

6.

GENERAL SUMMARY & RECOMMENDATIONS

6.1 Introduction

In order to effectively manage coastal resources, decisions should be made based on sound scientific information and with an agreed and attainable objective for the future state of the coast. Progress toward achieving these goals should be monitored against the pre-existing baseline. In an assessment of the current state of scientific knowledge of South African estuaries, Whitfield (1995) concluded that, of the 250 systems assessed, the state of information of 68% was “nil” to “poor”. Of the remaining estuaries, the state of information of 22% was classified as “moderate” while only 10% were regarded as having “good” or “excellent” information. Thus the necessary baseline information did not exist that would permit effective management of coastal resources.

There are approximately 370 river outlets along the South African coast (Table 6.1). During the period 1992 to 1999 a national survey was conducted on some 250 systems by the authors. This represents approximately 67% of the country's ‘estuaries’. Aspects of their geomorphology, fish communities, water quality and aesthetic state were investigated. This information was analysed and condensed to provide an assessment of the state of the nations estuaries. The use of indices is an effective method of communicating technical information to potential end-users who typically do not have any scientific background. It has been pointed out, however, that the use of a composite index incorporating a number of parameters can lead to a loss of information as a result of oversimplification (Morant & Quinn, 1999). It is suggested that a matrix method should be adopted so that the ratings of each component of the estuarine environment can clearly be seen. Thus some estuaries will be seen to be important in respect of a single component whereas others may be important in respect of two or more components. Estuaries can be assessed in this way to provide ratings on a national, regional (political or biogeographical) or local scale (Morant & Quinn, 1999). Such an approach has been adopted here and the results are presented in Table 6.1. These results are also presented in Appendix 1 where strip maps of the coastline are given together with a series of icons indicating the geomorphological classification,

biogeographic region, state of the fish community, water quality and aesthetics for each estuary.

6.2 Summary

A geomorphological classification of these systems revealed that many systems, particularly on the west coast, were not considered to be estuaries in any accepted definition either because they were dry or due to their small size. Six basic types of estuary were identified (Table 6.1). They were divided into estuaries which were normally open and systems which were normally closed. The normally open estuaries were further divided into barred (Types E & F) and non-barred systems (Type D). The barred estuaries could be classified according to the processes which maintain connection with the sea, that is river-dominated systems and tide-dominated systems. A lack of data, however, has only permitted a classification of these systems into small (Type E) and medium to large (Type F) estuaries based on mean annual runoff (MAR). Two types of normally closed estuaries were recognised, those where the normal water level was perched above sea level, and those where the water level was approximately at sea level. Again a lack of sufficient data only permitted these systems to be classified into large (Type C), medium (Type B) and small (Type A) estuaries based on surface area. A total of 206 estuaries were classified geomorphologically. Of the normally closed systems, 26 (13%) were classified as type A, 71 estuaries (34%) were type B systems, and 2 (1%) were type C estuaries. Of the normally open estuaries, 11 (5%) were type D systems, 34 (17%) belonged to type E, and 62 (30%) were type F estuaries.

This approach identifies for each type of estuary, a potential mode of physical behaviour related to tidal exchange, sediment transport, response to fluvial floods etc. Although a number of estuary types have been studied, there are several in which limited research has been undertaken and their physical processes are poorly understood. There may be differences within groups that relate to unidentified differences and these too are worthy of further consideration. The classification enables a management perspective that does not simply deal with the open estuaries or the large estuaries, but recognises that a range of estuary types exists and that examples of each type should be preserved.

Based on ichthyofaunal surveys and the classification of the 206 estuaries, three biogeographic regions were identified. These were the cool-temperate region from the Gariiep (Orange River) Estuary to Cape Agulhas, the warm-temperate region from Cape Agulhas to the Mdumbi Estuary, and the subtropical region from the Mdumbi Estuary to Kosi Bay. The various estuary types within each biogeographic region appeared to contain fairly distinctive fish assemblages. The species richness, species composition and relative abundance of the ichthyofauna of the various types of estuary were described for each region. Using these fish community characteristics as a reference, the state of the ichthyofauna of each estuary was assessed. Overall, 14 systems (7%) had a relatively low rating, 68 (33%) had a moderate rating and 124 (60%) had a relatively good rating (Table 6.1).

This suggests that the fish communities in most estuaries do not indicate degradation but it does identify those that are actually or potentially degraded and in which potential problems may exist.

Water quality surveys were conducted on some 250 systems. The water quality of each estuary was assessed in terms of its suitability for aquatic life (dissolved oxygen, oxygen absorbed, unionized ammonia), its trophic status (nitrate nitrogen, ortho-phosphate), and its suitability for human contact (faecal coliforms). Overall, approximately 74% of all the systems were classified as in a "Fair" or better condition. The remaining 24% were rated as "Poor" or "Very Poor" (Table 6.1). The approach we have adopted enables the category of impairment to be identified and prompts further study in estuaries identified as having poor water quality.

The aesthetic state of 251 systems was assessed during this study, 18 (7%) had relatively poor aesthetic ratings, 88 (35%) had a moderate rating and 145 (58%) were rated relatively good aesthetically (Table 6.1). This finding indicates the relatively localised high levels of aesthetic impairment adjacent to urban centres. It also indicates the high level of modification of the estuarine landscape through human activities. While this may not directly

impact on the natural environment, it serves to indicate the level of development centred on estuaries.

6.3 Recommendations

All of the basic data, as well as various forms of summarised data, need to be made available to interested parties from scientists to managers and even the general public. Probably the most appropriate method of accomplishing this is via a hierarchical database on the internet.

Much of the baseline data collected has not been fully analysed. Other aspects of fish community structure such as biomass composition, life-history styles and trophic structure should be investigated. A physical water quality impairment category, involving such indicators as temperature, salinity, pH, and turbidity should be explored as well as the potential for creating water quality rating curves for different estuary types in different biogeographic regions.

The geomorphological classification is based only on available data and additional information is required to improve its resolution. In particular, data on the frequency and persistence of mouth opening and on water and barrier crest levels is required. These may enable further subdivision of the categories identified here. Long-term data sets are also required to establish the range of the natural variation between and within estuaries on a seasonal basis and to monitor key systems. It is also suggested that while a number of types of system have been studied, the lesser known types of estuary should be examined to ascertain their geomorphological and hydrological functioning.

Significant gaps in the database also exist. A number of estuaries, particularly in the Transkei, have not been sampled. These and other missed systems should be sampled to create a full baseline.

Investigations into other estuarine components (e.g. hydrology, sediment biogeochemistry, vegetation, zooplankton, zoobenthos, birds, habitat assessment, catchment land-use) should

also be undertaken to ensure a more complete appraisal of the ecological integrity of the nation's estuarine resource.

Table 6.1. Summary of geomorphological classification, biogeography, fish community status (ichthyofauna), water quality and aesthetics of South Africa's estuaries (n/a = not analysed; n/s = not sampled).

No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
1	Gariep (Orange)	open, medium/large (F)	Cool-temperate	Good	Poor	Moderate
2	Holgat	dry	Cool-temperate	n/s	n/s	Good
3	Buffels	small/isolated	Cool-temperate	n/a	Very Poor	Moderate
4	Swartlintjies	small/isolated	Cool-temperate	n/a	Poor	Good
5	Spoeg	small/isolated	Cool-temperate	n/a	Good	Good
6	Bitter	dry	Cool-temperate	n/s	n/s	Good
7	Groen	isolated	Cool-temperate	n/a	Very Poor	Good
8	Brak	dry	Cool-temperate	n/s	n/s	Good
9	Sout (Noord)	small/isolated	Cool-temperate	n/a	Fair	Poor
10	Olifants	open, medium/large (F)	Cool-temperate	Good	Fair	Good
11	Sandlaagte	n/s	Cool-temperate	n/s	n/s	n/s
12	Jakkals	isolated	Cool-temperate	n/a	Poor	Moderate
13	Wadrif	isolated	Cool-temperate	n/a	Fair	Moderate
14	Verlore	closed, medium (B)	Cool-temperate	Moderate	Excellent	Moderate
15	Papkuils	isolated	Cool-temperate	n/s	Fair	Good
16	Berg	open, medium/large (F)	Cool-temperate	Good	Fair	Poor
17	Paternosterbaai	n/s	Cool-temperate	n/s	n/s	n/s
18	Saldanha/ Langebaan	n/s	Cool-temperate	n/s	n/s	n/s
19	Dwars (Noord)	dry	Cool-temperate	n/s	n/s	Good
20	Dwars (Suid)	small	Cool-temperate	n/s	Very Poor	Good
21	Modder	small/isolated	Cool-temperate	n/a	Good	Good
22	Jacobsbaai	dry	Cool-temperate	n/s	n/s	Moderate
23	Lêerbaai	dry	Cool-temperate	n/s	n/s	Good

24	Bok	small	Cool-temperate	n/a	Poor	Good
25	Silwerstroom	small	Cool-temperate	n/a	Fair	Good

Table 6.1. cont. Summary of geomorphological classification, biogeography, fish community status (ichthyofauna), water quality and aesthetics of South Africa's estuaries (n/a = not analysed; n/s = not sampled).

No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
26	Sout (Suid)	small/isolated	Cool-temperate	n/a	Poor	Moderate
27	Diep	closed, medium (B)	Cool-temperate	Good	Poor	Poor
28	Soutrivier	canalised	Cool-temperate	n/a	Very Poor	Poor
29	Houtbaai	closed, small (A)	Cool-temperate	Moderate	Fair	Moderate
30	Goeiehoop	n/s	Cool-temperate	n/s	n/s	n/s
31	Wildevöel	closed, medium (B)	Cool-temperate	Moderate	Poor	Good
32	Bokramspruit	small	Cool-temperate	n/a	Fair	Moderate
33	Schuster	closed, small (A)	Cool-temperate	Moderate	Good	Good
34	Krom	closed, medium (B)	Cool-temperate	Poor	Poor	Good
35	Olifantsbos	n/s	Cool-temperate	n/s	n/s	n/s
36	Booiskraal	small	Cool-temperate	n/a	Poor	Good
37	Buffels (Wes)	small	Cool-temperate	n/a	Poor	Good
38	Elsies	small	Cool-temperate	n/a	Fair	Poor
39	Silwermyl	closed, small (A)	Cool-temperate	Moderate	Poor	Moderate
40	Sand	closed, medium (B)	Cool-temperate	Moderate	Poor	Poor
41	Seekoe	canalised	Cool-temperate	n/a	Very Poor	Poor
42	Eerste	open, medium/large (F)	Cool-temperate	Good	Very Poor	Moderate
43	Lourens	open, small (E)	Cool-temperate	Good	Fair	Poor
44	Sir Lowry's Pass	open, small (E)	Cool-temperate	Moderate	Fair	Moderate
45	Steenbras	open, non-barred (D)	Cool-temperate	Moderate	Fair	Good
46	Rooiels	open, small (E)	Cool-temperate	Good	Good	Moderate
47	Buffels (Oos)	open, small (E)	Cool-temperate	Good	Fair	Good

48	Palmiet	open, medium/large (F)	Cool-temperate	Good	Good	Good
49	Kleinmond	closed, medium (B)	Cool-temperate	Poor	Fair	Moderate
50	Bot	closed, large (C)	Cool-temperate	Good	Good	Moderate

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
51	Onrus	open, small (E)	Cool-temperate	Good	Fair	Moderate
52	Mossel	small	Cool-temperate	n/s	Good	Good
53	Klein	closed, large (C)	Cool-temperate	Good	Good	Good
54	Uilkraals	open, medium/large (F)	Cool-temperate	Good	Fair	Moderate
55	Ratel	open, small (E)	Cool-temperate	Good	Fair	Good
56	Heuningnes	open, medium/large (F)	Warm-temperate	Moderate	Fair	Good
57	Klipdrifsfontein	closed, small (A)	Warm-temperate	Poor	Good	Good
58	Papkuils	n/s	Warm-temperate	n/s	n/s	n/s
59	Breë	open, medium/large (F)	Warm-temperate	Moderate	Good	Good
60	Duiwenhoks	open, medium/large (F)	Warm-temperate	Poor	Good	Good
61	Goukou (Kafferkuils)	open, medium/large (F)	Warm-temperate	Moderate	Good	Moderate
62	Gourits	open, medium/large (F)	Warm-temperate	Moderate	Good	Moderate
63	Blinde	closed, medium (B)	Warm-temperate	Moderate	Good	Good
64	Gericke	n/s	Warm-temperate	n/s	n/s	n/s
65	Hartenbos	closed, medium (B)	Warm-temperate	Moderate	Poor	Poor
66	Klein Brak	open, medium/large (F)	Warm-temperate	Moderate	Good	Moderate
67	Groot Brak	open, medium/large (F)	Warm-temperate	Moderate	Good	Poor
68	Rooi	small	Warm-temperate	n/s	n/s	Moderate
69	Maalgate	open, non-barred (D)	Warm-temperate	Good	Good	Good
70	Gwaing	open, non-barred (D)	Warm-temperate	Moderate	Poor	Good
71	Skaapkop	n/s	Warm-	n/s	n/s	n/s

72	Meul	small	temperate Warm- temperate	n/a	Very Poor	Moderate
73	Kaaimans	open, non-barred (D)	Warm- temperate	Moderate	Excellent	Moderate
74	Touw	closed, medium (B)	Warm- temperate	Good	Good	Moderate
75	Swartvlei	open, medium/large (F)	Warm- temperate	Moderate	Good	Moderate

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
76	Goukamma	open, medium/large (F)	Warm- temperate	Good	Good	Good
77	Knysna	open, medium/large (F)	Warm- temperate	Good	Good	Moderate
78	Noetsie	closed, small (A)	Warm- temperate	Good	Good	Good
79	Grooteiland	small	Warm- temperate	n/s	Good	Good
80	Kranshoek	small	Warm- temperate	n/s	Good	Good
81	Crooks	small	Warm- temperate	n/s	Fair	Good
82	Piesang	open, small (E)	Warm- temperate	Moderate	Fair	Moderate
83	Keurbooms	open, medium/large (F)	Warm- temperate	Good	Good	Moderate
84	Matjies	closed, small (A)	Warm- temperate	Poor	Good	Good
85	Brak	small	Warm- temperate	n/s	Fair	Good
86	Sout	open, non-barred (D)	Warm- temperate	Moderate	Good	Good
87	Groot (Wes)	closed, medium (B)	Warm- temperate	Poor	Good	Good
88	Helpmakaars	n/s	Warm- temperate	n/s	n/s	n/s
89	Klip	n/s	Warm- temperate	n/s	n/s	n/s
90	Bloukrans	open, non-barred (D)	Warm- temperate	Moderate	Good	Good
91	Witels	n/s	Warm- temperate	n/s	n/s	n/s
92	Lottering	open, non-barred (D)	Warm- temperate	Poor	Good	Good
93	Elandsbos	open, non-barred (D)	Warm- temperate	Moderate	Excellent	Good
94	Geelhoutbos	n/s	Warm- temperate	n/s	n/s	n/s

95	Kleinbos	n/s	Warm-temperate	n/s	n/s	n/s
96	Storms	open, non-barred (D)	Warm-temperate	Poor	Good	Good
97	Bruglaagte	n/s	Warm-temperate	n/s	n/s	n/s
98	Langbos	n/s	Warm-temperate	n/s	n/s	n/s
99	Sanddrif	n/s	Warm-temperate	n/s	n/s	n/s
100	Elands	open, non-barred (D)	Warm-temperate	Good	Good	Good

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
101	Groot (Oos)	open, non-barred (D)	Warm-temperate	Good	Good	Good
102	Eerste	small	Warm-temperate	n/s	Poor	Good
103	Klipdrif (Wes)	small	Warm-temperate	n/s	Very Poor	Good
104	Boskloof	small	Warm-temperate	n/a	Fair	Good
105	Kaapsedrif	small	Warm-temperate	n/a	Poor	Good
106	Tsitsikamma	closed, medium (B)	Warm-temperate	Moderate	Good	Good
107	Klipdrif (Oos)	closed, small (A)	Warm-temperate	Poor	Fair	Good
108	Slang	closed, small (A)	Warm-temperate	Poor	Fair	Good
109	Kromme	open, medium/large (F)	Warm-temperate	Good	Good	Moderate
110	Seekoei	closed, medium (B)	Warm-temperate	Good	Good	Moderate
111	Kabeljous	closed, medium (B)	Warm-temperate	Moderate	Fair	Moderate
112	Gamtoos	open, medium/large (F)	Warm-temperate	Good	Fair	Moderate
113	Van Stadens	closed, medium (B)	Warm-temperate	Good	Good	Moderate
114	Maitland	closed, small (A)	Warm-temperate	Good	Fair	Moderate
115	Bakens	canalised	Warm-temperate	n/a	Fair	Poor
116	Papkuils	canalised	Warm-temperate	n/a	Very Poor	Poor
117	Swartkops	open, medium/large (F)	Warm-temperate	Good	Good	Moderate
118	Ngcura (Koega)	salt-works	Warm-temperate	n/a	Good	Poor
119	Sundays	open, medium/large	Warm-	Good	Good	Moderate

120	Boknes	(F) closed, medium	temperate Warm- temperate	Moderate	Good	Good
121	Bushmans	(B) open, medium/large	Warm- temperate	Good	Good	Moderate
122	Kariega	(F) open, medium/large	Warm- temperate	Good	Good	Moderate
123	Kasuka	(F) closed, medium	Warm- temperate	Good	Good	Good
124	Kowie	(B) open, medium/large	Warm- temperate	Good	Good	Poor
125	Rufane	(F) open, small (E)	Warm- temperate	Moderate	Fair	Good

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
126	Riet	closed, medium (B)	Warm- temperate	Good	Fair	Good
127	Wes-Kleinemon	closed, medium (B)	Warm- temperate	Good	Good	Moderate
128	Oos-Kleinemon	closed, medium (B)	Warm- temperate	Good	Good	Moderate
129	Palmiet	n/s	Warm- temperate	n/s	n/s	n/s
130	Great Fish	open, medium/large (F)	Warm- temperate	Moderate	Good	Moderate
131	Old Woman's	closed, medium (B)	Warm- temperate	Good	Good	Moderate
132	Thatshana	closed, small (A)	Warm- temperate	Good	Fair	Good
133	Mpekweni	closed, medium (B)	Warm- temperate	Good	Good	Moderate
134	Mtati	closed, medium (B)	Warm- temperate	Good	Fair	Good
135	Mgwalana	closed, medium (B)	Warm- temperate	Good	Good	Good
136	Bira	closed, medium (B)	Warm- temperate	Good	Fair	Good
137	Gqutywa	closed, medium (B)	Warm- temperate	Good	Good	Good
138	Ngculura	open, small (E)	Warm- temperate	Moderate	Good	Good
139	Fresh Water Poort	dry	Warm- temperate	n/s	n/s	Good
140	Blue Krans	dry	Warm- temperate	n/s	n/s	Good
141	Mtana	closed, medium (B)	Warm- temperate	Good	Good	Good
142	Keiskamma	open, medium/large (F)	Warm- temperate	Good	Good	Good
143	Shwele-Shwele	dry	Warm- temperate	n/s	n/s	Good

144	Ngqinisa	closed, medium (B)	Warm-temperate	Good	Good	Good
145	Kiwane	closed, medium (B)	Warm-temperate	Moderate	Good	Good
146	Tyolomnqa	open, medium/large (F)	Warm-temperate	Good	Good	Good
147	Shelbertsstroom	open, small (E)	Warm-temperate	Moderate	Good	Moderate
148	Lilyvale	closed, small (A)	Warm-temperate	Good	Fair	Good
149	Ross' Creek	closed, medium (B)	Warm-temperate	Good	Fair	Good
150	Ncera	closed, medium (B)	Warm-temperate	Good	Good	Good

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
151	Mlele	closed, medium (B)	Warm-temperate	Good	Good	Moderate
152	Mcantsi	closed, medium (B)	Warm-temperate	Good	Fair	Good
153	Gxulu	closed, medium (B)	Warm-temperate	Good	Good	Moderate
154	Goda	closed, medium (B)	Warm-temperate	Good	Good	Good
155	Hlozi	closed, small (A)	Warm-temperate	Good	Good	Good
156	Hickmans	closed, medium (B)	Warm-temperate	Moderate	Fair	Moderate
157	Mvubukazi	small	Warm-temperate	n/a (no fish)	Fair	Good
158	Ngqenga	small	Warm-temperate	n/a (no fish)	Poor	Good
159	Buffalo	open, medium/large (F)	Warm-temperate	Moderate	Poor	Poor
160	Blind	closed, small (A)	Warm-temperate	Good	Very Poor	Moderate
161	Hlaze	closed, small (A)	Warm-temperate	Good	Poor	Moderate
162	Nahoon	open, medium/large (F)	Warm-temperate	Good	Good	Moderate
163	Qinira	closed, medium (B)	Warm-temperate	Good	Good	Moderate
164	Gqunube	open, medium/large (F)	Warm-temperate	Good	Good	Moderate
165	Kwelera	open, medium/large (F)	Warm-temperate	Good	Good	Good
166	Bulura	open, small (E)	Warm-temperate	Good	Good	Good
167	Cunge	closed, small (A)	Warm-temperate	Good	Good	Good
168	Cintsa	closed, medium	Warm-	Good	Excellent	Good

169	Cefane	(B) closed, medium	temperate Warm- temperate	Good	Excellent	Good
170	Kwenxura	(B) closed, medium	Warm- temperate	Good	Excellent	Good
171	Nyara	(B) closed, medium	Warm- temperate	Moderate	Excellent	Good
172	Imtwendwe	(B) closed, small	Warm- temperate	Good	Fair	Good
173	Haga-Haga	(A) closed, medium	Warm- temperate	Good	Good	Good
174	Mtendwe	(B) closed, small	Warm- temperate	Moderate	Good	Good
175	Quko	(A) open, medium/large (F)	Warm- temperate	Good	Good	Good

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
176	Morgan	closed, medium (B)	Warm- temperate	Good	Good	Moderate
177	Cwili	open, small (E)	Warm- temperate	Good	Fair	Moderate
178	Great-Kei	open, medium/large (F)	Warm- temperate	Poor	Fair	Good
179	Gxara	closed, medium (B)	Warm- temperate	Good	Fair	Good
180	Ngogwane	closed, medium (B)	Warm- temperate	Moderate	Poor	Moderate
181	Qolora	closed, medium (B)	Warm- temperate	Good	Poor	Good
182	Ncizele	closed, small (A)	Warm- temperate	Good	Very Poor	Good
183	Timba	n/s	Warm- temperate	n/s	n/s	n/s
184	Mbokotwana	n/s	Warm- temperate	n/s	n/s	n/s
185	Kobonqaba	open, medium/large (F)	Warm- temperate	Good	Poor	Good
186	Ngqusi/Inxaxo	open, medium/large (F)	Warm- temperate	Good	Poor	Good
187	Bowkers Bay	n/s	Warm- temperate	n/s	n/s	n/s
188	Cebe	closed, medium (B)	Warm- temperate	Good	Fair	Good
189	Gqunqe	n/s	Warm- temperate	n/s	n/s	n/s
190	Zalu	closed, medium (B)	Warm- temperate	Moderate	Fair	Good
191	Ngqwara	closed, medium (B)	Warm- temperate	Good	Fair	Good

192	Sihlontlweni (Gcina)	n/s	Warm-temperate	n/s	n/s	n/s
193	Nebelele	n/s	Warm-temperate	n/s	n/s	n/s
194	Qora	open, medium/large (F)	Warm-temperate	Moderate	Poor	Good
195	Mbozi	n/s	Warm-temperate	n/s	n/s	n/s
196	Mbokotwana	n/s	Warm-temperate	n/s	n/s	n/s
197	Jujura	open, small (E)	Warm-temperate	Good	Poor	Good
198	Ngadla	open, small (E)	Warm-temperate	Good	Poor	Good
199	Shixini	open, medium/large (F)	Warm-temperate	Moderate	Poor	Good
200	Beechamwood	n/s	Warm-temperate	n/s	n/s	n/s

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
201	Unnamed	n/s	Warm-temperate	n/s	n/s	n/s
202	Kwa-Goqo	n/s	Warm-temperate	n/s	n/s	n/s
203	Ku-Nocekedwa	n/s	Warm-temperate	n/s	n/s	n/s
204	Ngabarana	n/s	Warm-temperate	n/s	n/s	n/s
205	Nqabara	n/s	Warm-temperate	n/s	n/s	n/s
206	Gume	n/s	Warm-temperate	n/s	n/s	n/s
207	Ngomane	n/s	Warm-temperate	n/s	n/s	n/s
208	Ngoma (Kobole)	n/s	Warm-temperate	n/s	n/s	n/s
209	Unnamed	n/s	Warm-temperate	n/s	n/s	n/s
210	Mendu	n/s	Warm-temperate	n/s	n/s	n/s
211	Mendwana	n/s	Warm-temperate	n/s	n/s	n/s
212	Unnamed	n/s	Warm-temperate	n/s	n/s	n/s
213	Mbashe	open, medium/large (F)	Warm-temperate	Moderate	Fair	Good
214	Ku-Mpenzu	open, small (E)	Warm-temperate	Good	Fair	Good
215	Ku-Bhula	open, small	Warm-	Good	Fair	Good

216	(Mbhanyana) Dakana	(E) n/s	temperate Warm- temperate	n/s	n/s	n/s
217	Kwa-Suku	open, small (E)	Warm- temperate	Moderate	Poor	Good
218	Ntlonyane	open, small (E)	Warm- temperate	Good	Fair	Good
219	Nyumbazana	n/s	Warm- temperate	n/s	n/s	n/s
220	Nkanya	open, small (E)	Warm- temperate	Good	Good	Good
221	Sundwana	closed, small (A)	Warm- temperate	Good	Fair	Good
222	Xora	open, medium/large (F)	Warm- temperate	Good	Fair	Good
223	Bulungula	n/s	Warm- temperate	n/s	n/s	n/s
224	Ku- Amanzimnyana	n/s	Warm- temperate	n/s	n/s	n/s
225	Nqakanqa	n/s	Warm- temperate	n/s	n/s	n/s

Table 6.1. cont. Summary of geomorphological classification, biogeography, fish community status (ichthyofauna), water quality and aesthetics of South Africa's estuaries (n/a = not analysed; n/s = not sampled).

No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
226	Unnamed	n/s	Warm- temperate	n/s	n/s	n/s
227	Mncwasa	n/s	Warm- temperate	n/s	n/s	n/s
228	Lubanzi	n/s	Warm- temperate	n/s	n/s	n/s
229	Mhlalane	n/s	Warm- temperate	n/s	n/s	n/s
230	Mpako	n/s	Warm- temperate	n/s	n/s	n/s
231	Mtonjane	n/s	Warm- temperate	n/s	n/s	n/s
232	Ku-Bomvu	n/s	Warm- temperate	n/s	n/s	n/s
233	Nenga	open, small (E)	Warm- temperate	Good	Fair	Moderate
234	Mapuzi	open, small (E)	Warm- temperate	Moderate	Fair	Good
235	Mtata	open, medium/large (F)	Warm- temperate	Good	Poor	Moderate
236	Thsani	closed, small (A)	Warm- temperate	Moderate	Poor	Good
237	Mdumbi	open, medium/large (F)	Warm- temperate	Good	Fair	Moderate
238	Lwandilana	n/s	Subtropical	n/s	n/s	n/s
239	Lwandile	n/s	Subtropical	n/s	n/s	n/s

240	Mtakatye	n/s	Subtropical	n/s	n/s	n/s
241	Hluleka	n/s	Subtropical	n/s	n/s	n/s
242	Mnenu	n/s	Subtropical	n/s	n/s	n/s
243	Mtonga	n/s	Subtropical	n/s	n/s	n/s
244	Mpande	open, small (E)	Subtropical	Good	Fair	Good
245	Sinangwana	open, medium/large (F)	Subtropical	Moderate	Fair	Good
246	Ndluzula	n/s	Subtropical	n/s	n/s	n/s
247	Mngazana	open, medium/large (F)	Subtropical	Good	Fair	Moderate
248	Mngazi	open, medium/large (F)	Subtropical	Good	Good	Moderate
249	Tyityane	n/s	Subtropical	n/s	n/s	n/s
250	Ntloloba	n/s	Subtropical	n/s	n/s	n/s

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
251	Gxwaleni	closed, small (A)	Subtropical	Good	Good	Good
252	Bulolo	open, small (E)	Subtropical	Good	Fair	Moderate
253	Mtumbane	open, small (E)	Subtropical	Good	Poor	Moderate
254	Mzimvubu	open, medium/large (F)	Subtropical	Moderate	Fair	Moderate
255	Mnenga	n/s	Subtropical	n/s	n/s	n/s
256	Ntlupeni	open, small (E)	Subtropical	Good	Fair	Good
257	Manzana	n/s	Subtropical	n/s	n/s	n/s
258	Nkodusweni	n/s	Subtropical	n/s	n/s	n/s
259	Gugu	n/s	Subtropical	n/s	n/s	n/s
260	Mntafufu	open, medium/large (F)	Subtropical	Good	Fair	Good
261	Ingo	n/s	Subtropical	n/s	n/s	n/s
262	Ntyivini	n/s	Subtropical	n/s	n/s	n/s
263	Dakane	n/s	Subtropical	n/s	n/s	n/s
264	Mzintlava	n/s	Subtropical	n/s	n/s	n/s

265	Mguga	n/s	Subtropical	n/s	n/s	n/s
266	Mzimpunzi	n/s	Subtropical	n/s	n/s	n/s
267	Kwa-Nyambalala	n/s	Subtropical	n/s	n/s	n/s
268	Mbotyi	n/s	Subtropical	n/s	n/s	n/s
269	Mkozi	n/s	Subtropical	n/s	n/s	n/s
270	Myekane	n/s	Subtropical	n/s	n/s	n/s
271	Sikatsha	n/s	Subtropical	n/s	n/s	n/s
272	Cutweni	n/s	Subtropical	n/s	n/s	n/s
273	Mfihlelo	n/s	Subtropical	n/s	n/s	n/s
274	Mlambomkulu	n/s	Subtropical	n/s	n/s	n/s
275	Lupatana	n/s	Subtropical	n/s	n/s	n/s

Table 6.1. cont. Summary of geomorphological classification, biogeography, fish community status (ichthyofauna), water quality and aesthetics of South Africa's estuaries (n/a = not analysed; n/s = not sampled).

No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
276	Mkweni	n/s	Subtropical	n/s	n/s	n/s
277	Maviti	n/s	Subtropical	n/s	n/s	n/s
278	Tezana	n/s	Subtropical	n/s	n/s	n/s
279	Magogo	n/s	Subtropical	n/s	n/s	n/s
280	Kilroe Beach	n/s	Subtropical	n/s	n/s	n/s
281	Mbaxeni	n/s	Subtropical	n/s	n/s	n/s
282	Msikaba	open, medium/large (F)	Subtropical	Moderate	Good	Good
283	Butsha	open, small (E)	Subtropical	Moderate	Fair	Good
284	Kwa-Nondindwa	n/s	Subtropical	n/s	n/s	n/s
285	Daza	n/s	Subtropical	n/s	n/s	n/s
286	Mgwegwe	open, small (E)	Subtropical	Moderate	Fair	Good
287	Mkambati	n/s	Subtropical	n/s	n/s	n/s

288	Mgwetyana	open, small (E)	Subtropical	Moderate	Fair	Good
289	Mtentu	open, medium/large (F)	Subtropical	Good	Fair	Good
290	Sikombe	n/s	Subtropical	n/s	n/s	n/s
291	Kwanyana	n/s	Subtropical	n/s	n/s	n/s
292	Mtolane	n/s	Subtropical	n/s	n/s	n/s
293	Mnyameni	n/s	Subtropical	n/s	n/s	n/s
294	Unnamed	n/s	Subtropical	n/s	n/s	n/s
295	Mpahlanyana	n/s	Subtropical	n/s	n/s	n/s
296	Mpahlane	n/s	Subtropical	n/s	n/s	n/s
297	Mzamba	open, medium/large (F)	Subtropical	Good	Poor	Good
298	Mtentwana	closed, medium (B)	Subtropical	Moderate	Poor	Moderate
299	Mtamvuna	open, medium/large (F)	Subtropical	Good	Fair	Moderate
300	Zolwane	n/s	Subtropical	n/s	Good	n/s

Table 6.1. cont. Summary of geomorphological classification, biogeography, fish community status (ichthyofauna), water quality and aesthetics of South Africa's estuaries (n/a = not analysed; n/s = not sampled).

No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
301	Sandlundlu	open, small (E)	Subtropical	Good	Good	Moderate
302	Ku-Boboyi	n/s	Subtropical	n/s	Fair	n/s
303	Tongazi	open, small (E)	Subtropical	Good	Fair	Good
304	Kandandlovu	closed, medium (B)	Subtropical	Moderate	Fair	Good
305	Mpenjati	closed, medium (B)	Subtropical	Good	Good	Moderate
306	Umhlangankulu	closed, medium (B)	Subtropical	Good	Poor	Good
307	Kaba	closed, medium (B)	Subtropical	Poor	Fair	Good
308	Mbizana	closed, medium (B)	Subtropical	Good	Good	Good
309	Mvutshini	closed, small (A)	Subtropical	Good	Poor	Good
310	Bilanhlolo	closed, medium (B)	Subtropical	Moderate	Fair	Moderate
311	Uvuzana	n/a	Subtropical	n/a	Poor	Moderate

312	Kongweni	closed, small (A)	Subtropical	(no fish) Good	Fair	Moderate
313	Vungu	n/s	Subtropical	n/s	Very Poor	n/s
314	Mhlangeni	closed, medium (B)	Subtropical	Good	Fair	Moderate
315	Zotsha	open, small (E)	Subtropical	Moderate	Good	Moderate
316	Boboyi	n/s	Subtropical	n/s	Poor	n/s
317	Mbango	n/s	Subtropical	n/s	Very Poor	n/s
318	Mzimkulu	open, medium/large (F)	Subtropical	Good	Good	Moderate
319	Mtentweni	closed, medium (B)	Subtropical	Moderate	Good	Moderate
320	Mhlangamkulu	closed, medium (B)	Subtropical	Moderate	Fair	Good
321	Damba	closed, small (A)	Subtropical	Moderate	Good	Moderate
322	Koshwana	n/s	Subtropical	n/s	Good	n/s
323	Intshambili	closed, medium (B)	Subtropical	Moderate	Poor	Good
324	Mzumbe	n/s	Subtropical	n/s	Good	n/s
325	Mhlabatshane	open, small (E)	Subtropical	Good	Fair	Moderate

Table 6.1. cont. Summary of geomorphological classification, biogeography, fish community status (ichthyofauna), water quality and aesthetics of South Africa's estuaries (n/a = not analysed; n/s = not sampled).

No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
326	Mhlungwa	n/s	Subtropical	n/s	Fair	n/s
327	Mfazazana	n/s	Subtropical	n/s	n/s	n/s
328	Kwa-makosi	n/s	Subtropical	n/s	n/s	n/s
329	Mnamfu	n/s	Subtropical	n/s	n/s	n/s
330	Mtwalume	n/s	Subtropical	n/s	Fair	n/s
331	Mvuzi	n/s	Subtropical	n/s	Fair	n/s
332	Fafa	closed, medium (B)	Subtropical	Moderate	Good	Good
333	Mdesingane	n/s	Subtropical	n/s	Very Poor	n/s
334	Sezela	closed, medium (B)	Subtropical	Moderate	Poor	Moderate
335	Mkumbane	closed, small (A)	Subtropical	Good	Poor	Moderate

336	Mzinto	n/s	Subtropical	n/s	Good	n/s
337	Mzimayi	closed, small (A)	Subtropical	Good	Fair	Moderate
338	Mpambanyoni	closed, medium (B)	Subtropical	Good	Good	Moderate
339	Mahlongwa	closed, medium (B)	Subtropical	Good	Fair	Moderate
340	Mahlongwana	n/s	Subtropical	n/s	Poor	n/s
341	Mkomazi	open, medium/large (F)	Subtropical	Good	Good	Moderate
342	Ngane	n/s	Subtropical	n/s	n/s	n/s
343	uMgababa	n/s	Subtropical	n/s	n/s	n/s
344	Msimbazi	n/s	Subtropical	n/s	n/s	n/s
345	Lovu	open, medium/large (F)	Subtropical	Moderate	Poor	Moderate
346	Little Manzimtoti	closed, medium (B)	Subtropical	Good	Very Poor	Moderate
347	Manzimtoti	closed, medium (B)	Subtropical	Good	Very Poor	Poor
348	Mbokodweni	open, small (E)	Subtropical	Good	Very Poor	Poor
349	Sipingo	closed, medium (B)	Subtropical	Good	Very Poor	Poor
350	Durban Bay	n/s	Subtropical	n/s	n/s	n/s

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No.	System	Classification	Biogeography	Ichthyofauna	Water quality	Aesthetics
351	Mgeni	open, medium/large (F)	Subtropical	Good	Poor	Moderate
352	Mhlanga	closed, medium (B)	Subtropical	Good	Very Poor	Good
353	Mdloti	closed, medium (B)	Subtropical	Moderate	Fair	Moderate
354	Tongati	n/s	Subtropical	n/s	Poor	n/s
355	Mhlali	open, medium/large (F)	Subtropical	Good	Good	Good
356	Seteni	n/s	Subtropical	n/s	Fair	n/s
357	Mvoti	open, medium/large (F)	Subtropical	Poor	Poor	Moderate
358	Mdlotane	closed, medium (B)	Subtropical	Good	Good	Good
359	Nonoti	n/s	Subtropical	n/s	Fair	n/s

360	Zinkwasi	closed, medium (B)	Subtropical	Moderate	Fair	Moderate
361	Thukela (Tugela)	open, medium/large (F)	Subtropical	Moderate	Good	Moderate
362	Matigulu/Nyoni	open, medium/large (F)	Subtropical	Good	n/s	Good
363	Siyai	closed, medium (B)	Subtropical	Moderate	n/s	Good
364	Mlalazi	open, medium/large (F)	Subtropical	Good	n/s	Good
365	Mhlathuze (Mhlatuze)	n/s	Subtropical	n/s	n/s	n/s
366	Richards Bay	n/s	Subtropical	n/s	n/s	n/s
367	Nhlabane	n/s	Subtropical	n/s	n/s	n/s
368	Mfolozi/ Msunduzi	open, medium/large (F)	Subtropical	Moderate	n/s	Good
369	St Lucia	open, medium/large (F)	Subtropical	Good	n/s	Good
370	Mgobezeleni	open, small (E)	Subtropical	Poor	n/s	Good
371	Kosi Bay	open, medium/large (F)	Subtropical	Poor	n/s	Good