A demographic study of Crosthwaite parish: some genetic implications

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ABSTRACT

This thesis studies the demographic history of Crosthwaite Parish, Cumberland (Cumbria) during the period 1560-1800, and attempts to assess the factors affecting population change in the region over that period. It uses the demographic material to assess the influence of some of the population changes on the genetic structure of the population.

The study starts with a general introduction to the geography and population history of the region. The second chapter describes the methods used to record and cross-reference the Anglican parish registers which were the main source of material for this research. This is followed by an outline of the types of analysis used to obtain demographic information, and by a description of some attempts to assess pre-census population sizes in England and Wales.

The main section of the work involves the use of 'cohorts' to study changes in the size of the breeding population, family size, age at marriage, migration rates and the sex ratio of migrants. Indices of genetic isolation are calculated to indicate the likelihood of genetic drift occurring at any point during the period studied. A study of isonymy is used to calculate inbreeding coefficients.

The conclusion discusses the results obtained, and assesses the limitations and potential of historical population studies.

A Demographic Study of Crosthwaite Parish :
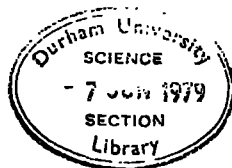
some Genetic Implications

by

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CONTENTS

LIST OF TABLES

List of Figures

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INTRODUCTION

It is obvious to the most casual observer that the appearance of mankind varies considerably throughout the world. Variations in skin colour, hair type, and body build are the most noticeable features which broadly distinguish populations from one another, but it is also recognised that such factors as blood group gene frequencies differ from population to population.

Movements of large and small groups of people many thousands of years ago and consequent admixture have made it difficult for any clear classification of human types to be made. In fact, much of today's research into human population variation seems to emphasise the need to study the various factors contributing to human diversity.

Controlled breeding experiments on animals such as the fruit fly have enabled the population geneticist to understand many of the mechanisms involved in population variation. It has been possible to control the environment, population sizes, sex ratios and breeding habits of these creatures to such a fine degree that many factors such as natural selection, genetic drift, and the influence of migration can clearly be seen to affect the genetic composition of the experimental populations.

Such a great understanding of population genetics was obtained from studies of creatures such as the fruit fly that it was a natural step forward to apply the same kinds of principles to the mechanisms of human population variation, and gene distribution. However it is not merely sufficient to assume that all the factors involved in fruit fly variation work in the same way for man. For example, man has complex rules about marriage and mating which may affect the amount of inbreeding in any population. In very small groups, such as some South American Indian tribes, the prohibition on mating with a close relative may force a man to seize a bride from another community, thus expanding the gene pool.

It is not possible to carry out controlled breeding experiments on human populations. Even if there were no moral objections, the practical difficulties would make it very hard to carry out such an experiment. For example, the lengths of human generations would mean that the project would take many years even if a small population were studied. At the present time, the only practicable means of piecing together the possible reasons for human population variation is to study the demographic history of a population. This, in conjunction with a detailed census of the existing population, and a survey of genetic markers such as those for many of the blood groups, can provide very useful information on the differentiation of human populations.

In small populations with no written records, the relevant historical material has to be obtained by piecing together genealogies passed on orally, and by making use of any other information which may throw some light on the population's past. Even vague myths about the group's movements may be taken into account. In most Western societies, there are written sources which provide some information of demographic interest, and these may go back several hundred years. In Britain it is possible to obtain a fairly full picture of some communities from the sixteenth century onwards, by using data from early tax returns, military muster records, parish records, and even some very local censuses. In a piece of research which is limited by time, and manpower, the most useful source is the range of Anglican parish registers.

This study utilises the Anglican parish records of Crosthwaite Parish in Cumberland, to carry out a demographic study spanning the years from the mid sixteenth to the beginning of the nineteenth centuries. The demographic material is used in conjunction with some theories of human genetic variation to see whether conditions were ever apt for the population to have become genetically differentiated from any neighbouring populations.

Variables such as population size, inbreeding, marriage distance and migration are studied.

This particular parish was chosen for a number of reasons. Geographically it is still regarded as an interesting, but out of the way corner of England, and in the past it was certainly fairly remote from the larger towns in the country. Its isolation made it a reasonable choice for a project concerned with human population genetic theory as it seemed possible that at some time in its recorded history it could provide a population which might show some of the conditions considered suitable for genetic differentiation to occur. The mountainous terrain made it a suitable region for studying the effect of geographical barriers on population movement. The influx of a comparatively large number of Germans in the sixteenth century was certainly unusual for such an isolated rural community, and it seemed possible that these incomers had some effect on the genetic structure of the population. Another point in favour of Crosthwaite as a region to study was the easy access to the parish records.

This particular work has two main aims. The first is to provide demographic information on the historical population of a small area, and to study its genetic implications. It also attempts to outline the problems encountered when using historical material of variable quality.

Notes on some historical population studies

Several other studies are referred to in this thesis, and it seems worthwhile to indicate one or two which have been of particular interest. Many historical population studies are concerned only with the demographic changes in various parishes, and are important for providing an insight into the problems and methods of analysis involved in the use of historical material. Such works include that of Sogner (1963) on seventeen Shropshire parishes, and Wrigley on Colyton in Devon. Useful references to Wrigley's work are detailed in the bibliography, and include papers on baptism coverage (1965), family limitation (1966), and mortality (1968).

An increasing number of studies has been carried out utilising demographic data on historical populations to provide an insight into the change in the genetic structure of populations. In Britain the most notable one concerns the Otmoor region of Oxfordshire. This work uses historical material obtained from the Anglican parish records from the early seventeenth century up to the present day, as well as data from the censuses of 1801 onwards. Information such as changing population sizes, birth and marriage rates, age at marriage, family size, and birth intervals are obtained. Marriage distance and orientation are also examined. Much of the above information is contained in early papers, for example Küchemann et al. (1967), Boyce et al. (1967), and Küchemann (1969). More recent papers on social mobility, and marital movement are those of Harrison et al. (1971), Harrison and Boyce (1972), and Jeffries et al. (1976). Part of the Otmoor study is concerned with the analysis of genetic parameters in the present population.

Dobson, Roberts and Rawling studied a group of parishes in Northumberland from the mid-seventeenth century until the early nineteenth. Their work deals largely with population movement and gene flow (Dobson and Roberts 1971) and isonymy and inbreeding (Rawling 1973, and Roberts and Rawling 1974).

The work of R.A. Cartwright (1973) on Holy Island off the Northumberland coast is of interest to the Crosthwaite study because of his use of cohorts to examine population change. Several useful hints on cohort analysis were obtained during discussions with Dr Cartwright.

CHAPTER 1

Geographical and historical background

A detailed account of only a short period of a population's history is inadequate unless it is placed in the context of the geography of a region, and in a broader historical framework. The geography, climate, and vegetation of an area determine to a large extent the economy, distribution of population, and mobility of the inhabitants. The comings and goings of earlier peoples leave social, economic and genetic reminders for their successors. For these reasons this chapter provides the broad historical and geographical background to the area.

Geology

The Lake District is the more appealing name given to the region which roughly coincides with the geological feature, the 'Cumbrian Dome'. The dome is the complex end product of phases of sedimentary rock formation, a series of volcanic episodes, and periods of mountain building. Today the oldest rocks have been exposed by glacial action and erosion, and these are the Skiddaw Slates and Borrowdale volcanics which form the heart of the Lake District. The heat and pressures exerted on the rocks during the periods of mountain building lead to the formation of slates of varying quality; the best of these, formed from the tuffs and ashes of the Borrowdale volcanics, are still quarried at Honister Pass in Crosthwaite Parish, and at Langdale and Coniston. Minerals such as quartz, lead, zinc and copper were also formed along old fault lines, and these have been exploited at various times. Volcanic intrusions such as Shap granite have provided a source of building material and roadstone (Shackleton 1973, and Millward and Robinson 1970).

The characteristic lakes and flat bottomed valleys of the region are the result of glacial action on the existing radiating pattern of drainage. The river valleys were scoured into deep U shaped troughs, and as the ice retreated, lakes formed in the hollows left behind. Other noticeable features resulting from the glacial retreat are the hummocky ridges or moraines which straddle many valleys, the bare scraped hill tops, and the hanging valleys with their precipitous waterfalls.

Climate

Overall the Lake District is noted for its cool, damp summers and mild winters. However, the presence of the mountains, and the range of altitudes are responsible for much local variety in climate.

The prevailing westerly air streams ensure a fairly temperate climate. Along the south-west coast of Cumbria the mean January temperature is 41°F, and the mean temperature for the warmest month is below 60°F. The aspect of the mountain slopes and the considerable differences in height above sea level give rise to some variety in temperatures; the higher and northward facing slopes experience lower temperatures than the lower ones or those with a southerly aspect.

Annual rainfall varies considerably from place to place. On the west coast, to the windward of the mountains, the annual precipitation is 40 inches. Further inland, over the fells, the amount rises to 55 inches in Keswick, and well over 100 inches in Seathwaite in Borrowdale, seven miles to the south. In the Eden valley, further east, in the shadow of the Lake mountains, the precipitation drops to 30 inches. In winter, much of this falls as snow, but it rarely settles for longer than a few days in the valleys. The mountain tops are often capped with snow from December until March or April.

The Lake District suffers seasonally from high winds. In the Eden valley the locally named Helm wind rushes down over the Pennines, particularly in spring. Over the fells, cool winds and low rainfall in late spring inhibit grass growth. Sheep and cattle farming are important in the region, and poor grazing at this time of the year can cause hardship to the animals on the fells (Smailes 1960).

Vegetation

Immediately after the last glaciation, the poor thin soils and cool climate only encouraged the growth of grasses and small shrubby plants such as juniper. Gradually, as the climate improved, pine and hazel spread throughout the area, and were replaced in turn by forests of oak and elm in the more fertile lowlands, leaving the higher fells to the pine forests. Pollen analysis suggests that by 3000 B.C. man was beginning to exert an influence over the vegetation of the area. Forest clearance and defoliation of the trees for fodder may have led to the rapid disappearance of the elm woodlands, and take-over by grasses and weeds. The erosion and leaching of the soil caused by this process was the beginning of a steady deterioration in the quality of the soils. Thousands of years of bad grazing practice have provided the Lake District with the type of fellside scenery that exists today. Rough unpalatable grasses, heather and bracken have gradually taken over many of the richer hillside pastures (Millward and Robinson 1970).

The deforestation initiated by the early Neolithic pastoralists of the Cumbrian coast and foothills spread further into the interior of the Lake District, and by the twelfth century only a few areas of forest remained. These were protected hunting preserves such as the vast Inglewood Forest, the Derwent Fells and the Copeland Forest. By the thirteenth century even these natural woodlands had dwindled considerably.

Today there are a few patches of oak existing at a height of about 1000 feet above sea level at Keskadale and Birkrigg in Newlands, and Martindale near Hawes Water. These may be the remains of the natural forest which once covered the whole area (Millward and Robinson 1970).

In the sixteenth and seventeenth centuries private forests of oak, birch and ash were established in response to the great demand for timber to be used in building and as pit props. Some of these plantations still survive at Ashness above Derwentwater. In the southern Lake District coppices of hazel, oak, ash and alder were planted to be burnt into charcoal for the iron bloomeries. These coppices, which were particularly widespread in the eighteenth and nineteenth centuries when the bloomeries abounded, form the characteristic vegetation of much of the southern Lake District today. Private softwood plantations were planted at the end of the last century, but it was at the beginning of the twentieth century, when the Forestry Commission was founded, that the softwood plantations became widespread. Although the vast expanse of softwoods aroused opposition at first, they have now become an accepted part of the Lake District.

Nowadays the heathery or bracken covered fell tops and expanses of forest seem to typify the Lake District vegetation. On the lower slopes of the fells and in the valleys are the scattered Lakeland farms. Much of the lower land is divided into areas of meadow and pasture of varying quality for sheep, beef and dairy cattle grazing. In the past, when the inhabitants of the region needed to be self-sufficient, a certain amount of land was usually given over to crops. Corn, barley and a few root vegetables were grown in the shared open fields for human and animal consumption (Millward and Robinson 1970). Today only the more fertile, flatter areas are used for crops. In the Crosthwaite region only the gently sloping lands near Underskiddaw and around Braithwaite are really

suitable for modern arable farming. Although some fields support oats, kale or turnips, most of the land has been turned over to high quality grasses for pasture (Dewdney and Wardhaugh 1960).

Geography of Crosthwaite Parish

Crosthwaite parish, shown in Figure 1:1, is situated just to the north of the central part of the Cumbrian Dome and is more or less bisected from north to south by the oldest Lake District rocks, the Skiddaw slates and the Borrowdale volcanics. The parish extends to a maximum of eight miles from east to west, and sixteen miles from north to south. Much of the land is mountainous, and settlement is restricted generally to the lower slopes of the fells and the valley bottoms. Place names found in the parish registers and manor court rolls suggest that the pattern of settlement has remained much the same over the past four hundred years. Today the parish consists of farms spread along the valleys, and a few hamlets and villages concentrated mainly on the edge of the broad plain between Derwentwater and Bassenthwaite Lake.

To the north the parish is bounded by Skiddaw, with the hamlets of Applethwaite, Millbeck, Ormathwaite and Lyzzick ranged along its lower slopes. Southwards there is a stretch of low hummocky land extending between Derwentwater and Bassenthwaite Lake. Much of the land near Bassenthwaite is marshy and is liable to heavy flooding. Keswick lies towards the north-east edge of the plain where the land begins to rise towards a col which links the town with the Vale of St John, and Wythburn. Today Keswick is predominantly a tourist centre for the northern Lake District. In the past it was an important market town because of its position near many of the sheep farming, wool producing areas of the north Lakes region, and its accessibility to the larger coastal towns in the west, and market towns in the north. Now only a small Saturday market

6

CROSTHWAITE PARISH

Fig. I·I

Bassenthwaite Lake

N

▲ Skiddaw

Millbeck

Applethwaite

Thornthwaite

R. Derwent

R. Greta

Portinscale

KESWICK

Braithwaite

NEWLANDS

Stair

Little Town

Derwentwater

St. John's Beck

Grange

ST. JOHN'S, AND

CASTLERIGG WYTHBURN

BORROWDALE

Thirlmere

Noddle Beck

- - Parish Boundary
— Roads
Land Over 500 ft.

Rosthwaite

Helvellyn ▲

Seatoller

Stonethwaite

Carlisle ○

M6

KESWICK ○

Whitehaven ○

Kendal ○

Mls.

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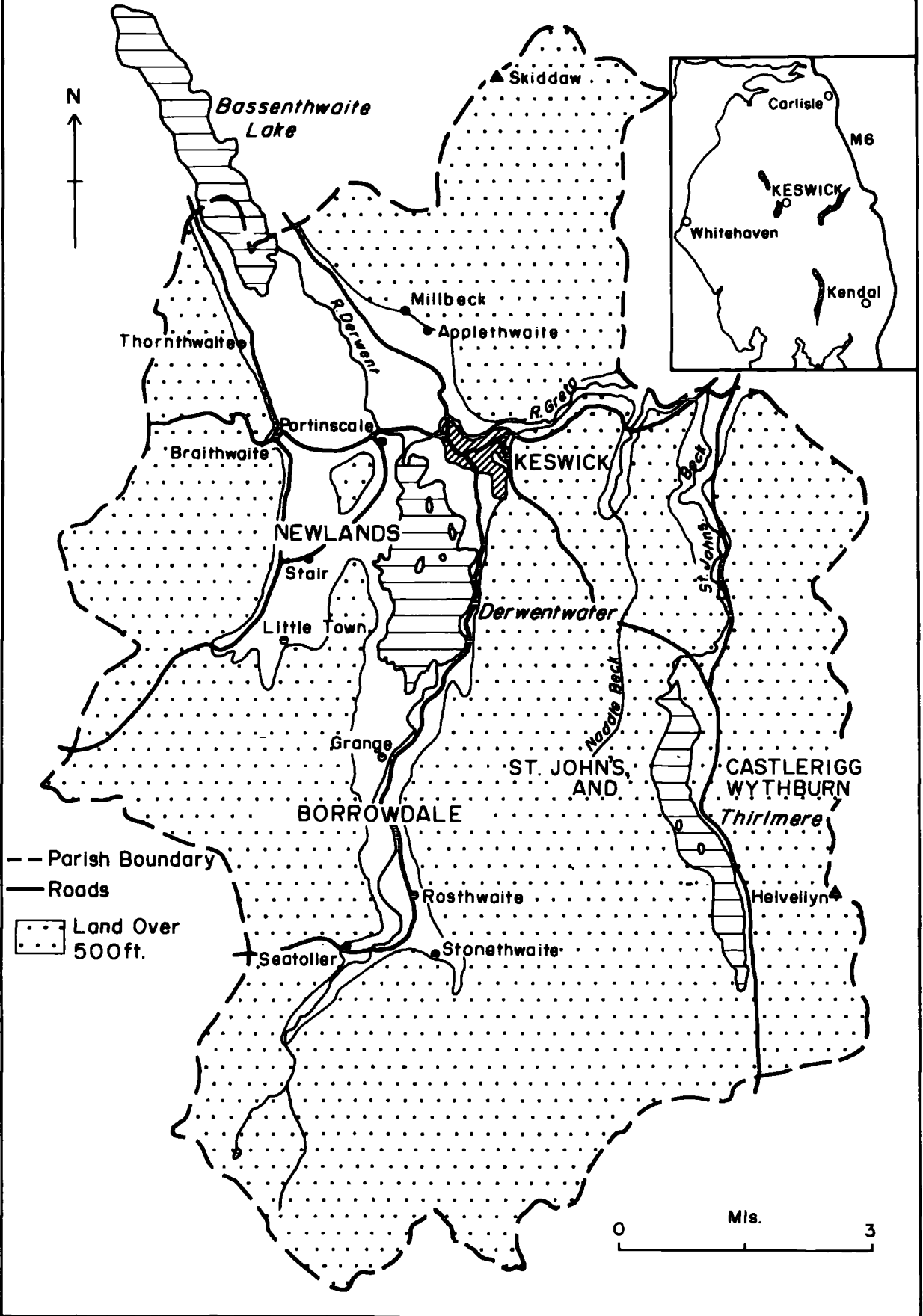
remains. A pencil manufacturing industry thrives using imported graphite. There are also cottage industries producing fancy gifts, and a small workshop which makes beaten stainless steel giftware.

The col above Keswick separates the town quite distinctly from the Vale of St John, and Wythburn, an area which contains scattered farms with clusters of homesteads at Dalehead and St John. Southwards, Thirlmere reservoir fills a valley which once consisted of farmlands sloping gently down to a much smaller lake. A Bavarian-style landscape of softwood forest was established around the lake after the completion of the reservoir at the end of the last century.

West of Wythburn, and south of Derwentwater is Borrowdale. The hamlet of Watendlath nestles high up in a hollow in the hills between Wythburn and Borrowdale, which is a large flat-bottomed valley surrounded by craggy cliffs and mountains. Access to the valley from the north is by the lakeside, past the village of Grange-in-Borrowdale, and through a narrow constriction at the valley mouth known as the Jaws of Borrowdale. The valley floor is patterned with pastures and meadow lands, broken up by the settlements of Rosthwaite, Stonethwaite, Seatoller and Seathwaite. At the southern end of Borrowdale, Honister Pass climbs steeply up to the slate quarries and over towards Buttermere and the west.

Westwards is the Vale of Newlands bounded by the softer, rolling hills of the Skiddaw slates. The head of the valley rises fairly gently towards Newlands Hause which leads to Buttermere and Crummock Water. The land supports sheep and dairy cattle, although some areas have been given over to specialised farming activities such as pig rearing. The only clusters of homes are found at the hamlet of Stair which grew up around a mill, and Little Town which today boasts about forty inhabitants. The valley mouth opens out around Swinside Fell on to the interlacustrine plain, and is occupied by the villages of Portinscale and Braithwaite, with Thornthwaite a little to the west.

Communications

Despite the apparent isolation of parts of Crosthwaite, the area has been a focus for some important routeways in the past. The Romans built several roads in the Lake District which was a region of strategic importance. In typical Roman fashion, many of the roads seemed to ignore physical difficulties, and High Street, for example, ran straight along a mountain ridge east of Ullswater. Few of these roads penetrated the interior of the Lake District, and the majority were confined to the coast, the main north-south routes between the Lakeland mountains and the Pennines, and the broader valleys on the periphery of the mountains. A Roman road ran between Cockermouth and Keswick, and may well have extended to Penrith, providing a link between the main routes to the west and east (Millward and Robinson 1970).

Until the mid-eighteenth century the area was a rather isolated niche in north-west England with poor roads, largely unsuitable for wheeled transport. Although larger centres such as Kendal, Penrith, Cockermouth and Keswick were more accessible, the remoter dales relied on packhorse trails such as the Styhead Pass route from Great Langdale to Borrowdale, and the Easedale route connecting Grasmere with Stonethwaite in Borrowdale (Rollinson 1967). Stockley Bridge, the old packhorse bridge near Seathwaite in Borrowdale now feels the tramp of fell boots rather than hooves. From 1752 turnpike roads were constructed in Cumbria, and in 1757 a carrier-wagon service was established between London and Kendal with a link to Carlisle (Rollinson 1967).

Today most of the heavy traffic moving north and south uses the motorway over Shap which lies to the east of the mountains. The present road from Penrith via Keswick to the coast is one of the main links between the Cumbrian industrial towns and the motorway.

Wythburn Valley and the Vale of St John were once part of an important route from the southern lakes to the northern towns of Cumberland. Today the motorway has diverted most of the heavy, long-distance transport, but the road still carries a great deal of seasonal tourist traffic. The roads through Newlands and Borrowdale are also busy tourist routes in the summer.

Apart from the roads there are many footpaths over the fells providing short cuts between the valleys. These are used by fell-walkers and sheep these days, and it seems possible that some of them were used in the past. Before motor transport they would have provided the quickest means of reaching other valleys and parishes. The tracks negotiated by the packhorses suggest that travellers were not unduly deterred by steep, narrow pathways.

General background history

There is little evidence of continuous occupation of the central Lake District in the Neolithic and Bronze Ages. The Neolithic pastoralists who probably initiated the process of deforestation in Cumbria had their settlements on the coastal lowlands and later on the fringe of hills surrounding the mountain region. Axe 'factories' have been found at Pike o'Stickle in Langdale, Glaramara in Borrowdale, Scafell and Scafell Pike. Rough axes were produced here, and the finishing process was carried out elsewhere, possibly at Portinscale. Other finds in the central valleys suggest that the area was at least being explored, although probably not inhabited on a permanent basis (Fell 1972).

The Beaker settlers of the Bronze Age possibly came from Iberia and Central Europe via Walney Island off south Cumbria, or over the Pennines. These people also preferred the lowlands and upland fringes, but have left behind some evidence of ventures into the central Lake District.

At Castlerigg, near Keswick, there is a megalithic stone circle which may
have served a ritual purpose, but does not necessarily signify a permanent
settlement.

From the Bronze Age until the arrival of the Romans little is
known about settlement in the Lake District. Burials of an East Yorkshire
type, discovered near Crosby Garret, suggest that a Celtic speaking people
had come into Cumbria about 300-200 B.C. - probably via the Pennines.
Once again there is little evidence that the interior of the region was
settled.

The Romans arrived in the region around 70 A.D. and settled
there for about three hundred years. They built roads and forts, mainly
in the areas surrounding the mountains. Civil settlements developed
around many of the forts at Old Carlisle, Maryport, Penrith, Ravenglass
and Brougham, but no villas are known in Cumbria (Fell 1972).

Hill forts at Castle How near Bassenthwaite, and Castle Crag
at the Jaws of Borrowdale, have not been fully excavated. However,
fragments of pottery have been found at the last site, and these indicate
that the place was occupied during or after the Roman period (Fell 1972).
These hill forts were probably occupied by local British populations and
could have been used as refuges early on in the Roman occupation of the
region, or later, when the Scots or Picts raided the area. There are
few place names indicating British settlement in the Lake District, and
those British words that do exist today are usually names of physical
features, such as Blencathra, Derwent, Cocker and Kent. However, a site
at Threlkeld three miles north of Keswick is thought to be British and of
post-Roman date (Millward and Robinson 1970). During the fifth century
the area was part of the powerful British kingdom of Rheged which held
land on both sides of the Solway and was under the dominion of the
Kingdom of Strathclyde. The region came under the influence of Christianity

before and after the Anglo-Saxon invasion. Local saints of this period
include St Kentigern (known as St Mungo north of the Solway) who
established a cross at Crosthwaite, and St Herbert who lived on an island
in Derwentwater.

There is little evidence of much displacement of the local
Britons by Anglians who started to occupy Cumbria in the seventh century.
The Britons appear to have continued under their new Anglian overlords
whose farming economy would not have been disrupted by the Romano-British
way of life (Fell 1972). Place names with the suffixes 'ham' and 'tun'
indicate the extent of later Anglian settlement in the lowlands around the
Solway Plain, the west coastal region, and the Eden valley. Examples of
such names include Addingham, Whicham, Camerton, Irton, Ulverston and
Brougham. Within the central Lake District the few Anglian names that
exist consist mainly of topographical features such as Buttermere and
Rydal.

In the ninth and tenth centuries Norse settlers arrived in the
Lakes. These newcomers were probably of Norwegian origin and came to
the region via the Hebrides, the Isle of Man, or Ireland. The Irish
element 'airghe' (erg) is found in Norse place names such as Sizergh,
Ninezergh, Mansergh, Mosser and Cleator (Fell 1972).

The pastoral Norse were the first inhabitants to exploit and
make their permanent homes in the central Lake District, whose wooded
valleys resembled their homelands. The deforestation which had begun
on the coastlands with the early Neolithic inhabitants now spread into
the mountain regions as the Norse pioneers moved inland. Norse names,
suggesting settlements rather than geographical features only, abound in
the central Lake District. Borrowdale retains many such names, including
Seathwaite (clearing amid the sedge), Rosthwaite (clearing with the heaps
of stones), Seatoller (shieling by the alder tree), and Watendlath (end
of the lake).

Much care is needed in interpreting the distribution of old names. It is possible that earlier ones were obliterated by later arrivals, thus giving only a partial picture of their true coverage. Norse elements were retained in the dialect of the Lakes people up to the eighteenth century. The late appearance in records of farms and hamlets with Norse names may well indicate that they were set up as late as the twelfth and thirteenth centuries (Millward and Robinson 1970).

Very few Viking finds have been discovered. Some graves have been found at Witherslack, Rampside (Barrow-in-Furness), Aspatria and Eaglesfield, away from the centre of the Lake District, and crosses showing Celtic and later influences exist at Gosforth, Aspatria, Cross-canonby, Gilcrux and Isel.

Evidence suggests that the Anglian influence was disrupted by the Viking settlement and expansion and that there was a revival of the old British (Celtic) kingdom of Strathclyde which reclaimed part of the Lake District. Part of the region was submitted to England by the Strathclyde and Scottish kings in 927 A.D. (Fell 1972), but it was to change hands several times.

The Lake District was little affected by the Norman conquest for thirty years or more. At that time the northern part of the region belonged to Scotland. After its acquisition by William Rufus, peasants were despatched to the area to settle and farm there. Although it was firmly established under the English by the twelfth century, Scottish cattle raiders made regular sorties into the area for many centuries.

The twelfth century was a time of growth and expansion in England as a whole, particularly in urban areas. Around this time many Norman villages arose in the lowlands north of the Lake mountains. This appears to have been a deliberate policy to strengthen the Norman political hold in the north-west (Millward and Robinson 1970). The abbeys of Furness,

Calder, St Bees, Carlisle, Holme Cultram and Shap were founded along the periphery of Cumbria at this time. In the late twelfth and thirteenth centuries grants of land in the interior region were made to the abbeys. In Crosthwaite, Furness Abbey was allocated land in Borrowdale; Grange-in-Borrowdale is the site of the monastic farm. Fountains Abbey of Yorkshire was granted the church and mill at Crosthwaite, Derwent Isle, Watendlath, and Langstrath with Stonethwaite off Borrowdale. Disputes over the ownership of the thriving dairy farm at Stonethwaite arose between the two abbeys in the fourteenth century and, after a few changes of hands, it was eventually returned to Fountains. The abbeys played a very important part in the wool trade at the time and apart from selling their own wool they acted as middlemen for the local sheep farmers (Millward and Robinson 1970).

By the twelfth century much of the original forest had disappeared although the hunting preserves of Inglewood, Derwent Fells and Copeland were still intact. New settlement was forbidden in these forests but population pressure meant that gradual encroachment into the woodlands was inevitable. The subdivision of the larger parishes into smaller chapelries to serve the more isolated communities indicates the extent of settlement at that time.

During the fourteenth and fifteenth centuries population growth slackened, following the general European trend. The Black Death is known to have reached the region in 1348, with further outbreaks of plague in 1361 and 1362 (Millward and Robinson 1970). Frequent sorties by Scots cattle raiders, particularly in north Cumbria, contributed to the hardships of the time.

In the late fifteenth and early sixteenth centuries the monasteries enjoyed a period of prosperity and extended their lands before being destroyed by Henry VIII. Around this time a type of rural middle class, represented by the 'statesman', arose in the region. The statesman

was a tenant farmer who had the right to pass on his lands to his heirs on payment of a small sum. In return for this arrangement he paid a fixed annual rent and had to be available for military service to his landlord. Following the economic depression of the fifteenth century, and the dissolution of the abbeys, many statesmen benefited from their fixed rents during the period of inflation and became wealthy through the sale of wool, cattle and timber. From Tudor times they began to become freeholders.

Much of the statesman's wool was sent to Kendal where a flourishing spinning and weaving industry had developed. These industries were also found on a smaller scale as cottage industries and were concentrated in particular areas such as Grasmere (Rollinson 1967).

Sheep farming was the main concern of the farmers of the time. The poor soils and climate were unsuitable for arable farming but certain crops such as skegg (oats) and barley were grown for bread and for animal consumption.

During 1564 and 1565 the Company of the Mines Royal was founded under the management of a German company which undertook to provide skilled miners from the Tyrol and Styria to mine for copper, silver, gold and quicksilver (Collingwood 1912). It is possible that about 120 men arrived in Crsothwaite throughout the period of approximately forty years that the mines were operated by the Germans (Bouch and Jones 1961). The most important mines were at Goldscope (Gottesgab) and Dalehead in Newlands. Others were opened at Barrow, Brandlehow and Ellers near Grange-in-Borrowdale in Crosthwaite parish, and further afield near Caldbeck, Grasmere and Coniston. Smelthouses were built at Brigham on the north side of Keswick and later at Coniston. It seems that there was some ill feeling between the Germans and the local people initially and Queen Elizabeth herself asked the local Justices of the Peace to ensure that the Germans were

protected (Collingwood 1912). Any bitterness between the miners and the Cumbrians was either very short-lived or can only have existed between some members of both communities. As early as 1565 the Germans were marrying local girls. Some of the German names remained in Anglicised form until the seventeenth century and one or two can be found in the parish records in the eighteenth century. These include Zenogel and Hechstetter.

By 1600 the mining operations in the Keswick region were suffering from financial problems. These, together with prospects of rich copper veins in the Coniston area, led to a decline in the mining activities in Crosthwaite. During the Civil War the smelthouses at Brigham were destroyed by troops.

In the sixteenth and seventeenth centuries wool and mining were not the only industries in the area. Charcoal burning was important as supplies were needed for the smelting activities of the copper mines and for the manufacture of crude iron. The ore was brought from sources at Furness to the charcoal burning regions where bloomeries were set up. Crosthwaite had a bloomery on Rampsholme Island on Derwentwater. Charcoal was also an ingredient of gunpowder and its production for this purpose retained its importance well into the nineteenth century.

The eighteenth century saw the beginning of the decline of the statesman. Bad winters from 1738-41, 1784-85 and 1792-95 ruined many farmers and caused much hardship in the area (Millward and Robinson 1970). The presence of a poor house, recorded in the parish registers from the 1750s onwards, indicates this. Smallpox is recorded in Cumbria in 1728-29 and this would very likely have added further hardship to the economic crises being suffered.

The enclosure of open fields and commons had begun in the seventeenth century and was well under way in the coastal areas by the

eighteenth century. The high price of wool encouraged some statesmen to enclose areas of the lower fells to improve pastures; today the dry stone walls built at this time are still to be seen winding up the steepest fellsides (Rollinson 1967). Many arable areas in the central Lake District avoided enclosure until well into the nineteenth century, and the unfenced strips which escaped the general 1836 Enclosure Act finally disappeared about 1860 (Millward and Robinson 1970).

During the late eighteenth century the cottage industries began to decline and industry began to develop on the coast where coal was mined. At this time Whitehaven was one of the four most important ports in England. Keswick acquired its own industry, manufacturing pencils, using local high quality supplies of graphite. The valuable graphite from Seathwaite in Borrowdale ran out in the early 1830s and the industry has relied on imported supplies since. Although slate quarrying was carried out at Honister Pass near Borrowdale in the seventeenth century this industry increased during the eighteenth century (Rollinson 1967).

Early tourist 'adventurers' were already exploring the central Lake District in the late eighteenth century, and some tourist attractions such as regattas on Windermere, Bassenthwaite Lake and Derwentwater were staged. Hostels sprang up in some of the towns and elements of commercialism such as boat hiring on the lakes developed. By the 1830s tourism had become quite important and hostelries were even found in some of the remoter valleys. The first railway from Kendal to Windermere was opened in 1847 and soon after this the railways reached other holiday centres; Keswick was connected with Penrith in 1865. During this period the ease of travel from the larger cities of the north, such as Manchester, encouraged many of the wealthier people to build permanent or second homes in the area, and large rows of terraced villas spread around the small towns.

While the tourist industry was already thriving in the mid nineteenth century there was a revival of some of the local mining activities. The Coniston copper mines which had been opened up again in the eighteenth century began to use modern techniques to increase productivity, and during the 1850s and 1860s they reached a maximum output. This gradually declined until the veins were worked out, and in the early twentieth century after the search for copper had ceased the mines were exploited for their barytes deposits. In Crosthwaite the Goldscope mine, Newlands, and the Brandley mine at Brandelhow on the lakeside, were re-opened to exploit the lead ores which had been discovered but not fully used by the Germans. The ore was crushed and dressed at the site. The giant water wheel which provided power at the Brandley site was a tourist attraction of the times. By 1860 most of the ore in these old mines had been worked, but in the late nineteenth century rich lead-bearing veins were discovered in Barrow in Newlands. By the early twentieth century these mines had also been abandoned.

The advent of steam meant that industries did not need to be located near the sources of water power, and much industrial plant was transferred to large centres such as Birmingham. Some, however, still relied on water power, and mills for bobbin making and paper making were established in the Lake District. At Millbeck near Skiddaw, fulling and carding mills were built in the early nineteenth century, and blanket material, flannel serge, carpets and kersey were manufactured in large quantities and despatched all over Britain. By the mid nineteenth century competition increased from the Yorkshire manufacturers, trade began to decline, and the mills closed (Millward and Robinson 1970).

While these small water-powered industries were thriving in the mountain areas, the greatest industrial development in Cumbria was taking place on the coast where the coal and haematite resources were being fully exploited and iron and steel industries were growing.

It is interesting to speculate whether the growth of industry in the area, and Britain as a whole, encouraged greater mobility of populations. Marshall (1971) refers to an account issued by the Constables of Derwent Ward between 1847 and 1851 in which 42,000 'vagrants' were recorded in 1848 alone. Unfortunately no mention is made of the origins or destinations of these people.

By the end of the nineteenth century most of the industry in the central Lake District had declined. Today, apart from the slate and granite quarries and some local specialised industries, the region is predominantly agricultural. Only a few overgrown spoil heaps and mine shafts hint at the activities that went on over a period of three hundred years or more.

In 1895 the National Trust was founded. The Honorary Secretary, Canon Rawnsley, was a Vicar of Crosthwaite and naturally he retained a particular interest in the Lake District. The Trust bought sites of archaeological interest, resisted projects which it considered harmful to the region, and bought areas of woodland and open fell for public access. In the 1940s an area of just under one thousand square miles, from Caldbeck to Cartmell, and from Gosforth (in the west) to Shap, was made into the Lake District National Park. Since then, great efforts have been made to retain the farming and character of the region in the face of a growing demand for transport, accommodation and recreation facilities (Millward and Robinson 1970).

The creation of a National Park indicates the importance of the area as a tourist region in the twentieth century. However, the central Lake District does not only see a flow of people during the busy summer months. In recent years the towns and villages have seen the arrival of a new section of the resident population. The area has become increasingly popular as a place for retirement. The influx of elderly

people has contributed to a change in the structure of the population. Young people have been moving away to find work in larger towns. Also competition for housing has increased between young native-born inhabitants and the new residents who are older and wealthier. This has caused inflated house prices and has forced many young couples to move to cheaper areas.

During the twentieth century the Lake District has undergone important changes. Its economy has become increasingly dependent on tourism and its population has aged. New roads from the south and within the area have made the region more accessible to summer visitors.

CHAPTER 2

Material and Methods

There are many potential sources of data for research into historical demography and these include wills, muster rolls, hearth tax returns and parish registers. Individually, most of these throw light on only a small section of the population, such as property owners or men eligible for military service. The Anglican parish records, although by no means perfect, provide a fuller picture of the past than any other single source. On the whole they give some information on a wide cross-section of the population of a parish.

A brief history of parish registers and an outline of the major causes of registration deficiencies are given in the Appendix.

The contents of the Crosthwaite registers

Until 1812, when standardised forms were issued, the amount of detail given in most registers was very variable and, more often than not, is inadequate for much research. The type of information contained in the Crosthwaite records is as follows:

Baptisms. Typical examples of entries until the end of the eighteenth century are:

> 10 August 1589   Marye daughter of John Wharton of Keswyck
> and Magdalene
>
> 1 April 1627   John son of John Birkett of Portinscalle
> and Jennett

The Christian name and surname of the child, and the Christian names of both parents, and the place of residence were usually recorded.

Place of residence was the most common omission in these entries,
particularly in the early seventeenth century.   Occasionally the father's
occupation or status was included.

18 April 1574	Janet Pughparker daughter of Symon Pughparker, Duchman (German) and Janet
13 May 1610	Joyse daughter of Johne Hohnsone, poore man and Jaine
29 March 1744	Joseph son of Mr Thomas Christian, Vicar of Crosthwaite and Emma (his wife)

Until the mid eighteenth century, the baptisms of illegitimate
children nearly always gave the names of both parents and were entered in
a number of ways.   After then the name of the mother only was given.
The detail in the first example is exceptional.

3 April 1580	John son of Persevell Howe of Keswyck single man and Elizabeth Ringrisell, Andray Ringrinsell wyfe, Duchman, base gotten
10 November 1605	George son of Anas Bowe and she confesseth that John Stanger of Portinskell is the father of it

After about 1780 the baptism records became far more detailed
and included the mother's maiden name.   The father's occupation and the
date of birth or age of the child were often given.

14 October 1787	Jeremiah son of Daniel Wane and Hannah his wife (late Bell) of Keswick
11 October 1789	Fletcher Clark son of John Ray and Sally his wife (late Tyson, heretofore Clark) of Keswick: this child was three year old when christened

Figure 2.1(b)   BAPTISM AND DUMMY MARRIAGE RECORD CARDS -

CROSS REFERENCED

Baptism Card

MAYSON	M	10462
John		
14.3.1628/9	*DMR 1623*	(William
		(Katherine
Eakin		

Dummy Marriage Card

MASON		DMR 1623	
William Mason			Katherine
Katherine	*10687*	*19.12.1624*	*Newlands*
* *John*	*10462*	*14. 3.1628/9*	*Eakin*
William	*9604*	*6. 5.1632*	*"*
Isabel	*9043*	*29.11.1634*	*"*
Elizabeth	*8708*	*19. 1.1637/8*	*"*
Robert	*8158*	*1. 4.1643*	*"*

Italic type denotes cross referencing

Figure 2.1(a)   EXAMPLES OF BAPTISM AND MARRIAGE RECORD CARDS –

CROSS REFERENCED

Baptism Card

TICKELL   F   12151

Elline

6.1.1607/8   8.7.1599 (John
                                            (Mabel *Studdert*

Skellgill

Marriage Card

TICKELL/STUDDERT   8.7.1599

John Tickell   Mabel Studdert

Skellgill   Hawse End

Richard	*13492*	*2. 2.1599/1600*	*Skellgill*
Janet	*12613*	*10.7.1603*	*Hawse End*
Winifred	*12614*	*19.6.1605*	*Skellgill*
* *Elline*	*12151*	*6.1.1607/8*	*"*
Anne	*12152*	*3.12.1609*	*"*
George	*11932*	*8.12.1611*	*"*
Mabel	*11808*	*24.8.1614*	*"*
Dorothy	*11374*	*6.8.1617*	*"*
Hugh	*11375*	*6.8.1617*	*"*

Italic type denotes cross referencing

Marriages.   Until the Hardwicke Marriage Act of 1753 (see Appendix)
the content of the Crosthwaite registers remained much the same.
Generally the full names of both partners and their place of residence
were given.   Sometimes their previous marital status or their occupations
were included.

6 July 1600	John Fisher of Snabbe and Jennet Fisher
	of Birkryge
23 June 1619	James Brathwaite, pedler a travaylor,
	and Anne Peale of Newlands
31 October 1731	Mr Timothy Nicholson of Whitehaven and
	Mrs Elisabeth Brownrigg of Ormathwaite

During the Commonwealth period few marriages were entered in
the records.   Those that were included the same information recorded in
previous years, with the addition of the name of the Justice of the Peace
who married the couple.   After the Hardwicke Marriage Act of 1753 the
name of the parish of residence was substituted for the actual place of
residence.   Crosthwaite residents had the name of the parish omitted
altogether.   By 1760 the names of the witnesses were also given.

26 May 1760	Simon Graham and Ann Todhunter
	W. Thos. Wilson, Mary Wilson

For the whole period studied, the names of the parents and the
ages of the couple were very rarely included.

Burials.   The quality of the burial entries varied frequently throughout
the period studied.   On the whole, the name and place of residence of
the deceased were recorded.   Information such as 'infant', 'widow', or
'widower' was often added after an entry, but the parent or former spouse
was rarely recorded until about 1730.   The term 'infant' seemed to apply

to children up to the age of about six years.   Sometimes the name of
the deceased was not given and the description 'child of' or 'wife of'
was recorded.   The cause of death only seemed to be added in particularly
unusual circumstances, such as in a case of drowning.   Age at death was
not included until the end of the eighteenth century.

9 June 1589	William Gaskarth of Wantwhait
16 May 1645	The child of John Buntting of Moure
27 July 1718	Elianor Fisher of Keswick: widow

After the 1730s the name of the father or husband of the dead
person was recorded regularly, and from 1772 the age and occupation of
the deceased was nearly always given.

2 April 1742	Ann daughter of William Dover of Cowdall
21 July 1772	Ruth wife of John Wren of Birket Bank, aged 74
27 December 1782	Joseph Fisher of Keswick, labourer, aged 54
27 December 1796	John Crosthwaite of Poorhouse, aged 93

Method of analysis of the Crosthwaite registers

The Crosthwaite registers were obtained by several means.
Two printed volumes of transcribed records provided information from 1562-
1812.   These included extra entries or variations recorded from the
Bishop's Transcripts (see Appendix).   From 1776 onwards the various sub-
divisions of the parish ⁻ the chapelries - began to keep their own records.
Those of Thornthwaite-cum-Braithwaite, and St John's, Castlerigg, and
Wythburn were available on microfilm obtained from the Cumbrian County
Record Office.   Those of Newlands and Borrowdale were copied from the
registers found in the churches.

Each registration entry was copied on to a separate 6" x 4" record card, set out as the examples in Figure 2.1 show. The baptism entires were given identity numbers as it was considered at the time that this would be of assistance in distinguishing between similar entries occurring within a short space of time. Originally the marriage records were also identified in a similar manner, but this proved unnecessary as there were fewer entries, and sufficient information was present to prevent any confusion.

The baptism entries were grouped into families where possible and these were filed in alphabetical order of surname. Within each surname group the families were filed in alphabetical order of the father's first name. Thus the family of Abraham Bowe was followed by that of Amos Bowe. Where there were several fathers with the same names, such as John Fisher, the families were arranged in chronological order. Although burials were not grouped into families, they were filed in alphabetical order in the same manner as baptisms.

Marriages were grouped rather differently. Within specified periods of ten years, such as 1570-79 and 1580-89, they were arranged in alphabetical order of the husband's name. Thus for the period 1570-79 the marriage of John Grave and Anne Fisher in 1572 was followed by that of Robert Grave and Elizabeth Bowe in 1571. For the period 1580-89 there was another set of marriages filed in the same way. At a later stage this simplified the process of linking various types of records.

Broadly speaking, there are two ways of analysing parish register material, known as aggregative analysis and family reconstitution. These have been fully described by Eversley (1966b) and Wrigley (1966).

Aggregative analysis is concerned with major changes in vital events, and the type of data required consists basically of annual figures of baptisms, marriages and burials. Once the records have been collected and filed in a manner such as the methods described above, it is possible

to calculate information such as male/female baptism ratios and family
size. In aggregative analysis, the data are generally grouped into five
or ten year periods to overcome minor annual fluctuations caused by possible
registration deficiencies. In small parishes, in particular, the annual
variation in the numbers of entries is sometimes considerable (Eversley
1966a), and single year figures tend to mask the underlying trends.
Although Crosthwaite was a sizeable parish with a possible population size
of around 1400 in the late sixteenth century, the figures are arranged in
twenty year groupings. This provides figures which approximately span
one generation and yet are small enough to enable major trends to remain
visible.

Another method of revealing the major trends is the use of the
moving average. In the case of parish register material it involves
taking the total number of baptisms (or marriages or burials) over a
specified period of years (for example, nine years from 1562-70) and
calculating the mean per annum for this period. This figure is then
allocated to the middle year, which in this case is the fifth year, 1566.
To calculate the mean for 1567, the figures for 1563-71 inclusive are
summed and averaged, and so on for later years. The actual number of
years grouped together for the calculation of the moving average depends
very much on the frequency of the natural major fluctuations which should
be distinguishable from the annual changes. In Crosthwaite, the main
fluctuations appear to occur every nine to eleven years, and a nine year
moving average is considered applicable.

Family reconstitution is more involved than aggregative analysis
and relies considerably on the degree of detail and accuracy of the register
entries. It entails linking up individual records of persons so that a
'life history' is available for analysis. In any parish the amount of
detail available is inadequate to build up a complete history of every
person, and in Crosthwaite only a few types of link were attempted.

The first step after filing was to attempt a link between the baptism register 'families' and their parents' marriages. When a link was established, the marriage and baptism cards were cross-referenced in the way shown in Figures 2.1(a) and (b). By doing this, marriage information was made available on the alphabetically listed baptism record cards, and baptism information on the chronologically grouped marriage cards. This procedure in itself provided some information; it revealed the numbers of childless unions as well as those baptisms for which no record of parental marriage existed.

In all parishes there are married residents for whom no record of the marriage exists locally. This can occur when a local man marries in another parish and then brings his bride to his own home to live, or when both partners come from another area. When a family could not be linked with a local marriage it was allocated a 'dummy marriage'. These were recorded in a similar manner to the actual marriages, as Figure 2.1(b) shows. There was no information on the bride's surname, either partner's place of residence, and the actual date of marriage. An assumed date of marriage one year prior to the first recorded baptism was allocated to each dummy marriage. This was undoubtedly inaccurate in most cases, but it was considered that the use of such a device was preferable to the exclusion of all the dummy marriages which constituted a large proportion of the total number of marriages during some periods. Moreover, they were used at a later point to help ascertain the amount of immigration. The dummy marriages were filed separately from the actual recorded marriages, but in the same way.

The only other link attempted fully was that between the baptism of females and their first marriage. This was done to calculate the age of women at their first marriage. In this instance, the chronological grouping of marriages, and the cross-referencing of marriages and baptisms,

proved useful. The actual procedure used was to study the marriages for each period of ten years and to trace the baptism of the bride. It was a fairly simple matter to search for the bride's parents' marriage or dummy marriage in previous ten year groupings and to find the baptism of the bride recorded on their record card. This process was much quicker than searching through all the baptism records belonging to the bride's surname.

A link was only made between two records if there was enough similar information on both entries to distinguish them from other possible linkages. Any ambiguous links were discarded and this therefore meant that the actual numbers of links accepted represented only a sample of the total possible links. Individuals with uncommon surnames or Christian names provided few problems. However, in Crosthwaite, a number of surnames were particularly common, and this, combined with the limited selection of Christian names in vogue at various times, often made linkages difficult. In many cases, unless other information such as place of residence, age or occupation was given, it proved impossible to sort out the numerous contenders for one linkage.

Misspelt Christian names and the use of pet names also caused problems. This study generally followed Steel's (1968) lists of name variations to deal with the problem. On occasion, however, records were linked even when there were quite noticeable variations in spellings. Such instances usually involved individuals with unusual surnames. For example, a sequence of baptisms gave the mother's name as Alice, Ellis, Ellen, Eleanor, and finally Alice again. In this case, a fairly logical series of mis-spellings could be seen, and the presence of the original name at the end suggested that the same woman was meant throughout.

No serious attempt was made to link the burial records with the baptisms or marriages. The lack of detail on most of them made it impossible to link them unambiguously.

Pre-census population size estimates
_____

With the Crosthwaite material limited use was made of both

aggregative analysis and family reconstitution.   In their own right these

methods provide interesting and useful information for studies in historical

demography.   However, for a fuller picture of changes in vital events,the

figures obtained need to be related to population sizes to provide figures

such as baptism and burial rates which can be compared over several periods.

One problem encountered by historical demographers concerns the

calculation of population sizes before the 1801 census.   A number of attempts

have been made to establish population sizes before the nineteenth century

and various sources have been utilised.   Two will be discussed here.   The

first source is the baptism and burial material from the parish registers

and the second consists of early tax returns and household counts which are

adjusted to give estimates of population size.

John Rickman and G. Talbot Griffith are probably most well known

for their use of parish register material to establish pre-census population

sizes.   Rickman produced two series of figures for eighteenth century

population sizes.   The first was published with the 1801 census report and

the second after his death, in the 1841 census report.   His first series

showed population sizes for England and Wales for every tenth year from 1700

onwards (Griffith T. 1926).   These figures were based on two sources - the

enumerated population of 1801, and the numbers of baptisms for every tenth

year from 1700-1780, and every year after that.   He obtained the last

information from incumbents throughout England and Wales.   His method

involved taking the baptism rate for 1801, using it as a constant, and

applying it to the numbers of baptisms for the previous year to obtain

population sizes.   Although he added a correction factor in his later figures,

there still remain many criticisms of the method.   No allowances were made

for migration, and his pre-1780 figures were for single years only.   Baptisms

can fluctuate considerably from year to year, and so a population size based on figures for one year in ten can give very misleading estimates. Rickman also based his estimates on baptisms only and did not take into account any natural increase - the excess of baptisms over burials, or births over deaths. His method obviously only gave the highest population sizes for the years which had the highest numbers of baptisms. However, it is quite possible that very high burial rates in the same years might have given smaller population sizes. Rickman's later figures did take marriages and burials into account (Griffith T. 1929). One of the main criticisms concerns the use of a constant baptism rate for the whole eighteenth century. There is no evidence whatsoever that the rates were constant and, in fact, the increase in dissent in the latter part of the century would have reduced the number of recorded baptisms, thus giving an artificially low estimate.

G. Talbot Griffith (1926) was influenced by Rickman's figures and he attempted to produce a more satisfactory way of calculating pre-census population sizes. He related the numbers of baptisms as found in the parish registers to the numbers of births in the civil registers for 1841; before then he considered them unreliable. He worked out that the baptisms needed to be inflated by 15% to bring them into line with the birth rate after civil registration. He also calculated a correction of 10% for marriages and burials. He then used these to work out the natural increase for pre-census dates and to calculate population sizes. Griffith himself admitted the possibility of error using a constant correction value over periods when the degree of dissent may have varied considerably, but felt that it was probably the best estimate available considering the imperfect data. This correction factor has been used in historical population studies (Eversley 1956/7) but no attempts have been made to apply it to the Crosthwaite data. Fruitless examinations of non-confirmist records have thrown no light

on the degree of dissent in the parish and there seems to be no justification for the use of Griffith's figures in this case.

Although there were no full censuses of the population prior to the turn of the nineteenth century, local population counts were attempted in some areas. In Cumbria, for example, a survey of households was used by Thomas Denton of Carlisle to calculate the population of 72 Cumberland parishes in 1688, and in 1747 Chancellor John Waugh counted families in the Diocese of Carlisle to obtain another estimate of population size. The raw data for these particular surveys appear to have been lost, and the methods used to establish the average number of persons per household or family are not clear (Bouch and Jones 1961).

Several papers have been produced to suggest methods for calculating the average number of persons per family, hearth, or household, as counts of such units are the most common sources used in population size estimates.

One of the earliest counts was undertaken by Gregory King towards the end of the seventeenth century. He used information from baptisms, marriage and burial registers to calculate a ratio of individuals to households for three different types of population. These were the city of London, other cities and market towns, and villages and hamlets. His material appears to have been selective, and Glass feels that his London sample, which gave a figure of 5.4 - 6.0 individuals per household, was unrepresentative and gave too high a ratio (Glass and Eversley 1965). His crude average for urban areas was 4.5 individuals per household and 3.92 for rural areas. Glass believes that some of King's statistics were possibly based on data produced by John Houghton in 1692 and that these gave rather low figures on the whole. He considers that there is not much evidence to substantiate King's ratios.

Krause (1957) tackles an estimate made for the late medieval household size by Professor Russell (1948). He considers Russell's estimate of 3.5 individuals per household too low, except perhaps for certain brief persons, and suggests that 4.5 - 5.0 is more realistic.

Laslett (1969) points out that a major problem in working out person to household ratios is the definition of 'household', which appears to have varied considerably. His own work was based on a sample of 100 parishes where population size, numbers of households, and, in some cases, details of household structure, were available. He concludes that although the structure and range of household size seemed to vary over time, the average numbers of persons per household appeared to remain fairly stable. He arrives at a mean of approximately 4.75 persons per household, but stresses that this should not really be used as a multiplier to establish population sizes.

The conclusions reached by these authors make it obvious that any one of the person to household ratios could provide dubious estimates of population size should they be used as multipliers. Where information other than the numbers of households is lacking, it is tempting to put forward some possible estimates of population size using such ratios. Bearing all the problems in mind, estimates using ratios of 4.5 - 5.0 have been used on some Crosthwaite and Cumbrian data as these seem to be in the region most favoured by recent authors. The calculated population sizes are certainly not meant to be taken as correct, and really only serve as crude indications of possible changes over time.

CHAPTER 3

An outline of the population change in Crosthwaite

parish 1560-1970

This section considers some of the main population trends
during the period covered by the thesis (1560-1800) using the parish registers
as a source of raw data. The nineteenth and twentieth centuries saw much
population growth in the area, and although they are beyond the scope of
the thesis, an outline of some of the main changes is included. The
contents of the censuses, available decennially since 1801, have varied
over the years and the earlier ones contain very little detail. However,
they are sufficient to enable a superficial examination of population
change.

1562-1800

Although it is not possible to find regular and reliable figures
of population size before the first census in 1801, estimates can be made for
a few dates before the nineteenth century. These give some indication of
the extent of population growth from 1560 to 1800.

In 1563 a count of households in various parishes was made for
the Church (Harleian MS 594). Crosthwaite had 320 households. If it is
accepted that there was an average of 4.5 to 5.0 individuals per household
(see Chapter 2), Crosthwaite had a population of between 1,550 and 1,600 in
1563. When the parish registers were well established in the late 1560s
the baptisms and burials were in the region of 95 per annum and 55 per annum
respectively (see Figures 3.1 and 3.2). This would give very rough baptism
rates of 59.3 per 1000 (assuming a population size of 1,600) and 65.9 per
1000 (assuming a population size of 1,440). Burial rates would be between
34.3 per 1000 and 38.1 per 1000. These figures are obviously not reliable

Fig. 3.1 BAPTISMS AND BURIALS IN CROSTHWAITE PARISH 1562-1810
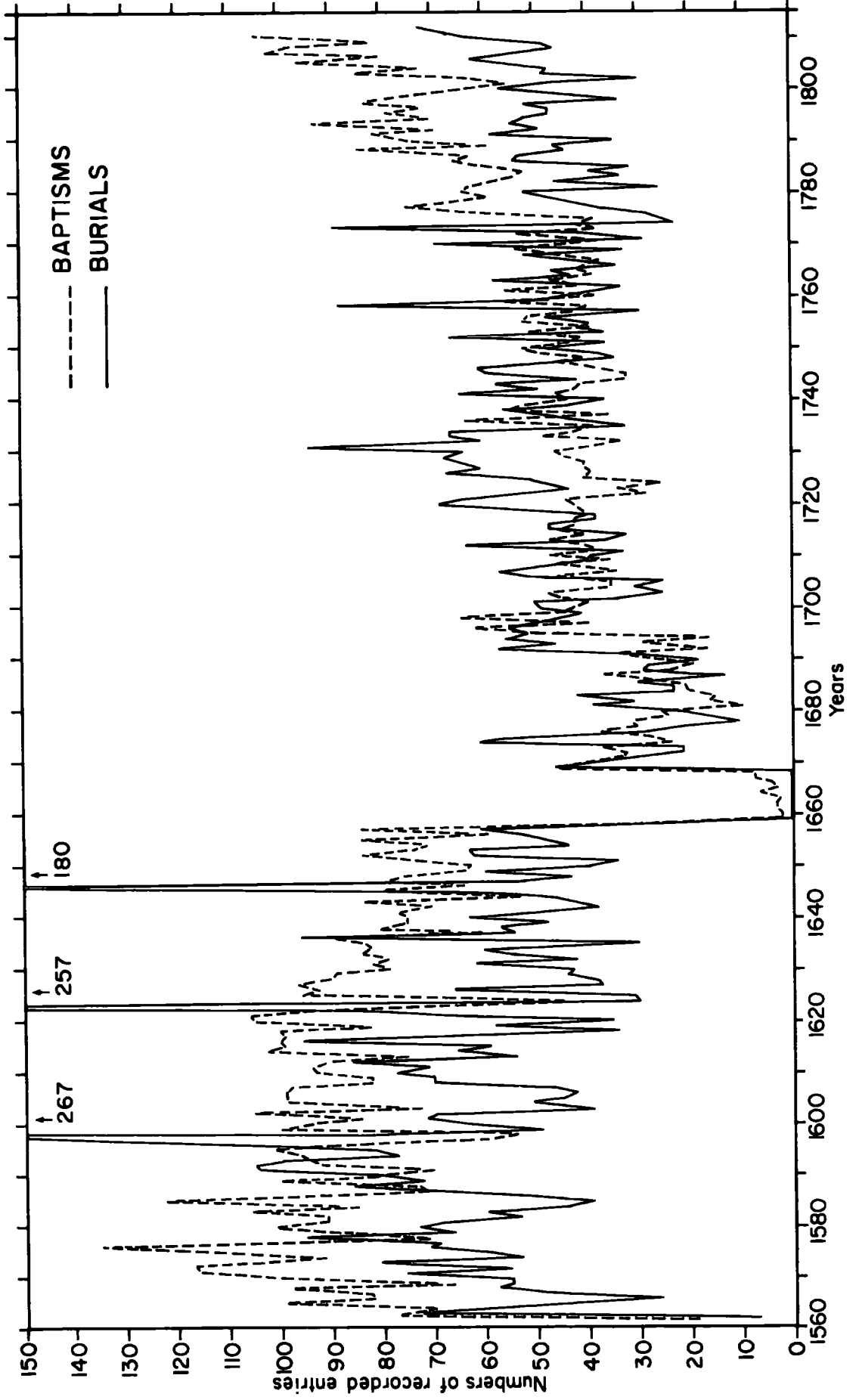
Fig.3.2 BAPTISMS, BURIALS AND MARRIAGES - 9 YEAR MOVING AVERAGE
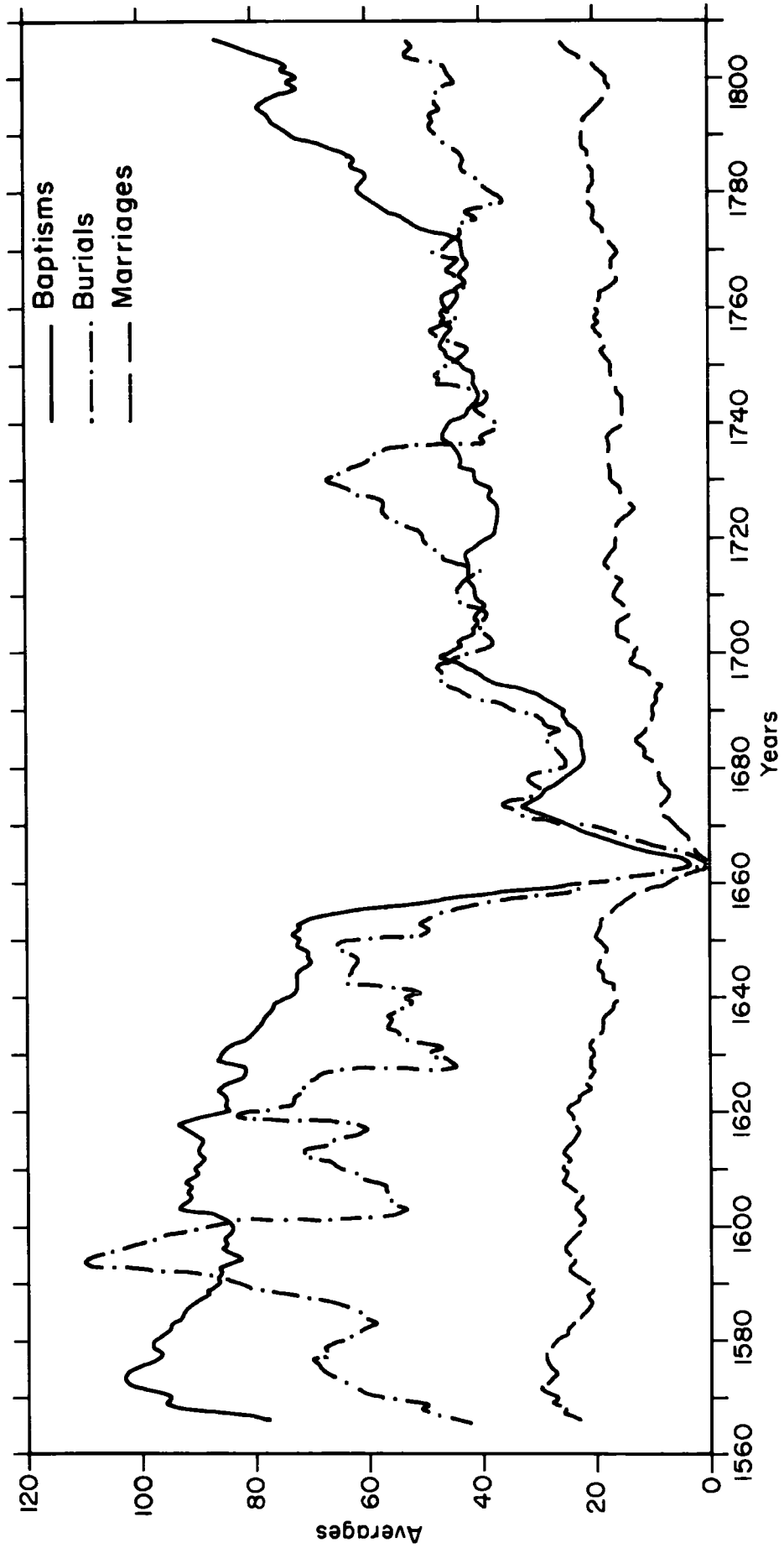
because they are based on very poor estimates of the population size.
The increase in the numbers of baptisms and burials at the beginning of the
1560s can be accounted for in several ways. The registers began half way
through 1562, thus giving a small number of baptisms and burials for that
year; this affects the moving average shown in Figure 3.2. A slow
acceptance of registration in the parish may also have led to low figures
early on. An increase in population size was occurring in England as a
whole around this time (Chambers 1972). This was accompanied by a rise in
the demand for corn and foodstuffs, and the farmers and landlords benefited
from the rising prices ensuing from this demand. It is probable that the
effect of population and price increases varied locally, and it is difficult
to establish whether the Cumbrian farmers gained any advantage. Certainly
this period marked the appearance of the statesman - the rural middle class
that had developed from the tenant farmers of earlier years. The population
was also swollen from 1565 onwards when German miners from the Tyrol and
Styria arrived in the parish (Collingwood 1912). Crosthwaite (1881-1882)
records that permission was asked of Queen Elizabeth for three to four
hundred miners to be brought to the area. The men arrived in small numbers
throughout the period that the mines were in operation (Collingwood 1912).
Bouch and Jones (1961) estimate that only about 120 men eventually came.
Some of them maintained wives and families back in their homelands and
subsequently returned to Germany (Collingwood 1912). A few brought their
wives with them and others married local girls and had children baptised in
the area. It seems possible that the increase in baptisms and burials during
the 1570s and 1580s was due in part to the influx of Germans. Bouch and
Jones (1961) consider that this could have led to a population size of over
2000 individuals by 1590. It is difficult to substantiate this claim.

By the 1590s there were already signs of a steadying in the numbers
of baptisms and a very slight but fairly constant decline in the numbers of
marriages. In 1596/7 there was an outbreak of plague with resultant high

mortality. In 1597 there were 267 burials recorded in the registers - about three times the usual number.

By the early 1600s local mining activities were in financial difficulty and many of the miners moved to the more successful workings at Hawkshead and Coniston. Here baptism entries are found for children of Germans who formerly lived in Crosthwaite (Collingwood 1910). Some of the men returned to Germany but those with local kin ties remained in Crosthwaite.

Although explanations of local significance may have been important in accounting for the high levels of baptisms and burials in the late sixteenth century, and for the gradual decline in the early seventeenth century, it seems that the parish was also following a national trend. Chambers (1972) suggests that the demographic boom described earlier in this chapter was disrupted by occasional epidemics and was succeeded after 1620 by a period of decline during which the numbers of epidemics increased. Plague occurred locally in 1623 and again in 1646. There was a gap in many parish registers during the Commonwealth period of government in the 1650s. In contrast, Crosthwaite records were quite well maintained until 1658, after which there was a gap of ten years. Perhaps the registration practices of the Commonwealth period ending in 1660 discouraged the registration of vital events in the parish books.

Even after the resumption of the parish records the numbers of baptisms, burials and marriages declined. It seems unlikely that religious dissent accounted for the lower figures. The Quakers had a strong influence in this region (Bouch 1948), but a search of the record books of the Society of Friends revealed a mere handful of people who could definitely be identified as Crosthwaite residents. Other Dissenting religious groups only began to establish themselves locally in the mid eighteenth century (Bouch and Jones 1961).

The post-Commonwealth figures do, in fact, seem to be a continuation of a sharp decline which may have begun as a gradual decrease in population numbers from about 1620 and accelerated during the 1650s. In 1688 a survey of parishes of the Diocese of Carlisle carried out by Thomas Denton gave Crosthwaite a population of 1560 (Bouch and Jones 1961). Bouch and Jones believe that this survey was based on a count of householders and that Denton used a multiplier of 5 to obtain his population sizes. They feel that this multiplier is too high, and suggest one of 4.5 individuals per household, which would have given Crosthwaite a population of 1,404 in 1688. These figures would indicate a slight fall in population size between 1563 and 1688. If one accepts Bouch and Jones' assumption that Crosthwaite had a population of over 2000 individuals in the 1590s, this decline is quite significant.

The period from 1690 to 1700 saw an increase in the numbers of baptisms and burials in Crosthwaite, although the excess of deaths over births suggests no natural increase. In contrast, the population of England as a whole was increasing at this time and Chambers (1972) suggests that a fall in bread grain prices in the 1680s and a weakening in the epidemic cycle could have encouraged this national growth. The 1690s were marked by bad harvests, an increase in the demand for bread grain, and a rise in prices, which would ultimately have been an advantage to the well-established farmers. This was a period of agricultural and industrial innovation and those farmers and industrialists who were reasonably well off could have profited by making use of improved methods. The poorer farmers, however, would possibly have had much difficulty in competing with their wealthy counterparts. Thus, the end of the seventeenth and the beginning of the eighteenth century saw both increasing wealth and poverty, and a widening of social divisions (Chambers 1972).

After a slight recovery in the numbers of baptisms over burials at the beginning of the eighteenth century, burials in Crosthwaite increased again. From about 1720, for approximately twenty years, burials exceeded baptisms which remained fairly stable. Chambers (1972) and Razzell (1965) attribute the high mortality in Britain to epidemics of smallpox, typhus and other 'deadly afflictions'. Smallpox was certainly recorded in Cumbria in 1728-9 (Jones 1958).

Estimates for Crosthwaite's population size are not available for the mid eighteenth century, but a count of families in the Diocese of Carlisle was undertaken by John Waugh, Chancellor of Carlisle, in 1747. He arrived at a population size of 48,501 for all the parishes in the Diocese (Jones 1958). It is not clear how Waugh used his count of families to calculate this figure, and this makes comparison with Denton's 1688 population count (based on the number of households) very difficult. Denton's estimate for the same parishes was 45,075 but the figure could be nearer 40,567 if a multiplier of 4.5 is used. Even if Waugh's figures are acceptable, the use of the two 1688 populations sizes gives very different proportions of population increase between the two dates. These are 7.6% and 19.6%, depending on whether the larger or smaller figure is used. If Waugh's figures are inaccurate, the calculations of the amount of population increase are very varied.

From the 1740s onwards the population increased rapidly in England as a whole. Crosthwaite seems to have lagged behind and experienced a period of stagnation as far as natural increase is concerned. By the 1770s the numbers of baptisms in particular showed signs of a rise. By the turn of the nineteenth century the population of Crosthwaite was 3,065 (1801 Census report). Considering the numbers of baptisms and burials at the time, the baptism and burial rates could have been in the region of 24.5 per 1000 and 15.6 per 1000 respectively. Thus it can be seen that although baptisms and burials were

reaching similar levels to those of the mid sixteenth century, the rates had declined.   It seems worthwhile pointing out again that the rates calculated on the basis of the population figures given can only be regarded as very general indications of change.   It has already been mentioned in Chapter 2 that there was growing dissent from the mid eighteenth century, and the establishment of Methodist and Congregational churches in the parish may have led to decreasing registration of vital events in the Anglican records.   This could therefore produce artificially low estimates of the early nineteenth century rates.

The population increase in Cumberland in the second half of the eighteenth century was probably considerably greater than that of the first half.   In 1801 the population size of the Diocese of Carlisle was 71,867 - an increase of 46.0% on Waugh's 1747 population size.   Allowances for inaccuracies in Waugh's figure still show a greater increase after the middle of the century.

There is still much controversy over the reasons for, and the consequences of, such an increase.   There is disagreement as to whether the increase in population stimulated economic growth by providing a larger demand for goods and potential work force for their production, or whether improved social and economic conditions led to lower mortality and higher fertility.   There is also much discussion concerning the greater or lesser effect of increasing fertility and decreasing mortlaity on the population growth of the time.   This was not tested in this thesis.   The effect of changes in mortality and fertility is difficult to assess from the limited information available before the censuses started.   The actual baptisms for Crosthwaite show a rapid increase after 1770, whereas the burials decline slightly and then climb only very slowly.   This could indicate that both increasing fertility and decreasing mortality played a part in the parish's population growth.   By the 1780s many of the diseases that had troubled the country

earlier in the century had been controlled to a large extent. The use of medicines and the drainage of swampy areas had led to a decline in the numbers of deaths from the ague (Chambers 1972). Razzell (1965) believes that innoculation against smallpox from the 1750s onwards protected and saved the lives of many children - the particularly vulnerable section of the population. The decline in infant and child mortality would have allowed more children to live and eventually reproduce.

It is possible that migration into the region contributed to the increase in population size towards the end of the eighteenth century. If immigrants included many young couples or individuals of marriageable age, any children they had baptised in the parish would have augmented the numbers of baptisms.

There are various techniques available to assess population movement before more reliable statistics became available, but they all suffer because of the poor quality of the primary data. The analysis of changes in the numbers of different surnames found in the records can only be used to show a relative change in the degree of population movement, but cannot provide migration rates. The effect of migration on the population size depends very much on the interrelationship between the net migration rates and the natural increase rates, and it is not possible to study this with the available material. However, towards the end of the eighteenth century Crosthwaite may well have experienced an increase in immigration as the baptism records show large numbers of new surnames at this time. The association of some of these new names with recently developed local industries is perhaps an indication of the attraction of the area to immigrants. These newcomers could possibly have augmented the increase in population size which was probably already accelerating because of an improvement in the rate of natural increase.

1801 onwards

In 1801 the first census of England and Wales was carried out
and more accurate figures of population size are available. These are shown
in Figure 3.3 and are taken from Swinbank (1959) and the census reports for
Cumberland. Crosthwaite as a whole experienced rapid growth until 1911,
with a slight dip in 1861. The peaks in population size in 1921 and 1939
are deceptive as the censuses took place over holiday periods and many people
in the parish on census night would have been tourists. It would probably
be more realistic to suppose a steadier increase from 1911 to 1951, followed
by a slight decrease in 1961. A breakdown of the population sizes of the
rural areas of Crosthwaite is not available for the 1971 census, but the
figures for Keswick are recorded and show an increase.

The differences between the urban and rural areas are marked
throughout the whole period from 1801-1961 (Swinbank 1959). Figure 3.3
shows that much of the growth of the parish as a whole was taken up by the
increase in Keswick's population. The rural areas varied but, in general,
there was little increase. Above Derwent showed a slight decline after
1851 when the local bobbin mills closed down and the lead mines on the sites
of some of the old German copper mines began to lose their importance.
After the turn of the century the population increased slightly once again.
This was probably helped by the developing popularity of the area as a
tourist district and place for retirement. Borrowdale's population size
remained steady throughout the nineteenth century. Slate was quarried in
various parts of the valley until the beginning of the twentieth century;
there was a minor drop in population size around this time. Today the only
quarries that still work in the valley are at Honister. Borrowdale
experienced an increase after 1911 and it is possible to attribute this to
the popularity of the valley as a tourist region. Borrowdale's scenic beauty
attracted some of the earliest travellers in the Lake District in the late
seventeenth century (Rollinson 1967).

CHANGES IN THE POPULATION SIZES
OF AREAS OF CROSTHWAITE PARISH

Fig.3·3

Crosthwaite

Keswick

Above Derwent

Castlerigg, Wythburn and St.Johns

Borrowdale

Underskiddaw

Population

Years
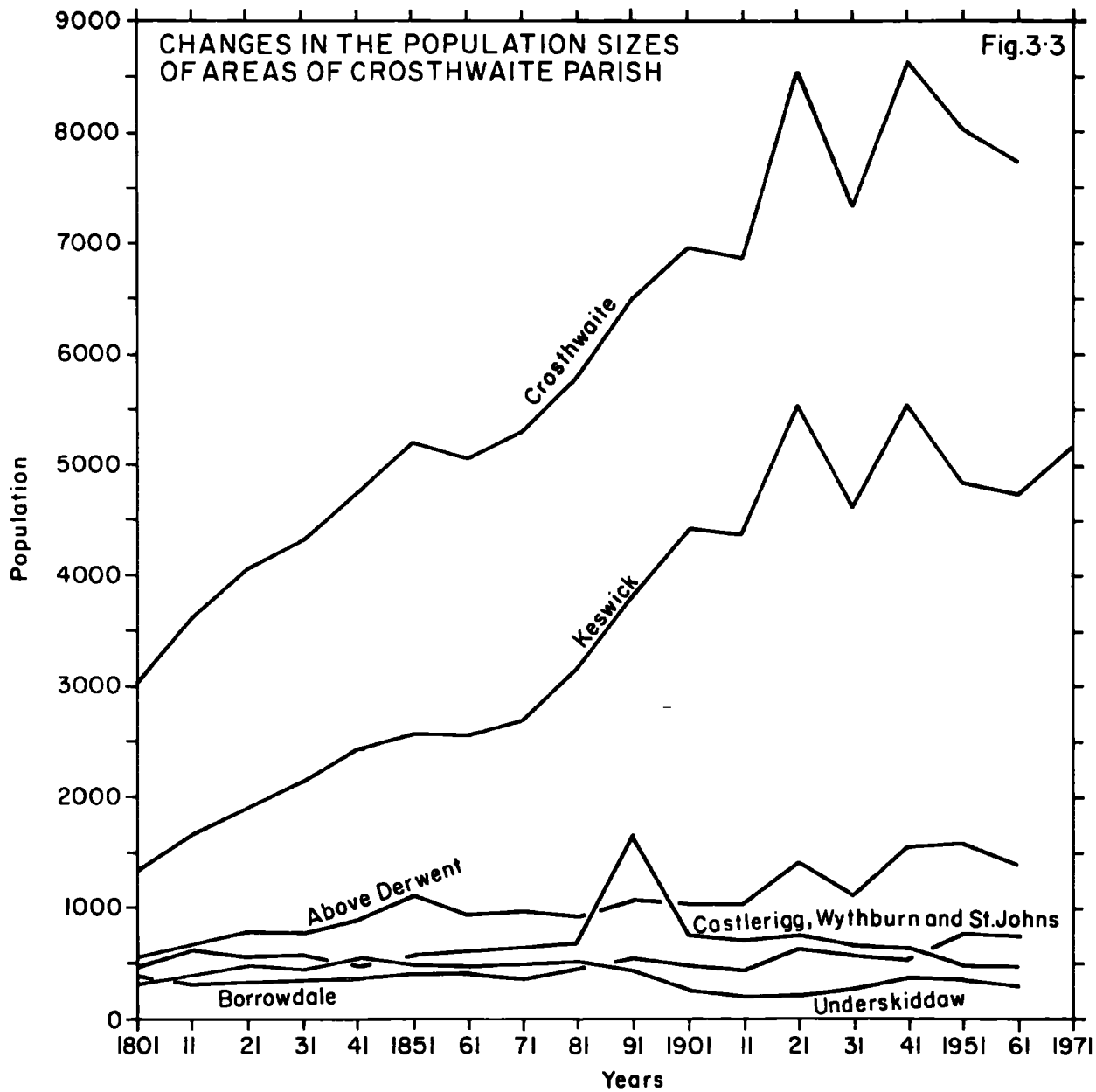
Underskiddaw's population stayed steady until near the end of the nineteenth century. The drop after 1891 was exaggerated because of boundary changes and the loss of four square miles of land to Keswick. This change is not however noticeable in Keswick's population figures. After 1920 there was a slight recovery in the population size, and since then it has remained fairly stable. St John's, Castlerigg and Wythburn had an interesting history. After a steady period with very little population increase there was a peak in 1891. This was caused by the presence of workers constructing the Thirlmere reservoir, which was completed in the 1890s, drowning a number of farms in the area. After this loss of land the population began to decline, and apart from the holiday peak in 1921 the population gradually dropped until, in 1961, it reached a level similar to that at the beginning of the last century.

Keswick's population increased rapidly until 1841, then steadied until 1871 when there was a renewed upward surge. The railway to Keswick was completed in 1865 and the accessibility of the town may have encouraged settlement in the area. This period saw the beginning of the real influx of tourists into the Lakes, and consequently the building of hotels and guest houses. At the beginning of the twentieth century the rapid growth halted and the population experienced a very slight decrease in size. The peaks in 1921 and 1939 have already been attributed to the presence of tourists. The actual population growth was probably more gradual until 1951, after which there was a slight decrease, followed by a recovery in 1971. As the 1971 figures for the rural areas are not available it is not possible to see whether they also experience an increase.

Apart from being able to follow the changes in population size it is also possible to study an alteration of the age structure of Keswick over a period of sixty years. For 1911, 1951, 1961, and 1971 the census data enable a breakdown of the age and sex structure of the town. It can

be seen from Figure 3.4 and Table 3.1 that the population of the town has

aged considerably since 1911.   In 1971 Keswick had a much smaller proportion

of young people (under 15 years old) and a greater proportion of old people

(65 years and over) than in 1911.   This is true of England and Wales as a

whole, and in fact Keswick had lesser and greater proportions of young and

old people respectively even in 1911.   The drop in the proportion of young

people in Keswick between 1911 and 1971 is not much different from the

national figures.   However, the percentage of old people increased by 12.5%

for Keswick compared with 7.7% (Cumberland) and 8.2% (England and Wales)

between 1911 and 1971.   The percentages of individuals in the 15-64 age

group decreased far. more in Keswick than in the county and in England and

Wales.

Table 3.1   Population of Keswick urban district (UD), Cumberland

administrative county (AC) and county borough (CB), and

England and Wales

	% in 1911	% in 1951	% in 1961	% in 1971
Persons under 15 years				
Keswick UD	26.3	16.3	18.3	19.8
Cumberland AC and CB	31.5	23.0	24.6	24.2
England and Wales	30.6	22.1	23.0	23.7
Persons 15-64 years inclusive				
Keswick UD	66.5	68.1	64.3	60.5
Cumberland AC and CB	62.9	66.3	64.0	62.5
England and Wales	64.2	66.6	65.1	62.9
Persons 65 years and over				
Keswick UD	7.2	15.6	17.4	19.7
Cumberland AC and CB	5.6	10.6	11.4	13.3
England and Wales	5.2	11.0	11.9	13.4

Fig. 3·4 AGE AND SEX DISTRIBUTION OF KESWICK U.D. PER THOUSAND POPULATION
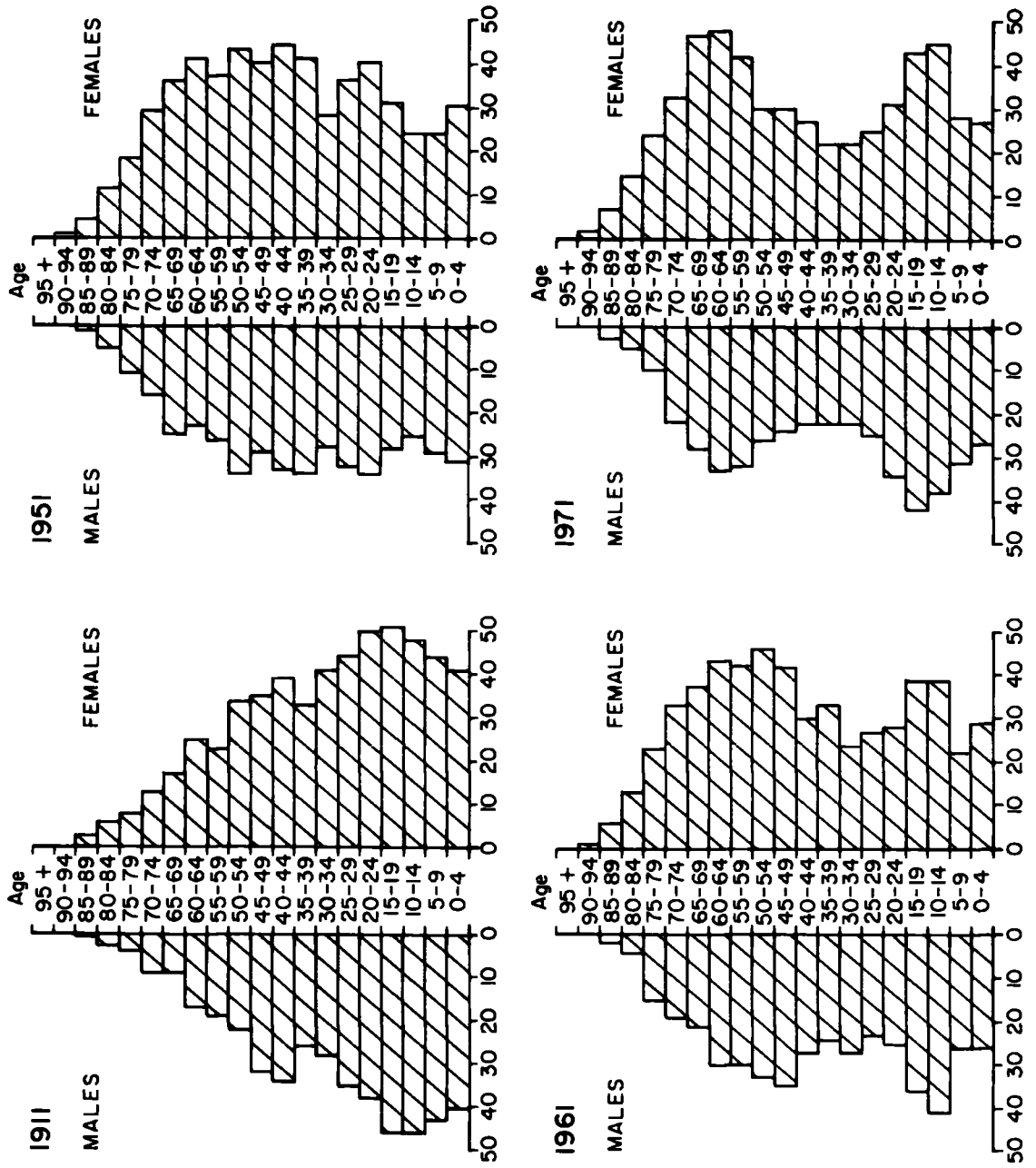
This ageing of the Keswick population can be attributed to the better living conditions and medical facilities available in more recent years. These factors are also applicable to the rest of the country. Keswick, however, has become a very popular place of retirement lately and this could account for the much greater increase in elderly people. Local people sometimes complain that the influx of retired folk has increased competition for housing, pushing the prices out of reach of the younger newly married couples. Restricted building policies have contributed to the problem of finding inexpensive housing. Pulled by the attraction of better jobs and entertainment facilities in the bigger towns, and pushed by the housing 'shortage', young adults have tended to move away.

In a period of only sixty years, a number of changes have taken place in the population size and structure. Even the past 170 years have seen a substantial alteration in the population. The data available for pre-census periods make a detailed analysis difficult. The precise course of population change is hard to establish. The following chapters attempt to sift out information which may lead to a better understanding of the demography of the parish before 1800. The effects of social and economic change on the population may then be considered more fully, and the genetic implications discussed.

CHAPTER 4

Breeding population and effective breeding population

The size of the total population is determined to a large extent by the numbers of breeding individuals in previous generations. The breeding population can be defined as those individuals in the reproductive age groups (15-49 according to Pressat 1972) who are successfully breeding and have not yet completed their families at the time they are studied. Variations in the size of the breeding population are of more use than total population sizes to the geneticist as they give a better indication of the possible influences of several theoretical genetic concepts.

The calculation of the breeding population

There are two ways of examining the numbers of people in the breeding population of historical populations. A 'census' of breeding individuals who have not yet completed their families can be carried out at intervals. This is useful in that the actual breeding populations are enumerated at different points in time and can be related to total population sizes. One disadvantage is that short-term demographic events such as a year of particularly high mortality (crisis mortality) which occur between the censuses of breeding individuals may not show up in the figures. This method was not used for the Crosthwaite material, largely because estimates of total population size were few and far between and were too unreliable to study in association with breeding population sizes.

For Crosthwaite, the population was examined in cohorts. A cohort consists of all those people for whom some key demographic event occurs between specified dates. Such an event may be marriage or birth. Once members of a cohort have been defined it is possible to follow them over time to study their group experience of several demographic events such as

reproduction or mortality. One cohort's experience can be compared easily with another's at a later period, as the same criteria are used in defining and studying them. In this study the cohorts of particular interest consisted of breeding individuals and were defined as those persons who 'married' within specified periods of twenty years and subsequently produced children. The term 'married' will be explained later. Cohorts consisting of the total number of persons marrying within specified periods were also examined.

A cohort of breeding individuals does not represent the actual breeding population size at any particular point in time and therefore cannot be compared with total population sizes. The length of time limiting each cohort may be decided upon according to a number of criteria. The time span used will influence the size of the cohort, and one of twenty years, for example, will contain more individuals than one of ten years. For the Crosthwaite material, periods of twenty years were used, starting with 1580-99, 1600-19 etc. These intervals were used to make them more comparable with other material which could only be satisfactorily examined in twenty year groupings because of sample sizes. A twenty year cohort also seemed to represent a reasonable approximation to a human generation length. Although it is fully appreciated that human generations overlap, this does at least give a crude indication of significant changes over generations.

The main advantage of cohorts is the simplicity of defining and using them. They are also easy to compare with those of different populations provided the same intervals are used. Another value is that each cohort covers some periods when short term demographic events or economic problems such as crisis mortality or bad harvests occur, and the effects of such factors are reflected to a certain extent in the size of the cohorts and the experience each cohort has of demographic variables such as mortality, migration and reproduction.

The individuals composing the breeding cohorts have been described as those 'married' within specified periods. People for whom there is an entry of marriage in the Crosthwaite register and who subsequently produce a family belong to a cohort. In Chapter 2 it was explained that many legitimate baptisms cannot be linked up to a parental marriage. These represent children whose parents married outside the parish and whose date of marriage is unknown. A 'dummy' marriage is allocated to each such couple and a date of marriage one year before the baptism of their first child in the parish is assigned to it. These marriages are included in the cohorts in the same way as ordinary marriages. Undoubtedly this introduces inaccuracies as some of the couples involved may have married several years prior to the baptism of their first Crosthwaite child and may have had other children baptized elsewhere. However, these 'dummy' marriages constitute a large proportion of the total number of marriages and it is considered preferable to include them with their disadvantages rather than omit them altogether.

The social distinction between legitimate and illegitimate children is unimportant when the breeding population is under consideration as the parents of illegitimate children are still breeding individuals. For simplicity's sake, any illegitimate children were regarded as 'singleton' families. For each such child baptized during the duration of a cohort, two individuals were added to the breeding population. It is quite likely that some people have several illegitimate offspring by the same or different partners, or that married members of a cohort also have illegitimate children. Unfortunately the records are such that it is often difficult to establish whether illegitimate children share any parents, or whether any of the parents have already been included in a particular cohort. Such instances would lead to an overestimation of the breeding cohort sizes as some individuals would be counted two or even three times during the span of

one cohort.   Remarriage within the period covered by a cohort would also introduce the same error.   The possibility of errors of the above sort has to be recognised, although little can be done to correct them.   One can only hope that overestimations of the breeding cohort sizes are compensated for by under-registration.

The breeding cohort as defined above are shown in Table 4.1 and Figure 4:1.   The gaps for the periods 1660-79 and 1680-99 are due to lack

Table 4.1   Breeding cohort sizes

Cohort	Fertile marriages	Illicit unions	Dummy marriages	Total	Breeding cohorts
1580-99	303	51	240	594	1,188
1600-19	295	77	233	605	1,210
1620-39	275	59	160	494	988
1640-59	190	22	157	402	804
1700-19	201	6	96	303	606
1720-39	167	18	103	288	576
1740-59	177	23	111	311	622
1760-79	216	46	98	360	720
1780-99	238	80	162	480	960

of registration or under-registration following the Commonwealth period. Changes in the breeding cohort sizes roughly follow the population trend suggested in Chapter 3.   There is an increase towards the end of the sixteenth century, with a period of decline during the seventeenth.   The end of the seventeenth century is thought to have seen a period of population

Fig. 4·1

BREEDING POPULATION (N) AND
EFFECTIVE BREEDING POPULATION (Ne)
COHORT SIZES
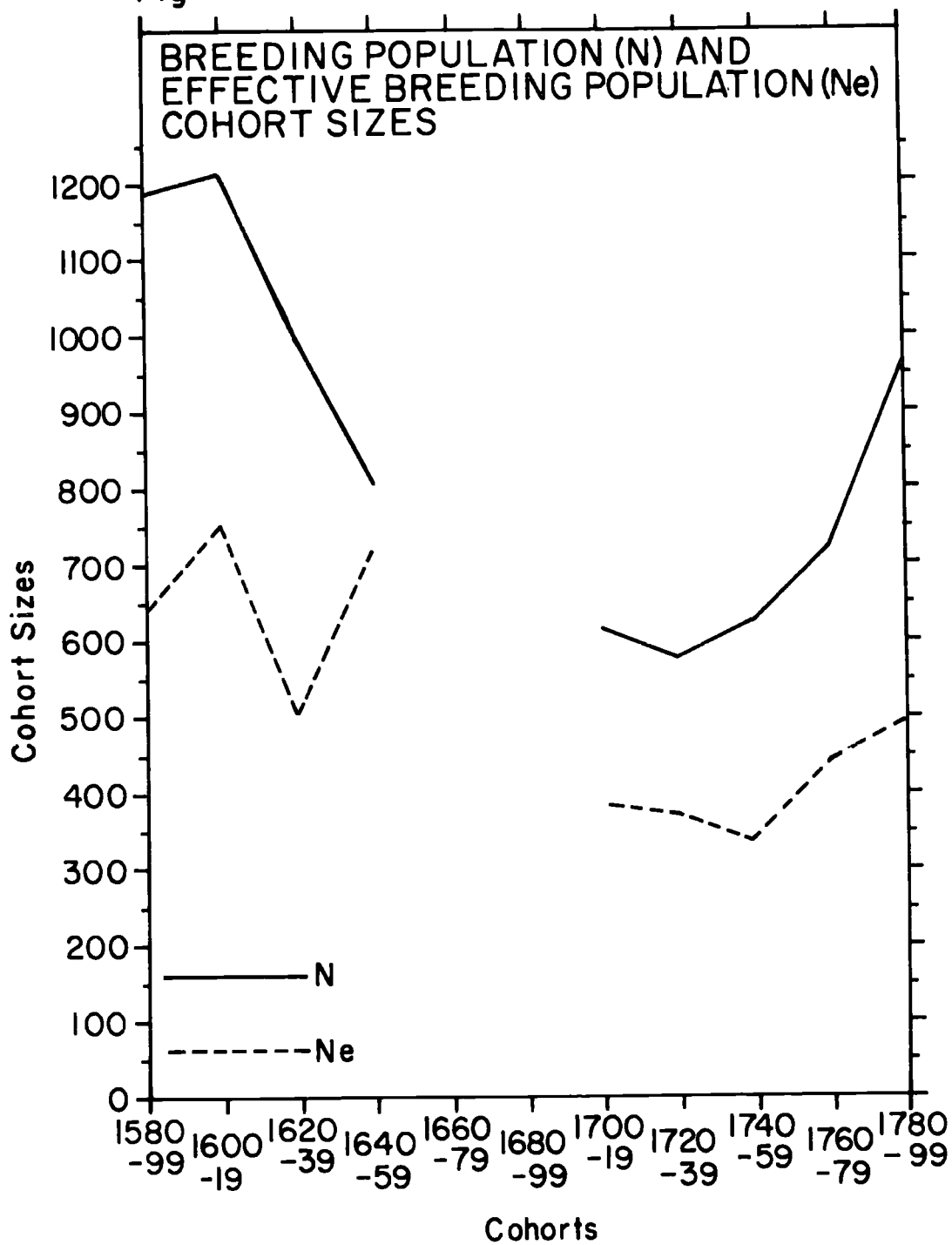
recovery in England and Wales as a whole (Chambers 1972), but the Crosthwaite

material for this time does not necessarily indicate a local increase.

Cohort sizes are not available over these years. The first half of the

eighteenth century seems to experience a population 'slump' and the drop in

cohort sizes supports this. The second half of the century was a time of

rapid population increase in England and Wales and this is also reflected

in the increasing cohort sizes. It is worth pointing out that the sharp

drop in the 1640-59 cohort size could be due in part to the effects of plague

in the 1640s and partly to under-registration. It is very likely that some

potential members of the cohort, who married within the period, did not start

producing children until the 1660s when very few baptisms were registered.

The parents would therefore not be included in the 1640-59 cohort.

Factors affecting changes in cohort sizes

Changes in the size of the breeding cohorts and the total population

size can be brought about in many ways. Two possibilities are the varying

quality of registration and changes in the amount of non-conformism. Some

demographic variables involved in population change may be quite easy to

study individually. For example, it is possible to follow variations in

the age of marriage, and changes in fertility, mortality, and migration.

However, the interaction of such variables and their combined influence on

breeding cohort sizes can be very complex and difficult to analyse, part-

icularly when many of the data are incomplete. Social and economic factors

such as war or bad harvests may also affect the size of the cohorts at

different times and in some cases it may be possible to attribute changes to

circumstances. Variables such as the above may bring about or be influenced

by changing moral attitudes which cannot be quantified or easily assessed.

Therefore, no matter how detailed an analysis of demographic change is, one

can never be certain that one has presented a comprehensive picture which

takes all possible influences into account. This section attempts to put forward some suggestions for changes in the cohort sizes.

Tables 4.2 and 4.3 and Figures 4:2 and 4:3 show some of the variables under consideration – the mean age of first marriage of women, mean family size, and the proportion of childless unions.

The mean age at marriage of women was studied, as a woman's reproductive period is limited up to the age of 45-50. Her fecundity (ability to conceive) also declines towards the end of her reproductive life (United Nations 1973). If a woman marries late, she not only has less time to produce a family, but her capacity to do so declines.

The age at first marriage is considered,as this, for the majority, marks the entry of the woman into her actual reproductive period. Theoretically, if the mean age at first marriage increases, one would expect a decline in fertility which could possibly influence the size of future breeding cohorts. Conversely, if the mean age at marriage decreases, one would expect an increase in fertility. This could perhaps be revealed in changes in the mean completed family size.

This premise would not necessarily apply in societies which practise birth control, as families are often artificially limited or delayed (Pressat 1972). Chambers (1972) points out that there is some evidence to suggest that family limitation (through abstinence) took place in France as far back as the fourteenth century, and Wrigley's article on Colyton in Devon (1966) indicates possible family limitation in the seventeenth century. The Crosthwaite material is not very constructive in this respect.

It is worth indicating that the calculations of age at marriage shown in Figure 4:2 are based on data for both fertile and infertile marriages. The total number of records that can be linked in each period is sometimes fairly small (60 or so), and would be very low indeed if only the fertile marriages were considered.

Fig. 4·3

MEAN FAMILY SIZE

Family Size

5·0
4·5
4·0
3·5
3·0
2·5
2·0
1·5
1·0
0·5
0

————— All Families

- - - - - Excluding Singletons

Cohorts

1580 1600 1620 1640 1660 1680 1700 1720 1740 1760 1780
-99 -19 -39 -59 -79 -99 -19 -39 -59 -79 -99

Fig. 4·2

MEAN AGE AT FIRST MARRIAGE
OF WOMEN

Age

50
40
30
20
10

Cohorts

1580 1600 1620 1640 1660 1680 1700 1720 1740 1760 1780
-99 -19 -39 -59 -79 -99 -19 -39 -59 -79 -99
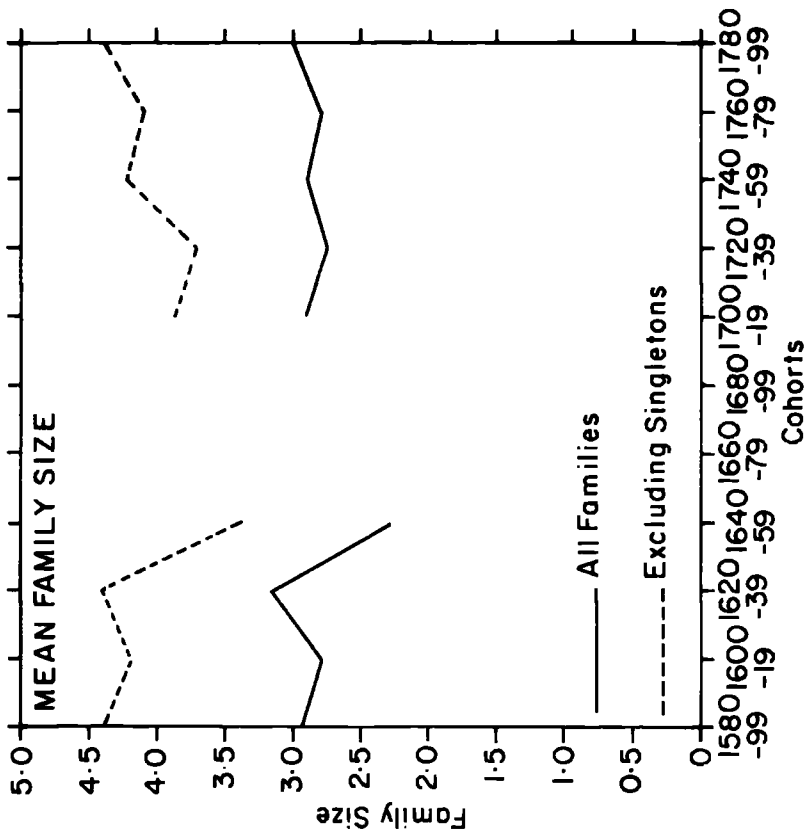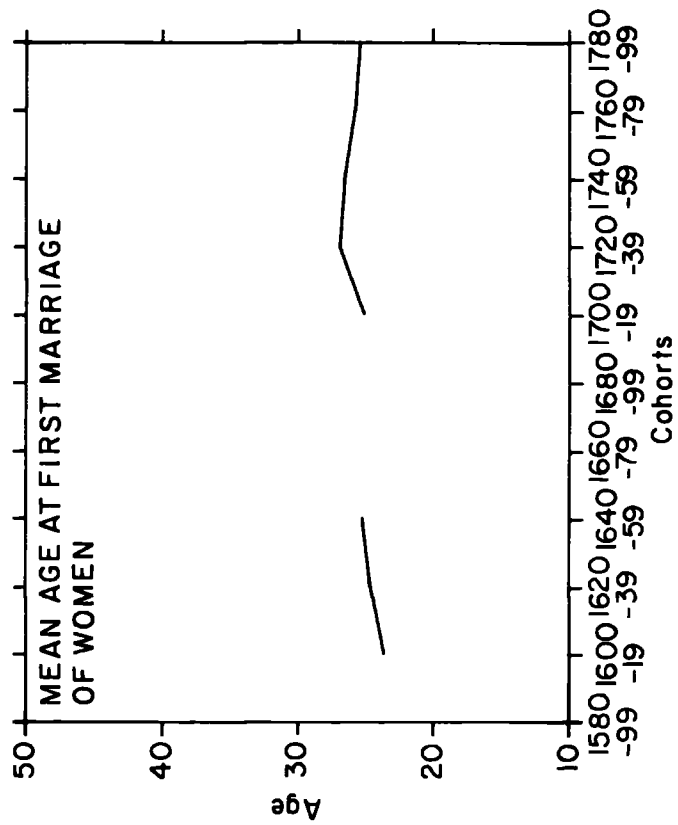
Table 4.2   Mean age at first marriage of women

Cohort	Mean age at first marriage	Number of women
1580-99	–	–
1600-19	23.82	163
1620-39	24.25	157
1640-59	25.08	130
1700-19	25.11	74
1720-39	26.80	102
1740-59	26.51	94
1760-79	25.64	74
1780-99	25.47	87

Table 4.3   Mean family size

Cohort	Mean - all families	Number of families	Mean - all families excluding singletons	Number of families excluding singletons
1580-99	2.93	594	4.36	341
1600-19	2.79	605	4.21	337
1620-39	3.15	494	4.42	310
1640-59	2.29	402	3.34	222
1700-19	2.88	303	3.87	198
1720-39	2.73	288	3.71	184
1740-59	2.88	311	4.24	181
1760-79	2.79	360	4.11	207
1780-99	2.99	480	4.39	282

In principle, when studying family size, the data should be restricted to the mean number of children produced by those couples who complete their reproductive life in the parish; that is, the mean 'completed family size'. The premature death or emigration of one parent or the family means that the potential family size is not fulfilled. By including all families in the study one obtains low family size figures which may not show any relation to the variations in the mean age at marriage.

For the Crosthwaite material, the total mean family sizes were studied, and an attempt was made to estimate mean 'completed family sizes'. The figures were based on the number of children produced by members of the breeding cohorts. For example, the family size for 1580-99 is calculated from the numbers of children produced by fertile couples who 'married' between these dates. Some of them may well have continued having children after the turn of the seventeenth century.

The total mean family size, shown by the solid line in Figure 4:3 is calculated from data for all fertile marriages occurring within a cohort period, and therefore includes families which were 'interrupted' by the premature death of one parent or the emigration of the couple. It is more usual to calculate mean family sizes by including those 'families' with no children. In this instance the definition of the breeding cohort excludes such families, and therefore the mean family sizes appear high. The omission of childless families also makes the figures comparable with those found in the study of the Otmoor region of Oxford (Küchemann et al. 1967). The Otmoor figures suggest slightly higher family sizes, but similar trends over the period covered by this study.

These figures are useful, as they give some indication of the actual reproductive performance of the various cohorts, and it is the children involved who represent a substantial proportion of potential future breeding cohorts.

The study of the family sizes of those couples who live beyond the reproductive ages gives a better indication of the full reproductive potential of the breeding section of a population, and this may be more realistically related to variations in age at marriage. Unfortunately the Crosthwaite data are inadequate for sifting out completed families from incomplete ones. In their Otmoor parishes study, Küchemann et al. (1967) noticed that when singleton families were discounted, the mean family size was very similar to figures obtained from the known completed families (4.3 for the former and 4.6 for the latter). It was decided to calculate the mean of all families in the breeding cohorts, excluding those with singletons, in order to find possible indications of the completed mean family sizes for Crosthwaite. These are shown by the broken line in Figure 4:3. The overall mean is 4.12, which is only slightly below the figure of 4.3 obtained by Küchemann et al. Obviously there is no certainty that this method is valid for the Crosthwaite data, and so the figures need to be used with caution.

It is worth noting that both sets of means follow much the same trend over the different cohort periods. The low 1640-59 breeding cohorts may well have larger families than suggested by the figures, but lack of registration in the late 1650s and 60s means that only some of their children are accounted for.

The proportions of childless unions were calculated to see whether any fluctuations could be associated with periods of hardship or affluence, or with changes in family size. The figures are based on the proportions of childless marriages only, as there is no evidence of the numbers of childless immigrants or infertile illicit unions in the records. The data are shown in Figure 4:4.

Age at marriage, mean family size, and the proportion of childless unions were considered together to see whether any constant interrelationship could be observed, and whether they could be associated with changes in the sizes of the breeding cohorts.

Fig. 4·4

PROPORTION OF CHILDLESS MARRIAGES

per cent
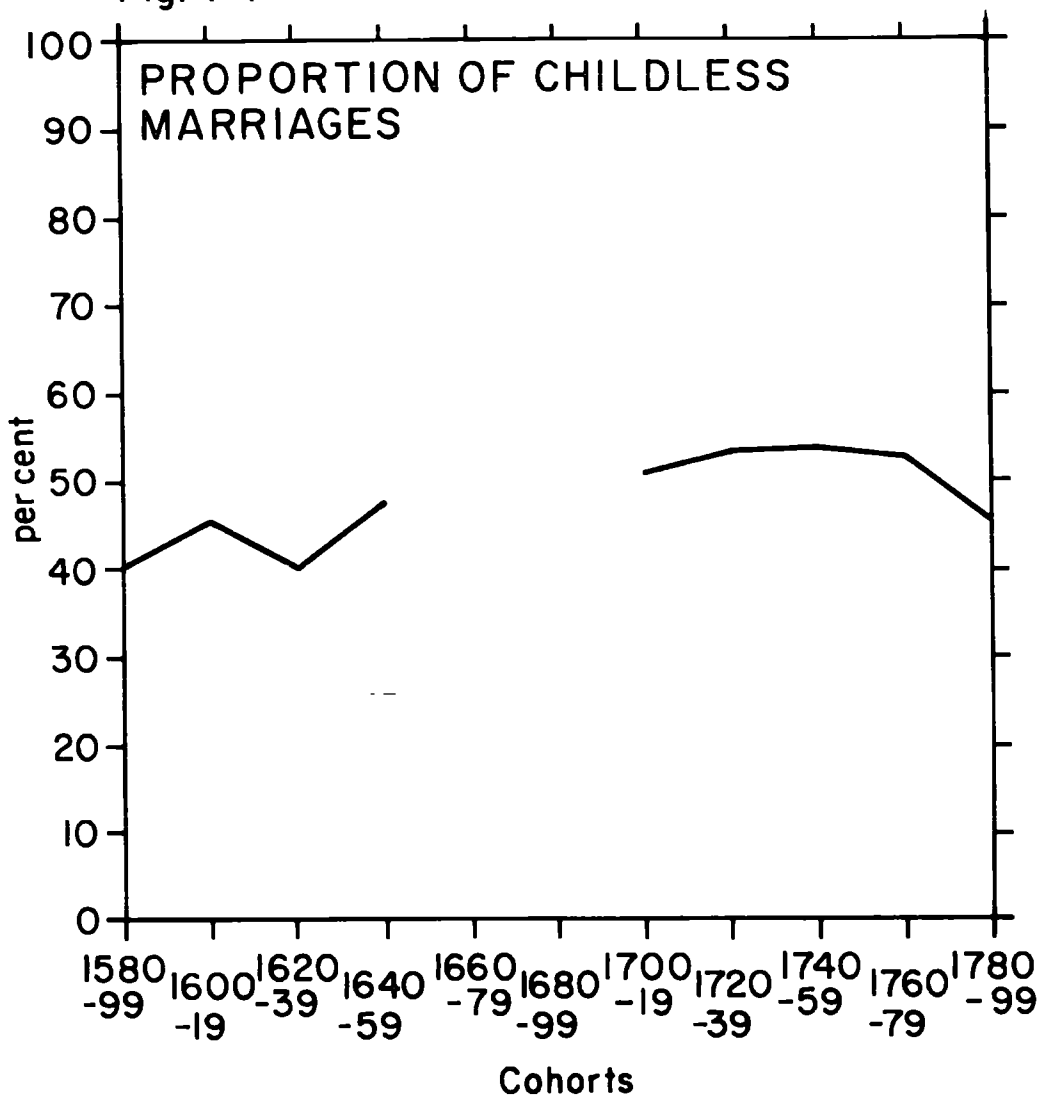
Cohorts

Table 4.4   Proportion of childless marriages

Cohort	Number of childless marriages	Total number of marriages	Proportion childless (%)
1580-99	192	471	40.8
1600-19	223	489	45.6
1620-39	165	409	40.3
1640-59	174	364	47.8
1700-19	168	329	51.1
1720-39	167	312	53.5
1740-59	193	359	53.8
1760-79	204	387	52.7
1780-99	176	389	45.2

The total period studied can be considered in three sections: 1580-1659, 1700-1759, and 1760-1799.

1580-1659

During the first period, age at marriage data were not available for the 1580-99 cohort. The 1600-19 showed a drop in mean family size and an increase in the proportion of childless unions. As there is no previous age at marriage data to compare with, it is not possible to suggest any association between the first two variables and fluctuations in age at marriage. The 1620-39 cohort shows an increase in age at marriage accompanied by a higher mean family size, and a decrease in childlessness. This suggests that there is no relationship between age at first marriage of women, and family size, or that other factors are operative; for example, sampling effects or mortality. The 1640-59 cohort's figures are probably unreliable as the steep drop in family size may well be due to under-registration; any demographic factors cannot be adequately sorted out.

1700-1759

The second period shows an apparent association between age at marriage and family size, particularly for the first two cohorts. Increasing age at marriage is accompanied by a decrease in family size, and an increase in childless unions. The last cohort of this period experiences a slight decline in age marriage, a noticeable increase in mean family size, but a very small rise in the proportion of childless unions.

1760-1799

The last period shows a continued decrease in age at marriage for the first cohort, with a small drop in family size and a slight decrease in the proportion of childless unions. The last cohort, however, maintains

the decreasing age at marriage but shows an increase in family size, and a noticeable drop in the proportion of childless unions.

Altogether it can be seen that no constant interrelationship between the three factors can be demonstrated with the Crosthwaite material. It may be that the assumption of any correlation is incorrect, or that other factors affect any interrelationship. With historical material, the accuracy of the data is frequently questionable and sampling errors can be introduced very easily. This makes detailed statistical analysis of such material difficult and possibly questionable. Mortality and migration also need to be considered, as variations in these factors could have an important influence.

Chambers (1972) indicates the possibility of an increase in fertility to compensate for periods of heavy loss of life. He also points out that Wrigley's study of Colyton in Devon (1966) shows no evidence of this. The Crosthwaite material, however, could indicate some such compensation. During 1623 there was an epidemic of plague which led to high numbers of burials. The mean family size of the cohort spanning this period increased. If several children in one family died as a result of the plague, it is possible that the parents compensated for these deaths by having more children, thus increasing the calculated mean family size. The decrease in childless unions could perhaps be accounted for by the remarriage of widows and widowers who subsequently started families.

It must be admitted that evidence of high mortality in families is scanty for this period; this was a particularly poor time for registration detail. However, plague outbreaks recorded in 1596/7 and 1646 reveal burial entries for individuals apparently from the same families, occurring within days of one another. The 1580-99 cohort has a high mean family size and there is a comparatively low proportion of childless marriages. Unfortunately there are no age at marriage data available, nor any previous data with which to compare this material. The 1640-59 cohort has a low mean family size,

but this may well be influenced by poor registration during the Commonwealth period.

The early to mid-eighteenth century also experiences high mortality, but there is no evidence of any compensation in the form of increased baptisms. In fact, the breeding cohorts of this period have comparatively low mean family sizes. The different trends shown for these two periods of high mortality may perhaps be explained by studying the pattern of mortality over these times. The high numbers of burials during the sixteenth and seventeenth centuries can be described as 'crisis' mortality: many people die within a short period of time. In the eighteenth century, the high levels of deaths are sustained over a long period, and do not seem to strike at families suddenly. It may be that the dramatic effect of crisis mortality encourages people to compensate, whereas steady, but undramatic periods of high mortality do not provoke such a reaction.

The smaller family sizes, and higher age at marriage during the mid-eighteenth century, could also have been influenced by hardship brought about by hard winters and poor harvests in the area from 1738-41.

The size of any one breeding cohort is influenced by the fertility and mortality experienced by previous cohorts and the sex ratio, numbers of marriages, mortality, and migration of potential members of the particular cohort under consideration. Theoretically, the experiences of preceding cohorts should give a rough indication of the potential size of later ones. For example, a cohort spanning a period of high natural increase could possibly indicate a higher following cohort size. However, such a simplistic relationship is impossible to establish over most of the period studied, apart, perhaps, from the end of the eighteenth century. Natural increase rates cannot be calculated, and one is reduced to making very broad descriptive comments on the relative proportions of births over deaths.

Natural increase and decrease are not enough in themselves to explain fluctuations in cohort sizes. Pre-reproductive age mortality, and an unbalanced sex ratio at birth may reduce the potential size of future cohorts. Matters such as war, involving high mortality among young adult males can distort the sex ratio and cause a drop in the possible size of a breeding cohort. Such factors may be analysed in some cases, but the Crosthwaite data preclude this.

Migration also needs to be considered. Even if the above variables favour increasing cohort sizes, high net emigration of young potential parents may offset these factors. Chapter 5 covers the problems of the analysis of migration in detail. Although some material is available, on the whole the data only reveal a relative change in the degree of migration, and can give no indication of the actual balance between natural increase or decrease and migration at any particular time. It is therefore difficult to assess the full impact of migration on population increase. The last twenty years of the eighteenth century are the only years when the available evidence suggests that high immigration may have contributed to an increase in the size of the breeding cohorts.

It can be seen that it is not possible to discern any regular pattern in the interrelationship of the variables discussed in this section. This is not altogether unexpected, as it is unlikely that the same factors operate on all the cohorts. It is possible to hint at some probable influences such as high mortality and migration, but historical population data such as those used in this study do not always supply the clues needed to find all the answers. A particular problem associated with much historical data is the difficulty of applying statistical techniques to aid analysis. The small and very varied sample sizes, based on inadequate and unreliable data make such analysis difficult and not very informative. Ultimately the form of analysis available is descriptive and deductive.

Effective breeding cohorts

The breeding population   cohorts as defined in this study
are useful from a demographic point of view as they are among the factors
determining population change.   Breeding cohort sizes are of more limited
use to the population geneticist who is more concerned with the way in which
gene frequencies are affected by population changes.   The Hardy-Weinberg
theory describing the stable nature of gene frequencies from generation to
generation only applies in certain idealised circumstances, when the breeding
population size is infinite, mating is random, the sex ratio is equal, and
factors such as differential migration and natural selection can be discounted.
Even in very large populations there may be several separate breeding units
which may be defined on geographical or social lines, or a combination of
both.   It is improbable that these smaller units are totally isolated from
one another, so new genes may be added, and others lost due to migration.
In the largest breeding populations mating is not random, and in the smaller
ones, one has to take into account the fact that the limited choice of spouse
increases the likelihood of inbreeding, even when marriages between known
relatives are avoided.

The breeding population can be adjusted in such a way that such
factors are accounted for, and an equivalent to the 'ideal' population can
be obtained.   This is known as the 'effective' breeding population.   In
this study 'effective' breeding cohorts are obtained.   It is likely that
several of these factors operate simultaneously in a single population, but
it is difficult to cope with these interactions mathematically (Morris 1972).
It is possible, however, to account separately for some of these with the
limited data available from parish records.

Inbreeding

The effect of inbreeding can be established by using population inbreeding coefficients in the following formula (in Morris 1972, adapted from Li 1963).

$$Ne = \frac{N}{1+F}$$

where Ne is the effective population size (cohort size),

N is the breeding population (cohort),

and F is the inbreeding coefficient.

The calculation of F is dealt with in Chapter 6 and is based on the numbers of isonymous marriages (marriages between people with the same surname).

The effective breeding cohort sizes in this case are shown in Table 4.5. These figures show a negligible reduction in the breeding cohort sizes for all periods, even though F varies considerably.

Variation in family size

Ne can also be calculated on the basis of variation in family size, using the following formula (in Morris 1972, adapted from Li 1963).

$$Ne = \frac{4N-2}{\sigma k^2 + 2}$$

where N is the breeding cohort size,

k is the number of gametes contributed by each parent,

and σk^2 is the variance of k (variance in family size).

k is calculated from the numbers of gametes contributed by members of each breeding cohort. Ideally only the variance of all surviving children should be used - those who reach maturity in the parish and who are potential members of future breeding cohorts. Children who are lost through emigration should also be excluded. In practice it is difficult to establish the numbers of surviving children because of linkage problems, and therefore the figures are based on the actual numbers of baptisms recorded for the parents in a breeding

Table 4.5   Effective breeding cohort size (Ne) adjusted for inbreeding (F)

Cohort	F	N	Ne
1580-99	.0166	1188	1168.6
1600-19	.0098	1210	1198.3
1620-39	.0105	988	977.7
1640-59	.0146	804	792.4
1700-19	.0023	606	604.6
1720-39	.0072	576	571.9
1740-59	.0049	622	619.0
1760-79	.0020	720	718.6
1780-99	.0071	960	953.2

Table 4.6   Effective breeding cohort size (Ne) adjusted for variance

in family size (k^2) - all families

Cohort	k^2	N	Ne
1580-99	5.49	1188	634.2
1600-19	4.44	1210	751.2
1620-39	5.97	988	495.6
1640-59	2.52	804	711.1
1700-19	4.34	606	382.0
1720-39	4.12	576	376.1
1740-59	5.39	622	336.4
1760-79	4.64	720	433.4
1780-99	5.88	960	487.1

cohort, and refer to all families, not just completed families. The figures are shown in Table 4.6 and Figure 4:1.

Unlike the inbreeding effect, the variance in family size reduces Crosthwaite's breeding cohorts quite substantially. On the whole, the effective breeding cohorts follow similar trends to the breeding cohorts, the most noticeable departure being the 1640-59 cohorts. In a population where the variance in family size is very low, the effective breeding population size will not be much lower than that of the breeding population. Between 1640-59, the majority of families were small, and variance in family size was low - largely because of the under-registration mentioned previously. The effective breeding population calculated for this cohort is therefore likely to be an overestimate.

Sex ratio

In monogamous societies it is reasonable to assume that the sex ratio of the breeding population is more or less equal, though in societies practising polygamy, the influence of an unbalanced sex ratio cannot be ignored. There is still a slight change of unequal numbers of each sex in a cohort, and although the effect may be negligible, it is worth pointing out. No allowance has been made for the possibility of the remarriage and reappearance of a widowed individual in the same cohort. One cannot be certain that illicit unions resulting in illegitimate children are not adulterous, so that a married man or woman may have children by another mate during the span of a single cohort. Unfortunately linkage problems make it difficult to establish the marital status of most parents of illegitimate children. It is also impossible to assess whether men or women are counted more than once in a cohort. The assumption has to be made that the sex ratio is equal.

Effective breeding population size and genetic drift

The size of the effective breeding cohorts may give some indication of the opportunities for genetic drift to occur. Genetic drift has been defined by Cavalli-Sforza and Bodmer (1971) as the random fluctuation of gene frequencies in a population of finite size. Morris (1972) qualifies this further by stating that the conditions defined by the Hardy -Weinberg formula are also applicable: genetic drift is effective in the 'ideal' small population which is difficult to define. The size of a small population in which genetic drift may operate can only be described when the interrelationships between the breeding population, selective value of the allele under consideration, the mutation pressure, and gene flow are understood. For historical populations these various factors are impossible to assess. The calculated effective breeding population sizes are attempts to cope with some of the factors involved. In general it is considered that small populations in which genetic drift is effective are those with breeding populations in the hundreds. According to this criterion, the breeding population and effective breeding population cohorts of Crosthwaite are small enough at most periods in the 250 years studied for drift to be operative. The mid-eighteenth century would appear to provide the best opportunities for drift. However, Morris (1972) points out that this broad definition of the appropriate population size for drift is an oversimplication and that "the exact measurement and demonstration of drift in any real population is an extremely difficult task." (p. 305). Thus the Crosthwaite cohort sizes calculated above give only the crudest indication of the opportunities for drift.

Index of isolation

Wright, in 1940-43 concludes that opportunities for drift to occur depend on the product of the effective breeding size and 'm'. the migration rate. 'Nem' is known as the index of isolation and can be calculated quite simply when the proportion of migrants per generation into the population is known. Where the product is less than 5, drift is likely to bring about quite marked changes in gene frequencies: between 5 and 50 there will still be some opportunities for drift; above 50 the opportunities will be very slight.

The calculation of migration rates is a problem in historical populations as the material available is very unreliable. It is possible to obtain crude measures of immigration from two sources. The first consists of 'dummy marriages', each of which represents at least one immigrant into the parish. In the calculation of 'm' each dummy marriage is considered as indicating only one immigrant. The proportion of dummy marriages to the breeding cohort size gives an approximate figure for 'm'. As this method only considers one partner of a dummy marriage as an immigrant, and ignores those migrants found in the actual marriage registers, it does tend to under-estimate 'm' and Nem. The results are shown in Table 4.7 and Figure 4:5.

The second source consists of the proportions of new names found in the population in periods of 20 years which correspond to the length of each cohort. Proportions of names can be misleading as each name may represent more than one individual. A few names are very common in Crosthwaite, and in a count of different surnames each of these would only be enumerated once, thus underestimating the number of individuals possessing it. On the whole, new names in the population are likely to represent fewer individuals than the common local names. Therefore the proportion of new names to total names would probably overestimate the proportion of actual incomers. 'm' and Nem as shown in Table 4.8 and Figure 4:5 are possibly rather high in this case.

Fig. 4·5

INDEX OF ISOLATION (Nem)
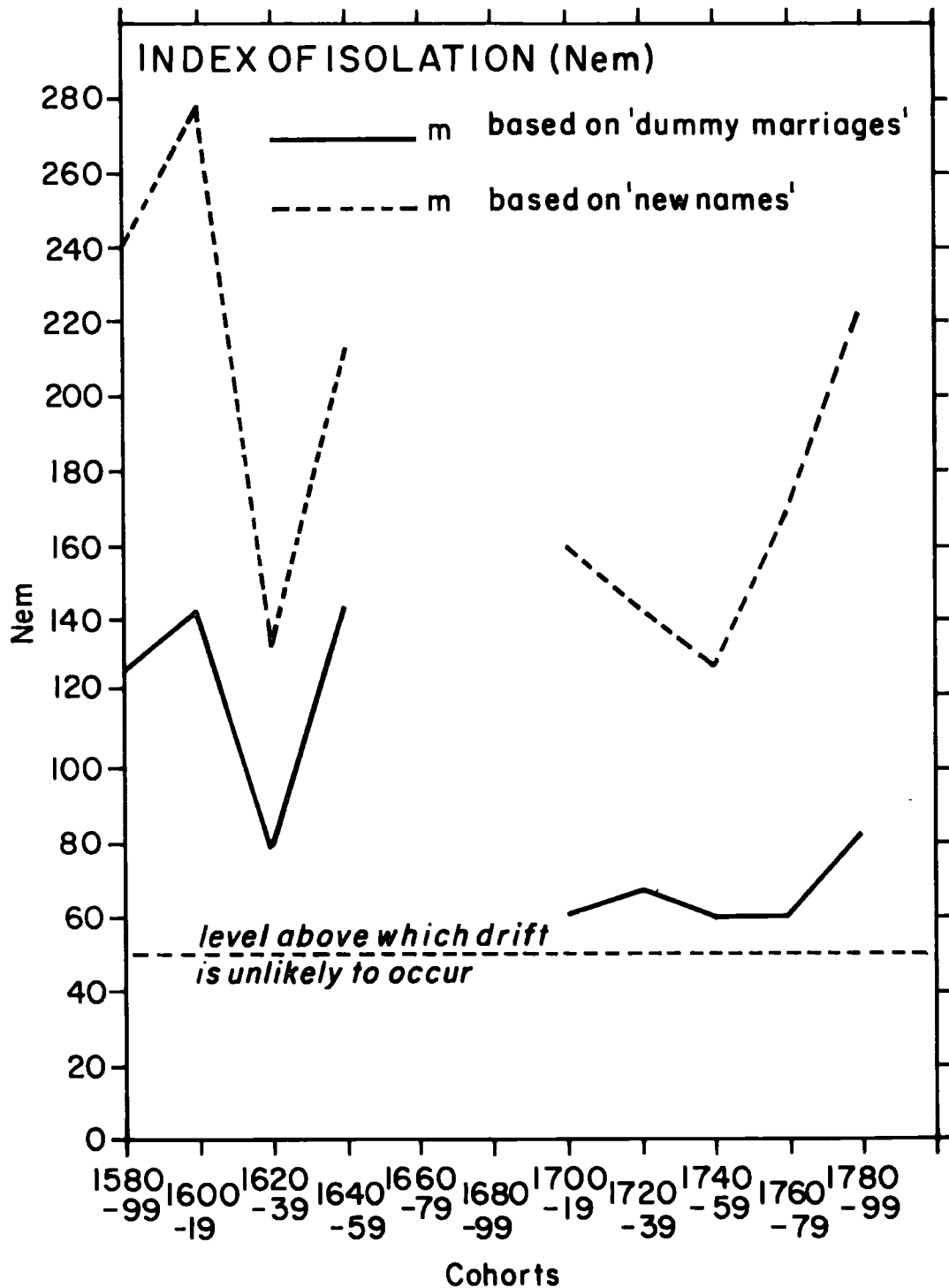
Table 4.7   <u>Index of isolation (Nem) based on dummy marriages</u>

Cohort	Ne	m	Nem
1580-99	634.2	0.20	126.8
1600-19	751.2	0.19	142.7
1620-39	495.6	0.16	79.3
1640-59	711.1	0.20	142.2
1700-19	382.0	0.16	61.1
1720-39	376.1	0.18	67.7
1740-59	336.4	0.18	60.6
1760-79	433.4	0.14	60.7
1780-99	487.1	0.17	82.8

Table 4.8   <u>Index of isolation (Nem) based on the proportion</u>

<u>of new names</u>

Years	Ne	m	Nem
1580-99	634.2	0.38	241.0
1600-19	751.2	0.37	277.9
1620-39	495.6	0.27	133.8
1640-59	711.1	0.30	213.3
1700-19	382.0	0.42	160.4
1720-39	376.1	0.38	142.9
1740-59	336.4	0.38	127.8
1760-79	433.4	0.39	169.0
1780-99	487.1	0.46	224.1

It is more likely that Nem falls somewhere between the two estimates. This makes it unlikely that drift produced any significant gene differentiation from cohort to cohort. It is interesting to see that despite the very different sources of data used in the calculations of m and Nem, the general trend remains fairly similar. A particular point to notice is the drop in Nem for the 1620-39 cohort, which covers a period of high crisis mortality during a plague epidemic when there may have been an inclination for the population to cut itself off from other communities. The 1640-59 figure also spans a period of plague, but is possibly spurious because of the probable overestimation of Ne.

The cohorts with the lowest figures for Nem are found during the early and mid part of the eighteenth century and coincide to a large extent with the population 'slump'. This is followed by a noticeable increase in Nem which would be expected in a population that is experiencing rapid population growth through natural increase and/or increased immigration. The figures suggest that opportunities for drift were negligible throughout the whole period.

The Crosthwaite figures can be broadly compared with those of Lasker and Kaplan (1964) for four Peruvian towns with total population sizes ranging between 1200 and 10,000. These towns appear to be composed largely of agricultural workers or fishing populations and are physically fairly isolated because of bad roads. The lowest Nem given is for the smallest town and is 92; the highest is 177. Lasker and Kaplan suggest that these figures, which were based on material compiled at various dates during this century, were small enough to indicate that random genetic drift may have been important in differentiating the populations at times in the past when they were very likely to have been more isolated.

Estimates of the degree of isolation of Crosthwaite parish prior to the mid-sixteenth century are not possible. There is perhaps a tendency

to assume that most rural areas, particularly mountainous ones, were very cut off until the coming of the railways or the car. The highly organised immigration of German miners in the sixteenth and seventeenth centuries may have been unusual, but it certainly shows that the parish was not isolated. Chapter 5 considers more fully the range and degree of migration experienced by the population over the period studied.

CHAPTER 5

Migration

Migration may have an important influence on the demographic

and genetic structure of a population in several ways.   Variations in the

age groups, sex ratio, and numbers of migrants may lead to changes in the

age structure, reproduction rates, and growth of a population.   The previous

chapter indicated the role of immigration and genetic isolation in influencing

the opportunities for genetic drift.   Varying migration rates and the extent.

of the area from which breeding immigrants are drawn (the extent of the gene

pool) may enable changes in the genetic structure of the population to be

studied.

Some information on many aspects of migration is available from

parish register material.

(a)   Migration rates

The lack of reliable population size figures and data on population

movement before the nineteenth century make it difficult to calculate

migration rates and to study the ages and sex ratio of migrants.   However,

it is possible to obtain some indication of population movement in Crosthwaite

Parish by using the following sources which can be extracted from the parish

registers.

(a)   Parish exogamous marriages - those marriages which take place in

      the parish between parish residents and outsiders.

(b)   Dummy marriages - the marriages which take place elsewhere, but

      result in the baptism of children in the parish.

(c)   Changes in the frequencies of surnames found in the baptism registers.

Each of the above is of limited value in studying the full implications of migration. The drawbacks and applications of these sources will be discussed separately.

Parish exogamy

Parish exogamy generally concerns those marriages which take place between a resident of a parish and an outsider. The numbers of exogamous marriages can be related to the total numbers of marriages taking place in the parish to provide crude immigration rates. There are, however, several drawbacks to using parish exogamy data. The material only deals with marital movement into the parish (concerning individuals who merely enter the parish to marry) and does not provide information on post-marital movement. Traditionally a bride marries in her own parish and subsequently may move to her husband's parish to live. This means that many of the marriages between Crosthwaite women and other-parish men may result in the loss of a Crosthwaite woman rather than the gain of an outsider. Conversely, many Crosthwaite men marrying in other parishes may bring their wives back to Crosthwaite. Unfortunately marriages of the last kind are not recorded locally, and it was impossible to study any references to the Banns.

Parish exogamy data do not give a full picture of immigration into the parish, and need to be interpreted with this in mind. However, such material has been used in a number of studies and it is possible to make broad comparisons of the trends in several parishes.

The Crosthwaite figures are shown in Table 5.1 and Figure 5:1. The data are arranged in 20-year intervals corresponding with those used in previous chapters. The numbers of exogamous marriages include cases in which both partners come from outside the parish. A certain number of marriage entries give no place of residence for the couple. It is assumed that these entries involve local couples. Even in the periods with the minimum of residence information, extra-parochial partners appear to be noted.

Fig. 5.1 PROPORTIONS OF PARISH-EXOGAMOUS MARRIAGES TO TOTAL MARRIAGES
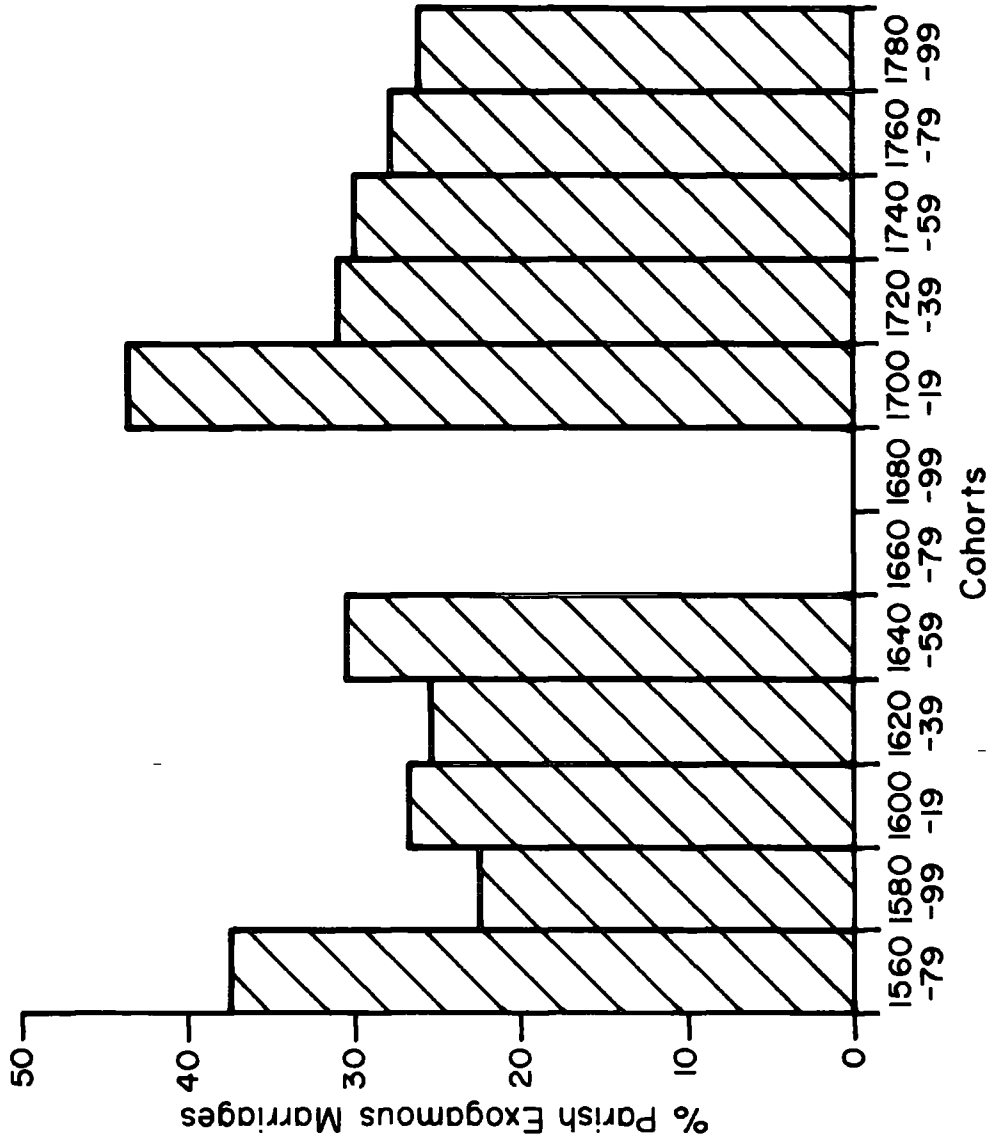
Table 5.1   Marital Movement

Proportions of parish-exogamous marriages

Cohorts	Parish exogamous marriages	Total no. of marriages	% exogamous marriages
1560-79	134	459	29.2
1580-99	83	471	17.6
1600-19	90	489	18.4
1620-39	89	409	21.8
1640-59	95	364	26.1
1700-19	98	329	29.8
1720-39	74	312	23.7
1740-59	79	359	22.0
1760-79	88	387	22.7
1780-99	82	389	21.1

Other studies use different intervals of time and are therefore not always strictly comparable. However, the various sources have been adjusted where possible to provide corresponding data and these are shown in Table 5.2. Most of these sources only provide information for the eighteenth century.

The Crosthwaite material is available from the late sixteenth century. The apparently high proportion of exogamous marriages in the period 1560-1579 is most probably explained by the influx of German miners who married local girls. 38 marriages occur between German men and Crosthwaite women, and 7 involve German men and women from other parishes. The drop in exogamy in the period 1580-99 could be accounted for by the slackening off of the immigration of miners.. The early seventeenth century sees a recovery in exogamy. It is not possible to study the mid-seventeenth century because of registration deficiencies, although the figures suggest a maintained increase.

Table 5.2   Parish Exogamy

Shropshire Parishes – (combined)

(from Sogner S. 1963)

Years	No. Endogamous		% Endogamous		Total		No. Exogamous	% Exogamous
1711–15	198)		63.7)		311)			
	)	447	)	66.5	)	672	225	33.5
1716–20	249)		69.0)		361)			
1721–25	269)		70.1)		384)			
	)		)		)			
1726–30	296)		67.3)		440)			
	)	1195	)	68.1	)1755		560	31.9
1731–35	351)		68.3)		514)			
	)		)		)			
1736–40	279)		66.9)		417)			
1741–45	308)		71.6)		430)			
	)		)		)			
1746–50	367)		71.1)		516)			
	)	1603	)	74.4	)2156		553	25.6
1751–55	367)		71.1)		516)			
	)		)		)			
1756–60	561)		80.8)		694)			

Table 5.2 (Continued)

Durham Parishes

(from Purvis M. 1975)

Parish	Years	% Exogamous
Coniscliffe	1690-99	29.4
	1730-39	25.0
	1770-79	40.5
	1800-09	52.0
Castle Eden	1730-39	20.0
	1770-79	46.2
	1800-09	41.7
St Nicholas (Durham)	1690-99	20.0
	1730-39	-
	1770-79	18.8
	1800-09	38.1
Dalton-le-Dale	1690-99	20.0
	1730-39	52.0
	1770-79	31.6
	1800-09	59.1

Table 5.2 (Continued)

Northumberland Parishes

(from Dobson T. and Roberts D. 1971)

Parish	Years	% Endogamous	% Exogamous
Warkworth	1689-1711	88.6	11.4
	1712-1761	77.5	22.5
	1762-1811	69.4	30.6
Felton	1662-1711	78.5	21.5
	1712-1761	74.5	25.5
	1762-1812	68.3	31.7
Rothbury	1662-1711	85.1	14.9
	1712-1761	80.5	19.5
	1762-1812	75.2	24.8
Alwinton	1719-1761	69.9	30.1
	1761-1811	66.1	33.9

Deerfield - Massachusetts

(from Swedlund A. 1971)

Years	No. Endogamous	% Endogamous	Total	No. Exogamous	% Exogamous
1680-99	16	80.0	20	4	20.0
1700-19	39	79.6	49	10	20.4
1720-39	42	79.2	53	11	20.8
1740-59	83	72.8	114	31	27.2
1760-79	116	81.7	142	26	18.3
1780-99	116	48.7	238	122	51.3

The beginning of the eighteenth century sees proportions of exogamous marriages as high as the late sixteenth century ones, followed by a steady decline. The only comparable trend is found in Sogner's Shropshire parishes (1963). Dobson and Roberts (1971), Purvis (1975), and Swedlund (1971) all show an increase in exogamy during the eighteenth century. This would seem more understandable considering the improved systems of communication and the development of industry in the second half of the century. One may suggest that industrial growth on the Cumbrian coast attracted young unmarried men who met and married their wives there, leaving no marriage record in Crosthwaite parish. Whether or not they returned to their native parish with their wives is a matter for further conjecture.

Sogner (1963) indicates that the decrease in exogamy in his parishes could be spurious. He notices that the increase in the numbers of endogamous marriages in the last decade studied (1751-60) is accompanied by a corresponding drop in the numbers of marriages in which both partners come from outside. He suggests that false place of residence information was given in the marriage records to avoid the Settlement Laws of the time. These laws enabled the authorities to return non-residents to their parish of origin if it was thought they were a burden. He also suggests that a short term of residence in the parish may have been adequate for some of these outsiders to qualify as parish residents.

These ideas do not provide full explanations for the drop in Crosthwaite's exogamy rates, as the number of cases involving pairs of outsiders increases in the corresponding period, and decreases later. It is possible, however, that a period of residence in the parish prior to marriage qualified individuals for Crosthwaite status. Certainly in the late sixteenth century several Germans are entered in records as Keswick residents. One must also be prepared to consider the apparent possibility of a real decline in marital movement into the parish, even if the explanation for it remains unknown.

Dummy marriages

Dummy marriages represent those couples who marry outside the parish, immigrate, and then have children baptised in the parish. There is no record of their marriage in the parish registers, but the baptisms of their children are present. Dummy marriages can be used to indicate the degree of post-marital movement into the parish.

Each dummy marriage represents at least one immigrant - for example, the 'outsider' wife of a Crosthwaite resident. In some cases both partners may be immigrants. For simplicity's sake each marriage is seen as indicating only one immigrant. This could therefore lead to an underestimate of the numbers of post-marital immigrants. These numbers are further underestimated because dummy marriages only involve fertile immigrants. Those post-marital immigrants who do not have children in the parish are not recorded.

The study of dummy marriages is of use to the population geneticist who is interested in the immigrants who contribute genes to the population. In the last chapter some of the errors of underestimating numbers were lessened by adding fertile parish exogamous marriages to the dummy marriages. These figures were then related to the numbers of individuals in the corresponding breeding cohorts to give crude immigration rates as shown in Table 5.3.

In the seventeenth century there is a decline in the actual numbers of dummy marriages + parish exogamous fertile marriages. The lowest figures are found in the mid-eighteenth century and are followed by a recovery towards the end of the century. This suggests an increase in the actual numbers of fertile immigrants in the second half of the eighteenth century.

The immigration rates, however, do not show this trend as clearly. This is obviously influenced to a certain extent by the calculation of each breeding cohort size. Some of these may be underestimated (for example, 1640-59), and the immigration rates may appear higher than they actually are.

Table 5.3   Post-marital movement

Immigration rates:

Ratio of dummy marriages + fertile parish exogamous

marriages to the breeding population

Cohort	Dummy Marriages	Fertile Exogamous Marriages	Total	Breeding Cohort Size	Immigration Rate
1650-99	240	24	264	1188	0.22
1600-19	233	29	262	1210	0.22
1620-39	160	31	191	988	0.19
1640-59	157	33	190	804	0.24
1700-19	96	40	136	606	0.22
1720-39	103	22	125	576	0.22
1740-59	111	11	122	622	0.20
1760-79	98	33	131	720	0.18
1780-99	162	25	187	960	0.19

As the degree of overestimation of the rates cannot be ascertained, it is impossible to say whether this compensates for any underestimation of the numbers of actual immigrants.   This makes any interpretation of the trends very difficult.

Both the numbers of immigrants and the immigration rates show a drop in the early seventeenth century, particularly during the period 1620-39 which spans the plague years of high mortality in 1622-3.   As explained above, the high rate for 1640-59 could be spurious.   The numbers and rates show a drop in the eighteenth century in keeping with the possible population slump of the middle of the century.   The numbers and rates recover towards the end of the century, although this is not particularly noticeable

as far as the rates are concerned.   This could be due in part to the great increase in the size of the breeding cohort for this period, to which the numbers of immigrants are related.

In general, the dummy marriage data suggest a decrease in post-marital immigration rates in the early seventeenth century, a similar drop in the mid-eighteenth century, and a recovery towards the nineteenth.

Name data

The analysis of surname data is based on the numbers of different surnames present in the parish records in specified 20 year intervals.   It is possible to study the numbers of names lost and gained in each period. Whereas the parish exogamy and dummy marriage material only provide information on incomers, a surname study enables some indication of the loss of individuals (through emigration or death) to be obtained.

There are two main sources of name data - marriage and baptism records, both of which have advantages and drawbacks.   Marriage records show marital movement involving those couples who marry into the parish; there is no really adequate means of establishing the length of their actual residence in the area.   A method for indicating the possible permanence of residing married couples can be used in limited circumstances, and this will be discussed later.   The main advantage of marriage entries is that they show the surnames of both partners.   Baptism records include the names of those individuals who migrate into the parish after marriage and have children baptised there;   they indicate the post-marital movement of fertile couples.   Such information is of relevance to the population geneticist who is concerned largely with the breeding section of the population.   To the demographer, the lack of information on the non-breeding post-marital immigrants may be regarded as a disadvantage. With baptism data only the surname of the father can be used, as the mother's maiden name is not recorded until the end of the eighteenth century.

Marriage records

The procedure for analysing the marriage records is as follows. For each period of 20 years corresponding to the breeding cohort spans, the surnames of all individuals - both male and female - are examined. The number of **different** surnames occurring in each period is recorded. This means that both rare and common names are noted only once and given equal weight. The numbers of new names and lost names are examined to give an indication of immigration and emigration. It is quite possible that some names are lost through death rather than emigration. Apart from the chance of emigrants returning, the genetic implications of loss through death or emigration are the same.

From the resulting figures it is possible to study the changes in the actual numbers of new and lost names, and to establish crude indications of net migration by subtracting the latter to the former. The numbers of new names can also be related to the total number of names in each period to obtain immigration rates. These rates are very probably overestimated. It is likely that each new name in the records represents only one or two new individuals. Some local names, however, are very common and belong to several people recorded in the registers. The total number of surnames in each period is therefore an underestimate of the total number of individuals involved, and the ratio of new to total names is too high. Conversely, the numbers of emigrants is probably underestimated as the loss of individuals with common surnames could go unnoticed. Migration rates, and the relation-ship between immigration and emigration, as calculated from surname data, need to be studied with caution.

Table 5.4 shows the frequency of surnames in the parish over the various 20 year periods. 1660-79 has been omitted because of registration deficiencies. The material can be broadly compared with other data on

Table 5.4   Marital Movement

<u>Immigration rates :-</u>

<u>Ratio of new names to the total number of names, and</u>

<u>net loss/gain of names based on marriage records</u>

Years	No. of New Names	No. of Lost Names	Total Names	Immigration Rate	Net Loss/Gain
1580-99	69	84	190	0.36	- 15
1600-19	84	59	215	0.39	+ 25
1620-39	74	90	199	0.37	- 16
1640-59	79	75	203	0.39	+ 4
1700-19	85	68	172	0.49	+ 17
1720-39	83	66	189	0.43	+ 17
1740-59	127	69	247	0.51	+ 58
1760-79	119	103	263	0.45	+ 16
1780-99	106	109	260	0.41	- 3

marital movement (parish exogamy). From the late sixteenth century

through the early seventeenth, the numbers of new names, migration rates,

and net migration figures fluctuate with a general tendency to a slight

increase. The increase in parish exogamy over this time is much steadier

and more noticeable. The eighteenth century is interesting as it shows

a maximum number of new names and a net migration gain in the period between

1740-59 which is a period of very low parish exogamy. After this the

numbers of new names decline steadily following the trend of parish exogamy.

At an earlier point mention was made of Sogner's idea that it might have

been possible for non-parishioners to acquire parish resident status after

a short stay in the area (1965). This would then account to some extent for the apparent drop in the rate of exogamous unions. The noticeable increase in the numbers of new names, coinciding with a drop in parish exogamy, supports this proposal and suggests that the apparent drop in marital movement may be exaggerated if not spurious.

Baptism records

The baptism records are analysed in the same way as the marriage registers, except that the surname of the father only is available. The figures are shown in Table 5.5. The actual numbers, immigration rates and net migration figures fluctuate from the late sixteenth century to the mid-seventeenth. After the turn of the seventeenth century there is a drop in new names, followed by only a very slight recovery in the period 1640-59. The dip coincides with the period spanning the plague epidemic of 1622-3. Net migration over this whole period shows a tendency for a loss of individuals which is very possibly influenced by high mortality.

The numbers of new names in the eighteenth century show a fairly steady increase up to the last 20 years when there is a great influx of names. These actual numbers give no hint of a possible 'slump' in the middle years of the century, but this is suggested to a certain extent by the immigration rates and the net migration figures. The other post-marital migration data available (dummy marriages + fertile parish exogamous marriages) show a drop in numbers and rates in the mid-eighteenth century, with a substantial recovery in the last 20 years.

The results of the various methods used to assess immigration rates are very confusing and inconclusive. Not only do marital movement rates and post-marital movement rates seem to pursue different directions over the various periods, but the methods used to assess the degree of both types of movement also seem to provide slightly differing trends.

Table 5.5   Post-marital movement

Immigration rates:-

Ratio of new names to the total number of names, and

net loss/gain of names, based on baptism records

Years	Number of New Names	Number of Lost Names	Total Names	Immigration Rate	Net Loss/Gain
1580-99	67	69	177	0.38	- 2
1600-19	75	49	203	0.37	+ 26
1620-39	46	76	173	0.27	- 30
1640-59	49	60	162	0.30	- 11
1700-19	57	36	135	0.42	+ 21
1720-39	57	40	152	0.38	+ 17
1740-59	61	53	160	0.38	+ 8
1760-79	66	58	168	0.39	+ 8
1780-99	106	43	231	0.46	+ 63

Some of the contradictory information may well be a result of the type of data used. For example, the drop in marital movement in the eighteenth century, particularly in the middle years, as shown by the parish exogamy data, may not conflict with the increase in the numbers and rates of new names appearing over this period. If a short period of residence in the parish qualifies individuals as parish residents, then many of the new names may represent people who are really outsiders, but who have lived for a short time in Crosthwaite.

The seventeenth century is a confusing period. Most of the data show little variation in the rates for the first twenty years compared with the last twenty years of the sixteenth century. The 1620-39 period generally shows a decrease in immigration although marital movement, as

indicated by the parish exogamy figures, shows an increase. Plague caused high numbers of deaths in this particular period, and this in itself could account for a loss of many names. It is also possible to argue that the local people were obliged to search further afield for mates. On the other hand, one could suggest that an outbreak of plague could cause a shortage of potential spouses in neighbouring areas as well, thus forcing the people to search nearer home for mates. In Chapter 6 information on inbreeding coefficients indicates that this period is one of relatively low inbreeding, with only a very small increase on the previous twenty years. This would suggest that, in this case, marriage partners come from a more extensive area.

It is difficult to assess the value of each method used to obtain immigration figures, and it is suggested that none should be regarded as reliable. Immigration data are necessary for other tests such as those used in the section on genetic isolation in Chapter 4. It is therefore important to realise that the results obtained for tests of genetic isolation may be biased because of the immigration data used.

(b) Immigrant sex ratio

The ages and sex ratio of migrants may be important in influencing population trends. The emigration of young adults could substantially reduce the population size in its own right, and also lead to a dearth of individuals in the reproductive age group and a subsequent drop in the number of births. The unbalanced emigration of either sex could also produce a drop in fertility by reducing the numbers of possible mates. The immigration of young adults could have the opposite result.

The age and sex of immigrants can not be determined except perhaps as a result of a very reliable family reconstitution. A rough indication

of the sex ratio of immigrants can be obtained from an examination of the parish exogamous marriages.

Table 5.6 shows the numbers and proportions of parish exogamous spouses of each sex. Throughout the period studied there is a higher proportion of males involved. This is in line with the practice of marrying in the bride's parish. In the late sixteenth century virtually all the exogamous partners are men. The proportions of men drop steadily until, towards the end of the eighteenth century, they once again increase. On the whole, the relative frequency of exogamous females fluctuates correspondingly. Except for the period 1740-59 there are few cases in which both partners come from elsewhere. These years correspond with the period in Sogner's study when the numbers of exogamous couples practically disappear. It seems possible that Crosthwaite had a lenient incumbent who was prepared to overlook some of the restrictions imposed by the Hardwicke Marriage Act and attracted some 'irregular' marriages from other parishes. Couples who wished to marry quickly without banns or licence may possibly have been able to do so in Crosthwaite.

A marriage in the parish of the bride may frequently be followed by residence in that of the groom. Thus it is likely that many of these exogamous marriages represent the emigration of a Crosthwaite woman rather than the immigration of an extra-parochial man. It is possible to obtain some indication of the permanence of the exogamous partners in the parish through an analysis of the parish exogamous records. The stability of these outsiders can be assessed by seeing whether they remain long enough in the parish to have children baptised there. It is assumed that those individuals who baptise no children, or only one child in Crosthwaite, emigrate. Those with two or more children in the parish are considered to be permanent residents. Obviously these assumptions introduce errors. Some individuals with 0-1 children may well be permanent settlers in the parish, just as some with two or more may well be emigrants.

Table 5.6   Immigrant sex ratio

                          (parish exogamous marriages)

Cohort	Marriages	No. Exog. Males	% Exog. Males	No. Exog. Females	% Exog. Females	No. Both	% Both
1580-99	83	78	94.0	3	3.6	2	2.4
1600-19	90	71	78.9	14	15.6	5	5.5
1620-39	89	64	71.9	19	21.3	6	6.8
1640-59	95	60	63.2	32	33.7	3	3.1
1700-19	98	50	51.0	45	45.9	3	3.1
1720-39	74	40	54.1	29	39.2	5	6.7
1740-59	79	45	57.0	15	19.0	19	24.0
1760-79	88	60	68.2	28	31.8	-	-
1780-99	82	75	91.5	7	8.5	-	-

Table 5.7 shows the proportions of exogamous males and females with two or more children (related to the total numbers of exogamous unions). Over virtually all the periods, the frequency of females remaining in the parish is higher than that of males. The first two and the last periods show more men remaining. This could be an effect of the large actual numbers of men who are marrying into Crosthwaite over these particular years. One might expect a larger actual number of males than females to remain. Table 5.8 shows the stability within each sex - for example, the proportion of resident males to the total number of exogamous males, rather than to the total number of exogamous marriages. It can be seen that in all the periods, the proportion of resident exogamous females to the total number of exogamous females exceeds that of resident exogamous males to the total number of exogamous males. Although generally fewer women actually marry into Crosthwaite parish, they tend to remain longer than the exogamous men. The proportion of 'stable' marriages involving two outsiders is negligible at all times.

It is probable that the sex ratio of immigrants is far more balanced than the data in Table 5.7 would suggest. It seems reasonable to suppose that many Crosthwaite men marrying elsewhere would return to Crosthwaite with their wives. This would compensate for the loss of Crosthwaite women. The marriages of such men are not recorded in the local registers. The only evidence of their presence in the parish would be found in the baptism registers if they have children after their return to the parish. Unfortunately, the parish of origin of the wife is not recorded under such circumstances, so there is no way of establishing the actual numbers of such immigrant women and assessing the full picture of the sex ratio of immigrants.

Table 5.7   Fertile exogamous marriages resulting in 2 or more children

as proportion of total numbers of exogamous marriages

with 2+ children

Cohort	No. Exog. Males	% Exog. Males	No. Exog. Females	% Exog. Females	No. Exog. Pairs	% Exog. Pairs	Total Exog. Marriages
1580-99	9	10.8	2	2.4	1	1.2	83
1600-19	9	10.0	6	6.7	-	-	90
1620-39	9	10.1	14	15.7	1	1.1	89
1640-59	8	8.4	10	10.5	-	-	95
1700-19	5	5.1	19	19.4	-	-	98
1720-39	7	9.5	9	12.2	-	-	74
1740-59	3	3.8	4	5.4	1	1.4	79
1760-79	8	9.1	10	11.4	-	-	88
1780-99	11	13.4	3	3.7	-	-	82

Table 5.8   Fertile exogamous marriages resulting in 2 or more children as proportions of total numbers of exogamous partners of each sex

Years	Exogamous males with 2+ children		Total exogamous males	Exogamous females with 2+ children		Total exogamous females	Exogamous pairs with 2 children		Total exogamous pairs
	Nos.	%		Nos.	%		Nos.	%	
1580-99	9	11.5	78	2	66.7	3	1	50.0	2
1600-19	9	12.7	71	6	42.9	14	-	-	5
1620-39	9	14.1	64	14	73.7	19	1	16.7	6
1640-59	8	13.3	60	10	31.3	32	-	-	3
1700-19	5	10.0	50	19	42.2	45	-	-	3
1720-39	7	17.5	40	9	31.0	29	-	-	5
1740-59	3	6.7	45	4	26.7	15	1	5.3	19
1760-79	8	13.3	60	10	35.7	28	-	-	-
1780-99	11	14.7	75	3	42.9	7	-	-	-

(c) Marriage distance and orientation

Population geneticists are not only concerned with changes in the amount of immigration. They are also interested in the extent of migration - the distance over which individuals travel to obtain mates and produce offspring. Harrison and Boyce (1972) distinguish between long range and short range movement. This is largely a matter of degree, but long range movement, involving the migration of populations over a period of years or even generations is of more significance as far as the general evolutionary changes of a species are concerned.

Genetically important short range migration tends to involve individuals, and is connected with their movement in search of a mate, and their subsequent settlement in a population in which they will have their families and contribute genes. The amount of gene flow from one area to another through such movement, and the range over which it takes place, may influence local genetic structure. The amount of gene flow and its implications have already been considered. The extent over which gene flow takes place can be studied by analysing marriage distance and orientation.

Marriage distance

Harrison and Boyce (1972) indicate that the distance and direction in which an individual travels to find a mate is generally limited by the range he covers in his normal everyday activities. After marriage, the couple may settle in either's place of residence, or perhaps they may move away altogether. Genetically important distances are not merely those between the birthplaces of spouses, but those between parents' and children's places of birth.

It is difficult to obtain a full picture of parent/offspring distances as information on post-marital movement is scarce or inadequate.

However, details of the place of residence of partners is frequently given in the marriage registers, and from this material it is at least possible to derive marriage distances. It is important to note that the place named in the records is not necessarily the place of birth. This can only be obtained by a full linkage of marital and baptism records.

In this study marriage distance is taken as the shortest distance by road or footpath between the partners' places of residence. Apart from one or two major changes in this century, the local road network seems to have altered little over the past hundred years or so. Recent Ordnance Survey maps and nineteenth century tithe maps were used for comparison. The marriage distance distributions are shown in Table 5.9 and Figure 5:2.

These figures show that over all the periods approximately 65% of the marriages for which marriage distance is known involve partners living within six miles of each other. In their Otmoor study, Küchemann et al. (1967) analyse the breeding population of the village of Charlton and discover that 65% of the exogamous partners are born within a radius of six miles of the village. These figures may not be strictly comparable with the Crosthwaite material as the latter includes data on endogamous marriages.

Figure 5:2 shows a similar skewed distribution of marriage distances to those observed in other studies such as those of Harrison and Boyce (1972), and Swedlund (1971). It is interesting to note the increase in the mid-eighteenth century - the period which had previously been described as having a population slump. Most of the immigration data in the two previous sections suggest a decrease over this period.

Mean marriage distances have not been calculated because of the effect of the few very long ones present in a number of periods, involving people from Germany, Holland and America. The median marriage distances given in Table 5.10 show that despite the occasional long distance, the median

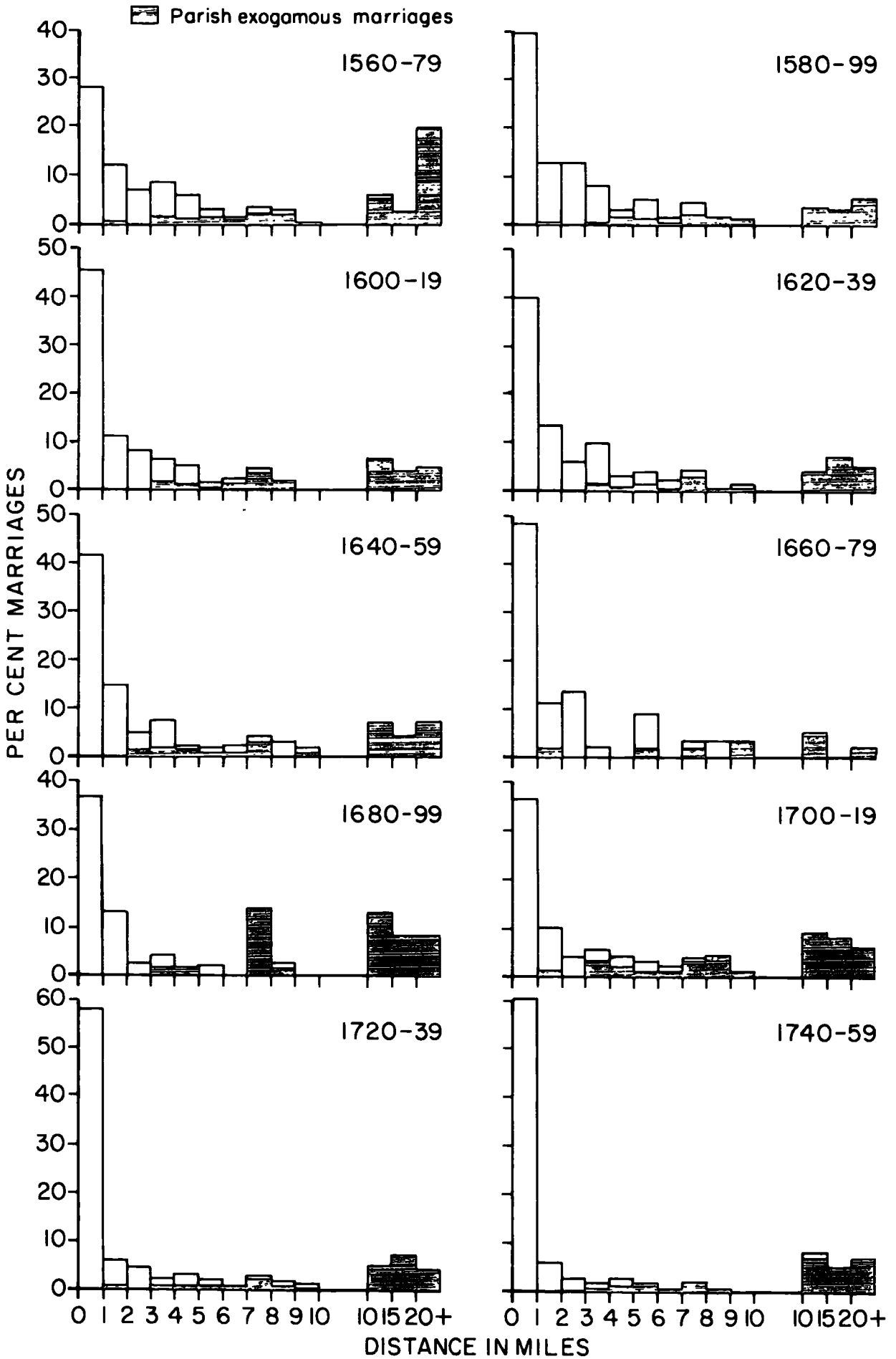# Fig.5·2 MARRIAGE DISTANCES IN MILES AT TWENTY YEAR INTERVALS

Parish exogamous marriages

PER CENT MARRIAGES

DISTANCE IN MILES

Table 5.9   Marriage distances - cumulative proportions

Years		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-15	15-20	20+	Total
							Distances in miles								
1560-79	Nos.	100	44	24	30	21	11	5	12	10	1	21	9	69	357
	%	28.0	40.3	47.0	55.4	61.3	64.4	65.8	69.2	72.0	72.3	78.2	80.7	100	
1580-99	Nos.	144	44	44	26	11	19	7	16	6	4	13	11	20	365
	%	39.5	51.6	63.7	70.8	73.8	79.0	80.9	85.3	86.9	88.0	91.6	94.6	100	
1600-19	Nos.	152	36	27	22	17	5	8	15	6	-	21	12	15	336
	%	45.2	55.9	63.9	70.4	75.5	77.0	79.4	83.9	85.7	85.7	91.9	95.5	100	
1620-39	Nos.	140	47	22	35	11	13	8	15	2	5	15	22	18	353
	%	39.7	53.0	59.2	69.1	72.2	75.9	78.2	82.5	83.1	84.5	88.7	94.9	100	
1640-59	Nos.	130	45	15	21	7	4	6	13	9	5	23	12	23	313
	%	41.6	56.0	60.8	67.5	69.7	71.0	72.9	77.1	80.0	81.6	88.9	92.7	100	
1700-19	Nos.	82	24	9	13	10	7	5	9	10	2	21	19	14	225
	%	36.4	47.1	51.1	56.9	61.4	64.5	66.7	70.7	75.2	76.1	85.4	93.8	100	
1720-39	Nos.	165	17	13	7	9	6	2	8	4	5	18	22	13	286
	%	57.7	63.6	68.2	70.7	73.8	75.9	76.6	79.4	80.8	82.5	87.7	95.4	100	
1740-59	Nos.	191	19	9	6	7	5	2	5	2	-	25	18	22	311
	%	61.4	67.5	70.4	72.3	74.6	76.2	76.8	78.4	79.0	79.0	87.1	92.9	100	

Table 5.10   Median marriage distances in miles

Years	Total Marriages	Median
1560-79	357	3-4
1580-99	365	1-2
1600-19	336	1-2
1620-39	353	1-2
1640-59	313	1-2
1700-19	225	3-4
1720-39	286	0-1
1740-59	311	0-1

remains below four miles and is as low as 0-1 miles in the mid-eighteenth century.   Detailed data on marriage distances are not available for the last two periods of the eighteenth century because of the Hardwicke Marriage Act which only required the recording of the parish of origin.   This is particularly unfortunate as these years cover a period when industry was expanding in Cumberland, communications were improving, and the potential for fairly long distance movement was increasing.   However, the limited data available on the parish of origin suggests that some of the distances involved in exogamous unions at this time were quite substantial.   This can be seen in Figure 5:3 which shows the orientation of marital movement.

The very low median marriage distances may perhaps be accounted for by the pattern of settlement in the parish.   Apart from Keswick, a market town, and villages such as Portinscale, Braithwaite, and Rosthwaite, most of the population is scattered in farmsteads which are fairly evenly distributed along the valleys.   The marriage distance figures suggest
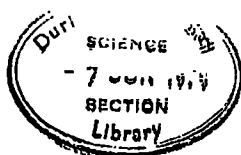
that much marital movement occurs between neighbouring farmsteads. The
slight tendency to an increase in numbers in the 7-10 mile range could
be accounted for by movement between valleys.

Orientation of movement

Küchemann et al. (1967) observe that the River Cherwell separates
a region of Otmoor that does not contribute many spouses to the village of
Charlton. Although it seems scarcely sufficient to constitute a physical
barrier, it may well have acted as a cultural one in the past. The
orientation of marital movement has been examined for the Crosthwaite
material to study the influence of both the terrain and the distribution
of population.

Figure 5:3 is based on parish exogamous marriages only. The
thickness of the lines gives an approximate indication of the numbers of
spouses contributed by particular places to Crosthwaite. Each line has
been drawn straight from the exogamous partner's place of residence to the
centre of Crosthwaite parish.

The figures show the greatest contributions from a westerly and
north-westerly direction - the coastal lowlands of Cumberland. This area
is (and was) easily accessible via the shores of Bassenthwaite Lake and
Whinlatter Pass near Braithwaite. The population of the time was
distributed in scattered farms, several large villages such as Lorton, and
a number of towns such as Cockermouth (a market town), Whitehaven and
Workington. The coastal towns increased in size and economic significance
in the eighteenth century, and this is reflected to a certain degree in the
extension of the westerly movement towards the coast at this time.

A lot of movement can be seen in a south-easterly direction -
particularly towards Grasmere, which is the nearest village to the south-
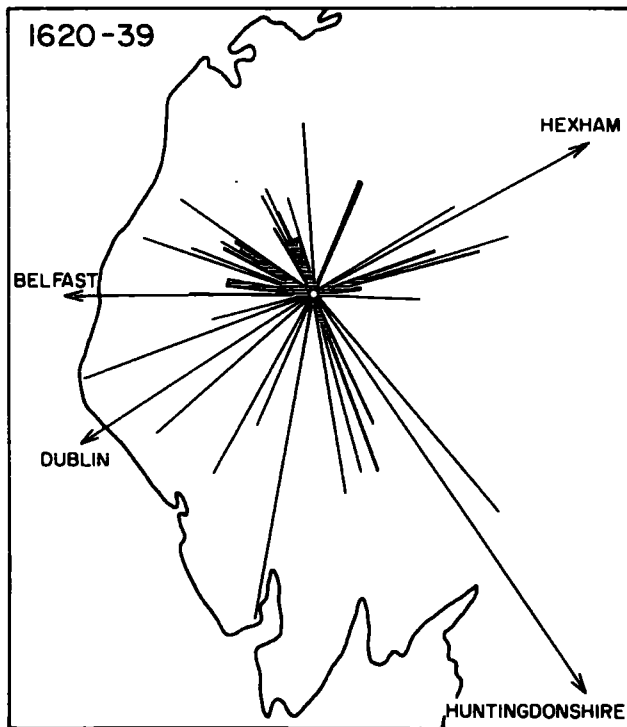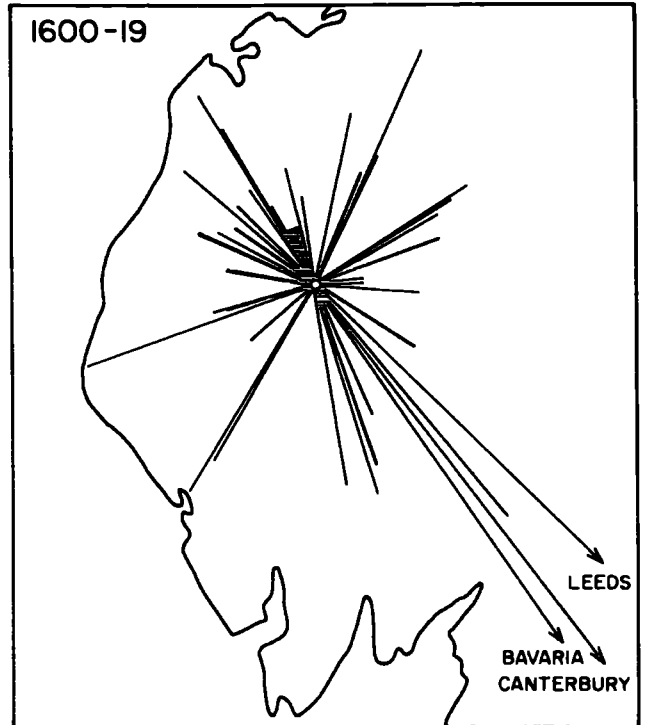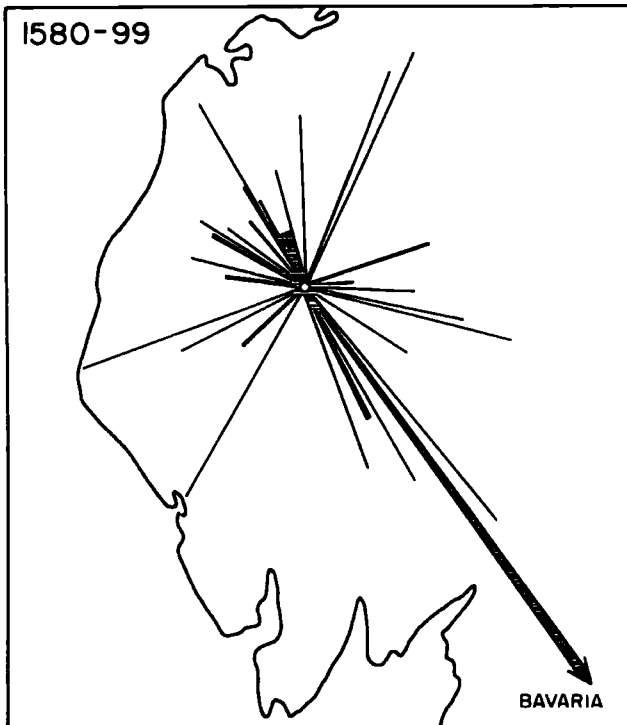east outside Crosthwaite parish. In the late sixteenth and early

Fig. 5·3a

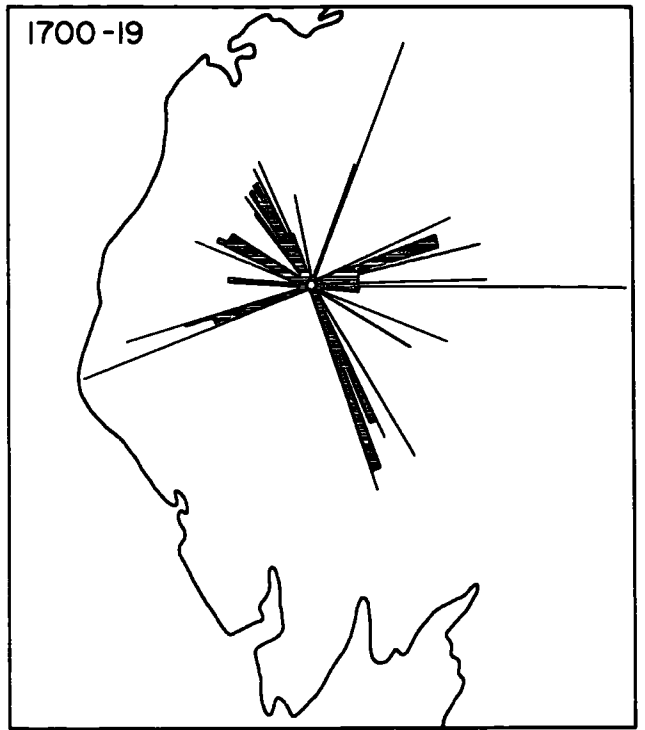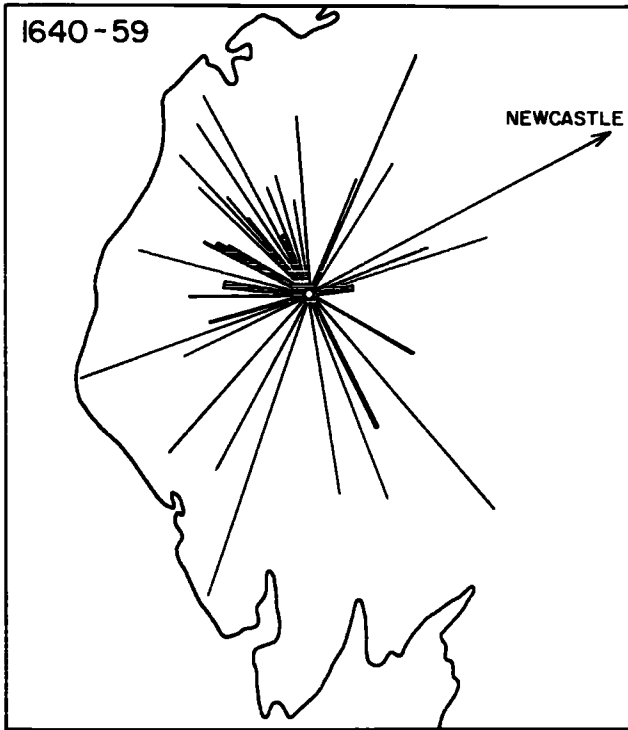ORIENTATION OF MARITAL MOVEMENT
Parish exogamous marriages

Fig. 5·3b

ORIENTATION OF MARITAL MOVEMENT

Parish exogamous marriages

1740-59

LIVERPOOL

LONDON and
MIDDLESEX

1760-79

COULTON
YORKS

WHITECHAPEL, LANCS
BISHOPS STORTFORD
CHELMSFORD

1780-99

DURHAM
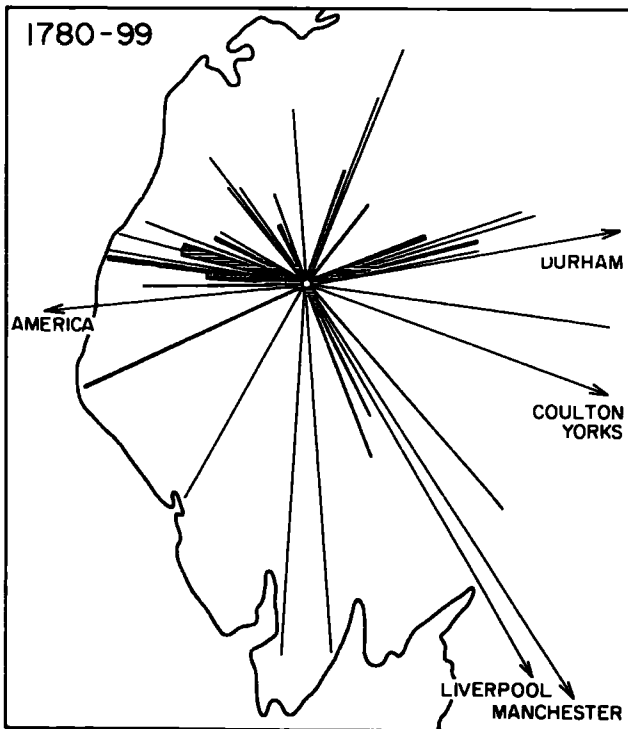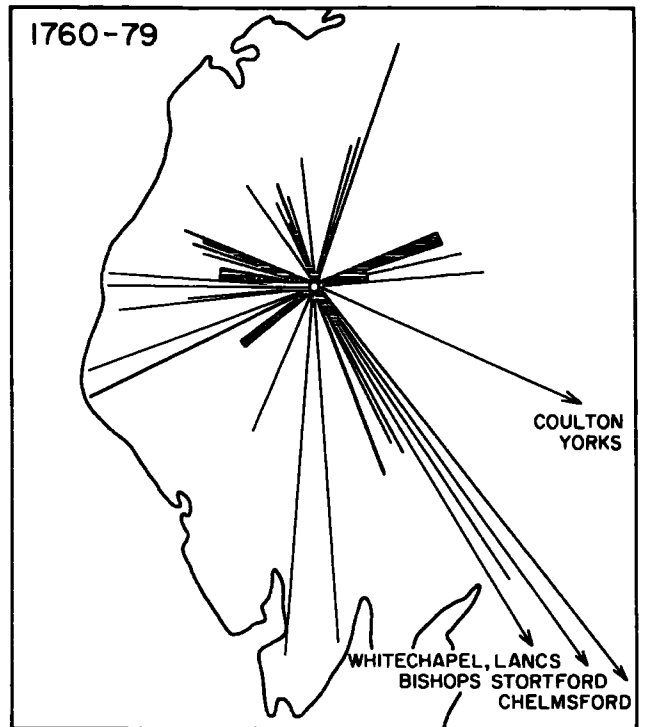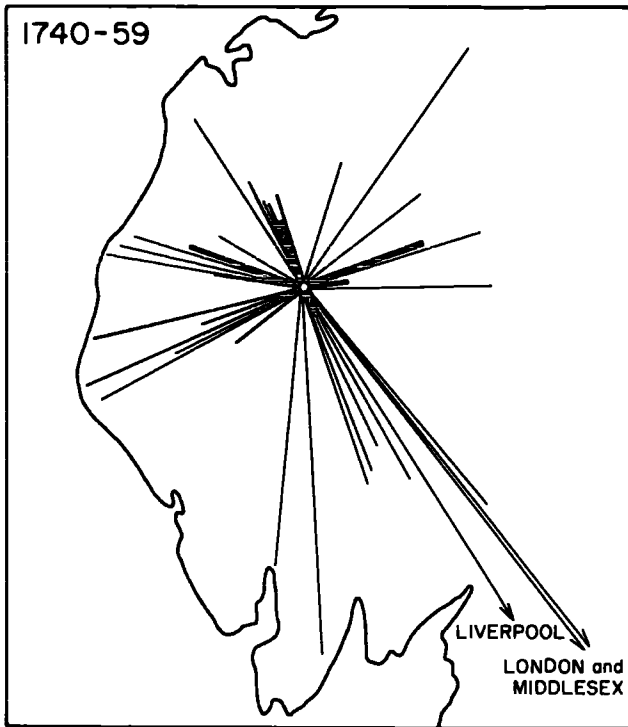
AMERICA

COULTON
YORKS

LIVERPOOL
MANCHESTER

Fig. 5·3c

ORIENTATION OF MARITAL MOVEMENT
Parish exogamous marriages

seventeenth centuries much of the south-easterly movement could be due to
links between the mining communities of Crosthwaite, Hawkshead, and Coniston.
In the late eighteenth century more movement in this direction is taken up
by long distance tracel from more southerly parts of the country.

Towards the north-east lie the town of Penrith and the large
village and parish of Greystoke. It can be seen that these accessible
places contribute a considerable number of partners.

On the whole most exogamous marital movement seems to involve
easily accessible places where the population is fairly highly concentrated.
Despite the fact that the lines shown in Figure 5:3 directly link the
various settlements to Crosthwaite it is possible to notice the influence
of the terrain to some extent. The areas to the south, east, and north-
north east of the parish show fewer contributions. These regions coincide
with the high land surrounding the parish - the Scafell region to the south,
the Helvellyn range to the east, and Skiddaw and Blencathra (Saddleback) to
the north and north-east. It seems reasonable to suggest that the mountains
formed quite an effective physical barrier between Crosthwaite and the areas
beyond them.

There may still be a tendency to assume that communities or
parishes, particularly in physically more remote areas, were very isolated
before the nineteenth century. The migration data suggest that contact
with other regions was maintained quite regularly, even though the degree
of movement varied from time to time. Social and economic factors have been
suggested to explain this. From the beginning of the period studied, the
amount of movement into the parish appears to have been enough to prevent
any local genetic differentiation from occurring. Most of the marital
contributions seem to come from nearby parishes at all times. This seems
to be the case in other studies such as those of Dobson and Roberts (1971)
and Küchemann et al. (1967). Migrants from places over 20 miles distant

do occasionally enter the parish to marry, but on the whole these are uncommon, and this is perhaps quite expected considering the road conditions and the means of transport available at the time. The influx of German miners is certainly an unusual experience.

Perhaps the main disadvantage of the data and method available for pre-census migration studies is the problem of establishing reliable net migration figures and population sizes to calculate net migration rates. The full implications of migration on population size cannot be appreciated without a knowledge of natural increase rates from which one can analyse the balance between population growth and migration. However, the limited data available do provide some insight into a very difficult area of analysis.

CHAPTER 6

Isonymy

Isonymy may be described as the possession in common of a surname. In societies where the surname is transmitted in a regular manner, isonymy may indicate some degree of biological relationship. Crowe and Mange (1965) recognised the potential of analysing isonymic marriages in a population to calculate inbreeding coefficients.

Inbreeding consists of two main components - random inbreeding (Fr), and non-random inbreeding (Fn). Fr is the result of a small effective population size which limits the choice of unrelated mates. In such conditions, apparent random mating may involve partners who are related to some degree. Fn occurs when there is a departure from random mating in a population. The effect of both is to reduce hererozygosity in a population.

Crow and Mange fully studied the possibility of using surname material to provide data on inbreeding and to calculate inbreeding co-efficients. They pointed out that except where there is cumulative inbreeding, or where marriages between direct descendants are involved, isonymous marriages will represent the same amount of inbreeding in the population for all degrees of consanguinity. They expand this by explaining that all sibs share a surname, whereas only one quarter of an individual's first cousins share the name. Therefore one isonymous marriage could indicate one marriage between sibs, or represent four marriages between first cousins. The inbreeding coefficient of first cousins is only one quarter as large as that of sibs. Since one isonymous represents four times as many first cousin marriages as sib marriages, the population inbreeding coefficient as calculated from isonymy data is the same regardless of the degree of relationship involved. It seems worthwhile pointing out that some societies encourage or forbid marriage with certain categories of cousins, and therefore the above assumptions may not always be valid.

If one assumes that the possession of the same surname is a true indicator of common ancestry, it is possible to calculate inbreeding coefficients for the two separate components of inbreeding - random and non-random. Fr can be calculated from the following formula:

$$Fr = \Sigma p_i q_i / 4 \qquad \text{(from Crow and Mange 1965)}$$

where p_i is the proportion of the male population with a certain name, and q_i is the proportion of females.

Fn can be calculated as follows:

$$Fn = (P - \Sigma p_i q_i) / 4(1 - \Sigma p_i q_i) \qquad \text{(from Crowe and Mange 1965)}$$

This makes use of the proportion of actual isonymous marriages in the population (P). It does not take into account the possibility that couples are less likely to be related if the surname is a common one.

The total inbreeding coefficient (F) is calculated in the following way:

$$F = Fn + (1 - Fn)Fr \qquad \text{(from Crow and Mange 1965)}$$

Crow and Mange's formulae have been applied to the Crosthwaite marriage data. The figures are based on all the marriages taking place in the parish, and 20 year cohorts are used. In Crosthwaite many marriages occur between people with common surnames - particularly Fisher. However, the tendency for these couples to live in the same hamlet or valley suggests that they may be related to some degree. Table 6.1 and Figure 6:1 show the inbreeding coefficients for Crosthwaite.

Perhaps the most interesting study to compare with the Crosthwaite material is that of Rawling (1973) of the parish of Warkworth, Northumberland, in the eighteenth century. He uses 25 year intervals. His figures for all unions (intra-parish and parish exogamous unions) are the most comparable with the Crosthwaite data, and can be seen in Table 6.2. He notices an increase in the numbers of isonymous marriages throughout the eighteenth

Fig.6·1 Inbreeding coefficients from isonymous marriage data, 20 year intervals from 1560
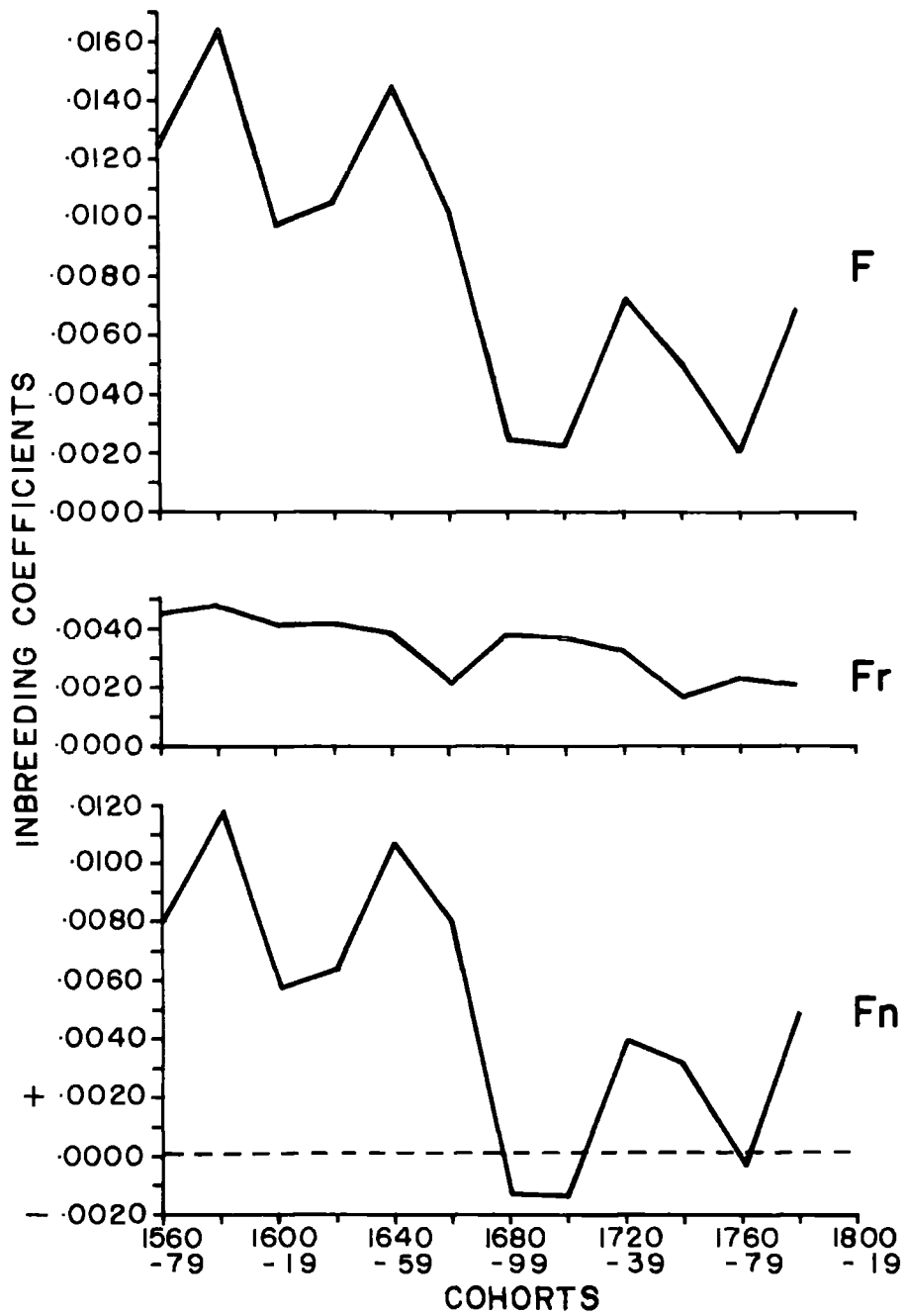
Table 6.1   Inbreeding coefficients from isonymy data

Cohort	Total Marriages	No. Isonymous	Fr	Fn	F
1560-79	459	23	.0046	.0080	.0126
1580-99	471	31	.0048	.0118	.0166
1600-19	489	19	.0042	.0057	.0098
1620-39	409	17	.0042	.0063	.0105
1640-59	364	21	.0039	.0107	.0146
1700-19	329	3	.0037	-.0014	.0023
1720-39	312	9	.0033	.0039	.0072
1740-59	359	9	.0018	.0031	.0049
1760-79	387	3	.0023	-.0003	.0020
1780-99	389	11	.0021	.0050	.0071

Table 6.2   Inbreeding coefficients from isonymy data: Warkworth -

Northumberland

(Rawlings P. 1973)

Years	No. Isonymous	Fr	Fn	F
1686-1711	2	.00165	.00015	.00180
1712-1736	2	.00180	-.00028	.00152
1737-1761	4	.00165	.00135	.00299
1762-1786	6	.00130	.00261	.00391
1787-1812	8	.00130	.00590	.00719

century which is generally the case in Crosthwaite.   His values for F

and Fn also increase.   Crosthwaite's values fluctuate considerably although

they are definitely higher at the end of the century than at the beginning.

Rawling points out that the actual levels of inbreeding (F) in

Warkworth are high, ranging from 0.0018 - 0.0072 (for all unions).

Crosthwaite's are 0.0020 - 0.0071 for the corresponding period.   He suggests

that his figures are comparable with inbreeding coefficients derived by

other means such as pedigree studies of isolates.   This would suggest that

there is little migration in both parishes over the period studied, and that migration even declines. The evidence for marital movement in Crosthwaite is rather ambiguous. However, Rawlings indicates that Dobson and Robert's study (1971) of the Northumbrian parishes suggests an increase in migration in the eighteenth century.

The high inbreeding coefficients for both parishes could also be overestimates of the true inbreeding values. Crow and Mange's isonymy calculation of inbreeding for the Hutterites gives a much higher value than that calculated by pedigree analysis (Mange 1964) quoted in Crow and Mange 1965). Their isonymy figures are 0.0495 compared with 0.0216 for pedigree analysis. In their study of Kippel, an isolated Swiss community, Friedl and Ellis (1974) notice that the inbreeding coefficient obtained from pedigree analysis (F = 0.00498) is only about a fifth as large as that calculated by isonymy.

Despite a rough attempt to adjust the Warkworth inbreeding coefficient for increasing migration, Rawlings' F values are still high. He concludes that the full value of isonmy studies can only be assessed when the accuracy of the F values are tested by comparing them with a thorough pedigree analysis. For most historical studies the standard of parish register entries and the complications involved in a full family reconstitution make such an analysis difficult.

It is probably unwise to rely on the actual values of isonmy analysis, although the general trends of the inbreeding coefficients may be studied in conjunction with various demographic factors.

Fr shows a fairly steady decline over the whole period, which would be expected in a population which was increasing in size. It is not possible to show any association between decreased inbreeding and increased marital mobility. However, it does seem that despite the apparent drop in exogamous marriages, the extent over which these extra-parochial individuals are obtained increases, particularly towards the west.

Non-random inbreeding fluctuates quite noticeably. It is interesting to compare these changes with the information on population size, migration, and social conditions. It is tempting to associate some of the noticeable peaks in the Fn values with the periods during which plague or high mortality occurs. These are mainly during the 1590s, 1620s, 1640s and the mid years of the eighteenth century. Apart from the period 1620-39 when the increase in Fn is negligible, the non-random inbreeding values are considerably higher during these times. It may be reasonable to suggest that high mortality in Crosthwaite and the surrounding areas limited the choice of mates and led to more marriages between relatives.

The ambiguous nature of the marital movement data has already been mentioned. Apart from the first period (1560-79) and the beginning of the eighteenth century (1700-10), the non-random inbreeding coefficients (Fn) tend to follow the same general trends as marital movement (assessed from parish exogamy). One would expect a converse relationship to exist, with increased immigration accompanied by lower inbreeding. It seems that either the sources of data are unreliable, or that the degree of marital movement has little influence on the amount of non-random inbreeding in the population, and that other factors such as high mortality are involved.

It is possible that the local system of land tenure could have had an indirect influence on the inbreeding values. The descendants of a tenant farmer could continue to farm the lands after his death on payment of a small sum. At certain times, marriages could possibly have taken place between related individuals to help keep larger areas of land in the family. In Newlands valley in the sixteenth century, lands seem to have passed to sons-in-law.

It is very probable that many factors combine to produce the fluctuations in the inbreeding coefficients, and that an analysis of any one of these aspects, such as mortality, only gives a partial indication of the mechanisms involved. Parish register studies of this type can suggest only a few of the many possibilities.

CHAPTER 7

Conclusion

In general this study has followed two lines.   It has considered material of a demographic nature and has attempted to analyse changes in population trends and to assess factors affecting them.   It has also used some of this information to provide material of more interest to the population geneticist who is concerned with ascertaining the influence of such variables on the genetic structure of human groups.

The demographic material uses breeding cohorts as the main units of study over the period under consideration.   The fluctuations in cohort sizes were accounted for in general terms by social and economic conditions and by variations in the reliability of the parish records.   The association of cohort size variation and other variables was not easy to establish. No simple explanation could be offered for most fluctuations in the sizes except perhaps for the end of the eighteenth century when there seemed to be a direct relationship between the increase in family size, higher immigration rates, and increasing breeding cohort sizes.   On the whole it proved impossible to establish constant links between other demographic variables such as family size and age at first marriage of women, or family size and mortality.   It is quite possible that unknown economic and social factors, as well as deficiencies in the data and methods of analysis, accounted for the lack of any regular association of variables.

Migration figures were equally unreliable, largely because of the nature of the source of data.   Marital and post-marital movement showed different and confusing results.   Many of these data were necessary for some of the analyses used in assessing the genetic isolation of the population.   It is therefore necessary to be fully aware of the risk in relying on any one source of migration data for use in such analyses.

The results for the sex ratio of migrants were dubious, but it is possible to state with a fair measure of certainty that the raw data were the main problem, and one can therefore qualify the results that were actually obtained. Although more exogamous marriages involved men rather than women from outside the parish, a higher proportion of the non-local women tended to remain in the parish. This is quite in line with the practice of marrying in the bride's parish and returning to the groom's to live. One can make allowances for the possibility that many Crosthwaite men marrying in other parishes actually returned to Crosthwaite to live.

The population geneticist is more interested in the 'effective' breeding cohort sizes which give some indication of the possibility for genetic differentiation to occur. Methods used to show the effect of inbreeding and family size on the breeding cohorts only showed a substantial reduction in size for the effective breeding cohorts when the variance in family size was considered. The effective breeding cohort sizes tended to follow the same trends as the actual breeding cohort sizes. They were used in conjunction with migration data to calculate opportunities for genetic drift to occur, and the indices of genetic isolation showed that it was unlikely that drift occurred at any time over the period for which the population was studied.

Marriage distance has been studied in quite a number of population studies, and there seems to be a consistent tendency for a highly skewed distribution of marriage distance, with a high proportion of marriages occurring between people living within a short distance of one another. The Crosthwaite material was in agreement with this. Marriage orientation showed the marked influence of the terrain on marital movement. Exogamous marriages tended to occur between people who had easy access to one another along main routes. Populations which were separated by mountains seemed to provide few partners, as might be expected.

Isonymy is used to study inbreeding, which can reduce hetero-
zygosity in a population. It seems that the inbreeding coefficients
calculated were very probably rather high, and it is therefore inadvisable
to accept them without qualification. There were some indications that
non-random inbreeding increased during periods of high crisis mortality,
when the choice of mates was possibly reduced.

During this study many tests were started and abandoned because
of the unreliability of the records and, unfortunately, because of lack of
time. Attempts to link burial records with baptism and marriage registers
proved impossible, and yet the information obtained from such a task would
have provided important modifications to such calculations as those for
completed family size. Work was started on a study of baptism intervals
to assess their relationship with such factors as age at marriage of
mothers, and total family size. It was hoped that such material might
have shown whether any family limitation was taking place in the population.
A study of the relationship between the geographical population distribution
and marital and gamete exchanges of these populations was started using a
computer programme to produce two dimensional 'maps' of the last two
factors. These maps were to be compared with the actual geographical
distribution of the population. Although some maps were obtained,
comparisons were not attempted because of the great difficulty in inter-
preting them.

Throughout this work, the problems of using historical material
have been stressed. The present writer feels that many of the difficulties,
apart from the nature of the actual data, could be minimised if the study
were on a larger scale, and a team of specialists were involved. Statist-
icians, demographers, and economic and social historians could possibly
obtain a vast amount of information which could answer many questions.
For the population geneticist this kind of work is of more use if the

historical material can be related to the existing population of the area.   A full study needs to include a sample of genetic markers for the present population and its neighbours, as population changes and factors such as indices of isolation only become meaningful when they are related to the living population of a region.

There is still much work to be done on the demographic history of Crosthwaite parish, and on the genetic implications.   This piece of research has provided a background for further work, and can be regarded essentially as a pilot survey.   The work involved seems of value in pointing out the many pitfalls that can be encountered, and which can so easily be ignored.   It is felt that the greatest lesson has been learned from the problems involved in piecing all the data together.

APPENDIX

A brief history of parish registers

Deficiencies in the registration system

The registers to record baptisms, marriages and burials were set up in 1538 during the reign of Henry VIII. Details concerning the maintenance of these records seem to have been inadequate and many early registers have been lost (Walne 1958). In 1598, during the reign of Elizabeth I, the incumbents were instructed to copy on to parchment all previous entries - at least as far back as the beginning of the Queen's reign. Future registers were to be maintained in the same books, and copies, known as the Bishop's Transcripts, were to be submitted annually to the Diocese. Many incumbents appear to have taken the beginning of Elizabeth's reign (1558) as the earliest date from which they needed to copy the records, and in most parishes entries prior to this date were lost or destroyed (Steel 1968).

Many parishes have records commencing around 1558. Parchment registers were in use in all parishes until the Commonwealth period when a vellum book was introduced and civil registration took over temporarily. A few church records were maintained during the 1650s, but in most parishes the entries were very scanty indeed.

During the Commonwealth period marriages were performed by a 'Parish Register' who was elected and could even be the existing incumbent or parish clerk. Some marriages were still recorded in the church registers even though the ceremony was a secular one. Also, many people did not have their children baptised, and after the Restoration there were frequent adult baptisms in many parishes (Steel 1968).

Until 31 December 1751 the Old Style Calendar was still being used and, at that time, the first day of the year was 25 March. In 1752 the calendar was brought into line with the system on the Continent and the first day of the year brought back to 1 January. The cumulative error incurred through the use of a 365 day year had already amounted to eleven days at that time, and this was corrected by omitting eleven days from the year 1752, making 14 September follow 2 September.

The Hardwicke Marriage of 1753 was aimed primarily at preventing clandestine, unregistered marriages; for example, those which were performed without banns or licence and by churchmen of doubtful reputation (Steel 1968). This may well have had the effect of increasing the numbers of registered marriages in some areas. The Act also made it necessary for the marriage to be performed in the parish in which one of the parties resided.

After the General Registration Act of 1836, full civil registration of births, marriages and deaths began. It is uncertain just how much this affected parish registration, but it is possible that the church records became less reliable in some areas. Eversley (1956/7) points out that in the areas of Worcestershire he studied there was evidence to suggest that registration of baptisms and burials declined, but marriages remained much the same.

Registration deficiencies

Apart from Acts which affected registration from time to time, other factors also appear to account for gaps or low numbers of entries in the records. Many instances have been noted of the misuse of parish registers or carelessness with which they were maintained (Steel 1968). The early parchment records are known to have been used by tailors and lace-makers for patterns, or even by parsons' wives as kettleholders. Many seem to have been lost. In the sixteenth and seventeenth centuries, the incumbent

or clerk was only required to record the previous week's baptisms, marriages, and burials every Sunday. Generally, notes were made on rough paper and copied up later, and from instances where the original clerk's notes have been found it seems that many were incorrectly recorded in the registers and others were not even entered at all.

The incumbent's personality, as well as his degree of diligence, often determined the accuracy and fullness of the entries. Although they were required to enter all baptisms, marriages, and burials in the records, some were obviously bothered by the character of a few of their parishioners and refused to register their marriages or baptisms (Steel 1968). Illegitimate children may have been omitted quite frequently. The parishioners' opinions of the incumbent may have discouraged some individuals from marrying or baptising their children locally (Steel 1968).

From the beginning of parish registration it seems likely that certain sections of the population were never or rarely included. These were the various religious bodies known as Dissenters, and included Quakers, Jews, Roman Catholics and a number of Non-conformist Protestant groups such as the Methodists and Congregationalists. In the sixteenth and seventeenth centuries, Roman Catholic individuals were expected to baptise their children in the Anglican Church even if they had already performed the ceremony in their own church. In 1694 an Act came into force declaring that the births of Dissenters should be entered in separate lists. Up to 1753 most dissenting groups married in their own places of worship with no second ceremony in the Anglican Church. After the Hardwicke Marriage Act of that year, marriages by dissenting ministers were checked, and apart from Quakers and Jews, Non-conformists were required to marry in the Anglican Church. Burials of Non-conformists almost certainly took place in Anglican churchyards in the sixteenth and seventeenth centuries, largely because of the lack of private burial grounds. However, many of these burials would have been

private or occurred secretly with the compliance of a tolerant incumbent and would therefore not have been recorded (Steel 1968). Towards the end of the eighteenth century numerous private cemeteries were opened up for Non-conformists.

For a large part of the history of parish registers it was theoretically necessary for Dissenters to have their baptisms, marriages, and burials recorded in the Anglican registers. However, it is difficult to ascertain whether they did comply, or even whether the incumbent would allow them, should they even wish to do so. Prejudice against dissenting individuals may well have prevented a lot of baptisms, marriages, and burials from being recorded.

It seems to be generally accepted that Non-conformism does not significantly influence population analysis until the late eighteenth century. After this time parish registers are thought to become less reliable as indicators of the actual number of baptisms, marriages, and burials (Eversley 1966 and Krause 1967). After the introduction of Civil Registration in 1837 it is possible that the reliability of the parish records diminished further.

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