APPENDIX D

SPECIALIST REPORT ON INVERTEBRATES

SPECIALIST REPORT ON INVERTEBRATES OF THE ORANGE RIVER MOUTH AREA

TH Wooldridge

Department of Zoology, University of Port Elizabeth

INTRODUCTION

Relatively little information exists on the invertebrate fauna of the Orange River Mouth. Brown (1959) described the estuarine fauna as 'extremely poor' and ascribed this to extreme changes in salinity between summer and winter. The information was based on a 5-day visit to the area in July of 1956 by the Zoology Department at the University of Cape Town. At that time, the team concentrated on the macrofauna present in intertidal areas along the south bank. The northern bank was not accessible to the party because of diamond mining operations in the area.

Both Brown (1959) and Day (1991) concluded that the Orange River does not have a 'real estuary' and classed the system as a river mouth. This description was also used by Whitfield (2000) in his general classification of South African estuaries.

None-the-less, the lower Orange River Mouth area (includes the lower 10 km of the river approximately) is of considerable conservation importance and was declared a RAMSAR site in 1991. Extensive wetlands are a feature of the area (Fig 1) and it is currently the only RAMSAR site in the arid Northern Province (Northern Cape Directorate Environment and Conservation and the Namibian Ministry of Environment and Tourism (2002). Counts of wetland birds in the 1980s showed that waterbird numbers and species richness could exceed 26 000 individuals (Dec 1985) and nearly 60 species, respectively.

GENERAL DESCRIPTION

The system of rivers that feed the Orange River is extensive, covering a large part of the summer rainfall area in the central part of the country. Morant & O'Callaghan (1990) document a catchment area of 549 000 km^2. Although inland summer rainfall is sometimes heavy, the coastal region is extremely arid. Cowan (1995) notes that the annual average precipitation of the Orange River Mouth is only 50 mm and occurs mainly in winter. However, coastal fog is a frequent occurrence and can persist until midmorning. A sandbar may close the mouth during the winter dry season, which then opens with the onset of summer rains in the interior.

Seasonal changes in river flow vary considerably. At times of flooding, banks along the lower 10 km become inundated and the river can reach up to 2.5 km in width (Day 1981). Maximum channel depth attains 14 metres. The strong river flow leads to freshwater conditions along the channel and the plume can extends for several kilometres offshore. During low flow periods, the lower reaches do not exceed 1.5 km in width having a maximum depth of about 2 metres (Day 1981). The mouth becomes constricted to about 30 m and during very dry years and mouth closure is possible. Extensive marshes occur along the south bank inside the river mouth. The river mouth, mudflats, intrafluvial marshlands, inlets near the mouth and adjacent pans at one time provided a large area of sheltered shallow water.

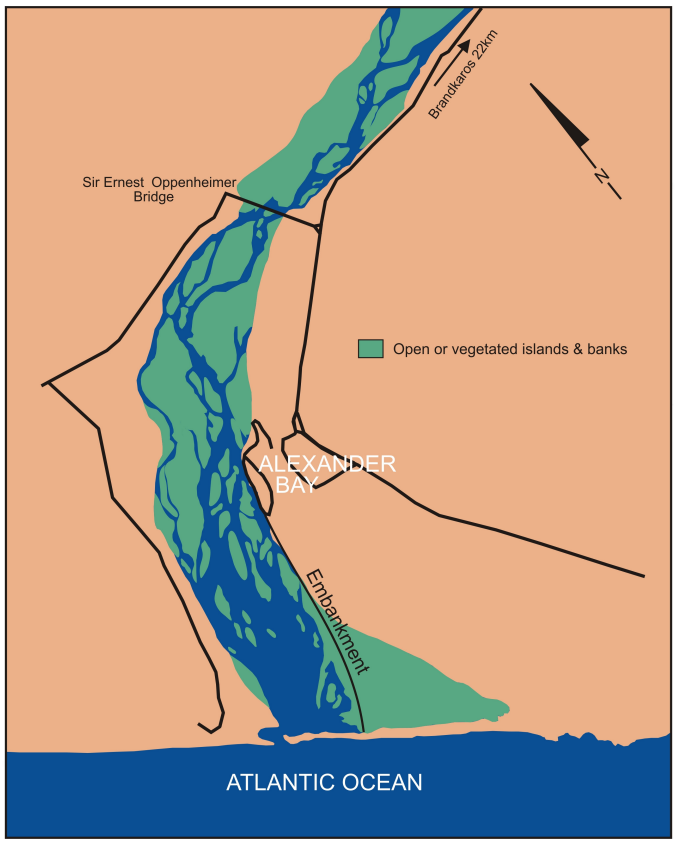

Fig.1. The Orange River Mouth area showing the network of islands and mudbanks prior to a major flood in March 1988. The Ernest Oppenheimer Bridge is approximately nine kilometres from the sea. Mudbanks particularly change in configuration as floods scour the lower reaches. Modified from Morant & O'Callaghan (1990).

ABIOTIC CONDITIONS

The highest average maximum air temperature occurs in January (24.4°C) and the lowest average minimum temperature of 8.5°C occurs in July (Cowan 1995). Brown (1959) recorded a sea temperature of around 14°C and stated that this did not change appreciably between seasons. Estuarine water temperatures on the other hand are highly variable, ranging from near 14°C to over 25°C upstream.

Around the low tide mark at the mouth, the sediment is coarse and is composed of a mixture of sand and gravel. Percentage fine material and organic matter is also negligible in these sandy substrata. Sediment characteristics change abruptly inside the mouth when the estuarine sediment changes to fine mud. Percentage available organics also increases slightly (1.2%). Fine muds extend upstream for at least 8 km, the limit of the study undertaken by Brown (1959). When the substratum on the south bank was sampled, Brown (1959) recorded the presence of H_2S within 1 cm of the surface.

The estuary itself is shallow, exceeding 2 m in few places when the mouth is open. At times of floods, depth may increase up to 14 m as indicated by driftwood along the banks. The water may become extremely turbid and at the time of Brown's visit (July), a sechii disc was not visible at 25 cm water depth. Salinity values inside the mouth vary considerably and are dependent upon the state of the mouth, tide and river flow pattern. Around low spring tide, brackish water values of 4.5 and 6.3 were recorded on either side of the mouth, but increased above 34 on the high tide the following day (Brown 1959).

THE ESTUARINE MACROBENTHOS

At the times of Brown's visit, no intertidal benthic organisms were recorded along 8 km investigated upstream of the mouth. No samples were collected subtidally or in the backwater regions along the south bank. Four species were collected from sand in the supratidal zone (Table 1).

Table 1. Invertebrates recovered by Brown (1959) from samples collected in sandy substrata in the supratidal zone near the mouth.

Species	Maximum abundance recorded
Amphipoda	
Talorchestia quadrispinosa	54
Isopoda	
Tylos granulatus	-
Insecta	
Lamproscatella dichaeta	-
Philonthus sp.	-

Plankton netting met with little success, and a single isopod (*Eurydice longicornis*), a beetle and a few copepods were collected near the mouth. Samples collected in the backwaters were marginally richer, with nine *E.longicornis,* one beetle larva and seventeen copepods netted.

The paucity of invertebrates in main channel reaches was also evident in a study undertaken in 1987 (Morant & O'Callaghan 1990). Sampling was undertaken below the Ernest Oppenheimer Bridge (nine kilometres from the sea). No estuarine invertebrate species were found, although the freshwater bivalve (*Corbicula africana*) and the riverine shrimp (*Caridina nilotica*) were recorded. At that time, spring tide penetration of seawater extended 2.5 km upstream. Morant & O'Callaghan (1990) also state that the biota of the Orange River mouth must have evolved under a flow regime that varied between almost no fluvial input to extreme floods. These floods obviously scour the system and components of the biota then recolonize between flood events.

MONITORING REQUIREMENTS

Because of the paucity of information available on invertebrates in the lower Orange River Mouth area (subtidal component particularly), it will be necessary to undertake a full sampling programme. This will involve a comprehensive set of sites below the Ernest Oppenheimer Bridge, concentrating stations in the lower three kilometers particularly. The saltmarsh area on the south bank must be included, as well as a number of sites in the braided channel region. A total of about 20 subtidal and intertidal sites should be identified. A minimum of four trips should be undertaken and spread over two years (Two summer trips and two winter trips).

Biological sampling

Invertebrate categories that should be sampled are:

- Subtidal benthic invertebrates – collected with a benthic grab (200 cm^2 bite) and the contents sieved through a 500 µm mesh screen. Nine replicates should be taken at each site. Diurnal sampling.
- Intertidal benthic invertebrates – collected with a benthic corer (100 mm internal diameter) down to a depth of 25 cm. The core should then be sieved through a 500 µm mesh screen. Nine replicates should be taken at each site. Diurnal sampling.
- Macrozooplankton sampled at night and retained by a 200 µm mesh net. Nocturnal sampling.
- Hyperbenthos (retained by a 500 µm mesh net). Diurnal sampling.

Abiotic sampling

The following parameters should be recorded/collected at each of the biological sampling sites and on each occasion, although the suite of parameters will be site dependent: Readings at subtidal sites should be taken at the surface and thereafter at 0.5 m depth intervals. A sediment sample must be collected at all sites and analysed for particle size and organic content.

- Salinity
- Temperature
- Oxygen – percent saturation as well as in mg/l
- pH
- conductivity
- chlorophyll *a*
- turbidity
- water depth

REFERENCES

Brown, A.C. 1959. The ecology of South African estuaries Part IX: Notes on the estuary of the Orange River. Trans. Roy. Soc. S. Afr. **35**: 463-473.

Cowan, G.I. 1995. Appendix 1. Wetlands of International Importance listed by South Africa. In: Wetlands of South Africa (Cowan, G.I. ed.). Department of Environmental Affairs and Tourism, Pretoria. pp12 – 20.

Day, J.H. 1981. Chapter 14. Summaries of current knowledge of 43 estuaries in southern Africa. In: Day J.H. (ed), Estuarine Ecology with particular reference to southern Africa. A.A. Balkema, Cape Town. pp. 251-329.

Morant , P.D. & O'Callaghan, M. 1990. Some observations on the impact of the March 1998 flood on the biota of the Orange River mouth. Trans. Roy. Soc. S. Afr. 47: 295-305.

Northern Cape Directorate Environment & Conservation and the Namibian Ministry of Environment and Tourism 2002. Conservation area management plan. Orange River Mouth Transboundary RAMSAR site (ORMTS). 71 pp.

Whitfield, A.K. 2000. Available scientific information on individual South African estuarine Systems. WRC Report no. 577/3/00