

## **ESTUARY SITE VISIT REPORT**

DATA TO FORM PART OF THE:

**BUFFELS, SWARTLINTJIES, SPOEG, GROEN, SOUT ESTUARY EWR REPORT  
(RDM/WMA06/00/CON/COMP/0316)**

**SITE VISIT REPORT: 3 – 10 OCTOBER 2016.**

30 OCTOBER 2016

Note: This is a summary of raw data collated during the study produced as a monthly delivery. As such it cannot be read from a technical viewpoint as a stand-alone report.

## TABLE OF CONTENTS

### TABLE OF CONTENTS i

1	INTRODUCTION	1
1.1	BACKGROUND	1
1.2	PURPOSE OF THIS	1
2	SALINITY PROFILE MEASUREMENTS	1
3	MACROPHYTE AND MICROALGAE FIELD TRIP REPORT	1
3.1	MACROPHYTES	1
3.2	MICROALGAE	1
3.3	OCTOBER FIELD TRIP NOTES	1
3.3.1	Buffels – 5 October	1
3.3.2	Swartlintjies – 6 October	2
3.3.3	Spoeg – 7 October	2
3.3.4	Bitter – 7 October	3
3.3.5	Groen – 8 October	3
3.3.6	Brak – 9 October	3
3.3.7	Sout – 9 October	3
3.4	SUMMARY	4
4	FISH AND INVERTEBRATE SURVEYS	1
4.1	BUFFLES ESTUARY	1
4.2	SWARTLINTJIES ESTUARY	1
4.3	SPOEG ESTUARY	1
4.4	GROEN ESTUARY	1
4.5	SOUT ESTUARY	1
5	BIRD SURVEYS	1
6	PRELIMINARY ESTUARY FUNCTIONAL ZONE	1

### LIST OF TABLES

Table 2.1	Salinity measurements .....	2
Table 5.1	Bird counts at the Buffels Estuary. ....	1
Table 5.2	Bird counts at the Swartlintjies Estuary.....	2
Table 5.3	Bird counts at the Spoeg Estuary.....	3
Table 5.4	Bird counts at the Groen Estuary .....	3
Table 5.5	Bird counts at the Sout Estuary .....	5

## LIST OF figures

Figure 6.1	Buffels Estuary preliminary functional zone.....	2
Figure 6.2	Buffels Estuary photograph (downstream section and mouth) .....	3
Figure 6.3	Swartlintjies Estuary preliminary functional zone.....	4
Figure 6.4	Swartlintjies Estuary looking upstream .....	5
Figure 6.5	Spoeg Estuary preliminary functional zone .....	6
Figure 6.6	Spoeg Estuary .....	7
Figure 7.4	Groen Estuary .....	8
Figure 7.5	Sout Estuary preliminary functional zone .....	9
Figure 6.6	Sout Estuary photographs .....	10

## INTRODUCTION

## BACKGROUND

This field report serves as a portofolio of evidence of a site visit undertaken from 3 to 10 October 2016. The team consisted of:

Lara van Niekerk (Task Leader)

Dr Stephen Lamberth (Fish and birds)

Prof Janine Adams (Microalgae and macrophytes)

Dr Taryn Ryddin (Microalgae and macrophytes)

Delana Louw (Study Leader) (Cross-sectional surveys and birds)

## PURPOSE OF THIS

The purpose of this report is to document the preliminary findings as collated during the site visit. This findings will be analysed in preparation for an EWR specialist meeting taking place during November 2016. A report (RDM/WMA06/00/CON/COMP/0316) will document the analysis of the survey results as well as the outcomes of the November specialist meeting.

---

## SALINITY PROFILE MEASUREMENTS

The following data sets records the average depth, temperature, salinity, pH, dissolved oxygen and turbidity for the Buffels, Swartlintjies, Groen, Spoeg and Sout Estuaries as measured during the 2016 October site visit by Lara van Niekerk.

Table Error! No text of specified style in document..1 Salinity measurements

	Date	Time	Locality	Reach	Depth m	Temperature °C	Salinity ‰	pH	DO <sub>2</sub> m.gl <sup>-1</sup>
<b>Buffels</b>	5/10/20106	11:50B1	Lower	0.50	17.02	28.35	8.52	6.87	
				0.00	17.04	28.45	8.63	6.77	
		12:30B1A	Lower	0.50	17.91	28.60	8.73	7.32	
				0.00	17.97	28.36	8.72	7.45	
		13:15B2	Middle	1.70	17.51	5.67	9.06	7.04	
				1.00	17.51	5.67	8.72	7.26	
				0.00	17.58	5.66	8.63	7.63	
		14:45B3	Upper	1.30	16.64	2.55	8.19	3.02	
				0.50	16.69	2.53	7.97	3.17	
				0.25	17.61	2.52	7.82	5.53	
0.00	17.52			2.51	7.90	6.67			
<b>Swartlintjies</b>	06-Oct-16	11:40S1	Lower	0.50	20.16	108.70	7.91	3.56	
				0.00	20.48	108.70	8.05	3.53	
		12:10S2	Middle	0.30	23.04	110.00	7.76	6.15	
				0.00	23.04	110.00	7.76	6.15	
		12:40S3	Middle	0.30	27.36	110.70	7.69	7.37	
				0.00	27.36	110.70	7.69	7.37	
		13:00S4	Upper	0.80	22.86	119.58	7.78	5.24	
				0.00	22.87	119.81	7.80	5.41	
<b>Spoeg</b>	07-Oct-16	11:20Sp1	Lower	0.90	17.79	25.28	8.23	6.24	

Date	Time	Locality	Reach	Depth m	Temperature °C	Salinity ‰	pH	DO <sub>2</sub> m.gl <sup>-1</sup>	
				0.00	17.80	25.20	8.00	6.57	
	12:30	Sp2	Middle	0.30	19.59	24.93	8.01	7.89	
				0.00	19.61	24.89	7.99	7.76	
	12:20	Sp3	Middle	0.30	19.14	22.96	7.88	8.31	
				0.00	19.13	22.87	7.82	8.54	
	12:00	Sp4	Upper	2.00	17.91	22.64	7.65	6.15	
				1.00	18.46	22.70	7.91	6.55	
				0.00	18.61	22.46	7.74	6.55	
<b>Bitter</b>	07-Oct-16	16:00	Only water	Lower	0.50	23.88	44.50	8.04	12.43
<b>Groen</b>	08-Oct-16	10:30	G1	Lower	1.00	18.03	87.07	8.39	0.62
					0.00	17.93	87.22	8.48	3.21
					0.50	17.69	87.10	8.40	3.20
	10:50	G2	Lower	0.40	18.20	88.52	8.57	5.70	
					0.00	18.20	88.52	8.60	5.34
	11:20	G3	Middle	0.20	20.30	81.04	8.43	3.83	
	11:43	G4	Middle	0.00	19.81	46.60	8.26	5.16	
					0.40	19.81	46.60	8.26	5.16
	12:09	G5	Upper	0.50	20.90	39.30	8.30	5.92	
					0.00	24.60	43.90	7.99	5.61
	13:09	G6	Upper	0.50	26.24	44.15	8.02	5.50	
	13:00	G7	Top	1.10	27.16	70.17	7.33	0.25	

Date	Time	Locality	Reach	Depth m	Temperature °C	Salinity ‰	pH	DO <sub>2</sub> m.gl <sup>-1</sup>
				0.50	25.39	53.28	7.84	1.08
				0.00	23.15	36.11	7.97	2.01
			River Sump	0.00		8.00		
Sout	09-Oct-16	11:20St1	Lower (below road)	1.00	19.17	42.21	8.37	7.67
				0.00	19.17	42.21	8.37	7.67
		11:10St2	Lower (above road)	2.00	19.08	48.00	8.28	5.80
				0.00	19.08	48.00	8.28	6.22
		11:40St3	Middle (Main body)	0.00	25.47	77.15	8.34	8.10
				0.10	25.47	77.15	8.34	8.10
		12:55St4	Upper (above road)	0.00	18.88	101.79	7.69	6.16
				1.00	18.88	101.79	7.69	6.16

## MACROPHYTE AND MICROALGAE FIELD TRIP REPORT

Janine Adams and Taryn Riddin

Department of Botany, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, 6031.

Email: Janine.adams@nmmu.ac.za

### MACROPHYTES

#### *Distribution*

The distribution of macrophytes was noted in the field laterally in response to elevation and along the length of the estuary in relation to the salinity gradient. Filamentous algae and unknown estuarine plants were collected for identification. Species richness and community composition was assessed in the field. In situ measurements of the groundwater salinity and electrical conductivity were made using an YSI handheld multiprobe. This was to identify sites of freshwater seepage and groundwater input that would be important in maintaining diversity in this arid area. The adjacent terrestrial vegetation types and dominant species were assessed. Impacts in the estuary functional zone were identified and ranked.

#### *Habitat mapping*

The estuarine functional zone (estuarine habitat area) was digitized using the most recent (2011 and 2014) aerial photographs obtained from the National Geo-spatial Information (previous Chief Directorate: Surveys and Mapping) as well as Google Earth images. Earliest aerial photographs (1943, 1985) were also digitised and estuarine open water areas mapped. Macrophyte habitats (inter- and supratidal salt marsh, reeds and sedges) were mapped and the boundaries ground-truthed during the field visit. Changes over time were determined by visual comparison of the past aerial photographs. All maps were digitised in ESRI ArcGIS™ Version 10.2.

### MICROALGAE

For the five estuaries water column samples were collected at sites along the length of the estuary to assess phytoplankton biomass (chlorophyll-a). Replicate samples were taken. Samples were preserved with glutaredehyde to assess community composition back at the laboratory. Phytoplankton biomass (chlorophyll *a* concentration) was measured by collecting water samples at a single depth. The samples were then gravity-filtered through glass-fibre filters (Whatman© GF/C) and frozen until laboratory analysis.

For phytoplankton community analysis water samples of 200 ml were collected from each site and preserved using two drops of undiluted glutaraldehyde. The Coulon and Alexander (1972) method was used to settle the samples overnight in 26.5 mm diameter settling chambers. Two drops of Rose Bengal were added to 50 ml of preserved water samples and then allowed to settle for 24 hours before identification. Once settled, a Zeiss IM 35 inverted microscope was used to count and identify the microalgal groups at a magnification of 630X during which either a minimum of 200 frames or 200 cells were counted. The cells were classified according to different algal groups/classes, i.e. Bacillariophyceae (diatoms), Dinophyceae (dinoflagellates), Cyanophyceae (blue-green algae), Chlorophyceae (green algae), and flagellates. Cell density (cells ml<sup>-1</sup>) was calculated.

### OCTOBER FIELD TRIP NOTES

Buffels – 5 October

Estuary was bisected in two by old berm and road. The berm was approximately 23 m in length and 1.2 m in height. Microalgal samples taken at 4 sites. Two on the west of the berm, one to the east and the fourth site was adjacent to the golf course (Tee 13) over a small wooden bridge. This was in a freshwater wetland area where *Phragmites australis* was dominant with some *Typha capensis*. This forms part of a reed lined former channel. Salinity at site 1 was 28.3 ppt, 4.1 ppt at Site 3 and Site 4 was 3 ppt (Lara). Algae were collected at Site 3. Salt marsh species included *Sporobolus*, *Sarcocornia*, and *Juncus kraussii*.

Transects were taken through the main channel and then through old blind channel. Salinity here was 6.2 ppt and *Potamogeton pectinatus* was growing in the still water. Transect also taken at wood bridge (V1 grass & reeds, V2 thick reeds, V3 *Potamogeton* and algae, V4 start of vegetation *Typha* and *Phragmites*, V5 start of grass).

Very disturbed in upper reaches and sites of culverts. Dense *Acacia cyclops* being cut down. Augered at one site no groundwater, further upstream there was groundwater near a *Juncus kraussii* stand. Salinity was 2.4 to 3.1 ppt, depth to groundwater approximately 1 m. Further upstream more roads and dead reeds, extensive earthworks and alteration of channel, numerous small crossings.

Macrophyte health was a D for this system which is correct, possibly lower.

Swartlintjies – 6 October

After spending some time at the mining offices and having every electronic device stickered with a blue Transhex label we departed with a security officer. Small 4 x 4 ride over beach to the mouth.

Microalgal sample Site 1 taken at mouth, salinity 107 ppt Lara and temperature 20.6 °C, Site 2 was 65 ppt. Many brine shrimp in samples for all sites (1-3) which made filtering difficult.

Good macrophyte zonation with *Sarcocornia pillansii* with *Sporobolus* followed by *Drosanthemum* ?? (with pink flower) then grasses or mixed *Namaqua* duneveld. Three vegetation transects taken, see notebook for detail.

Macrophyte health was an F – not sure why? Nearby mining, this should be scaled up to a C depending on level of freshwater abstraction. Mine dumps were close by, see photos for last vegetation transect. Also may be salt water seepage from mine areas; no sign of wind-blown sand and dieback of vegetation.

Spoeg – 7 October

Beautiful good condition, lush vegetation. May be artificial mouth formation? *Ruppia* abundant in the lower reaches, macroalgae collected for identification. *Sarcocornia natalensis* in lower zone followed by *Sarcocornia pillansii*. Elevation was measured along one long transect which covered a small island with water channels either side (see notebook for zone details).

Microalgae sites: Site 1 salinity was 25.3 ppt and temperature 17.3 °C. Site 2 was opposite the first bank of the island, salinity here was 25 ppt and temperature 17.7 °C. Banks consisted of *Sporobolus virginicus* and *Sarcocornia pillansii* with *Ruppia* in the water. Site 3 occurred just before the start of the reeds on the north bank which was a steep slope. Salinity was 23.4 ppt and temperature 18.6 °C. Lara collected water just upstream from here for Site 4. Further upstream a path was found across the river. Salinity here was 8.2 ppt and temperature 18.8°C. This occurred further upstream than Lara's last site. We drove to the caves and walked to the reeds in the river course. There was standing water that was 9.5 ppt and 18.4 °C. The GPS point for this site was 30.47097 S and 17.36897 E.

Macrophyte health was an A for the macrophytes and this is correct unless there has been large freshwater abstraction.

Bitter – 7 October

We took a walk from the road to Groen to the mouth area of the Bitter, there was a small 10 x 10 m pool where Lara took measurements. Salinity was 45 ppt. *Sarcocornia pillansii* was dominant in the river course. Water was stagnant with macroalgal blooms. Brakgras *Sporobolus virginicus* was also present.

Groen – 8 October

More connected than on previous field trip with less macroalgal and not such stagnant conditions in the upper reaches. Photos taken on cellphone.

Microalgae for Sites 1 and 2 only sampled 250 ml as water yellow. Site 1 had brine shrimp, black bits and small black round moving things. Salinity at Sites 1, 2 and 3 over on meter (i.e. > 100 ppt). No shrimp were found in the Site 3 samples. Site 4 (at start of island) in upper reaches. Salinity was 38-40 ppt and temperature 21.2 °C. Water quite clear some macroalgae fringing edges, sample collected. Site 5 was at the start of the reeds, salinity was 43.6 ppt and temperature 21.6 °C. Cyanobacterial mat present in some areas.

Site 1 reeds was taken where there were small pools of water (*Isoleptis* seepage site). Salinity was 10.9 ppt. Site 2 was upstream of this, damp but had to auger surface for water to measure with meter (6.9 ppt). Site 3 was next to the causeway in line with the first SANParks house. Augered to 30 cm water pooled easily (6 ppt).

One vegetation transect in lower reaches, ~30 m to V1, 8 m *Sarcocornia pillansii*, scattered *Sarcocornia pillansii*, *Drosanthemum* to water's edge. V4 opposite bank, 2 m *Sarcocornia natalensis*, 10 m *Sporobolus*, 10 m *S. pill*, 10 m dune terrestrial then end (V7).

Macrophyte health was an A, can stay this unless freshwater abstraction is more than thought, then must be reduced as lower reaches now a salt pan, don't know if this was natural? Water surface area has decreased over time possibly indicating some freshwater abstraction. Freshwater seep in upper reaches must be protected. How much of this water from SANParks offices?

Brak – 9 October

Drove past this small dry estuary. The upper reaches were a dry open saline pan. Nearby there was rehabilitation of dry open areas with kelp chips. The system was bisected by a road. On the sea side *Sarcocornia pillansii* occurred in the dry river channel. We drove to the mouth but there was no water there.

Sout – 9 October

The small hypersaline Sout Estuary is in a highly degraded condition as the upper reaches are a salt pan and the entire estuary has been reworked due to these activities. The estuary supports fringing salt marsh that grows in the disturbed habitat. We sampled microalgae in two lower ponds close to the mouth area. The pond closest to the mouth was anoxic and smelly with clear water and thick macroalgae around the edges. Salt marsh consisted of *Sarcocornia pillansii*, *Sarcocornia natalensis*, *Sporobolus virginicus* and *Limonium linifolium*. The microalgal Site 1 was closest to the mouth, 500 ml was sampled and an sample taken for

identification. Salinity was 42 ppt. Site 2 was the adjacent pond where salinity was 45 -48 ppt. Small black particles occurred in the water. Site 3 was in front of the salt pan area. It was disconnected from Site 2 and flamingos were numerous. Some brine shrimp occurred in the water sample as well as black particles. Salinity was 77.8 at Site 3. Only 250 ml was sampled for phytoplankton biomass (chlorophyll-a) as the water was thick with fine silt / organics. Site 4 was at the end of an intake channel. The water was clear and salinity was 101 ppt; 500 ml was sampled. Macrophyte score was a D for this estuary which should be lower as the system has been completely transformed.

#### SUMMARY

The five small estuaries sampled represented a range of conditions and pressures; from the highly transformed Buffels and Sout estuaries to the near pristine Spoeg Estuary. Swartlintjies, Bitter, Groen and Sout were hypersaline. Buffels, Spoeg and Groen had salinity gradients up the length of the estuary. The golf course and water run-off probably lowers salinity in the Buffels. The Spoeg had patches of reeds in the upper and riverine reaches indicating seepage sites and the Groen had a stretch of reeds in the upper reaches indicating an important groundwater fed area. Because of the arid highly saline conditions *Sarcocornia pillansii* was dominant. This plant grows in extreme saline dry environments. Brakgras *Sporobolus virginicus* was co-dominant. Where there was a more gradual elevation gradient then *Sarcocornia natalensis* was found growing closer to the water's edge (Spoeg and Groen). Submerged macrophytes only occurred in the fresher section of the Buffels and were abundant in the Spoeg Estuary.

## FISH AND INVERTEBRATE SURVEYS

Fish and invertebrate surveys undertaken by Dr Stephen Lamberth.

### BUFFLES ESTUARY

A survey was undertaken and the following fish was identified:

18 Flathead mullet (*Mugil cephalus*). The size ranged from 55 to 70 cm which indicated that they must have been in the estuary for 8 to 10 years, i.e. the estuary has not opened for the last 8 to 10 years

30 harders (*Liza richardsonii*). The size ranged from 38 to 44 cm.

Invertebrates sampled included saltflies, choronomid larvae and oligochaetes.

### SWARTLINTJIES ESTUARY

No fish was surveyed due to its hyper saline state.

Invertebrates sampled included brine shrimp and salt flies.

### SPOEG ESTUARY

A survey was undertaken and the following fish was identified:

Breeding population of Flathead mullet (*Mugil cephalus*) of about 50: The size ranged from 60 to 75 cm which indicated that they recruited 8 to 10 years ago.

A breeding population of gobies (*Caffrogobius*) in the system. Substantial population (estimated 10 000)

### GROEN ESTUARY

Used to be fish present, but they died out due to current hyper salinity.

Brine shrimp was sampled

### SOUT ESTUARY

No fish present due to hyper salinity.

Shrimp (*Palaemon peringueyi*(sp ?)). Isolated population which is interesting due to the fact that they are isolated in one pool. Genetic testing is therefore being done.

Brine shrimp was sampled

## BIRD SURVEYS

Bird identification and counts were undertaken at each of the estuaries by Stephen Lamberth and Delana Louw. The results are provided in the tables below.

Table **Error! No text of specified style in document..2** Bird counts at the Buffels Estuary.

Species	CSIR (14 Oct 1980) (Heineken 1980)	2016	Comments
White-fronted Sandplover	60	1	
Curlew Sandpiper	17	1	
Turnstone	5		
White-breasted Cormorant	37		
Cape Wagtail	10	3	
Coot	1	12	
Ringed Plover	4	1	
Ruff	5		
Cape Wagtail	1		
Cape Cormorant	27		
Southern Black-backed Gull	150		
Hartlaub's Gull	355		
Grey-headed Gull	4		
Common Sandpiper	1		
Stilt	2		
South African Shelduck	2		
African Sandmartin	4		Wrong identification - does not occur.
Cape Wagtail	2		
White-throated Swallow	2		
Greenshank	1		
Blacksmith Plover	3		
Karoo Scrub Robin	4		
Masked Weaver	2		
Pied Starling	1		
Wattled Starling	12		
Red Bishop bird	54		
Stone Chat	1		
Namaqua Dove	3		
Rock Pigeon	1		
Cape Sparrow	abundant		

Species	CSIR (14 Oct 1980) (Heinecken 1980)	2016	Comments
Brown throated martin			50 plus
Sacred ibis			10
Cape teals			11
Flamingo greater			1
Lesser flamingo			1
King fisher pied			1
Cape shoveler			2
Black crane			heard
Egyptian goose			heard
Stilt			11
Grebe black necked			2

Table **Error! No text of specified style in document..3** Bird counts at the Swartlintjies Estuary

Common name	Scientific name	CSIR (Heinecken 1980)	Anchor (22 June 2016)	2016
Cape Teal	<i>Anas capensis</i>		11	16
South African Shelduck	<i>Tadorna carna</i>	6		
Red-knobbed Coot	<i>Fulica cristata</i>	10		
Greater flamingo	<i>Phoenicopterus ruber</i>		17 ( 5 juveniles)	29
White-fronted plover	<i>Charadrius marginatus</i>	19	7	2
Black-winged stilt	<i>Himantopus himantopus</i>	2	30	8
Pied avocet	<i>Recurvirostra avosetta</i>	1	6	
Three-banded plover	<i>Charadrius tricollaris</i>	2		
Sanderling	<i>Calidris alba</i>	12		
Curlew sandpiper	<i>Calidris ferruginea</i>	23		
Blacksmith lapwing	<i>Vanellus armatus</i>	4		
Common-ringed plover	<i>Charadrius hiaticula</i>		1	
Kelp gull	<i>Larus dominicanus</i>		1	2
Hartlaub's gull	<i>Larus hartlaubii</i>		2	
Antarctic tern	<i>Sterna vittata</i>		1	
Cape wagtail	<i>Motacilla capensis</i>	6	3	2
Grey-backed cisticola	<i>Cisticola subruficapilla</i>		11	
African stonechat	<i>Saxicola torquatus</i>	2	6	
Yellow canary	<i>Crithagra flaviventris</i>		10	
Bokmakierie	<i>Telophorus zeylonus</i>		3	
Cape long-billed lark	<i>Certhilauda curvirostris</i>		7	
Rufous-eared Warbler	<i>Malcorus pectoralis</i>		2	

Common name	Scientific name	CSIR (Heinecken 1980)	Anchor (22 June 2016)	2016
Southern double-collared sunbird	<i>Cinnyris chalybeus</i>		1	
Karoo prinia	<i>Prinia maculosa</i>		2	
Pied crow	<i>Corvus albus</i>	3	2	
Sand martin	<i>Riparia riparia</i>	2	11	
Common ostrich	<i>Struthio camelus</i>		? (Footprints)	
Sandpiper Common	<i>Actitis hypoleucos</i>			4

Table Error! No text of specified style in document..4 Bird counts at the Spoeg Estuary

Species	CSIR (17/18 Oct 1980) (Bickerton 1981)	2016
Dabchick	1	
South African Shelduck	2	
Cape Teal	14	2
Red-knobbed coot	20	2
White-fronted Sandplover	8	2
Crowned Plover	2	
Blacksmith Plover	2	
Curlew Sandpiper	14	
Little Stint	1	
Sanderling	4	
Ruff	6	
Common Sandpiper	2	
Avocet	7	2
Hartlaub's Gull	2	1
Caspian Tern	1	
Black necked grebe		11
Greater flamingo		30
Little Egret	1+	
Little swits		11
Black headed heron		1
Pale chanting goshawk		1
Bokmakierie		1
Hadedda		heard
Lesser flamingo		5

Table Error! No text of specified style in document..5 Bird counts at the Groen Estuary

Species	79-01-11 Grindley	J R	80-01-19 J Cooper	80-10-20 ECRU	2016
Black necked Grebe			12	10	82
Cape Dabchick			4	1	
White breasted Cormorant			5	3	6
Cape Cormorant				1	
Grey Heron			1	4	
Greater Flamingo			49	282	108
Lesser Flamingo				13	40
Egyptian Goose				1	1
South African Shelduck			2	2	2
Cape Shoveller			1		
Yellow-billed Duck			12		
Cape Teal		30	34	38	15
Black Harrier				2	
Red-knobbed Coot		4	72	50	
Ringed Plover			7	2	3
White-fronted Sandplover		3	5	8	6
Chesnut-banded Sandplover		3			1
Kittlitz's Sandplover			6	2	3
Three-banded Sandplover			18	3	2
Grey Plover			1		
Blacksmith Plover			5	4	heard
Curlew Sandpiper		106	73	32	
Little Stint		25	61	3	13
Sanderling			1	10	9
Ruff			9	3	
Common Sandpiper		1		2	2
Marsh Sandpiper			5		2
Greenshank		8	2	3	
Wood Sandpiper			1		
Avocet		19	24	3	3
Black-winged Stili		5	9	2	20
Southern Black-backed Gull				6	1
Caspian Tern		1			
White-winged Black Tern		3	3		
European Swallow		12			

African Sand Martian	4			
Cape Wagtail	5	9	8	5
Hadeda				12
Glossy ibis				1
Hartlaub's gull				13
Ringed Plover				2
Grey tit				3
Red bishop				50
Feral pigeon				1
Bokmakierie				5

Table **Error! No text of specified style in document..6** Bird counts at the Sout Estuary

Common name	Scientific name	2016
Cape Teal	<i>Anas capensis</i>	4
Greater flamingo	<i>Phoenicopterus ruber</i>	47
White-fronted plover	<i>Charadrius marginatus</i>	11
Pied avocet	<i>Recurvirostra avosetta</i>	5
Three-banded plover	<i>Charadrius tricollaris</i>	7
Sanderling	<i>Calidris alba</i>	4
Curlew sandpiper	<i>Calidris ferruginea</i>	5
Kelp gull	<i>Larus dominicanus</i>	3
Cape wagtail	<i>Motacilla capensis</i>	2
Ethiopian snipe	<i>Gallinago nigripennis</i>	1
Chestnut banded plover	<i>Charadrius pallidus</i>	7
Marsh Sandpiper	<i>Tringa stagnatilis</i>	1
Lesser flamingo	<i>Phoeniconaias minor</i>	16
Common Sandpiper	<i>Actitis hypoleucos</i>	6
Caspian tern	<i>Hydroprogne caspia</i>	1

## PRELIMINARY ESTUARY FUNCTIONAL ZONE

Preliminary estuary functional zones provided by Dr T Riddyn and photographs by Lara Van Niekerk.

These zones were used for the lateral borders of the vegetation assessment and represents the estimate of the estuary functional zone. Based on the ground truthing assessment and vegetation cues, these will now be revised and updated.



Figure **Error! No text of specified style in document..1** Buffels Estuary preliminary functional zone



Figure **Error! No text of specified style in document..2** Buffels Estuary photograph (downstream section and mouth)

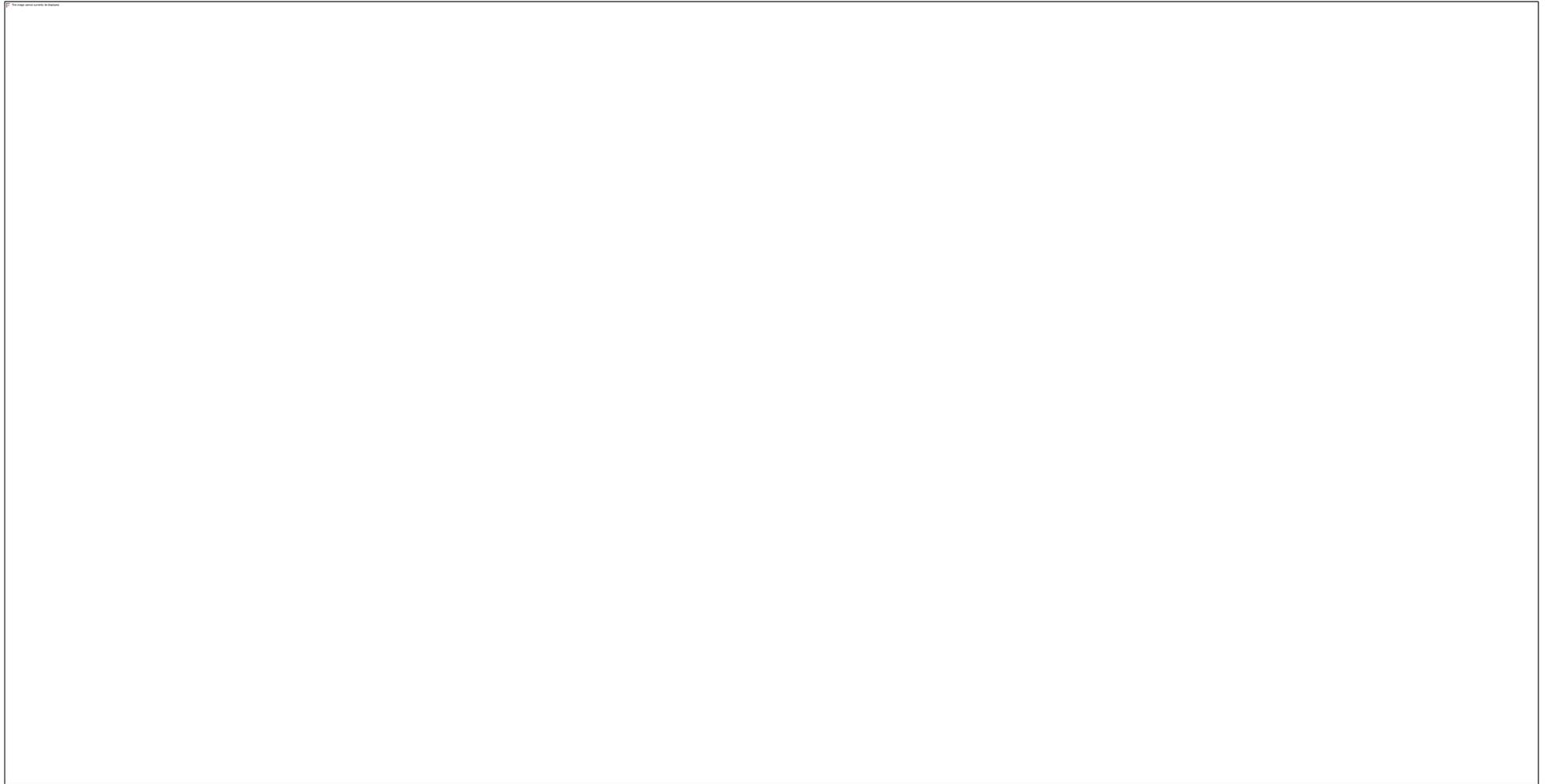


Figure **Error! No text of specified style in document..3** Swartlintjies Estuary preliminary functional zone



Figure **Error! No text of specified style in document..4** Swartlintjies Estuary looking upstream



Figure **Error! No text of specified style in document..5** Spoeg Estuary preliminary functional zone

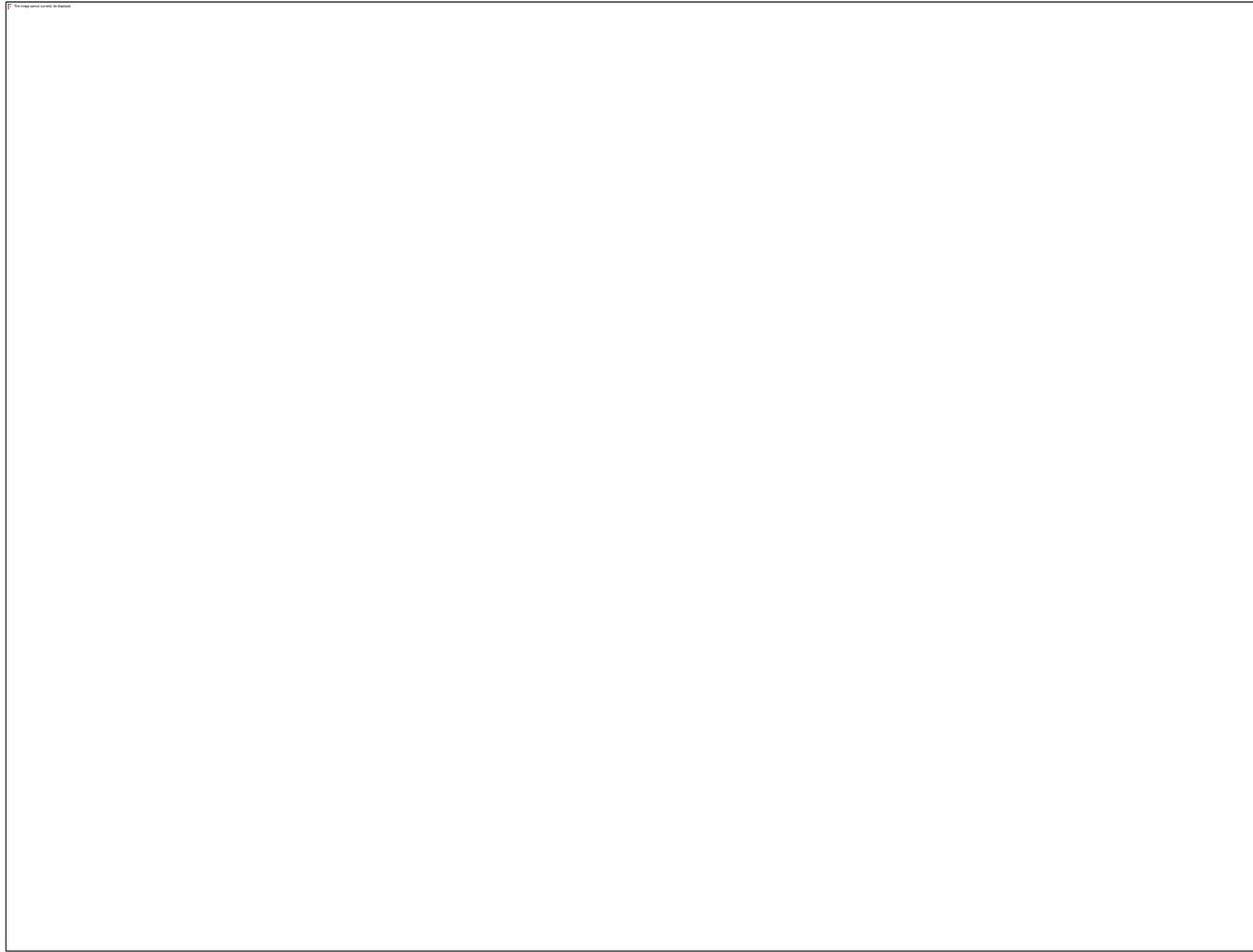


Figure **Error! No text of specified style in document..6** Spoeg Estuary

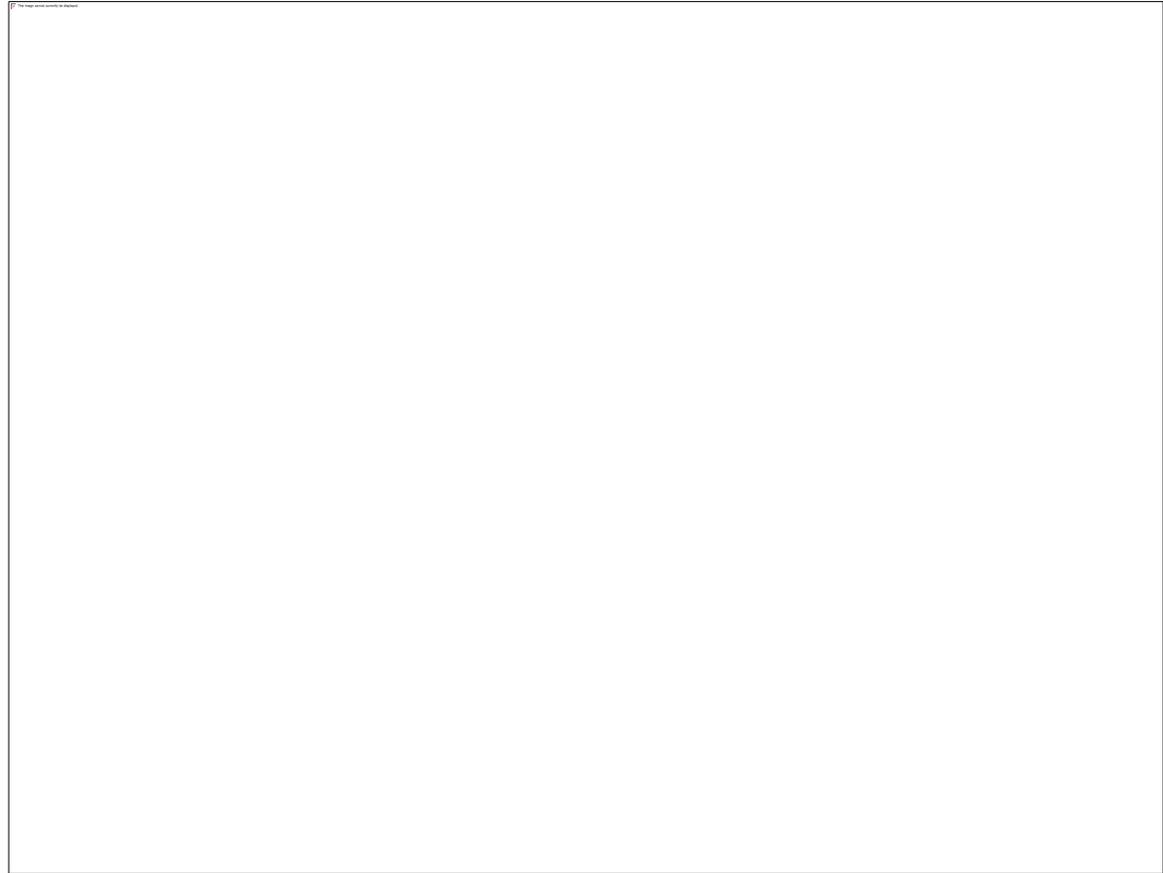
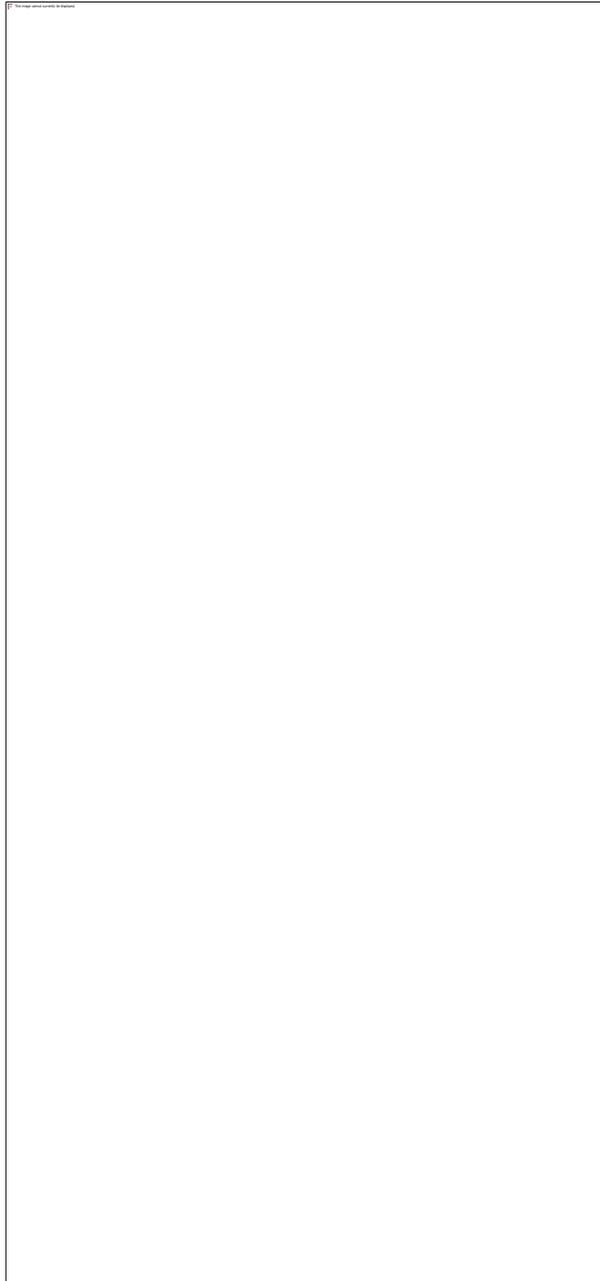


Figure **Error! No text of specified style in document..7** Groen Estuary

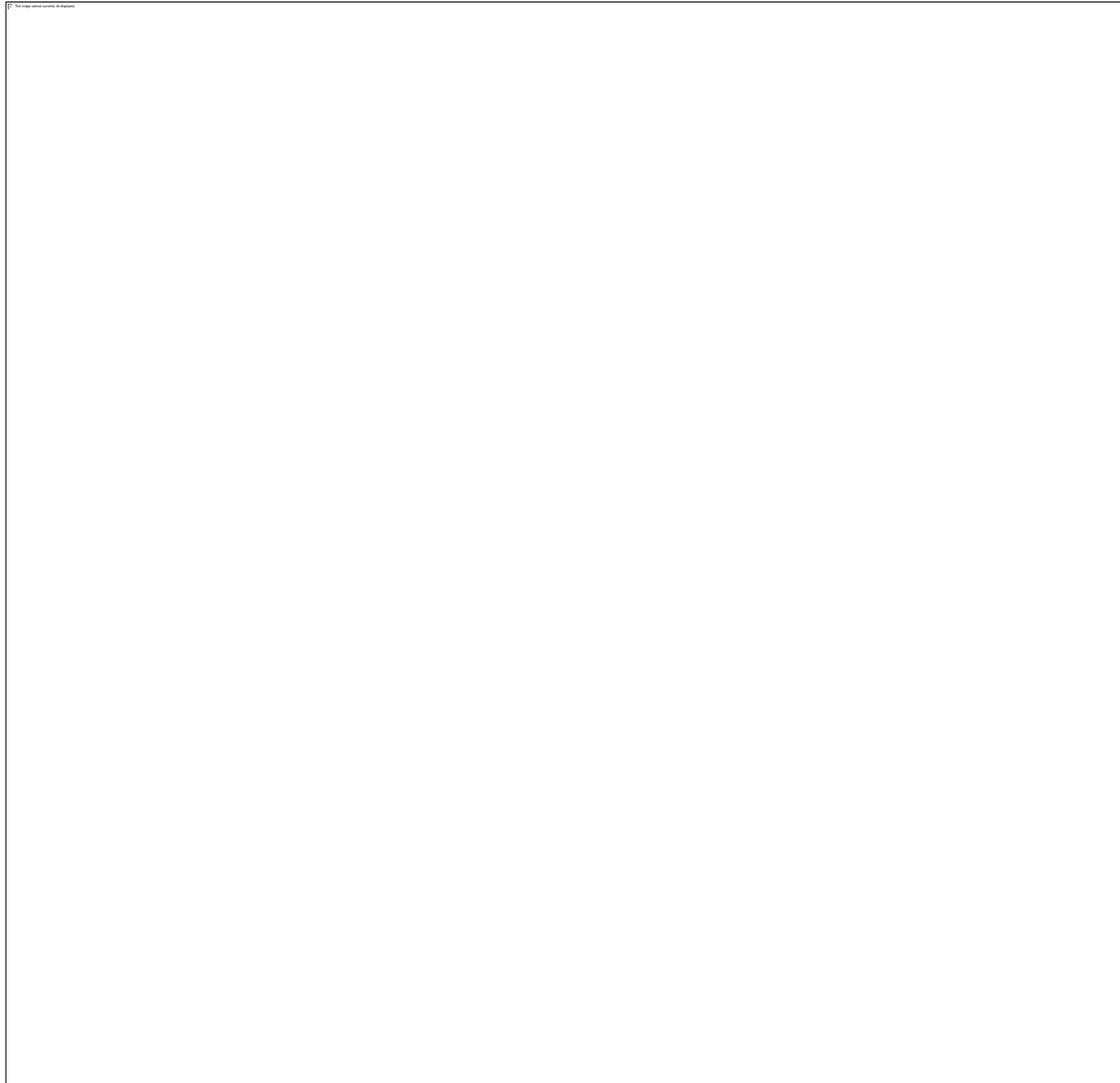


Figure **Error! No text of specified style in document..8** Sout Estuary preliminary functional zone



Figure **Error! No text of specified style in document..9** Sout Estuary photographs