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## The Arctic Skuas of Fair Isle

### 1.1 The Arctic Skua and its breeding grounds

The Arctic Skua is a circumpolar Arctic species that breeds as far north as Spitzbergen. At the southern end of its range, it breeds in small colonies in parts of the Hebrides and the north of Scotland. But in the British Isles it is common only in Shetland (59°N) where it is fairly widespread. Large colonies are found on the islands of Fair Isle, Foula, Bressay, Noss, Fetlar and Unst. Isolated pairs and loose colonies can be found throughout Shetland. Recently it has been giving ground to the Great Skua or Bonxie. In 1950, the largest Shetland colony of Arctic Skuas was to be found in the bird reserve of Hermaness on Unst, the most northerly point of the British Isles. This colony was completely overwhelmed by Bonxies as they rapidly increased in numbers between 1950 and 1975, completely taking over the bird reserve. The largest compact colonies of Arctic Skuas are now to be found on Fair Isle and Foula: about 130 pairs breed on Fair Isle and 300 pairs on Foula. Both colonies are under attack. The Foula colony is being pushed into a smaller and smaller area by the spread of the Bonxies. On Fair Isle, the predators are human. Unfortunately, Arctic Skuas are recorded as having been shot on Fair Isle – bodies with bullet holes having been found. In spite of such depredations about 120–140 pairs have bred since 1975.

The Arctic Skuas of Shetland on the islands of Fair Isle and Foula are the subjects of this book. I studied them first in the period 1958–61, when I was a research student collaborating with Peter Davis who was then Warden of the Fair Isle Bird Observatory. Twelve years later, a Lecturer at Cambridge University, I returned to Fair Isle to test theories of sexual selection in the Arctic Skuas having obtained a research grant from the Natural Environment Research Council. I had set up and analysed mathematical models of Darwin's theories of sexual selection in birds and proposed to test these models with data of the matings and relative fitnesses of the Arctic Skuas. This research came to an end in 1979. By that time I had collected enough

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demographic data on the Arctic Skuas to obtain good estimates of the parameters of sexual selection. Using statistical tests, I could refute specific models of the mechanism of selection. At the beginning of this second period of research I was most fortunate to have the assistance of John W.F. Davis. He spent four years working with me on the project from 1973–76. In the later years, 1977–79, Roger Broad and Iain Robertson, Wardens of the Bird Observatory, generously assisted in catching the adult birds for ringing.

The season of field work on the Arctic Skuas of Shetland begins in mid-May when the first pairs lay their eggs. The first eggs are usually laid on the same day each year. The birds are remarkably precise and consistent in timing when they breed. My own arrival in Shetland was seldom timed as precisely as the birds'. British Airways' flights to Shetland are often delayed by fog, sometimes for several days, for Sumburgh Airport is built on a narrow isthmus of land at the southern tip of Shetland where sea fog is very likely to occur in summer. So relief was often mixed with pleasure as the plane at last set down on the runway at Sumburgh. If British Airways could get in to Sumburgh, it was certain that Loganair could take one of their eight-seat Islander aircraft to Fair Isle, to land 200 ft up on the gravel airstrip situated in the middle of Fair Isle in the Arctic Skua colony.

Until 1973, only a rough stony track constructed during the war existed to justify the name 'airstrip'. From the area round this original airstrip, the Arctic Skuas began their colonization of Fair Isle. Their original nests were found on either side of the road to Ward Hill where it crossed the airstrip. From this centre, the Arctic Skuas quickly spread to Sukka Mire, Byerwall and Homisdale and up onto the heather moorland of Swey. They crossed Homisdale to Eas Brecks. The colony's centre of gravity gradually moved north. By 1977, Wirvie Brecks had become the most densely colonized area. It is easy to see why a colony should move its centre like this. Young birds cannot displace the holders of the original territories. They establish new territories for themselves at edges of the colony. As they become older they give rise to a new centre from which the colony can expand in new directions. The old centre becomes less populous as the original birds die. Some new birds may now establish themselves in territories where birds have died, but many new birds look for areas where there are no existing pairs to compete with. The maps in figure 1.1 show how the colony has expanded and moved since 1948.

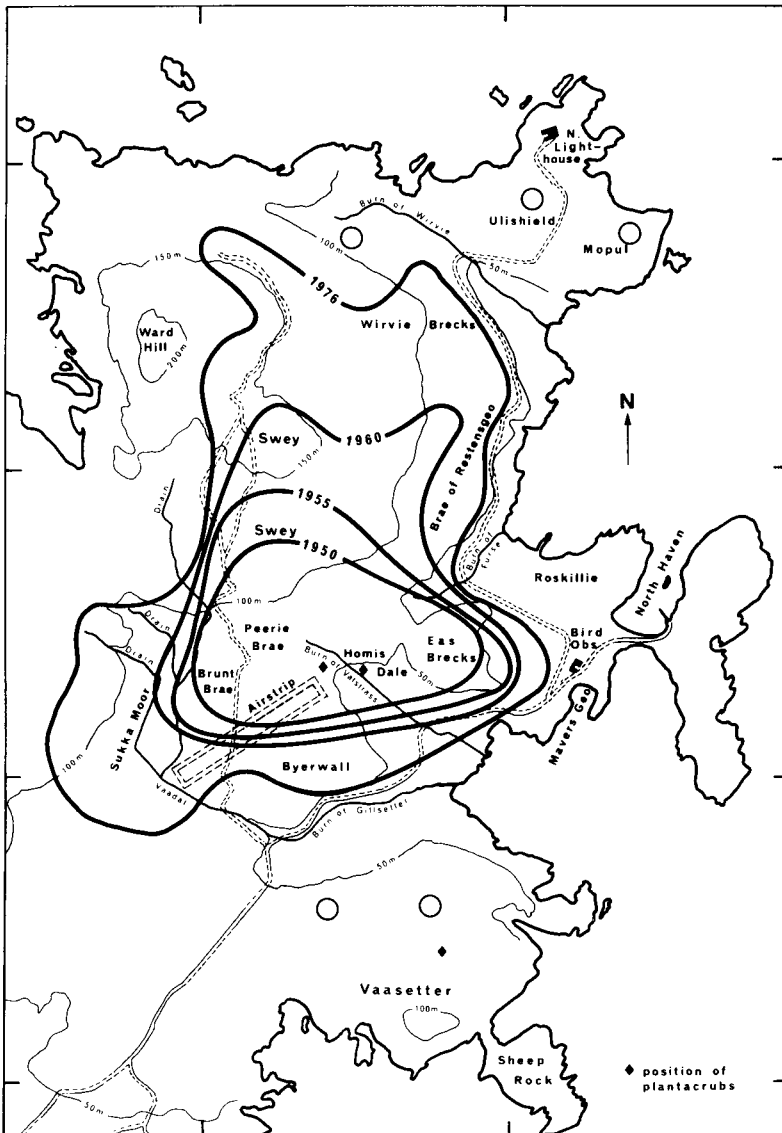
By the time the modern airstrip was under construction in 1973, the airstrip area had already become less densely occupied. The construction work itself, however, caused little disturbance. Pairs continued incubating

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only 20–30 m away from the continual movement and noise of the bulldozers. This is one of the great advantages of the Arctic Skua as a bird to study: it seems almost impossible to put the birds off their nests. Regular checks of nests to determine the laying and hatching dates of the eggs and

Figure 1.1 Map of Fair Isle showing the limits of the Arctic Skua colony in different years. Nests of isolated pairs in 1976 are shown as clear white circles.



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the fledging of chicks have no apparent effect at all. After the eggs in a nest have been checked, for example, the birds are usually back at the nest incubating again within a few minutes. Trapping birds on their nests while they are incubating the eggs – as we shall see, this is the only practical way of catching them – never seems to upset them or put them off: they are back sitting on the eggs as soon as they have been ringed, released and the traps removed.

Some pairs do still nest near the airstrip. East of the airstrip, on Byerwall, nests are densely packed, and here also 'clubs' of young, first and second year birds often congregate round a small water hole. Air traffic is only a momentary disturbance, even to birds nesting by the side of the runway. As the map shows, the airstrip lies in a SW–NE direction on the moorland above Homisdale. Unless the wind is blowing strongly from the north or east, the plane lands towards the SW, approaching over Eas Brecks, which is another of the more densely colonized areas. The new Bird Observatory is situated just below Eas Brecks on the road to North Haven. From the airstrip, a direct line to the Bird Observatory takes you across part of Byerwall, down into Homisdale, up over Eas Brecks and down again to the Observatory. These areas all form parts of the Arctic Skuas' colony. They show the different habitats that Arctic Skuas choose for nesting.

Byerwall, like much of the higher ground of Fair Isle, consists of short tufts of heather (*Calluna vulgaris*) with some Crowberry (*Empetrum nigrum*) separated by stony patches of ground, moss, *Nardus stricta*, Fescue and other grasses. Byerwall dries rapidly after heavy rain. The rocky subsoil is only two or three inches below the surface and surface water drains quickly away. This barren aspect of the higher ground was produced by peat cutting. Fair Isle was overlain with peat, as much of Shetland still is today. Most of the peat was cut in the nineteenth century, when the population rose to an almost insupportable 350 people. Some peat is still left on the west side of the island below Ward Hill. Peat cutting continues there today. When a peat bank has been cut, the top few inches of turf are relaid over the rocky subsoil where the peat was removed. Thus only a very shallow layer may be left on top of the subsoil. Arctic Skuas nest among the heather and rocks of such areas as Byerwall, Eas Brecks, Swey and Wirvie Brecks where the original peat has been almost completely removed. Except on the steep slopes below Swey, the heather is very short and stunted: sheep graze any new growth that appears. Over-grazing probably explains why these areas remain so barren and rocky. But this seems no problem to the skuas. A shallow scrape in the grass or heather is a sufficient nest for them (Figure 1.2).

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Peter O'Donald

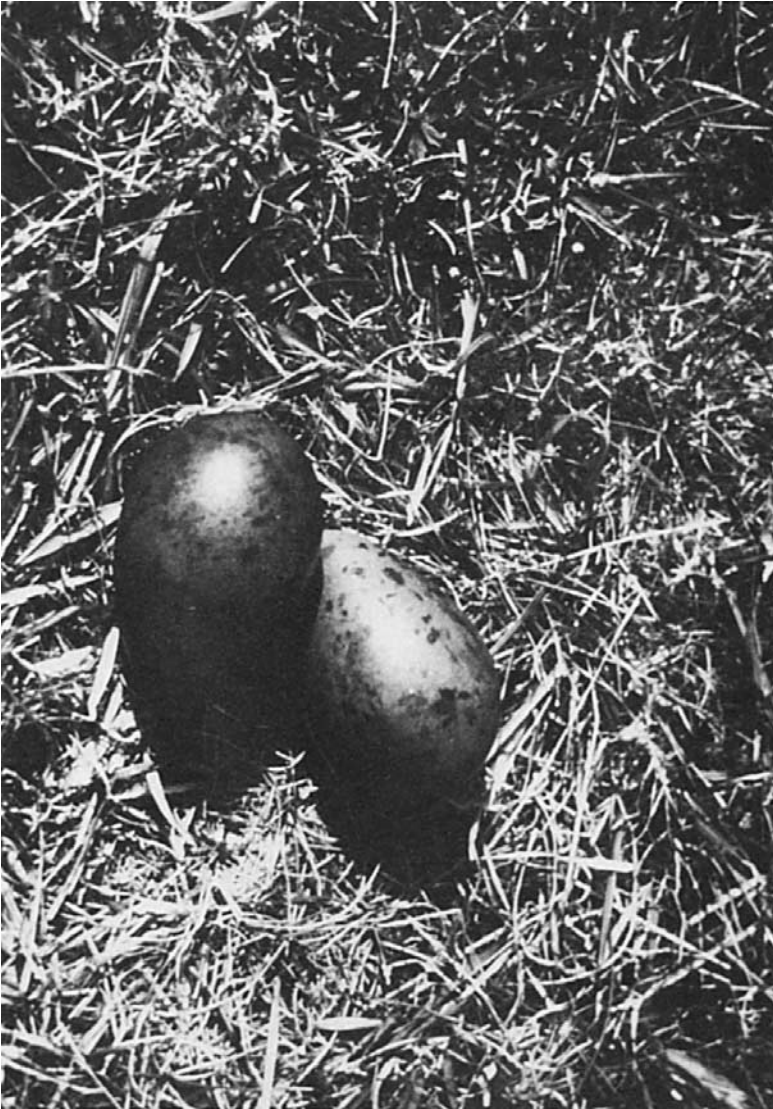
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On Byerwall, which is a fairly densely populated part of the colony, the nests are about 80 m apart. The nesting area is quite level and shielded by rising ground from the road to the runway and the hut where passengers wait for the plane. On climbing over this rise and looking down on Byerwall, birds will be seen flying off their nests. Many nests can be found

Figure 1.2 An Arctic Skua's nest with eggs.



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quite easily, simply by walking through the colony and trying to note the spot where a bird was seen to fly up from. To approach over a rise is the best way of spotting them fly up. Unlike a bird merely sitting in the heather, an incubating bird gets up immediately and flies straight into the air. A bird sitting in the heather will probably stand up and look round for a few moments before taking flight. By remaining alert to notice the spot where a bird suddenly came up from, you can often walk straight to the nest. As you approach, the pair of birds fly over their territory in a slow, undulating flight making anxious, low, squeaking calls. Other nearby pairs will attack the threatened pair if they cross the territorial boundaries. The intruding ornithologist may then be forgotten for a few moments while a furious aerial chase takes place. The birds scream round the sky in tight turns making their wild squealing cries *eeeow eeow*. Back over their own territory, the chase over, they will often attack as you approach. When you are near the nest itself, they will flop out of the sky in their distraction behaviour. They always start their attempts at distraction in the same way. They suddenly seem to stop flying and flutter to the ground. The distraction display itself varies greatly between individual birds. Some birds go almost frantic: they jump up and down squeaking loudly, helplessly beating their wings on the ground. Some scurry about, wings spread and drooped, in the characteristic injury-feigning pattern of behaviour. Other birds are simply cowards, running away to watch from a distance and doing nothing. These cowards are really the most annoying although they never press home an attack: they are off the nest at the first hint of danger and keep well away whatever happens. It is sometimes almost impossible to get a good view of them, and particularly difficult to get a good view of the combination of colour rings which uniquely identifies each individual bird.

The bravest birds are usually the easiest to identify: they yell and scream and injury-feign just a few metres from you. Their combination of colour rings is easy to see as they jump up and down. This behaviour usually lasts for only a few minutes. After brief attempts at distraction, the birds then attack. Those with the most vigorous distraction behaviour are often the most aggressive. They drive you from their territory, diving at you at high speed. They often strike with extended feet. Robert Gillmor's drawing shows an attacking skua about to strike. Walking through the colony without protection often brings many painful buffets to the head. We usually carry a cane held above our heads for the birds to aim at and hit.

The nests are marked with canes, placed a few metres away from the nest itself. A tag on the top of the cane gives the number of the pair. Viewed from the rising ground above Byerwall, canes can be seen dotted here and

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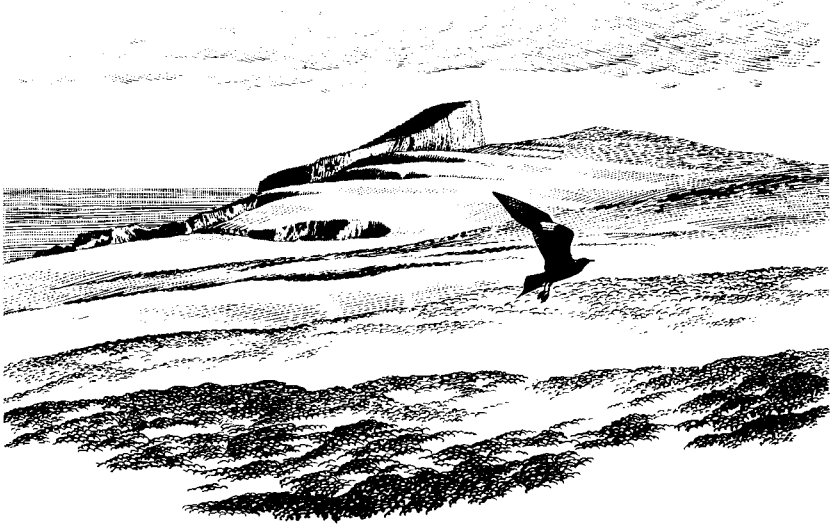
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A dark Arctic Skua flies up from its nest on Eas Brecks, Sheep Craig in the background.



An Arctic Skua attacks. Its mate feigns injury on the ground.



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there. Some birds immediately fly off their nests; others can be seen through binoculars sitting on their nests beside the canes. They soon get used to the daily checking of each nest. Often they will incubate until you are no more than about 100 m away. They settle back on their nests as soon as you have passed through their territories.

From the dry heather moor of Byerwall the ground dips sharply into Homisdale. This is one of the most sheltered parts of Fair Isle. The valley floor is a sphagnum bog through which the Burn of Vatstrass flows in a straight drainage channel. In May and June, when the skuas are nesting, it is colourful with lady's smocks (*Cardamine pratensis*), cotton grasses (*Eriophorum augustifolium*), butterworts (*Pinguicula vulgaris*) and spotted orchids (*Dactylorhiza fuchsii*). It becomes drier towards the head of the valley. Here it is pasture – a small area of excellent grazing – before giving way to heather on the upper slopes. The plantacruvs marked on the map are an interesting agricultural survival. They are small stone-built enclosures in which seedlings can be grown protected from the wind. Most of them are now ruined, but one is still occasionally used to rear seedling cabbages. They are useful places to hide in while looking for the skuas' nests in Homisdale or waiting for a bird to enter a trap. The nesting habitat of Homisdale is quite different from Byerwall. The nest is often to be found in the middle of a tuft of grass raised slightly above the level of the bog. The nest scrape may be quite damp. This would presumably chill the eggs more rapidly at those times when the birds are not incubating. But nests in these boggy places suffer no significant reduction in hatching or fledging rates.

Continuing northwards towards the Bird Observatory, the ground rises gently to the heather moor of Eas Brecks. This is a densely colonized area similar in habitat to Byerwall. To the west it dips into the shallow valley carrying the Burn of Furse northwards from the head of Homisdale to the sea. The skuas have colonized the whole of the area of Furse and Eas Brecks lying south of the road to the North Lighthouse. Above Furse the ground rises steeply through deep heather to the moorland of Swey, about 4–500 ft (112–153 m) above sea level. The skuas seem to be unable to nest on these steep slopes. But eider ducks make their warm, down-lined nests under the protection of the heather bushes. When the plateau of Swey has been reached, the skuas again occupy the ground. This is a rocky, stony area like Byerwall and Eas Brecks. In a few places, narrow peat banks have been left uncut. The ground is thus uneven, with raised ledges of peat. But it is just as barren as Byerwall and Eas Brecks – more so perhaps – with larger rocky outcrops. This continues northwards from Swey. The ground slopes gently down across a mile of moorland towards the road to the



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North Lighthouse. Skuas occupy the whole area to the west of the road and south from Wirvie Brecks. Wirvie Brecks is the most northerly area yet to have been colonized by the Arctic Skuas. It is now the densest part of the whole colony. The nests are only about 40 m apart in some places. Further west, the Bonxies are in occupation. They set up their territories earlier than the Arctic Skuas who are then unable to dislodge them from ground Arctic Skuas formerly held. Thus, in competition, the Bonxies always win the territories. They have indeed expanded rapidly throughout Shetland, sometimes at the expense of colonies of Arctic Skuas. But for their nesting sites, Bonxies prefer wetter, less rocky areas: they always make their nests in a grassy spot, never in the heather.

South of Wirvie Brecks, the Arctic Skua colony continues along the Brae of Restensgeo joining up with the parts of the colony on Swey and Eas Brecks. Most recently, in 1978 and 1979, two pairs have nested on the heather at Roskillie on the other side of the road to Eas Brecks. The road itself continues round the east side of Eas Brecks to reach the Bird Observatory in a green 'cup' overlooking Mavers Geo and the North Haven.

Any brief tour of an Arctic Skua colony will show that it is polymorphic. Most birds are a dark brown, but about a quarter are pale with a white belly, breast and neck. Some of the pale birds have a darker band across the breast between neck and belly; others have a completely white front. A closer look at the dark birds will show that they also vary between themselves. Some have a collar of paler feathers round the neck. This may vary from an almost white neck to an only slightly lighter brown neck. The belly may also appear somewhat paler or flecked in those birds with pale or white collars. Other birds are completely dark brown, with no paler neck or belly feathers. This is a striking example of a polymorphism in plumage. The different types of plumage are called the phenotypes. We have distinguished three main phenotypes: pale, non-melanic birds with white belly and neck; intermediate melanic birds with brown or dark brown belly and paler or white collars round the neck; and dark melanic birds, uniformly dark brown. These phenotypes have increasing amounts of dark brown melanic pigment deposited in the feathers. Somewhat arbitrarily, we may separate the intermediates into two classes: intermediates with some white neck feathers and slightly lighter brown belly feathers, and dark intermediates recognizable as having only a few pale straw-coloured or yellow feathers on the sides of the neck and ear coverts giving the neck a slightly paler look beneath a cap of dark brown feathers on the crown.

Matings can be seen between any of these phenotypes. Most pairs are

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matings of intermediates with intermediates or intermediates with either darks or pales, for most birds are intermediates. I first saw this polymorphism in 1958 when I was spending a holiday on Fair Isle. It seemed an obvious subject for genetic and ecological study. K. Williamson, the first Warden of the Bird Observatory, had already begun an intensive field study of the Fair Isle Arctic Skuas (see Williamson, 1965). P.E. Davis, who succeeded as Warden, and myself, then a research student, carried this work on until 1962. I resumed the work in 1973 with a Research Grant from the Natural Environment Research Council.

Any sharp differences in morphology, like the different phenotypes of the Arctic Skuas, are almost certainly genetic. More continuous phenotypic variation may be expected to be determined by both environmental and genetic factors. The polymorphism is widespread (Southern, 1943); it is stable if we can judge from counts of pale and dark birds made by a number of ornithologists over many years (Jackson, 1966; O'Donald & Davis, 1959; O'Donald, 1980c; Pennie, 1953; Perry, 1948; Yeates, 1948); and it is clinal, changing from a high frequency of melanics at the southern end of the Arctic Skua's range to about 100 percent pale at the northern end. A stable clinal polymorphism of strikingly different phenotypes clearly invites ecological and genetic study: balanced selection, or selection and migration, almost certainly maintains the stability of the polymorphism at each point; ecological variation along the cline gives rise to changes of selective value at different points; the adaptive significance of the polymorphism can thus be analysed in relation to ecological factors. By ringing the adult birds, their survival and reproductive rates can be measured throughout their adult lives. If all the nests can be found and all the breeding adults ringed, complete demographic data can be obtained on all the birds in the population. Thus the selection acting on the different phenotypes can be measured. In this respect, birds are often better organisms to study than animals of many other groups: nests are easily found and inspected; the adults can usually be caught. The whole population can be marked and identified and individuals' fates followed throughout their lives. With their exposed nests on easily accessible moorland and bog, the Arctic Skuas seemed almost ideal for detailed ecological and genetic research. The next section describes the methods we used to study them.

### **1.2 Catching the Arctic Skuas**

Arctic Skuas start to return to their Shetland breeding grounds in April. On Fair Isle, the first birds arrive between 16 and 18 April. By the end