Wetlands of the Cunene River

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ABSTRACT

The Cunene River with a total length of approximately 890 km, rises in the vicinity of Nova Lisboa in Angola. From the Ruacana Falls the Cunene River flows westwards for 340 km before it enters the Atlantic Ocean and forms the international boundary between Namibia and Angola. Floodplain wetlands occur between Matunto and Calueque in Angola. No literature could, however, be found on these wetlands. No floodplains occur west of Ruacana falls due to the steep fall in gradient. Seven endemic fish species are known in this system of which two species are listed as rare.

INTRODUCTION

According to Bell-Cross (1965-1966) the eastern and western basins were the only two drainage basins in Central Africa in the late Tertiary. The eastern basin comprised the Chambeshi, Kafue, Upper Zambezi, Kavango and Cunene River systems. After the Tertiary drainages were disrupted, the Cunene River was isolated by a coastal tributary. The Cunene River rises in the vicinity of Nova Lisboa and flows southwards over a distance of 550 km before plunging over the Ruacana Falls. From the Falls the Cunene River flows westwards for 340 km before it enters the Atlantic Ocean and forms the international boundary between Namibia and Angola.

REGIONAL ACCOUNT

The total catchment area of the Cunene measures 106 500 km², of which 14 100 km² lies in Namibia (Fig. 1: Midgley 1966). The headwaters of the river lie at elevations of between 1 700 and 2 000 m above sea level.

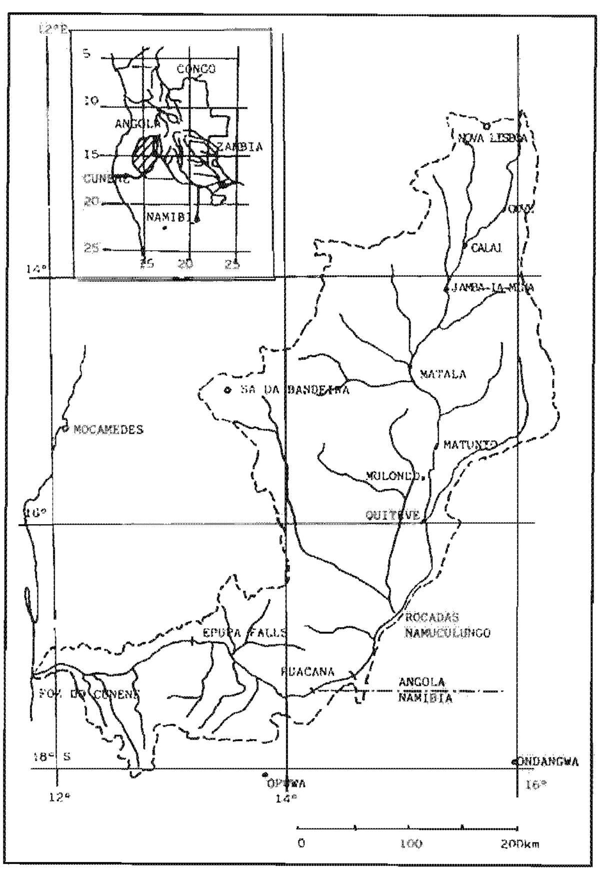

FIGURE 1: The Cunene River system catchment (after Midgley 1966).

Along the western boundary of the catchment area is an escarpment beyond which the land drops to the west as much as 600 m in some places. This forms a funnel through which moist air is carried from the west which gives rise to typical orographic rainfall over the upper reaches of these catchment areas. On the eastern side, the divide between the Cunene and the parallel, south-flowing Cubango River, is not so pronounced. This results in metereological conditions that are similar to conditions found in the headwaters of the two rivers. A relatively small portion of the upper catchment area consists of small hills while the lower catchment area west of Ruacana is extremely rugged.

A longitudinal section of the Cunene River is shown in Figure 2 (Midgley 1966). The main river, as far down as Matunto, appears to have a steep gradient. The fall of 600 m within 395 km (1:660) is the result of falls and rapids while the actual riverbed is relatively flat between these obstacles. The river occasionally becomes braided, particularly in the steeply-graded reaches and rapids, but generally runs within reasonably high banks.

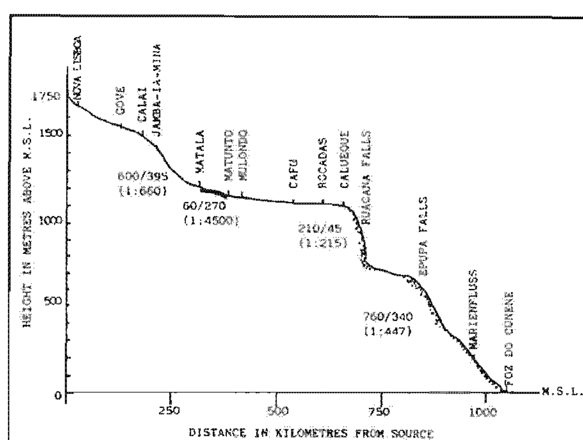

FIGURE 2: Longitudinal section of the Cunene River (after Midgley 1966).

From Matunto, starting just upstream of Mulondo, the river gradient flattens markedly all the way to Calueque. This section is covered by Kalahari sand. The fall in gradient is only 60 m (1:4 500) over a distance of 270 km while only the eastern side of the river is confined by a pronounced riverbank. The other bank is normally indefinite and thus the flood plain widens considerably.

In the 45 km stretch from Calueque to Ruacana, the river drops approximately 210 m (average slope 1:1215) caused by a series of rapids with the biggest drop of 120 m at the Ruacana Falls. In the 340-kilometre distance from Ruacana to the Atlantic Ocean, the total fall is 760 m. The river channel is sometimes steeply banked. There are several rapids and falls, of which the Epupa Falls is the highest.

In the lowlands, run-off is poor, except during years of above average rainfall. The side streams feeding the main tributaries in the lower areas consist of shallow channels, often several hundred metres wide with grassy banks. These glades sometimes form narrow defined channels carrying an intermittent flow.

There are few side streams in the lower reaches. Towards the main river, gradients tend to flatten out and the streams decrease in magnitude and eventually disappear into the marshy plains. Unfortunately, no information could be found on these wetlands of Angola.

There are no floodplains to the west of Ruacana due to the fast runoff of the Cunene River caused by the steep gradient and complex geological formations (Plate 1). The Cunene mouth is not a true estuary due to a rocky outcrop near the river mouth. This natural barrier prevents seawater from entering the river for more than a short distance (Penrith 1978). According to Noble & Hemens (1978) a river mouth is where the river valley extends to the coastline and the volume of discharge is large. The areas of tidal exchange are limited, wetland areas are negligible and typical estuarine characteristics are absent or poorly developed.

DOMINANT ABIOTIC FACTORS

Rainfall

Rainfall decreases from 1 300 mm in the vicinity of Nova Lisboa in the upper catchment area to 10 mm at the Cunene River mouth in the lower catchment area. The rainfall is highest in summer, with most rain occurring in the months of October to March (Van der Merwe 1983). The river flow follows the rainfall pattern with a flood in late summer. The annual variations in maximum flood discharge is usually quite small but on rare occasions substantial floods occur, caused by prolonged rains over the whole catchment area (Table 1).

TABLE 1: Cunene River flow (million cubic metres) at Ruacana falls (Dept. Water Affairs).

Season	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	August	Sep	Total
1933/34	88	123	235	249	136	468	1068	872	360	201	126	84	4052
34/35	113	237	368	584	677	490	713	761	425	243	157	108	4876
35/36	124	216	467	545	654	850	694	441	305	213	143	97	4769
36/37	101	227	676	1442	1351	1301	2499	2191	866	395	239	158	11446
37/38	181	567	925	1015	884	791	963	823	588	403	271	184	7595
38/39	192	477	1043	1540	1305	722	641	549	374	250	166	112	7371
39/40	80	163	206	394	1203	1577	1220	792	498	322	212	146	6813
40/41	207	306	582	626	1230	1569	944	588	378	247	163	110	6950
41/42	127	131	125	404	589	592	615	382	229	147	96	65	3502
42/43	42	104	376	540	415	483	678	510	309	197	129	88	3673
43/44	40	177	397	447	429	1222	1616	743	327	183	115	76	5772
44/45	67	176	187	455	1030	965	668	393	218	130	80	51	4420
45/46	53	345	694	593	328	341	562	416	243	149	94	63	3881
46/47	129	269	868	1269	1348	1258	1530	1441	683	355	222	151	9523
47/48	98	98	113	114	325	360	313	216	121	74	45	28	1905
48/49	25	77	126	265	599	1133	1258	655	343	208	133	90	4914
49/50	45	89	119	757	1008	1580	1658	864	408	230	144	94	6996
50/51	35	21	528	823	1030	2460	3211	2509	1254	500	258	160	12789
51/52	103	122	363	377	515	561	506	350	210	131	82	53	3373
52/53	57	186	237	152	95	316	553	382	214	127	78	50	2447
53/54	41	34	47	214	777	1573	1513	898	481	289	185	123	6175
54/55	73	65	58	74	60	95	279	218	111	60	33	19	1145
55/56	2	55	181	450	462	446	735	602	356	206	126	83	3704
56/57	39	25	29	42	72	996	1251	511	223	121	74	49	3432
57/58	27	284	598	511	278	381	541	345	174	99	59	37	3334
58/59	16	82	287	387	466	464	598	515	337	220	144	96	2612
59/60	47	97	261	419	673	1226	1347	836	442	267	173	117	5905
60/61	59	196	307	622	883	1354	1715	1383	779	389	214	135	8046
61/62	108	170	940	2234	959	851	1315	1021	415	293	226	161	8694
62/63	102	139	299	745	1068	3022	2851	1274	522	400	267	187	10865,
63/64	127	193	299	277	447	665	953	450	216	168	138	92	4026
64/65	58	92	136	363	700	2281	2745	1184	474	315	230	156	8737
65/66	122	86	267	736	1024	809	1054	438	245	187	150	112	5230
66/67	81	78	150	222	279	379	711	767	266	155	106	65	3259
67/68	47	154	830	2075	1727	1151	1299	741	386	260	185	113	8973
68/69	64	97	277	332	567	1940	2158	973	393	270	195	118	7383
69/70	74	225	762	730	1324	2141	1315	670	375	274	203	125	8218
70/71	77	164	258	377	618	1149	1029	661	233	152	95	53	4866
71/72	39	41	57	127	81	129	252	267	94	67	38	18	1211
72/73	2	8	91	518	665	630	883	688	207	126	81	60	3960
73/74	-45	126	140	185	151	115	760	549	129	90	90	83	24611
74/75	77	132	156	280	259	384	427	310	188	189	177	127	2706
75/76	120	178	291	183	249	526	681	754	453	286	192	125	4093
76/77	107	140	321	420	470	411	961	755	334	226	170	131	4448
77/78	117	130	372	282	152	309	654	634	307	200	156	127	3441
78/79	117	108	209	130	515	2234	2169	692	396	287	252	181	7290
79/80	180	150	120	102	256	143	100	106	101	101	92	120	1571
80/81	88	101	61	122	153	208	192	228	151	93	80	76	1561
81/82	69	41	105	249	1549	1684	1059	518	305	180	162	130	6051
82/83	86	98	150	215	390	483	438	358	204	175	147	124	2868
83/84	94	141	237	524	987	2539	3538	1467	649	426	321	228	11151
84/85	187	288	512	482	352	896	1437	1057	492	349	364	216	6594
85/85	182	195	209	181	884	2122	1940	573	335	253	200	163	7237
86/87	149	173	157	125	175	956	1080	631	293	190	140	97	4168

Geology

The geology of the upper catchment area north of Matunto and west of a line through Cahama and Calueque is not complex, consisting mainly of granite and igneous intrusions. South of Matunto the basal rock is covered by Kalahari sand. A norite belt emerges as the Zebra mountains south of the Epupa Falls, extends west of Otchinjau and ends in the vicinity of Matala. West of Calueque the geological formation (band of gneiss, diorite, conglomerates, calcite siltstone alternating with quartzite and granite) becomes contorted and complex (Midgley 1966).

DOMINANT BIOTIC FACTORS

Vegetation

According to Midgley (1966) the high-lying areas of the Cunene catchment area can be classified as grasslands, with isolated clumps of indigenous trees with some afforestation on the hills. From Calai there is a change to parkland consisting of trees up to 10 m high, interrupted occasionally by grassy glades which form the courses of the tributaries. South of Matunto there is a change to Mopane savanna, with little undergrowth in the drier parts to the south. A small part of the lower catchment area is covered with desert vegetation.

Wildlife

The following fish species are endemic to the Cunene River (Jubb 1967; Penrith 1970, 1982): *Haplochromis steindachneri, Thoracochromis albolabris, Thoracochromis angolensis, Thoracochromis buysi, Serranochromis (Sargochromis) coulteri (Cunene happy), Synodontis vanderwaali* and *Synodontis thamalakansis*.

Only two fish species of the Cunene River, *Brycinis lateralis* (striped robber) and *Clarias theodorae* (snake catfish), are listed as rare in the Red Data book, with the possibility of becoming endangered (Skelton 1987).

An isolated population of the Nile soft shell turtle (*Trionyx triunguis*) occurs in the Cunene mouth (M. Griffin, pers. comm.). Both the protected Nile crocodile (*Crocodylus niloticus*) and the water leguan (*Varanus niloticus*) also occur in the Cunene River.

Birds of conservation significance which occur at the Cunene River are *Pelecanus onocrotalus* (white pelican), *Ciconia nigra* (black stork), *Podiceps nigricollis* (blacknecked grebe), *Morus capensis* (Cape gannet) and *Charadrius pallidus* (chestnutbanded plover).

Both the protected Cape clawless otter (*Aonyx capensis*) and spotted-necked otter (*Lutra maculicollis*) are found in the Cunene River.

According to Smithers (1983) the occurrence of the hippopotamus (*Hippopotamus amphibius*) in the Cunene River is doubtful. J.A. Holtzhausen (pers. comm.), however, saw fresh spoor of an adult hippopotamus in December 1985 at the Hippopool near Ruacana, and fresh tracks were found in March 1991 near Epupa Falls (C.J. Brown, pers. comm.).

CONSERVATION PROBLEMS

A fish survey was carried out by Holtzhausen and Van Zyl in 1986. During this survey they found that the hydro-electric power station at Ruacana (when in operation) causes the water level of the Cunene River to fluctuate by approximately 1 metre. These fluctuations have a negative influence on the recruitment of the tilapias, especially *T. rendalli*. The effect that these fluctuations have on the ecology of the fauna of this river system, is as yet unknown.

At present 6,4 million cubic metres of water is drawn annually from the Cunene River for use in Owamboland. It is predicted that in 6-8 years time, this amount may increase to 19 819 million cubic metres. The peak demand for water in Owamboland is during October when the river is at its lowest level. For instance, during October 1955 and 1972, the total flow of water was only 2,0 million cubic metres. Under normal circumstances, the withdrawal of water from the Cunene River would not be a threat to the riverine fauna. Should the water flow drop to less than 2,0 million cubic metres, the effect could be catastrophic. It is estimated that if the water is withdrawn at a rate of 800 l/s (19 811 million cubic metres), 70% of the river's water would be removed (data supplied by the Dept. of Water Affairs).

A major problem is the translocation of indigenous fish species from one system to another by means of artificial drainage links. Genetic mixing of certain strains of the species, genetically isolated for a very long time, may occur. There is a possibility that fish from the Cunene River could eventually end up in the Okatana canal. In high rainfall years fish from the canal might enter the Cuvelai system. Fish species that might enter the Cuvelai system are *P. castelnaui* (dwarf stonebasher), *M. lacerda* (western bottlenose), *M. acutidens* (silver robber), *H. odoë* (African pike), *C. stappersii* (sidestripe catfish), *O. mocrochir* (greenheaded bream), *B. codringtonii* (Upper Zambezi yellowfish), *B. eutaenia* (orange-fin barb), *B. fasciolatus* (red barb) and *S. robustus jallae* (nembwe).

CONCLUSION AND FUTURE ACTION

To avoid the large-scale introduction of fish and other organisms into the Cuvelai system from the draw-off point at Ruacana, the intake should be covered by a grid-screen. According to Skelton & Merron (1984) a screen of 1 cm diameter or less is necessary to exclude the bulk of fish species presently in the river. The existing Okatana canal between Ongongo and Ombalantu should be monitored.

Further investigation of the fauna of the Cunene River is necessary to (i) assess species diversity and distribution, (ii) understand the ecology of the fish species, and (iii) determine the activity and possible entrainment of fish at the draw-off point at Ruacana.

REFERENCES

BELL-CROSS, G. 1965-66. The distribution of fishes in Central Africa. *Fish. Res. Bull. Zambia*. 4:1-20.

HOLTZHAUSEN, J.A. 1987. Verslag: Visopnames in die Kunenerivier, Oktober 1986. Unpublished internal report. N18/2/1/43. Department of Nature Conservation and Recreation Resorts, Namibia.

JUBB, R.A. 1967. Freshwater fishes of Southern Africa. A.A. Balkema, Cape Town.

MIDGLEY, D.C. 1966. Cunene River Hydrological Studies. Report: South West Africa Administration Water Affairs.

PENRITH, M.L. 1970. Report on a small collection of fishes from the Cunene River mouth. *Cimbebasia*, 1(7).

PENRITH, M.L. 1982. Additions to the checklist of Southern African freshwater fishes and a gazetteer of Southwestern Angolan collecting localities. *J. Limnol, Soc. sth. Afr.* 8:71-75.

SKELTON, P.H. and MERRON, G.S. 1984. The fishes of the Okavango River in S.W.A. with reference to the possible impact of the Eastern National Water Carrier on fish distribution. *Investigation Report* No. 9.

SKELTON, P.H. 1987. South African Red Data Book - Fishes. *South African National Scientific Programmes Report* No. 14.

SMITHERS, R.H.N. 1983. Die Soogdiere van die Suider-Afrikaanse Substreek, University of Pretoria.

VAN DER MERWE, J.H. (1983) *Nasionale Atlas van S.W.A.* Cape Town. Nasionale Boekdrukkery.