

BIRD POPULATIONS IN THE SOLENT, 1951-77

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Introduction

Five groups of birds depend wholly or in part on the littoral and sub-littoral zones of the Solent estuarine system:—

- (i) waders, which feed mainly on the invertebrate fauna of intertidal mud;
- (ii) 'dabbling' ducks, shelduck and Brent geese, which generally feed in shallow waters on invertebrates at or near the mud surface, and/or on algae and *Zostera* on muds and sands;
- (iii) 'sawbills', sea-ducks, grebes and cormorants, which feed on fish and other organisms in shallow waters;
- (iv) gulls, which obtain food from other sources but depend on the littoral zone for roosting and, in the case of the black-headed gull, for breeding sites;
- (v) terns, which obtain their food from shallow waters and breed at or near the upper limit of the tide.

Since the 1950's a great deal of information has been accumulated on the occurrence of these five groups of birds in the Solent area. In Langstone Harbour, many opportunistic counts of estuarine birds have been made since 1952 and regular monthly counting commenced in 1968. Wildfowl in most Solent estuaries and harbours have been counted monthly since 1952 on behalf of the Wildfowl Trust, although there are few complete "runs" spanning the whole period to 1977. Wader numbers at high water roosts have also been recorded monthly throughout the region since 1969, initially as a result of the Birds of Estuaries Enquiry (sponsored jointly by the Royal Society for the Protection of Birds and the British Trust for Ornithology). Unfortunately, data for Chichester Harbour are incomplete. Few counts have been made between April and September and only the high water roosts in the Sussex half of the harbour were

included before 1971/72. Additional information is provided by the *Hampshire Bird Report* and *Sussex Bird Report* which are published annually by the respective county ornithological organisations.

The main intention of the Birds of Estuaries Enquiry was to assess the populations of birds, especially waders, occurring in each estuary in Britain and Ireland, and to determine seasonal and annual variations. The wildfowl counts organised by the Wildfowl Trust have a similar purpose, although they also extend to wetland areas inland. Since 1966, annual international counts of wildfowl and waders have been organised by the International Waterfowl Research Bureau in order to assess migrant and wintering numbers throughout Europe and North Africa. Thus, numbers recorded from the Solent area can be set in an international as well as a national context.

Waders

Table 1 gives monthly counts of 12 species of intertidally feeding waders averaged for the years 1971/72 to 1976/77. During this period, peak numbers were recorded in January 1975 when the 5,460 ha of mudflats in the Solent held 105,000 waders of which 90,000 were dunlin. Numbers of curlew and black-tailed godwit actually feeding on the mudflats are variable since these species also forage on arable and pasture land. In the West Solent the mudflat area is small and curlew habitually feed on farmland, whilst in the three eastern harbours which have large expanses of mud, relatively small numbers of birds forage inland. In the Ythan Estuary, Goss-Custard (1969) showed that during the winter, redshank were forced to feed on pastures at high tide as well as on mudflats when exposed in order to fulfil their energy requirements. In the milder climate of the Solent, however, this species only resorts to

Table 1: Average monthly counts of waders in the Solent during October-March 1971/72 to 1976/77

Species	Oct	Nov	Dec	Jan	Feb	Mar		Max. Count
Oystercatcher <i>Haematopus ostralegus</i>	2646	2567	2517	2613	2477	1687	3949	(Oct 1976)
Ringed Plover <i>Charadrius hiaticula</i>	1124	730	697	699	561	225	2151	(Aug 1972, Sept 1976)
Grey Plover <i>Pluvialis squatarola</i>	2117	1377	1583	1795	2134	1345	4012	(Oct 1973)
Turnstone <i>Arenaria interpres</i>	535	491	512	533	534	369	799	(Sept 1973)
Curlew <i>Numenius arquata</i>	3366	2904	2408	3138	3249	2188	4979	(Sept 1976)
Black-tailed Godwit <i>Limosa limosa</i>	1481	1204	1201	1237	1123	1012	2180	(Sept 1976)
Bar-tailed Godwit <i>Limosa lapponica</i>	948	936	1067	1648	1117	428	2478	(Feb 1977)
Redshank <i>Tringa totanus</i>	5850	3188	2772	3042	3065	2309	6987	(Sept 1976)
Spotted Redshank <i>Tringa erythropus</i>	64	20	25	20	15	15	124	(Sept 1974)
Greenshank <i>Tringa nebularia</i>	91	23	11	9	8	9	228	(Sept 1972)
Knot <i>Calidris canutus</i>	294	1088	1308	1821	1293	327	3402	(Jan 1977)
Dunlin <i>Calidris alpina</i>	39432	56983	59432	72176	70172	36625	90790	(Jan 1975)

inland feeding after prolonged rain when large numbers of earthworms are brought near to the surface. A similar situation also pertains for oystercatchers which in more northerly areas such as Morecambe Bay regularly feed on farmland (Wilson, 1973).

Other species of waders such as curlew sandpiper, little stint and whimbrel occur in the intertidal zone in small numbers during their autumn and spring migrations. In addition, lapwing, golden plover and snipe, all of which normally feed on freshmarshes and farmland, periodically visit the intertidal zones. However, no comprehensive data are available for these species. Wintering flocks of ruff occur on grazing land at Titchfield Haven, Pennington Marshes and elsewhere. The Pennington Marsh flock increased from 10 birds in January 1958 to 180 in January 1972, when it probably constituted the largest winter population in the British Isles. Numbers have subsequently declined, although winter flocks of up to 150 birds have occurred sporadically in many localities adjoining the intertidal regions.

It is unfortunate that comprehensive wader counts for the Solent are only available for the October-March period (Table 1), since large assemblies of birds also occur in July-September. During this period, numbers of oystercatcher, ringed plover, grey plover, turnstone, curlew, black-tailed godwit, redshank and greenshank increase and reach their annual peaks in August-October. This is followed in most years by a decline in the numbers of most of these species in October-December after the moult. There may be a further rise in numbers in January-February although winter populations of ringed plover, curlew, redshank, spotted redshank and greenshank are significantly smaller than in the summer. As yet, it is not known to what extent the winter flock comprises birds remaining after the moult and how many originate elsewhere. In contrast to the species listed above, numbers of bar-tailed godwit and knot are insignificant in July-September and dunlin seldom exceed 10,000. The main influx of these species occurs after the moult in November and December. The winter wader populations start to decline rapidly in late February and by early April, numbers of all species are relatively small. The Solent is not noted for large coastal assemblies of waders during the northward spring passage although migrating flocks are visible (or audible at night) in April and May. Small non-breeding populations of most species remain on the coast throughout the spring and early summer.

Although there is relatively little information on the origin of the Solent wader populations, it is reasonable to suggest that a large proportion of the summer assemblies of species such as redshank and curlew which breed widely in Britain, come from relatively locally. Data from small samples of redshank indicate, however, that both British and Icelandic races are present. For example, measurements of 19 birds caught in Chichester Harbour in November 1971 were consistent with the British race, *Tringa totanus britannica*, and a sample of 42 from a catch in October 1972 in Portsmouth Harbour showed a high proportion of Icelandic birds, *T. t. robusta*, which had just completed their moult. Eight black-tailed godwit caught at the same time, had bill lengths more consistent with the Icelandic *Limosa limosa islandica* than the European race, *L. l. limosa*. Furthermore, measurements from dead black-tailed godwit from the Solent have invariably indicated an Icelandic origin for this population (Cohen and Taverner, 1972). Ringing recoveries from 4,800 dunlin, comprising 2,700 birds

caught in Portsmouth Harbour in October-March, 500 from Chichester Harbour in November and 1,600, mostly on spring and autumn passage that were netted in Langstone Harbour, showed that the wintering population originated in northern Scandinavia or Arctic Russia and arrived in the harbours after moulting in the southern North Sea in autumn. Measurements of the wader catches were consistent with the 'northern' race, *Calidris alpina alpina*, which breeds from northern Scandinavia to the Taimyr peninsula. Dunlin present in the harbours in summer/autumn and again in spring, however, were of the 'southern' race *C. a. schinzii*, and originated from Britain and Iceland. These moulted in the harbours before moving on to winter elsewhere (Stevenson, 1971, 1972a, b, 1973, 1977).

Between 1971 and 1977, the Solent supported in excess of 1% of the European and North African population of seven species of waders and more than 1% of the British population of nine wader species (Table 2). Internationally, the area assumed special importance for its populations of ringed plover (3.5%), grey plover (7%), black-tailed godwit (3%) and dunlin (6%). In a national context, it supported no less than 7% of the ringed plover, 21% of the grey plover, 24% of the black-tailed godwit and 13% of the dunlin wintering in Britain. The Solent is also one of the few wintering areas in Britain for spotted redshank although numbers of this species are small.

The distribution of the more numerous species of waders and wildfowl amongst the estuaries and harbours of the Solent is shown in Table 3 for the 1972/73 season. Portsmouth, Langstone and Chichester Harbours have been treated individually while Southampton Water has been taken to include the Itchen and Hamble Estuaries and the shore eastwards to Titchfield Haven. The West Solent includes the Medina Estuary, Newtown Harbour and the Western Yar Estuary on the Isle of Wight and the north shoreline of the Solent westward of Calshot Spit. These divisions are not born entirely of convenience. For example, waders which feed at low water in the Itchen and Hamble Estuaries depend on roosts in Southampton Water, and there are interchanges between the north and south shores of the West Solent depending on certain combinations of tide, weather and time of day. Langstone and Chichester Harbours held the largest numbers of most species although more ringed plover occurred in Southampton Water. Ports-

Bar-tailed godwit *Limosa lapponica*

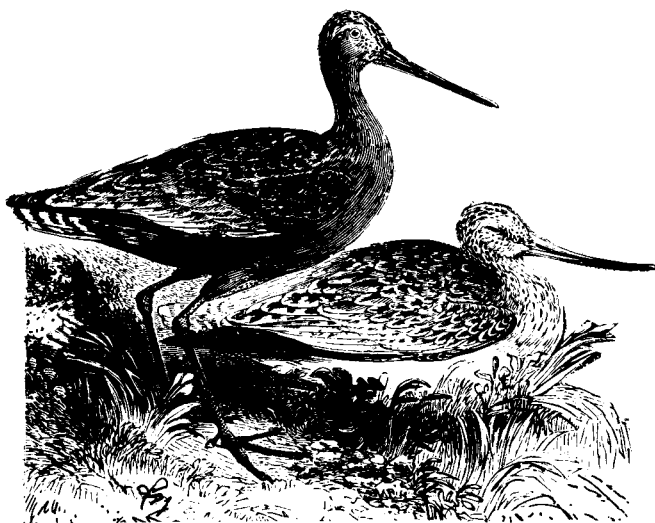


Table 2: Average winter numbers of some waders in the Solent as percentages of estimated British and European populations 1971/72 to 1976/77

Species	Numbers in Europe and N. Africa*	Numbers in Britain*	Numbers in The Solent†	Solent as % European Population	Solent as % British Population
Oystercatcher	560000	200000	2600	0.46	1.3
Ringed Plover	20000	10000	700	3.5	7.0
Grey Plover	30000	10000	2100	7.0	21.0
Turnstone	?	10000	534	?	5.0
Curlew	150000	60000	3200	2.1	5.3
Black-tailed Godwit	40000	5000	1200	3.0	24.0
Bar-tailed Godwit	90000	43000	1600	1.8	3.7
Redshank	125000	80000	3100	2.5	3.9
Dunlin	1200000	550000	72200	6.0	13.1
Knot	600000	350000	1800	0.3	0.5

* Derived from Prater (1974). These estimates are considered to hold good for the six winters considered here (Prater *in litt*).

† Figures in this column are the January or February average counts (whichever is higher) from Table 1, rounded to the nearest hundred.

mouth Harbour held relatively few birds except for dunlin in relation to its size than other areas.

The long time series of counts in Langstone Harbour has permitted an analysis of trends to be made (Tubbs, 1977). Of nine species of waders for which sufficient data were available, six (oystercatcher, grey plover, black-tailed and bar-tailed godwits, knot and dunlin) increased over the 1952-75 period, two (redshank and curlew) declined after the mid-1960's, and one (ringed plover) showed no clear long term trend. It has been suggested that there may be a relationship between the decline of redshank, curlew and also shelduck in Langstone Harbour since the late 1950's, and the increased discharge of sewage effluent into the harbour which has resulted in a greater cover of green algae and a reduction in the suitability of the muds as feeding grounds (Tubbs, 1977).

Average monthly counts of the ten most numerous species of waders in the Solent are given in Table 4 for the period October-March for the years 1971/72 to 1976/77. Although these values show no dramatic changes over this short period, in general they provide some indication of a long term upward trend for most species, rather than a static or declining situation. The successive reduction in numbers of dunlin of 3, 11 and 14% over the latter three winters appears from preliminary data for 1977/78 to have ceased, and numbers have recovered to a level near to that of 1972/73. Additional fragmentary information from earlier years also suggests long term upward trends for all species except oystercatcher in Southampton Water and possibly the West Solent, and whimbrel which have declined sharply in the Solent as a whole since the 1950s.

The Solent supports only relatively small numbers of breeding waders. Redshank and lapwing breed locally on freshmarshes and grazing land adjoining the intertidal zone, and ringed plover and oystercatcher breed on shell banks and shingle beaches, mainly along the north-west shore of the Solent. Between 1966, when wardening of the breeding sites began, and 1977, the oystercatcher population rose from 20 to 53 pairs and that of the ringed plover from 30 to 45 pairs. Even though these numbers represent only a small fraction of national breeding populations, they are large for the south coast.

Wildfowl

Table 5 gives average monthly counts for the seven most numerous species of wildfowl during September-March 1970/71 to 1976/77. All seven species depend to varying degrees on terrestrial as well as littoral food sources and hence the data include counts from freshmarshes and grazing adjoining the shores.

Numbers of dabbling ducks start to increase in August and reach peaks in November-January when the Solent may support 500-800 mallard, 3,000-5,000 teal, 2,000-3,000 wigeon, 250 pintail and 50-100 shoveler. Numbers fall sharply in March-April to leave only a residual breeding population of mallard. The winter distribution of these species in the Solent estuaries and harbours is indicated in Table 3. The Solent has increased in significance as a resort for dabbling ducks since the mid 1960s. Peak counts for most intertidal areas have become progressively higher and large numbers of ducks are now present for a longer period during the autumn and winter than previously. The modest population of pintail which now overwinters is a phenomenon of the late 1960s and early 1970s. Although local

Table 3: Distribution of some waders and wildfowl in the Solent at peak counts during 1972/73

Note: The data do not necessarily represent the maximum number of a species recorded from individual estuaries.

Species	Chichester Harbour	Langstone Harbour	Portsmouth Harbour	Southampton Water	West Solent	Month
Oystercatcher	1010	839	228	415	83	Jan
Ringed Plover	300	600	277	914	60	Aug
Grey Plover	1225	484	60	223	290	Feb
Turnstone	11	35	32	135	240	Feb
Curlew	1890	1130	530	567	445	Sep
Black-tailed Godwit	1400	223	—	105	203	Dec
Bar-tailed Godwit	1400	282	7	—	—	Jan
Redshank	3545	1870	750	323	278	Sep
Spotted Redshank	22	—	—	3	58	Oct
Greenshank	90	78	8	21	11	Sep
Dunlin	21130	30000	13650	6900	6000	Jan
Knot	545	1000	100	2	—	Jan
Teal	700	820	—	1625	370	Feb
Wigeon	1180	1470	—	235	826	Jan
Pintail	41	136	—	4	82	Jan
Shoveler	—	70	—	30	29	Feb
Goldeneye	65	108	28	39	—	Jan
Merganser	49	23	—	1	37	Nov
Shelduck	2860	1190	42	703	822	Jan
Brent Goose	4360	5600	170	—	660	Feb

Table 4: Average of monthly counts from October-March 1971/72 to 1976/77 for ten numerous waders in the Solent

Species	1971-2	1972-3	1973-4	1974-5	1975-6	1976-7
Oystercatcher	2107	2110	2592	2567	2316	2812
Ringed Plover	650	601	578	627	860	660
Grey Plover	835	1440	2205	1772	1914	2182
Turnstone	502	416	530	410	489	630
Curlew	2897	2490	2627	2996	2490	2875
Black-tailed Godwit	981	1229	1043	1688	1158	1158
Bar-tailed Godwit	956	825	1087	828	955	1340
Redshank	3411	2864	3434	3184	2596	3779
Knot	632	912	868	990	1396	1230
Dunlin	44495	55050	65482	63226	56270	48026

Table 5: Average monthly counts of wildfowl in the Solent during September-March 1970/71 to 1976/77

Species	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Max. Count
Mallard <i>Anas platyrhynchos</i>	358	581	726	769	635	584	298	1106 (Dec 1976)
Teal <i>A. crecca</i>	1042	1919	2979	3680	2949	1823	711	7350 (Dec 1976)
Wigeon <i>A. penelope</i>	131	1058	1625	2118	2638	1827	825	3748 (Jan 1973)
Pintail <i>A. acuta</i>	13	88	107	183	239	203	140	382 (Jan 1977)
Shoveler <i>A. clypeata</i>	5	17	21	44	75	83	44	134 (Jan 1977)
Shelduck <i>Tadorna tadorna</i>	148	566	1439	2547	4907	5499	3017	8958 (Feb 1972)
Brent Goose <i>Branta bernicla</i>	—	321	5348	9246	10625	9903	5711	14282 (Dec 1975)

(based upon data from the Birds of Estuaries Enquiry and the Wildfowl Trust)

increases in mallard populations may be the outcome of rearing and releasing programmes of wildfowlers' organisations, the reasons for similar rises in other species must be sought elsewhere. Tubbs (1977) suggested that, as with waders, the greater number of wildfowl may be related to a reduction in hunting pressures in north-west Europe as a whole. However, other factors are also likely to have been involved.

Most of the north European population of shelduck assembles in July and August in the Waddensee to moult, leaving 'caretaker' pairs attending crèches of young birds (Coombes, 1950; Goethe, 1961). In the autumn and winter they disperse to intertidal areas around the north-west European coastline before moving to their breeding grounds in the spring. The first post-moult influx of shelduck into the Solent area occurs in November with numbers reaching a peak in January or more often February (Table 5). The average (5,499) and maximum (8,958) winter peak counts between 1970 and 1977 represented 4.4 and 7.2% respectively of the north European population. Figure 1 shows annual peak counts for four components of the Solent estuarine system for the period 1951/52 to 1976/77. In Langstone Harbour, numbers rose progressively from less than 1,000 in the early 1950s to 4,000 in 1964/65 and 1967/68 before declining in subsequent years to average only 872 for the five winters from 1972/73. This decline is reflected in the less complete data from Chichester and Portsmouth Harbours, the West Solent and Southampton Water and can probably be attributed to a redistribution of the post-moult assemblies during a succession of very mild winters. At its peak in 1967/68, Langstone and Chichester Harbours carried 8,900 shelduck, which by extrapolation would suggest a Solent population in excess of 11,000.

The dark-bellied race of the Brent goose, *Branta bernicla bernicla*, breeds within a relatively confined area of northern Siberia. It winters on the coasts of north-west Europe from Denmark to Biscay, where its

preferred foods are eelgrasses (*Zostera* spp) and green algae, mainly *Enteromorpha*, growing on intertidal muds. A decline of the dark-bellied Brent goose and also of the light-bellied form *B. b. hrota*, which winters on both sides of the Atlantic, has been linked with the widespread disappearance of *Zostera* in the 1930s. However, the extent of the decline in bird numbers and the importance of other factors are both arguable. Since the 1950s, *Zostera* beds in many intertidal areas have recovered and the Brent goose has also improved its position. The total population of the dark-bellied race rose slowly from an estimated 16,500 in 1955/56 to 48,000 in 1972/73 and then sharply to 115,000 in 1976/77. This trend has been mirrored by the dramatic increase in numbers wintering in the Solent (Fig. 2), from maximum counts of 300 in 1951/52 to 14,282 in 1975/76. At first, Langstone Harbour was the main resort, but in recent years, Chichester Harbour has assumed equal importance and Portsmouth Harbour and the West Solent have become established wintering areas. In the winter of 1955/56, the first for which such calculations are possible, the maximum counts of Brent

Shelduck, *Tadorna tadorna*

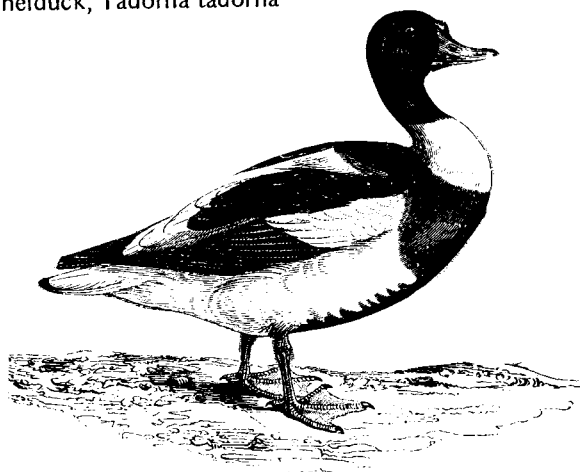


Figure 1. Maximum counts of Shelduck *Tadorna tadorna* in the Solent 1951/52 — 1976/77.

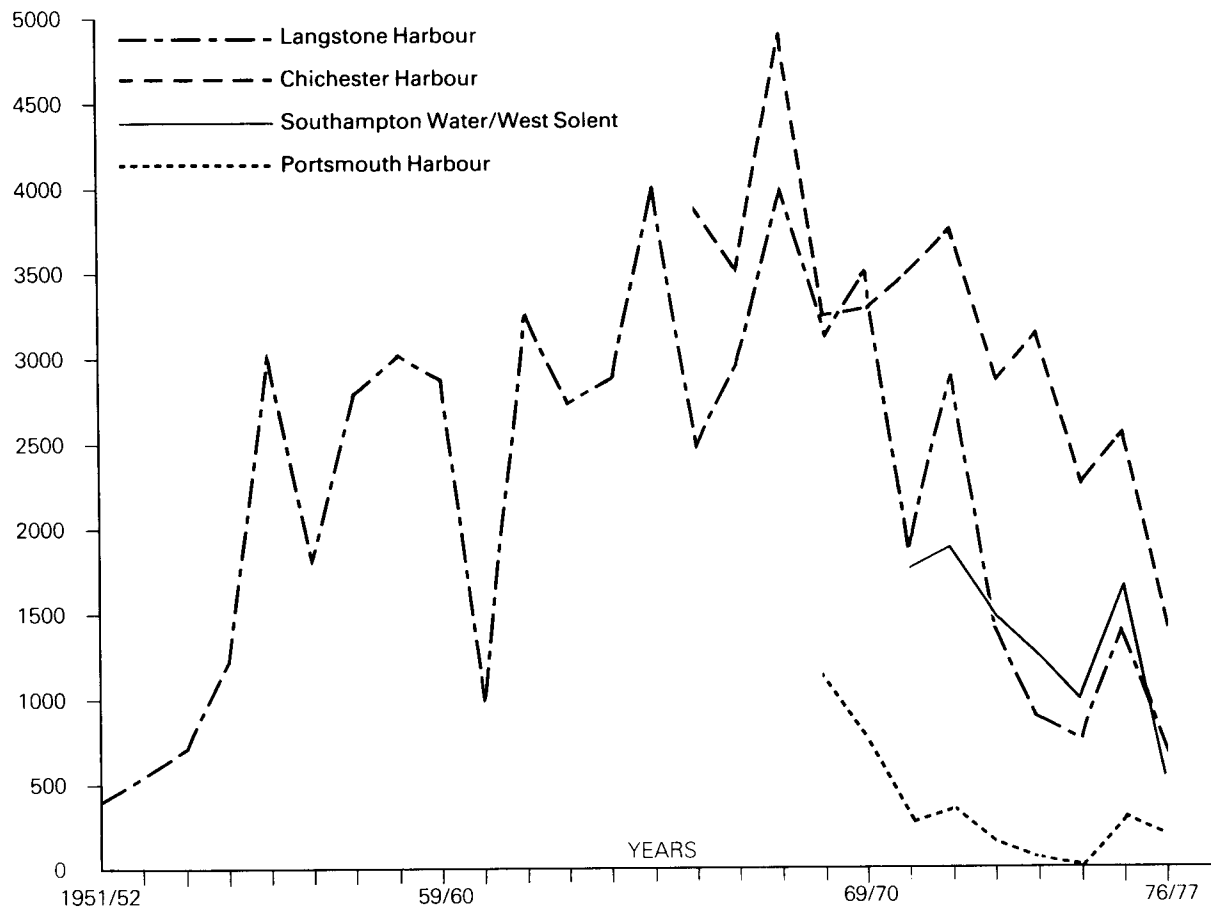
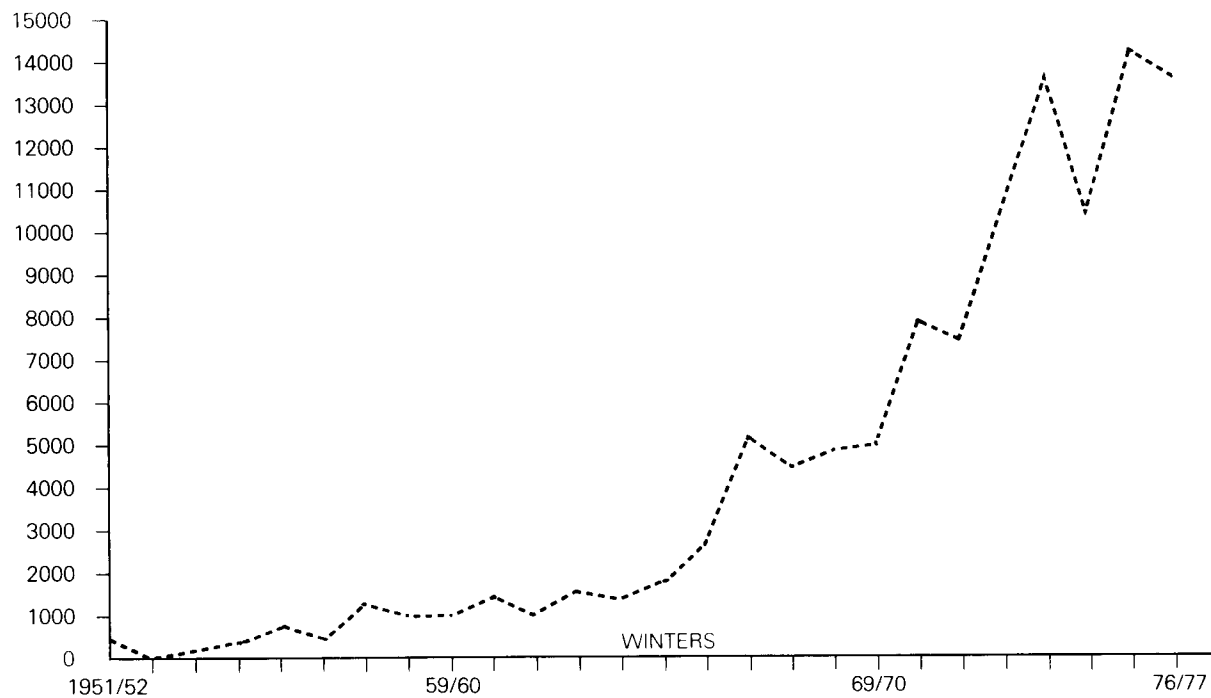


Figure 2. Maximum counts of Brent Geese *Branta bernicla bernicla* in the Solent 1951/52 — 1976/77.



geese in Langstone and Chichester Harbours represented 4.6% of the estimated total world population. Until the early 1970s, the proportion of the total population occurring in the Solent in January and February mounted steadily to 16% in 1966/67 and 25% in 1972/73. Since then, although numbers have continued to increase, they have represented a smaller proportion of the still increasing world total.

As well as the recovery of the *Zostera* beds, reduced winter mortality due to legal protection has probably contributed to the increase in Brent geese populations. In addition, ecological changes in the Solent area since the 1950s have also favoured the come-back. During this time, the die-back of *Spartina anglica* marshes has left eroded, slumping platforms of mud which in places are rich in *Enteromorpha*. In Langstone Harbour, *Enteromorpha* has also spread rapidly over the mudflats since the early 1960s, a phenomenon associated with increased sewage effluent discharges (Portsmouth Polytechnic, 1976). Although most of this weed either becomes detached and accumulates in drifts at high water mark or is incorporated into the mud, the amount of algae available to geese in the early winter has dramatically increased. Similarly, *Enteromorpha* has become abundant in both Portsmouth and, locally, Chichester Harbours. In Langstone Harbour, *Zostera noltii* and *Z. marina* var. *angustifolia* have spread rapidly since the late 1960s. Beds have also become established in the harbours of Portsmouth and, very locally, Chichester. However, since 1972/73, the mid-winter intertidal food resources in Langstone and Chichester Harbours have proved inadequate for the large number of geese present, and an increasing proportion have fed on pasture and autumn sown cereals adjoining the intertidal zone. Small groups have also used terrestrial feeding sites elsewhere in the Solent area. Although adding to the food supply of Brent geese, the depletion of the mud infauna by the blanketing effect of green algae may have contributed to the relatively sharp decline in shelduck in Langstone and Portsmouth Harbours as well as to the anomalous declines in some waders mentioned earlier (Tubbs, 1977).

Diving birds

Only great crested grebe, goldeneye, merganser and cormorant regularly achieve populations in excess of 100 individuals in the Solent area. Marine ducks such as scoter and long-tailed duck occur regularly and black-necked grebe, Slavonian grebe and eider overwinter in small numbers. However, the total population of diving birds in the region is relatively small and it is doubtful if they form a significant proportion of the national total. Between them, these species feed on a wide spectrum of prey, mainly fish, crustaceans and molluscs.

Great crested grebe reach peak numbers in November-December. They congregate mainly in Langstone Harbour where numbers have varied between 27 and 91, with a mean of 63, between 1957 and 1973. Dispersal from Langstone occurs in December-January and in subsequent months, birds are distributed in ones, twos and small groups (but occasionally 30-40 together, presumably on a good feeding ground) throughout the Solent. The intertidal channels of Langstone Harbour also support a mid-winter population of black-necked grebe. Maximum numbers occur in February-March and have varied from 10 to 41, with a mean of 30, between 1957 and 1973. In the 1960s and early 1970s up to nine and five occurred regularly in the West Solent and Chichester Harbour respectively, whilst individuals were occasionally recorded elsewhere. Wintering Slavonian grebe occur

mainly in the West Solent and in the entrance channels of Langstone and Chichester Harbours. They generally appear in ones and twos, although 7-8 sometimes winter in the entrance to Chichester Harbour. This species tends not to penetrate far into either harbours or estuaries. During sustained low temperatures, all three grebe species move out of the eastern harbours, probably in response to movements or changes in the availability of prey. The winter feeding ecology of grebe in tidal waters, however, has received little attention and both this movement and the early winter movement of great crested grebe out of Langstone Harbour require further examination.

Large numbers of cormorants feed in the Solent throughout the year and in the August-March period there are large communal roosts in Southampton Water and the eastern harbours. Although co-ordinated counts of cormorants in the Solent have seldom exceeded 300 birds, the number at Southampton Water roosts alone can sometimes exceed 200. In addition, more than 100 cormorants have sometimes been observed flying into Chichester and Langstone Harbours at dusk. It is reasonable to suggest that the autumn and winter populations of the region in the 1970s probably amounted to around 400 birds, many possibly deriving from the large breeding colonies on the chalk cliffs immediately east of The Needles.

The largest flocks of goldeneye occur in the upper channels of the eastern harbours. Maximum counts often coincide with periods of cold weather when this species, in contrast to grebe feeding in the same area, remains within the harbours. In Langstone, Chichester and Portsmouth Harbours, respective peak counts have varied between 25 and 153 birds with a mean of 74 (1951-77), 25 and 225 with a mean of 93 (1964-77) and 28 and 130 with a mean of 63 (1968-77). Numbers elsewhere in the Solent have seldom reached 40 individuals.

The largest assemblies of merganser have also been recorded in the eastern harbours where this species feeds during the day and flights to sea at dusk. Daytime counts of 40-70 birds have been normal during 1952-77 although morning and evening flight counts have often yielded 100 or more individuals. Elsewhere, flocks are widespread during November-March although they seldom exceed 20-30 birds.

The occurrence of eider in the Solent is a comparatively recent phenomenon consistent with the spread of this species around the English coast since the 1940s. Flocks tend to build up in individual localities over successive winters and then gradually abandon them, presumably in response to changes in food supply. In the

Pair of Goldeneye (G St J Hollis)



late 1950s and early 1960s, for example, 15-40 birds wintered on mussel beds in the entrance to Chichester Harbour but by the mid-1960s, numbers had fallen to ones and twos. In winter 1968/69, up to 130 eider were present off Hillhead compared with less than 20 in previous or subsequent winters, and assemblies of up to 30 birds have similarly occurred off the Beaulieu Estuary, Calshot Spit, Hurst Spit, and elsewhere.

Gulls

Although the numbers of gulls feeding on the coast in autumn and winter are greatly exceeded by those which forage inland and return to the coast only to roost, they are a numerically, and presumably ecologically, important component of the intertidal zone. Apart from the breeding colonies of black-headed gulls which are conspicuous in the West Solent in the spring, the records of gull numbers are fragmentary. Although small gulleries have existed in the West Solent since at least the turn of the century, numbers of individuals remained consistently small until the 1950s, probably as a result of excessive egg collecting. The colony in the Beaulieu Estuary, now one of the largest in the British Isles, remained relatively stable at 1,000-2,000 pairs of birds between 1957 and 1962. Subsequently, the population rose dramatically, probably because of careful controls on commercial egg collectors (Taverner, 1965), to 6,706 pairs in 1966 and 17,000-20,000 by 1971-73. Numbers have since declined to about 15,000 pairs in 1976. Further west, large colonies of black-headed gulls bred during the 1950s and 1960s on the *Spartina* marshes on both sides of the Lymington River and westward to Keyhaven. Estimates at Keyhaven showed a rapid increase from 558 pairs in 1959 to 5,000 pairs in 1968, since when numbers appear to have fallen, probably as nesting space has become restricted following *Spartina* die-back. The first reliable estimate for the Lymington-Keyhaven *Spartina* marshes as a whole, was made in 1973 when there were 9,000 breeding pairs. The Newtown colony has varied between 50 and 500 pairs between 1959 and 1977 following a precarious and persecuted existence for some decades. In Southampton Water, two small colonies totalling about 100 pairs in 1973, have become established since the mid-1960s between the Esso Marine Terminal and Calshot Spit. Prior to this they bred on *Spartina* marsh, now reclaimed, to the north of the Terminal.

Since 1968, the black-headed gull colony in the Beaulieu Estuary has held a small number of Mediterranean gulls. However, females usually seem to be absent and males have paired with female black-headed gulls resulting in the production of infertile eggs or hybrid and, presumably, sterile young. Hybrid Mediterranean X black-headed gulls have also attempted to breed with black-headed gulls (Taverner, 1970, 1972). Since 1968, herring gulls have colonised the north-west Solent shore and breeding pairs have risen from one in 1966 to more than 40 in the 1970s.

Assemblies of non-breeding gulls of all the common British species are present on the coast during the breeding season. Outside the breeding season, the numbers of gulls feeding in the intertidal zone are small compared with those which roost on the coast and forage on agricultural land, urban tips and in the docks. Although incomplete, Birds of Estuaries counts suggest that coastal feeding common and black-headed gulls may be numbered in hundreds compared with the thousands of inland feeders. Large roosts of these two species together with small numbers of the larger species occur

in Southampton Water, the eastern harbours, and elsewhere. However, relatively few quantitative data are available. On 10 January 1959, 10,800 common and 5,100 black-headed gulls were counted as they flighted into Langstone Harbour to roost. In January 1972, similar counts in Portsmouth and Langstone Harbours gave 716 and 291 herring gulls, 8,096 and 12,945 black-headed gulls, 165 and 2,236 common gulls and 550 and 58 great black-backed gulls respectively. A further count in December 1972 in Langstone Harbour gave 495 herring gulls, 9,028 black-headed gulls, 2,522 common gulls and 388 great black-backed gulls. The decline in the number of common gulls roosting in the harbours since the 1950s is notable. Although these latter counts were certainly incomplete because not all flight lines were covered, they serve to indicate the order of magnitude of the populations. Counts on 10 December 1972 of gulls flighting into and assembling at roosts in Southampton Water suggested a roosting population in the order of 30,000-35,000, mainly comprising common and black-headed gulls.

Terns

The average and maximum numbers of sandwich, common and little terns breeding on the north-west Solent shore between 1966 and 1977 are given in Table 6. Roseate terns are usually also present although breeding is seldom proved. Since the mid 1960s a further ternery has become established in Chichester Harbour. This comprised 30-40 pairs of common terns and 40-50 pairs of little terns in the late 1960s and has since increased to around 50 pairs of common and 100 pairs of little terns. In addition, sandwich terns became established in 1975 with a total of 35 breeding pairs in 1976. Common and little terns also breed irregularly in Newtown Harbour (West Solent) and in Southampton Water. The average populations of sandwich, common and little terns in the West Solent represent about 1.5, 2 and 6% respectively of the total breeding populations of Britain and Ireland (Lloyd *et al.*, 1975). Little terns in particular, are vulnerable to human disturbance. Locally, for example a colony bred on Hurst Spit until disturbance became excessive in the early 1960s. Today, the little tern colonies in the West Solent are situated on shell banks lying along the outer margins of the *Spartina* marshes, whilst most sandwich and common terns nest among *Spartina* and *Halimione*, often in company with black-headed gulls. Wardening which commenced in the Beaulieu Estuary in 1962 and further west at Keyhaven in 1966, affords some protection from disturbance and numbers of terns have probably risen as a result. Colonies of all three species, however, are prone to be washed out on high spring tides, and a longer term threat lies in the die-back of the *Spartina* and the subsequent erosion and slumping of the mud platforms. Thus, whatever formal conservation arrangements are made, the long term future of the terneries (and gulleries)

Table 6: Average breeding populations of Terns on the North-West Solent shore 1966-1977

Species	Average number of breeding pairs	Maximum number of breeding pairs
Sandwich Tern	202	282
Common Tern	256	330
Little Tern	98	153

of the north-west Solent will be affected most by the physical and ecological changes which are taking place.

Conclusions

The accepted ornithological criteria for assigning international importance to wetlands as propounded by the International Wetlands Conferences in Ramsar, Iran (1972) and Heiligenhafen, West Germany (1974) are:

(i) the wetland should support at least 1% of the population of one or more species of waders or waterfowl in an international flyway. In the present context this constitutes Europe and North Africa;

or

(ii) the wetland should support totals of 20,000 or more waders and/or more than 10,000 wildfowl of all species.

The Solent estuarine system regularly holds more than 1% of at least seven species of waders and, in recent winters, has supported as much as 25% of the world population of dark-bellied Brent geese and 7% of the north-west European shelduck population. In addition, the total numbers of wildfowl and waders present are well above the qualifying levels. In fact, Langstone and Chichester Harbours individually qualify for international recognition (Tubbs, 1977). Nationally the Solent and Langstone and Chichester Harbours are individually among the twenty most important intertidal systems in the British Isles for their wader populations (Prater, 1971-74). The Solent also supports one of the largest colonies of breeding black-headed gulls in the British Isles and important breeding colonies of sandwich,

common and little terns. The colonies of little terns are of special importance as they constitute about 6% of the total breeding population of this vulnerable species in the British Isles. In addition the West Solent has relatively large breeding populations of ringed plover and oystercatcher which are also species vulnerable to disturbance during their breeding season in the densely populated south and east of England.

Recent increases in the populations of waders and some wildfowl can probably be attributed in the main to external influences, although ecological changes within the Solent, such as extensive die-back of *Spartina* marshes with the corresponding increase in the area of mudland and the increase in *Zostera* and *Enteromorpha*, may be operating to their advantage. The spread of *Enteromorpha* in Langstone and Portsmouth Harbours, probably the result of increased effluent discharge, may, however, have passed a threshold beyond which it is reducing the suitability of these areas for shelduck and some waders. Similarly, *Spartina* die-back in the West Solent, while increasing wader and wildfowl feeding grounds, may ultimately lead to the loss of breeding habitats for gulls and terns.

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