OBSERVATIONS ON THE FAUNA AND FLORA OF RECLAIMED LAND AT CALSHOT, HAMPSHIRE

By R. S. K. Barnes and J. M. Jones

Introduction

Land can be reclaimed from the sea by one of two methods, the distinction between them being based on whether or not the land so formed is predominantly composed of artificially added material. Naturally reclaimed land, formed by the embankment of salt-marshes (and hence 'semi-natural' rather than 'natural'), has received a moderate amount of study (e.g. Petch 1945), mainly by botanists. As the land drains, the vegetation slowly changes from salt-marsh communities to pastureland, although many halophytes disappear rapidly after embankment. The drainage ditches often remain brackish for many years (e.g. Lambert 1930), unless they are sluiced at the seaward end. In general, if the salt-marsh is allowed to form land as naturally as possible (i.e. with a minimum of embankment), the pastureland so formed is of better quality than if the speed of reclamation is artificially increased (see the summary of reclamation by salt-marshes in Steers, 1969).

Artificially reclaimed land is produced by the construction of a barrage to seawards of the high water mark and by the infilling of the area to landwards of the barrage with material derived from elsewhere (usually from the adjacent seabed). The biology of such artificially produced land has been very seldom studied, mainly because after the substrate has settled and drained it is usually converted into building land as soon as possible, and concrete then renders it unattractive to most organisms. Since naturally reclaimed land tends to remain in use as pasture, it is available for study to a much greater extent.

Southampton Water has recently been the site of much artificial land reclamation (Fig. 32). Most of the north-eastern fringe of the Water has been reclaimed for the construction of the Southampton Docks Complex and parts of it are still being reclaimed for that purpose. Dibden Bay, near Hythe (SZ 415087), is in the terminal phases of reclamation at the time of writing; and the site of Fawley Power Station was salt-marsh less than ten years ago. It is with the area of reclaimed land between Fawley Power Station and Calshot Spit (SZ 480018) shown on Fig. 32 that this paper is concerned.

During the five or six years that this land has been in existence, both it and its enclosed pools of standing water have acquired a considerable and in many ways interesting fauna and flora. In particular, the pools were colonised by a number of animals generally associated with brackish environments; the land surface acquired a carpet of salt-marsh and waste-ground plant species; and the whole area provided a suitable habitat for considerable numbers of estuarine birds and for birds associated with 'farmland'. These three aspects of the area's biology are considered here, following a description of the reclamation process which created the habitat.

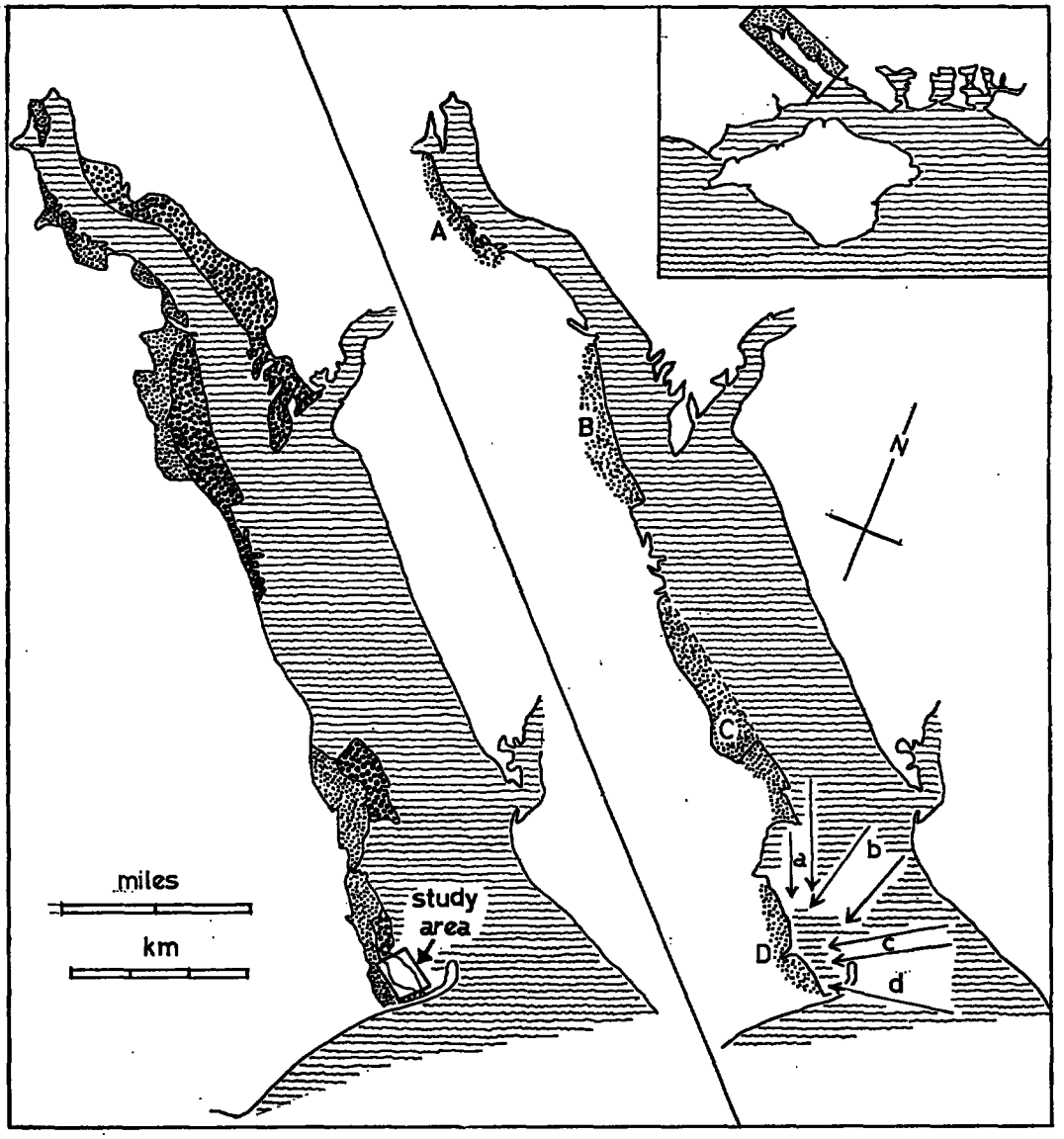

Fig. 32.

a. Sketch-map of Southampton Water showing the land reclaimed from the sea during the last 150 years. Land reclaimed by infilling behind a barrage wall is heavily stippled. The area of reclaimed land studied is marked.

b. Sketch-map of Southampton Water showing the location of the major roosts ('A' – Eling; 'B' – Dibden Bay; 'C' – Fawley; 'D' – Calshot) and the main flight lines of birds using the Calshot roost ('a' – from Southampton Water, the Test and the Itchen; 'b' from the Hamble; and 'd' from the East Solent are used by waders; 'c' from Titchfield Haven is used by wildfowl).

The Development of the Reclaimed Land

Prior to 1963 this area was salt-marsh, with a main drainage channel situated across the centre of what is now the reclaimed land. During the second half of 1963 the salt-marsh was partially isolated by a barrier, built in the position of the present high water mark, a sluice allowing water to drain from the marsh into the sea, via the main drainage channel. In 1964, after the secondary drainage channels had dried, the marsh was completely isolated from the sea, leaving the main drainage channel as standing water. The area was then progressively converted into land by infilling with material derived from the bed of Southampton Water, so that by early 1965 the whole area exhibited a more or less dry surface (*cf.* the present state of Dibden Bay) at about from four to six feet above mean high water spring tide level.

By the August of 1965, however, the area formerly occupied by the main drainage channel had begun to subside somewhat and was becoming filled with rainwater and probably groundwater. This process continued so that by early 1966 a large pond was present over the central region of the reclaimed land, although during the later months of that year, this area of standing water was reduced, until by November one large pool, of about 3,500 square metres and several small pools formed its only remnants. Aerial photographs show that the land had not yet acquired any noticeable flora. The pools continued to exist, keeping their approximate sizes and shapes, from November 1966 to July 1970.

In the summer of 1970 levelling of the land commenced, preparatory to handing it over to other control, and several of the smaller pools were filled. Much of the area lost its cover of vegetation. The larger pools and the land surrounding them, however, were not so treated, as local conservation bodies had requested a delay in filling and levelling so that proposals for the area to become a nature reserve could be discussed. Subsequent to the bulldozing, a vegetation cover re-established itself.

The Flora

Much of the interest in land reclaimed in the manner described above lies in the provision of a bare surface for future plant colonisation. Although the analogy cannot be taken too far, the circumstance parallels the opportunities for plant colonisation after the retreat of ice from glaciated regions. Unfortunately, the flora of this area was investigated only after a vegetation cover had established itself, but by the autumn of 1969 the species present consisted of a number from marine influenced habitats on the one hand and others from 'waste-land' regions on the other. Both of these environments are characterised in the early and middle stages of succession by open ground, shade intolerant species, and have a number of species in common with exposed, high altitude situations (see Pennington, 1969, for further discussion on the subject of plant colonisation of bare ground).

The substrate was, by late 1969, a dry, cracked, mud, shell and stone mix. However, this was only in the form of a surface crust of variable thickness, beneath which the mud was extremely soft and wet. The soft mud formed the substrate of the pools of standing water. In places the crust was of sufficient thickness to accommodate rabbit warrens: by late 1970 it was evidently sufficiently strong to support bulldozers.

As indicated earlier, the vegetation cover consisted only of a field and ground layer, trees and shrubs being absent except for a few small birches (*Betula*) and sallows (*Salix*) on higher ground. The dominant species were Sea Aster, *Aster tripolium*, a characteristic species of salt-marshes – but not particularly abundant in those of Southampton Water – and Creeping Bent, *Agrostis stolonifera*, a widespread coloniser of bare ground and a pasture grass. *A. stolonifera* occurs in the Juncetum of salt-marshes (Hepburn 1952), in pastures, especially where moist and on chalk and siliceous rocks, and it acts as a primary coloniser of bare areas in fen-carr, dune slacks and stabilised shingle spits (Tansley 1968). Other sub-dominant species, each forming quite extensive monospecific patches, were Yorkshire Fog, *Holcus lanatus*, Annual Beard-grass, *Polypogon monspeliensis*, and Sea Club-rush, *Scirpus maritimus*. The latter three indicate particularly well the diversity of the flora. *Holcus* is generally a grassland and waste-ground species; *Scirpus* is 'perhaps the most typical plant of brackish water, being commonly found along the banks of tidal rivers and dykes, or forming a border to saline swamps' (Hepburn 1952); and *Polypogon* is, in many places, an introduced species associated with woollen waste (the seeds arriving with imported woollen packing material), although in a few submaritime habitats in the south and south-east of England it may be native (Salisbury 1961). Near Calshot it may be either, since woollen waste was present on parts of the reclaimed land.

Other common species included: Sea Couch-grass, *Agropyron pungens*, Sea Rush, *Juncus maritimus*, the sea-spurrey, *Spergularia marina*, and Scentless Mayweed, *Tripleurospermum maritimum* (all typical of maritime or submaritime regions); Codlins, *Epilobium hirsutum*, Marsh Willow-herb, *E. palustre*, Great Reedmace, *Typha latifolia*, and the Common Reed, *Phragmites communis* (associated with freshwater habitats); and Ragwort, *Senecio jacobea*, Birdsfoot-trefoil, *Lotus corniculatus*, White Melilot, *Melilota alba*, the American Willow-herb, *Epilobium adenocaulon*, and various docks, *Rumex* spp. (mainly Crisped Dock, *R. crispus*), thistles, *Cirsium* spp. (mainly Creeping Thistle, *C. arvense*) and hawk's-beards, *Crepis* spp. (mainly Beaked Hawk's-beard, *C. taraxacifolia*), all characteristic of waste-ground.

Cord-grass, *Spartina anglica*, the dominant plant on the adjacent salt-marshes, was, not surprisingly, extremely rare on the reclaimed land. The absence of periodic inundations of sea water would normally account for this, but the few scattered plants of this species present all appeared to be healthy and were not even associated with particularly moist areas. It must be emphasised at this juncture that the *Scirpus* and *Typha*, normally to be found intimately associated with standing water, were growing through the same dry, cracked ground as supported the terrestrial *Senecio*, *Agrostis* and *Lotus*, although their roots were probably in the semi-liquid, sub-surface mud.

No zonation of the vegetation was discernible, rather the more abundant species were distributed in discrete, contiguous, and to a large extent monospecific patches all over the dry flat, generally being as common to seawards as to landwards. *Phragmites*, alone, was only found near the pools of standing water, this species probably having invaded the region from an adjacent freshwater ditch. No succession was apparent over the observation period; even after the bulldozing of the surface the same species appeared to re-establish themselves without any marked changes in dominance.

TABLE I: THE MACROFAUNA OF THE POOLS

MOLLUSCA	COLEOPTERA
Hydrobia jenkinsi	*Agabus biguttatus*
	Hygrotus inaequalis
ODONATA	*Rantus exsoletus*
Ischnura elegans (nymphs)	*Gyrinus caspius*
Sympetrum sanguineum (nymphs)	*Berosus affinis*
	Enochrus maritimus
EPHEMEROPTERA	*Helophorus aquaticus*
Cloeon dipterum (nymphs)	*Ochthebius marinus*
	MALACOSTRACA
HEMIPTERA	*Sphaeroma rugicauda*
Plea leachi	*Neomysis vulgaris*
Corixa panzeri	*Palaemonetes varians*
Sigara concinna	
Sigara stagnalis	TELEOSTEA
Notonecta viridis	*Gasterosteus aculeatus*

THE POOLS

The areas of standing water were all brackish. The largest pool varied in salinity from 3·1 to 9·2°/$_{oo}$ (parts per thousand by weight of dissolved solids), i.e. from about 10 to 26% of the value for sea water, and from 5·8°C. to 26·0°C. in temperature (a maximum of over 31°C. was once recorded from the shallows in July). The average salinity over a yearly cycle was probably in the region of 6°/$_{oo}$, with the evaporation/precipitation ratio leading to higher values in summer and lower in winter. The maximum recorded salinity from any of the pools was 10·2°/$_{oo}$, therefore they fall into the (mixo)oligohaline and (mixo)mesohaline divisions proposed at the Venice Symposium of 1958 (held in order to arrive at an agreed series of sub-divisions applicable to saline water), although as Heerebout (1970) has pointed out, the Venice System categories do not always apply particularly well to isolated and fluctuating brackish pools.

Besides being fringed by the vegetation cover of the surrounding land and particularly by *Phragmites communis*, all the pools bore a submerged flora of Fennel-leaved Pondweed, *Potamogeton pectinatus*, whilst the large pool also provided a habitat for abundant growths of the semi-aquatic Celery-leaved Crowfoot, *Ranunculus sceleratus*, and clumps of a water crowfoot, *R. baudotii*. The three latter species are known to frequent brackish as well as fresh water. *R. sceleratus* forms a zone near the high water mark of some of the local salt-marshes (e.g. near Sowley).

The fauna inhabiting the several pools did not differ appreciably from one to the next, a characteristically brackish assemblage being present in each. This is shown in Table 1. Of the species recorded therein, several, including most of the Coleoptera, were present in small numbers. Only *Ischnura*, *Neomysis*, *Hydrobia* and *Sigara stagnalis*

were abundant in all the pools investigated, whilst sticklebacks, *Gasterosteus aculeatus*, were plentiful in the smaller ponds. *Sigara stagnalis* showed high levels of infestation by an unidentified red ectoparasitic mite. A number of other unidentified species have been omitted from the table. These include the larvae of stratiomid, tipulid and other Diptera, of Coleoptera and of limnephilid Trichoptera. The coleopteran larvae, of course, may not be of species additional to those recorded in Table 1.

The record of the occurrence of *Sympetrum sanguineum* in these pools is of some interest, in that its larvae have previously been found only in pools and ditches where *Typha* and horsetails, *Equisetum* spp., grow, where they live on or amongst the roots of these plants (Longfield 1960). Both plant genera were absent from the pools on this reclaimed land, although *Typha* was present away from the areas of standing water (see above).

The fact that 76% of the identified macroscopic aquatic fauna was comprised by insects (a percentage which would have been higher if the unidentified material was taken into consideration) clearly demonstrates its predominantly freshwater ancestry. In fact, 86% (all except the Crustacea) of the fauna were freshwater organisms capable of penetrating varying degrees of brackish water (for the maximum recorded salinities from which these species have been obtained see Butler and Popham 1958, etc.). Insect species can, of course, actively and rapidly move into suitable new environments by using their powers of flight.

Typically brackish species 'conspicuous by their absence' from these pools were *Idotea chelipes*, *Corophium volutator*, *Gammarus zaddachi*, *Pomatoschistus microps*, and perhaps *Nereis diversicolor*, all species invading brackish water from a marine ancestry, and all present in to some extent comparable pools locally (e.g. near Beaulieu). Many of these species would have been present in pools on the original salt-marsh and are capable of living in salinities such as those of the pools in question, although a lower limit approaching 3°/$_{oo}$ may be just beyond the range for successful reproduction for some, i.e. *Idotea*, *Corophium* and *Nereis*. The substrate may also have been somewhat unfavourable to the latter three. Perhaps, however, a major factor with respect to the absence of many species from the marine end of the brackish spectrum is the limited capacity for dispersal across land shown by marine species and the comparatively short life of the pools: these more marine species just may not have had sufficient time to get into these habitats.

A comparison of the fauna list given above with that provided by Nicol (1935) for the 'less saline pools' near the top of a salt-marsh at Aberlady Bay (Firth of Forth) is quite instructive in this context, as marine species could penetrate into the Aberlady Bay pools during the high water periods of spring tides. Although Nicol's pools were in the same general salinity range, 0·5–15·0°/$_{oo}$ with a mean value slightly below 5°/$_{oo}$, only three species are common to Calshot and Aberlady. The Calshot pools also contain two species which were only found in the 'more saline pools' (average salinity 15–20°/$_{oo}$) at Aberlady Bay. The relationships between the fauna of these pools on reclaimed land and those inhabiting similar brackish pools elsewhere have been more fully discussed in an earlier paper (Barnes, Dorey and Little, 1971).

The plankton of the pools was not investigated, but a cursory examination disclosed an abundance of ostracods and species of *Cyclops*.

TABLE II: MAXIMUM HIGH WATER COUNTS OF DUCKS AND WADERS AT CALSHOT RECLAMATION AREA 1969/70–1971/72

Species	1969/70 Winter (Dec.–Feb.)		1970/71 Winter (Dec.–Feb.)		1971/72 Winter (Dec.–Feb.)	
Mallard	50		208		154	
Teal	55		369		100	
Wigeon	250		200		100	
Shelduck	320		470		550	
	Autumn (Aug.–Nov.)	Winter (Dec.–Feb.)	Autumn (Aug.–Nov.)	Winter (Dec.–Feb.)	Autumn (Aug.–Nov.)	Winter (Dec.–Feb.)
Oystercatcher	50	114	17	120	53	154
Lapwing	186	121	640	120	156	205
Ringed Plover	180	30	146	70	154	38
Grey Plover	—	1	—	3	4	6
Turnstone	215	25	106	63	196	60
Snipe	6	2	3	2	3	2
Curlew	490	114	450	55	150	200
Whimbrel	1	—	1	—	7	—
Black-tailed Godwit	65	32	76	—	6	2
Common Sandpiper	5	—	2	—	—	—
Redshank	250	205	500	31	35	150
Spotted Redshank	4	—	3	—	—	—
Greenshank	9	—	10	1	4	1
Dunlin	110	500	1,000	1,000	105	700

THE AVIFAUNA

The reclaimed area provides an essential roost and breeding site for the local estuarial bird population, some one hundred species have been recorded from it to date. Its use as a roost and as a breeding site are considered separately below, and a few notes on the non-estuarial avifauna are appended.

Roosting species

Wildfowl, waders and gulls roost, and to a lesser extent feed, in the area, the species and their numbers fluctuating with the seasonal passage of migrants. On the central south coast, wildfowl populations reach a maximum in mid-winter, whilst the populations of most waders achieve peaks both during the autumn migration and in mid-winter. The relevant figures for the Calshot reclamation are given in Table II and provide a measure of the importance of the area as a roost.

Birds' flight into the area is along four main flight lines (Fig. 32), with some waders often travelling considerable distances in order to roost on the reclaimed land. Gulls, however, may approach from all directions. There is considerable local movement at periods of high water between the Calshot and Fawley roosts (see Fig. 32), caused mainly by disturbance.

The importance of the reclaimed land as a roost is likely to increase as the other suitable sites on Southampton Water are being reclaimed for industry (see Fig. 32, a and b). The three other roosts in Southampton Water are at Eling, Dibden Bay and Fawley (Fig. 32). The future of all these is, however, uncertain: the Eling roost suffers continuous disturbance and will be greatly reduced in area by the Western Extension Scheme for Southampton Docks; Dibden Bay is in the final stages of reclamation and when this is completed its character is likely to be changed by development; and the Fawley roost is scheduled for reclamation for industry. The Calshot roost has so far been less important than these three, but will probably soon be the most important, if not the only, Southampton Water roost. Efforts are consequently being made to safeguard the area as a nature reserve.

Breeding species

The varied habitats provided by the reclaimed area near Calshot allow a wide range of bird species to nest. A breeding survey was carried out during 1970–72 on behalf of the British Trust for Ornithology, using the mapping method as standardised by the International Bird Census Committee. This survey (Table III) showed 113 territories held by 25 species in 1970, increasing to 129 territories of 30 species in 1972, on an area of approximately 120 acres (approx. 0·5 km.^{2}), i.e. a density of 226 pairs/km.^{2} increasing to 258 pairs/km.^{2}.

The 25–30 species that breed can be broadly divided into three groups: those of the rough grass habitat which show a high population density, those of the ponds and reed beds which show an average density, as do those that breed in the scrub and trees on the landward fringe of the region.

The most abundant species were reed bunting, *Emberiza schoeniclus*, skylark, *Alauda arvensis*, lapwing *Vanellus vanellus*, meadow pipit, *Anthus pratensis*, sedge warbler, *Acrocephalus schoenobaenus*, ringed plover, *Charadrius hiaticula*, redshank, *Tringa totanus*, and yellow wagtail, *Motacilla f. flavissima*. Reed bunting nested amongst the vegetation fringing the pools (mainly in *Scirpus*); skylark, meadow pipit and yellow wagtail amongst the patches of *Aster* and *Agrostis*; lapwing and ringed plover on the many open, shingle-strewn patches; redshank in clumps of *Scirpus* or grasses on fairly open, dry ground; and the sedge and reed warblers in the fringing *Phragmites* beds.

To draw a few broad comparisons with the region under discussion:

1. In areas of extensive *Phragmites*, usually the size of the territory controls the number of pairs, whilst in this region it is the size of the reed beds which limits the population.
2. On farmland, the population densities are generally much lower than those found on this region. For example, 26–38 and 22–26 pairs of skylark and lapwing per km.^{2} respectively breed on the reclaimed land, but only 22·8 and 1·57 pairs/km.^{2} respectively on Midland farmland (Williamson 1967).

3. On heathland, observation shows that the population density is also far lower than that recorded for this reclaimed area.

From the above it will be apparent that this comparatively small area forms a breeding refuge of some importance, which function, it is hoped, it will continue to serve if it achieves nature reserve status.

TABLE III: CENSUS OF BREEDING BIRDS AT CALSHOT RECLAMATION AREA 1970–72

Species	Number of Pairs		
	1970	1971	1972
Mallard	2	2	2
Shelduck	1	2	2
Mute Swan	1	1	1
Red-legged Partridge	5	6	5
Water-Rail	—	—	1
Moorhen	4	3	7
Coot	1	1	1
Oystercatcher	2	1	2
Lapwing	11	13	13
Ringed Plover	9	9	7
Snipe	1	1	1
Redshank	6	7	5
Skylark	13	13	19
Blue Tit	—	—	2
*Wren	2	2	4
*Song Thrush	1	3	1
*Blackbird	2	1	3
Wheatear	—	1	—
Reed Warbler	3	2	2
Sedge Warbler	10	8	6
*Whitethroat	1	1	1
*Willow Warbler	—	1	1
*Chiffchaff	—	1	1
*Dunnock	2	3	2
Meadow Pipit	11	11	14
Pied Wagtail	2	1	2
Yellow Wagtail	6	5	4
*Chaffinch	—	—	1
*Greenfinch	2	2	2
Goldfinch	—	—	1
Linnet	1	1	—
Reed Bunting	14	15	16
Total pairs	113	117	129
Total species	25	28	30

*Territories of these species overlapped onto adjoining land.

Other species

Avian predators recorded from this area to date are seven in number. Kestrel, *Falco tinnunculus*, barn owl, *Tyto alba*, and little owl, *Athene noctua*, have bred in adjacent farmland and have at times hunted over the region. Hobby, *Falco subbuteo*, and osprey, *Pandion haliaetus*, have been seen during passage periods, and merlin, *Falco columbarius*, and hen harrier, *Circus cyaneus*, have occasionally been observed hunting the area during winter.

A number of passerines which are known to breed on the reclaimed land have been documented above; in addition, during winter moderate-sized flocks of a variety of seed-eating finches, buntings and larks frequent the region.

SUMMARY

The history of an area of reclaimed land proposed as a nature reserve and situated adjacent to Fawley Power Station is briefly recorded and the flora and fauna of this area is described. Such environments are of particular interest by virtue of their transitory nature, because they provide breeding refuges and roosts for a large number of estuarine and coastal birds, and because of the high salinity of the substrate.

The vegetation cover of this area is comprised of species otherwise characteristic of several separate environments (salt-marshes, freshwater and waste-ground). The fauna of the pools on the land is one derived from freshwater elements capable of tolerating and penetrating brackish regions; the marine elements are not numerous, but are nevertheless present. The area is used as a roost by large numbers of waders, wildfowl and gulls, and since the alternative roosts in Southampton Water are being reclaimed for building purposes, it may soon form the only suitable remaining site. A survey of breeding birds in 1970–72 revealed a maximum of 129 territories of 30 species in 1972.

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REFERENCES

Barnes, R. S. K., Dorey, A. E., and Little, C., 1971. 'An ecological study of a pool subject to varying salinity (Swanpool, Falmouth). An introductory account of the topography, fauna and flora', *J. anim. Ecol.*, **40**, 709–734.

Butler, P. M., and Popham, E. J., 1958. 'The effects of the floods of 1953 on the aquatic insect fauna of Spurn (Yorkshire)', *Proc. R. ent. Soc.* (A), **33**, 149–158.

Heerebout, G. R., 1970. 'A classification system for isolated brackish inland waters, based on median chlorinity and chlorinity fluctuation', *Netherl. J. Sea Res.*, **4**, 494–503.

Hepburn, I., 1952. *Flowers of the Coast.* London: Collins.

Lambert, F. J., 1930. 'Animal life in the marsh ditches of the Thames Estuary', *Proc. zool. Soc. Lond.*, 1930, 801–808.

Longfield, C., 1960. Distribution of the British species [of Dragonflies]. In: Corbet, P. S., Longfield, C., and Moore, N. W. *Dragonflies.* London: Collins.
Nicol, E. A. T., 1935, 'The ecology of a salt-marsh', *J. Mar. Biol. Ass. U.K.*, **20**, 203–261.
Pennington, W., 1969. *The History of British Vegetation.* London: E.U.P.
Petch, C. P., 1945. 'Reclaimed lands of West Norfolk', *Trans. Norf. Norw. Nat. Soc.*, **16**, 106.
Salisbury, Sir Edward, 1961. *Weeds and Aliens.* London: Collins.
Steers, J. A., 1969. *The Sea Coast.* 4th Ed. London: Collins.
Tansley, A. G., 1968. *Britain's Green Mantle.* 2nd Ed. (Revised: Proctor, M.C.F.). London: Allen & Unwin.
Williamson, K., 1967. 'The bird community of farmland', *Bird Study*, **14**, 210–226.

APPENDIX

The fauna was identified using the various relevant publications of the Freshwater Biological Association (for the Ephemeroptera and Hemiptera); the Ray Society (for the mysid and the hydrophilid Coleoptera); the Royal Entomological Society of London (for the Coleoptera Hydradephaga); and of A. E. Gardner in the Entomologist's Gazette (*5* and *6*) for the Odonata, and C. Bocquet *et al* in the *C.R. Acad. Sci., Paris* (*239*) for *Sphaeroma.*

Butcher's *New Illustrated Flora* (Hill) and Clapham, Tutin and Warburg's *Flora of the British Isles* (C.U.P.) were used for the vegetation.

A reference collection of the invertebrate species recorded herein is housed in the C.E.R.L. Marine Biological Laboratory, Fawley.

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