IDENTIFYING THE MAJOR WINTERING GROUNDS OF PALEARCTIC WADERS ALONG THE ATLANTIC COAST OF AFRICA FROM MARINE CHARTS

by Alan Tye

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The value of the African coast between Guinea and Angola as a wintering ground for Palaearctic migrant waders is less well-known than other parts of the East Atlantic Flyway. I use marine charts to identify coastal sites likely to be of international importance in this region and discuss the value of less-important areas. The apparent value of sites as assessed on charts is compared with their value determined by topographic maps and field survey for Guinea-Bissau. In the region considered, Guinea, Sierra Leone, Nigeria, Cameroon, Gabon and Namibia may support large wintering populations, but there are no sites likely to be as important as those in Guinea-Bissau and Mauritania. The latter two areas probably hold over 75% of the Palaearctic waders wintering on the entire Atlantic coast of Africa. Most waders probably occur in well-defined, sheltered sites, rather than on the open coast, which is mainly sandy except in the Bight of Biafra and north of Cape St Ann (Sierra Leone). Densities on open coast are low, except in Namibia and South Africa, where high densities are associated with upwelling and rockier coasts. Armchair methods using charts and possibly satellite imagery may be one of the best way initially to identify promising areas for waders.

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INTRODUCTION

There has been much recent discussion of the supposed gap in our knowledge of wader populations on the Atlantic coast of Africa between Guinea-Bissau and South Africa (*e.g.* Poorter and Zwarts 1984, Piersma 1987). Compared with other parts of the East Atlantic Flyway there is certainly less information available from this region. However, I hope to show here that the major wintering grounds for Palaearctic waders on Africa's Atlantic coast are already known and often documented, or can be pinpointed by the use of coastal marine charts.

In this paper I attempt to identify all sites on the Atlantic coast of Africa between Guinea-Bissau and Namibia which, on the basis of size and habitat, may be important for wintering Palaearctic waders. I compare the evidence from charts with documented information, both as a check on the charts and to supplement the information. As a further check, I examine the charts covering ornithologically well-known areas in Guinea-Bissau (Poorter and Zwarts 1984), Sierra Leone (Tye and Tye 1987), Namibia (Whitelaw *et al.* 1978) and South Africa south to Langebaan Lagoon (Pringle and Cooper 1975). Finally, I attempt to predict the size of wader populations along the Atlantic coast of Africa.

The findings and predictions may help to focus attention on areas worth more detailed study on the ground.

METHODS

The use of marine charts

I used British Admiralty charts as an aid to identifying sites likely to be of international importance for waders on the basis of size and total numbers, as defined by the Cagliari criteria of the Ramsar Convention, *i.e.* regularly holding over 20 000 waders (Lyster 1985). I make no attempt to predict species composition at any site.

Coastal marine charts are constructed primarily to permit safe coastal navigation and are thus generally more detailed in areas which are or have been heavily used by shipping. Busy areas are normally mapped at large scales, often 1:25 000 or greater. Regions which are less frequented are mapped at smaller scales, often 1:100 000 or smaller. For the same reason, surveys are repeated more frequently and charts up-dated in busy areas and where coastal features are subject to change.

Marine surveys primarily involve sounding, and mapping the coastline and conspicuous objects on-shore which may be useful aids to navigation. Modern charts also include relevant results from coastal topographic surveys. Soundings are shown corrected to chart datum, which is normally extreme low water at a nearby coastal station. Inshore, soundings are taken to 0.1 m or, on older charts, to 1 ft. They are usually more closely-spaced arounds hazards such as sand-banks and wrecks, and close to the 0.0 m, which is normally shown as a contour. In addition, soundings are often taken in the intertidal zone which, when corrected to chart datum, show the 'drying height' (height above chart datum). Surveys also include sampling the bottom sediment: the intertidal zone is generally marked as sand, mud or mud-and-sand, with mangroves and other coastal swamps also marked.

The British Admiralty issues charts of the entire African coast (and elsewhere), compiled from their own surveys and from surveys by other former colonial powers, African governments and commercial survey companies.

All the above considerations affect the amount and quality of information that may be extracted from charts. Charts are generally most detailed and up-to-date in and around ports, harbours, estuaries, sheltered bays, other anchorages, and oilfields. They are least detailed for open, featureless coastline with few landing-places. Fortunately for the wader biologist, it is the former which are most important for waders: few birds occur on exposed coastline, which is mainly steep sand beach. Hence most potential wader sites are charted at large scales, from recent, detailed surveys. Since the positions of mudflats and sand-banks are of crucial importance to navigation, they are normally well-charted.

From my experience of intertidal areas in West Africa, and from descriptions of other sites in the ornithological literature, it appears that charts give a reasonable portrayal of the intertidal zone. However, their limitations should be understood. First, owing to regular seasonal and less regular or progressive factors, some banks and flats change in area or position. Where such changes occur, charts cannot be used to determine these features with precision, but they do allow the overall size of the intertidal zone to be estimated, as changes affect detail, rather than gross structure. Comparisons with more recent surveys reveal that even 19th-century surveys can be of use.

Second, the charts are primarily concerned with marine navigation, but in general extend inland as far as major ports. Since many ports are far inside large rivers (*e.g.* Port Harcourt, Calabar, Matadi), the charts often cover all areas with a significant tidal range. Indeed, the River Niger is charted up to Old Bussa, 800 km from the sea. Coastal lagoons are rarely charted. They can be either brackish and tidal, or fresh and usually non-tidal. An indication of their value for waders may be gained by examining the charts in conjunction with topographic maps (the latter available for most of coastal Africa at 1:50 000 or 1:100 000), which show mangrove and sometimes tidal range. However, I have avoided predicting the value of uncharted coastal lagoons, and simply indicate their location and size.

A third shortcoming is in the portrayal of sediment type. For the sea bottom this is detailed and precise, giving colour, consistency and composition, but it is much less detailed for the intertidal zone. The distinction between sand and mud is not standardised: pure sand and soft mud are probably always correctly designated but muddy sand may be classed as mud, sand or mud-and-sand (pers. obs.). Here, what is shown on the chart must be interpreted in the light of personal experience, descriptions in the literature, and knowledge of how sediment patterns relate to coastal structure.

Finally, charts obviously do not say anything about the macrobenthos and use of an area by birds.

Site assessment

I examined charts for evidence of either large intertidal flats (*i.e.* with a great horizontal tide range) or a great length of muddy foreshore, or extensive mangroves. All these are important wader habitats in tropical Africa. However, site size is quoted throughout in terms of area of muddy intertidal zone excluding mangroves, as mangroves do not normally support many waders in the absence of mudflats. The importance of a site depends on a combination of its size and the density of waders. As elsewhere, wader densities in Africa vary according to sediment type (Summers *et al.* 1977, Altenburg *et al.* 1982, Tye and Tye 1987). Some density estimates based on censuses are available (Table 1).

censuses have also been carried out in Ghana (Grimes 1972, MacDonald 1978), although the exact area of the census sites was not given, so densities cannot be estimated. Other wader observations, including some partial censuses, have been made in Ivory Coast (Thiollay 1985), Nigeria (Serle 1957, Smith 1966, Elgood 1982), southern Cameroon (Germain *et al.* 1973), Gabon (Christy 1982), and Angola (Serle 1955).

For sheltered sites, densities range from 2-30 waders ha^{-1} (Table 1). In order to estimate the importance of other sites, it is necessary to use a simple size criterion. I list all sites with at least 1000 ha of muddy intertidal zone, which would reach international importance at 20 birds/ha (in the upper part of the range in Table 1) and indicate sites of 4000 ha or more, which would reach international importance at 5 birds/ha, as likely to be of special importance.

RESULTS

Validation of the method: Guinea-Bissau

As far as I can ascertain, intertidal areas as wader habitat have not been measured by detailed survey anywhere on Africa's Atlantic coast, so validation here of the use of marine

Table 1. Estimates of wader densities in sheltered sites on the Atlantic coast of Africa.

Site	Density ($no.ha^{-1}$) mean	range	Habitat	Source
Guinea-Bissau	7.2	1.3-9.5	Mud/muddy sand	Poorter & Zwarts 1974
Sierra Leone	15.5	5-28	Mud/muddy sand	Tye & Tye 1987
Walvis Bay, Namibia		9.9	Muddy sand	Whitelaw *et al.* 1978[1]
Sandwich Harbour Namibia	12.3	17.1	Muddy sand	Whitelaw *et al.* 1978[1]
Langebaan Lagoon, South Africa	28[2]	22-34	Muddy sand	Pringle & Cooper 1975[1]

[1] Density calculated from bird numbers given in this source, and site sizes in Table 7 of this paper.
[2] Mean of the two years' estimates at same site.

charts simply consists of comparing intertidal areas thereon, with the same areas measured on topographic maps. Poorter and Zwarts (1984) estimated from topographic maps and field survey, that Guinea-Bissau had a total intertidal zone of 157 000 ha and that 1 120 000 waders wintered there. The marine charts for Guinea-Bissau show an intertidal zone of *c.* 143 000 ha which, at 7.2 birds/ha (Poorter and Zwarts' mean density) would hold 1 030 000 birds. The discrepancy in area may be due to errors in my measurements, or to Poorter and Zwarts' estimates, or to uncharted tidal areas in the upper reaches of estuaries. However these figures seem in reasonable agreement (within 10%), suggesting that topographic and marine surveys produce similar results. Hence the technique of using charts to measure intertidal areas seems a valid one.

Guinea

Guinea has 2 sites with at least 4000 ha of intertidal zone and a further 8 with >1000 ha (Table 2). Of the 2 largest sites, one is an estuary, the Riviere Forecariah, while the other is a shallow bay, protected by Cap Verga and Presqu'ile de Camayenne/Iles de Los.

Sierra Leone and Liberia

Sierra Leone has two sites known to be of international importance (Table 3). One of these, the Sierra Leone River, has <2000 ha of intertidal mud, but has high wader densities (Tye and Tye 1987). Two other sites, the Sherbio River and Scarcies Estuary, probably hold internationally important populations of some species (Tye and Tye 1987).

However, Sierra Leone marks the southern limit of the strip of indented, muddy coast which extends south from Cap Skirring (Senegal). Over half of the coastline of Sierra Leone is steep sand beach. South of Cap St Ann in Sierra Leone, as far as the Cavally River on the Liberian/Ivory Coast border, the entire coast is exposed, narrow sand beach, relieved only by some rocky headlands (in Liberia) and small sandy inlets. Some of the inlets have small muddy-sand flats, but the combined area of all these probably does not exceed 100 ha.

Ivory Coast to Nigeria

The coastline from the Cavally River to the Niger Delta is also exposed, narrow sand beach, with rocky headlands and some streches of low cliffs. There are small inlets at the mouths of the rivers Sassandra, Bandama, Komoe, Volta and Mono and at the entrances to the coastal lagoons of Ngni, Ebrie, Aby, Nokoue and Lagos. These narrow, short estuaries probably have less than 500 ha of intertidal muddy sand combined. However, this stretch of coast is the richest in lagoons along the entire Atlantic coast (Table 4) and has large salt pans in some areas. Most of the lagoons are, at present, open to the sea, and so are brackish and tidal, though some are closed or only

Table 2. Coastal habitats in Guinea.

Site/coastal stretch	Coastal character	Length of shore (km)	Intertidal area (ha)
Rio Nunez estuary	Mud & sand	*c.*90	*c.*3900 *
R. Nunez to Cap Verga	Mud & sand	*c.*47	*c.*3500 *
Cap Verga to Rio Pongo	Mud & sand	*c.*40	*c.*10000 **
Rio Pongo	Mud	*c.*33	*c.*3000 *
R. Pongo to Riviere Dubreka	Sand & mud	*c.*30	*c.*3000 *
R. Dubreka to Conakry	Mud & sand	*c.*40	*c.*2000 *
Conakry & Iles de Los	Rock & sand	-	-
Conakry to Riviere Soumbouya	Mud	*c.*13.5	*c.*2400 *
R. Soumbouya & R. Morebaya	Sand & mud	*c.*32	*c.*3600 *
Riviere Forecariah	Sand & mud	*c.*30	*c.*4000 **
Riviere Melikhoure	Sand & mud	*c.*30	*c.*2000 *
R. Melikhoure to Yelibuya Island	Narrow sand beach	*c.*15	-

*Sites >1000 ha: internationally important (i.e. >20 000 waders) if density of birds is high (>20 birds/ha)
**Site >4000 ha: internationally important if densities of birds moderate (>5 birds/ha).

Table 3. Coastal sites in Sierra Leone.

Site/coastal stretch	Coastal character	Length of shore (km)	Intertidal area (ha)
Scarcies Estuary	Muddy sand	*c.*30	*c.*350 *
	Sand-banks	-	>4000 *
Scarcies to Sierra Leone River	Sand beach	*c.*38	-
Sierra Leone River	Mud & muddy sand	*c.*110	*c.*1800 *●
Cape Sierra Leone to Cape Shilling	Sand beach & rock	*c.*40	-
Yawri Bay	Mud	*c.*60	*c.*9100 **●
Sherbro River	Mud & sand	>60	>6500 **
Cape St Ann to Liberia	Steep sand beach	-	-

●Known to hold >20 000 waders
*, ** see Table 2.

Table 4. Coastal lagoons in Ivory Coast, Ghana, Togo, Benin and western Nigeria.

Lagoon	Length of shore (km)	Width of intertidal zone (m)
Lagune Tadio and outliers	*c*.100	Probably <250
Lagune Ebrie	*c*.100	Probably <50
Lagune Aby	*c*.150	Probably <50
5 small lagoons between Cape Coast and Apam	*c*.20	<200
4 small lagoons between Apam and Accra	*c*.30	<250
Small lagoons between Accra and Prampram	*c*.21	<50
Songaw Lagoon	*c*.40	?
Angaw/Keta Lagoons	*c*.90	?
Lac de Togo/Lagune de Wo	*c*.50	?
Lac Nokoue	*c*.75	?
Lagos Lagoon	*c*.120	?

Table 5. Coastal sites in the Bight of Biafra.

Site/coast	Coastal character	Length of shore (km)	Intertidal area (ha)
Ondo Coast	Mud	*c*.100	*c*.1000 *
Bonny River	Mud & muddy sand	*c*.50	*c*.2100 *
Cross River	Mud	*c*.60	*c*.4500 **
Rio del Rey	Mud & muddy sand	*c*.80	*c*.2000 *
River Cameroon	Mud	*c*.80	*c*.6200 **

*, ** see Table 2.

seasonally-breached and so are fresher water. MacLaren (1952-53) gives a description of this coastline.

For reasons discussed above, charts cannot be used to measure the intertidal area of these lagoons, but I have attempted to indicate the maximum width of the intertidal zone and to give an estimate of the length of shoreline, where such information can be gleaned from topographic maps. It is impossible to estimate wader numbers on the lagoons, though densities seem low (D. Reynolds *in litt.*) and the salt works hold populations numbering in the 100's rather than 1000's (see *e.g.* Grimes 1972, MacDonald 1978).

<u>Niger Delta and Bight of Biafra</u>

From about 4°45'E, where the Nigerian coast bends south towards the Delta, the open coastline becomes muddy for *c.* 100 km, where the eastward-setting current has deposited fine sediments (MacLaren 1952-53). The intertidal zone is narrow, owing to the small tidal range in the Bight of Biafra (MacLaren 1952-53) but this strip of coast is probably more important for waders than open, sandy coasts nearby (Table 5: Ondo Coast).

The coastline of the Niger Delta from the Benin River to the Bonny River estuary is exposed sand beach subjected to heavy surf. There are small estuaries at the many mouths of the Niger (Escravos, Forcados, Ramos, Dodo, Pennington, Middleton, Fishtown, Sengana, Nun, Brass, St Nicholas, Sta Barbara, San Bartholomeo, Sombreiro and New Calabar Rivers) and an extensive network of narrow mangrove creeks. Waders are uncommon on the open shore but the combined total of waders in the delta creeks and estuaries may well exceed 20 000 birds (see counts in Smith 1966). However, the entire Niger Delta can scarcely be considered a single 'site' (having a coastline nearly 400 km long and an area exceeding 15 000 km^2), and numbers in any given estuary probably do not exceed 5 000 birds. Smith (1966) gives counts in the Escravos and Warri Rivers, probably two of the most important areas in the delta.

The Bonny River is the largest and probably most important estuary in the Delta region, forming its present eastern limit (Table 5), and possibly holding over 10 000 birds (see sample counts in Smith 1966). East of the Bonny River, the exposed, sandy coast continues to the Cross or Calabar River, broken by three small estuaries of the Andoni, Opobo and Kwa Ibo Rivers. The largest of these, the Andoni, holds few waders (Smith 1966).

The inner Bight of Biafra has an indented coastline with softer sediments, and receives several short but seasonally-powerful rivers. The Cross River and River Cameroon are probably of international importance and the Rio del Rey may be (Table 5). The coast between these estuaries is sandy, or rocky at the base of Mount Cameroon, with small, volcanic sand beaches which hold few waders (Serle 1965).

South of the River Cameroon as far as Cabo San Juan (Equatorial Guinea) the coast is sandy or rocky and exposed, with narrow beaches. It is broken by the estuaries of Riviere Sanaga, R. Njong, R. Bongola/Campo and Rio Benito, plus smaller inlets, but these are predominantly sandy and none has an intertidal zone greater than 250 ha.

The Gulf of Guinea Islands (Bioko or Fernando Po, Sao Tome, Principe and Annobon) have exposed, rocky coasts with small sandy bays.

<u>Gabon to Angola</u>

Corisco Bay, on the Equatorial Guinea/Gabon border, is probably of international importance (Table 4). The most extensive mudflats are in the south of the bay (Baie de Mondah) with a further area of mud shores in the north around the mouth of the Rio Muni. The Estuarie du Gabon is a second site of probable international importance (Table 6), where the area of mudflat may actually have increased recently due to building works (Christy 1982). South of there, the coast is exposed and sandy until the Baie de Nazare and Baie du Lopez are reached, but protected by Cap Lopez. Combined, these two neighbouring bays exceed 4000 ha of intertidal mud and sand (Table 6).

Between Cap Lopez and the Zaire River, the open coast is again exposed and predominantly sandy. However, this is a second important area for coastal lagoons (Table 6). Most or all of these are brackish and open to the sea but, as in Ivory Coast-Nigeria, their value for waders can only be guessed.

The Zaire River estuary contains a large area of sand-banks and much muddy shoreline (Table 6). These may support a large wader population, though densities seem low (see paucity of records in Petit 1899, Vrydagh 1953).

From the Zaire River to Baia dos Tigres in southern Angola, the coast is exposed and sandy with small sandy bays behind rocky headlands but no significant inlets. The bays are too small to hold large numbers of waders and densities are low (*e.g.* Serle 1955, Erard and Etchecopar 1970). However, Baia dos Tigres itself may, despite its predominantly sandy nature, support a significant number of waders (Table 6) as it may benefit from upwelling (see below).

Namibia and South Africa

The Namib coast is open, exposed sand dunes, broken by small bays of which the largest is Walvis Bay (Table 7). This site and Sandwich Harbour are both known to be of international importance (Whitelaw *et al.* 1978) despite their moderate size, as they have high wader densities. In addition there are large salt-works at Cape Cross, Walvis Bay, Conception Bay and Spencer Bay, some of which (those shown on charts) are included in Table 7, and which may support large wader populations (see Whitelaw *et al.* 1978).

Despite its open nature, particular stretches of the Namib coast, e.g. a 30 km strip between the Swakop River and Walvis Bay (Whitelaw *et al.* 1978) support unusually high wader densities. This may be an effect of the Benguela Current upwelling and producing nutrient-rich sediments and kelp beds. The latter are associated with high wader densities in South Africa (Summers *et al.* 1977).

South of Walvis Bay, the coast gradually becomes rockier. Bays remain sandy with a narrow intertidal zone, until St Helena Bay and Saldanha Bay are reached. Although the main parts of these bays are also sandy, Langebaan Lagoon, a more sheltered offshoot of Saldanha Bay, has large areas of muddy sand (Table 7) and is known to be of international importance (Pringle and Cooper 1975). Note than Langebaan's importance is not due to large size, but to a unusually high densities (Table 1).

Minor sites

Above, I have discussed sites of 1000 ha or more. Although smaller sites are individually unlikely to hold great numbers, their combined total may make a significant contribution to the wintering areas of the flyway population. At 20 birds/ha, as in some small inlets in Sierra Leone, an inlet with 250 ha of intertidal muddy sand would hold 5000 waders, although average densities on most sites are probably lower (Table 1). There are 24 small

Table 6. Coastal sites from Gabon to Angola.

Site/coastal stretch	Coastal character	Length of shore (km)	Intertidal area (ha)	
Corisco Bay	Mud & muddy sand	*c.*95	*c.*7700	**
Estuaire du Gabon	Mud	*c.*75	*c.*4300	**
Baie de Nazare	Sand & mud	*c.*15	*c.*1000	**
Baie du Cap Lopez	Sand & mud	*c.*15	*c.*3300	**
7 lagoons between Cap Lopez and Zaire River	Mainly sand	*c.*400	?	
Zaire River	Mud shores	*c.*270	*c.*1000	**
	Sand-banks	–	*c.*3500	**
Baia dos Tigres	Sand & mud	*c.*60	*c.*1200	*

*, ** see Table 2.

Table 7. Coastal sites in Namibia and South Africa.

Site/coastal stretch	coastal character	Length of shore (km)	Intertidal area (ha)	
Walvis Bay	Sand	*c.*20	*c.*2600	*●
Sandwich Harbour	Muddy sand	*c.*20	*c.*1300	*●
Conception Bay	Salt pans	–	*c.*4000	
Conception Bay to Spencer Bay	Salt pans	–	*c.*8500	
St Helena Bay/Berg River	Salt pans & muddy sand	*c.*20	*c.*1000	*
Langebaan Lagoon/Riet Bay	Muddy Sand	*c.*20	*c.*1700	*●

*, ● see Table 2.

Table 8. Estimates of wader densities on the open Atlantic coast of Africa.

Site	Density (birds/km)	Habitat	Source
Sierra Leone	<1	Sand beach	Tye, unpubl.
West Cameroon	Max. 34	Pebble & sand beach	Serle (1965)
Namibia	7.0-399.8, mean 81.7	Sand beach in richest 225 km	Whitelaw *et al.* (1978)
Namibia	'very low'[1]	Sand beach on remaining 1150 km	Whitelaw *et al.* (1978)
South Africa:			
Cape Peninsula	Max 268	Rock & sand	Pringle & Cooper (1977)
SW Cape, W coast	15.2	Sandy	Summers *et al.* (1977)
SW Cape, S coast	1.7	Sandy	Summers *et al.* (1977)
SW Cape, W coast	39.8	Rocky	Summers *et al.* (1977)
SW Cape, S coast	5.0	Rocky	Summers *et al.* (1977)
SW Cape, W coast	61.8	Mixed sand/rock	Summers *et al.* (1977)
SW Cape, S coast	4.5	Mixed sand/rock	Summers *et al.* (1977)

[1] By implication, below their range for the richest stretch of beach, i.e. birds/km.

bays and inlets between Guinea-Bissau and Saldanha Bay (including those in the Niger Delta and southern Cameroon, mentioned earlier) with intertidal areas of 100 - 1000 ha; most are towards the small end of this range.

Open coastline

Much of Africa's Atlantic coast consists of exposed, narrow, sandy shores, with small rocky headlands. densities of waders on such coastline are low (Table 8), and usually comprise only species which can feed on sand (*e.g.* Grey Plover *Pluvialis squatarola*, Sanderling *Calidria alba*, Common Sandpiper *Actitis hypoleucos*) or on rock (e.g. Turnstone *Arenaria interpres*, Common Sandpiper, Whimbrel *Numenius phaeopus*), although many other species are occasionally recorded. Densities seem much higher on the Namib and south-west Cape coasts (Table 8), where they are associated with upwelling of nutrient-rich waters, and rockier shores. In these areas, densities are lower on beaches without kelp, and on the south coast of South Africa, where the effects of upwelling are less (Summers *et al.* 1977).

Between Cape St Ann (Sierra Leone) and the Cross River (Nigeria) are *c.* 2600 km of predominantly sandy coast and between the River Cameroon and Swakopmund are another *c.* 3200 km. From Swakopmund to Langebaan are *c.* 1200 km of shore which might support higher densities (Table 8).

DISCUSSION

How many waders winter on Africa's Atlantic coast, and where?

It is known that Guinea-Bissau probably holds *c.* 1 120 000 (Poorter and Zwarts 1984), Sierra Leone *c.* 160 000 (Tye and Tye 1987), certain Namibian sites *c.* 75 000 (Whitelaw *et al.* 1978) and Langebaan Lagoon *c.* 50 000 (Pringle and Cooper 1975). For the other major sites discussed in this paper (Tables 2,5,6,7 and accompanying text), excluding lagoons and salt-pans, I have used a figure of 5 birds/ha to estimate populations. This produces a total for these other sites of 381 000 birds (on 76 200 ha). In addition, the 24 minor sites, which have a combined area of approximately 6000 ha, would support 30 000 Palaearctic waders at this density.

Densities on open coastline are usually lower than in sheltered sites, except for certain parts of the Namib and South African coasts (where most counts have been made). Nowhere on Africa's Atlantic coast has as much rocky shoreline as South Africa, and nowhere benefits from upwelling as much as Namib. Hence wader densities in most areas are likely to be lower than in these two countries. Bearing these facts and Table 8 in mind, I have used a figure of 2 birds/km to make a rough estimate of the number of waders wintering on open coast north of Swakopmund (Namibiab) and 20/km for the rest of the coast of Namibia and South Africa.

At these densities, the stretches of open coast between Cape St Ann and the Cross River and between the River Cameroon and Swakopmund would together support *c.* 12 000 waders, while the strip from Swakopmund to Langebaan would support a further 24 000. These birds would probably be largely those species listed above as predominantly on the open coast.

Even if densities are twice as high as assumed here, the number of birds wintering on open coast would be small, except in Namibia and South Africa, although it might include a significant proportion of the population of Sanderlings.

These figures add up to a grand total of 1.85 million Palaearctic waders. It seems unlikely that the birds wintering in lagoons and salt-pans would take the total over 2 million. One million of these birds winter in Guinea-Bissau. These figures compare with an estimate for the Banc d'Arguin of 2.25 million (Altenburg *et al.* 1982). It seems evident on the basis of these rough calculations that the Banc d'Arguin and Guinea-Bissau are the two most important wintering sites, holding over 75% of the waders likely to be wintering on the entire Atlantic coast of Africa, assuming that the estimates for these two areas are correct, and that no other has exceptionally high densities.

Passage migrants

Although smaller sites may hold fewer birds at any one time, they, as well as larger sites, may be important refuelling stops for many more birds during the migration periods. To assess the role of particular sites during migration, detailed field-work needs to be carried out at

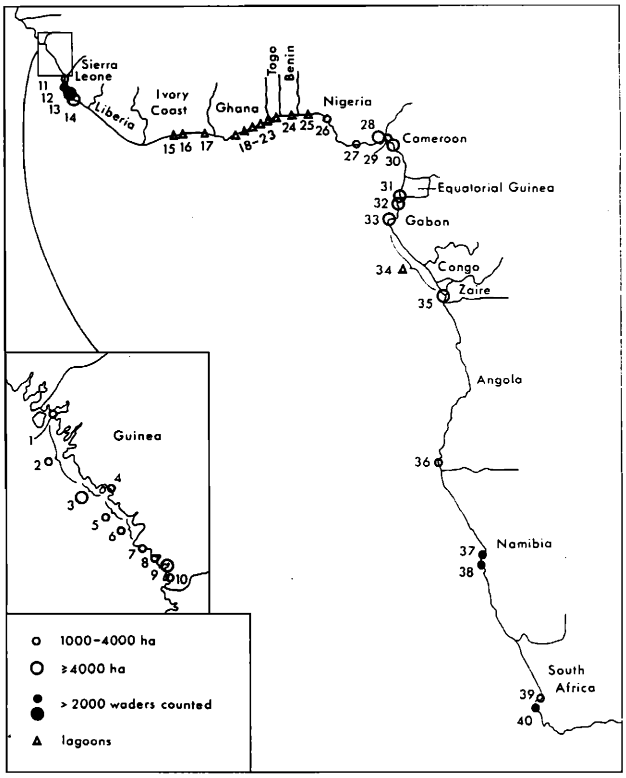

Figure 1. Coastal sites of probably or known international importance for waders on the Atlantic coast of Africa.

the appropriate seasons. However, enough information is available at present to indicate the best places for such studies, based on present knowledge of major migration routes. Birds wintering down the African coast as far as western Ghana may follow the coastline from north-west Africa, while birds wintering from eastern Ghana eastwards may cross the Sahara (Walsh 1971, Grimes 1974, Elliott *et al.* 1976, MacDonald 1978, Summers and Waltner 1979, Tye and Tye 1987). Many waders wintering in South Africa migrate through east Africa (Summers and Waltner 1979, Pearson and Britton 1980). A second major route to South Africa might exist down the Atlantic coast from the Bight of Biafra (see Tye and Tye 1987) but there are few stop-over sites between Gabon and Namibia (Figure 2), and such as there are are very small. This might suggest that most waders take the more easterly routes, a suggestion supported for some species by ringing recoveries involving South African birds (Elliott *et al.* 1976, Summers and Waltner 1979), or fly non-stop as far as Gabon. The sites discussed above, between Gabon and eastern Nigeria, are large enough to accommodate the few hundred thousand waders which are known to winter in Namibia and South Africa, but it is not certain whether any southern African birds do actually take this route. However, it is noteworthy that Sanderling, arguably the species most associated with sandy shores outside sheltered sites, may well travel primarily via the Atlantic coast (Summers and Waltner 1979).

Suggestions for future research

I have attempted to identify all coastal sites of major importance as wintering grounds for Palaearctic waders on Africa's Atlantic coast using charts. This is a useful first step providing allowance is made for reasonable variations in bird density, because the importance of a site is correlated with its size, however crude that correlation may be. Most of the important wader wintering grounds in coastal Africa do seem to be already known, or can be identified on marine charts. Charts may be a useful tool for other poorly-known areas of the world, but they are not the only means of armchair wader-spotting. Most topographic maps of tropical areas do not show the intertidal zone (excluding mangroves) well, although much of the temperate zone has such coverage. However, Landsat photographs might be used to pinpoint areas, given the appropriate interpretative techniques and photography during the low water period.

Cheap armchair methods may be the best way initially to find promising areas, before indulging in expensive field surveys covering long stretches of coastline, although field survey remains vital to examine areas identified by armchair methods as promising. However, most field research should be directed not into expeditions to 'find' such areas, but towards ecological studies within them and their conservation.

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WSG INTERNATIONAL PROJECT ON BLACK-WINGED STILTS: SECOND PROGRESS REPORT

by Philippe J. Dubois

INTRODUCTION

The main event of the year was a technical meeting held from 12-13 December 1986 at Rochefort, France, between the national co-ordinators of the WSG Project. Portugal, Spain, France and Italy were represented. We discussed the results of studies carried out in each country in 1986, together with the L.P.O. Expedition to Morocco in September 1986. An international colour-marking scheme was adopted, starting in 1987. A project proposal will be submitted to the E.E.C. for a co-operative study on Black-winged Stilts in Southern Europe.

RESULTS

As the first progress report, we summarise the results of the studies carried out in each country.

<u>Portugal</u> (co-ordinator: Rui Rufino, CEMPA, Lisboa).

<u>Les Batty (supervising students at the University of Faro)</u>
Feeding and feeding behaviour of *Himantopus himantopus* in one salina at Faro (by Antonina M. dos Santos).
Studies of feeding rates (number of paces, number of items ingested and number of pecks) and food availability. The results suggested that the main prey was *Artemia salina*, although other prey were taken when the salinas had a lower salinity level.

<u>M. Bolton (at Portimao)</u>
Study of factors affecting hatching success in a small population in South-west Portugal. The major factor influencing hatching success seems to be the degree of vulnerability to ground predators.

<u>A. Xeira (Tejo Estuary)</u>
(This work was started in 1983 by Goncalo Jardim of which a note was published)
The 1985 and 1986 studies focussed on changes in breeding and non-breeding numbers, clutch size and hatching success, breeding success, and dispersion.
In the breeding seasons a total of 12 adults and 26 juveniles were colour ringed. Two adults ringed in 1985, were present at the site this season.

<u>G. Vowles (Algarve)</u>
41 young were ringed in 1985 and 25 in 1986 in Algarve.

<u>Spain</u> (co-ordinator: Luis J. Alberto, Facultad de Ciencas, Sevilla)

From regional censuses carried out for 3 years in Spain, the national population was estimated to be 8 000 pairs, well below the "over 20 000 pairs" stated in the literature (BWP).

<u>France</u> (co-ordinator: Philippe J. Dubois, L.P.O., Rochefort).

In 1986, 166 juveniles were ringed (135 colour-ringed) together with 8 adults. The first results from the colour-ringing programme which began in 1983 show that some degree of philopatry occurs in juveniles, some birds can breed from the first year but most of them seem to breed only from the third year, and that some mate-changing occurs during the breeding season.
The significance of supranormal clutches was also studied. Some sightings of birds coming from the Atlantic coast were made in Morocco, Sardinia and Camargue.