

## Coastal Wildlife Database

### Data Scoping & Assessment Study

Final Report

July 1994

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## 1. Summary

NRA Anglian Region has collected ecological data on coastal sea defences and estuaries using standard methodologies since 1989 to provide a baseline for ecological monitoring and input to strategic planning. A large and unique data set has been developed but has not been fully exploited due to the problems associated with data retrieval, interpretation and assessment.

The major data sets held include coastal botanical and breeding bird surveys and wintering wader and wildfowl surveys. They are held in a variety of forms including as raw data, on section survey forms, or as bound reports. This makes it difficult to get at data easily. In some cases parts of the data set have been computerised, but this is by no means complete.

Despite the use of standardised survey methodologies there are still inconsistencies in the actual data, recording units and assessment methodologies. Much of the botanical and breeding bird data has not been assessed. The wader and wildfowl data has been assessed, but this information is only available in bound reports relating to individual estuaries. It is also in a form that is not readily understandable by non-specialists.

To exploit the data set to the full it is essential that interpreted data is easily available for use by all of NRA's functions where it is needed. At present the supply of ecological information to other functions and even to NRA's area conservation staff is limited. Continuing developing such a database at considerable cost can hardly be justified unless more use is made of the information. It is essential that the ecological data needs of the organisation as a whole are clearly defined, and that the handling, interpretation and availability of the existing information is improved before further surveying is carried out.

The report details a series of recommendations that provide a prioritised development programme in project form. The programme aims to ensure that NRA functions other than conservation are alerted to the presence and value of areas of ecological importance, that the basis for such designation is sound and that information at what ever level of complexity is readily available.

NRA has been developing Geographic Information systems (GIS). GIS provide great potential for making integrated ecological information available across all NRA functions where it is needed. They also provide opportunities for enhancing the assessment and data interpretation methodologies used within NRA's conservation function. In particular "The Shoreline Management System" has been established as an aid to planning and monitoring the sea defences of the Anglian coast. Little ecological information is available for this system at present. The recommendations provide a logical series of projects laying the foundations for the integration of ecological data into NRA's GIS.

## **2. Introduction**

Lee Donaldson Associates Environmental Consultants were commissioned by the National Rivers Authority, Anglian Region to undertake a data scoping and assessment study of information held in its Coastal Wildlife Database.

## **3. Background**

NRA Anglian Region has pursued a policy of collecting ecological data on coastal sea defences and estuaries using standard methodologies since 1989. A large and unique data set has been developed but has not been fully exploited due to the problems associated with data retrieval, interpretation and assessment.

Large scale investment in such data sets can only be justified if the data is used. It is vital that the ecological data needs of NRA are reviewed so that future decisions on survey needs, data handling and assessment can be well informed.

NRA has been developing Geographic Information systems (GIS). In particular "The Shoreline Management System" has been established as an aid to planning and monitoring sea defences along the Anglian coast. Little ecological information is available for this system at present.

GIS provide great potential for making integrated ecological information available across all NRA functions where it is needed. They also provide opportunities for enhancing the assessment and data interpretation methodologies used by NRA's conservation function.

## **4. Scope of the study**

This project was intended to examine the data holdings of NRA Anglian Region relating to coastal and estuarine areas.

The definition of these areas is problematic. Whilst the area could normally be defined by taking Mean High Water as the maximum extent of the study, many of the drain systems of the Wash, Broads and Essex Estuaries are tidal well inland. NRA has had difficulties in defining where coastal and estuarine survey methodologies should give way to river corridor survey methodologies. Frequently tidal sections of river have been surveyed using river corridor survey methodology rather than coastal survey methodology. To avoid confusion we have defined the project area on the basis of this change in survey methodologies. The data from river corridor surveys of tidal reaches of rivers have been ignored.

The project addresses only information held by NRA's Conservation function and does not include invertebrate data or fisheries data held by other sections of NRA.

The lack of a coherently organised information system, with some information retained by contractors, some stored in contract reports and others on computer where the key field of grid reference has often been omitted has made compilation of this report very difficult. It has not been possible to carryout the study to the level of detail we would normally hope to achieve as a result. We have only been able to compile the report on the basis of the information that was readily available. In particular the quantities of data given in the tables are only estimates and the maps detail only the approximate extent of the various survey data sets.

## **Section I**

### **Review of the existing data holding**

#### **1. Types of data held**

NRA holds three main types of ecological data relating to coastal and estuarine areas.

- Survey data collected during the course of surveys commissioned by NRA.
- Survey data commissioned by other organisations now held by NRA.
- Reviews of data held by other organisations.

#### **1.1 NRA commissioned survey data**

Data collected as a result of NRA commissioned surveys makes up by far the largest data set held by Anglian Region. It largely falls into two distinct units defined by survey methodology:

- Data collected to NRA Anglian Region standard methodologies largely after 1989.
- Data collected prior to 1989 to a variety of methodologies following a variety of NCC, BTO, RSPB and other methodologies.

Data collected under NRA Anglian Region standard methodologies consist of ornithological and higher plant records.

##### **1.1.1 Ornithology**

Ornithological data has been collected using two distinct methodologies:

- wintering wildfowl and wader surveys.
- breeding bird surveys carried out as part of coastal survey.

## **Wintering wildfowl and waders**

The aim of these surveys was to identify the most important intertidal areas used by waders and wildfowl for feeding and other purposes.

Intertidal areas were divided into 2km long survey units measured along the sea wall. A total of 10 visits were made, twice each month from October to February over one or two winters. Maps were prepared at 1:10,000 scale showing various assessments of the density of the communities and distribution of species.

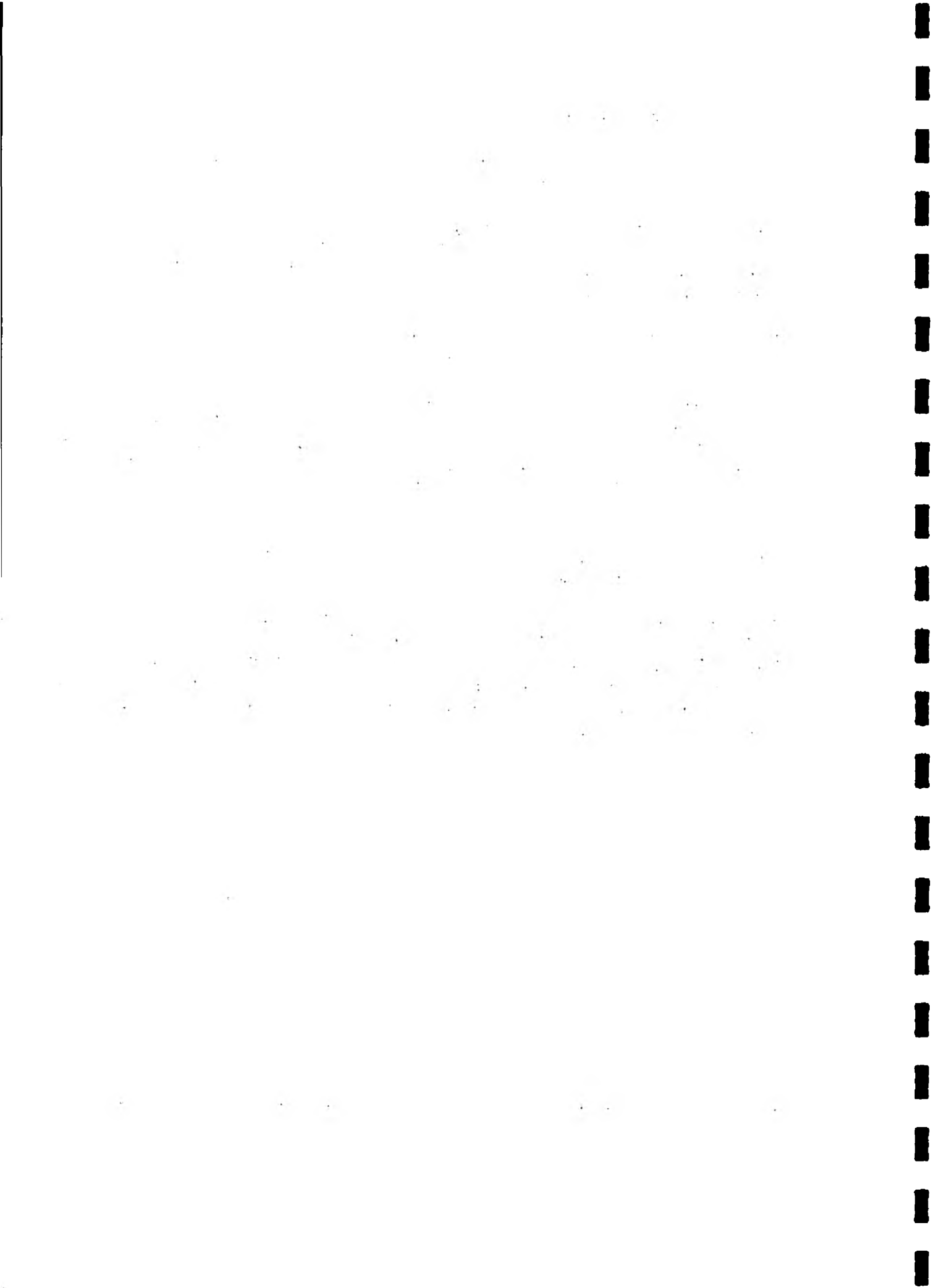
The South Humber Coast and the Lincolnshire Coast were surveyed at low and high tides. An attempt was also made to record mid-tide populations.

The Hamford, Orwell, Deben and Stour surveys are non-standard. They include data from other sources eg British Association of Conservation and Shooting (BACS) and Suffolk Wildlife Trust (SWT). The Hamford Water survey area was divided into 49 zones counted twice a month or fortnightly. The Deben & Orwell were counted as whole estuaries once a month on the same low tide. The Stour was divided into 40 units and the whole estuary was counted at one time, once monthly.

Information from these reports has been converted to provide maps similar to those carried out under standard NRA survey methodology.

These reports eg. Hamford Water also include assessed data from the Birds of Estuaries Enquiry (BoEE) co-sponsored by the British Trust for Ornithology (BTO), Joint Nature Conservation Council (JNCC), Royal Society for the Protection of Birds (RSPB) and Department of the Environment Northern Ireland (DoE NI). This methodology involved monthly counts. Priority was given to surveying in September, December and February. Coverage was very variable. The surveys provide high tide counts.





**Table 1 Wader and wildfowl surveys**

Area	Date	2km Sections	Units	Coastal survey sections	Gaps
Crouch Roach Blackwater	1991-92	96	13		EWV numbers start here at 1  ECVV 051-053, 074 not surveyed fully no access.
Mersea Island	1993-94	15	3	39	190-232 excluding 216, 219 & 229
Dengie Flats	1993-94	8	0	28	
Salcott Channel	1992-93	5	1	22	
Estuary of Blyth	1992-93	5	8		
Estuary of Humber	1989-80	42	13		
Estuary of Colne	1992	25	5		Unit 4 only 4 counts due to access restrictions 119-120 not surveyed
Hamford Water	1988-89, 1992-93	16	4	58	
Estuary of Stour	1988-89, 1989-90	17	7		

Site	Date	2km Sections	Units	Coastal survey sections	Gaps
Butley Estuary	1993-94	4	2		
Breydon Estuary	1993-94	7	3		
Alde Estuary	1993-94	14	10		
Lincolnshire Coast	1989-90	20	3		
Deben Estuary	1987-88, 1988-89	18	4		
Orwell Estuary	1988-89, 1989-90	15	7	49	
<b>Totals</b>		<b>307</b>	<b>83</b>		

### **Coastal breeding bird surveys**

Breeding bird surveys were conducted as part of NRA's coastal survey (see Appendix III). Birds were recorded using CBC codes and activity symbols and were mapped on section maps at approximately 1:2500 scale. Three visits were carried out one each in April, May and June. This field data is currently held by Ecosurveys and has not been examined as part of this project. Mapped data has not been supplied to NRA.

Gaps were identified between River Corridor Survey and Coastal Survey programmes. Gaps were identified on the rivers Welland, Witham, Nene and Great Ouse in 1989 and in Suffolk in 1990. The former areas were surveyed in 1989 and those in Suffolk in 1992.

Surveys have been carried out on the following sections:

**Table 2 Breeding Bird Surveys**

Area	Sections	Km	Date	Comments
Essex		460	1990	
Lincs:			1989	Humberston Fitties to Saltfleet Haven
Lincs:			1989	Wainfleet Haven - Fosdyke Bridge
Suffolk/Norfolk/Lincs east of Fosdyke Bridge		443	1991	Total Lincs km to 1991 including cross banks, tidal rivers etc.
Essex		256	1993	Crouch and Chelmer
Essex		106	1993	Colne & Blackwater
Norfolk	COAS 369-433 SECB 136-177 XXBT 001 XXBU 001 XXBV 001	55	1993	North Norfolk
Lincs	COAS 240-293 SECB 001-004 XXBC 001	30	1993	Lower Witham
Lincs	COAS 001-022 COAS 023-118	60	1993	Grimsby/Ancholme
Gap survey	Deben 001-082 Orwell 001-084 Stour 001-038 Horsey Island 001-014 022-090 Blyth 001-037 Butley 001-024 Alde 001-123	186	1992	Suffolk
<b>Total</b>		<b>1596</b>		

### **1.1.2 Botany**

The majority of data was collected to NRA's Coastal Survey Methodology (see Appendix III).

The sea defence was divided into 500m sections, each visited twice. The methodology used DAFOR scale to estimate species abundance, full BSBI cards (see Appendix) and up to 2 x 2m quadrats per 500m section. Habitat approximately 25m to the landward and 50m to the seaward was recorded at phase 1 level. Sketch maps were prepared for each section at approximately 1:2500 scale.

Gaps were identified between River Corridor Survey and Coastal Survey programmes. Gaps were identified on the rivers Welland, Witham, Nene and Great Ouse in 1989 and in Suffolk in 1990. The former areas were surveyed in 1989 and those in Suffolk in 1992/3.

Specific recording cards for target species designed to provide compatibility with NCC surveys were used for some surveys (See Appendix III).

**Table 3 Coastal botanical survey**

Area	Sections	Km	Date	Comments
Essex	992	460	1990	Sections missing 229-30, 457-499, 510- 599, 993-997  Quadrat data missing  143, 172-3, 176
Lincs/Norfolk/ Suffolk			1991	East of Fosdyke Bridge
Lincs and South Humberside Sea Wall			1989	Whitton Ness to Chowder Ness, New Holland to Cleethorpes
Lincs:			1989	Humberstone Fitties to Saltfleet Haven
Lincs:		443	1989	Wainfleet Haven - Fosdyke Bridge
				Total Lincs km to 1991 including crossbanks, tidal rivers etc.

Area	Sections	Km	Date	Comments
		256	1993	Crouch and Chelmer
Essex		106	1993	Colne & Blackwater
Essex	COAS 369-433 SECB 136-177 XXBT 001 XXBU 001 XXBV 001	55	1993	North Norfolk
Norfolk	COAS 369-433 SECB 136-177 XXBT 001 XXBU 001 XXBV 001	55	1993	North Norfolk
Lincs	COAS 240-293 SECB 001-004 XXBC 001	30	1993	Lower Witham
Lincs	COAS 001-022 COAS 023-118	60	1993	Grimsby/Ancholme
Gap survey	Deben 001-082 Orwell 001-084 Stour 001-038 Horsey Island 001-014 022-090 Blyth 001-037 Butley 001-024 Alde 001-123	186	1992	Suffolk
<b>Totals</b>		<b>1596</b>		



NRA has also commissioned a number of other vegetation surveys of coastal areas:

**Table 4 Other botanical surveys**

Area	KM	Date	Comments
Lincs and S Humberside sea wall	157?	1989	Field data converted to NVC. NCC saltmarsh and sand dune data incorporated to produce NVC maps
Barton and Barrow Clay Pits		1989	NVC survey of SSSI
Mablethorpe North End-Skegness Pier Lincs	25	1989	NVC standard survey of hard defences
Gibraltar Point and Seacroft Lincs		1989	NVC standard survey of part of NNR
Salt Fleetby - Theddlethorpe Dunes		1989	NVC of NNR
<b>Total</b>	<b>183?</b>		

#### **NVC surveys**

These differ notably from the coastal survey methodology as they used full NVC methodology involving the use of 2 x 2 m quadrats for herbaceous vegetation and 10 x 10m quadrats for scrub and DOMIN scale cover/abundancy recording. NVC communities were presented on 1:5000 scale maps.

The original Lincs - South Humberside Coast survey data were converted to NVC using the dominant species and more abundant plants in discrete habitats. This data was combined with that from NCC and the University of Hull (converted where necessary to NVC). NVC communities were plotted on 1:5000 maps.

## **1.2 Survey data collected by other organisations.**

### **1.2.1 Ornithology**

As part of the Essex Coastal Survey post 1970 records from a variety of organisations were collected and consolidated. Where possible these were allocated to coastal survey 500m sections. This was done on the basis of 6 figure grid references, so the allocations are likely to be inaccurate on occasions. The data was derived from a wide range of surveys carried out by different organisations including NCC Colchester, NERC (report on Outer Thames Estuary), Essex Wildlife Trust, Southend Museum Biological Records Centre, individual recorders etc. Records without 6 figure grid references were also consolidated into a separate group.

### **1.2.2 Botany**

As for ornithology. The data collated included survey information from a 1983-86 survey of sea defences, conducted for each 1000m.

### **1.2.3 Other groups**

As part of the same consolidation exercise, data relating to various invertebrate groups and reptiles and mammals were also collated and where possible tied to 500m coastal survey sections using 6 figure grid references. The data includes SSSI notification information, data from the Invertebrate Sites Register etc.

## **1.3 Reviews of data held by other organisations.**

### **1.3.1 Ornithology**

NRA commissioned a desk study of the available information on wintering waterfowl feeding in the Wash, Lincs & Norfolk. The study covered the mudflats and salt marshes of the Wash, between Wainfleet Haven, Lincs and Heacham, Norfolk. Information was collated from ITE, EN, RSPB, Wildlife Trusts etc. and assessed as far as was possible. Community and species distributions were mapped using ITE's "Wash Birds and Invertebrates" study transects at 1:10,000 scale. The distribution was assessed as a percentage of the average maximum counts for the Wash (Grimett & Jones, 1989).

### **1.3.2 Botany**

NRA commissioned a desk study of botanical information available on soft defences in Norfolk and Suffolk. The report covers 10 areas of the Norfolk and Suffolk Coast.

**Table 5. Norfolk and Suffolk desk study sites**

**Norfolk**

Holme Dunes	TF 694 439 - TF 720 450
Thornham - Titchwell	TF 728 440 - TF 764 443
Holkham Bay	TF 860 455 - TF 914 456
Warham - Stiffkey	TF 930 440 - TG 005 442
Cley - Salthouse	TG 048 442 - TG 095 440

**Suffolk**

Kessingland - Benacre	TM 536 954 - TM 532 826
Covhithe Broad	TM 525 808 - TM 523 805
Southwold - Dunwich	TM 508 757 - TM 479 707
Hollesley - Bawdsey	TM 375 438 - TM 358 405
Felixstowe Ferry	TM 329 373 - TM 329 368

Existing data from saltmarsh, sand dune and shingle surveys and other sources were examined and evaluated. NVC maps were prepared where possible. The scale of these maps was not stated in the report. It differs depending on the size of the site.

#### 1.4. Summary of data quantities and formats

**Table 6 Survey units and assessment formats**

Survey		Sections	Km	Survey unit	Survey map scale	Assessment Map scale	Assessment
Wintering wildfowl and waders			307	2km + units upto 5km	1:10,000	1:100,000	Maximum counts for individual species and all waders and wildfowl as % of local and regional populations.
Breeding coastal surveys	bird	3192	1596	500m	1:2500 approx		None. Mapped populations.
Botanical surveys	coastal	3192	1596	500m	1:2500 approx		None. 2x2 quadrat data DAFOR. Target species card. BSBI card.
NVC surveys	botanical			Various site based	Various	Various	NVC community maps.

**Table 7 Data quantities and formats**

**Species records**

<b>Survey</b>	<b>Sections</b>	<b>Survey frequency per annum</b>	<b>Maximum species nos. possible</b>	<b>Estimated record total</b>
Wintering wildfowl and waders	307	10	55	90,000
Breeding bird coastal surveys	3192	5	?	130,000
Botanical coastal surveys	3192	2	1034	400,000
NVC botanical surveys	366?	2	?	60,000
<b>Total</b>				<b>680,000</b>

**Wader and wildfowl surveys**

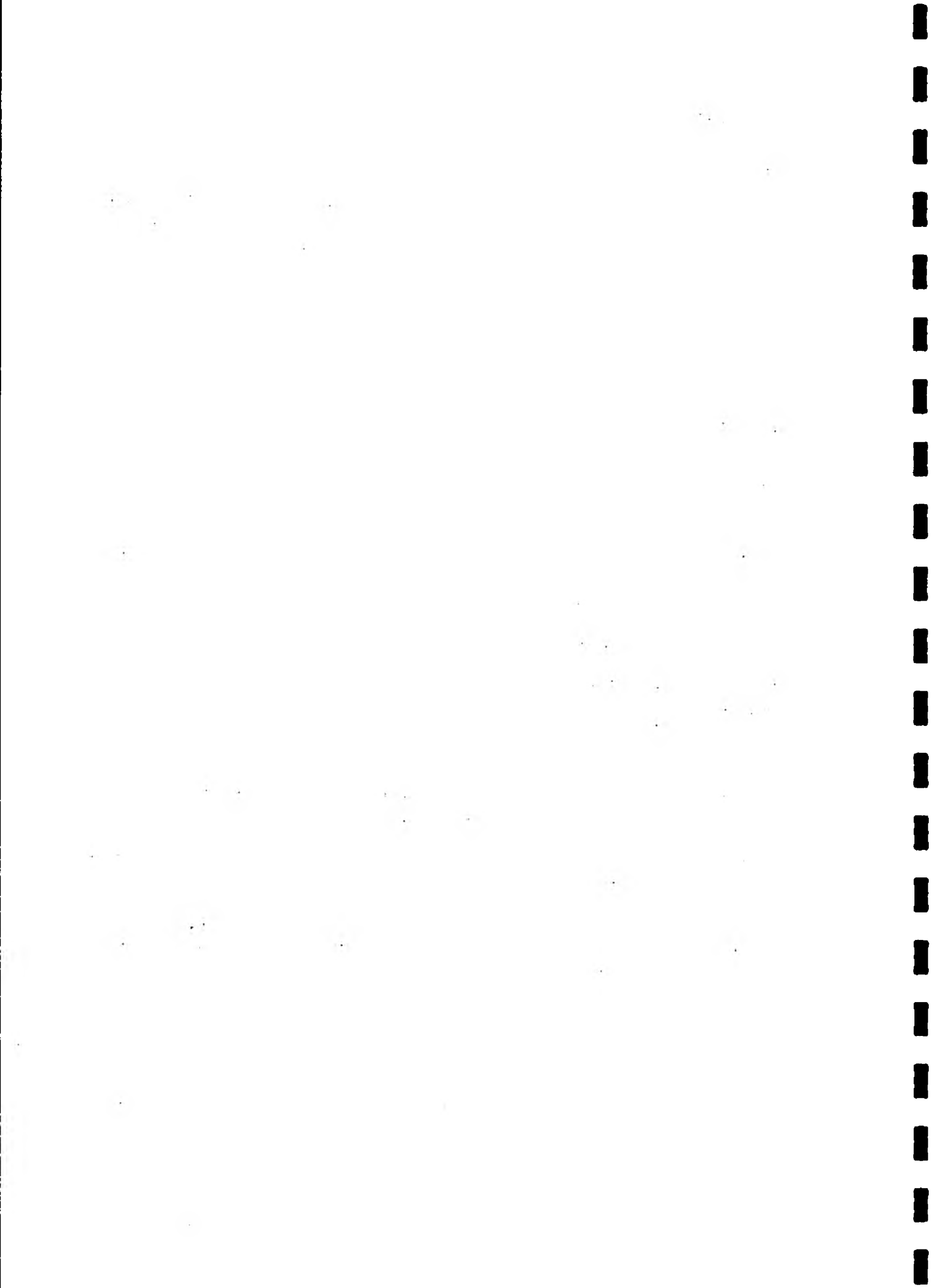
Survey sheets include the following fields:

Section code and number  
BTO species code  
Date and time of each visit  
Numbers each visit

The sheets do not give grid references for the section or recorder details. Weather details are given separately by survey date and grid references for each section are also tabulated.

Assessments provide totals for each species for each month separately for bird feeding on the intertidal area or using the intertidal zone of each section.

Tabulated summaries of the maximum count of each species of birds feeding and using the intertidal zone are give. The feeding population is expressed as a % of the regional population and the using population is expresses as a % of the national population.



### **Breeding bird coastal surveys**

The raw data is held by Ecosurveys. It was not possible to examine it for this project. The reports contain textual descriptions of the populations of each section. These include details of breeding population numbers etc.

### **Botanical coastal surveys**

The botanical surveys provide standard BSBI cards and NCC target species cards (see Appendix III)

The BSBI and target species cards include the following data fields:

- Section code and number
- Date of each visit
- Surveyor's name
- Species recorded with species code
- DAFOR abundancy rating.
- NVC botanical surveys

Quadrat data was also recorded.

The 500m survey maps include additional information on adjacent land use, defence dimensions, quadrat locations etc. This data needs to be extracted to be retrievable.

### **NVC botanical surveys**

The survey methodology included the completion of community sketch maps and the recording of quadrat data from each identified community type using the DOMIN scale of cover-abundance. Standard NVC tables were compiled from quadrat data. Detailed community maps were drawn for each site at various scales.

### **Other data**

The wide range of data from surveys carried out by NRA prior to 1989 and from surveys carried out by other organisations is very varied in format, coverage and usefulness. A detailed study would be required to identify all the data structures and survey and assessment methodologies used.

## 2. Gaps in existing survey data

### 2.1 Coastal plant and breeding bird surveys

There are considerable areas of coast that have not been surveyed. This is generally because of access difficulties or because NRA is not responsible for flood defences in those areas.

**Table 8 Gaps in coastal survey**

River	Grid ref	Grid ref	KM
Stour right bank	TM 106 319	TM 162 317	6
	TM 164 320	TM 223 318	7
	TM 233 328	TM 258 323	4
Brightlingsea Creek	TM 083 165	TM 104 168	3
Alresford Creek	TM 055 204	TM 066 196	2
Colne	TM 025 233	TM 041 214	3.5
	TM 007 253	TM 015 248	1
	TM 033 222	TM 027 205	3
Colne & Roman River	TM 027 205	TM 044 210	3
Roman River	TM 012 204	TM 018 203	1
Colne	TM 050 193	TM 035 197	0.5
Geedon Creek	TM 040 191	TM 028 169	10
Mersey Island	TM 018 147	TM 022 153	1
	TM 003 138	TM 009 123	2.5
	TL 839 084	TL 863 065	3.5
Blackwater Crouch	TQ 928 962	TQ 934 956	1
	TQ 835 977	TQ 853 965	4
	TQ 768 941	TQ 772 940	0.5
	TQ 805 954	TQ 817 957	2
	TQ 827 956	TQ 838 954	3
	TR 927 946	TR 925 937	1.5
Paglesham Creek	TR 911 913	TR 914 910	0.5
Paglesham Reach	TQ 776 860	TQ 783 855	1
Benfleet Creek	TQ 736 858	TQ 753 846	3
Vange Creek	TQ 695 808	TQ 695 794	2
Thames	TQ 692 770	TQ 692 767	0.5
	TQ 680 758	TQ 686 761	1
	TQ 668 757	TQ 678 758	1.5
<b>Total</b>			<b>72.5</b>



The Essex Coastal Reports identifies the following omissions in addition:

**Sections missing**

229-30  
457-499  
510-599  
993-997

**Quadrat data missing**

143  
172-3  
176

Grid references are missing for many sections.

## **2.2 Wader and wildfowl surveys**

The desk study of the available information on wintering waterfowl feeding in the Wash, Lincs & Norfolk identified requirements for 68.5km of survey of waterfowl feeding on the mudflats and saltmarshes and passerine surveys to NRA's standard survey methodology.

No wader and wildfowl surveys have been carried out in the inner Thames estuary. Here there are important sites such as at Stanford le Hope. The only available information at present is that collated as part of the coastal survey.

No wader and wildfowl surveys exist for the area of the N. Norfolk coast for which NRA has responsibility for sea defences, (Heacham - Holkham).

## **2.3 Botany**

The desk study of Botanical Information available on soft defences in Norfolk and Suffolk identified a requirement for considerable survey work particularly on saltmarsh and shingle of each of the ten sites.

### **3. Existing assessment methodology**

Whilst raw data is of value its direct use by NRA for most functions is limited. Assessed data that identifies areas of wildlife importance, species distribution etc. is required. This has been recognised in the design of most of the survey methodologies. Some form of assessment has been carried out involving some but not all of the data. There has been considerable variation in how assessment has been applied. In particular the survey unit basis used for assessment is quite variable.

#### **3.1 Wader and wildfowl surveys**

The assessment methodology used has been standardised for most reports. Mapped assessments at approximately 1cm = 1km scale are provided for each survey section and each survey unit. The maps show peak counts for each species and summed maximum totals for all waterfowl and all waders for each survey section and survey unit as an index of abundance against international, national, regional and local abundance criteria.

For assessment purposes there has been considerable variation in how survey units have been defined in each survey area. In some cases survey sections have been lumped into units in others they have not. Each unit covered a variable number of 2km sections generally 1-4, but only 1-2 in case of Blyth and 3-8 in the case of the Deben. In most cases assessments are provided for both survey units and sections. However in some cases eg. the Deben, totals for waders and waterfowl are only assessed on a survey unit basis. No survey section assessments are provided.

##### **3.1.1 International and national assessments**

The basis for assessment of national and international importance is constant for nearly all the wader and wildfowl surveys. International abundance level criteria have been defined following Pirot et al (1989) for wildfowl, and Smit & Piersma (1989) for waders. National abundance level criteria for wildfowl follow Owen et al (1986) with updates from NWC data. Wader criteria follow Moser (1987).

Assessments of populations reaching internationally or nationally significant numbers are only given within the text of each report. This section generally states which species are present in significant numbers, with frequency of the occurrence of such numbers within the entire study area.

This information has not been presented in mapped form. Summed maximum totals of waders and of waterfowl have been plotted. This summary provides a means of comparing different survey areas and individual areas with national and international criteria. The data has been assessed for survey units or sections according to bands relating to peak numbers present. The bands are <5000, 5k-9,999, 10k-19,999, >20K.

### 3.1.2 Regional assessment

There is considerable variation in the methods used for the assessment of regional importance. In most instances 2km survey sections were amalgamated to form larger survey units, though this was not always the case. Assessment maps were provided showing species abundancies in relation to regional mean populations derived from BoEE counts using data from Essex and Suffolk Bird Reports.

**Table 9 Definition of regions**

Lincolnshire Coast	No comparative data available
East Norfolk	?
Suffolk estuary	Blyth, Alde/Ore, Deben, Orwell, Stour
North Essex/South Suffolk coast	Stour, Orwell, Deben, Hamford Water
Mid Essex coast	Essex Coast between the Colne and Foulness

It should be noted that there is an overlap between the Suffolk Estuary and North Essex/South Suffolk Coast Regions.

The mapped abundancies are plotted as percentages of the regional count for each section or survey unit. The percentage bands are:

<1%.  
1-4.99%,  
5-19.99%  
>20 %.

Tabulated counts are presented as abundance maps for each species for each 2km section. Tables give a break down of maximum feeding and using shore counts for Salcott, Colne, Blackwater and Blyth surveys but not for the Hamford or Orwell surveys.

#### **Lincolnshire coast**

In the case of the Lincolnshire coast there was no suitable regional or county total against which to assess abundance. Therefore the populations were only assessed against the total number of waders recorded in the 84/85 Non-estuarine Coast of Britain and Northern Ireland Survey (Moser

& Summers 1987). This only carried out recording in January and December. The survey did not include wildfowl there was therefore no comparative data available.

The South Humber survey gives maps of feeding and using distribution summed for all wildfowl all waders, and for individual species for each section.

### **Deben, Hamford Water, Orwell**

Species abundance is shown relative to the four year North Essex/South Suffolk coast mean as a form of assessment of regionally important species. Four years were included as no data was available for Hamford Water in the 1989/90 survey. The mean is derived from BoEE counts using data from Essex and Suffolk Bird Reports. Counts have been summed to give a monthly total for the region for each species. The peak count was then averaged.

In the case of Hamford Water the data was reassessed and survey units were defined based on feeding units.

### **Colne, Blackwater/Crouch/Roach, Dengie Flats, Mersea Island, Salcott Channel**

The populations were assessed against the mid Essex Coast population. The Salcott Channel population was also assessed against the mean Blackwater population. These regional mean populations were again extrapolated from Essex Bird reports, largely from BoEE counts, though not in all cases.

### **Alde/Orr, Blyth, Butley**

The populations were assessed against the Suffolk estuaries population.

### **Stour**

The Stour was originally surveyed as 40 sections by the RSPB + BoEE. The data were converted to fit 17, 2km sections by Ecosurveys maintaining the RSPB section boundaries where possible. The populations were assessed against North Essex/South Suffolk estuaries mean population.

### **Breydon**

The populations are assessed against the five year East Norfolk and Suffolk Estuaries mean.

### **3.1.3 Local assessment**

The Alde/Orr, Colne, Blackwater, Crouch & Roach, Orwell and Deben reports shown summed wader and individual species distribution maps relative to each estuary as a whole. This provides a means of assessing the relative importance of survey units and sections within each estuary. Other areas such as the Salcott Channel were not treated in this manner and there is therefore no local assessment.

The populations of the Breydon of each species are compared with five year peak WeBS counts for the Breydon/Berney Marshes in addition to distribution within the study area.

The Stour was originally surveyed as 40 sections by the RSPB + BoEE. The data were converted to fit 17, 2km by Ecosurveys. The populations were assessed against those of the Stour estuary as a whole.

## **3.2 Target Species**

There is some variability in the number of species recorded in the wader and waterfowl surveys. In most instances the species recorded included Cormorant, Grey Heron, all wildfowl (swans, geese, ducks), raptors, Kingfisher, Skylark, pipits, Pied Wagtail, Carrion Crow, Starling, finches and buntings. Brent Gees on the water and in the channel and or on fields behind the sea wall were also recorded.

In the case of Hamford Water the above target species list was used in 1992 but only Cormorant, Grey Heron, wildfowl and waders were recorded in 1988.

The Orwell survey recorded waterfowl but not Canada Goose, Snipe and diving ducks.

The Deben survey did not record diving ducks.

The Stour survey did not include Golden Plover and Lapwing.

## **3.3 Coastal breeding bird surveys**

The coastal surveys do not really provide any assessment of the distribution of sections of importance. The only assessment can be derived is diversity. This is only available through REDS and has not been mapped.

### **3.4 Botany**

The coastal survey reports identify primary, secondary and cross banks of interest and rare species sites in part of the reports. This information is not displayed in mapped form. The reports do not detail the assessment criteria used. No attempt has been made to assess the large quantity of quadrat data recorded during the survey.

### **3.5 Other groups**

No attempt has been made to assess any of the data held by NRA relating to invertebrates, mammals or reptiles.

#### **4. Existing data handling**

##### **4.1 Ecological survey data**

NRA have been computerising considerable quantities of ecological data from the Coastal Surveys. Little information from other surveys has been handled.

The system is based on Foxpro version 1.02. It provides rapid access to individual survey section species list and enables searches to be made for species occurrence. No mapping of such selected data is possible at present. The system also enables a limited amount of assessment to be carried out such as providing a list of species found in 5% or less of sections.

##### **Coastal survey data**

The majority of bird and plant records from the coastal survey have been computerised:

**Table 10 Computerised coastal survey data**

<b>Code</b>	<b>Sections</b>	<b>Stretch</b>
COAS	510	Lincs Coast
LAWY	2	Lawyers Creek Spit
SECB	177	Secondary Bank Lincs Coast
THIB	45	Third Bank Lincs Coast
TNEN	79	Tidal Nene
TWEL	22	Tidal Welland
TWIT	22	Tidal Witham
XXBA-V	30	Cross banks
TIOU	49	Tidal Ouse
EOCA	999	Essex Coast
<b>Total</b>	<b>1935</b>	

There are some serious problems with this data. In particular the grid references for many sections have not been recorded. This is a incomprehensible omission with severe implications for use of the data by GIS or for other purposes. The lack of such data has greatly hampered the preparation of this study.

##### **4.2 Other data sets**

A number of other data sets have also been computerised mainly using Easy Map. Such data includes water quality and statutory sites.

### 4.3 Extent of uncomputerised data

Large quantities of data currently held by NRA remain uncomputerised.

**Table 11 Estimated data quantities outstanding**

	Sections	Species records	Comments
Ornithology			
Wildfowl and waders	259	120,000	all processed except 1993 data ?
Coastal survey	145	70,000	
Other bird surveys		20,000	
Botany			
Coastal surveys	2316	50,000	NVC quadrat data
			all species records processed
NVC surveys		25000	old consolidated data
Other botanical surveys		10,000	
Other groups		10,000	old consolidated
Total		305,000	

With such large quantities of unprocessed data it is clear that computerisation of the entire dataset is unrealistic in anything but the long term. Data processing needs to be prioritised and the aims of such computerisation clearly defined. It is essential that the existing computerised data is checked to ensure that all survey section grid references are present as a first priority.



## **Section II**

### **Future Development of the Coastal Wildlife Database**

#### **1. Potential use of the coastal wildlife database**

NRA has collected a large quantity of ecological data. It is essential that the data needs of the organisation are examined before and decisions are made about future data collection or the development of an information system. Almost every data set held by NRA could become a GIS data set, from field survey maps, through species records to distribution maps assessing the value of differing areas of coast for wildlife. GIS could also be used to carryout research that could be beneficial, for example, examining the relationship between the distribution of wading birds and sediments. However the costs and timescale involved in computerising all NRA's data holdings would be prohibitive. The benefits of computerising each data set needs to be carefully examined and prioritised.

##### **1.1 Identifying needs**

Although not part of the project brief we consider this issue to be of such fundamental importance that we have included an analysis of the major potential and current needs of Conservation staff and Strategic Engineering. A full consultation exercise has not been carried out as this was not part of the brief. We have not examined the needs of routine maintenance, fisheries, recreation etc. functions of NRA nor have we discussed the needs with more than 2 staff in Conservation and one in Engineering.

##### **1.2 Strategic engineering requirements**

NRA has implemented a large scale GIS project for sea defence management based on Intergraph. This provides the basis of a regional monitoring and strategic information system. The GIS and associated databases contain a wide range of data sets including cross sectional and bathymetric information, data from wave and tide gauges, sediment analysis, geology, assets, historic erosion etc.

The system is supported by regular field monitoring of linear transects at 1km separation on the coast from the Thames to the Humber. The permanently marked transects are resurveyed every 6 months.

Currently little ecological data is available to this system. The need for data sets falls in to two main categories:

- data that aid prediction of changes to coastal processes.
- data concerning areas of ecological importance that are likely to be influenced by coastal management strategies.

A variety of data sets could assist in the prediction of changes in coastal processes. The most valuable would be those that enable monitoring of changes to plant and invertebrate communities of the intertidal zone to be carried out. This would assist in the prediction of changes to sedimentation processes that could affect coastal management requirements.

The needs for data on areas of ecological importance include information on land adjacent to the sea defence and the plant, bird and invertebrate communities of the intertidal zone.

In all cases interpreted data is needed rather than raw data, so that readily understandable mapped assessments are available on GIS. The availability of such data sets would alert coastal defence engineers to the need to consult with Conservation staff over the potential impact of any proposals.

### **1.3 Conservation requirements**

#### **1.3.1 Strategic issues**

Information is required for input into the strategic planning of coastal defences, managed retreat and for river catchment planning. Comparative assessments of the value of specific areas for Wading Birds, Waterfowl and other wildlife are required together with information on ecosystem dynamics and population movements. These would enable the impacts of strategic proposals to be assessed.

#### **1.3.2 Planning issues**

NRA is involved in commenting on a wide range of planning issues, from strategic policy, to site specific planning applications. The data requirements of this function are very varied. In general site specific information would be required for sites of interest. This necessitates the acquisition of information on site status and comparative quality. Such assessment relies on the availability of information on habitat and species statuses.

### **1.3.3 Routine maintenance**

Information is also required to enable the impact of routine maintenance work to be assessed and for mitigating measures to be designed and implemented. Again needs are generally site specific and similar to those required above.

Information is also required in the development of management regimes. As part of this requirement data is needed on the success of previous mitigation and management measures, implying a requirement for monitoring and post project appraisal. Such needs could include data on all groups, though this is likely to be prohibitively expensive.

### **1.3.4 Other data needs**

Conservation would benefit from access to a wide range of data sets either currently held on GIS or that could be incorporated into GIS. These include the location of flood defence structures, land ownership, land use, geology, flood plains, ADAS agricultural land grades, local authority boundaries etc. GIS would also give access to geomorphologic data held by engineering, and to mapped engineering proposals.

## **2. Problems with the existing data and data management system**

NRA Anglian Region has collected large quantities of ecological information but has not exploited the data's potential to the full. This is largely because the collected data is not readily accessible in a usable form. Data can be retrieved on a site or section basis, but has to be interpreted by an ecologist before it can be used by other functions. Comparative assessments are not available for certain data sets such as the coastal survey.

GIS development presents opportunities for ensuring that the data is used cost effectively. GIS could also aid the assessment of data but its greatest benefit will be in making interpreted data available across all functions of NRA and potentially to all local offices. However the variety of data formats and survey methodologies that have been used and the variety of information held will pose problems.

### **2.1 Data storage**

Only about 5% of the available data from coastal surveys and desk studies has been computerised.

Paper record data is currently stored in a variety of systems. Coastal survey is stored by section. The raw data is stored separately. Additional consolidated data for all groups is stored with this information. The actual ornithological field record sheets are currently still with Ecosurveys Ltd.

The wader and wildfowl and NVC plant survey data is only accessible through reports. It has not been integrated with the coastal data. The field records are again still held by Ecosurveys Ltd. For information on any section of coast it is necessary to go to several data sources.

Data is only available to the area offices by duplicating existing information.

### **2.2 Survey methodologies**

In general the 2km long wintering wildfowl and wader survey sections were defined in direct relationship to the coastal survey methodology 500m sections. However in some instances more or less than four 500m coastal survey sections were included in a single wintering wildfowl and Wader Survey Section. In case of Salcott some ECOA sections were not included in the CCW sections eg 235-237. With the Orwell and Hamford Water the wildfowl and wader sections cover more of the coast than the coastal survey.

The Wintering Wildfowl and Wader survey sections are measured along the sea wall. The intertidal area of each unit was generally defined by lines drawn perpendicularly to the sea wall at each end of the unit to low water mark. However these limits were adapted to take into account the presence of creeks, bays etc. As a result whilst defined pragmatically on ecological grounds the sections can vary in area by a factor of more than 25. There may be problems defining these

on GIS. It is likely that defining the actual survey areas would be more useful to engineering than using the current system of mapping employed in the reports.

The wildfowl and wader report maps detailing the survey sections are traced from OS maps then photocopied. There are likely to be some distortions in their size and hence scale. Digitising these and the section boundaries defined on them would result in inaccurate mapping.

### **2.3 Assessment**

No attempt has been made to assess the relative value of the coastal survey information, or the NVC botanical survey data.

#### **Wintering wildfowl and wader surveys**

The wintering wildfowl and wader survey maps show the peak populations in each section categorised into percentage bands against a series of assessment criteria. This information needs "translation" into easily understood assessments ie locally important, regionally, nationally etc. if it is to be usefully mapped using GIS.

The wintering wildfowl and wader survey data is assessed on the basis of two separate geographic systems, survey sections and section units.

There are problems with extrapolation or errors between the survey unit assessments and section assessments. (see Hamford Water report, Greylag map 5 and map 27 etc.)

### **2.4 Data accuracy**

There are inherent dangers in using GIS systems. Information presented by GIS tends to be regarded as depicting the objective truth. It is important that all users realise that the underlying data may not be totally accurate. There are a number of problems with the existing survey data and assessment methodologies that always need to be kept in mind.

Survey information can rapidly age. Ecological systems are dynamic. It is important that survey data is updated and that GIS does not present a frozen picture of the state of the conservation resource.

#### **Wintering wader and wildfowl data**

BoEE counts upon which the assessments of the wintering wildfowl and wader populations are made are based on a different survey methodology. BoEE counts are often based on different areas to the NRA survey units.

The data has generally only been collected over one season. Changes in annual conditions can have a major impact on bird populations. Basing an information system on such a limited survey period may lead to some areas of coast being undervalued. It is important that interpreted data put on to GIS at least takes this into account.

Different parts of each study area were counted at low tide over two days. Therefore birds of the more mobile species may have been double counted or missed. These errors may cancel each other out. Peak counts are not subject to such errors.

### **3. Future Development**

It is hard to justify continuing expenditure on ecological survey whilst the use made of the existing data is so limited. The coastal wildlife database is potentially of great value but is hampered by poor retrieval and assessment facilities and lack of interpretation.

GIS provides opportunities for solving these problems in a cost effective manner. However it would also be easy to expend large amounts of resources transferring existing data to GIS with only limited increases in efficiency. The development of GIS applications and data sets needs to be carefully planned and prioritised to ensure that the maximum benefit is derived.

The coverage and quality of ecological data will be critical to the implementation of any effective GIS system. The need for comprehensive coverage and up to date information must be balanced against the need to make the data useful and easily accessible.

#### **3.1 Effects of doing nothing.**

Large quantities of data would remain little used. It would be possible to access data for site specific needs but strategic use would be very limited. If surveying continues the problem will simply get worse and it will become increasingly hard to justify expenditure on survey as comparatively little use will be made of the data.

#### **3.2 Effects of limited development without GIS**

Some data is likely to be gradually added to the computer system providing improved retrieval and analysis. A paper mapped key to the data system could be developed to improve retrieval and could be distributed to other functions. Similarly paper assessment maps could also be developed. Such systems would be less efficient and more costly in staff terms than developing GIS. Ecological information would be less likely to be used by functions other than Conservation.

Many of the actions required to develop GIS would also be needed to improve the usability of the existing data. Assessment systems would still have to be developed and survey gaps filled.

#### **3.3 Effects of programmed GIS development**

GIS provides the opportunity of maximising the use of ecological data by making it available across NRA's functions and to differing offices. GIS could also be used to improve data handling and assessment in a wide number of ways. Priorities for GIS implementation need to be defined if it is to be used effectively. Many of the actions needed are to sort out and make available the existing data. These actions should be undertaken regardless of whether GIS is adopted. They should be designed to ensure compatibility with GIS should it be adopted.

### **3.3 Priorities**

- provide access for conservation staff to existing GIS data sets and expand the information to include sets such as land use, location of proposed works etc. that are already being considered by other functions within NRA.
- develop an alert map system to provide mapped information on the comparative importance of sections of coast, the intertidal land and land immediately behind the coastal defence.
- develop a mapped key to conservation data resources.
- develop the existing coastal management system to include ecological monitoring data on intertidal plant communities, ornithology and invertebrates to enhance prediction of changes and in the coastal system and for strategic planning purposes.

#### **Rationale**

The ecological data held by NRA needs to be as widely available as possible if the large expenditure on its collection is to be justified. Other functions require interpreted data. Provision of such data must be a priority. Whilst it would be valuable for conservation functions for raw data to be treated as a GIS set, this can only be regarded as a long term aim. Assessment procedures are needed urgently and can be developed without computerising data any further.

There would be little advantage in adding some types of data to GIS including data sets such as the field survey sketch maps, especially where there are difficulties with variability in scale, text recognition etc.

The research potential of GIS is endless. However NRA need to define their role in research carefully. There are a large range of research areas where NRA could become involved, but where other organisations such as ITE and BTO would be the more appropriate controlling body, even where NRA has collected and currently holds the field data.

Where research can be directly applied to flood defence monitoring it is far more justifiable. NRA has established a coastal monitoring system. This currently lacks ecological input and it is hard to integrate the existing coastal wildlife database with this system. Establishing an ecological survey system integrated with the coastal monitoring system would represent a shift in survey objectives and necessitate a change in some of the survey methodologies. However adopting such proposals would result in far more valuable information being made available.



### **3.3.1 Existing GIS Data sets**

#### **Justification**

A considerable number of GIS data sets already exist and could be invaluable to conservation staff. These would enable staff to carryout their duties more effectively, particularly those operating at an area level.

#### **Development**

Conservation should be involved in prioritising what additional data sets are added to GIS. Several are already being considered by other functions that may be of value.

### **3.3.2 Alert system**

#### **Justification**

It is essential that interpreted ecological data is made available for strategic and engineering functions if NRA is to fulfil its duties. This can be most quickly and effectively done through the development of an alert map system using GIS. This would not require the existing field data to be computerised.

#### **Development problems**

A number of fundamental issues need to be resolved before an effective alert system can be developed:

- What size land parcels should be used as the basis for the assessment system? Coastal survey uses 500m sections but the wildfowl and wader surveys use 2km units or larger survey units?
- Should assessments of local, regional and national and international importance for birds, plants and invertebrates be combined on one alert map? If so what criteria should be used for this "global assessment?"
- The surveys are incomplete. Can assessment be adequately carried out using the existing coverage of survey data from all available sources?

## **Requirements**

The development of such a system would also require:

- "translation" of the existing wildfowl and wader distribution maps into local, regional, national and international importance maps.
- the development of a similar assessment system for coastal bird and flora survey data to that developed for RCS and the assessment of that data.
- Addition of Grid References to all computerised data where absent. Checking of all Grid References.
- desk studies need to be carried out to provide information on the remaining areas of coast for which wader and wildfowl surveys have not been carried out.

Initially the assessments made in the desk studies of ornithological information in those areas where NRA has not funded surveys would suffice, but in the long term survey data to NRA standard would be needed. This does not have to be carried out directly by NRA but could be organised through BTO.

The assessment of the coastal survey data could be easily achieved as the associated field data is computerised. The assessment could be carried out more effectively using GIS facilities particularly if the quadrat data collected as part of the survey methodology is to be used in the assessment procedure.

### **3.3.3 Mapped key to conservation data**

#### **Justification**

Although an alert system would be effective in distributing interpreted information it is still vital that there is easy access to the background data used in its production. It is likely that this data will remain distributed between reports, survey sheets, and some computerised data. The effectiveness of data retrieval could be enhanced by providing a computerised pointer system.

#### **Requirements**

A GIS data set providing maps of all coastal, wader and wildfowl survey sections with pointers to the storage location of the relevant report, coastal survey sections, NVC survey units, together with information on the date of survey etc. would greatly improve the current retrieval system. This system could be integrated with the alert system if 500m units were chosen as the basis of that system.

### **3.3.4 Coastal management system**

#### **Justification**

NRA has developed a coastal management monitoring system. This involves transect surveys at 1km throughout the length of the entire coast twice a year. The system lacks any ecological input other than rough assessments of the vegetation type present. Changes in vegetation and invertebrate populations can give vital information on changes in coastal processes. If communities could be mapped in relationship to the monitoring survey transects it would be possible to enhance the predictive capacity of the system for engineering purposes. The information could also be used to increase understanding of the requirements of bird populations. Once a base line has been established it is probable that remote sensing and photoimaging could be used to monitor changes in plant communities, substantially reducing surveying costs.

#### **Requirements**

An assessment of the potential for integrating ecological data with the coastal management system is required. This should examine whether such a system is feasible in scientific and cost terms and the survey methodologies that could be used. The potential for the use of remote sensing, aerial photography etc. in future monitoring should be examined.

#### **4. Projects**

Suggested projects are listed in priority order. Some could run concurrently but others are dependent on the completion of earlier priority projects.

##### **4.1 Mapped key to conservation data**

It is vital that there is easy access to the field data held by NRA. This data is distributed between reports, survey sheets, raw data sheets, consolidated site records and some computerised data. The effectiveness of data retrieval could be enhanced by providing a mapped and computerised pointer system. Some of this system already exists, for example coastal survey sections and grid references are recorded on computer. The system would be most effectively produced using GIS. An interim solution would be to use paper maps and develop a computerised key database. This should be compatible with GIS so that it can be integrated with GIS in future.

##### **Requirements**

A GIS data set providing maps of all coastal, wader and wildfowl survey sections with pointers to the storage location of the relevant report, coastal survey sections, NVC survey units, together with information on the date of survey etc. This system could be integrated with the proposed alert system, if 500m units were chosen as the basis of that system.

##### **Timescale**

It is estimated that a paper mapped system utilising NRA's existing computing facilities would take 20 days to establish. A further 10 days would be required to add and check grid references.

##### **4.2 Develop comparative assessment procedures for production of a GIS based alert map system**

Interpreted geographic information is required by functions other than conservation and would be of great use within the section. The simplest approach would be to assess the wildlife interest of each section of coastline and categorise it as of local, regional, national or international importance. Some elements of this system already exist eg. the assessment maps provided in the wader and wildfowl survey reports. However some fundamental issues need to be resolved before such a system is developed.

## **Requirements**

Examine what size land parcels should be used as the basis for the assessment system. Existing NRA surveys use a variety of survey units eg coastal survey uses 500m sections, wildfowl and wader surveys use 2km units or larger survey units.

Assess whether it is feasible to establish a system to assess the comparative overall value for wildlife of coastal units. Should assessments of local, regional and national and international importance for birds, plants and invertebrates be combined on one alert map? What criteria should be used for this "global assessment? Assessment systems used by other organisations should be investigated, particularly those of English Nature, BTO and local records centres.

## **Timescale**

An estimated 20 days would be required to undertake the project.

### **4.3 Develop an assessment system for coastal bird and flora survey data.**

No assessment of the coastal survey data has been carried out. A large quantity of data has been collected including botanical quadrat data and breeding survey information. NRA has already devised an assessment methodology for RCS. A similar assessment methodology is required for coastal surveys.

## **Requirements**

Develop assessment procedure for coastal surveys. Assess the value of using quadrat data and NVC as the basis for the floristic assessment. The existing RCS assessment system and systems used by English Nature, BTO and local records centres should be examined.

## **Timescale**

An estimated 15 days would be required to undertake the project.

#### **4.4 Provide distribution maps showing the location of sections of coast of local, regional, national and international importance**

Following on from 4.2 once the scale of unit to be used is resolved and an assessment system has been adopted the existing information will need conversion.

##### **Requirements**

Re-assess existing wildfowl and wader distribution maps to provide maps showing the distribution of local, regional, national and international important sections or survey units.

This project should only proceed after project 4.1. That project will define the survey unit size at which the assessments should be made and whether it is necessary to define assessments for individual species, for only certain species or only for grouped species eg all waders.

##### **Timescale**

An estimated 30 days work would be required to undertake the project if paper maps were to be supplied. Establishing the system on GIS would require additional liaison and establishment time and time to digitise the sections. However less time would be required as maps would not have to be produced by hand. Using GIS it is estimated that 25 days work would be required.

#### **4.5 Assess coastal survey bird and flora data**

##### **Requirements**

Once an assessment methodology has been designed the coastal plant and bird data should be assessed.

The assessment of the coastal survey data can be easily achieved as the associated field data is computerised. The assessment could be carried out more effectively using GIS facilities particularly if the quadrat data collected as part of the survey methodology is to be used in the assessment procedure.

##### **Timescale**

Using existing computer facilities it is likely that 50 days work would be required assess the entire data set. However project 4.3 may suggest assessment methodologies requiring only part of the data set to be analysed in full.

#### **4.6 Desk study of ornithological data on the North Norfolk Coast**

There is no ornithological information other than the breeding bird surveys for the N. Norfolk Coast between Holkham and Heacham.

##### **Requirements**

The desk study should identify previous survey data relating to the wader and wildfowl populations of the area. All potential data holding organisations should be approached to establish the extent, type and date of the information held and whether it would be available to NRA. Where possible the data should be assessed using the methodology adopted after project 4.2. The information should be presented in a mapped form relating to the survey units adopted.

##### **Timescale**

An estimated 20 days would be required to carryout the study.

#### **4.7 Desk study of the ornithological data of the north intertidal zone of the inner Thames estuary**

There is no ornithological information other than the breeding bird surveys for the inner Thames estuary in Essex.

##### **Requirements**

The desk study should identify previous survey data relating to the wader and wildfowl populations of the area. All potential data holding organisations should be approached to establish the extent, type and date of the information held and whether it would be available to NRA. Where possible the data should be assessed using the methodology adopted after project 4.2. The information should be presented in a mapped form relating to the survey units adopted.

##### **Timescale**

An estimated 15 days would be required to carryout the study.

#### **4.8 Desk study of land immediately adjacent to Sea Defences**

The only comprehensive information available to NRA on the ecological value of land immediately behind the sea defence is phase 1 survey data from the coastal survey.

##### **Requirements**

A desk study is required to assess the coastal survey information to establish which sites are likely to be of ecological significance. Other sources of data held by other organisations should be investigated and collated. The study should identify sites of known or possible interest and prioritise survey requirements in relation to strategic issues such as planned retreat.

##### **Timescale**

An estimated 35 days would be required to carryout the study.

#### **4.9 Assessment of ecological input to the coastal management system**

NRA has developed a coastal management monitoring system. This involves transect surveys at 1km throughout the length of the entire coast twice a year. The system lacks any ecological input other than rough assessments of the vegetation type present. Changes in vegetation and invertebrate populations can give vital information on changes in coastal processes.

##### **Requirements**

An assessment of the potential for integrating ecological data with the coastal management system is required. This should examine whether such a system is feasible in scientific and cost terms and the survey methodologies that could be used. The potential for the use of remote sensing, aerial photography etc. in future monitoring should be examined.

##### **Timescale**

An estimated 20 days would be required to carryout the study.



## **Appendix I**

### **Maps**

# LDA

Philip Collins BSc AMA ALI

Barry Tranter BSc PhD

Data Scoping Study

Date

May 1994

Client

NRA Anglian Region

Ref

Map1.

Location of NRA sea defences.

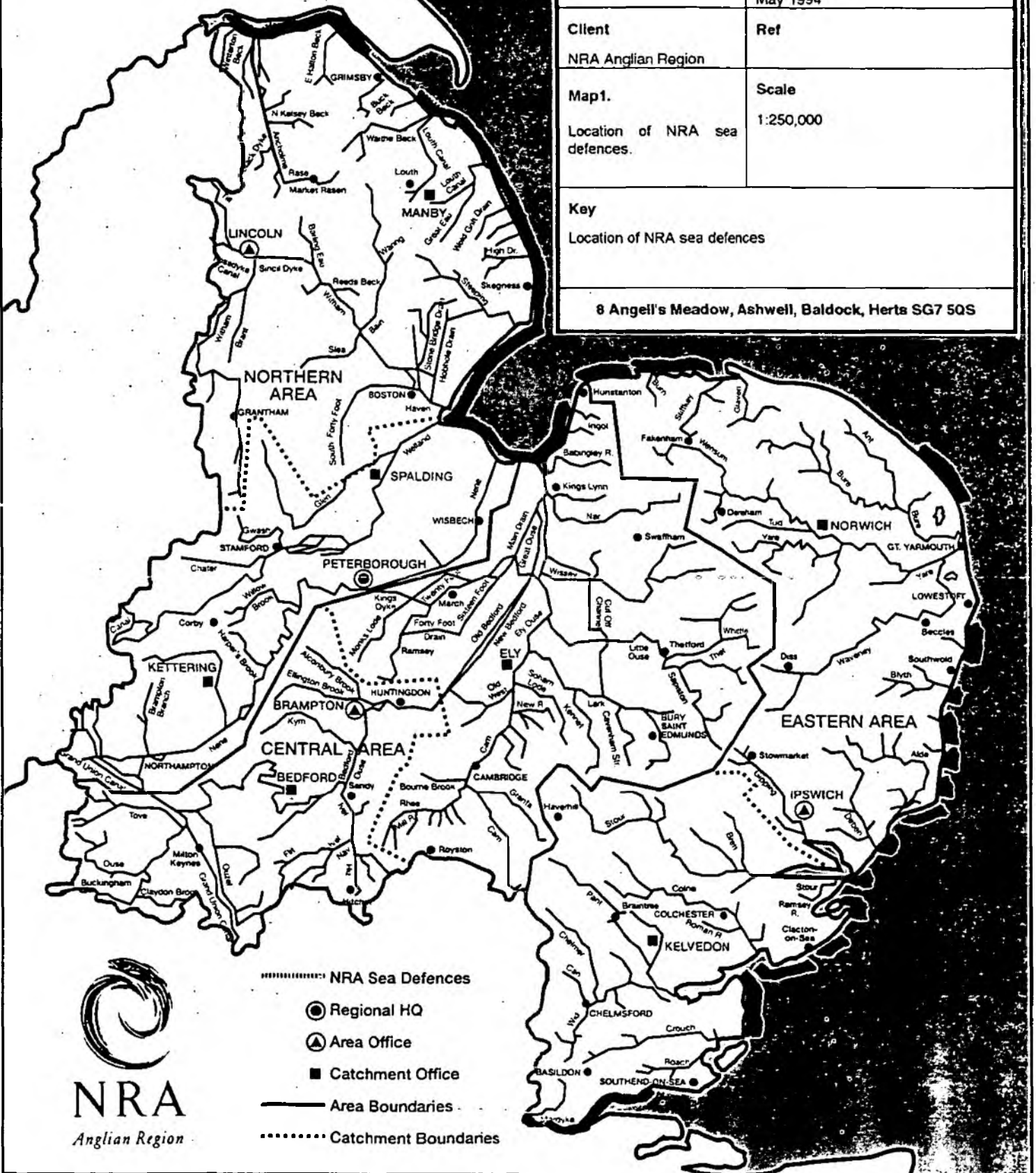
Scale

1:250,000

Key

Location of NRA sea defences

8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS



## Appendix II

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## **Appendix III**

### **Coastal survey methodology**

Methodology

BSBI card

Target species card

## COASTAL SURVEY

### METHODOLOGY FOR LINEAR PLANT SURVEY

#### 1 INTRODUCTION

##### A DEFINITION OF AREA TO BE SURVEYED

For comparability between sections it is essential that the definitions of the survey corridor are fully understood. The corridor is that width of sea defence and adjoining land that would be affected by major engineering works and may be defined as follows:

###### (a) Primary Banks

The area to be surveyed includes the raised bank, any soke drain to landward of it and any marsh or other habitat for approximately 50 metres to seaward. This is the distance likely to be affected by any decision to excavate borrow pits in order to raise the banks locally. Where arable land occurs right up to the landward soke drain this need not be surveyed; otherwise a distance of approximately 25 metres to landward of the soke drain should be included in the survey (Figs A1, A2).

###### (b) Secondary, Tertiary Or Cross Banks

The area to be surveyed includes the raised bank, any soke drains beside it and any land between the bank and drains (Fig A3).

##### B ACCESS

The NRA has a right of access to the coastal defences for the purpose of management, which covers this survey. In the Northern area, the policy is to inform riparian landowners, as a matter of courtesy, when such access will be needed, but this has not been done in the Central and Eastern areas. Obtaining permission is the responsibility of the NRA, not the surveyor.

All surveyors are provided with an ID card, identifying them as NRA contractors and with a letter setting out the aims and intentions of the survey. Should any surveyor meet a landowner who has not been informed about the survey:

- (i) Show the letter and ID card and explain what you need to do;
- (ii) If access is still refused, ask for the landowner's name and address and withdraw, marking the relevant map(s) "owner refused access";
- (iii) Return to the sea bank at the next convenient point and resume the survey; and
- (iv) As soon as possible after completing the day's survey, inform your team leader of the circumstances and give them the owner's name and address.

## 2 FIELD WORK

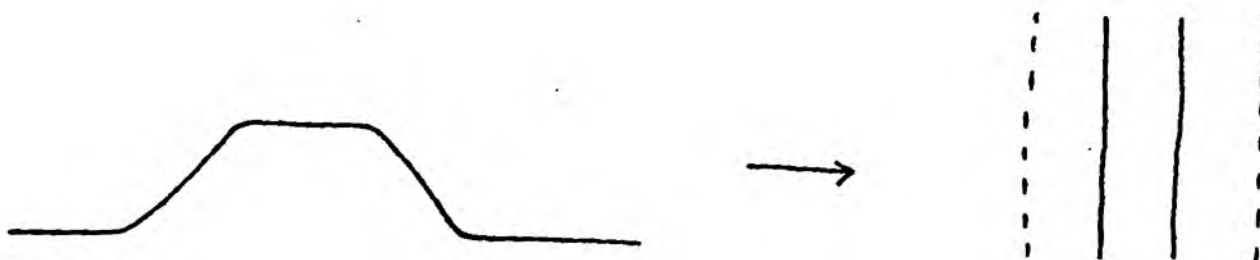
### (a) FIRST VISIT

During this visit a habitat map will be compiled and plant species within the corridor will be recorded given the survey time limits. A representative photograph of each section will be taken.

#### A Habitat Map

Prior to fieldwork, draw a sketch map of each section on plain A4 paper. Use the OS map provided as a guide for bank form but enlarge the bank width (not the length) in order to accommodate details. It is not advisable to use the OS map provided for field work as it may be out of date and if the bank is narrow there is insufficient width for you to unambiguously annotate details.

Where possible the most northerly end of the bank should be at the top of the page and a compass point should be included on the map. The bank top is defined by two continuous lines and the base of the bank either side by dotted lines:



The distance between the dotted line and the continuous line represents the steepness of the bank, a narrow distance representing a steep bank. This can only be schematic and is intended to show variation within one 500m section:



In the field, annotate your outline map with the features seen on the ground. It is recommended to use the standard symbols provided in the key right from the start. If a suitable symbol is not provided, then a target note will suffice.

Note down the adjacent land use (eg rape, cereal, sugar beet, houses and gardens, saltmarsh, industry, hay field, ley, improved pasture, semi-improved pasture, marsh, reed bed, waste, set aside, amenity grassland, conifer plantation, woodland, orchard, farm etc) with, where appropriate, the extent and type of grazing. Do not forget the field boundaries.

The location of rabbit burrows, vole and rat holes, and other resident mammals in the corridor should also be noted, particularly because their tunnels/burrows can provide passage for water during times of flood.

Other important geographical features which need to be included are railways, roads, tracks, drains, ponds, bridges and buildings. Please check your OS map as you work to ensure that you include any designated footpaths because they may not be immediately obvious in the field.

A cross section through a "typical area" of each 500m section should be drawn and where there is distinct variation, more than one should be drawn. The cross section should show the height of herbaceous vegetation, the location of shrubs, trees and fences, as well as approximate bank height and bank top width in METRES as well as the width of front and back berms. The cross section must extend back to the adjacent crop, soke drain, saltmarsh or other delineating feature. This is ESSENTIAL INFORMATION for the NRA.

B Plant Communities

The dominant plant communities (use 5-6 examples of dominant and abundant species) on the bank, and relevant berms should be marked and areas differing significantly from this should be indicated (see key). Target plant species should be indicated on the map by their full common names after confirming with Team leader. Plants which are not mature enough to be accurately identified can also be indicated on the map to ensure identification on the second visit. Botanically rich patches should be picked out and 3-4 exemplary species targeted to that area.

All shrubs and trees should be named and accurately marked on the map indicating their location.

C Photography

A representative photograph of each 500m section will need to be taken. The position from which it was taken and it's direction should be clearly marked on the map using the symbol provided in the key.



Where there is doubt over sub-species, record the aggregate rather than the species sensu stricta:

Nast mic  
    off\*  
    off

At the end of each section, add the DAFOR rating to each of your species records:

D = Dominant  
A = Abundant  
F = Frequent  
O = Occasional  
R = Rare

Some species have been added to the list after it was compiled and these will appear after "z" in non-alphabetical order. Note that ferns and allies are all put together at the top of the first column. If you record any plants not on the card, merely write the scientific name in full in the space at the bottom of side two. Any species which you are in doubt about will need vetting by your team leader, county recorder or some reputable person. Any species which have been vetted should be marked as such on the plant card and the vetter's name included.

(ii) The Target Species Card

This should be completed using the same method as for the main plant card with additional notes on the location within the section that the find was made. You may prefer to make notes on your habitat map and then fill in the card at home to avoid taking another piece of paper into the field.

A cross section through a "typical area" of each 500m section should be drawn and where there is distinct variation, more than one should be drawn. The cross section should show the height of herbaceous vegetation, the location of shrubs, trees and fences, as well as approximate bank height and bank top width in METRES as well as the width of front and back berms. The cross section must extend back to the adjacent crop, soke drain, saltmarsh or other delineating feature. This is ESSENTIAL INFORMATION for the NRA.

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E     Back Home

Identify any difficult specimens collected in the field and add them to your plant list.

Plants will keep best for identification in a sealed plastic box with a few drops of water on them, stored in the fridge.

Scan your field notes to see if any plants marked on the habitat map or elsewhere are missed from the card and if so, complete your card. Check your habitat maps for completeness and use a highlighter pen for things on the map which will need completing/checking on the second visit. Transfer appropriate records from your habitat map to the Target Species card, with DAFOR rating and add any comments as appropriate.

(b)    SECOND VISIT

Check your habitat map for accuracy, completing your highlighted notes and note any changes in the composition of the dominant species. Check your bank measurements for accuracy.

In addition, record no more than two 2x2m quadrats to indicate the grassland communities on the sea wall. These should be located at random along the landward face of the seawall and all species present, along with plant litter, bryophytes and bare ground, should be recorded and given a value for their % cover. Mark the locations of the quadrats with a cross and label "Q1" , "Q2" as appropriate. Make a note if the vegetation sampled by the quadrats is typical of the sea wall as a whole or is centred on a rich area.

Complete your plant card.

Note any management suggestions - tree planting, mowing or grazing regime suggestions, clearing out of old adjacent ponds etc.

### 3 THE WRITE-UP

#### A THE MAP

After the first survey visit, there will be sufficient information for you to start drawing the skeleton of the final map, which should be accurately drawn using a Rotring or other Indian ink pen on clean white A4 paper. Spend a little while planning your map before committing pen to paper - remember that ideally, map, labels and cross-section will need to fit on the same piece of paper. If there is no space for the cross-section, this should be drawn on a separate piece of paper. Punch the holes in the left margin, if not already there, before starting. The bank should have its northern most end at the top of the page and don't forget to include a compass point.

All plant names should be English common names, do not use Latin or other names. Use the symbols provided in the key and use Target Notes for special areas.

After the second survey visit complete your final map.

#### B THE TEXT

##### Plant Communities

A short description of the section generally should open your text and this should then continue with the land use to seawards and then the land use to the landwards. A general value of the site is not inappropriate here.

The vegetation on the bank top, seaward face and the landward face should then be described in that order give an indication of species rich/poor areas within the text. Communities on the bank faces should be described using 5-6 species (English common names) examples and a general "height" description eg "The bank top is dominated by unmanaged cock's-foot, nettles, cow parsley, cleavers and false oat grass". Do not forget to highlight the distribution of scrub and trees within this part of the text!

The dominant species on the adjacent berms (where relevant) should next be described. Follow on with description of any soke drains and then the total number of species recorded. Continue the write-up with the new paragraph heading Target Species, under which you describe the sites of these species (as shown on the map), in the following order: seaward land surface (plant names); sea bank (plant names); berm (plant names); soke dyke (plant names). No DAFOR ratings should be included here as they are on the card. Indicate the total number of species in this category.

An example of a completed text and handy phrases and abbreviations for use in the write-up are given in the appendices.

#### C THE PLANT CARD

Carefully check your card for any mistakes in annotations and for any missed species.

Count up species on the card and write the total with a circle around it at the bottom of the plant card on side two. All annotations must be made in ink. Ensure that each species has a DAFOR rating and that the card has surveyor name, section code and two survey dates. Indicate on the card if records of rare or critical species have been vetted or determined by other people. Complete the transfer of appropriate records from the standard plant card to the Target Species card.

#### D PHOTOGRAPH

Glue the photograph on to a sheet of white A4 paper, either below the cross-section or on its own if the cross-section is on the same sheet as the map. If the photograph is on its own then remember to write the section code on the top right hand corner of the sheet of paper.

#### E MANAGEMENT SUGGESTIONS

Use this heading to cover any management suggestions. Examples are given in the appendices.

## SAFETY

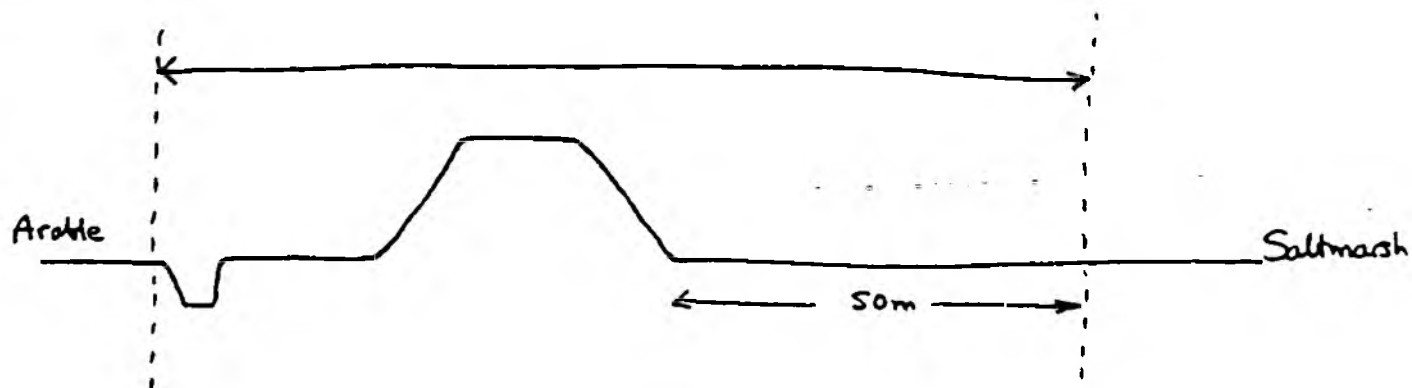
Female surveyors may like to consider carrying screech alarms for personal safety. To ensure your safety, there are some basic rules to follow; these include not taking any risks in the field and leaving details of each days travels and expected time of return at your lodgings or home.

Familiarize yourself with giant hogweed if you do not already know this species. Under no circumstances touch this plant because its' sap is highly corrosive and will cause painful burns.

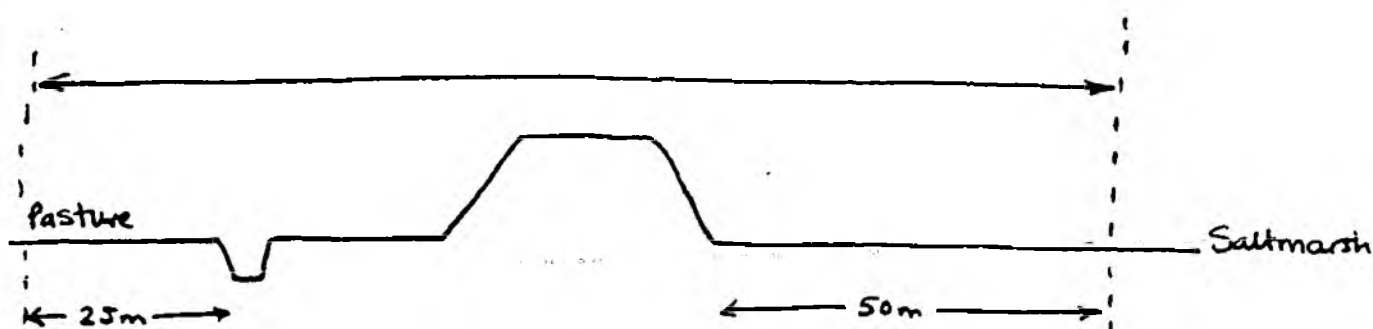
Please take enough liquids to drink in the field. Survey in England is not normally in mediteranean conditions, but in recent years the very warm summers have proved tiring for surveyors not used to remembering to drink little and often.

A EXAMPLES OF THE EXTENT OF SEA WALL CORRIDOR

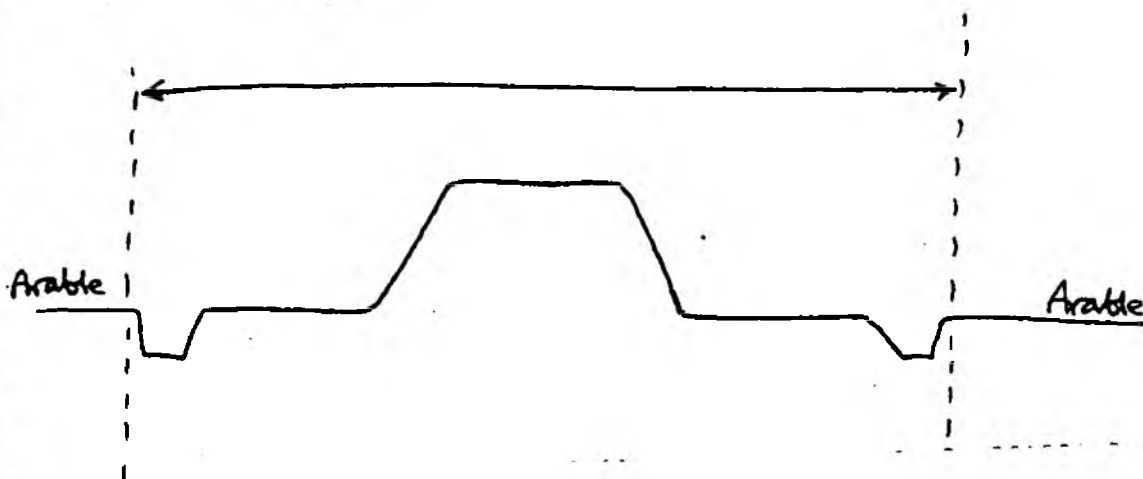
- 1 SEA WALL WITH PARALLEL SOKE DRAIN AND ARABLE BEYOND



- 2 SEA WALL WITH PARALLEL SOKE DRAIN AND PASTURE (OR OTHER SEMI-NATURAL HABITAT) BEYOND



- 3 SEA WALL (SECONDARY, TERTIARY OR CROSS BANK)



COAS 545

Plant Communities

An angled section of sea bank with saltmarsh and a borrow pit to seawards; sugar beet, cereal, improved pasture, game cover and a poplar plantation occur on the landward side, beyond a parallel soke drain.

The bank top is dominated by mown perennial rye grass, white clover, crested dog's-tail and annual meadow grass. The seaward face is dominated by sea couch and false oat grass. The landward berm and face are dominated by false oat grass, tall fescue, cock's-foot, Yorkshire fog and rough meadow grass. The bank is open apart from a little goat willow scrub along the soke drain, which is dominated by common reed and sea club rush.

A species-poor section dominated by tall coarse grasses.

57 species recorded.

Target Species

Saltmarsh: saltmarsh rush.

Bank: sea barley.

2 species recorded.



COAS 545

An angled section of ice bank with saltmarsh and a borrow pit to seawards, and 1950s beet, cereal, improved pasture, game cover & a poplar plantation to landwards, beyond a parallel sike drain.

The bank top is dominated by mature RYE, white clover, CDT & annual meadow grass. The seaward face is dominated by SC & FOG. The landward face & berm are dominated by FOG, tall fescue, CF, YF & RMG.

The bank is separated from a little GOW scrub along the sike drain, which is dominated by CR & sea club rush.

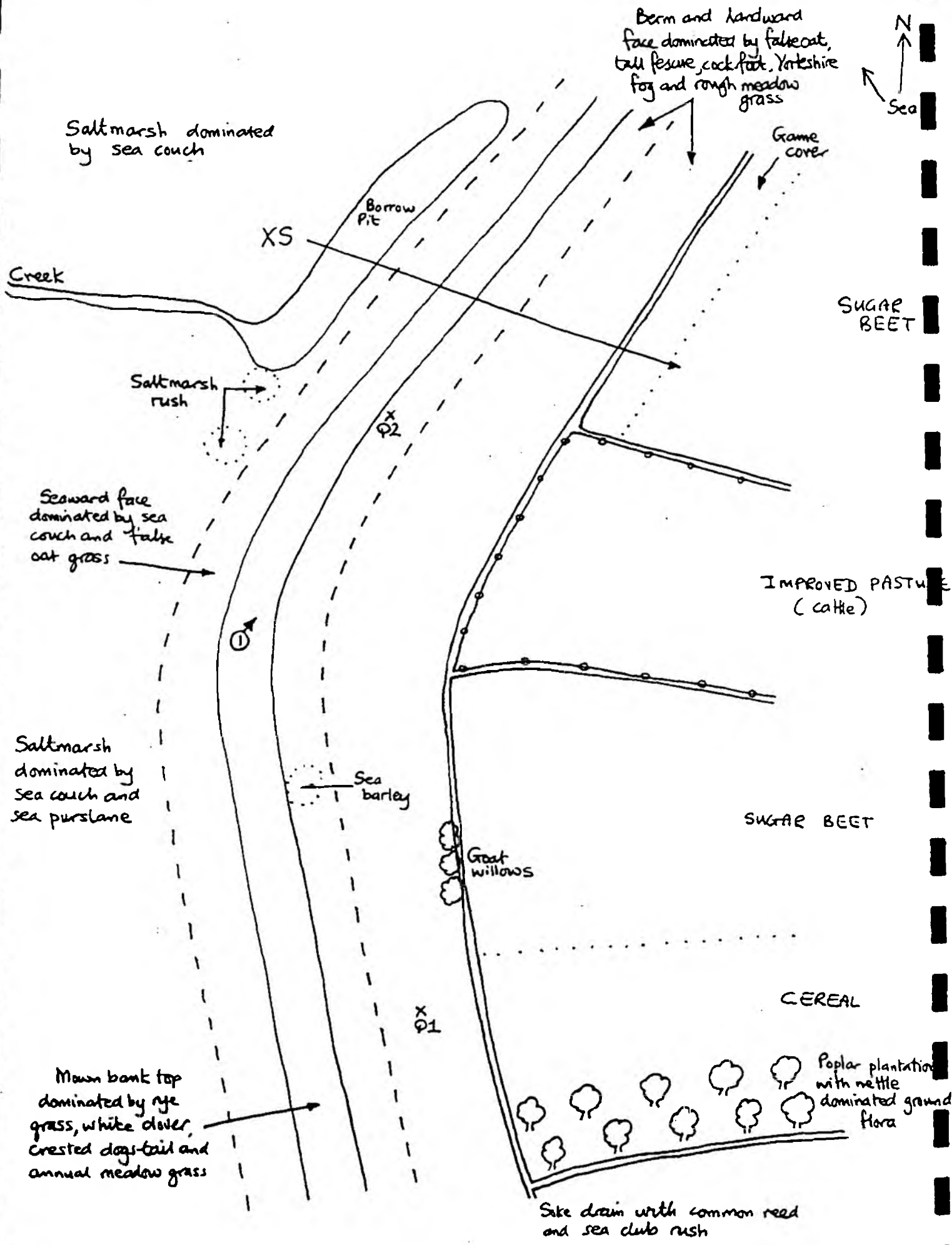
A species-poor section dominated by tall coarse grasses.

ST

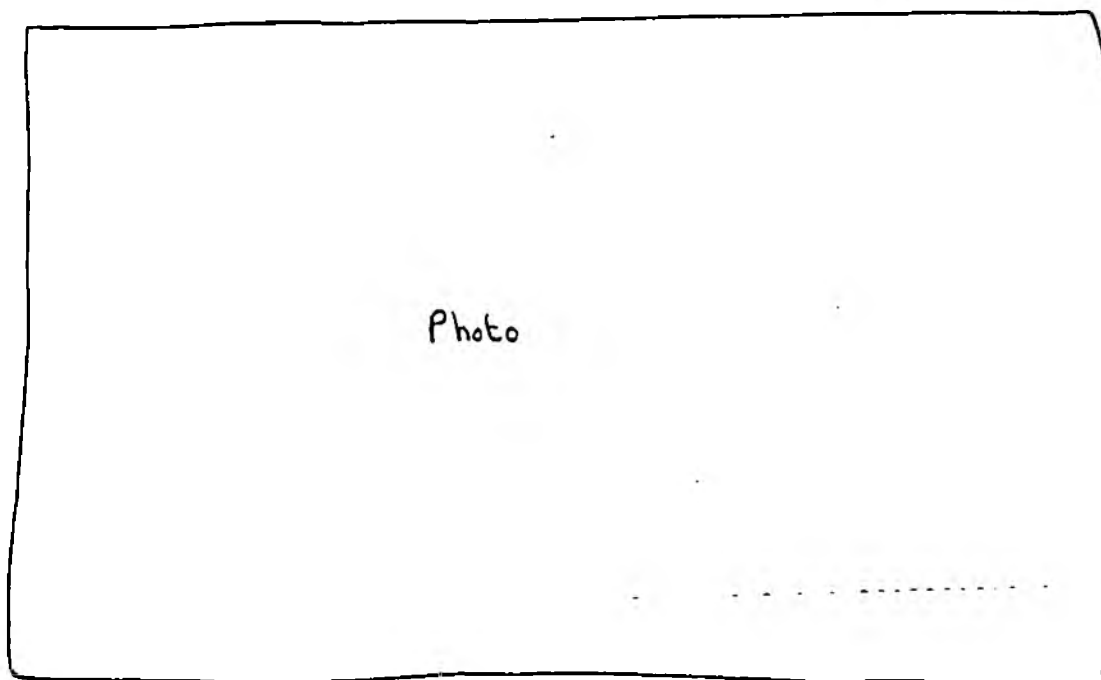
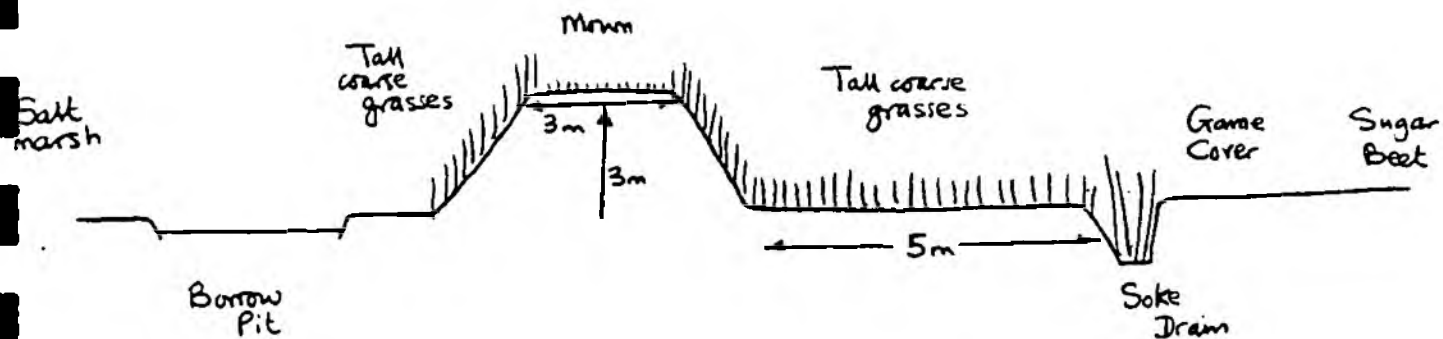
T.S.

Saltmarsh: saltmarsh rush; bank: sea barley

2



# Cross Section



SOME USEFUL PHRASES FOR THE SEA BANK WRITE-UP

A straight section of sea bank, with saltmarsh to seawards and cereal to landwards, beyond a parallel soke drain.

An angled section of sea bank ...

A curving section of sea bank with cereals on each side.

The bank top and landward face are dominated by ...  
The seaward face ...

The reinforced seaward face has scattered .....,  
whereas the top and landward face ...

The open bank is dominated by ... - use where there  
are no trees or shrubs and the flora of the top and  
both faces is similar.

# Record Card - Essex Seawall Survey 1990 (NCC Target Species)

Date 13.08.90 Section ECDA ON 201 Recorder JOHN W. DIGBY

DAFOR

NOTES

DAFOR

NOTES

- 1 Alopecurus bulbosus
- 2 Althaea officinalis
- 3 Anthriscus caucalis
- 4 Artemisia graveolens
- 5 Artemisia maritima
- 6 Bupleurium tenuissimum
- 7 Cakile maritima
- 8 Calystegia soldanella
- 9 Carex arenaria
- 10 Carex distans
- 11 Carex divisa
- 12 Cerastium diffusum
- 13 Cerastium semidecandrum
- 14 Ceratophyllum submersum
- 15 Chenopodium botryoides
- 16 Chenopodium vulvaria
- 17 Crambe maritima
- 18 Crithmum maritima
- 19 Cynoglossum officinale
- 20 Eryngium maritimum
- 21 Euphorbia paralias
- 22 Frankenia laevis
- 23 Genista tinctoria
- 24 Glaucium flavum
- 25 Halimione pedunculata
- 26 Honkenya peploides
- 27 Hordeum marinum
- 28 Inula crithmoides
- 29 Lactuca saligna
- 30 Lathyrus japonicus
- 31 Lathyrus nissolia
- 32 Lepidium latifolia
- 33 Leymus arenarius
- 34 Limonium humile
- 35 Lotus tenuis
- 36 Medicago arabica
- 37 Medicago polymorpha
- 38 Moenchia erecta
- 39 Myosotis ramosissima
- 40 Myosurus minimus
- 41 Oenanthe lachenalii
- 42 Ononis spinosa
- 43 Paraphalis incurva
- 44 Petroselinum segetum

LO

Barrin-dyke

- 45 Peucedanum officinale
- 46 Phleum arenarium
- 47 Polygonum oxyspermum (ssp. raii)
- 48 Polygonum monspeliensis
- 49 Puccinellia fasciculata
- 50 Puccinellia rupestris
- 51 Ranunculus baudotii
- 52 Ranunculus sardous
- 53 Rumex maritimus
- 54 Rumex palustris
- 55 Ruppia cirrhosa
- 56 Sagina maritima
- 57 Salicornia perennis
- 58 Salicornia pusilla
- 59 Salsola kali
- 60 Schoenoplectus lacustris (ssp. tab)
- 61 Silene maritima
- 62 Spartina maritima
- 63 Suaeda vera (S. fruticosus)
- 64 Torilis nodosa
- 65 Trifolium fragiferum
- 66 Trifolium glomeratum
- 67 T. ornithopodioides
- 68 T. squamosum
- 69 T. striatum
- 70 T. subterraneum
- 71 Typha angustifolia
- 72 Vulpia fasciculata
- 73 Zostera angustifolia
- 74 Z. marina
- 75 Z. moltii

LF

pasture & bank side

(2)

- D DOMINANT
- A ABUNDANT
- F FREQUENT
- O OCCASIONAL
- R RARE

Circle the relevant species & give it a DAFOR rating. Any field observations relevant to these species can be made under notes eg: mown 2nd visit, spray damage, dumping, large stand 3m<sup>2</sup>, close to F.R. etc.

Survey for NRA by

ECO SURVEYS Ltd  
Unit 1 & 4

S. Lines Enterprise Workshops  
Station Yd, Station Workshops  
Ruskington, Lincs NG34 9DG  
Tel: (0526) 833794

## SECTION CODE

## DATES SURVEYED

## SURVEYORS NAME

Asple	adi	87	Anmop	are	173	Callu	vul	260	Cicer	mac	347	Epipa	hel	436	Halim	por
	mar	88	Anaca	pyr	174	Calth	pai	261	Cicho	int	348	Erica	cin	437	Heder	hel
3	rut	89	Anaga	arv	175	Calys	pul	262	Circ x	int	349		tet	438	Helia	num
4	tri	90		ten	176		sep	263		lut	350	Erige	ace	439	Helle	foe
	qua	91	Anchu	arv	177		sil	264	Cirsi	aca	351		can	440		vir
	tri	92	Andro	pol	178		sol	265		arv	352	Erinu	alp	441	Herae	man
	vir	93	Anemo	nem	179	Campa	glo	266		dis	353	Eriop	ang	442		sph
8	Athyr	94	Angel	syl	180		lat	267		eri	354		lat	443	Hespe	mat
	spi	95	Anten	dio	181		rapunculo	268		hel	355		vag	444	Hiera	agg
	Botry	96	Anthe	arv	182		rot	269		pai	356	Erodi	cic	445		pil
	Ceter	97		cot	183		tra	270		vul	357	Eroph	ver	446	Hippo	com
12	Crypt	98	Antho	odo	184	Capse	bur	271	Clema	vit	358	Eryng	mar	447	Hippo	rha
13	Cysto	99	Anthr	syl	185	Carda	ama	272	Clino	vul	359	Erysi	che	448	Hippu	vul
	Dipha	100	Anthy	vul	186		fle	273	Cochl	ang	360	Euony	eur	449	Holcu	lan
	Dryop	101	Aphan	*arv	187		hir	274		dan	361	Eupat	can	450		mol
		102		arv	188		imp	275		*off	362	Eupho	amy	451	Honke	pep
	dil	103		mic	189		pra	276		off	363		exi	452	Horde	mur
18	fil	104	Apium	gra	190	Carda	dra	277	Coelo	vir	364		hel	453		sec
	ore	105		inu	191	Cardu	aca	278	Colch	aut	365		lat	454	Humul	lup
	arv	106		nod	192		nut	279	Coniu	mac	366		peplus	455	Hyaci	non
21	Equis	107	Aquil	vul	193	Carex	acuta	280	Conop	maj	367	Euphr	egg	456	Hydro	vul
22		108	Arabi	tha	194		acuti	281	Conva	maj	368	Fagus	syl	457	Hyosc	nig
	palust	109	Arabi	hir	195		are	282	Convo	arv	369	Fallo	con	458	Hyper	and
	syl	110	Arcti	lap	196		bin	283	Cornu	san	370	Festu	aru	459		elo
	tel	111		min	197		caryop	284	Coron	did	371		gig	460		hirsut
26	var	112		min	198		cur	285		equ	372		*ovina	461		hum
27	Gymno	113		min	199		dem	286	Coryd	cla	373		pra	462		mac
	Huper	114	Arena	*ser	200		dia	287		lut	374		*rubra	463		mon
	Hymen	115		ser	201		dio	288	Coryl	ave	375		viv	464		perfor
	Isoet	116	Armer	mar	202		distan	289	Coton	mic	376	Filag	min	465		pul
31	Lycop	117	Armor	rus	203		disticha	290		sim	377		vul	466		tet
32	Ophio	118	Arrhe	ela	204		ech	291	Crata	mon	378	Filip	ulm	467	Hypoc	rad
	Oreop	119	Artem	abs	205		ela	292		lae	379		vul	468	Ilex	agu
	Osmun	120		mar	206		ext	293	Crepi	bie	380	Foeni	vul	469	Impat	gla
35	Phego	121		vul	207		flacca	294		cap	381	Fraga	ves	470		nol
36	Phyll	122	Arum	mac	208		hir	295		pal	382	Frang	aln	471		par
37	Polyp	123	Asper	cyn	209		hos	296		ves	383	Praxi	exc	472	Inula	con
		124	Ast*nov	b	210		lae	297	Crypt	jap	384	Fumar	mir	473	Iris	foe
	int	125		tri	211		las	298	Cymba	mur	385		off	474		pse
40	vul	126	Astra	dan	212		lep	299	Cynog	off	386	Galan	niv	475	Isole	set
41	Polys	127		gly	213	mur	lag	300	Cynos	cri	387	Galeo	bif	476	Jasio	mon
	set	128	Atrip	gla	214		nig	301	Cytis	sco	388		spe	477	Junc	acuti
	asu	129		lac	215		otr	302	Dacty	glo	389		*tet	478		art
	Selag	130		lit	216		ova	303	Dacty	fuc	390		tet	479		*buf
45	Abies	131		pat	217		pal	304		inc	391	Galin	cil	480		buf
46		132		pro	218		panicea	305		mac	392		par	481		*bul
	gra	133	Atrop	bel	219		panicula	306		pra	393	Galiu	apa	482		bul
	pro	134	Avena	fat	220		pen	307		pur	394		cru	483		conгло
49	cam	135	Avenu	pra	221		pil	308	Danth	dec	395		elo	484		eff
50	pla	136		pub	222		pse	309	Daphn	lau	396		*mol	485		ger
	pse	137	Balde	ran	223		pul	310	Daucu	car	397		mol	486		inflex
	mil	138	Ballo	nig	224		rem	311	Desch	ces	398		odorat	487		koc
	pta	139	Barba	int	225		rip	312		file	399		*pal	488		mar
54	Acino	140		ver	226		rostra	313	Desma	mar	400		pal	489		squ
55	Acoru	141		vul	227		ser	314		rig	401		saxat	490		subnod
	Adoxa	142	Belli	per	228		spi	315	Digit	pur	402		ste	491		ten
	Aegop	143	Berber	vul	229		sylv	316	Diplo	mur	403		uli	492	Junip	com
	Aescu	144	Berul	ere	230		ves	317		ten	404		ver	493	Kickx	ela
59	Aethu	145	Beta	mar	231	Carli	vul	318	Dipsa	ful	405	Genis	ang	494	Knaut	arv
	Agrim	146	Betul	pen	232	Carpi	bet	319		pil	406		tin	495	Koele	agg
	pro	147		pub	233	Casta	sat	320	Doron	par	407	Genti	ama	496	Labur	ana
	Agros	148	Biden	cer	234	Catab	agu	321	Draba	inc	408		cam	497	Lamia	gal
63		149		tri	235	Centa	mon	322	Drose	int	409	Geran	col	498	Lamiu	alb
64		150	Black	per	236		nig	323		rot	410		dis	499		amp
	cap	151	Blysm	com	237		sca	324	Echiu	vul	411		end	500		hyb
	gig	152	Brach	pin	238	Centa	ery	325	Eleoc	aci	412		luc	501		mac
	sto	153		syl	239		pul	326		mul	413		molle	502		pur
	vin	154	Brasa	nap	240	Centr	rub	327		palust	414		pha	503	Lapsa	com
68	Aira	155		nig	241	Ceras	arv	328		qui	415		pra	504	Larix	dec
69		156		rap	242		dif	329		uni	416		pus	505		x
	Ajuga	157	Briza	med	243		font	330	Eleog	flu	417		pyr	506		kae
	Alche	158	Bromu	com	244		glo	331	Elode	can	418		robert	507	Lathr	squ
72	fil	159		ere	245		sem	332		nut	419		san	508	Lathy	mon
73	fil	160		hor	246		tom	333	Elymu	can	420		syl	509		pra
		161		ram	247	Chaen	min	334		far	421	Geum x	int	510		syl
	Alism	162		ste	248	Chae	tem	335		pyc	422		riv	511	Lemna	gib
77	Allia	163	Bryon	dio	249	Chama	law	336		rep	423		urb	512		minor
78	Alliu	164	Buddl	dav	250	Chame	ang	337	Empet	nig	424	Glauc	fla	513		pol
	sco	165	Butom	umb	251	Cheli	maj	338	Epilo	bru	425	Glaux	mar	514		tri
	urs	166	Cakil	mar	252	Chene	alb	339		cil	426	Glech	hed	515	Leont	aut
	vin	167	Cala	can	253		bon	340		hir	427	Glyce	dec	516		his
82	Alnus	168		epi	254	Chene	mur	341		montan	428		flu	517		tar
83	Alope	169	Calli	agg	255		pol	342		obs	429		max	518	Lepid	car
	gen	170		han	256		rub	343		pal	430		x ped	519		het
	myo	171		obt	257	Chrys	seg	344		par	431		pli	520		rud
86	pra	172		sta	258	Chrys	alt	345		ros	432	Gnaph	syl	521	Leuca	vul
					259		opp	346		tet	433		uli	522	Leymu	are
											434	Groen	den			

523	Ligus	ova	612	Odont	ver	694	Potam	alp	701	Rumex	*ace*	868	Solid	can	955	Valer	dio
524		vul	613	Oenan	aqu	695		ber	702		ace	869		gig	956		off
525	Lilliu	mar	614		cro	696		cri	703		acetosa	870		vir	957	Valer	loc
526	Limon	vul	615		fis	697		gra	704		con	871	Sonch	arv	958	Verba	nig
527	Linar	pur	616		lac	698		luc	705		crispus	872		asp	959		thap
528		rep	617	Oenot	cam	699		nat	706		hyd	873		ole	960	Verbe	off
529		vul	618		ery	700		obt	707		lon	874	Sorb	*ari	961	Veron	agr
530	Linum	cat	619	Onobr	vic	701		pectin	708		obt	875		auc	962		ana
531	Liste	ova	620	Ononi	rep	702		per	709		san	876		int	963		arv
532	Litho	arv	621		spi	703		pol	710		acu	877	Sparg	ang	964		bec
533		off	622	Onopo	aca	704		pus	711		*ape	878		eme	965		cat
534	Litto	uni	623	Ophry	api	705	Poten	ang	712		ape	879		ere	966		chanae
535	Lolliu	mul	624	Orchi	mas	706		ans	713		ere	880		min	967		fil
536		per	625		mor	707		arg	714		mar	881	Spart	ang	968		hed
537	Lonic	per	626	Origa	vul	708		erecta	715		nod	882	Sperg	arv	969	hed	hed
538	Lotus	cor	627	Ornit	umb	709		pal	716		pro	883	Sperg	mari	970	hed	luc
539		uli	628	Ornit	per	710		rep	717		sag	884		med	971		mon
540	Lunar	ann	629	Oxali	ace	711		ste	718		agg	885		rub	972		off
541	Lupin	arb	630	Papav	arg	712	Primu	far	719		alb	886	Spira	agg	973		persic
542	Luzul	cam	631		dub	713		ver	720		aur	887	Stach	arv	974		pol
543		mul	632		rho	714		vul	721		cap	888		x	975		scu
544		pil	633		som	715		vu x ve	722		ole	889		off	976		ser
545		syl	634	Parap	str	716	Prune	vul	723		fra	890		pal	977	Vibur	lan
546	Lychn	flo	635	Parie	jud	717	Prunu	avi	724		pen	891		syl	978		opu
547	Lyciu	bar	636	Paris	qua	718		cerasus	725		phy	892	Stell	als	979	Vicia	cra
548		chi	637	Parna	pal	719		dom	726		pur	893		gra	980		hir
549	Lycop	eur	638	Pasti	sat	720		lauro	727		repens	894		hol	981		lat
550	Lysim	nem	639	Pedic	pal	721		pad	728		tri	895		*med	982	sat	nig
551		num	640		syl	722		spi	729		vim	896		med	983	sat	sat
552		pun	641	Penta	sem	723	Pseud	men	730		kal	897		neg	984		sep
553		vul	642	Betas	alb	724	Pucci	dis	731		ebu	898		nem	985		syl
554	Lythr	por	643		fra	725		mar	732		nig	899	Suaed	mar	986		tet
555		sal	644		hyb	726	Pulic	dys	733		val	900	Succi	pra	987	Vinca	maj
556	Mahon	aqu	645	Phala	aru	727	Pulmo	off	734		min	901	Symph	riv	988		min
557	Malus	syl	646		can	728	Pyrol	min	735		off	902	Symph	off	989	Viola	arv
558	Malva	mos	647	Phleu	are	729	Pyrus	pyr	736		eur	903		x	990		can
559		neg	648		pra	730	Querc	cer	737		off	904	Syrin	vul	991		hir
560		syl	649		pra	731		ile	738		gra	905	Tamus	com	992		lut
561	Marru	vul	650		pra	732		pet	739		hyp	906	Tanac	par	993		odorat
562	Matri	mat	651	Phrag	aus	733		rob	740		ste	907		vul	994		pal
563		rec	652	Picea	abi	734	Ranun	acr	741		tri	908	Tarax	agg	995		rei
564		cam	653		sit	735		*aqu	742		spa x	909	Taxus	bac	996		riv
565	Mecon	ara	654	Picri	ech	736		aqu	743		col	910	Teu	scoro	997		tri
566		lup	655		hie	737		aur	744		lac	911	Thali	fla	998	Viscu	alb
567	sat	sat	656	Pimpi	maj	738		bulbo	745		tab	912		min	999	Vulpi	bro
568	Melam	pra	657		sax	739		cir	746		nig	913	Thlas	arv	1000		myu
569	Melic	nut	658	Pingu	vul	740		fic	747		mar	914	Thuja	pli	1001	Wahle	hed
570		uni	659	Pinus	con	741		bul	748		syl	915	Thymu	pra	1002	Zanni	pal
571	Melil	alb	660		nig	742		fic	749		ann	916	Tilla	cor	1003	Popul	nig
572		alt	661		syl	743		fla	750		aur	917		x	1004	Tilla	pla
573		off	662	Plant	cor	744		hed	751		nod	918	Toril	jap	1005	Cerat	dem
574	Menth	aqu	663		lan	745		lingua	752		umb	919		nod	1006	Anara	ret
575		arv	664		maj	746		omi	753		gal	920	Trago	pra	1007	Salix	agg
576		x pip	665		mar	747		pel	754		min	921	Trich	ces	1008	Ranun	flu
577		x ver	666		med	748		pen	755		acr	922	Trifo	arv	1009	Poa	angus
578		x vil	667	Plata	bif	749		repens	756		alb	923		cam	1010	Helia	rig
579	Menya	tri	668		chl	750		sce	757		ang	924		dub	1011	Helia	ann
580	Mercu	per	669	Poa	ann	751		trif	758		ref	925		fra	1012	Anthe	tin
581	Milliu	eff	670		com	752	Rapha	rap	759		rosea	926		hyb	1013	Oenot	str
582	Mimul	agg	671		nemor	753	Resed	lut	760		tel	927		medium	1014	Galiu	spu
583	Moehr	tri	672		*pra	754		luteola	761		tec	928		mic	1015	Galiu	pum
584	Molin	cae	673		pra	755	Reyno	jap	762		aqu	929		pra	1016	Bromu	arv
585	Monti	fon	674		sub	756		sac	763		eru	930		rep	1017	Menth	spi
586		per	675		tri	757	Rhamn	cat	764		jac	931	Trigl	mar	1018	Anthr	cau
587		sib	676	Polyg	ser	758	Rhin	*min	765		aqu	932		pal	1019	Chara	agg
588	Mycel	mur	677		vul	759	Rhodo	pon	766		syl	933	Tripl	ino	1020	Stell	pal
589	Myoso	arv	678	Polyg	mul	760	Rhync	alb	767		vis	934		mar	1021	Hotto	pal
590		dis	679	Polyg	amp	761	Ribes	alp	768		vul	935	Trise	fla	1022	Alism	lan
591		lax	680		are	762		nig	769		lig	936	Trit x	cro	1023	Anchu	off
592		ram	681		*avi	763		rub	770		vul f	937	Troll	eur	1024	Calli	pla
593		scorp	682		avi	764		san	771		tin	938	Tsuga	het	1025	Calli	her
594		sec	683		bis	765		uva	772		alb	939	Tussi	far	1026	Isati	tin
595		syl	684		hydro	766	Rorip	amp	773		arv	940	Typha	ang	1027	Atrip	sab
596	Myoso	aqu	685		lap	767		pal	774		sil	941		lat	1028	Rumex	pal
597	Myric	gal	686		minus	768		syl	775		alba	942	Ulex	eur	1029	Bromu	lep
598	Myrio	alt	687		oxy	769	Rosa	agg	776		dio	943		gal	1030	Ulmus	car
599		spi	688		per	770		arv	777		mar	944	Ulmus	gla	1031	Pontin	agg
600	Myrrh	odo	689		poly	771		*can	778		vul	945		pro	1032	Calam	syl
601	Narci	pse	690	Popul	alb	772		pim	779		mar	946	Umbil	rup	1033	Azo	filic
602	Nardu	str	691		x canad	773		*rub	780		alb	947	Urtic	dio	1034	Potam	tri
603	Nardu	oss	692		x canes	774		rugosa			arv	948		ure			
604	Nastu	mic	693		tre	775		*tom			amo	949	Utric	aus			
605		*off				776	Rubus	cae			off	950		min			
606		off				777		cham			ori	951		vul			
607		o x m				778		*fru			lat	952	Vacci	myr			
608	Neott	nid				779		ida			dul	953		oxy			
609	Nepet	cat						sax			nig	954		vit			
610	Nupha	lut															
611	Nymph	alb															

Total Number species Recorded:



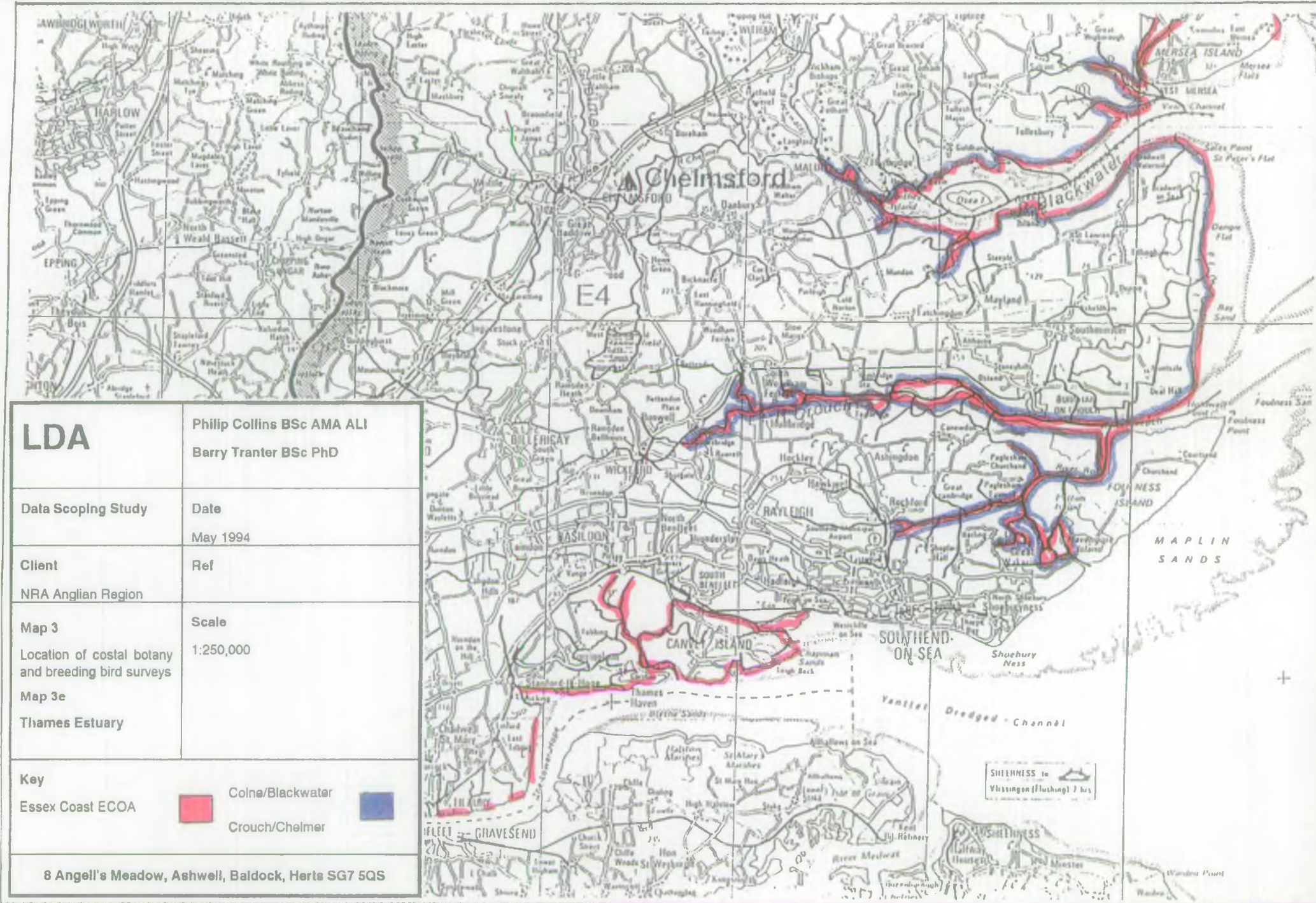


LDA	Philip Collins BSc AMA ALI Barry Tranter BSc PhD
Data Scoping Study	Date May 1994
Client	Ref
NRA Anglian Region	
Map 2.	Scale 1:250,000
Location of Wader and Wildfowl surveys	
Map 2b	
Lincolnshire coast	
Key	
Lincs Coast 1989-90	
The Wash, Lincs & Norfolk Desk Study	
8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS	



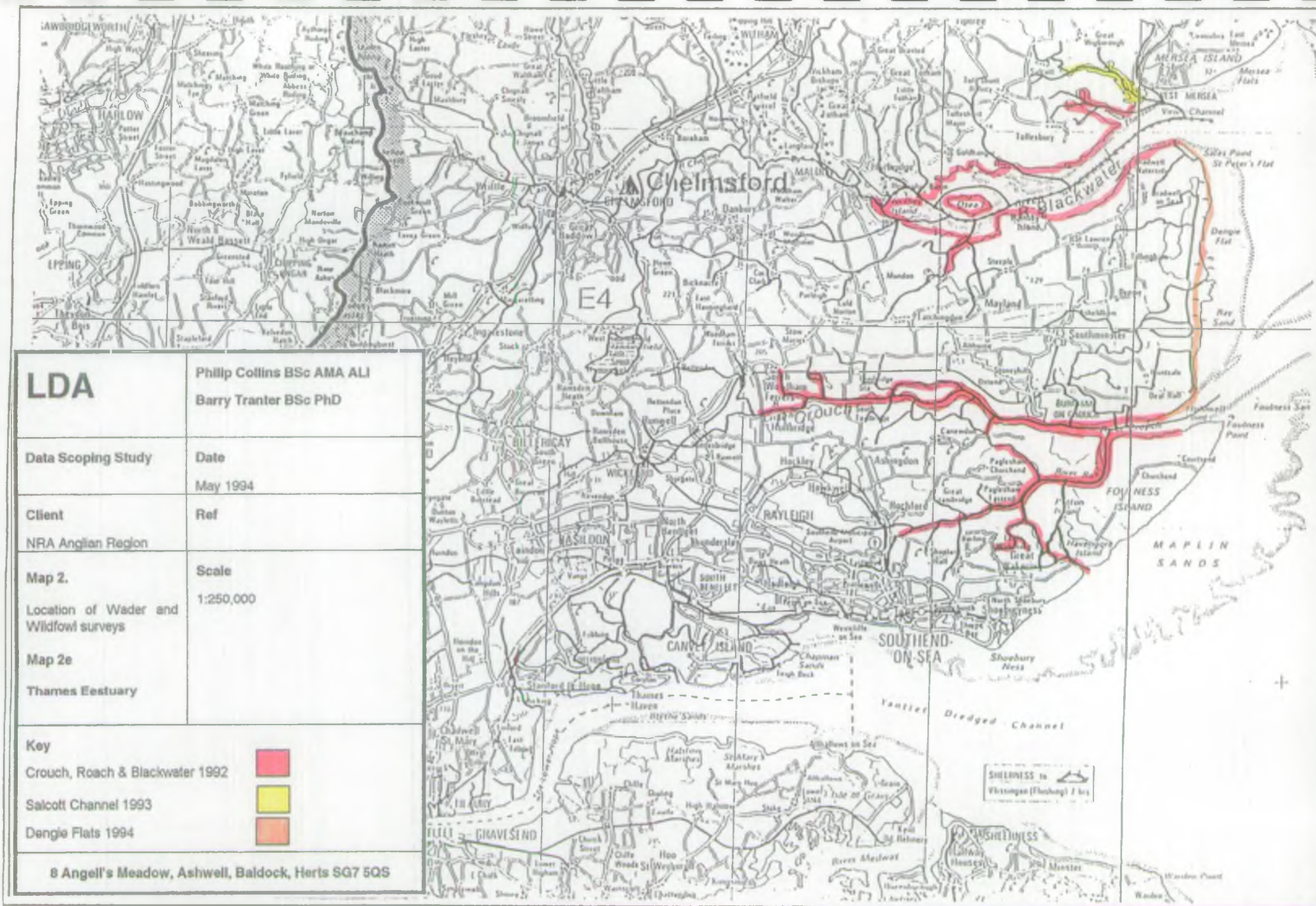






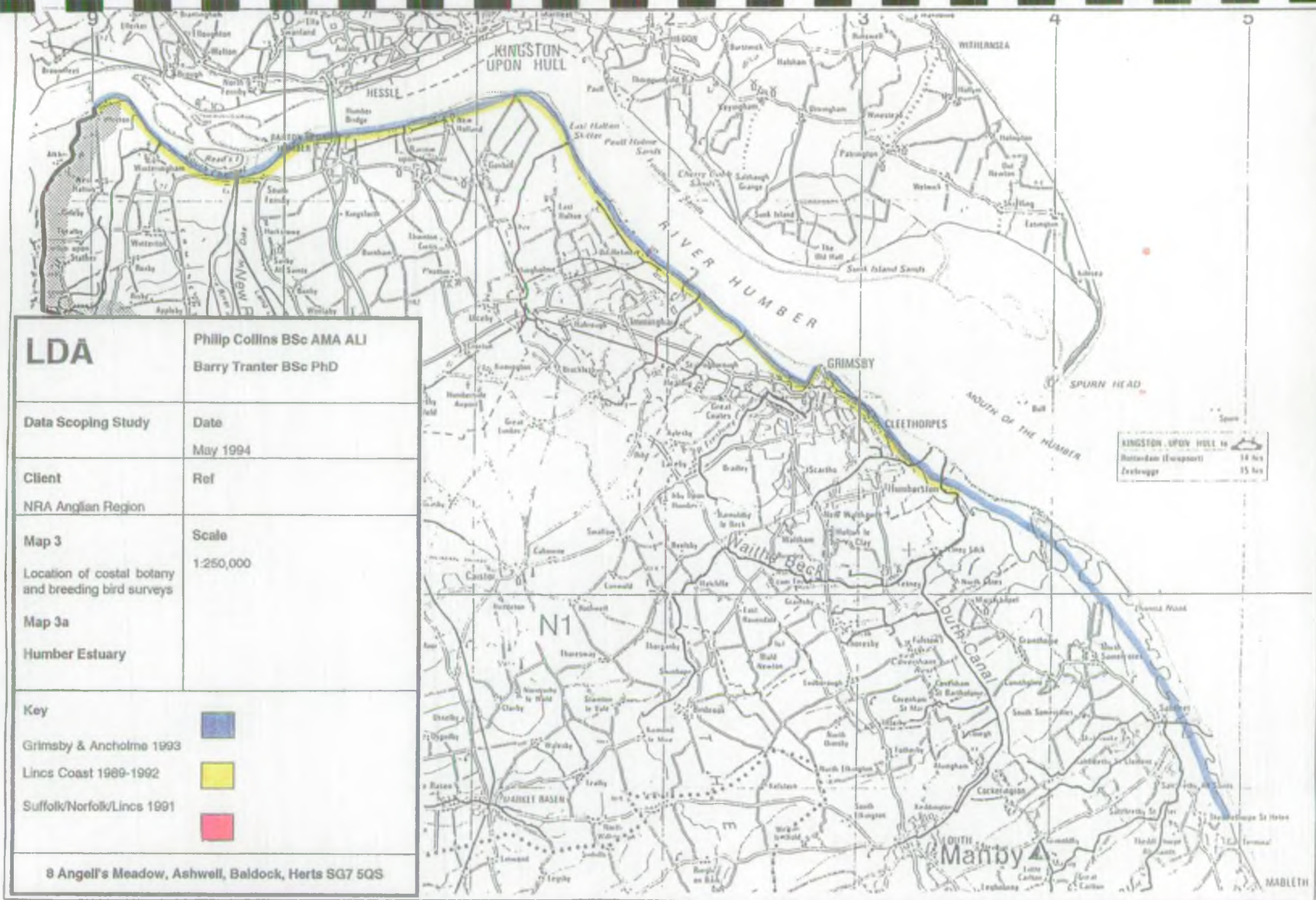






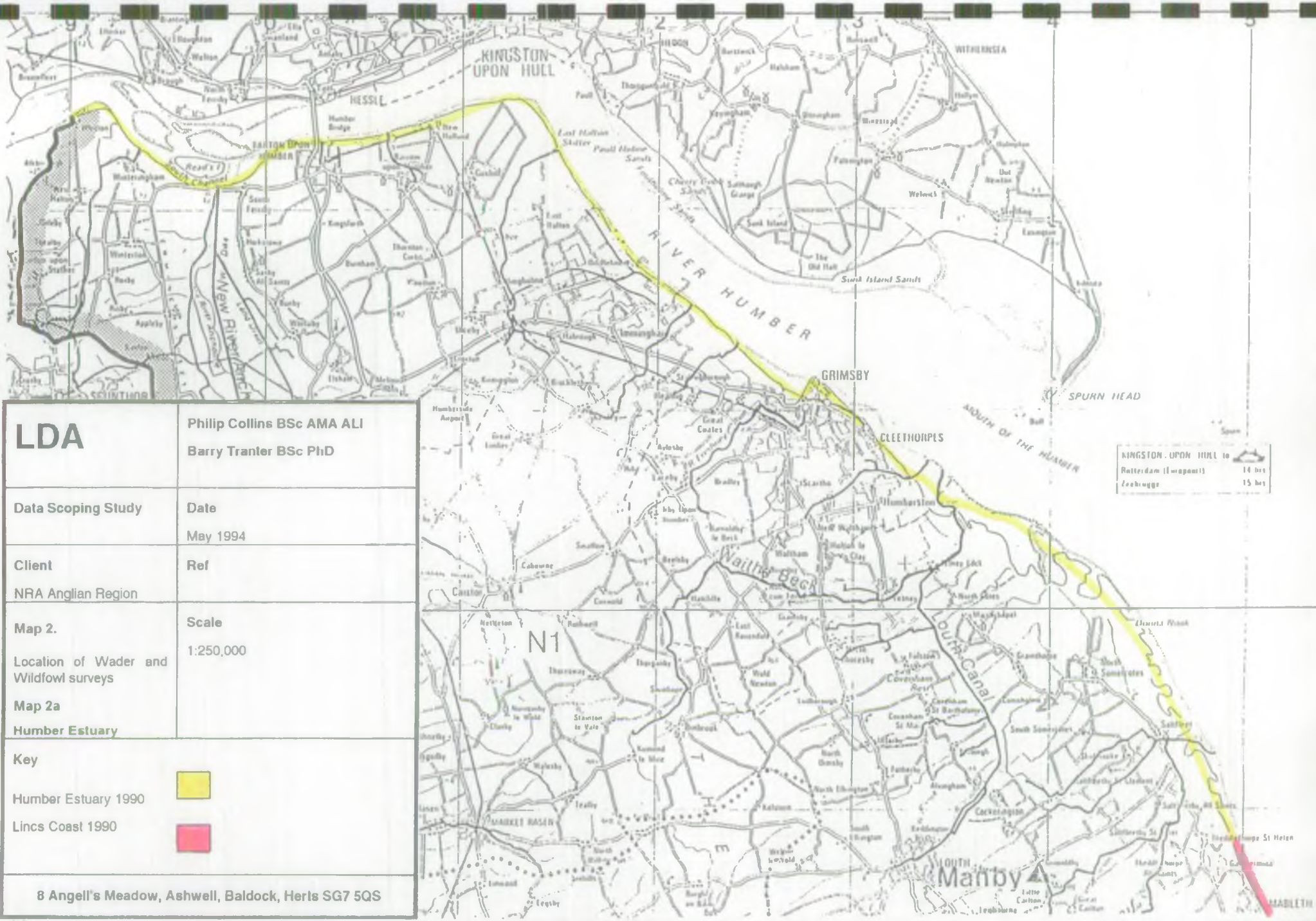












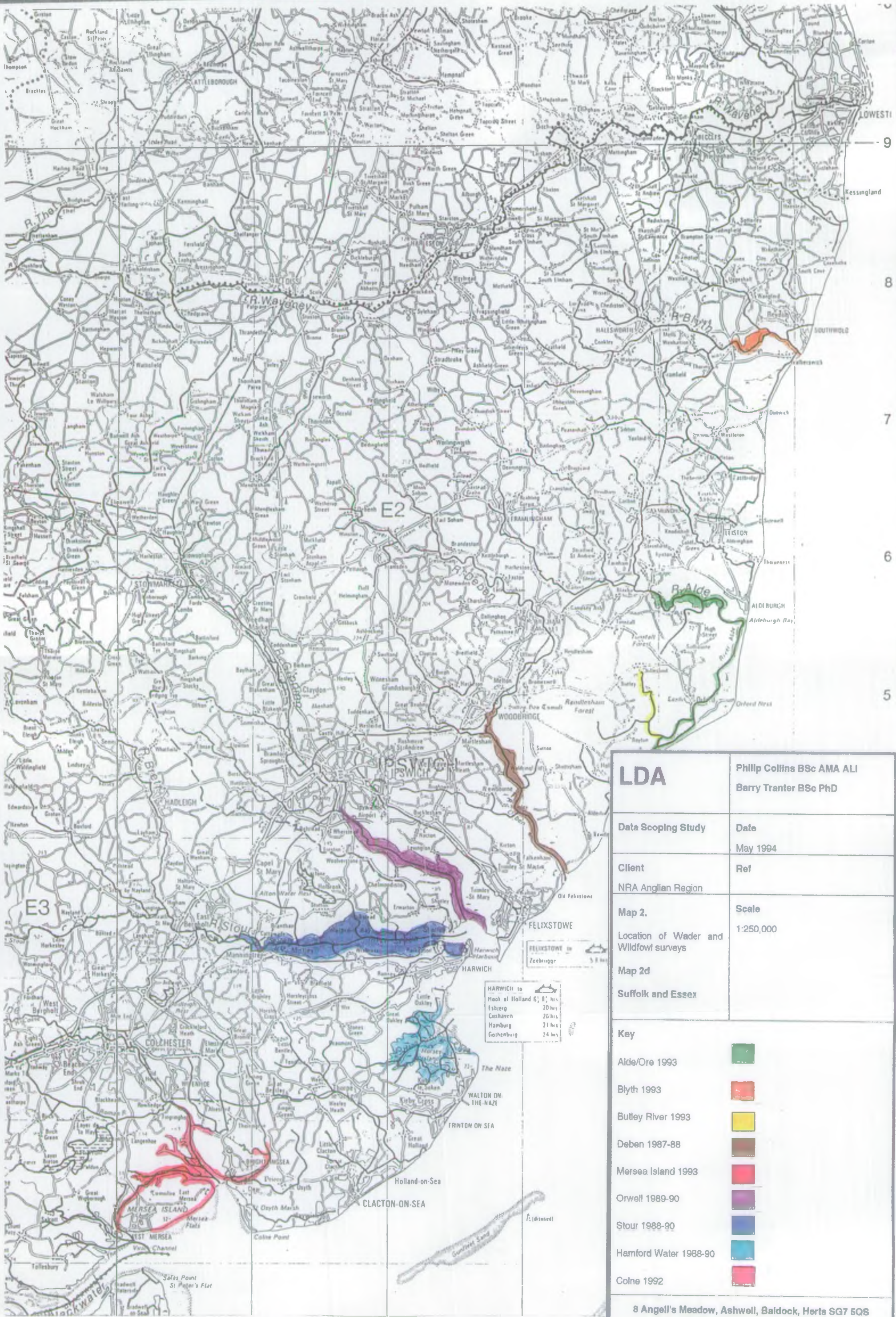
KINGSTON UPON HULL to  
 Rotterdam (Europe) 14 hrs  
 Leobing 15 hrs

<b>LDA</b>	Philip Collins BSc AMA ALI Barry Tranter BSc PhD
Data Scoping Study	Date May 1994
Client NRA Anglian Region	Ref
Map 2. Location of Wader and Wildfowl surveys Map 2a Humber Estuary	Scale 1:250,000
Key	<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: yellow; margin-right: 5px;"></div> Humber Estuary 1990 </div> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 20px; background-color: pink; margin-right: 5px;"></div> Lincs Coast 1990 </div>
8 Angel's Meadow, Ashwell, Baldock, Herls SG7 5QS	









<b>LDA</b>		Phillip Collins BSc AMA ALI Barry Tranter BSc PhD
Data Scoping Study	Date	May 1994
Client	Ref	
NRA Anglian Region		
Map 2.	Scale	1:250,000
Location of Wader and Wildfowl surveys		
Map 2d		
Suffolk and Essex		
Key		
Aide/Ore 1993		
Blyth 1993		
Butley River 1993		
Deben 1987-88		
Mersea Island 1993		
Orwell 1989-90		
Stour 1988-90		
Hamford Water 1988-90		
Colne 1992		
8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS		







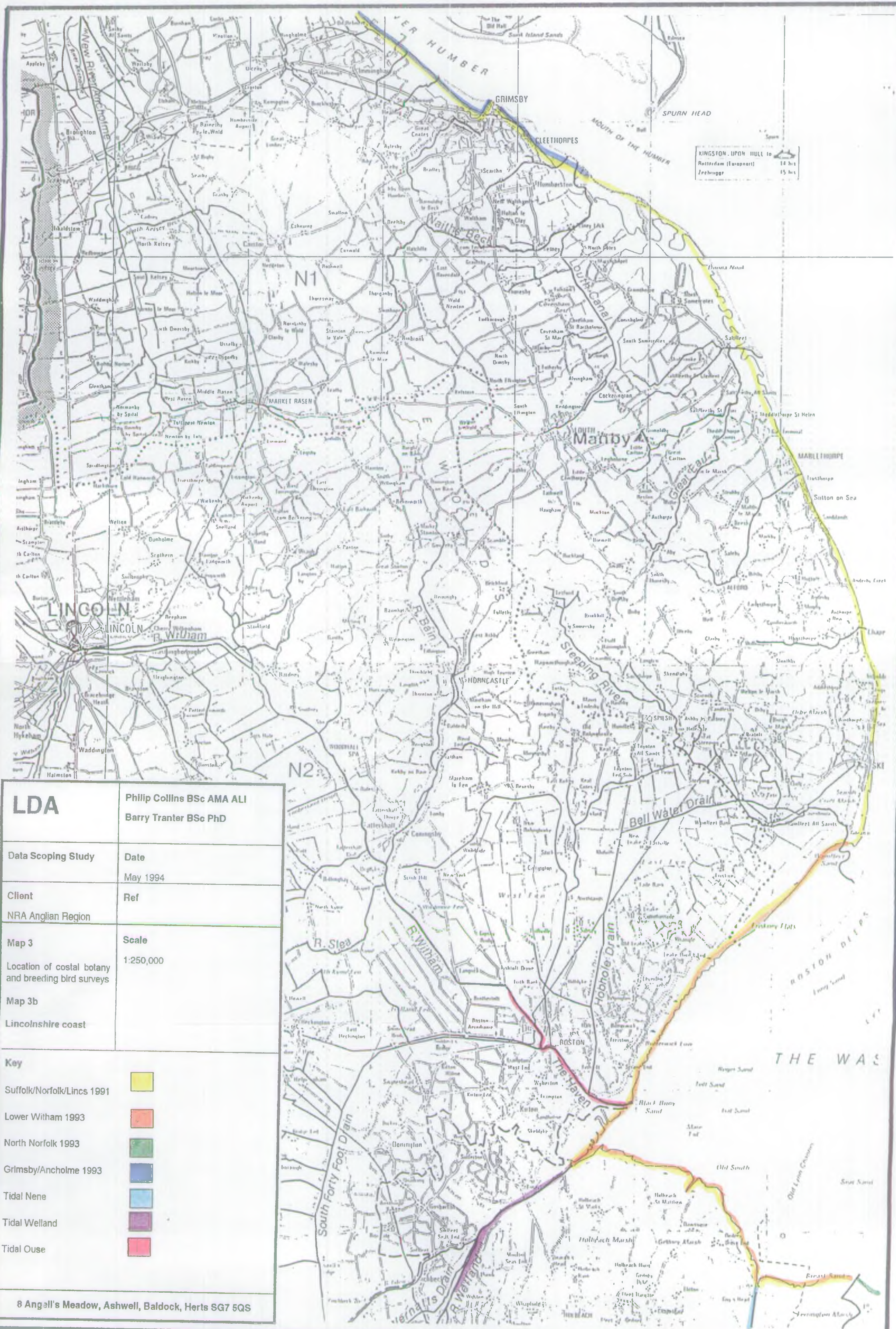


<div> <div></div> <div>LDA</div> </div>	Philip Collins BSc AMA ALI Barry Tranter BSc PhD
Data Scoping Study	Date May 1994
Client NRA Anglian Region	Ref
Map 2. Location of Wader and Wildfowl surveys  Map 2c North Norfolk	Scale 1:250,000
Key  Breydon Estuary  The Wash, Lincs & Norfolk Desk Study	<div> <div></div>  <div></div> </div>
8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS	









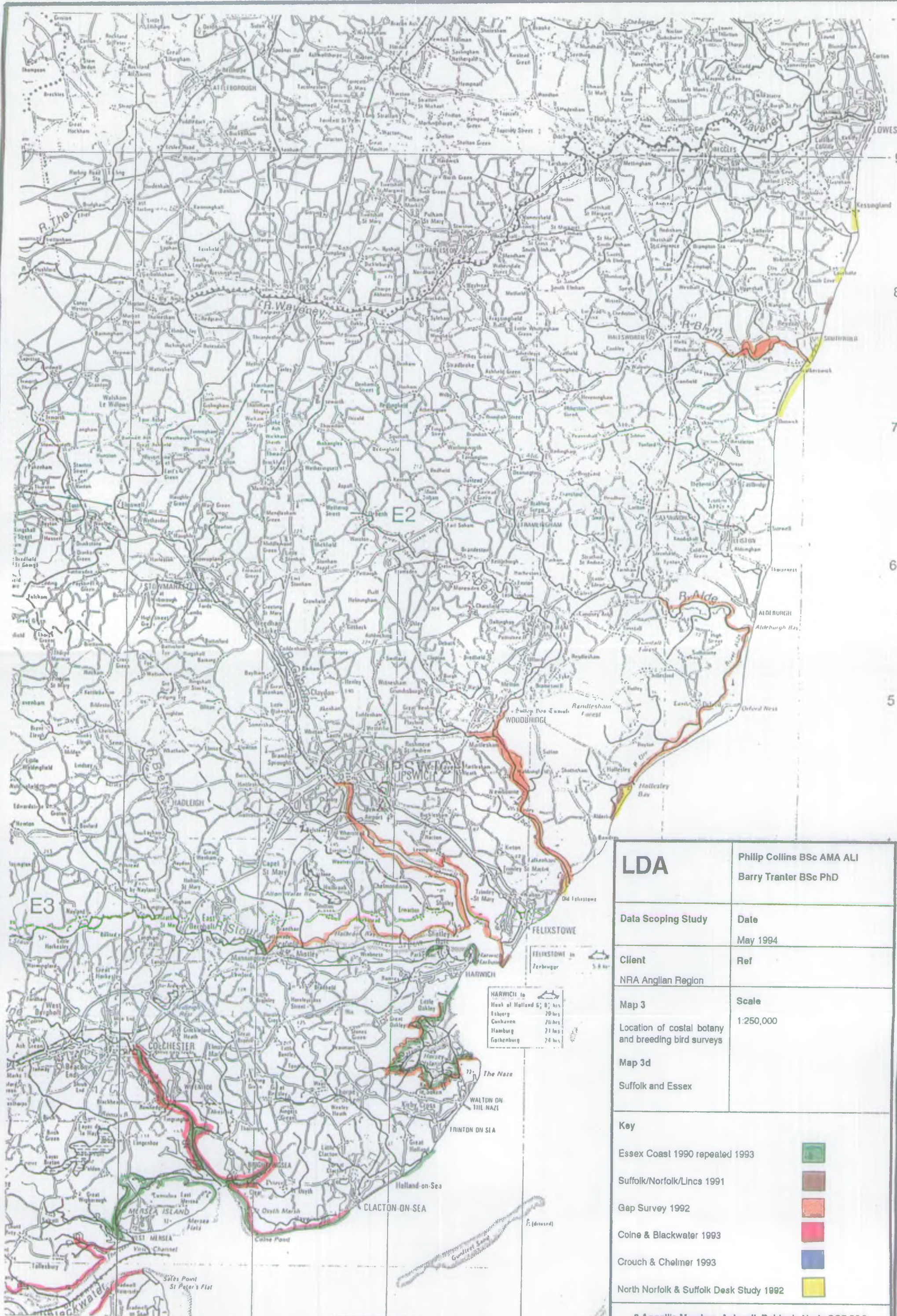
<b>LDA</b>	Philip Collins BSc AMA ALI Barry Tranter BSc PhD
Data Scoping Study	Date May 1994
Client NRA Anglian Region	Ref
Map 3 Location of coastal botany and breeding bird surveys	Scale 1:250,000
Map 3b Lincolnshire coast	
<b>Key</b>	
Suffolk/Norfolk/Lincs 1991	
Lower Witham 1993	
North Norfolk 1993	
Grimsby/Ancholme 1993	
Tidal Nene	
Tidal Welland	
Tidal Ouse	
8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS	









<b>LDA</b>	Phillip Collins BSc AMA ALI Barry Tranter BSc PhD
Data Scoping Study	Date May 1994
Client NRA Anglian Region	Ref
Map 3 Location of coastal botany and breeding bird surveys	Scale 1:250,000
Map 3c North Norfolk	
Key	<div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: yellow; margin-right: 5px;"></div> Suffolk/Norfolk/Lincs 1991 </div> <div style="display: flex; align-items: center; margin-top: 5px;"> <div style="width: 15px; height: 15px; background-color: green; margin-right: 5px;"></div> N. Norfolk 1993 </div> <div style="display: flex; align-items: center; margin-top: 5px;"> <div style="width: 15px; height: 15px; background-color: red; margin-right: 5px;"></div> Desk study 1992 </div>
8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS	







LDA		Phillip Collins BSc AMA ALI Barry Tranter BSc PhD	
Data Scoping Study		Date May 1994	
Client NRA Anglian Region		Ref	
Map 3 Location of coastal botany and breeding bird surveys  Map 3d Suffolk and Essex		Scale 1:250,000	
<b>Key</b>			
Essex Coast 1990 repeated 1993			
Suffolk/Norfolk/Lincs 1991			
Gap Survey 1992			
Colne & Blackwater 1993			
Crouch & Chelmer 1993			
North Norfolk & Suffolk Desk Study 1992			
8 Angell's Meadow, Ashwell, Baldock, Herts SG7 5QS			



