The St. Lucia Game Reserve occupies an area of 36 826 hectares. It comprises the water area and islands of Lake St. Lucia and a strip of land approximately 0.8 km wide around most of the shoreline. The northeastern sector is set aside as a wilderness area, but the remainder is available for boating and recreational activities. A substantial segment of the lake area has restricted access due to military control and the use of the area for missile testing purposes.

St. Lucia Park, an area of 12 545 hectares, has some camping facilities, but a portion of the park is maintained as a conservation area.

False Bay Park on Lake St. Lucia, has an area of 2 247 hectares which is set aside for recreation, has camping facilities and provides angling, boating and game viewing.

Note on the Mkuzi Swamp

The Mkuzi Swamp is an integral part of the St. Lucia System, but it seems that very little research has been carried out in that area. It is a northern extension of St. Lucia Lake which has become shallow enough to support rooted and floating vegetation including stands of papyrus species. A natural bar at the southern end of the swamp inhibits the intrusion of saline water. There are four stretches of open water in the swamp: Ndlaka, Demezane, Mbazwan and Butterfly. Where the river enters the swamp there is a delta which contains four open lakes: Mpempe, Ntshangwe, Mdlanzi and Tshanetsha, forming an ecosystem hydrologically separated from the main Mkuzi swamp by two dry, narrow and steep sections at the toe of the delta.

A channel was once excavated from the Mkuze River near Mpempe Pan to a point near Demezane Pan in an attempt to introduce more fresh water to Lake St. Lucia. This channel has now closed and no attempts are planned to re-open it as the probable deliterious effect on the Mkuze swamps would seem to outweigh any advantage that might be gained by reducing the salinity of the northern end of Lake St. Lucia (Alexander 1976).

8.10 THE WILDERNESS LAKES

by J.S. MEPHAM

The Wilderness Lakes comprise a number of small estuarine lakes and lagoons located on the southern coast of Cape Province in the Republic of South Africa. They lie parallel to the coast between the Outeniqua Mountains to the north and coastal sand hills to the south. The lakes are fed by a number of rivers, most of which periodically breach the dunes to drain into the Indian Ocean. These old consolidated dunes protect the system from the prevailing southerly on-shore winds.

The systems dealt with here are:

8.9.a. The Touw River Floodplain (including Rondevlei, Langvlei, Eilandvlei and the Wilderness Lagoon),
8.9.b. Swartvlei,
8.9.c. Groenvlei.

Some authors use the term 'Wilderness Lakes' to refer only to those water bodies situated on the Touw River Floodplain, while others include Swartvlei and Groenvlei as part of the Wilderness Lakes System. In this account I shall use the term Touw River Floodplain for all those areas included in section 8.10.a.

The term 'vlei' is used in South Africa to indicate a range of wetland situations showing more or less seasonal flooding, and which include coastal and estuarine lakes having extensive areas of reeds and sedges, and other shallow water bodies such as may occur inland on river floodplains, which are dominated by similar emergent hydrophytes.

1. Geology

The system has been derived from river valleys which were drowned after the last ice age, about 16 000 years ago, and were then subsequently partially infilled by Quaternary sands. In this area calcium carbonate has cemented sand ridges to form wisespread aeolianite or dune rock. Inland from these Quaternary sands is a 200 m high coastal platform of Tertiary age, through which the rivers have cut deep valleys. The rivers originate in the Outeniqua Mountains, which comprise intensely folded Table Mountain sandstone.

2. Climate

It is mild and temperate, virtually frost free, with little variation in the mean temperature (see Fig.8.2 George).

Type: Cf (Köppen)

Air Temperature: mean daily max. range: 26°C summer, 19°C winter
mean daily min. range: 16°C summer, 6°C winter

Rainfall: Rain falls throughout the year and there is no discernible pattern. Monthly totals may vary from 10 to 160 mm with a mean annual total falling on Swartvlei Lake (1974-78) of 550 mm, and on the Outeniqua Mountains of 900-1000 mm.

Winds: SW winds predominate throughout the year, and in addition N and NE winds are common in the winter and SE winds in the summer. The chains of lakes, which lie in an E-W direction are afforded some measure of protection by the higher lying lands to the north and south. Data from the nearby town of George show that 80% of the winds are below 20 $km.h^{-1}$, and that 97% are below 30 $km.h^{-1}$. Very strong winds are rare in this area.

Cloud: skies are frequently overcast, with no great seasonal variation.

Solar Radiation: is low because of the predominantly cloudy conditions.

summer	2.25 $KJ.m^{-2}.day^{-1}$
winter	0.75 $KJ.m^{-2}.day^{-1}$

Evaporation: Class A pan: Mean annual evaporation from Swartvlei Lake is 1127 mm, which is equivalent to a total annual loss of between 9.92 and 12.13 x 10^6 m^3 depending on the fluctuating area of the lake.

8.10.a THE TOUW RIVER FLOODPLAIN

A detailed account of this area is to be found in Allanson and Whitfield (1983).

1. Geography and morphology

The Touw River flows in a southerly direction from the Outeniqua Mountains widening into the Wilderness Lagoon just behind its mouth, which is usually closed by a sand bar. On the floodplain to the east, the lagoon is linked to a chain of three small lakes which are themselves fed by the Touw River, and to a lesser extent by the Duiwe River and the Langvlei Spruit (Fig. 8.22). The direction of water flow into or out of these lakes depends upon the prevailing conditions at any time. Most of the Touw River Floodplain lies below the 5 m asl contour.

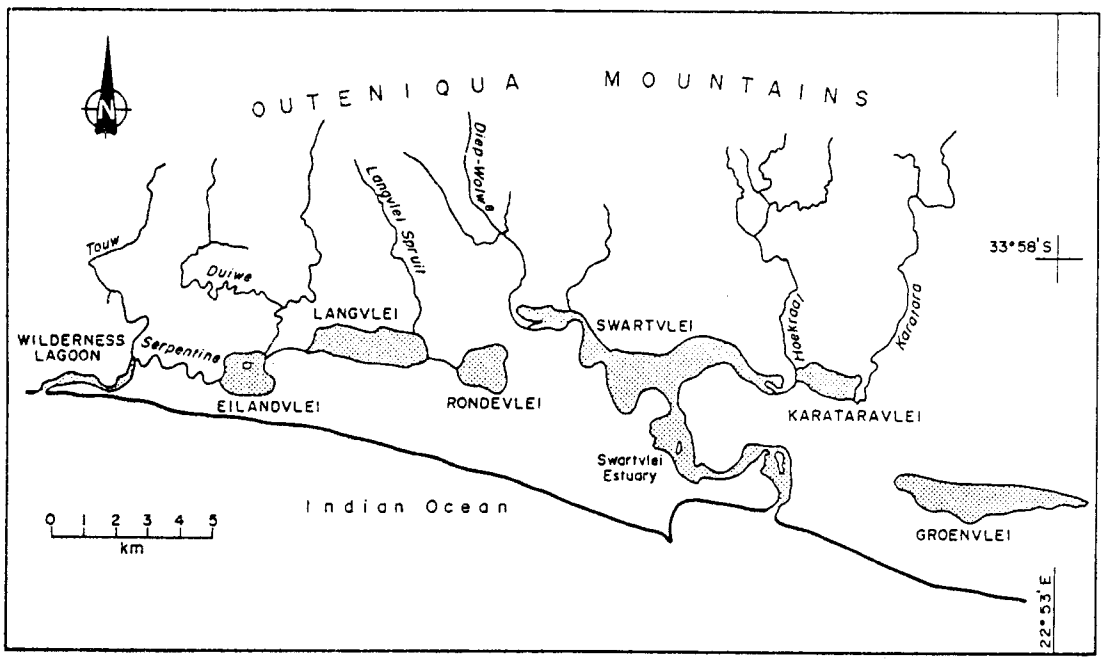


Fig. 8.22 Map of the Wilderness Area, showing lakes, lagoons and rivers.

Dimensions of Various Components of the Touw River Floodplain:

	Length m	Width m	Area ha	Depth m
Rondevlei			130	5
Channel		2-3		
Langvlei			216	4
Channel	900	200	15	
Eilandvlei			143	6.5
Serpentine	5600			2.75
Wilderness Lagoon	1300	180	18	
Total area			911	

Rondevlei is the easternmost lake and furthest from the sea and the Touw River. It is not fed directly by any streams and is thus usually the most saline of these lakes. At times it even becomes endorheic when the water level drops below that in the channel linking it to the next lake.

Langvlei is the largest of the lakes and is almost completely surrounded by reed beds. It is fed principally by two streams, the Langvlei Spruit and the Touw River, but also receives the overflow from Rondevlei via a short channel, which is now dredged and kept 2-3 m wide, between reed beds on either side.

Eilandvlei lies to the west of Langvlei to which it is connected by a channel almost permanently blocked by macrophytes. It is so called because of the presence of Drommedaris Island within it. The Duiwe River runs into the NE side of the lake, close to the entrance of the channel from Langvlei. When the mouth of Wilderness Lagoon is open, seawater may reach Eilandvlei via the Serpentine. This is the only lake in the system which sometimes shows meromictic conditions (Coetzee 1979).

The Serpentine is a meandering channel about 5.6 km long which passes through a swamp to connect Eilandvlei with the Touw River.

The Wilderness Lagoon lies behind the mouth of the river and periodically opens to the sea. When the mouth is open high tides may cause backing up of fresh water in the lakes and channels, and incursion of sea water into normally fresh water areas.

The straight line distance from Rondevlei to the estuary mouth is 13 km and the gradient through the system is only very slight. This means that when the mouth of the lagoon is closed, movement of the water through the system is slow and in the event of floods the flow may be reversed up the channels, with consequent inundation of the adjacent floodplain.

Location: The system lies between 33°59'-34°00'S and 22°35'-22°44'E.

Catchment Area:		
	Touw River	103 km^2
	Duiwe River	34 km^2
	Langvlei Spruit	9 km^2

Altitude: almost the entire area is less than 5 m asl

Other Features: Drommedaris Island has suffered only minor interference by man. It is about 270 m long, 90 m wide, 32 m high, has a surface area of 6.34 ha, and is surrounded by reed beds.

Soils: are derived from Pleistocene and Recent coastal sands, but most of the floodplain is covered with a dark alluvium, rich in organic matter. A few higher areas have a loose sandy soil which is low in humus content.

2. Hydrography and hydrology

No figures are available for evaporation, but estimated runoffs for the various catchments are given below.

Rainfall and runoff for the catchments of the Touw River Floodplain

	mean annual rainfall mm	mean annual runoff 10^6 m^3
Touw River	915	22.6
Duiwe River	910	6.0
Langvlei Spruit	900	1.5
Approximate total	2725	30.0

Floods reaching more than 2.6 m asl result in flooding of residential properties along the shores of the Wilderness Lagoon. Using hydraulic models it has been estimated that the water can be kept below this level, provided that the sand sill at the mouth of the estuary is maintained at 2.1 to 2.4 m asl.

3. Physico-chemical characteristics

		Non-flood Conditions mean	range	Flood Conditions mean	range
Temperature	Wild. Lagoon	19.3	12.0-24.5	16.6	13.5-20
	Touw River	18.0	10.0-26.5	16.1	13.0-19
°C	Eilandvlei	19.4	12.5-25.5	18.3	15.0-22
	Langvlei	20.0	13.0-27.5	17.8	12.5-23
	Rondevlei	20.1	13.0-27.0	18.5	13.0-23
Salinity	Wild. Lagoon	7.8	0-25	2.0	0-4
	Touw River	4.6	0-18	0.3	0-2
°/oo	Eilandvlei	6.2	4-10	3.2	2-4
	Langvlei	10.6	8-13	6.2	4-8
	Rondevlei	13.9	12-16	11.6	9-13
Oxygen	Wild. Lagoon	7.3	1.4-9.6	7.2	6.1-8.5
	Touw River	6.5	2.9-10.0	7.0	4.1-9.5
$mg.l^{-1}$	Eilandvlei	7.5	0.3-11.7	7.1	4.3-8.9
	Langvlei	7.0	0.6-11.2	7.0	1.2-9.6
	Rondevlei	7.1	0.2-14.4	7.3	2.4-9.5
pH	Wild. Lagoon	8.0	7.2-9.0	6.9	6.1-7.3
	Touw River	7.2	5.2-8.6	6.1	5.1-7.0
	Eilandvlei	8.1	7.5-9.2	7.6	7.4-7.7
	Langvlei	8.1	7.2-9.2	8.1	7.8-8.3
	Rondevlei	8.7	8.3-9.7	8.6	8.6-8.7
Turbidity	Wild. Lagoon	135	100-170	55	50-60
Secchi disc	Touw River	clear to bottom		65	60-70
cm	Eilandvlei	179	90-320	42	20-70
	Langvlei	142	50-250	92	50-160
	Rondevlei	62	30-140	52	40-70

4. Nutrients

Soluble	Wild. Lagoon	0.8	0-2.2	3.5	0-8.7
Reactive	Touw River	0.6	0-1.8	2.6	0-6
Phosphate	Eilandvlei	1.4	0-9.0	3.0	0-10
	Langvlei	3.6	1-18	2.7	1.6-5.1
$10^{-6}g.l^{-1}$	Rondevlei	4.1	1-20	0.8	0-2
Total	Wild. Lagoon	7.8	1-17	28.3	3-39
Phosphate	Touw River	8.0	1-16	17.2	3-45
	Eilandvlei	22.3	3-59	61.4	31-85
$10^{-6}g.l^{-1}$	Langvlei	36.2	5-66	42.0	25-48
	Rondevlei	65.4	10-117	63.7	50-73
Nitrate	Wild. Lagoon	29.0	7-60	71.0	28-137
(NO_3N)	Touw River	21.9	3-52	54.5	33-77
	Eilandvlei	8.3	0-39	94.4	36-174
$10^{-6}g.l^{-1}$	Langvlei	159.4	1-569	43.0	13-70
	Rondevlei	30.0	12-44	28.2	23-32

5. Phytoplankton

Chloro-phyll a	Wild. Lagoon	1.8	0.4-7	8.8	0.5-32
	Touw River	-	-	-	-
	Eilandvlei	8.2	1-19	29.3	6-59
$10^{-6}g.l^{-1}$	Langvlei	11.0	0.4-36	46.5	13-146
	Rondevlei	13.1	3-37	20.2	6-52

6. Macrophytes

The most common emergent macrophyte in the shallowest water is Phragmites australis, which is found surrounding all the lakes and lining the channels. It frequently extends into a broad swamp and merges with the terrestrial grasslands and scrub. Scirpus litoralis and Typha latifolia are usually found with the Phragmites, and also extend into the deeper water. Typha latifolia is not found in the Wilderness Lagoon nor in the lower reaches of the Touw river, no doubt due to high salinities which occasionally occur when sea water penetrates this far. Where there has been interference in the wettest areas Juncus kraussii has taken over as the dominant vegetation. It is found in all the lakes and channels, but not around the relatively undisturbed Drommedaris Island.

The submerged macrophyte Potamogeton pectinatus occurs throughout the system, its density and distribution varying from season to season, and from year to year. In the lower parts of the system some Ruppia cirrhosa (syn. spiralis) is found, with the maximum production by this species occurring in Eilandvlei. This species is not found in the channels. In addition, dense beds of Characeae, mainly Chara globularis var. kraussii and Lamprothamnium, have occurred in Langvlei, although they have subsequently been shaded out by Dinoflagellate blooms.

Free-floating and floating-leaved aquatic plants are rare in this system, possibly because of the high salinity of the water. However Salvinia molesta has been recorded here, and it is possible that if the salinity of Eilandvlei continues to decline in response to reduced tidal inflow, then excessive growth of Salvinia may become a major problem.

Estimated above ground annual production of major aquatic plants in the Touw River System during 1978/79. (After Howard-Williams, 1980).

	$t.y^{-1}$
Typha latifolia	182.8
Phragmites australis	1086.0
Scirpus litoralis	351.6
Characeae	46.6
Ruppia cirrhosa (syn. spiralis)	1.2
Potamogeton pectinatus	286.3
Total	1954.5

7. Invertebrates

Zooplankton: According to Coetzee (1983) the Zooplankton of the Touw River floodplain supports an estuarine fauna which, during 1976, was dominated by lamellibranch veliger larvae and copepods. The two most important copepod species were Arcartia natalensis and Pseudodiaptomus hessei. During periods of high rainfall freshwater organisms (e.g. Cladocera) are flushed into the system, whereas marine zooplankton enter when the estuary is open to the sea. The greatest variety of zooplankton occurs in areas closest to the estuary mouth, but the greatest numbers have been recorded from Eilandvlei.

Mean daytime numbers:	Eilandvlei	14 641 m^{-3}
	Rondevlei	13 108 m^{-3}
Mean daytime standing crop:	Langvlei	17 mg dry mass.m^{-3}
	Rondevlei	15 mg dry mass.m^{-3}
	Eilandvlei	6 mg dry mass.m^{-3}

Macro-invertebrates: The mean biomass of macro-invertebrates from the Touw River Floodplain between January 1979 and June 1980 (after Davies 1981):

Locality	Invertebrate Biomass in Sediments	(g dry mass m^{-2}) on Potamogeton
Wilderness Lagoon	19.2	-
Lower Touw River	13.0	128.9
Western Serpentine	4.3	91.0
Eastern Serpentine	4.6	35.7
Eilandvlei	5.9	54.8
Langvlei (inshore)	9.9	-
Langvlei (offshore)	14.7	-
Rondevlei (inshore)	19.5	-
Rondevlei (offshore)	23.5	-
Touw River System Mean	12.7	77.6

Most of the aquatic invertebrates in this system are true estuarine species and would tend to disappear if the system were to become entirely freshwater, as would happen if the mouth were not opened periodically. The dominant marine/estuarine species include the amphipods Corophium triaenonyx, Grandidierella lignorum and Melita zeylanica, the isopods Exosphaeroma hylecoetes and Cyathura estuaria, a bivalve Musculus virgiliae, a polychaete Phaecopomatus enigmatica, a crab Hymenosoma orbiculare, and a prawn Callianassa kraussi. The most important freshwater/estuarine component comprises various members of the Chironomidae. These animals feed on detritus derived mainly from Potamogeton, Ruppia and Characeae. Extensive weed cutting has resulted in drastic reductions in numbers, as was seen in 1979 when there was a complete collapse of invertebrate stocks in the Serpentine. A die-back of the Potamogeton beds in Eilandvlei resulted in a major decline of the epifauna from 297 g dry mass.m^{-2} in May 1979 to 23 g dry mass.m^{-2} in May 1980 (Davies 1981).

8. Fish

Prior to the construction of a sluice in the Serpentine, the lakes were dominated by marine/estuarine fish species, which entered the estuary from the sea as small juveniles during summer (October to March), and susequently migrated to the upper lakes. Normally they returned to the sea for spawning after two years. When some species such as Mugil cephalus, Liza richardsoni and Rhabdosargus holubi were trapped in Rondevlei for a period of five years, they did not reproduce. All the marine/estuarine species here are able to tolerate salinity fluctuations, but not when the salinity falls below 2 °/₀₀ in conjunction with low temperatures, which has resulted in the death of many fish. (Whitfield et al. 1981). The principal fish species in the Touw River Floodplain prior to the construction and operation of the Serpentine sluice gate are listed below. (Data from van Wyk 1977, and Ratte).

Species	Common name	Type
Lichia amia	Leervis	marine/estuarine
Oreochromis mossambicus	Mozambique tilapia	freshwater
Hyporhamphus capensis	Knysna halfbeak	marine/estuarine
Monodactylus falciformis	Cape moony	marine/estuarine
Liza dumerili	Groovy mullet	marine estuarine
Liza richardsoni	Southern mullet	marine/estuarine
Liza tricuspidens	Striped mullet	marine/estuarine
Mugil cephalus	Flathead mullet	marine/estuarine
Myxus capensis	Freshwater mullet	marine/estuarine
Lithognathus lithognathus	White steenbras	marine/estuarine
Rhabdosargus holubi	Cape stumpnose	marine/estuarine
Hepsetia breviceps	Cape silverside	estuarine
Gillchristella aesturias	Estuarine round-herring	estuarine

9. Other vertebrates

Birds: According to Boshoff and Palmer (1981) the Wilderness Lakes comprise one of the most important wetland areas in the Cape Province, in terms of permanently available habitats for water birds. The system supports large populations of herbivorous and piscivorous birds, including ducks of several species, and it is an important site for both Palearctic migrant waders and southern African waterfowl undergoing moult migrations. The lakes also provide refuge and food for seabirds during adverse weather conditions off the southern Cape coast. Boshoff and Palmer (1981) counted more than 7000 water birds from 65 different species at Langvlei. Two rare species are found in this area: Circus ranivorous (African marsh harrier) and Tyto capensis (grass owl). The Cape Department of Nature and Environmental Conservation has recommended that Langvlei and Rondevlei be listed in terms of the Ramsar Convention as a 'Wetland of International Importance'.

Mammals: Palmer (1979) investigated the rodents and shrews in the system. He found Otomys irroratus (vlei rat), Rhabdomys pumilio (striped mouse), Crocidura flavescens (red musk shrew) and Myosorex varius (forest shrew) on the lower floodplain.

10. **Human activity and development**

At present a coast road runs just north of the dunes between the lakes and the sea, but there are plans to construct a new coastal freeway, which will undoubtedly have a detrimental effect if it passes through, or close to, the Wilderness lakes complex. The lagoon and lakes are important for tourism and recreation (water sports, sight seeing and picnicking) and the small town of Wilderness has grown up around the mouth of the river .

Nature reserve status prevails over the Touw River valley upstream of the plateau face and at Rondevlei. Agriculture and forestry are practised locally elsewhere in the system, and the remaining areas are covered by indigenous scrub and scrub forest, together with some invading exotic species.

8.10.b SWARTVLEI

Swartvlei is an estuarine lake, which is only occasionally cut off from the sea by a sand bar. This account deals mainly with the characteristics of the lake per se. A more detailed account of the area is to be found in 'Estuaries of the Cape' Part II, Swartvlei. CSIR. Stellenbosch. 1983.

1. **Geography and morphology**

Swartvlei is situated between Groenvlei in the east and the Touw River to the west (Fig.8.22).

Location: 34°0'S, and 22°46'E

Area: 8.8 km^2 (approximately)

Length: 9 km (maximum)

Width: 3 km (maximum)

Depth: 5.5 m (mean), 16.7 m (maximum)

2. **Hydrology and hydrography**

Most fresh water enters the lake from the Wolwe, Hoëkraal and Karatara Rivers which flow down from the Outeniqua Mountains to the north. The rivers are brown due to the presence of dissolved organic matter, and this in turn produces the dark colour of the lake; hence the name 'Swartvlei' (swart = black).

Precipitation occurs throughout the year, and the rivers are perennial with no distinct seasonality of flow. Occasional floods cause peak inflow periods, but these are short lived. Inflow is about 5 times as high as rainfall, so that Swartvlei Lake does not become hyper-saline (in the same way as Lake St Lucia does).

The nearby Sedgefield Municipality removes about 2.6 x 10^5 m^3 of water per year. The Department of Environmental Affairs is considering building dams on the Wolwe and Karatara Rivers, which would then alter the amount of water flowing into Swartvlei, and possibly cause an increase in salinity.

	Catchment Area km^2	Mean Runoff $10^6 m.^3 y^{-1}$
Wolwe River	125	19.8
Hoëkraal River	109	24.8
Karatara River	106	20.1
Streams and precipitation		1.0
Total	340	66.0

Tidal influence: During the tidal phase, when the mouth is open, sea water enters the system at spring tides. When sea water enters the lake, it usually does so as a wedge, pushing underneath the less dense, fresh water, forming a distinct layer. At neap tides there is a continuous outflow from the lake, which often lasts for several days. During each period of spring to neap tide, a volume of 1.164 x 10^6 m^3 of water enters the estuary, giving an annual tidal inflow of 26 x 10^6 m^3.

During the lagoonal phase, when the estuary is closed by a sand bar, the level of water in the lake rises from river inflow, and the salinity decreases. This situation tends to last until residential properties are threatened by the rising waters, and an artificial breach is made in the sand bar. The estuary becomes closed in this way almost every year.

3. Physico-chemical characteristics of the water

Swartvlei lake is meromictic showing vertical stratification of salt concentration. Whereas the surface layers may show salinity of 1-8°/₀₀, the bottom may have more than 20°/₀₀. This stratification is disrupted only by very strong winds. Because there is little mixing, the deeper layers become anoxic, and hydrogen sulphide is produced by the reduction of proteinaceous sulphur, leading to a toxic environment in the deeper parts of the lake.

Temperature: seasonal changes are slow.

surface temperature,	January, February, mean	25°C
surface temperature,	June, July, mean	15°C

pH: 8

Dissolved Oxygen:	January, February, mean	7 $mg.l^{-1}$
	July, August, mean	9-10 $mg.l^{-1}$

Phosphorus:	soluble reactive phosphate, surface	$1.10^{-6} g.l^{-1}$
	total dissolved phosphorus, surface	$30.10^{-6} g.l^{-1}$
	total phosphorus, bottom (unavailable for plant growth)	$100.10^{-6} g.l^{-1}$

4. Macrophytes

The floating macrophyte Salvinia sp. is present in the tributaries, but does not extend into the lake, presumably because of the higher salinity and exposure to wind.

There is extensive growth of submerged and emergent macrophytes in water of less than 3 m. Potamogeton pectinatus is particularly important, growing submerged in water to a depth of 2 m. Together with its periphyton, it forms the basis of the primary production in the lake. In the shallow water behind the Potamogeton various members of the Charophyta are found. The emergent species Scirpus litoralis and Phragmites australis grow along the edges of the vlei, with the less prominent Typha capensis and Scirpus maritimus.

Productivity has been estimated at:

Potamogeton	1310×10^3 kg. y^{-1}
Chara	344×10^3 kg. y^{-1}
Phragmites	303×10^3 kg. y^{-1}
large algae, e.g. Cladophora spp.	90×10^3 kg. y^{-1}
smaller, attached algae e.g. Cocconeis	98×10^3 kg. y^{-1}

5. Phytoplankton

Populations are low and the waters of Swartvlei are classified as oligotrophic. The phytoplankton community consists largely of diatoms, dinoflagellates and flagellates. Robarts (1976) concluded that much of the phytoplankton was occupied by nanoplankton diatoms, the commonest being Coscinodiscus lineatus. He estimated that the population of the nanoplankton never exceeded 3.5×10^5 cells per litre, and indicated that rates of primary production (344 kg $\times 10^3$ dry weight per annum) in the pelagic zone were the lowest recorded for for any African water body.

6. Invertebrates

Zooplankton: Coetzee (1981) found two distinct communities. An aerobic one was dominated by Arcatia natalensis, Pseudodiaptomus hessei, Musculus virgiliae, veligers and calanoid copepod nauplii. In regions of low oxygen tension a community comprising cyclopoid copepods, cyclopoid nauplii and the larval and juvenile stages of polychaetes was found.

Other Invertebrates: There is a rich littoral invertebrate community, which is important in supporting a wide range of fish species. A large invertebrate population is associated with the littoral plants and is dominated by 5 species; the bivalve Musculus virgiliae, the isopod Exosphaeroma hylecotes and amphipods Corophium triaenonyx, Grandidierella lignorum and Melita zeylanica. Other important species include the tanaid Apseudes digitalis, the isopod Cyathura estuaria, the crab Hymenosoma orbiculare, and various chironomids and ostracods (Davies 1982).

7. Fish

There are 33 species present in the system, the most important of which are Monodactylus falciformis (Cape moony), which feeds on invertebrates associated with aquatic macrophytes, and Rhabdosargus holubi (Cape stumpnose), which consumes both invertebrates and plant material. Various species of mullet feed on detritus from the plant beds.

8. Other vertebrates

Amphibia: Eight species of frogs and toads have been recorded in the area.

Reptiles: 17 species of snake, and various tortoises, terrapins and turtles have been recorded.

Birds: Altogether 57 species have been recorded on the lake, in densities ranging from 100 to 5000, with an average of approximately 1000.

Mammals: 29 species have been recorded from the immediate vicinity of the lake, including monkeys, various carnivores and rodents.

9. Human activity and management

Swartvlei forms part of the natural lakeland area of the Southern Cape Province. It is a popular holiday area for aquatic recreation of all types.

8.10.c GROENVLEI

Groenvlei is the most easterly of the Wilderness lakes, but is different from the rest in having no outflow. It is green in colour, and hence its name (groen = green). Some description of the area is given by Coetzee (1980) and Martin (1960).

1. Geography (Fig.8.22)

Location: 22°50'E; 34°S.

Length: (maximum) 3.7 km

Width: (maximum) 0.9 km

Surface Area: 2.48 km^2

Maximum Depth: 5.5 m

Average Depth: 3.7 m

Landscapes: The lake is separated from the sea by high coastal dunes. Geological data indicate that it was formerly connected to

the sea via part of the Swartvlei estuary. The small catchment area consists almost entirely of vegetated dunes.

2. Hydrography

This is an endorheic lake, with no direct outflow, nor any distinct inflow streams. The water balance depends entirely upon rainfall, spring flow, evaporation and seepage.

3. Physico-chemical characterisitcs of the water

Since Groenvlei is relatively shallow, the waters are easily mixed by wind action.

Temperature:	January, mean	27°C
	July, mean	13°C
pH:	November, mean	8.9
	June, mean	8.6

Transparency: Fairly turbid, with a mean Secchi disc value of 1.1 m. The green colour of the lake is due to the high level of soluble plant pigments found in the lake.

Salinity: This has remained fairly constant for the last 30 years at 2-3°/₀₀.

Total Dissolved Solids:		2 $g.l^{-1}$
	Ca	54 $mg.l^{-1}$
	Mg	114 $mg.l^{-1}$
	Na	987 $mg.l^{-1}$
	K	23 $mg.l^{-1}$
PO_4-P	April/May	0.2 $10^{-6}g.l^{-1}$
	March	0.05 $10^{-6}g.l^{-1}$
	mean, annual	0.19 $10^{-6}g.l^{-1}$
$(NO_3+NO_2)N$	July	7.0 $10^{-6}g.l^{-1}$
	April	1.0 $10^{-6}g.l^{-1}$
	mean, annual	1.8 $10^{-6}g.l^{-1}$

Pigments: (chlorophyll + phaeophytin)

March	12.0 $mg.m^3$
August	0.5 $mg.m^3$
mean, annual	4.0 $mg.m^3$

4. Macrophytes

The margins of the lake support Phragmites australis, Typha latifolia ssp. capensis, Cladium jamaicense and Scirpus litoralis. The submerged species Najas marina, Chara vulgaris and Chara globularis var. kraussii occur widely across the bottom.

5. Invertebrates

Zooplankton: The zooplankton of Groenvlei differs markedly from the rest of the Wilderness lakes. It is dominated by fresh water cyclopoid nauplius larvae, copepodites and adults, as well as ostracods, cladocerans and chironomid larvae, which Coetzee attributes to the low salinity of Groenvlei. A checklist is available in Coetzee (1980). The mean zooplankton standing crop is 10 mg dry mass per m^3, with numbers reaching their maximum in autumn (April/May) i.e. one month after the maximum value for the phytoplankton standing crop is obtained. During the daytime most members are found at the bottom of the lake, but at night they rise through the water column.

Benthic and Epiphytic Invertebrates: A number of relict estuarine species are found here, including Pseudosphaeroma barnardi and Grandidierella lignorum, which is a tube dwelling amphipod found in brackish conditions (with salinity less than 4°/₀₀). This latter species is endemic to the region between Cape Agulhas and Natal and is found in all the Wilderness lakes. Both of these species are also found in Lake Sibaya (8.8).

6. Fish

Two species of land-locked estuarine fish are found in Groenvlei, Gilchristella aestuarius (whitebait) and Hepsetia breviceps. Introduced fish include Micropterus salmoides (large mouth bass), Lepomis macrochirus (blue gill sunfish), and Gambusia affinis (mosquito fish). In 1976 Oreochromis (= Sarotherodon) mossambicus was introduced for angling and to help curb algal growth.

7. Other vertebrates

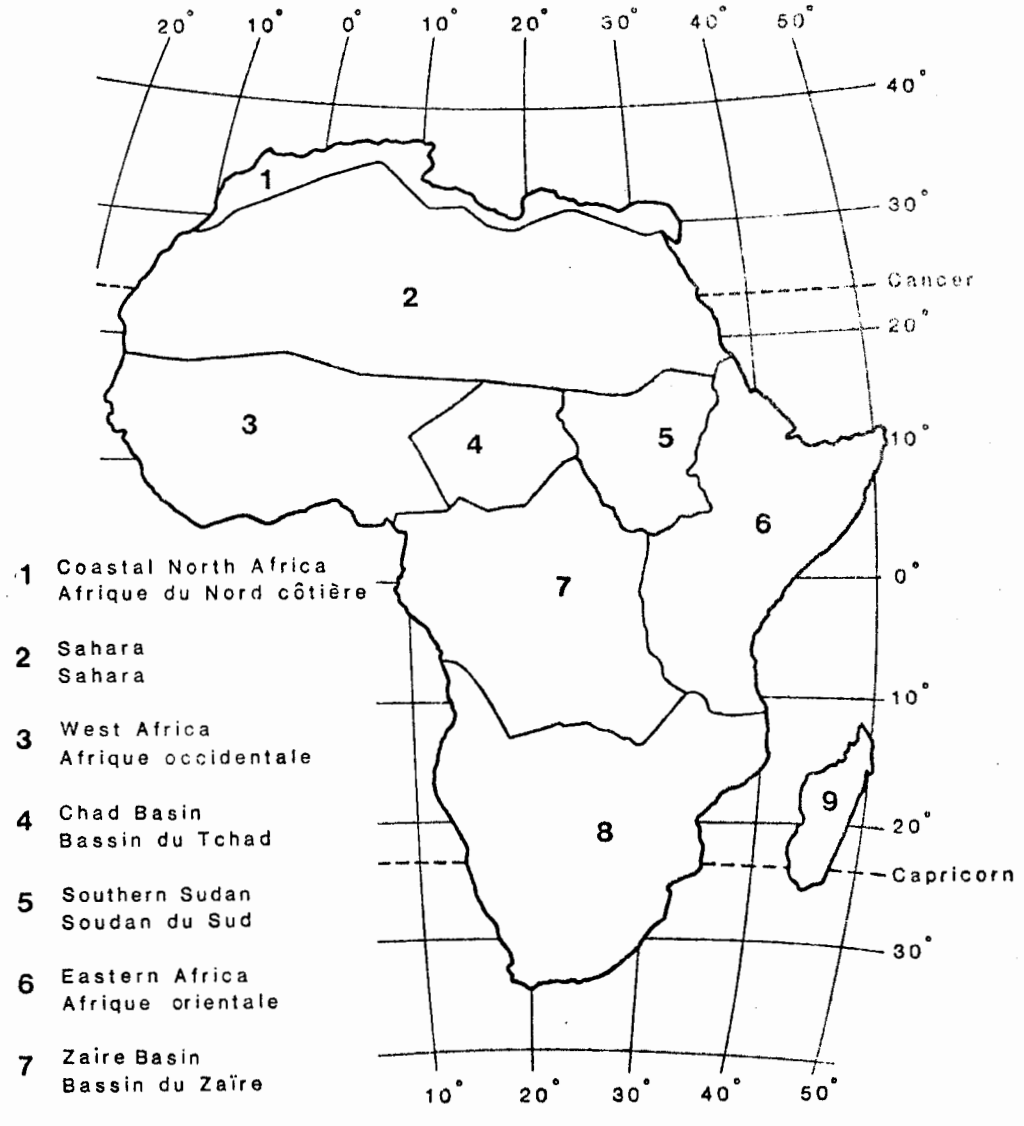
Reptiles: tortoises are common on the surrounding sand flats and dunes.

Birds: A great variety of birds is found on the lake, reedbeds and mudflats, including dabchicks, cormorants, ducks, moorhens, kingfishers and the Cape sea-eagles (Haliaeetus vocifer).

Mammals: There are no true aquatic mammals living in the water, but various rodents, e.g. vlei rats (Otomys spp.) and mole rats (e.g. Bathergus suillus), are found in the surrounding vegetation.

8. Human activity

The lake and its seaward catchment form part of the Goukamma Provincial Nature Reserve.



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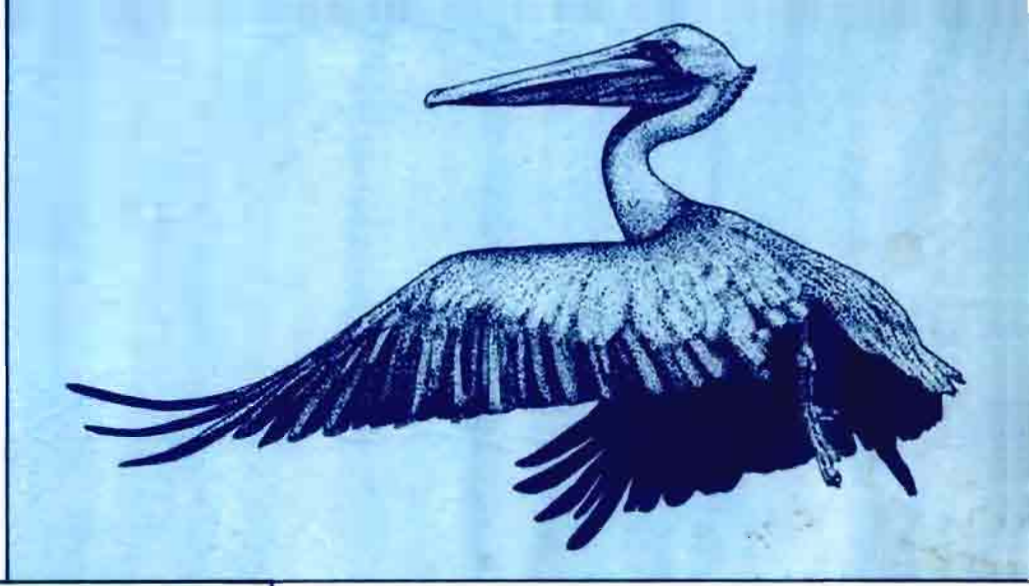

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Zones humides et lacs peu profonds d'Afrique

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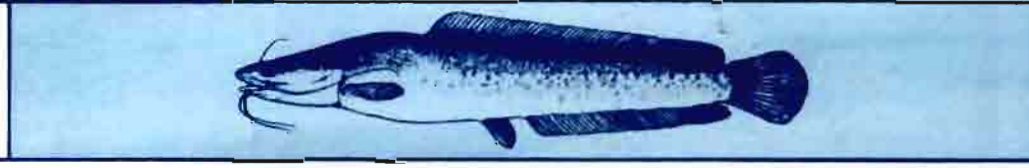

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