A historical note on the outflows of the Okavango Delta System

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Introduction

As pressure on land and water resources in Botswana has increased, consideration has been given to the utilisation of the Okavango Delta region. The use of such a complex and delicate ecosystem requires careful planning, a fact recognised by the UNDP/FAO (1977) study of the Okavango as a water resource.

One project arising from the UNDP/FAO study has been the formulation of a mathematical model to quantify and predict changes in the hydrological network (Dincer et al. 1976). This, of necessity, is limited by the spatial and temporal limitations of available accurate data; in this case to the period since 1952.

As the delta system is constantly in a state of adjustment to natural and man-made changes the value of the mathematical model can be supplemented by consideration of the historical record. This paper summarises what is known of the Okavango Delta outflows for the period 1849-1983, drawn from the observations of travellers, administrators and engineers, together with available aerial photography (since 1937) and satellite imagery (since 1972).

The principal sources used in this paper are listed in the bibliography. It is not possible to quote the source of every observation, nor has the list of potential sources been exhausted.

The data used is non-quantitative and varies in reliability. Remote sensing data and the direct observations of experts are reliable, whilst eye-witness recollections vary in quality. For this reason the earlier part of the record (particularly before 1925) must be interpreted with caution.

Physical Background

The Okavango Delta is shown in figure 1, whilst the outflows from the system are indicated for the historical period in figure 2. The Okavango Delta covers an area of approximately 22,000 km^2, receiving an average annual inflow of $10{,}5 \times 10^9$ m^3 (UNDP/FAO vol 1:1). About 95% of this water is lost within the Delta by evapo-transpiration or groundwater recharge, the remainder drains towards the Zambezi River or one of the three lake basins (Lake Ngami, the Mababe Depression and the Makgadikgadi Pans) which for the end-sinks of the endoreic drainage system. Th amount of outflow varies from year to year with chang in inflow, precipitation and hydrological conditio in the swamps. The direction of outflow may be furth influenced by changes within the swamps due t blockage (natural, animal or man-made) or loc tectonic events.

A useful summary of the hydrology of the Okavang is given by Wilson & Dincer (1977) whilst a discussio of Okavango inflows can be found in UNDP/FAO vo 1:62-68.

Extensive lake shorelines and abandoned swamp indicate regime changes during the Quaternary (Cook 1980), but these are regarded as beyond the scope (the present inquiry.

The Outflows

Considered in an anti-clockwise direction the outflow are as follows:

(1) The Magwegqana (Selinda) Spillway connects th Okavango to the Linyanti (and hence to the Zambez along a channel some 120 km in length at a gradient c 1:4,000. The channel was not visited by European until late in the 19th Century due to its inaccessability early accounts gave conflicting opinions on the directio of flow. Landsat imagery clearly shows the bulk of th water coming from the Okavango, meeting backflo from the Linyanti about 10 km upstream of the Linyant confluence.

The Spillway floods sporadically in "good" year (a ratio of 1:3 from the limited data available). Ther is no evidence to suggest that any changes in th regime have occured in the historical period.

(2) The Savuti channel connects the Linyanti to th Mababe Depression, a distance of 94 km at a gradien of 1:5,200. Strictly speaking it is not an outflow of th Okavango under its present regime, although Du Toi (1925:19) noted a connection between the Magwegqan and Savuti channels.

The Savuti appears to have flowed frequently unt the late 1880's, then dried up until 1958, with flow i most years subsequent to this. Stigand (1923:415 has commented on the synchronous desiccation of th Savuti and Thaoge systems, but they may havedifferen causes. Certainly the absence of water in the Savut

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The absence of a substantial body of water in the Mababe Depression during the period of European expansion suggests that Savuti flows 1849 - 1890 were no greater than in recent years. This may not have been the case in the 18th Century, when oral tradition supports the existence of a "Lake Mababe" (Tlou 1972:152).

(3) The Mababe River conveys water from the Nqogha branch of the Okavango to the southern extremity of the Mababe Depression. In fact the water arrives by two routes, the Moanachira-Khwai-Mochaba-Kudumane system flowing to the east, and the Gomoti-Mghelo-Zamkuio system flowing in an arc further south. The two rivers join 8 km from Mababe, but have not been differentiated in figure 2.

The Mababe fed a substantial swamp in the 19th Century, and oral reports (Campbell & Child 1971) describe a river deep enough to hinder passage. The river dried up around 1910, and has subsequently reached the Depression only in 1925 and 1957, although water was present at the Kudumane-Zamkuio confluence (upper Mababe) on several occasions in the 1950s.

(4) The Thamalakane system is the major outflow of the Okavango, collecting water from the central distributaries along the Thamalakane Fault, then bifurcating below Maun into the Lake (Nghabe) and Boteti Rivers, flowing to Lake Ngami and the Makgadikgadi Pans respectively. The ratio of flow between the two rivers was 2:1 in favour of the Boteti until the construction of a bund 2 km below the bifurcation in 1969; present flow ratios are about 5:1 (Kraatz 1976). As the annual flood reaches the upper section of both rivers every year (with the possible exceptions of 1933 and 1935-36) Toteng and Rakops have been used as gauging points to reveal more subtle variations in flow.

(5) The Kunyere River flows along a fault line from the Xudum system to Lake Ngami, joining the Lake River at Toteng. The river reaches Toteng in most years, but carries a smaller volume of water than the Lake River in a "good" year.

(6) The Thaoge River entered Lake Ngami from the north until the early 1880's (Shaw 1983) although the flow in the system, together with the level of Lake Ngami, had been declining during and prior to the period under consideration (Shaw, in press). Unlike the other outlets the Thaoge was originally represented by a series of anastamosing channels (i.e. true swamp) rather than a single distributary, yet it is probable that only one outflow was operative by the 1850's. The gradual diminution of flow over decades suggests that natural and man-induced blockages were a major factor in this system.

Conclusion

The pattern of outflows shown in figure 2 can be broken down into 3 episodes:

(1) 1849 - c.1900: The period starts with the function of all seven outlets at current average or above average flows, and ends with the drying up of Lake Ngami, the lower Thaoge, the Savuti, and, slightly later, the Mababe River.

(2) 1900 - 1951: This period coincides with the incidence of limited flows throught the remainder of the system, interspersed with good years such as 1910, 1925 - 27 and 1944. The decade of the 1930's saw a very dry period in the history of the Delta.

(3) 1951 to Present: The last thirty years have seen good but cyclic flows in the Thamalakane system, a resumption of flow in the Savuti and the occasional presence of water in the Mababe River. The period ends at 1983 with the lowest inflow on record and outflow conditions equivalent to 1933.

The mathematical model developed by the UNDP/FAO Project and employed by the Department of Water Affairs is based within the third period, and uses selected portions of the Okavango Delta for which quantitative data is availabe. The model has shown the existence of regime changes at approximately decadal intervals. These changes are not predictable and are a limiting factor in long-term water-use planning (UNDP/FAO vol. 1:85). The historical record shows that long-term changes of greater magnitude occur outside the reference of the model, some of them non-cyclic within the given time span. These must certainly have important consequences for the utilisation of the Delta region.

BIBLIOGRAPHY

Andersson, C.J. (1857): Lake Ngami, or explorations and discoveries during four years wanderings in the wilds of southwest Africa.— Harper Bros., New York. Reprinted C. Struik, Cape Town, 1967.

Baines, T. (1864): Explorations in Southwest Africa. — Longman, Green & Co. Reprinted Gregg Int. Pub. 1968.

Baldwin, W.C. (1894): African hunting and adventure.— Bentley & Son, London.

Brind, W.G. (1955): The Okavango Delta. Report of the 1951—53 field surveys.— Report to the Resident Commissioner; Mafeking (unpublished).

Cambell, A. & G. Child (1971): The impact of man on the environment of Botswana.— Bots. Notes & Records *3*:91—109.

Chapman, J. (1886): Travels in the interior of South Africa. (Two vols). Bell & Daldy, London. Reprinted A.A. Balkema, Cape Town, 1971.

Cooke, H.J. (1980):Landform evolution in the context of climatic change and neo-tectonism in the middie Kalahari of North Central Botswana.— Trans. Inst. Brit. Geog. New Series *5*: 80—99.

* Dincer, T., H.M. Ernest & J. Lewis (1976): Study of the water balance and flow distribution in the Okavango Delta and its selected portions using a mathematical model.— DP/BOT/71/506 Tech. note 24.

Du Toit, A.L. (1926): Report of the Kalahari Reconnaissance of 1925.— Dept. of Irrigation, Pretoria.

Green, F. (1857): Narrative of an expendition to the northwest of Lake Ngami.— Eastern Province Monthly Magazine *1*.

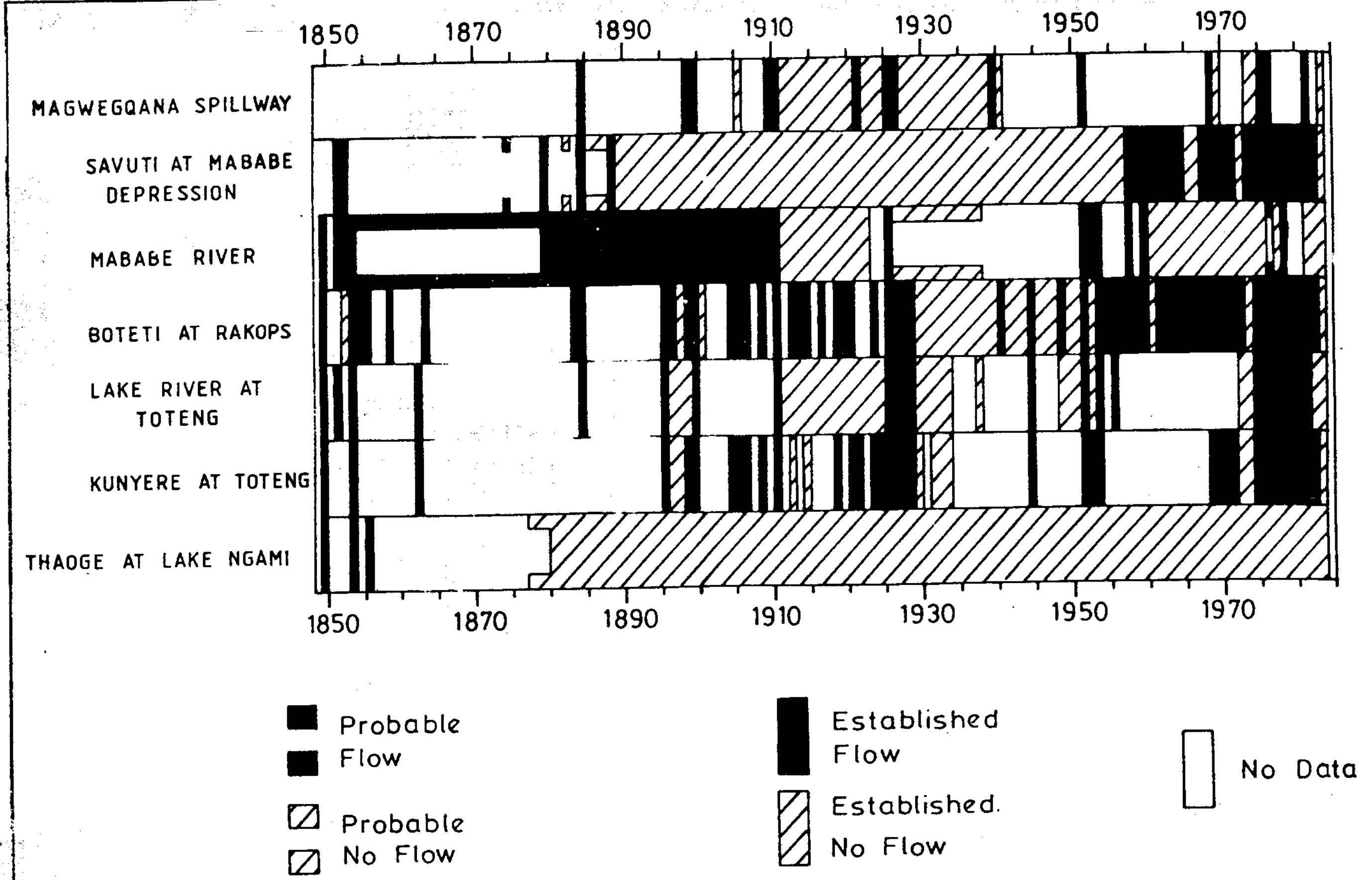

Figure. 2 Outflows from the Okavango System 1849 - 1983

Grove, A.T. (1969): Landforms and climatic change in the Kalahari and Ngamiland.; Geog. J. *135*:191—212.

Hepburn, J.D. (1895): Twenty years in Khama's country.— ed. C.H. Lyall. Reprinted Frank Cass & Co 1970.

Holden, W.C. (1855): History of the colony of Natal.— Alexander Heylin, London. Reprinted C. Struik, Cape Town, 1963.

Jeffares, J.L.S. (1938): Ngamiland water ways surveys 1937.—Report to the Resident Commissioner, Mafeking (unpublished).

Kokot, D.F. (1948): An investigation into the evidence bearing on recent climatic change in southern Africa.— Dept. of Irrigation, Pretoria.

* Kraatz, D.B. (1976): Control of flow between the Boteti and Lake Rivers.— U.N.D.P. Tech. note *15*. Bot/1/506.

Leyland, J. (1866): Adventures in the far interior of South Africa including a journey to Lake Ngami.— Routledge & Sons, Liverpool. Reprinted C. Struik, Cape Town, 1972.

Livingstone, D. (1858a): Missionary travels and researches in South Africa.— Harper Bros., New York. Reprinted Johnson Reprint Corp., 1971.

Mackenzie, I.A. (1946): Report on the Kalahari expedition, 1945.— Govt. Printer, Pretoria.

McKiernan, G. (1954): The narrative and journal of Gerald McKiernan in South West Africa, 1874—1879. Van Riebeeck Society. Cape Town.

Oswell, W.E. (1900): William Cotton Oswell, hunter and explorer. The story of his life.— Heinemann, London.

Passarge, S. (1904): Die Kalahari.— Berlin.

Selous, F.P. (1881): A hunters wanderings in Africa.— Books of Rhodesia (reprinted 1976), Bulawayo.

Shaw, P.A. (1983): Fluctuations in the level of Lake Ngami: the historical evidence.— Bots. Notes & Records *15*:79—84.

Stigand, A.G. (1912): Notes on Ngamiland.— Geog. J. *39*:376—379.

Stigand, A.G. (1923): Ngamiland.— Geog. J. *62*:401—419.

Streitwolf, H. (1911): Der Caprivizipfel.— Susserott, Berlin.

* Tlou, T. (1972): The taming of the Okavango swamps.— Botswana Notes & Records, *4*:147—159. Gaborone.

Westgate, K.N. (1976): Environmental extremes in the Bechuanaland Protectorate, 1889—1955.— Disaster Research Unit (unpublished).

* Wilson, B.H. (1973): Some natural and man-made changes in the channels of the Okavango Delta.— Botswana Notes & Records, *5*: 132—153. Gaborone.

* Wilson, B.H. & T. Dincer (1977): An introduction to the hydrology and hydrography of the Okavango Delta.— Symposium on the Okavango Delta, 1976, Botswana Society, Gaborone.

* U.N.D.P./F.A.O. (1977): Investigation of the Okavango Delta as a primary water resource for Botswana.— DP/Bot/71/506 Tech Report, 2 vols.

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