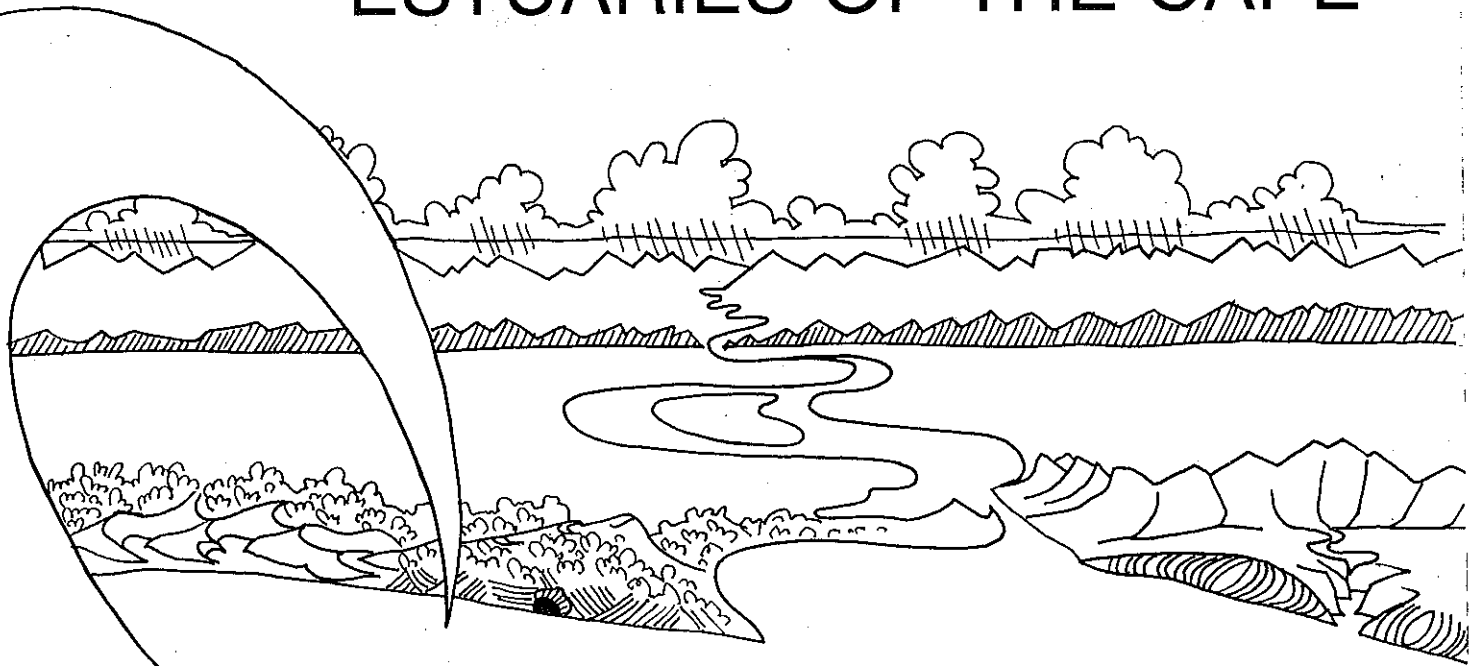


COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
NATIONAL RESEARCH INSTITUTE FOR OCEANOLOGY
ESTUARINE AND COASTAL RESEARCH UNIT – ECRU



ESTUARIES OF THE CAPE



PART II

SYNOPSIS OF AVAILABLE INFORMATION
ON INDIVIDUAL SYSTEMS

EDITORS: A E F HEYDORN
J R GRINDLEY

REPORT NO. 1

SPOEG (CW5)

ESTUARIES OF THE CAPE

PART II: SYNOPSES OF AVAILABLE INFORMATION ON INDIVIDUAL SYSTEMS

REPORT NO. 1: SPOEG (CW5)

(CW5 – CSIR Estuary Index Number)



FRONTISPIECE: SPOEG ESTUARY – ALT. 500 m, ECRU 79-08-14

COMPILED BY : I B BICKERTON

ECRU SURVEY : 17/18 OCTOBER 1980
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Preface :

The Estuarine and Coastal Research Unit (ECRU) was established by the National Research Institute for Oceanology of the CSIR in 1979 with the following aims :

- to contribute information relevant to the development of a cohesive management policy for the South African coastline;
- to compile syntheses of all available knowledge on the 167 estuaries of the Cape between the Kei and the Orange rivers;
- to identify gaps in information and to stimulate research at Universities, Museums and other institutions to fill these.

The Unit was established at the request of the Government and the Department of Water Affairs, Forestry and Environmental Conservation contributes substantially to the running costs.

In 1980 the Unit published its first report under the title "The Estuaries of the Cape, Part I - Synopsis of the Cape Coast, Natural Features, Dynamics and Utilization" (by Heydorn and Tinley) . As the name of the report implies, it is an overview of the Cape Coast dealing with aspects such as climate, geology, soils, catchments, run-off, vegetation, oceanography and of course, estuaries. At the specific request of the Government, the report includes preliminary management recommendations.

The present report is one of a series on Cape Estuaries being published under the general title "The Estuaries of the Cape, Part II." In these reports all available information on individual estuaries is summarized and presented in a format similar to that used in a report on Natal estuaries which was published by the Natal Town and Regional Planning Commission in 1978. It was found however, that much information is dated or inadequate and that the compilation of Part II reports is therefore not possible without brief prior surveys by the ECRU. These surveys are usually carried out in collaboration with the Botanical Research Institute and frequently with individual scientists who have special interests in the systems concerned. One of these is Prof J R Grindley of the University of Cape Town who is co-editor of the Part II series.

These surveys are however not adequate to provide complete understanding of the functioning of estuarine systems under the variable conditions prevalent along the South African coastline. The ECRU therefore liaises closely with Universities and other research institutes and encourages them to carry out longer-term research in selected estuarine systems. In this way a far greater range of expertise is involved in the programme and it is hoped that the needs of those responsible for coastal zone management at Local-, Provincial- and Central Government levels can be met within a reasonable period of time.

Finally, it has been attempted to write the Part II reports in language understandable to the layman. However it has been impossible to avoid technical terms altogether. A glossary explaining these is therefore included in each report.



F P Anderson
DIRECTOR

National Research Institute for Oceanology
CSIR

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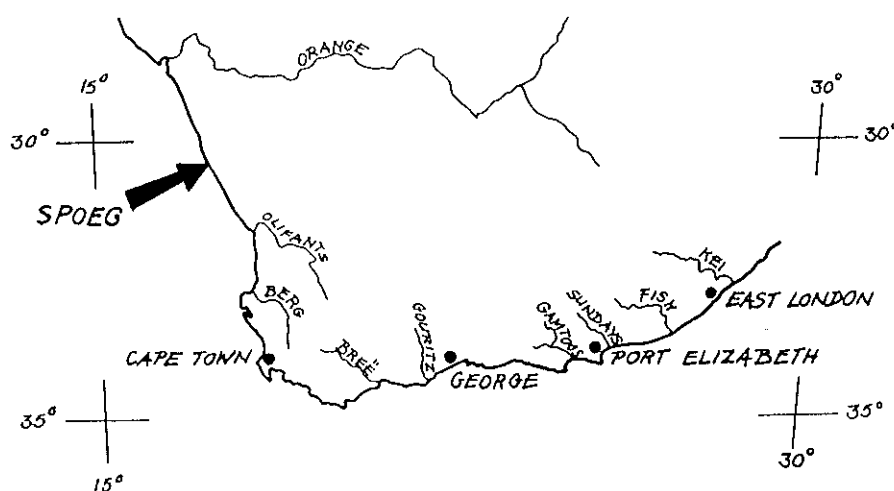
SPOEG

1. SYNONYMS AND DERIVATIONS

No synonyms recorded.

2. LOCATION

30° 28' S 17° 22' E



The mouth of the Spogeg is situated 221 km south of the Orange River mouth, 19 km south of Hondeklipbaai and 47 km north of the Groen River mouth. (1:50 000 Sheet 3017 AD; 1:250 000 Topographical Sheet 3017).

2.1 Accessibility :

Accessible via 18 km of farm roads from the main road to Hondeklipbaai. The turn-off is 15 km inland from Hondeklipbaai. Just past the farm Swartfontein an initially good farm road deteriorates into a sandy track, which can only be traversed by four-wheel drive vehicles (1:50 000 Sheet 3017 AD and ECRU survey.)

3. ABIOTIC CHARACTERISTICS

3.1 Catchment :

Area

1375 km² (Heydorn and Tinley 1980).

River length

The total river length from the Kamiesberg mountains in the catchment to the mouth is approximately 95 km (1:250 000 Topographical Sheet 3017).

Tributaries

Kraairivier, Horeesrivier (1:250 000 Topographical Sheet 3017).

Mean annual run-off

The mean annual rainfall in the upper reaches of the catchment ranges between 100 and 200 mm, whilst in the lower reaches it varies from 50 to 100 mm (Le Roux and Ramsey 1979; Heydorn and Tinley 1980). The Spoeg lies in a region of episodic rainfall (Heydorn and Tinley 1980).

3.2 Flow :

There is no recorded information, but the configuration of the riverbed implies that the river has flowed in the past and is likely to do so on future occasions. A series of pools of water (Plate I) and a lagoon (Plate II) were present in the lower reaches of the riverbed at the time of the ECRU survey.

Much of the riverbed has fine brown silt and some longitudinal sand ridges suggest flood flows at some time in the past. The nature of the vegetation suggests availability of underground water and it is probable that there is considerable underground flow in the sandy riverbed. A meandering flow channel is indicated along the length of the estuary by the predominant occurrence of the sedge Juncus kraussii.

Flood history and level fluctuations

There is no recorded information, but the nature of the river and the valley through which it flows indicate that strong flood flows have occurred in the past. The nature of the riverbed vegetation at the time of the ECRU survey suggested that there had been no flooding in recent times.

3.3 Obstructions :

The farm road to Swartfontein (as mentioned in Section 2.1) crosses the riverbed approximately 8,5 km from the mouth (1:50 000 Sheet 3017 AD) via a low road causeway (Fig. 1). Between this causeway and the mouth, four fences demarcating the diamond concession area cross the riverbed. These fences are situated respectively 200 m, 800 m, 2 km and 5,5 km upstream of the mouth (1:50 000 Sheet 3017 AD).

3.4 Siltation

Fine brown silt covers much of the riverbed, but in the last 2 to 3 km, this is largely overlain by sands.

The Spoeg has a relatively small catchment area and probably only flows into the sea at times of extreme flooding. As the dune covered catchment readily absorbs the run-off (Rogers 1977), the mouth does not appear to be subject to heavy fluvial sediment deposition. This can be seen from aerial photography of the Spoeg, particularly that taken soon after heavy rainfall e.g. Job No. 12 of 1943.

The older dune plumes on the northern banks of the estuary (Fig. 2) have probably originated from the river-borne sands being blown northwards out of the riverbed by the predominant south-westerly winds. These winds predominate in the summer months (Heydorn and Tinley 1980) when there is very little rainfall and most rivers in Namaqualand are dry. The positions of these dune plumes probably reflect periods when sandblows were possible due to dying off of

vegetation in the riverbed, or when floods brought down heavy deposits.



FIG. 1 : Road causeway across the bed of the Spoeg approximately 8,5 km from the mouth, looking upriver. (ECRU 80-10-17)

A terrace on the northern side near the mouth is approximately 1 m above the valley floor (Fig. 2). The terrace consists of fine brown silt with a calcareous layer about 30 cm below the surface in places. Fine fragments of shell are present in the lower layers. The form of this terrace suggests that it is probably related to a past raised sea level.

3.5 Landownership/use :

(a) Catchment

Extensive sheep farming. Some of these farms are owned by De Beers Consolidated Diamond Mines and are leased to the farmers.

Prospecting pits already exist north and south of the river (Aerial Photography, Job No. 348 of 1980).

(b) Around the estuary

The mouth area is marked as a "Place of public resort" (1:50 000 Sheet 3017 AD). Local residents utilize the mouth area for picnicking.

Prospecting pits have recently been established to the north and south of the estuary (Aerial Photography, Job No. 348 of 1980). To the south some of these pits fall into the area designated as "public resort".

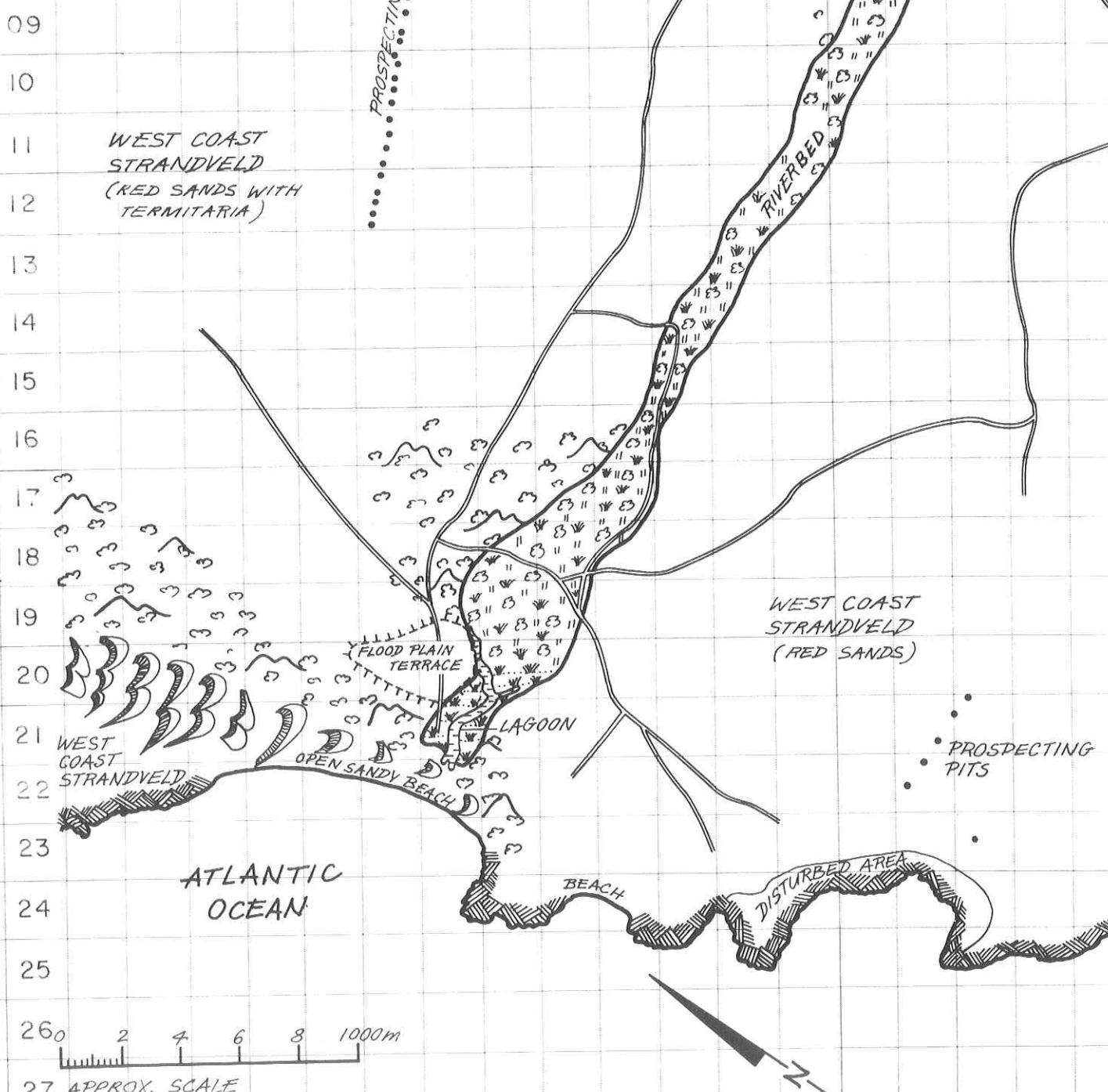
3.6 Local authority :

Namaqualand Divisional Council.

FIG. 2 SPOEG ESTUARY

LEGEND

- ROADS
- OPEN WATER
- VEGETATION-STABILIZED DUNES
- VEGETATED RIVER BED
- MOBILE DUNES
- SALT MARSH
- ROCKS



26 0 2 4 6 8 1000m
 27 APPROX. SCALE

3.7 Estuary uses :

Rough grazing as well as water supply for stock. Limited picnicking as mentioned under 3.5

3.8 Morphometry of the estuary

Area

The water surface area in the lagoon as measured from Aerial Photography, Job No. 326 of 1979, was approximately 1,3 ha.

The lower valley area with evidence of estuarine vegetation up to 3 km from the mouth, is approximately 53 ha as measured from Aerial Photography, Job No. 348 of 1980.

Shape

There is a long straight valley in the estuary area, with an almost flat floor and steeply sloping sides, particularly on the southern bank. Cliffs form the southern bank in the Kliphuis area. A wandering channel which would carry low flow water, can be observed clearly.

The width of the valley varies from 100 to 400 m (1:50 000 Sheet 3017 AD).

Bathymetry

See Table 1 and Fig. 2 with overlay for water depths and channel widths measured during the ECRU survey.

Generally, the water depth was not greater than 1 m and the channel width from 6 to 10 m.

3.9 Geomorphology :

Geology

(After Coward (1981) unpublished)

The geology of the riverbed and inland catchment area is predominated by granites of the Namaqualand-Natal metamorphic complex. Along the coast, these bedrock granites are overlain by unconsolidated sands, with fluvial and terrestrial gravels, shells, limestone and calcrete cappings.

The Spoeg, as is the case with other Namaqualand rivers, has been incised into granite bedrock and can be seen as a small water-course running down a wide shallow valley. The valley is filled with alluvium and rounded granite boulders. Granite outcrops can be seen in places in the valley and also along virtually the whole of the adjacent coastline.

Nature of bottom materials

See Table 1 and Fig.2 with overlay for substrate observations made during the ECRU survey.

Generally all pools and the lagoon have fine-grained muddy bottoms.

Sandbar characteristics

At the time of the ECRU survey there was a 100 m wide sandbar separating the mouth from the sea, with its highest point approximately 1,5 m above sea level. The crest of the sandbar was almost flat (Plate III) but the adjoining beach was steep and of coarser sand than the bar itself.

Configuration of adjacent shore

There are rocky granitic points to the north and south of the Spoeg mouth. These flank a symmetrical arcuate bay (Fig. 2). The beach is steeply sloping and characterized by cusps and troughs indicating circulation cells and rip currents.

3.10 Oceanography :

Major currents

The Namaqualand coastline is under the influence of the northward-flowing Benguela Current and the characteristic upwelling of cold nutrient-rich water of sub-Antarctic and South Atlantic origin. Upwelling is enhanced during summer, by the prevalence of southerly to south-easterly winds, which tend to move inshore surface water away from the coast, thereby making room for the deeper-lying cooler water (Heydorn and Tinley 1980).

The influence of the Benguela Current, combined with predominantly southerly winds, is largely responsible for the cool climate at the coast and the prevalence of fog during the nights and in the mornings.

Waves

The prevailing swells are generated in the South Atlantic and approach the West Coast, predominantly from a south-westerly or south south-westerly direction. They reach a height of over 1,6 m for 50 percent of the time in the nearshore area, as measured at Oranjemund, approximately 233 km to the north of the Spoeg (J Rossouw pers. comm.). Wave frequency at Buchu Bay, approximately 206 km to the north of the Spoeg is 10 - 15 seconds for 95 percent of the waves (Ashby, Harper and Van Schaik 1973).

The wave and swell patterns of the West Coast play a major role in the longshore distribution of marine sediments, erosion and deposition phenomena and hence also in beach and dune formation (Tankard and Rogers 1978).

Surf zone currents

At the time of the ECRU survey, four circulation cells were present along the length of the beach as shown by the presence of rip currents. The major rip was in the southern corner and the overall longshore drift was from north to south.

Tides

The ECRU survey was carried out during neap tides which occurred on 17 October 1980. Low tides were at 02h15 and 15h19 on 17 October 1980 and at 04h09 and 16h57 on 18 October 1980. High tides were at 09h04 and 21h34 on 17 October and at 10h34 and 23h00 on 18 October.

Tidal levels in 1980 for Port Nolloth (142 km north of the Spoeg mouth) were as follows :

LAT	MLWS	MHWS	HAT
-0,21	0,09	1,66	2,03

This gives a tidal range between MLWS and MHWS of 1,57 m and between LAT and HAT of 2,24 m (South African Tide Tables 1980).

3.11 Physico-chemical characteristics :

No data are available other than those collected by the ECRU on 17 and 18 October, 1980. They are summarized in Table 1 below.

TABLE 1 : Physico-chemical data collected during the ECRU survey.
See Fig. 2 with overlay for grid references.

Date		80-10-17	80-10-18	80-10-17	80-10-18
Time		18h30	11h00	17h30	14h30
State of mouth		C L	O S	E D	
State of tide		Incoming, low at 15h19	Outgoing, high at 10h34	Incoming, low at 15h19	Outgoing, low at 16h57
ECRU Grid Ref.		2207	2107	2008	2007
Position of Sampling site		at mouth	100m from mouth	250m from mouth	400m from mouth
Depth (m) at Sampling site		0,5-1,0	0,3-1,0	1,0	0,1-0,4
*Width (m)		0	10	7	6
Diss. O ₂ (mg/l)	Top	No data	8,2	No data	16,0
	Bottom	No data	9,5	No data	16,0
Salinity (‰)	Top	22	25	22	20
	Bottom	22	25	No data	20
Temp. (°C)	Top	21,0	20,2	23,0	22,5
	Bottom	21,9	20,2	22,0	22,5
pH		7,0	7,0	7,0	7,0
Secchi disc transparency(m)		0,5	0,5	0,3	0,1
Water colour		No data	Green	Green/Brown	Milky green
Substrate		Medium sand	Fine mud	Black anoxic silt	Fine sand over- lain by silt

* Estuary/River width at sampling site

These values represent a typical no-flow situation which is likely to be prevalent in this estuary for prolonged periods. Overtopping of the sandbar by storm waves during high-tide conditions, may influence the salinity, as would rare instances of river flow. Under the circumstances it seems obvious that groundwater seepage must be responsible for maintaining water levels and also for imparting at least some measure of stability to the physico-chemical characteristics of this system and furthermore, that the groundwater must be of relatively low salinity. This was confirmed by salinity measurements in pools in the riverbed at Grid references 1611, 1312 and 1013 during the October 1980 visit by the ECRU to the Spoeg. These salinities were 15 parts per thousand, 9 parts per thousand and 6 to 25 parts per thousand respectively. The great variation in salinity in the pool at Grid Ref. 1013 was due to the point of entry of groundwater where the salinity was 6 parts per thousand. Further salinity measurements were made on 11 February 1981, when A E F Heydorn and T J E Heinecken paid a fleeting visit to the Spoeg Estuary with a party of Government Officials. At this time, the salinity at the mouth (Grid Ref. 2207) was 31 parts per thousand whilst at the head of the lagoon (Grid Ref. 2007) it was 10 parts per thousand.

The replenishment of low salinity water through groundwater seepage probably gives this system its unusual ability to support a wide diversity of plant and animal life (See Section 4 below), either permanently or at least for prolonged periods in the arid environment of the Namaqualand coast. This characteristic should be protected if the stability of the system is to be maintained.

Nutrients

Pools in the north-western corner (Grid Ref. 2007) of the estuary, fringed by Phragmites reeds, appeared to be eutrophic at the time of the ECRU survey. This is borne out by the high oxygen levels (16mg/ℓ) measured there. The water was an opaque milky-green colour, possibly indicating a mixed algal and bacterial bloom and there were some blue-green algae present.

Increased nutrient levels probably result from flocks of ducks utilizing this sheltered pool.

Aerial photography (Job 306 of 1978 and Job 326 of 1979) of the Spoeg, suggests that algal blooms occur in the lagoon from time to time.

Other nutrients

No data.

3.12 Pollution :

Sewage, Oil, Metals, Pesticides, Herbicides and Other forms of pollution

There was no evidence of pollution due to any of the above factors at the time of the ECRU survey. No other data are available.

3.13 Public health aspects :

Bacteriology

A milky bloom in pools (Grid Ref. 2007) in the north-western corner of the estuary at the time of the ECRU survey was probably partly bacterial.

Others

No data.

4. BIOTIC CHARACTERISTICS

No information on the plant and animal life of the Spoeg Estuary could be found in the literature. The observations below, made by the ECRU during its two-day visit are superficial but nevertheless give an indication of the importance of the range of animal and plant life of this wetland in an otherwise arid environment.

4.1 Flora :

Phytoplankton/diatoms

The greenish discoloration in pools (Grid Ref. 2007) in the north-western corner of the estuary, suggested the presence of unicellular algae besides bacterial activity. Blue-green algae were observed floating in some pools.

Aquatic vegetation

(a) Estuary

The aquatic grass Potamogeton pectinatus was distributed in pools of water in the riverbed and also in the lagoon. Another aquatic grass Ruppia maritima occurred in the mouth region. There were also creeping Cyperaceae at the mouth.

(b) Adjacent shoreline

The kelp Ecklonia maxima occurs in the nearshore region on the shoreline adjacent to the Spoeg mouth and kelp plants are washed up on the beach in substantial numbers.

Semi-aquatic vegetation

Species found in the riverbed up to 3 km from the mouth, during October 1980, included the following :

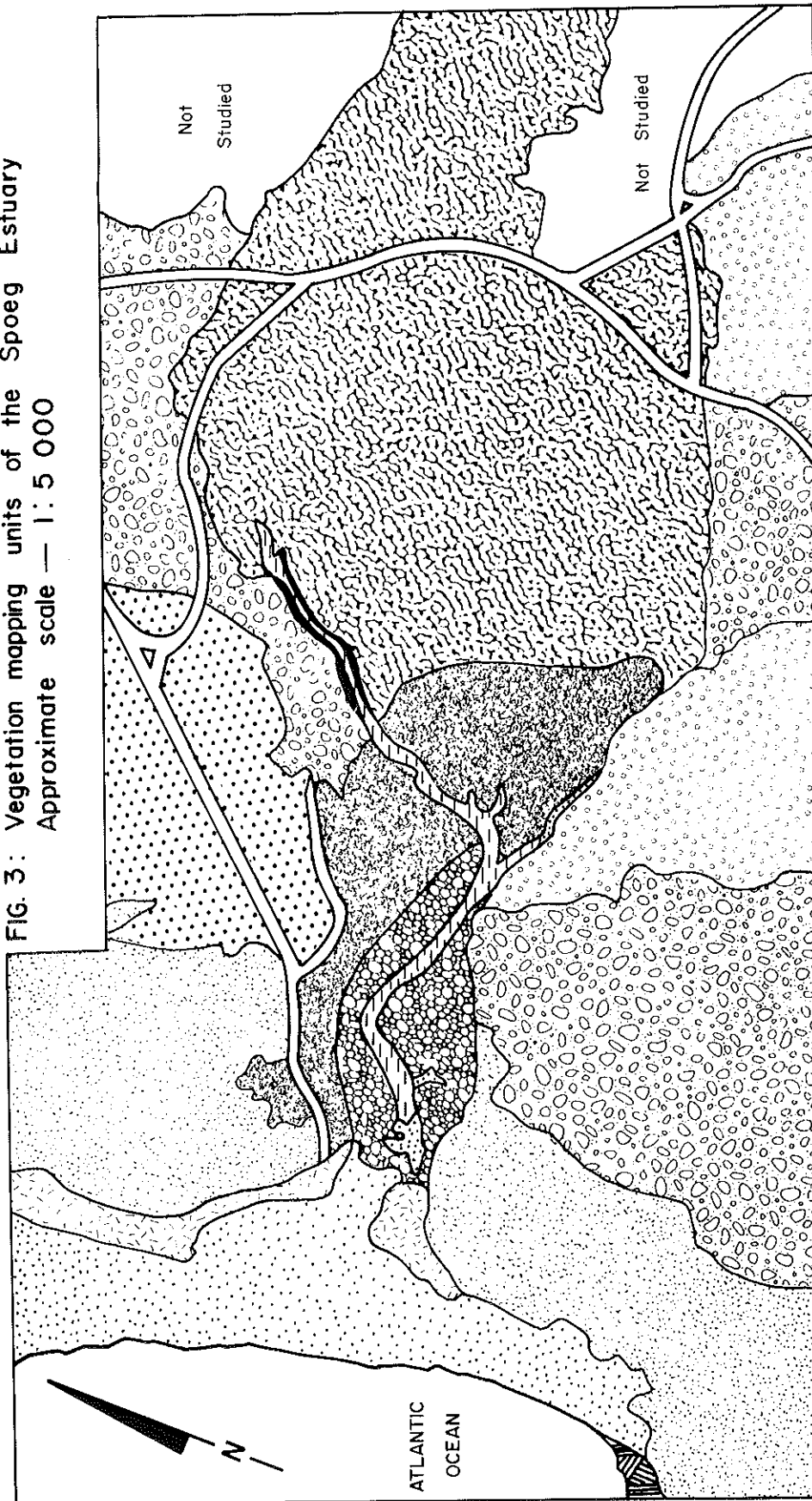
saltmarsh succulents	<u>Sarcocornia pillansii</u>
	<u>Sarcocornia natalense</u>
sea thrift	<u>Limonium scabrum</u>
Sedges	<u>Triglochin bulbosum</u>
	<u>Scirpus nodosus</u>
	<u>Juncus kraussii</u>
reeds	<u>Phragmites australis</u>
grasses	<u>Eragrostis sabulosa</u>
	<u>Paspalum vaginatum</u>

Terrestrial vegetation












(Contribution by Miss R Parsons, Botanical Research Institute, and Miss A le Roux, C P A Department of Nature and Environmental Conservation.)

This region falls into Acocks Veld Type 34 (b), Strandveld Proper, which is described as an open semi-succulent scrub (Acocks 1975).

FIG. 3: Vegetation mapping units of the Spoeeg Estuary
 Approximate scale — 1 : 5 000



LEGEND

- | | | | | | | | | |
|---|------------------------------|----------------|---|-------------------------------|-----------------|---|---|------------------------|
|  | <u>Phragmites australis</u> | Reedswamp |  | Riverbed | Dwarf Shrubland |  | <u>Ruschia</u> sp. (Le Roux & Parsons 63) | Dwarf Shrubland |
|  | <u>Sarcocornia natalense</u> | Saltmarsh |  | <u>Sarcocornia pillansii</u> | Saltmarsh |  | <u>Euclea</u> sp. (Le Roux & Parsons 36) | Dune Shrubland |
|  | Dwarf Shrubland | Dune Community |  | <u>Zygophyllum morgansana</u> | Shrubland |  | <u>Eragrostis cyperoides</u> | Hummock Dune Grassland |
|  | Beach & Open Sand | |  | Rocks | | | | |

Nine main vegetation mapping units were identified and their spatial distribution may be seen in Fig. 3. Species composition within each mapping unit is shown in Appendix I. The Sarcocornia pillansii and Sarcocornia natalense Saltmarsh areas have the highest total cover (100 percent) while the Eragrostis cyperoides Hummock Dune Grassland has the lowest (10 percent). The maximum height of the vegetation varied from 0,2 m (Dwarf Shrubland Dune Community) to the 3,0 m of the Phragmites australis Reedswamp. The highest species diversity is found in the Riverbed Dwarf Shrubland Community (23 spp.) while the Sarcocornia natalense Saltmarsh has the lowest with only one species being recorded.

The vegetation mapping units can be consolidated into five main plant formations : reedswamp saltmarsh, dwarf shrubland, shrubland and grassland. Of these, the dwarf shrubland covers the most extensive area of approximately 22,98 ha followed by the shrubland (22,18 ha), saltmarsh (4,87 ha), grassland (0,95 ha) and reedswamp (0,01 ha).

The vegetation is in good condition and shows no sign of disturbance although there is mining to the north of the river. The riverbed covers an extensive area and there is a mosaic of vegetation with no one species dominant. Higher up the riverbed there is evidence of grazing by sheep. Much lichen was present, especially in the Euclea sp. *(Le Roux and Parsons 36) Dune Shrubland - see Fig. 3.

4.2

Fauna :

Note : As mentioned in Section 4, only cursory observations were possible during the ECRU survey and the lists below should not be interpreted as being representative of all animals in the habitats mentioned.

Zooplankton :

During the ECRU survey, Prof. J R Grindley took a plankton sample which is yet to be analysed. Superficial examination of the sample indicated that small copepods were present in the lagoon.

Fauna on

(a) hard substrates

The following intertidal animals were found to be abundant on the adjacent shoreline, living on the rocks :

Ribbed mussel	<u>Aulacomya ater</u>
Black mussel	<u>Choromytilus meridionalis</u>
Whelk	<u>Argobuccinum argus</u>
Limpets	<u>Patella granitina</u>
	<u>P. granularis</u>
	<u>P. argenvillei</u>
Keyhole limpet	<u>Fissurella mutabilis</u>

(b) soft substrates

The following intertidal animals were found to be common at the mouth of the Spoeg :

Sand mussel	<u>Lutraria lutraria</u>
Isopod	<u>Tylos granulatus</u>

* Le Roux and Parsons species numbers e.g. Le Roux and Parsons 36, refer to specimens unidentified by the B.R.I. at the time of writing.

(c) vegetation

Large numbers of amphipods, Melita zeylanica were present in the water-inundated saltmarsh vegetation at the edges of the lagoon at the time of the ECRU survey.

Insects

Water boatmen (Family: Corixidae) were present in the lagoon during the ECRU survey.

Other invertebrates

Cuttlefish shells (Sepia officianalis) were found on the adjacent shoreline and the dried shells of terrestrial snails were seen around the estuary during the ECRU survey.

Fish

During the ECRU survey, gill netting the lagoon (Grid Ref. 2107) for a period of 16 hours overnight, yielded 3 mullet. The catch was made up of two large Mugil cephalus (total length 57 cm and 50 cm) and one specimen of Myxus capensis which had a total length of 37 cm.

Reptiles and Amphibians

During the ECRU survey numerous geckos and skinks were seen.

Birds

Although the lagoon at the mouth of the Spoeg has a surface area of only about 1,3 ha, a relatively large number of water birds were found there during the ECRU survey. The following species were recorded :

Lagoon

<u>Roberts No.</u>	<u>Species</u>	<u>No. seen</u>
6	Dabchick	1
90	South African Shelduck	2
98	Cape Teal	14 (3 juveniles)
212	Red-knobbed Coot	20
235	White-fronted Sandplover	8
242	Crowned Plover	2
245	Blacksmith Plover	2
251	Curlew Sandpiper	14
253	Little Stint	1
255	Sanderling	4
256	Ruff	6
258	Common Sandpiper	2
269	Avocet	7
289	Hartlaub's Gull	2
290	Caspian Tern	1

River valley (up to 3 km from mouth)

<u>Roberts No.</u>	<u>Species</u>
123	Cape Rock Kestrel (nest with 5 chicks)
169	Black Harrier
181	Cape Francolin

217	Kori Bustard
307	Namaqua Sandgrouse
383	White-rumped Swift
506	Rock Martin
525	Grey Tit
566	Karoo Chat
570	Familiar Chat
576	Stone Chat
583	Karoo Robin
621	Crombek
638	Grey-backed Cisticola
650	Karoo Prinia
686	Cape Wagtail
722	Bokmakierie
760	Lesser Double - collared Sunbird
786	Cape Sparrow
866	Yellow Canary
873	Cape Bunting

Mammals

During the ECRU survey a dead Cape Fur Seal pup (Arctocephalus pusillus) was found on the beach. Localized colonies of Cape Fur Seals are found along the Namaqualand shoreline (A E F Heydorn pers. comm.)

A porcupine (Hystrix africae-australis) skull was found in the vicinity of the estuary.

The tracks of the following mammals were also seen :

Steenbok	<u>Raphicerus campestris</u> (abundant)
Grey Duiker	<u>Sylvicapra grimmia</u>
Bat-eared Fox	<u>Otocyon megalotis</u>
Water Mongoose	<u>Atilax paludinosus</u> (abundant)

In addition mole rat mounds were noted and there was evidence of abundant rodents. During the visit by ECRU personnel on 11 February 1981, a steenbok (R. campestris) and a Red Meerkat (Cynictis penicillata) were sighted.

The following additional mammals have been recorded by Stuart, Lloyd and Herselman (1980) in the vicinity of the Spoeg.

Bush Karoo Rat	<u>Otomys unisulcatus</u>
Brants Karoo Rat	<u>Parotomys brantsi</u>
South African Pygmy Gerbil	<u>Desmodillas auricularis</u>

5. SYNTHESIS

The state of knowledge of the Spoeg is largely limited to the information obtained during the ECRU survey of 17/18 October 1980. Information on the flood history, in particular, is lacking.

Although a substantial sandbar separated the mouth of the Spoeg from the sea at the time of the ECRU visit, it is nevertheless regarded as an estuary for the following reasons :

- (1) The saltmarsh/lagoon system which contains substantial amounts of water even during drought periods.
- (2) The likelihood of temporary connection with the sea subsequent to flow periods.

- (3) The likelihood of extensive overtopping of the sandbar by storm waves during high tide periods.

It appears that, during dry periods, when there is no surface run-off and the mouth is closed, a substantial waterbody is maintained in the lagoon by subsurface freshwater seepage (Plate II and Fig. 4).

Under these conditions, the evaporative water loss is largely replaced by subsurface inflow, thereby preventing the escalation of salinities in the main body of the lagoon. Maintenance of such a water body probably allows the extended survival of many aquatic organisms which are intolerant of hypersaline conditions. At the time of the ECRU survey, these ranged from small planktonic forms of life to exceptionally large mullet which must have been present in the lagoon for several years.



FIG. 4 : Upper reaches of lagoon, and floodplain of Spoeg Estuary, from southern bank, looking northwards. (ECRU 80-10-17)

The ecological importance of the Spoeg estuary as a wetland habitat was further substantiated by the fact that seventeen species of water-associated birds were recorded there during the ECRU survey. This is particularly significant when considering that the surface area of the lagoon was only 1,3 ha at the time.

Although diamond prospecting has been carried out to the north and south of the estuary (Fig. 2), the estuary itself is virtually undisturbed and has retained its natural features. The system is not only of great aesthetic beauty, but because of the animal and plant life which it supports in this predominantly arid region, it is of potential ecological importance. It is therefore felt strongly that these unique environmental features should be preserved by the granting of conservation status to the area, and that it be protected against the inroads of the mining industry, which are so evident elsewhere along the Namaqualand Coast.

6. ACKNOWLEDGEMENTS

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Mr E van Wyk of the farm Swartfontein kindly allowed the ECRU survey team access to the Spoeg Estuary and also to camp on his farm. De Beers Consolidated Diamond Mines granted permission for the survey to be carried out in areas under their jurisdiction and this is gratefully acknowledged. The survey was carried out at the request and with the financial support of the Dept. of Water Affairs, Forestry and Environmental Conservation. The encouragement of this Department, the Cape Estuaries Steering Committee and the S.A. National Committee for Oceanographic Research is gratefully acknowledged.

GLOSSARY OF TERMS USED IN PART II REPORTS

- abiotic: non-living (characteristics).
- aeolian (deposits): materials transported and laid down on the earth's surface by wind.
- alien: plants or animals introduced from one environment to another, where they had not occurred previously.
- alluvium: unconsolidated fragmental material laid down by a river or stream as a cone or fan, in its bed, on its floodplain and in lakes or estuaries, usually comprised of silt, sand or gravel.
- anaerobic: lacking or devoid of oxygen.
- anoxic: the condition of not having enough oxygen.
- aquatic: growing or living in or upon water.
- arcuate: curved symmetrically like a bow.
- barchanoid (dune): crescent-shaped and moving forward continually, the horns of the crescent pointing downwind.
- bathymetry: measurement of depth of a water body.
- benthic: bottom-living.
- berm: a natural or artificially constructed narrow terrace, shelf or ledge of sediment.
- bimodal: having two peaks.
- biogenic: originating from living organisms.
- biomass: a quantitative estimation of the total weight of living material found in a particular area or volume.
- biome: major ecological regions (life zones) identified by the type of vegetation in a landscape.
- biotic: living (characteristics).
- breaching: making a gap or breaking through (a sandbar).
- calcareous: containing an appreciable proportion of calcium carbonate.
- calcrete: a sedimentary deposit derived from coarse fragments of other rocks cemented by calcium carbonate.
- Chart Datum: This is the datum of soundings on the latest edition of the largest scale navigational chart of the area. It is -0,900 m relative to land levelling datum which is commonly called Mean Sea Level by most land surveyors.
- coliforms: members of a particularly large, widespread group of bacteria normally present in the gastro-intestinal tract.
- community: a well defined assemblage of plant/or animals clearly distinguishable from other such assemblages.
- conglomerate: a rock composed of rounded, waterworn pebbles 'cemented' in a matrix of calcium carbonate, silica or iron oxide.
- culm: a sand spit or beach ridge usually at right angles to the beach formed by sets of constructive waves.
- "D" net: a small net attached to a "D" shaped frame riding on skids and pulled along the bottom of the estuary, used for sampling animals on or near the bottom.
- detritus: organic debris from decomposing plants and animals.
- diatoms: a class of algae with distinct (brown) pigments and siliceous cell walls. They are important components of phytoplankton.
- dynamic: relating to ongoing and natural change.
- ecology: the study of the structure and functions of ecosystems, particularly the dynamic co-evolutionary relationships of organisms, communities and habitats.
- ecosystem: an interacting and interdependent natural system of organisms biotic communities and their habitats.
- eddies: a movement of a fluid substance, particularly air and water, within a larger body of that substance.
- endemic: confined to and evolved under the unique conditions of a particular region or site and found nowhere else in the world.
- enon: most striking formation in the Cape. Crammed with pebbles and boulders, phenomenally embedded and massive, yellow or brilliantly red in colour, producing remarkable hills. Curiously carved into crags and hollows.

epifauna: animal life found on the surface of any substrate such as plants, rocks or even other animals.

epiphyte: a plant living on the surface of another plant without deriving water or nourishment from it.

episodic: sporadic and tending to be extreme.

estuary: a partially enclosed coastal body of water which is either permanently or periodically open to the sea and within which there is a measurable variation of salinity due to the mixture of sea water with fresh water derived from land drainage (Day 1981).

eutrophication: the process by which a body of water is greatly enriched by the natural or artificial addition of nutrients. This may result in both beneficial (increased productivity) and adverse effects (smothering by dominant plant types).

flocculation (as used in these reports): the settlement or coagulation of river borne silt particles when they come in contact with sea water.

fluvial (deposits): originating from rivers.

food web: a chain of organisms through which energy is transferred. Each "link" in a chain feeds on and obtains energy from the preceding one.

fynbos: literally fine-leaved heath-shrub. Heathlands of the south and south-western Cape of Africa.

geomorphology: the study of land form or topography.

gill net: a vertically placed net left in the water into which fish swim and become enmeshed, usually behind the gills.

habitat: area or natural environment in which the requirements of a specific animal or plant are met.

halophytes: plants which can tolerate salty conditions.

HAT (Highest Astronomical Tide) and LAT (Lowest Astronomical Tide): HAT and LAT are the highest and lowest levels respectively, which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions; these levels will not be reached every year. HAT and LAT are not the extreme levels which can be reached, as storm surges may cause considerably higher and lower levels to occur (South African Tide Tables 1980).

hummock (dune): a low rounded hillock or mound of sand.

hydrography: the description, surveying and charting of oceans, seas and coastlines together with the study of water masses. (flow, floods, tides etc.).

hydrology: the study of water, including its physical characteristics, distribution and movement.

indigenous: belonging to the locality; not imported.

intertidal: generally the area which is inundated during high tides and exposed during low tides.

isohyets: lines on maps connecting points having equal amounts of rainfall.

isotherms: lines on maps joining places having the same temperature at a particular instant, or having the same average, extremes or ranges of temperature over a certain period.

lagoon: an expanse of sheltered, tranquil water. (Thus Langebaan lagoon is a sheltered arm of the sea with a normal marine salinity; Knysna lagoon is an expanded part of a normal estuary and Hermanus lagoon is a temporarily closed estuary (Day 1981)).

limpid: clear or transparent.

longshore drift: a drift of material along a beach as a result of waves breaking at an angle.

littoral: applied generally to the seashore. Used more specifically it is the zone between high- and low-water marks.

macrophyte: any large plant as opposed to small ones. Aquatic macrophytes may float at the surface or be submerged and/or rooted on the bottom.

marls: crumbly mixture of clay, sand and limestone, usually with shell fragments.

matrix: medium in which a structure is embedded.

meiofauna: microscopic or semi-microscopic animals that inhabit sediments but live quite independently of the macrofauna, or benthos.

metamorphic: changes brought about in rocks within the earth's crust by the agencies of heat, pressure and chemically active substances.

MHWS (Mean High Water Springs) and MLWS (Mean Low Water Springs): the height of MHWS is the average, throughout a year when the average maximum declination of the moon is 23°, of the height of two successive high waters during those periods of 24 hours (approximately once a fortnight) when the range of the tide is greatest. The height of MLWS is the average height obtained by the two successive low waters during the same periods (South African Tide Tables 1980).

morphometry: physical dimensions such as shape, depth, width, length etc.

osmoregulation: the regulation in animals of the osmotic pressure in the body by controlling the amount of water and/or salts in the body.

pathogenic: disease producing.

photosynthesis: the synthesis of carbohydrates in green plants from carbon dioxide and water, using sunlight energy.

phytoplankton: plant components of plankton.

piscivorous: fish eating.

plankton: microscopic animals and plants which float or drift passively in the water.

quartzite: rock composed almost entirely of quartz recemented by silicon. Quartzite is hard, resistant and impermeable.

riparian: living on the banks of rivers or streams.

rip current: the return flow of water which has been piled up on the shore by waves, especially when they break obliquely across a longshore current.

salinity: the proportion of salts in pure water, in parts per thousand by mass. The mean figure for the sea is 34,5 parts per thousand, written 34,5 ‰.

secchi disc: a simple instrument used to measure the transparency of water.

sheet flow: water flowing in thin continuous sheets rather than concentrated into individual channels.

slipface: the sheltered leeward side of a sand-dune, steeper than the windward side.

teleost: modern day bony fishes (as distinct from cartilagenous fishes).

trophic level: a division of a food chain defined by the method of obtaining food either as primary producers, or as primary, secondary or tertiary consumers.

trough: a crescent shaped section of beach between two cusps.

wetlands: areas that are inundated or saturated by surface or ground water frequently enough to support vegetation adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

zooplankton: animal components of plankton.

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APPENDIX I

Species composition and physical features of the vegetation mapping units of the Spoeg Estuary.

	Phragmites australis Reedswamp	Sarcocornia natalense Salmarsh	Sarcocornia pillansii Salmarsh	Dwarf Shrubland Dune Community	Zygochloa montana Shrubland	Riverbed Dwarf Shrubland	Ruschia sp (Le Roux & Parsons 63) Shrubland	Euclea sp (Le Roux & Parsons 36) Shrubland	Fragrostis cymatodes Hummock Dune Grassls	Open water	Beach and Open sand	Rocks	Roads	Total
Total Cover (%)	90	100	100	55	45	90	40	35	10					
Height (m)	0-3,0	0-0,5	0-0,5	0-0,2	0-1,5	0-0,5	0-0,5	0-0,75	0-0,25					
Area (ha)	0,01	1,48	3,39	3,42	10,71	14,58	4,98	11,47	0,95	0,47	4,41	0,10	1,23	57,2
% of Studied Area	0,02	2,59	5,93	5,98	18,72	25,49	8,71	20,05	1,66	0,82	7,71	0,18	2,15	100,01
<i>Phragmites australis</i>	*													
<i>Paspalum sp.</i> (Le Roux & Parsons 65)	*													
<i>Sarcocornia natalense</i>		*												
<i>Sarcocornia pillansii</i>			*											
<i>Juncus sp.</i> (Le Roux & Parsons 27)			*											
<i>Eragrostis sabulosa</i>				*			*							
<i>Psilocaulon sp.</i> (Le Roux & Parsons 6)				*										
<i>Pteronia sp.</i> (Le Roux & Parsons 60)				*										
<i>Pentzia suffruticosa</i>				*										
<i>Limonium equisetinum</i>				*										
<i>Hypericis sp.</i> cf. <i>angrae-pequenae</i>				*										
<i>Chaetobromus dregeanus</i>				*			*							
<i>Drosanthemum sp.</i> (Le Roux & Parsons 4)				*										
<i>Galenia fruticosa</i>				*										
<i>Didelta carnosus</i> var. <i>tomentosa</i>				*										
<i>Tetragonia fruticosa</i>				*										
<i>Othonna floribunda</i>				*										
<i>Asparagus capensis</i> var. <i>littoralis</i>				*										
<i>Melanthus comosus</i>				*										
<i>Arctotis decurrens</i>				*										
<i>Lebeckia cinerea</i>				*										
<i>Helichrysum sp.</i> (Le Roux & Parsons 52)				*										
<i>Osteospermum oppositifolium</i>				*										
<i>Salsola sp.</i> cf. <i>Zeyheria</i>				*										
<i>Senecio sp.</i> (Le Roux & Parsons 48)				*										
<i>Scirpus nodosus</i>				*										
<i>Nemisia sp.</i> (Le Roux & Parsons 55)				*										
<i>Senecio littoralis</i>				*										
<i>Helichrysum sp.</i> (Le Roux & Parsons 47)				*										
<i>Lycium sp.</i> (Le Roux & Parsons 3)				*										
<i>Ruschia sp.</i> (Le Roux & Parsons 63)				*										
<i>Ruschia sp.</i> (Le Roux & Parsons 64)				*										
<i>Cephalophyllum spongiosum</i>				*										
<i>Pteronia sp.</i> (Le Roux & Parsons 57)				*										
<i>Lampranthus sp.</i> (Le Roux & Parsons 29)				*										
<i>Euclea sp.</i> (Le Roux & Parsons 36)				*										
<i>Pharnaceum microphyllum</i>				*										
<i>Helichrysum sp.</i> cf. <i>niveum</i>				*										
<i>Pteronia sp.</i> (Le Roux & Parsons 61)				*										
<i>Trachyandra divaricata</i>				*										
<i>Helichrysum sp.</i> (Le Roux & Parsons 60a)				*										
<i>Gazania sp.</i> cf. <i>rigida</i>				*										
<i>Carpobrotus sp.</i> (Le Roux & Parsons 73)				*										
<i>Arctotheca populifolia</i>				*										
<i>Eragrostis cymatodes</i>				*										
<i>Zygochloa montana</i>				*										

PLATE I :

Spoeg Riverbed approximately 1,5 km upstream of the mouth (Grid Ref. 1611) showing saline pool fringed with estuarine vegetation.

(ECRU 80-10-17)

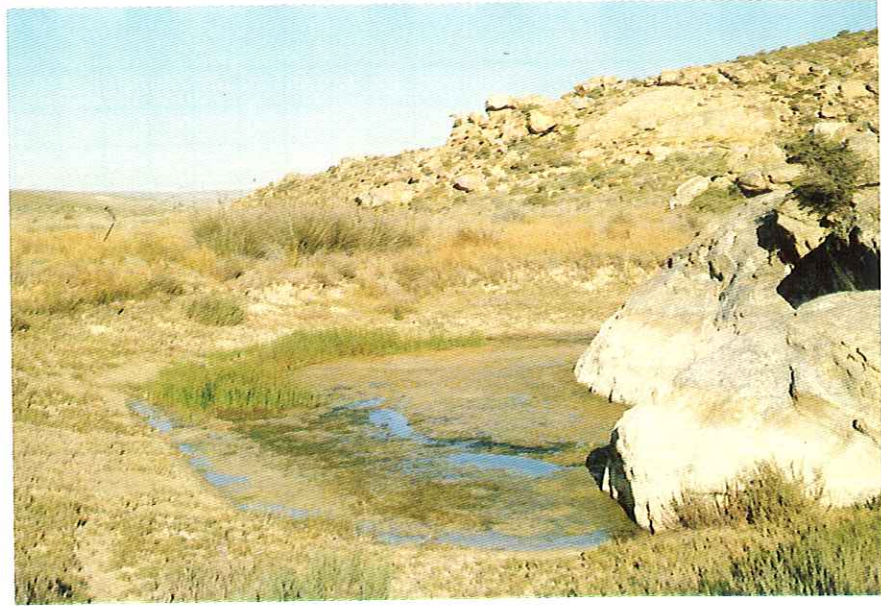


PLATE II :

Lagoon at mouth of Spoeg Estuary from southern bank showing well-defined water body surrounded by saltmarsh vegetation (Sarcocornia spp.) on floodplain.

(ECRU 80-10-17)



PLATE III :

Sandbar and lagoon at mouth of Spoeg.

(ECRU 80-10-17)

