

Grey seals, *Halichoerus grypus*, of the Dee Estuary and observations on a characteristic skin lesion in British seals

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Grey seals on the West Hoyle Bank feed on a variety of fish and have a high incidence of dermal lesions, often associated with emaciation and nematode parasite infection. *Corynebacterium phocae* has been isolated from an active lesion. The significance of large numbers of seals in the Dee Estuary bearing lesions is discussed and the occurrence of seals with lesions elsewhere in British waters is reviewed. No evidence was found to associate the dermal lesions with any environmental factor and it is probable that lesions develop as a result of infection of minor wounds.

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Introduction

In response to a request by the Dee & Clwyd River Authority for advice on seal damage at salmon netting stations on the North Welsh coast observations were made on the group of Grey seals, *Halichoerus grypus* (Fabricius), which haul out on the West Hoyle Bank in the estuary of the Welsh River Dee. Previous knowledge of these seals has been summarized by Craggs & Ellison (1960) and is confined mainly to records of abundance and seasonal fluctuation of numbers.

Materials and methods

Three visits were made to the West Hoyle Bank in May, June and October, 1973. Three seals were collected by shooting for histological and bacteriological examination. A freshly dead seal found washed up and one which was found sick and died in captivity were examined *post mortem*. The ages of these seals were determined by examination of cementum layers in the roots of the canine teeth, (Hewer, 1964). Stomach and gut contents were examined for identifiable food remains and several faecal samples collected from the seals' basking place were washed through a fine sieve with quantities of sea water. Any otoliths recovered were identified.

Location, numbers and appearance of seals

As recorded by Craggs & Ellison (1960) the group of seals in the Dee Estuary generally hauls out at low tide on the east side of the West Hoyle Bank almost exactly 1 km west of Hilbre Island (Fig. 1). At this point the bank dries to a height of about 5 m above sea level (though the seals always stay close to the water's edge) and slopes abruptly to the deep (about 4 m) water of Hilbre Swash, affording a ready escape route for the seals when disturbed.

Numbers vary from day to day, depending on weather conditions (Craggs & Ellison, 1960). On 30 May 1973 31 seals were hauled out at low water. Of these at least nine were adult bulls, four of them very large animals; animals identified as females appeared to be of various ages, insofar as this can be judged in the field. One pale sandy-coloured first-year animal was seen. It is believed that only a small number of animals was seen on this occasion because of disturbance.

Mr Peter Bailey, warden of Hilbre Island, has recorded 85 seals hauled out on 30 January 1973; 78 on 20 February 1973; 60 on 16 June 1973 and 125 on the following day. Between 18 and 30 June 1973 numbers varied from 60 to 150. On 29 July 1973 between 150 and 160 seals were hauled out.

It was observed on the May and June visits that between 30 and 50% of the seals bore conspicuous skin lesions. The lesions consisted of ulcerative areas up to 50 cm in diameter. They occurred more frequently on the anterior half of the body, particularly on the ventral aspect. In October only two out of 70 seals were positively identified as bearing lesions, although opportunity for observations on that occasion was limited. It was noted on the May visit that many of the seals' coats were in poor condition, although since Grey seals moult in January to March (Bonner, 1972) it might have been expected that the coats would be nearly prime.

Feeding habits

From the stomach of the adult cow (HG 188) the remains of at least 15 eels, *Anguilla anguilla* (L), up to about 70 cm total length and weighing (partially digested) 2.3 kg were recovered. Nearly all the fish had had their heads removed prior to ingestion. No other food remains were recovered from this seal.

The small emaciated male (HG 189) had no food remains in its stomach but from compacted faeces in the rectum were recovered 11 otoliths from whiting, *Merlangus merlangus* (L), between 15 and 20 cm long (1½ years old); 22 otoliths from pout, *Trisopterus luscus* (L), up to about 15 cm long (3½ years old); and 2 otoliths from haddock, *Merlanogrammus aeglefinus* (L), about 20 cm long (1½ years old).

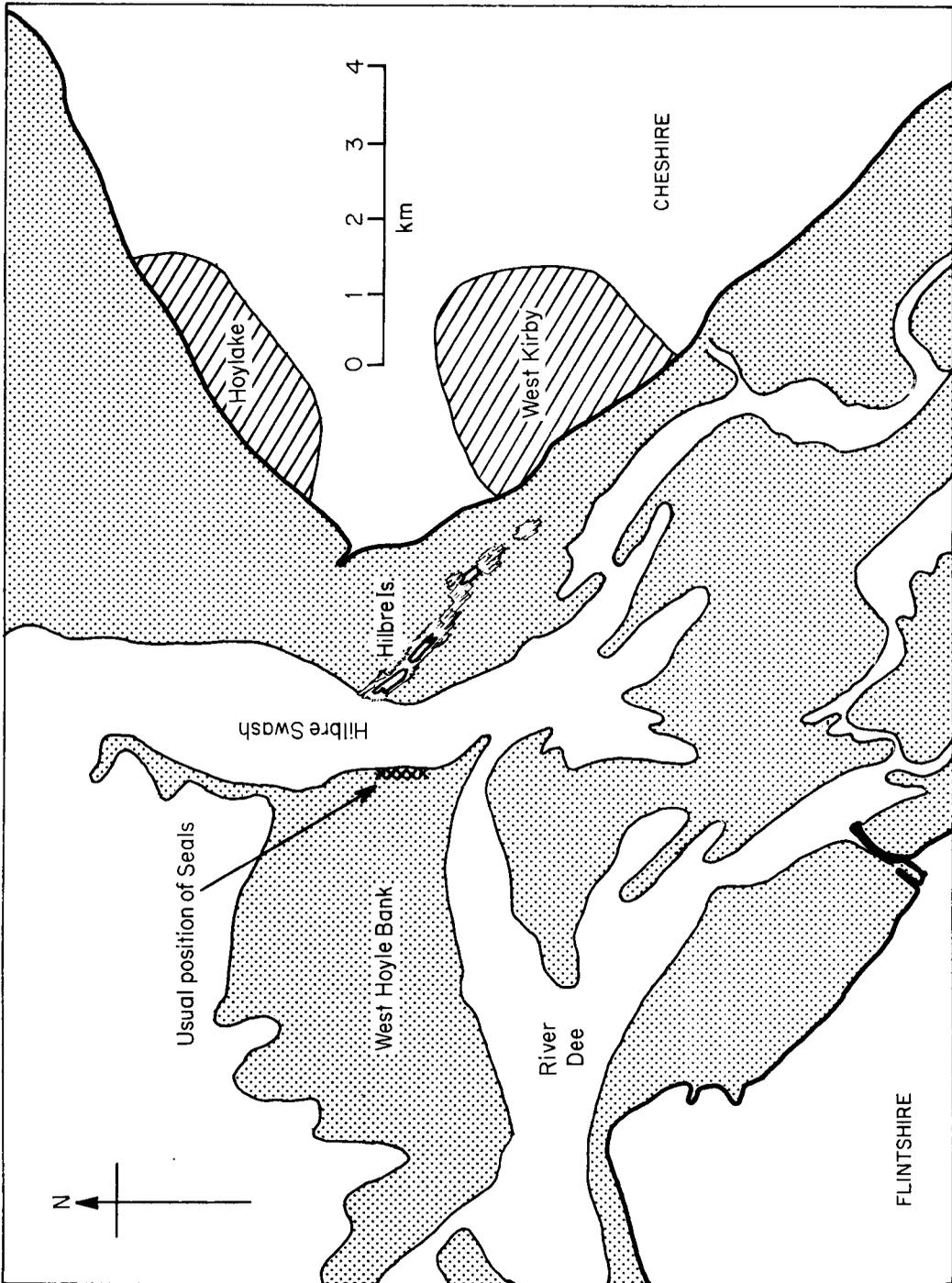


Fig. 1. Usual position of Grey seals in the Dee Estuary.

The stomach of the large bull (HG 205) contained no food remains, but examination of the intestine and rectum contents revealed a very large number of fish otoliths—515 in total. These were of the dab, *Limanda limanda* (L), or flounder, *Platychthys flesus* (L), type (it was not possible to distinguish between these) and were from fish aged $1\frac{1}{2}$ – $2\frac{1}{2}$ years. One otolith was tentatively identified as being from a sole, *Solea solea* (L). Shrimp remains and large numbers of polychaete worm chaetae on which the fish had presumably been feeding were found. It is unlikely that the very large number of otoliths present represent one meal or feeding period of the seal. The faeces were solid and rather compacted and were probably the accumulated residue of several meals.

The emaciated young female seal (HG 192) had no food remains in any part of the gut, corresponding with its emaciated condition.

Eight faecal samples recovered from the surface of the sand yielded as follows:

- Sample 1 Remains of about 30 small lamellibranch molluscs, the common tellin, *Tellina tenuis* (da Costa), all less than 12 mm long (some of the shells were intact and closed); and 10 otoliths of the dab/flounder type up to about 30 cm long ($3\frac{1}{2}$ years old).
- Sample 2 A very few pieces of *Tellina* shells and 3 otoliths from flounders of the same size/age range as from sample 1.
- Sample 3 1 otolith from a whiting about 15 cm long ($1\frac{1}{2}$ years old) and 3 otoliths from flounder/dab less than 20 cm long (up to $2\frac{1}{2}$ years old).
- Sample 4 1 otolith from a whiting about 20 cm long ($1\frac{1}{2}$ years old).
- Sample 5 A few fish bones which could not be identified.
- Sample 6 1 otolith from flounder or dab.
- Sample 7 1 otolith from plaice, *Pleuronectes platessa* L., and 4 from flounder or dab. The 4 otoliths were not paired and therefore represent 4 fish.
- Sample 8 5 plaice otoliths, representing 3 fish, and 5 flounder/dab otoliths representing 4 fish.

Some chitinous remains, which may be shrimp exoskeletons, were also recovered from the faecal samples but could not be identified.

Autopsy results

The first specimen (HG 188), collected on 14 June 1973, was a pregnant female measuring 174 cm from nose to tail and aged $16\frac{1}{2}$ years (about the middle of the normal breeding span). Its weight was not recorded. The animal was in good condition with a blubber layer over the sternum 6.5 cm thick. There were no detectable external lesions but on opening the thorax the lungs were found to be slightly nodular. Histological examination showed that the nodules were caused by invasion of an unidentified nematode. The nematode, *Otostrongylus circumlitus* Raillet, is often found in the lungs of the Common seal, *Phoca vitulina* L., and there is one record of this species in the Grey seal (Bonner, 1972). Another nematode, *Parafilaroides gymmurus* Raillet, causes bronchitis and catarrhal pneumonia in Dutch Common seals and van den Broek & Wensvoort (1959) concluded that this was an important cause of natural mortality in the Waddenzee.

The second specimen (HG 189), collected on the same date, was a juvenile male aged $2\frac{1}{2}$ years. It measured 127 cm from nose to tail and weighed 29.5 kg (to nearest

0.5 kg). A healthy animal of this length and age would be expected to weigh about 55 kg. The ventral blubber layer was less than 0.8 cm thick, indicating that nearly all the fatty reserves had been exhausted. The animal was observed to be very weak before it was shot. There was an irregular lesion 2–3 cm across on the ventral surface, slightly to the right of the mid-line and equidistant from the insertion of the foreflippers and the umbilicus (Plate I(a)). The lesion was in a healing stage. The epidermis had been completely eroded and there was a massive polymorphonuclear cell exudate. The thickened dermis contained lymphocytic foci forming perivascular cuffs; granulation tissue was forming on the external surface. There was a superficial bacterial flora but it was not possible to demonstrate any fungi, mites or significant bacteria. The seal was suffering from a severe purulent pneumonia with massive release of mucilaginous oedema fluid. There was epithelialization of the alveoli with extensive emphysema. Many nematodes were present but they probably did not account for all the inflammatory response.

The third specimen (HG 205) was collected on 4 October 1973. It was an adult male measuring 206 cm from nose to tail and aged 20 years. Its weight was not recorded. At this age a male Grey seal would be approaching the end of its expected breeding life. The seal was in poor condition; the blubber over the sternum was only 2.5 cm thick (a thickness of 5.0–5.5 cm would be expected in an animal of this size at the beginning of the breeding season). The first digit was missing from the left hind flipper as was the claw from the fifth digit of the right hind flipper. Just behind the right jaw was a vertical healing scar 7 × 2 cm and posterior to this on the right shoulder was a raw ulcerated lesion, rounded in outline and measuring 9.6 × 8.0 cm (Plate I(b)). The centre of this lesion was in an active state and showed histologically a superficial layer of fibrin, polymorphonuclear leucocytes and red blood corpuscles under which was young granulation tissue containing inflammatory cells of the lymphoid series, polymorphonuclear leucocytes and blood-vessels, many of which were thrombosed (Plate II(a)). There had been attempts at epithelialization in parts (Plates II(b) and (c)). Under-running the edge of the lesion were sinuses in the thickened inflamed dermis (Plate II(d)). A streptococcus resembling *S. dysgalactiae*, and a diplococcus were isolated from the lesion but the predominant organism was *Corynebacterium phocae*. This organism was identified as having the features described by Breed, Murray & Smith (1957) except that it did not ferment trehalose.

Internally, the left testis was small and adherent to the wall of the inguinal canal. Histologically the testicular tissue was replaced by a mass of longstanding fibrous tissue with no recognizable testicular tissue and a complete absence of sperm. The epididymis was also involved but tubule tissue was still present. These changes indicate the animal had suffered a severe orchitis at some time in the past. A mesenteric lymph node showed extensive fibrosis but the lymphoid tissue was otherwise normal. The lungs had areas of fibrosis, particularly in the peribronchial tissue, with alveolar epithelialization of adjacent tissue. There were areas of inflammatory tissue containing mononuclear cells, lymphocytes and alveolar macrophages with occasional giant cells. There was slight evidence of emphysema. Large numbers of nematodes were present. A 5 mm diameter abscess-like structure anterior to the right thyroid was present and histologically this was found to be a cystic structure, probably of branchial origin.

An emaciated subadult female seal, aged 4½ years (HG 192) was found freshly dead on Hilbre Island on 2 July 1973. It measured 5 ft 11½ ins (182 cm) nose to tail and weighed 163 lbs (74 kg). The blubber layer over the sternum was only 12 mm in thickness



(a)



(b)

PLATE I. (a) Partly healed lesion on ventral surface of HG 189. (b) Active lesion on right shoulder of HG 205.

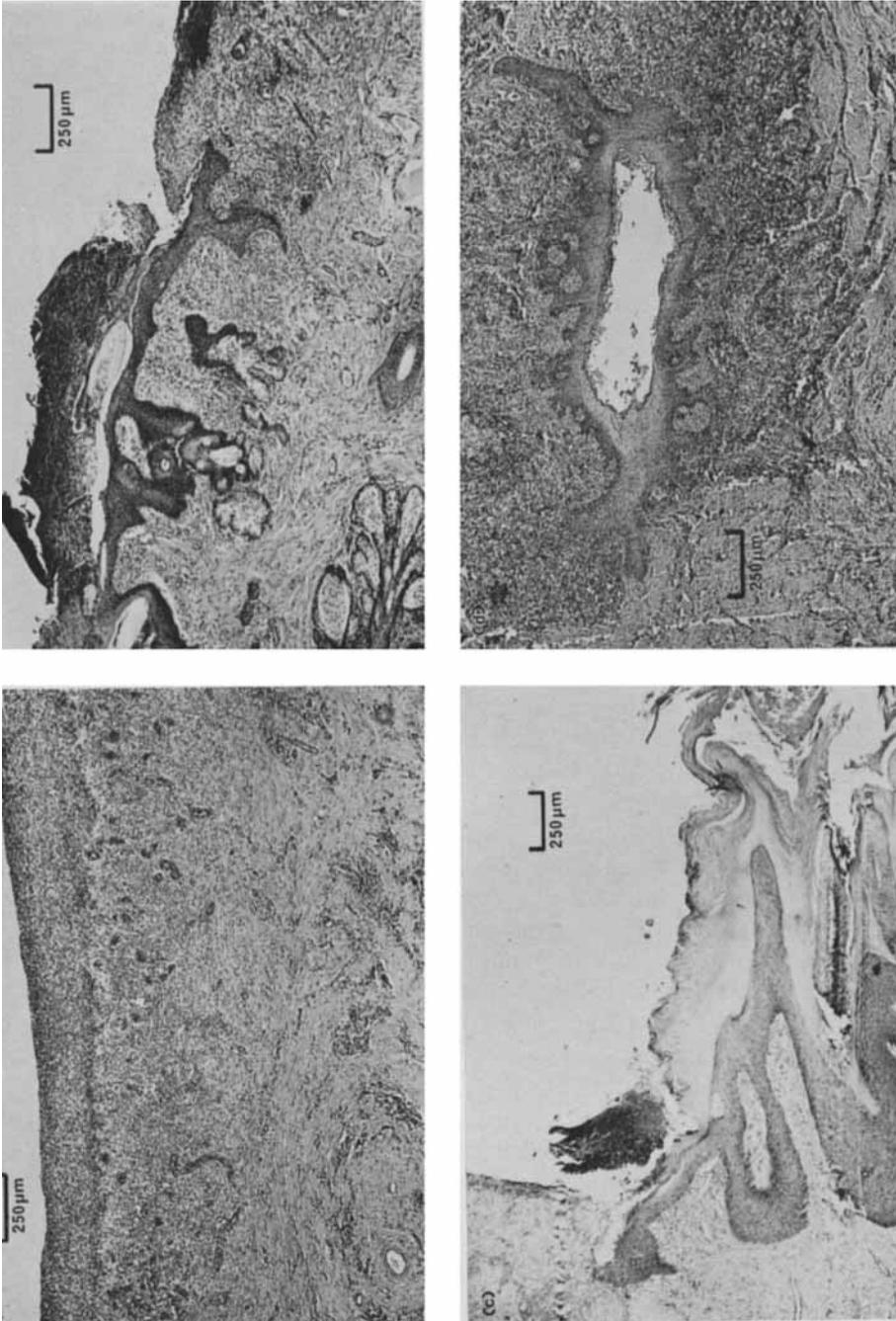


PLATE II. Photomicrographs stained in haematoxylin and eosin of active lesion (HG 205) (a) Centre of lesion, showing a superficial layer of exudate made of fibrin, polymorphonuclear leucocytes and red blood corpuscles, under which is a layer of actively proliferating granulation tissue also containing inflammatory cells. At the bottom of the photograph inflammatory foci can be seen in the dermis. (b) Edge of lesion, showing attempted epithelialization with ingrowth across the inflammatory zone. A mass of exudate overlies the epithelium. (c) Edge of lesion, showing hypertrophic epithelium with excessive keratin (upper left of photograph) which has failed to grow across the lesion. (d) Sinus underrunning the edge of the lesion. It is lined with stratified squamous epithelium and surrounded by an intense inflammatory reaction.

indicating a nearly total depletion of fat reserves. There was an irregular area of hairless skin about 3 cm across 10 cm anterior to the right shoulder and a partially-healed lesion about 3 cm long over the right scapular area. The tongue was ulcerated along the edges of both sides to within 1 cm of the tip, the ulcers being 4 mm wide. Ulcerated areas extended laterally from the teeth for 4–8 mm around the upper jaw, except in the region of the incisors, and all around the lower jaw. Large numbers of the mite, *Halarachne halichoeri* Allman, were present in the pharynx. The ventral and anterior edges of the lungs were pneumonic. There was a haemorrhagic enteritis from which an *Edwardsiella* sp. was isolated. The small intestine contained numerous acanthocephalans of the genus *Corynesoma*, probably *C. strumpsum* Rudolphi or *C. aemerme* Forss.

In November 1972, a female Grey seal pup (72L-1888) was found ill at Leasowe and died ten days later. The age of the pup was estimated at four to seven weeks by Mr Peter Bailey. It weighed 36 lbs (16.3 kg) which is near the birth weight. A healthy pup aged four weeks would weigh 41–45 kg. Death probably resulted from emaciation and depletion of fat reserves. There were multiple subcutaneous abscesses, the largest in the abdominal wall. Streptococci untypable by routine methods were isolated from the abscesses and it seems probable that the latter had developed from skin wounds. There were infected ulcers on both hind flippers and eczematous lesions on the skin of the head. Internally pathological findings consisted of gastroenteritis, pulmonary congestion and oedema, while the upper respiratory tract was infested with the mite, *Halarachne halichoeri*.

Discussion

Grey seals have hauled out on the West Hoyle Bank for many years. Craggs & Ellison (1960) reported 14 there in 1942 and showed that between 1951 and 1957 maximum numbers increased from about 40 to nearly 120. Craggs (personal communication) reported a maximum of 212 present in 1973. The absence of white-coated pups from the West Hoyle Bank indicates that it is not a breeding site—this would be expected as the bank is tidal and Grey seals normally produce their pups in localities where there is a safe refuge above high-water mark. The emaciated pup (72L-1888) was probably a straggler from a more distant group. Such dispersion is characteristic of young Grey seals (Hickling *et al.*, 1962). Craggs & Ellison (1960) have shown that there is a seasonal variation in numbers present with maxima in June and January and minima around the breeding season in October and the moulting season in March. The capture of the pregnant cow (HG 188) demonstrates that the West Hoyle Bank group includes some active breeders for part of the season.

Such a large group of seals must be associated with one or more major breeding assemblies. The nearest breeding centres are in Pembrokeshire, 200 km distant, and in the Hebrides, nearly 600 km distant. Small groups of breeding seals are found at Lambay Island, Co. Dublin, (180 km); the Isle of Man (125 km); and Puffin Island, Anglesey (55 km), though these colonies are all much too small to be the origin (even collectively) of the Dee Estuary seals. It is impossible to decide with which of these breeding sites the Dee seals are associated. It seems likely that the group is taking advantage of the food resources of Liverpool Bay and the relative security of the tidal sandbank.

The wide variety of fish remains recovered from the seals and the faecal samples, together with observations by Mr Peter Bailey of the seals feeding on sprats, *Sprattus sprattus* (L.), indicate that these seals are general feeders, preying on those species of fish

most readily available. It is very probable that further sampling would reveal a wider range of food species. The absence of common fish such as cod, *Gadus morhua* L., from our records is no indication that these species are not taken in this area. Similarly, the absence of remains of salmon, *Salmo salar* L., is no evidence that the seals do not cause significant damage to the salmon fishing of North Wales. Salmon netmen at Rhyl complain that they suffer most damage from what they term "rogue" seals—individuals which wait at the nets until a salmon is caught and then swim in to take it. They report that these seals will ignore other species of fish, such as bass, *Dicentrarchus labrax* (L.), which are caught in the net. Such behaviour may be learnt by a few individuals, rather than be characteristic of the group as a whole. We are informed by Mr Bailey that salmon are never encountered in Hilbre Swash but it is certain that the feeding range of the seals that haul out on the West Hoyle Bank extends much further than this.

The high incidence of unhealthy animals in the Dee Estuary seals is puzzling. It is not usual to notice so much overt disease in wild adult seals but this population has attracted attention in this respect before. In July 1971, Professor H. R. Hewer wrote to one of us (WNB) of the Dee seals:

"I was struck by the high proportion, 10–15 %, of bulls *and* cows showing raw wounds. We could not get near enough to examine these of course, but many were extensive (12–15 ins) and occurred on all parts of the body".

Hewer was able to obtain a dead specimen with a partly-healed lesion and it may be pointed out here that, although precise data are lacking, dead seals are very much more abundant on the shores of the Dee Estuary than in other parts of their range where the species is far more abundant.

Of the five animals examined in this study four were emaciated and there was a high incidence of parasitic infestation, perhaps associated with poor condition. It seems unlikely that the observed emaciation was the result of a lack of availability of food in the area and it is possibly associated with disability consequent on disease.

The lesions found on the Dee seals are easily recognizable at a distance and are not confined to this area, nor to the Grey seal only.

At Scroby Sands, off Caister in Norfolk, on 18 May, 1968 an emaciated female Common seal (PV 11), aged 17 years, measuring 148 cm from nose to tail and weighing 52 kg was collected which bore an extensive lesion on its left flank. The lesion formed a vertical belt about 20 × 60 cm some 25 cm posterior to the left fore-flipper and covering more than a third of the body's circumference. The skin and blubber layer had been completely eroded, exposing the tissues beneath and necrosis extended into the deep muscle layers. At the time it was believed that this was the result of mechanical injury and further information was not collected.

On 23 June 1971, another emaciated female yearling Common seal (PV 130) measuring 111 cm nose to tail and weighing 63 lb (28.6 kg) was shot at Thief Sand, the Wash. A partly-healed lesion 121 × 98 mm was situated on the ventral surface around the umbilicus. The lesion consisted of a raw nodular area with pale granular spots and appeared to be a long-standing condition. Hairless areas, which might have been healed lesions, were present on the dorsal surface anterior to the tail and above both fore-flippers. It was noted the seal was very heavily infested with the louse, *Echinophthirius horridus* Olfers. The umbilical lesion was examined by Dr L. E. Mawdesley-Thomas who described it as

an area of chronic superficial ulceration. This ulceration was associated with a cellular response mainly with cells of the lymphocytic or chronic inflammatory type. Many Gram-negative cocci were seen but fungi such as *Saprolegnia* were not found (Mawdesley-Thomas, personal communication).

Besides those animals which were examined closely there have been numerous sightings of individuals with similar lesions at Scroby and the Wash. Additionally, extensive observations of seal-tracks on sandbanks have often revealed blood stains which were believed to have resulted from the lesions.

Van Haaften (1962) describes similar findings in Common seals in Dutch waters. In 1961 van Haaften estimated that about 10% of the seals in the Waddenzee suffered from abscesses, mostly on the ventral part of the body or around the mouth. Blood was seen on seal-tracks. Van Haaften noted also the presence of the lungworms, *Otostrongylus circumlitus* and *Parafilaroides gymnurus*, in the seals.

On 26 September 1966, a group of Grey seals was observed by Mr J. B. Murray (personal communication) near Fidra Island in the Firth of Forth off East Lothian. Over 50 were in the group and seven animals were observed closely while out of the water. All of these had lesions on the ventral surface. Two of these extended from the level of the insertion of the fore-flippers to beyond the umbilicus; one seal showed a large lesion with a partly healed scab and four had less extensive injuries. Mr Murray observed that when moving on land the seals did not hitch along on their bellies in the usual manner but "hopped" on the side on which they were lying. Both Grey and Common seals occasionally move in this manner when uninjured but Mr Murray's suggestion that the Fidra seals moved in this way to avoid pain from their lesions seems very reasonable.

A Common seal was seen at the Holm of Ire, Orkney, on 2 August 1971, with a large raw patch on its abdomen and a report was received of another Common seal at St Mary's Holm, Orkney, at the end of June of that year, with a raw patch under its chin (Miss E. R. Bullard, personal communication).

An adult Grey seal (HG 73) aged eight years was shot on 23 August 1970, in the Firth of Clyde and a section of skin bearing a typical lesion was sent to one of us (WNB).

Finally, Bonner (1970) reports an account of four adult Grey seals at the Lizard, Cornwall, in November 1969, with lesions on their necks which could be similar to those described from the Dee.

The significant organism cultured from the lesion on the adult Grey seal (HG 205) has been identified as *Corynebacterium phocae*. This was described by Svenkerud *et al.* (1951). They examined Harp seals, *Pagophilus groenlandicus* (Erleben); Ringed seals, *Pusa hispida* (Schreber); Bearded seals, *Erignathus barbatus* (Erleben); and Hooded seals, *Cystophora cristata* (Erleben). They found a condition which they compared to swine erysipelas, consisting of multiple haemorrhagic lesions of varying size lying subcutaneously in the plane of the junction between the corium and the blubber, less commonly extending into the blubber itself. They did not describe the lesion as involving erosion of the skin itself over large areas. They recognized that seals often develop skin lesions but considered them to be distinct from those associated with *Corynebacterium phocae*.

There is therefore a very clear distinction between the lesions described by Svenkerud *et al.* and those seen on Grey seals in the Dee and on both Grey and Common seals elsewhere in the British Isles. It is possible that *Corynebacterium phocae* may be associated with different lesions in different species but the wide range of seals studied by Svenkerud

et al. and the presence of what seem identical lesions in both Grey and Common seals make this unlikely to be the explanation.

Corynebacterium is associated with clinical disease in a variety of animals. *C. diphtheriae*, the causative organism of diphtheria in man causes a localized inflammation of the throat and its powerful exotoxin causes an acute toxæmic reaction. Other species such as *C. pyogenes*, *C. renale* and *C. ovis* cause substantial financial losses in agricultural practice with the formation of acute or chronic suppurative lesions.

More exotic species are also affected—*C. renale* has been shown to be a cause of pyelonephritis in Malayan water buffalo (Chong Su-Kheng & Lim, 1962); a *Corynebacterium* has been associated with skin lesions in monkeys (Holt & Gose, 1961), and there are examples of many other species being affected.

An unidentified species of *Corynebacterium* has been isolated from swabs taken from infected and from apparently healthy eyes of Grey seal pups at the Farne Islands (Bonner, 1972).

Johnston & Ridgway (1969) described a condition in the White-striped porpoise, *Lagenorhynchus obliquidens*, which developed large blisters on the back caudal to the dorsal fin. These became necrotic and an ulcerated area remained even after treatment with antibiotic. *Pseudomonas aeruginosa* was isolated from these lesions. The same organism was cultured from infected eyes of Grey seal pups found in Cornwall (Bonner, 1970).

The occurrence of a high incidence of dermal lesions in seals from the Dee, East Anglia, the Firth of Forth, the Waddenzee, and an isolated example from the Firth of Clyde (where Grey seals are not common) makes it tempting to associate the lesions with a high degree of industrial pollution. For example, studies in British waters have shown that parts of the Irish Sea, the North Wales coast, the Firth of Clyde, the Severn Estuary and the North Sea have high concentrations of heavy metals compared with other areas. These concentrations are in general confined to the coastal margins (Preston, 1973). It is not probable that this is the case in Orkney, however, though the identification of the lesion from this area is less certain than from either the Dee or East Anglia. From these data there is nothing to connect the occurrence of dermal lesions with any aspect of pollution. It seems much more probable that the lesions are initiated by superficial skin wounds allowing the *Corynebacterium* to gain access and set up the ulcerative lesion.

Much remains to be done on the pathology of seals. It is hoped that the collection of further specimens will throw light on the aetiology of the lesions described.

Summary

The Grey seals which haul out on the West Hoyle Bank in the Dee Estuary are thought by fishermen to be implicated in damage to salmon fisheries on the North Wales coast. No evidence to support this contention was found, but lack of positive evidence does not prove the contrary. Analysis of food remains from gut-contents and faecal samples collected on the sandbanks showed that the seals had been feeding on eels, whiting, pout, haddock, sole, plaice and dab or flounder, or both. It was concluded that the seals are non-specific feeders, taking those species of fish most readily available. It appears that the Dee seals are essentially a feeding group, although the capture of a pregnant female suggests association with breeding assemblies elsewhere.

Observations on this group of seals revealed a high incidence of dermal lesions. Autopsies were made on three seals taken and on two washed up on the shores of the Dee.

Four of these animals were emaciated and had high levels of parasitic nematode infection. A skin lesion in a healing stage was found in one specimen and another seal had a large active lesion from which *Corynebacterium phocae* was isolated.

Both Grey and Common seals bearing similar lesions have been seen in other British waters and van Haaften (1962) has recorded another example in a Common seal from Dutch waters.

The lesion associated with *Corynebacterium phocae* in the Grey seal is quite distinct from that caused by this organism in four other species of seal described by Svenkerud *et al.* (1951). No evidence was found to connect the incidence of dermal lesions with any environmental factor and it is thought that the lesions develop as a result of the infection of minor wounds.

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