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THE IMPACTS OF LAND USE ON HEADWATER STREAMS IN AKWA IBOM STATE, NIGERIA

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ABSTRACT

Studies on the effects of land use on some headwater streams in Akwa Ibom State reveal that many of them are physically stressed by siltation from eroded materials from adjoining lands which are exposed to water erosion through cultivation and excavation of laterite near streams. One of these secondarily suffers from dewatering arising from a nearstream water pumping station. Where the extent of stress is such that recovery proves impossible, substantial stretches of the headwaters have dried up, giving way to terrestrial habitats.

The effects of these perturbations on the stream biota and overall stream stability as it relates to the maintenance of stream integrity are discussed, and suggestions aimed at restoring the integrity of the streams proferred.

The destruction of significant portions of inland waters with their biota under the pretext of providing food and potable water, may prove to be a shortsighted option in the years ahead, if presently, this outcome is judged insignificant and not worthy of attention.

INTRODUCTION

Akwa Ibom State is relatively rich in streams. These represent significant aquatic ecological systems which, if properly utilized, could supplement (in terms of fish production) efforts of marine artisanal fishermen in providing the much-needed protein food to our protein-deficient populace. Presently, the persistence of these streams is threatened by riparian agriculture, the construction industry and potable water resources development, among others. The adverse effects of the activities of these agencies on the streams have the potential of reducing their species diversity through habitat degradation.

This paper highlights some of these streams and the nature of the physical stress to which they are subjected and emphasizes the need

for concern over their integrity, with the goal of maintaining as much as possible a complete array of their resident biota.

The investigation was carried out between December, 1984 and February, 1985; and July, 1987 – March 1988 inclusive. Assessments of the extent of physical disruptions were made by observations and through interviewing residents of the adjoining areas of each stream on the change in the stream status over the years. Materials and methods employed in fish sampling have been reported elsewhere (Udoidiong, 1988).

RIPARIAN AGRICULTURE

In the pre-war era, cultivation of the land did not lead to severe (if any) adverse impacts on our streams, presumably because the presure on land was minimal. Presently, however, the continuing upsurge in population with its attendant food crisis, has forced many people to be engaged in crop farming resulting in the cultivation of any available land, including stream banks. This leads to the removal of nearstream vegetation and exposure of the banks to erosion. Several streams in the state are affected in this way but among those investigated, Udom and Mission streams in Ikono Local Government Area (LGA); Afaha Obong stream in Abak LGA; Nung Oku stream in Ibesikpo (Uyo LGA) and Akpa Atak Eka – a stream within the ravine behind the University of Cross River State in Uyo are seriously affected.

For about 0.5km from the initial source (opposite Archibong Memorial Grammar School, Ukpom), the channel of Udom stream has become dry land, with the water seeping through at a different point. This drying up has been attributed to siltation arising from erosion of the hillsides denuded by cropping. There is little or no swamp land flanking Mission stream, in Ikono LGA; and the banks are extensively cultivated with food crops. The upper reaches are affected by eroded sand from the cultivated banks. Below the small pool (which is the origin of the stream) and for a long distance the water flows through a narrow channel with less ease due to obstructions by woody debris. A substantial part of the littoral zone in this stretch has been silted, being now an unconsolidated admixture of

mud and sand. The low-lying nature of the banks has not insured this stream against erosion menace. The initial source of Afaha Obong Stream, as well as a substantial stretch of the headwater channel below the bridge along Utu Etim Ekpo road, have suffered the same fate as Udom stream. The inconvenience of this drying on the immediate community must have motivated the reclamation attempt by a former Chairman of Abak Local Government Council - an effort that could not be entirely said to have been useless. Nung Oku stream, reported to have accomodated canoes used for fishing and palm produce transportation some decades ago, has dried almost to extinction due to eroded sand from the extensively cultivated banks. Much of the channel in the headwater has been reduced to slow-flowing rivulets, leaving large areas completely taken over by terrestrial plants.

The point of origin of Akpa Atak Eka is under severe stress, signalling the beginning of its end, as large quantities of sand and wooden debris are being deposited each rainy season. The steep slopes are cultivated yearly by the villagers and some staff of the University of Cross River State.

EXPLOITATION OF LATERITE

Construction companies making use of laterite have contributed immensely to the degradation of streams in Akwa Ibom State. In Ikot Ekpene, the effect of the exploitation of this resource has been borne by Nkap stream which originates behind Goreti Girls School. About 50m from the source is a laterite excavation site. The terrain of the area enables the sand and silt eroded during spates to be deposited in the stream with pronounced effects on water quality. Enquiries revealed that this source used to be several times larger than what it is today - a small, shallow pool less than $8m^2$ in area. Siltation of a part of this headwater is, however, recent because the deposited sand is unconsolidated and an unsuspecting visitor could get stuck in the "deceptive sandy flat". In some portions at the land-water interface, faster currents erode newly silted sand but deposit same a few meters away where there is a slack. The channel has been severely reduced and when the water is clear, no trace of fish can be seen.

Abak stream at the bridgehead along Uyo road, also suffers from the use of laterite in recent times. Although this stretch was silted prior to the construction of the new bridge, it is evident that erosion of the laterite used for the road construction has denatured the stream channel the more. Moreover, the wooden scaffolds erected in the stream bed to aid in the construction have impeded flow velocity thus enhancing siltation. A significant part of what used to be covered by water has become terrestrial, and the presence of fish has been greatly affected due to habitat destruction resulting from silted sand and succession of terrestrial habitats.

POTABLE WATER DEVELOPMENT

Most parts of Akwa Ibom State enjoying potable water obtain it from boreholes with no surface reservoir for this purpose. The water supply for Abak urban comes from a borehole at Abiakpo in Otoro. This borehole is sunk close to the headwater of Abak stream. This stretch of the stream suffered initially from mild siltation resulting from erosion of the cultivated banks, and lately from apparent dewatering through groundwater depletion due to the Water Board pumping station sited close by.

The choice of nearstream sites for the sinking of boreholes may be informed by the relative nearness of the groundwater table, which in turn would reduce drilling cost; but the destruction of a significant portion of a stream with all its biota in order to provide potable water may prove to be a shortsighted option in the years ahead if presently, this outcome is judged insignificant.

SAND AND GRAVEL EXCAVATION

Many streams in this state support a thriving business of sand and gravel trade, exploited mostly from the stream bed, without any readily observable adverse effect on the stream apart from transient changes in water quality during scooping and washing. At Nung Oku village, a reserve of gravels on the stream banks is commercially exploited. The clayey washings from the excavated gravels and

erosion of the exposed quarry banks have increased the suspended matter in the water, and reduced stream flow has enhanced silting of the stream bed. Sooner or later some stretches of Nung Oku stream will dry up, leaving behind small, spring-fed pools.

SOLID WASTE DISPOSAL

In Uyo urban, solid waste disposal falls short of acceptable standards. These wastes are merely dumped in the ravine and left without further attention. This composite of rubbish and garbage has contributed to the degradation of the ravine streams. During rains parts of the heaps are washed into the streams, some stretches of which have already been silted. The materials become entrapped by wooden debris in the water causing reduced flow of water and enhancing siltation by eroded sand. The pollution potential of the organic fraction of the waste is well known to ecologists.

SILTATION

Siltation arising from erosion of cultivated stream banks and/or excavated nearstream lands could have destabilizing effects on streams. It leads to reduction in width and depth of the water, making them shallower and causing temperature increases. Ontogenetic, depth-dependent foraging in some fishes is related to temperature, with juveniles feeding in shallower, warmer waters while adults prefer deeper, cooler waters (Bowen, 1978). If the depth of the water is reduced by siltation it follows that adults of species responsive to above foraging regime could be displaced. Many riparian inhabitants of streams under study agree that many large-sized fish species that once inhabited these streams have disappeared. Desirable species with low temperature optima could be outnumbered and even replaced by less-desirable ones tolerant of increases in water temperature (Karr and Schlosser, 1978).

Reduction in stream width leads to obliteration of the littoral zones where habitat conditions are more favourable for many fishes and macroinvertebrates. This effect is apparent in Nkap, Akpa Atak

Eka and Abak streams. Disruptions of these habitats, therefore, lead to reductions in the number and species of fish and other aquatic faunas. According to Sorensen et. al. (1977), as bottom type is simplified by deposition of sediment (which leads to covering of spawning grounds/eggs, or prevents the emergence of newly hatched fry) species diversity decreases.

Reductions in invertebrate and fish production occur in streams when nearstream vegetation is removed. This is because shed leaves, plant debris and other allochthonous materials which constitute a significant energy source to the stream biota would no longer be available.

Siltation has caused the drying up of portions of Udom, Afaha Obong and Abak streams, and the losses in water, fishes and other aquatic life are enormous. Local residents of the riparian areas of each streams deriving their livelihood from these streams and their swamps are consequently adversely affected.

FISH COMPOSITION

Data on fish composition and abundance were obtained from three of the streams investigated, viz Udom, Nung Oku and Mission streams (Table 1).

In Udom stream 17 fish species representing 10 families were recorded. Of this number, 14 species contributed less than 5% each to the total catch and were considered rare. In the pools of this stream the shrimps, Desmocaris trispinosa and Macrobrachium dux are found and have been exploited for subsistence. Nineteen species of fish belonging to 12 families were recorded in Nung Oku stream, out of which 15 species were considered rare, while out of the 22 species recorded in Mission stream and belonging to 12 families, 15 species were rare. Macrocrustaceans, viz., the shrimps, Macrobrachium and Desmocaris spp. and the crab, Sudanonautes sp. were also caught.

The systematic list of fishes shown in Table 1 may not be exhaustive for the respective stream regardless of the perturbations they are currently experiencing; neither would it be justifiably

Table 1. Summary of data on fish composition of some of the streams surveyed.

Family/Species	Stream		
	US	NS	MS*
Amphilidae			
Phractura sp.	2[a](0.6)[b]	-	-
Anabantidae			
Ctenopoma kingsleyae	2(0.6)	7(2.6)	-
Bagridae			
Auchenoglanis fasciatus	1(0.3)	7(2.6)	-
A. occidentalis	2(0.6)	-	-
A. akiri	-	-	9(3.93)
Parauchenoglanis sp.	-	-	17(7.42)
Cichlidae			
Chromidotilapia batesii	4(1.1)	1(0.4)	-
C. guntheri	13(3.7)	65(23.9)	1(0.44)
C. caudifasciatus	-	-	3(1.31)
Hemichromis fasciatus	1(0.3)	47(17.3)	1(0.44)
H. elongatus	-	-	3(1.31)
Thysia ansorgii	3(0.9)	5(1.8)	-
Pelvicachromis pulcher	-	1(0.4)	-
Nanochromis robertsi	-	-	7(3.06)
Channidae			
Parachanna africana	-	1(0.4)	2(0.87)
Characidae			
Alestes chaperi	-	-	3(1.31)
Alestes leuciscus	17(4.8)	-	-
Alestes longipinnis	-	10(3.7)	-
Clariidae			
Clarias gariepinus	-	-	1(0.44)
Cyprinidae			
Barbus callipterus	-	45(16.6)	-
Cyprinodontidae			
Epiplatys bifasciatus	47(13.4)	50(18.5)	23(10.04)
E. sexfasciatus	39(11.1)	11(4.1)	30(13.10)
Procatopus sp.	6(1.7)	3(1.1)	-
Eleotridae	-	-	-
E. vittata	-	-	3(1.31)
Malapteruridae			
Malapterurus electricus	1(0.3)	2(0.7)	5(2.18)

	Stream		
	US	NS	MS*
Mastacembelidae			
Mastacembelus lenqicauda	-	-	1(0.44)
Mormyridae			
Brienomyrus brachyistius	198(56.-)	2(0.7)	56(24.45)
Gnathonemus petersii	-	-	24(10.48)
Isichthys henryii	11(3.1)	-	17(7.42)
Marcusenius abadii	-	-	4(1.75)
M. isidori	-	-	14(6.11)
Notopteridae			
Papyrocranus afer	2(0.6)	9(3.3)	1(0.44)
Xenomystus nigri	-	3(1.1)	-
Polypteridae			
Calamoichthys calabaricus	1(0.3)	1(0.4)	4(1.75)

a = number of specimens; b = % number of specimens

US = Udom stream; NS = Nung Oku stream; MS = Mission stream

*Data from King, R. P. (in prep.).

assumed that it is a true representation of the ichthyofaunal statuses of the stream prior to these disruptions. However, a major source of worry is the large number of rare species in each of the streams, which could be a reflection of the high level of habitat perturbations they are experiencing. Sadly, our current level of understanding our aquatic ecosystems and their processes prevents us from making definite assessments of the degree of physical and biological changes brought on them by these degradative processes. We are also unable to make predictions and projections about specific future trends without adequate historical data. Yet the threat of extinction of some streams is real and the perturbations are exacerbating yearly.

RECOMMENDATIONS

Attention should be paid to the assessment of habitat quality in streams. These are not usually assessed during physicochemical studies although it is known to limit fish communities as a result of siltation and bank instability (Judy et al. 1984). Assessment of water quality on the basis of physicochemical standards alone is insufficient for the assessment of biotic integrity of streams (Karr and Dudley, 1981). Programmes aimed at management and public enlightenment should be evolved to take into account the following suggestions;

- Prohibit the removal of riparian vegetation which serves as sediment break, and belt of shelter from excessive heat of the sun.
- Maintenance of natural channel morphology to check or reduce bank erosion and hence high concentration of suspended solids in the water.
- Discourage the excavation of laterite near streams to avoid erosion and subsequent silting.
- Refrain from utilizing nearstream ground water sources to prevent dewatering.
- Development of surface water reservoirs to provide potable water and be used for the cultivation of fishes.

- Create an agency (independent of the Ministry) specifically charged with the responsibility of managing the inland waters of the state.

CONCLUSION

The irreversible drying of substantial portions of the headwaters of some streams in Akwa Ibom State is due to lack of management of the watershed ecosystems. Continued neglect of these ecosystems will translate into persistent degradation and outright destruction of aquatic resources. Streams and their resident biota should be conserved for the fact that in an integrated form they contribute to the maintenance of earth's life support systems (Angermeier et al. 1986). A choice between protecting the environment and economic growth is not advocated here, since ecology and economy are not mutually exclusive realms. Rather, both should be effectively harnessed for more production.

REFERENCES

Angermeier, P. L; Neves, R. J. and J. R. Karr, 1986. Nongame perspectives in aquatic resource management. Midwest fish and wildlife conference special publication.

Bowen, S. H. 1978. Benthic diatom distribution and grazing by Sarotherodon mossambicus in Lake Sibaya, South Africa. Freshwater Biology, 8: 449 - 453.

Juddy, R. D; Jr., Murray, T. M; Svirsky, S. C. and M. R. Whitworth, 1982. National fisheries survey Volume 1 technical report: Initial findings. U.S. Environmental Protection Agency and U.S. Department of Interior, FWS/OBS-84/96, 140 pp.

Karr, J.R. and I. J. Schlosser, 1978. Water resources and the land-water interface. Science, 201: 229 - 234.

Karr, J. R. and D. R. Dudley, 1981. Ecological perspectives on water quality goals. Environmental Management, 5: 55 - 68.

Sorensen, D. L; McCarthy, M. M; Middlebrooks, E. J. and D. B. Porcella, 1977. Suspended and dissolved solids effects on freshwater biota; A review. EPA-600/3-77-042, Ecological Research Series, Environmental Protection Agency, Corvallis, Oregon.

Udoidiong, O. M. 1988. A comparative survey of the fish communities of two Nigerian headwater streams in relation to man-made perturbations. Biological Conservation, 45: 93 - 108.