al.* 1987), Cornwall (Meyer & Simpson 1988, see Appendix VII); and very recently from an adult found dead at Marloes (Study Area W4) (R. Haycock & V. Simpson pers. comm's.), the first record I have from Wales. Gapeworm is known to affect the Magpie and Carrion crow (Meyer & Simpson 1988, see Appendix VII), the Rook to a considerable extent (Holyoak 1971, Barus *et al.* 1972) and Starling (Lapage 1956).

It has been suggested (Bignal *et al.* 1987) that relatively small and isolated Chough populations might be vulnerable to outbreaks of chronic gapeworm infection, particularly nestlings if the parents are collecting food from an infected area, or concentrating on a particular type of food such as earthworms, if heavily infected. Meyer and Simpson (1988, see Appendix VII) noted that parasitic infections normally only become significant when the host is under stress, possibly from intercurrent disease or malnutrition, or where the challenge is very high, *i.e.* in captivity, which is virtually what Bignal *et al.* are suggesting. If the environment is being contaminated by other corvids or Starlings, which are themselves not affected, there are obvious dangers to less resistant predators or less experienced and stressed birds. Brown & Thompson (1986) suggested that dominant Golden plovers and Lapwings can identify infected prey, but the situation may be

envisaged where stressed birds, perhaps when feeding young under difficulties, breeding for the first time, or when pioneering in unknown areas (=less experienced), could be as at risk as subordinate birds (Meyer & Simpson 1988, see Appendix VII). Resistance to gapeworm could be impaired by malnutrition-induced stress, and Choughs feeding sub-optimally, due to insufficient optimal or degraded habitat, could be at increased risk from gapeworm (*ibid.*). In conclusion, disease is unlikely to have been a primary factor but may have been a secondary element, and could also be inhibitory to recolonisation.

3.4.5 INTERSPECIFIC RELATIONS

3.4.5a Predation

The Chough has few avian predators (Rolfe 1966). Bonhote (1907) claimed the Peregrine "will attack it, resulting in very rapid extermination", and it has, more recently, been implicated in some local declines, *e.g.* Islay and other Scottish islands (Baxter & Rintoul 1953); but although remains are occasionally found at eyries, it is extremely doubtful if this predator has affected the status of the Chough in Britain (Ratcliffe 1980). Cade (1960) believes that the Peregrine is a good example of the basic Errington hypothesis: *i.e.* vertebrate predators live on the expendable *surpluses* of their prey populations. There are records of Peregrines taking Choughs in Pembrokeshire but only 3 in 20 years of observation (Gilbert 1927), and one in Snowdonia (Ratcliffe 1980). The skull in Figure 1.3 was from a Peregrine plucking site at Strumble collected by R. Spicer. It is possible that a Peregrine accounted for one of the last 'true' Cornish Choughs (Penhallurick 1978). I twice saw a Peregrine stoop unsuccessfully at Choughs which had returned to Cornwall after an absence of 20 years, and it is probable that, when very sick from the affects of gapeworm (3.4.4), a Peregrine finally succeeded in catching one (see Appendix IV).

Bonhote allowed that the 2 species could co-exist peacefully, and Ryves (1948) describes such at all the sites he knew in Cornwall. Peregrines and the larger corvids can, though, cause disturbance (3.4.5 and 6.3.3). In Pembrokeshire (Study Area W1: Mwnt-Cemaes), no direct attacks were witnessed but on one cliff where they nested about 100m apart, a Peregrine would often indulge in mock or redirected attacks, as described by Ratcliffe (1980) in relation to Ravens, during nest visits by Choughs, causing considerable alarm. This nest failed to produce young in 1988 but did the following year when the Choughs moved a short distance away out of sight around a headland.

Rolfe (1966) cites possible predation of nesting or young Choughs by Little owls, Hooded crows, Foxes and rats, but these cannot be significant given the usual inaccessibility of Choughs' nest-sites (Bullock 1980). Warnes (1985) also cites rats, and adds ferrets and feral cats as possible predators of nests on Islay; rats have also been known to raid nests on the Calf of Man.

3.4.5b Competition

The Jackdaw is the species which has generated most comment with regard to Chough status. In the early literature the Jackdaw is frequently cited as being a major cause in the decline of the Chough (see, *e.g.* Gray 1871, Bonhote 1907). Gray wrote:

"In almost every district I have visited of late years, jackdaws have increased to an excessive extent; and until some other and more satisfactory explanation be given for the Chough's absence, the increase of one bird, I suspect, must be looked upon as the cause of the decrease of the other."

Rolfe (1966) stated: "Older writers, almost to a man, held the Jackdaw responsible ... assuming a simple equation between the increase of the one species and the decline of the other". Stewart

(1928) expressed the conundrum, probably drawing on Buchanan (1882):

"Nearly all accounts seem to agree that everywhere the places it (the Chough) once frequented or now tenants in diminishing numbers, swarm the ubiquitous Jackdaw, and strange to relate it is everywhere said to live on the friendliest terms with that bird."

The role of the Jackdaw was diminished by Ryves (1948) and more recent authors, though it is still heard frequently from the layperson, and given credence by some, *e.g.* Dobson (1952), Guichard (1962) and Yeatman (1971). Darke (1971) suggests reasonably that competition might occur at times. He recognised that the Jackdaw prefers insect food when available (see Coombs 1978), and cites the following personal observation:

"a field of barley which failed as a result of depredations by wireworm was resown in late May, at a time when the jackdaws were feeding their nestlings on the cliffs. Immediately after drilling, while the earth was still disturbed, a horde of jackdaws settled on the field and attended it until the corn was showing well above ground ... [the Jackdaws were thought to be eating the corn, but] ... when one was shot, its crop was found to be full of wireworm (the larvae of elaterid click beetles) ... the birds were probably instrumental in saving the corn."

Darke suggests that where Choughs and Jackdaws are rearing young in close proximity, some competition for insect larvae seems inevitable. Goodwin (1986) accepts that where Jackdaws and Rooks are absent or restricted, the Chough could exploit a wider range of feeding places. Dory (1983, 1989) argues against Jackdaw involvement by referring to the situation in the European Peaks, particularly the Cantabrian mountains and the Covadonga National Park, Asturias, which has seen a dramatic reduction in Chough numbers "Only 20 years ago, flocks of hundreds ... were commonly seen in the low valleys during winter, now they are hardly ever seen. In the same way, the presence [on the coast] mixed with gulls in some places, is something that has disappeared almost completely". The Jackdaw, while increasing on the Continent in the last decades, is not present in Cantabrica, "so that possibility can be ruled out" (Dory 1983).

Jackdaws did increase synchronously with a Chough decrease between 1830 and 1890 but the Chough decline had begun somewhat earlier (3.2). It is perhaps more likely that alterations in habitat quality, caused by human activity (3.4.6e), have affected it to the benefit of the Jackdaw and the detriment of the Chough independently.

In the few Chough/Jackdaw interactions noted during the present study, Choughs were the instigators. There were also territorial disputes between Choughs and other sympatric corvids in which this was not necessarily the case (see Section 6.3.3) but with the possible exception of competition between Choughs and Rooks for leatherjackets (*Tipula* spp. larvae) and wireworms (Elateridae larvae) on old pasture, there seemed little overlap in niche partitioning.

3.4.6 HUMAN INTERFERENCE

3.4.6a Shooting and intentional killing

Rolfe (1966) gives shooting as an important pressure. Choughs have been hunted in substantial numbers, like any other large bird which has come into association with man. As a crow it has perhaps been killed more than most, sportsmen and farmers not discriminating on the finer points of comparative corvid ecology. Rolfe (*ibid.*) and Goodwin (1986) suggest that their relative tameness could have increased the toll *cf.* other corvids. Couch (1838) remarked that the decline was "a circumstance chiefly owing to the persecution it suffers at the hand of the sportsman, and

those who supply Naturalists with specimens..." In 1827, on the Isle of Man, Jardine (1838-43) "procured nearly thirty specimens in a forenoon." The purposeful slaughter explained by sport and pest control was compounded by casual slaughter such as displayed in the account from Braunton in Devonshire of 6 being killed on "a manure heap" from one blast by a sportsman wishing to discharge his muzzle-loader. Generally, a mix of motives pertained, as shown by the fate 4 of 6 nests on the east Manx coast in 1939: (i) 3 young stoned to death in the nest, (ii) 4 possibly taken for cage-bird show, (iii) 2 reared but shot within 8 weeks, (iv) 1 taken prior to fledging (Williamson 1959).

In Cornwall, the inherent interest in the species added to the toll: many historical records are a result of shootings. Three of only 4 Choughs recorded on the Isles of Scilly between 1870 and 1901 were shot (Penhallurick 1978). Coombs (1978), Bullock (1980), and Thomas (pers. comm.) in France, indicate that shooting still occurs in modern times.

Birds were also trapped for taxidermy, notably in Victorian times (many survive today in museums, businesses and private houses), their skins and even for meat (3.3.1). Bullmore (1866) refers to "large numbers" being caught in baited (it is not known with what) steel traps: "several dozen are sent annually to Falmouth". In the Royal Cornwall Gazette (RCG) (16.v.1870), a pair was priced at £3.10s.0d. Owen (1985) blamed such "large-scale trapping" partly for the decline of the Cornish Chough, and Penhallurick (1978), citing an advertisement in the RCG (23.vii.1891) for their capture, says "There is ample evidence that the main reason - perhaps the only significant cause (of its decline) ... has been its persecution by the very men who so revered it as their national bird."

Before the war (presumably II), a single Chough in good feather was worth £5 alive or dead (Palmer 1950s, undated pamphlet, *The Old Cornwall Society*).

3.4.6b Trapping for captivity

In Cornwall the Chough has been intentionally live-trapped and hand-reared since at least the C16 (Carew 1602). Subsequent authors have testified similarly, *e.g.* in Cornwall, Camden (1610), Borlase (1758), Montagu (1802), Edmonds (1862), L'Estrange (1865), Rodd (1880) and, in Pembrokeshire, Mathew (1894). It was "very common to see tame ones in their (Cornish) gardens" (Maton 1797). That the Chough had a role as a status symbol, both by its regular appearance as an heraldic device (3.2), and by the fact that Carew in the C16 and Borlase in the C18 often made gifts of them to eminent personages, including two young ones to the Chancellor of the Exchequer in 1757, there can be no doubt.

Choughs, in common with other corvids, make long-lived and endearing pets when hand-reared and were often tamed (Beckerlegge 1972). One at Padstow Bird Gardens in Cornwall was still very healthy at more than 22 years old in 1991. Borlase himself had one still alive at 14 years old in 1763 (Pool 1966, quoted in Penhallurick 1978); he described the species as "very amusing when kept tame; [being] docile, regular and constant to its hour for meat" (1758). Quarrymen in N Wales traditionally took one or two (but not all) from nests each year for competitive bird-showing (S. Latchford pers. comm.). In Cornwall, Malan (1891) had several Choughs and recorded that they attempted nest building but did not lay eggs. A small flock kept in a garden in Exeter had been reared from young taken in S Cornwall (D'Urban & Matthew 1895), these are the skins now in Exeter Museum (Lloyd 1929). Many young birds acquired on nest-robbing missions were reared and kept either as pets or for sale (see Section 3.4.6a). The majority of those seen until quite recently in cage bird shows were presumably obtained thus. These have now formed the founder stock of the current captive-breeding programme (see Chapter 7).

3.4.6c Accidental trapping

Many Choughs were trapped accidentally on cliffs in the early 1900s (Ryves 1948). The cliffs were, in places, so "thoroughly sown with open gins to trap rabbits", that the decline was attributed to this (Cox, quoted in Penhallurick 1978). It is not possible to quantify this or relate it to intentional trapping (3.4.6a-b). Some were released or cared for by the trappers (Darke 1971). Chenoweth (in loc. cit.) describes how between Newquay and Perran Sands in the war years "trappers tilled their traps in the open near the cliffs ... often caught them"; he maintained this was one of the causes of their disappearance. They cannot have been common even then because one trapper at least did not recognise the species. Ian Bullock believes a corpse he found with a smashed leg in Ireland in 1979 met a similar fate (Bullock *et al.* 1983a).

3.4.6d Egg collecting

Despite often inaccessible nest sites, trade in Chough eggs flourished in the C19, and eggs are still taken illegally from Wales (Bullock *et al.* 1983a, R. Meyer unpubl. data). Eggs were used as a source of food in the Isle of Man in historic times (Cullen & Jennings 1986). In Pembrokeshire, towards the end of the C19, it was "rapidly becoming scarce, and were it not for its sagacity in building in holes and crannies of inaccessible cliffs, it would long ago have been exterminated, as all its eggs would have been taken to meet the demands of collectors" (Mathew 1894). S.W. Jenkin writing in *The Naturalist* (1856) remarked "they would ere this have been exterminated"; also "the egg of this bird is much sought after" (Blight 1861); and "they were so much sought after, and the eggs so prized, they will soon be extinct" (Hill, in Johns 1863). Darke (1971) summarised the Cornish view: "Egg collectors from England played a large part ... as they had always done, offering the near poverty-stricken working man relatively large sums... Many of these men were hardened wreckers, used to recovering the great spars and hatch covers [from] the rocks ..." In *ca.* 1900, a clutch of eggs earned a retired wrecker £1 (*ibid.*). Eggs taken from Berry Head in Devonshire in 1880, one of the last breeding attempts in the county, are lodged in Torquay Museum (Loyd 1929).

3.4.6e Changes in land-use

Changing land-use as a cause of Chough decline was not appreciated until 15 years after Rolfe's (1966) survey. The importance of low-intensity pastoral agricultural systems was largely ignored, despite earlier clues, *e.g.* Whittaker (1947), Holyoak (1967, 1972), Donovan (1972), Cowdy (1973) and Gatehouse & Morgan (1973), until Bullock's work in the late 1970s (2.1; and see, *e.g.* Bullock 1980; Roberts 1982, 1983; Warnes 1982; and Bignal & Curtis 1989). Use of the land changes in direct and obvious, and indirect and subtle ways, affecting virtually all British mainland wildlife, even the Chough, which used to be regarded as a denizen of only the 'wild' and rocky fringes of Britain (3.2). However, human use of the land substantially affects the Chough; such effects are an integral part of this study. Comments here are, therefore, confined to those of an introductory and background nature.

Man can affect Chough habitat in 2 ways: (i) by creating or removing it, and (ii) by managing it (Owen 1985). Most important are the effects upon invertebrate communities and their accessibility to the birds. For example, low-intensity pastoral systems, where invertebrate communities are not destroyed by ploughing or biocides are crucial (Curtis *et al.* 1989), as are close-cropped open swards (Bullock 1980) with earth-exposures (see Chapter 4). Occasional and selective 'cool' burning also creates open vegetation and bare earth (Haycock & Bullock 1982). Until very recently 'swaling' (controlled burning notably of 'furze') was a common winter activity on the clifflands of Cornwall and West Wales (F. Ansell & E. Latter pers. comm's.); it is still widely practised today in some parts, notably Islay (E. Bignal pers. comm.). "'Furze' is ... gorse which was harvested in faggots and used

as a source of quick-heat... Furze-shoots formed a useful first-bite for stock in spring-time and farmers would not have wasted this valuable grazing resource" (Herring 1987). Burning by humans has, since *ca.* 3000BC, profoundly affected the landscape, and is one of the oldest management techniques known to man. In the West Country after the onset of the wet, oceanic post-glacial phase, burning was responsible for all the extensive clearances (Balchin 1983). Cornwall, never since well-wooded, was described in 1542 as "a pore and very barren cuntry of al maner of thing, except Tyn and Fysse." A contemporary poet wrote:

*O Cornwall! wretched spot of barren ground,
Where hardly aught but rocks and furze is found...*

As stated (3.3.1), even by contemporary C18 standards, Cornish agriculture was considered coastal and "primitive" (Fraser 1794). However, a primitively farmed, poor and barren coastal landscape with rocks, furze (*Ulex*), tin mines and attendant mules and pit ponies (=rough grazing) (see 3.4.6f) might suit a Chough very well (see Chapter 4).

The decline of tin mining perhaps more than any other single factor changed the face of Cornwall's coastal landscape. The engine houses and some of the shafts and adits still remain, now the nest-sites of Jackdaws not Choughs, but the effects of the extensive rough grazing associated with this form of primitive mining has disappeared; Ratcliffe (1980; see Section 1.3.2) has described these effects. When functioning at its prime, the industry affected the landscape in two major ways: (i) the miner-farmers, enclosed much of the waste land into small squarish clifftop fields which reached right down the cliff-slopes almost to sea level, as in West Penwith (Russell 1971); and (ii) by the laying waste of much farmland (Balchin 1983). A depression in 1830-50 caused many thousands of miners to emigrate to Australia, America and Canada; a brief upsurge was followed by another depression during the American Civil War, in turn followed by the great boom of 1870-72 - which represented the all-time high of the industry: 26,500 people employed in 230 mines. However, this was followed by 50 years of depression and by 1921 only one active mine remained (*ibid.*); World War II saw a brief resurgence but with only a few mines reopened. Virtually all are now closed.

Ploughing up of coastal heaths, intensification of arable farming, retraction of grazing, and the advance of industry and other human developments, all act in visible ways which are quantifiable to some extent (4.6.3). The more subtle effects of human activity upon the countryside are likely to be of chemical origin and may require closer scrutiny to detect, *e.g.* the treatment of crops against animal and plant diseases, and the application of nitrogenous fertilizers. Compare the emerald green acres of improved monotypic rye-grass with old, permanent or unimproved pasture. The latter looks *untidy*, and is characterised by >5-10 herb species/square metre. If such unimproved pasture receives reasonably heavy grazing, or sufficient exposure such as on clifftops, a tight herb-rich sward, rich in invertebrate fauna, *e.g.* ants, Coleoptera and Diptera (staple Chough prey; see Chapter 5) is also likely to be present. As grazing pressure reduces, there is a proportionate increase in vegetation height and decrease in viability to Choughs (Bullock & del-Nevo 1983, Roberts 1983, Williams 1989, Mitchley 1990). Rotational pasture is used by Choughs on Islay (Signal *et al.* 1988, C. McKay pers. comm. *cf.* 4.3.3) where the resource is likely to be dung invertebrates, provided these have not been precluded by the use of antiparasitic drugs such as 'Ivermectin' (McCracken 1989) and tipulid larvae.

The use of sheep-wool by Choughs as a nest-lining is well-known (Williamson 1959, Holyoak 1972); samples collected from nesting areas during the breeding season were analysed in order to

investigate the possibility of chicks being affected by chemical residues within the nest (Appendix III).

3.4.6f Impact of human presence

To what extent did an indigenous and expanding human population, with increasing mobility and leisure-time, and a modernising post-Industrial Revolution agriculture, affect the clockwise pattern of decline plotted in Figure 3.4? The current western distribution has been given (1.3.2; see also Section 3.3.2), and the importance of islands is discussed (7.3.2), but did Cornwall become the last English refuge of the Chough largely on account of its bioclimate and geography (a large peninsula =quasi-island) or also because of its remoteness from 'civilisation'?

This section examines the repercussions of human presence on the Chough.

E. Signal (unpubl.), discussing a proposed development on a remote part of the Inner Hebridean island of Islay (a Chough stronghold, possibly analogous to Cornwall during the C18-19), wrote:

"The physical developments (buildings and roads) and the impact of people, vehicles and activities will introduce noise and disturbance, and thereby directly and indirectly erode the value of the area... (it) will affect breeding choughs by generating direct nest disturbance at breeding sites, resulting in incubating parents being kept away from eggs or young for prolonged periods so that the clutch or brood chills and dies. Breeding performance and therefore recruitment to the population will decline".

During times of no disturbance at one nest, in a farm outbuilding, visits by the parents to the nest were on average every 28.2 minutes (2.1 visit/hour), during times of farmyard disturbance this reduced to 48 minutes (1.25 v/h) (*ibid.*). Ratcliffe (1980) and Dory (1989) cite the increase of road traffic, walkers, campers, climbers (coastal routes are increasingly used) and second-home ownership as contributory.

Cornwall, sometimes known as 'West Barbary' (Jenkins 1970), was very much a wild outpost even as late as the C19. In 1663, 'the post' took 8 days to reach Penzance from London, and ordinary travel was much slower (>3 weeks); well into the C18, wheeled traffic was rare (*ibid.*). In the 1750s, the roads were said to be the "worst ... in all England. A great part are intolerable ... whilst most of those which have been improved are so extremely narrow and uneven that they are almost inaccessible to all kinds of wheeled vehicles... the one grand article that has so much prejudiced travellers against the county" (*ibid.*). Thereafter, upon the development of the stage-wagon (the forerunner to the stage-coach), the 'main roads' improved, but until the end of the C18, practically all merchandise was carried by mules and ponies (*ibid.*), of a breed which thrived on grass and furze (Fiennes 1698). In the mid-C18 there might, at Hayle, "usually be seen above five hundred, oftentimes a thousand animals at work [bearing coal from that port to the mines and surrounding countryside]" (Borlase 1758). At this time, "many of the country roads ... were grass-grown tracks, divided in some places by rocks or brakes of furze" (Jenkins 1970). In his original edition of *Cornwall and its people* (1945), Jenkins remarked of the old mule tracks and 'pannier-lanes' still remaining but "over-grown with brambles, furze, and other vegetation".

At the turn of C18, most inhabitants of west Cornwall were still scarcely travelled beyond their homesteads, and were "isolated ... from the moderating influences of the outside world" (*ibid.*). In 1761, the turnpike-road still did not reach beyond Marazion "and the St Ives and Land's End districts remained, in consequence, in a splendid isolation which caused no small inconvenience to the growing mercantile interests of those areas" (G.B. Millett in loc. cit.).

It is evident from the foregoing that at the time the Chough was, by all accounts, beginning to decline seriously (the turn of the C18; see Table 3.1), the improvement in roads would be taking effect. Not only did this have a profound affect upon the mobility of the local populace, it also brought about an invasion from without. Additionally, until these times, oxen, mules, ponies and horses were the primary form of locomotive power and draught. The rough-grazing and pasture necessary to sustain this population must have been very considerable, as would the consequent organic backput into the environment. Such features of 'primitive' countryside, decreased synchronously throughout the C19 while, at the same time, the impact and repercussions of the human population increased. Corn crops and store cattle replaced dairy produce as the chief commodity off the farm (Roberson & Stamp 1941). "This change could not have come about except for the improvement of communications between Cornwall and the rest of England, especially the construction of the mainline in the [18]sixties" (*ibid.*). A similar pattern of events with local variations was probably occurring throughout the 'Celtic fringe'.

On 4 May 1859, the main railway connecting Cornwall with England over the River Tamar was opened. Balchin (1983) wrote: "subsequent events were to make this an historic date in the evolution of the Cornish landscape as thereafter the county lost its isolation and became wide open to English influences". As a result of 'the second English invasion', the economic base changed from mining and fishing to tourism, and agriculture changed from the subsistence type to more specialised dairy farming and early flowers and vegetables for export (*ibid.*). The Victorians arrived in Cornwall in large numbers, and made for the wildest stretches of coast, previously inhabited only by fishermen, tanners and crofters, and a few Choughs.