Chapter 30
Unsustainable tendencies and the fisheries of Lake Victoria

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Abstract

During the last 15 years the fisheries of Lake Victoria have been subject to intense fishing effort coupled with deteriorating conditions in the aquatic environment. Efforts to set and maintain ecological limits for the control of fish exploitation have not been successful and the goal of sustainable development for the Lake's fisheries has proved elusive. The factors that contribute to unsustainable tendencies in the Lake's fisheries are explored and the problems that need to be addressed if the adverse trends that affect production and management are to be overcome are investigated.

Keywords: fisheries, Lake Victoria, sustainability.

30.1 Introduction

Lake Victoria is the second largest freshwater lake in the world and the largest in Africa. Yet the lake's formidable size and vast water holding, have not prevented a series of deleterious changes taking place over a relatively recent time scale. Since the 1920s, the lake has been subject to cumulative impacts that have affected not only the physical and chemical quality of its waters, but also the structure and diversity of the lake biota (Coulter, Alanson, Bruton, Greenwood, Hart, Jackson & Ribbink 1986; Craig 1992; Hecky & Bugenyi 1992; Hecky 1993; Mugidde 1993; Lowe-McConnell 1996; Ogutu-Ohwayo, Hecky, Cohen & Kaufman 1997). In the last three decades there has been a steady build-up of fishing effort. This intensified in the 1990s, but possibly

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more important than the amount of fish harvested, was that:

(1) a large proportion of the catch was taken using fishing gears or methods that are injurious to the stock base; and
(2) the introduction of alien species has led to a restructuring of the species composition of the fish community (Ogutu-Ohwayo & Hecky 1991).

These changes in turn have had pronounced social and economic effects on the human communities of the lakeside that depend upon fish for their livelihood (Harris, Wiley & Wilson 1995; Geheb 1999). The decline of Lake Victoria's fish stocks is mirrored in many of the coastal marine fisheries in other parts of the world, and is part of a pervasive crisis where the condition of overfishing is endemic. Indeed, FAO (1995) estimated that some 70% of all the world's fish stocks are now overfished, so that globally the catch of fish has stagnated and we appear to have reached, or even exceeded, the limits of the sustainable harvest in the oceans and large freshwater bodies.

In response to the problems of Lake Victoria, a number of research programmes have been commissioned in an attempt answer to questions that continue to vex the minds of biologists, economists, social scientists and governments concerned with the lake. One of the main tasks is to investigate how it might be possible to establish a sustainable harvesting regime for the lake fisheries. The task is complicated by the debate over what constitutes a 'sustainable' exploitation regime and what the conditions might be for establishing 'sustainable development' over an acceptable time horizon.

The Lake Victoria Fisheries Research Project (LVFRP), initiated in 1997, has sought to address these questions. In essence, the conceptual basis of the project was born out of the need to gain a better understanding of the processes governing the dynamics of the lake fisheries. The intention is to use this information to develop a strategy that can eventually be deployed to help rehabilitate fish stocks and maintain the fishing industry of Lake Victoria. Although not stated directly, understanding the processes that detract from, and might contribute to, 'sustainable development' of the lake's fisheries is an implicit outcome of the research. This chapter sets out to examine the issue of sustainable development in the context of the lake's fisheries.

30.2 Threats to the maintenance of production in the lake fisheries

Lake Victoria has a surface area of 68 000 km^2 and is set in a catchment area of 258 700 km^2. This water mass is distributed within the sovereign boundaries of Kenya (6%), Uganda (43%) and Tanzania (51%). The lake's resources have always been an essential component of the socio-economy of the lakeside communities. Of the 30 million people living in, or around, the catchment area, it is estimated that about 100 000 people are employed directly in the lake fisheries. Another two million are thought to benefit indirectly from the fish industry. This is based on evidence that between 400 000 and 500 000 t of fish are produced each year, with a value of up to US $400 million. Although the figure needs to be treated with caution, as the level of productivity has been subject to spectacular changes over the last three decades (Mkumbo, Ezekiel, Budeba & Cowx, Chapter 8 of this book).

Prior to the introduction of alien fish species the lake's fish fauna was dominated by up to 300 haplochromine species, which accounted for 80% of the fish biomass (Lowe-McConnell 1996). The fish are small and bony and in terms of their socio-economic importance the haplochromines were of most value to local consumers. However, the dominance of haplochromines was challenged in the early 1950s when the alien species Nile perch, *Lates niloticus* (L.) and Nile tilapia, *Oreochromis niloticus* (L.), were introduced to the lake. These species were brought in to boost production, as much sought after food fish, that had the reputation for rapid growth as well as possessing well-established market outlets. Although Nile perch took time to become established, by the early 1980s it had begun to dominate catches. Correspondingly, many of the other species, especially the haplochromines, began to decline. Nile perch became the main predator of haplochromines and certainly contributed to the substantial reduction in the biomass of these species, so much so, that by 1985 Nile perch made up 59% of the total annual catch of lake fish (Mkumbo *et al.*, Chapter 8).

The success of the Nile perch fishery was recognised not only in East Africa but also internationally, and a thriving overseas market for the species was established. Inevitably the success of the fishery attracted other users, which brought with it a subsequent increase in fishing effort. The build-up has been especially noticeable in the last decade, with the Nile perch fishery subject to intense pressure, from not only increased capacity, but also through the use of illegal gears (including poisons). In lakeside fishing communities, partly as result of immigration, the population has increased and with it agricultural and industrial activity. This in turn resulted in the following major changes that, for the most part, have had an effect upon the lake's fisheries.

Over the last two decades there is no doubt that use of illegal fishing methods and gears has compromised and seriously threatened the future of fisheries in each of the riparian states (Owino 1999). Although the threat may have had a relatively low key beginning, the scale of investment in new technology has expanded rapidly, to the point, for example, where some fishing operations are undertaken with beach seines that are hundreds of metres in extent and drift nets that may be kilometres in length. Furthermore, small meshed nets may also be found sewn into the gears that are then operated by powerful trawlers. These methods and gears have given the industry the capacity to make economically efficient fish catches. In many instances the techniques used do not discriminate between juvenile and adult fish, leading to a reduction of the stock base. Although highly undesirable, the adverse impact of unselective and efficient fishing gears and methods was dwarfed by the damaging effects of fish poisons.

Poisoning of fish in Uganda is believed to have begun in 1996 when two fishermen from outside of the country used pesticide to stun and kill lake fish (*The New Vision*, 25 March 1999). The technique was successful in making cheap and easy catches of fish, and thus other fishermen quickly adopted it. The use of pesticides became widespread in the riparian countries (*The East African*, 8–14 February 1999, p. 6) and it was not long before there were deaths of people poisoned by consuming contaminated fish. It seems unthinkable that anyone could be so shortsighted as to opt for poisoning as a harvesting method. Yet there were reasons for it including: a decline in the availability of naturally occurring plant poisons that were used prior to pesticides; the availability

of synthetic agro-chemicals that were efficient substitutes; conventional fishing gears were expensive compared to pesticides; and there was, and is, a great consumer demand for fish caught by whatever method.

The incidences of death of people eating poisoned fish caused the authorities to react, although penalties in law were not a strong deterrent. In Uganda, for example, an offender who was caught and convicted would be liable to a fine of only 50 000 Ugandan shillings (≡US $28). In Tanzania, the punishment for first time offenders convicted of poisoning fish was a fine of 300 000 Tanzanian shillings (≡US $378) and the possibility of 3 years' imprisonment. However, in Tanzania, as the enormity of the crime against the lake and its people hit home, it was suggested that fish poisoning should be deemed an offence under the Economic Sabotage and Organised Crimes Act.

The effects of the use of fish poisons were also felt outside of East Africa, as the international community was obliged to act to protect its own consumers, and on 25 March 1999 the European Union (EU) banned the import of fish from East Africa, including Lake Victoria (The East African, 8–14 February 1999). This was a devastating blow to the national economies of those countries bordering the lake. For example, in Uganda, before the ban, the Nile perch fishery was the country's second most important generator of export revenue. The governments and stakeholders in the fisheries around the lake acted together to tackle the fish poisoning threat and their efforts appear to have worked. Nevertheless the international community, and the EU in particular, took time to be convinced, and the international ban was not been completely lifted until February 2001.

Beyond the use of illegal fishing methods and gears there are other threats with which the lake's resources and peoples have had to contend. The early part of the 1990s, for example, was marked by an explosion in the growth of water hyacinth, *Eichhornia crassipes* (Mart.) Solms. This plant is a surface dwelling weed that was introduced to fresh waters in Africa from its native home in South America. Its spread was aided by the rivers that feed into Lake Victoria. As well as congestion and blocking of landing areas, the water hyacinth gave rise to less obvious but more telling problems: reduction in light penetration; reduced levels of dissolved oxygen; and damage to fish breeding areas (Njiru, Othina, Getabu, Tweddle & Cowx, Chapter 21). At its peak it was estimated that there were 1.25 million t of weed dispersed over the lake's surface (Twongo, Bugenyi & Wanda 1995). Mechanical methods and use of herbicides were to prove largely ineffective at controlling the weed. Indeed, it is only since 1998 that there has been progress in finding a way of limiting its spread. Work on the biology of the weed in its native South America showed that two species of weevils were predators of the weed in its original habitat. Specimens of the weevils were imported and cultured in East Africa and after successful laboratory and field trials the insects were released to Lake Victoria. The early results indicate that in many locations in Uganda, and Kenya and Tanzania, the weed is in retreat although it is not clear if this is due to the effects of the introduced biological controls or has resulted from the impact of a yet unidentified cyclic phenomenon (Njiru *et al.*, Chapter 21).

It is easy to understand how these relatively catastrophic and high profile threats afflicting the lake have attracted public interest and alarm. However, well before the introduction of Nile perch and water hyacinth there were processes active in the lake and its catchment area which may well, in the fullness of time, eclipse the magnitude

of the other problems. Around the lake margins and further afield in the catchment area, the rapid and inexorable transformation of land utilisation patterns, has surreptitiously entrained a series of far reaching changes that are now influencing the lake environment and its biota. Deforestation, farming, industrial development and population growth (partly as a result of immigration) are all hastening the pace of change in the utilisation and availability of the lakes resources. For the most part these changes have had a detrimental effect upon the quality of the lake waters (*The Guardian*, 8 July 1992, p. 10). The release of nutrients from anthropogenic activities in the catchment has set off a chain of reactions. For instance, there have been substantial increases in chlorophyll concentration and primary productivity, as well as decreases in silica and sulphur concentrations, in sharp contrast to the measurements of these indicators made 30 years ago (Hecky & Bugenyi 1992). Furthermore, an anoxic zone has developed near the lake bottom with a subsequent loss of productivity and restriction of the areas that will sustain fish life. There is also concern that the waters starved of oxygen are expanding and anoxic conditions have been discovered in shallow areas of the lake (Hecky, Bugenyi, Ochumba, Gophen, Mugidde & Kaufman 1994).

In summary, Lake Victoria has been subjected to deteriorative processes that increasingly threaten the viability of its natural resources and especially the industry based on fish. Yet governments, where and when they have intervened, have had little success in stemming the overall decline. In part this may be because of a misjudgement of the complexity and seriousness of the situation, furthermore there is the likelihood that the interventions were not of the right order of magnitude or comprehensiveness to be effective.

30.3 Unsustainable tendencies and the lake fisheries

The parlous situation with respect to the fisheries of Lake Victoria is mirrored elsewhere in the world's fishing industries (McGoodwin 1994; Crean & Symes 1996) and for many researchers, the goal of sustainable development seems as far away as ever. Indeed it is argued that the processes that work against sustaining resource exploitation are not accurately portrayed.

The concept of sustainable development of natural resources has come to prominence during the last 30 years (Norgaard 1988; Newby 1990). Whilst it has had a profound influence on our views of the exploitation of natural resources, authorities charged with balancing the needs of industry with maintenance of the natural biological capital, have discovered that the practical expression of this ideal has proved elusive.

Despite the intuitive appeal of the concept, and its widespread adoption as a policy goal by governments and non-governmental organisations alike, it has come to be viewed by some as an ambiguous ideal with little practical utility (Manning 1992). Not least of all this has been because of the difficulty of defining ecological limits of natural systems where the scientific knowledge is usually partial, imperfect and contestable (Pearse & Walters 1992; Wilson & Kleban 1992). Furthermore, there is the difficulty, or some would argue, impossibility, of seeking to maintain economic growth within defined ecological limits (Lélé 1991). Rather than this narrow perspective, Redclift (1991),

for example, perceived the utility of sustainable development as deriving from the multi-dimensional nature of the concept. A concept which would incorporate environmental, economic and, most importantly, social and moral components. Rees (1985) commented that the achievement of sustainable development would depend on being able to balance the complex processes, which create social values and drive political and economic decision-making. However, the author was pessimistic that there seemed little prospect that current economic, social and political processes could be adjusted to sustainable forms within the necessary time scale. Norgaard (1988, p. 607) sounded a more hopeful note by asking whether sustainable development might not be an expression of the 'resource base, environment, technologies and culture evolving over time in a mutually reinforcing manner?'.

Despite problems associated with the practical expression of the sustainable development concept, there is support from all quarters for the institution of processes that would lead to the equilibration of the social, economic and environmental dimensions of resource exploitation. However, there are, as yet, no emerging strategies of how this might be achieved. For the most part, the current institutional and organisational make up of most governments ensures that there is heavy reliance on continual (and usually unsuccessful) interventions, most of which involve adjustment of the regulatory framework.

These broader commentaries on the complexity and deep-rooted nature of problems associated with sustainable development of natural resource systems have been placed in a specific fisheries context. Drummond & Symes (1996) cast doubt on the capacity of governments (in this case the European Commission) to treat the ills of the prevailing fisheries management policies by adopting the classic 'command and control' methods. They argued that this would not be sufficiently all-embracing and penetrative to counter what they termed 'unsustainable tendencies'. They argued that the process of drawing ecological limits with the intention of controlling economic and social institutions is a flawed approach that will not give rise to a sustainable outcome. Thus, interventions invoked to maintain resource exploitation within limits, at best only temporarily suspend the deeply rooted processes that might ultimately bring about 'extinction' of the resource and the dependent exploitation processes.

The Drummond & Symes (1996) model may be taken a stage further and can be extended into the conceptual representation realised by Lélé (1991). The author produced what was considered a 'more realistic' interpretation of sustainable development (Fig. 30.1), which draws together elements that are rooted in the disciplines of biology, ecology, technology, economics, social science and the environmental science. It is essentially a flow diagram but there is a tendency for the inputs to be unidirectional and concentrate on a 'sink' where environmental degradation and poverty are linked together. The processes that establish the sink are driven by, amongst other things, short-term decisions, loss of biological capital and pollution. In the model the variables of access to resources, culture/values and technology via environmental degradation strongly influence the directional flow between affluence and poverty. Interventions (by government) are not shown in the model but may be assumed to have occurred, however, with the net outcome of serving only to reinforce the deteriorative flows already established.

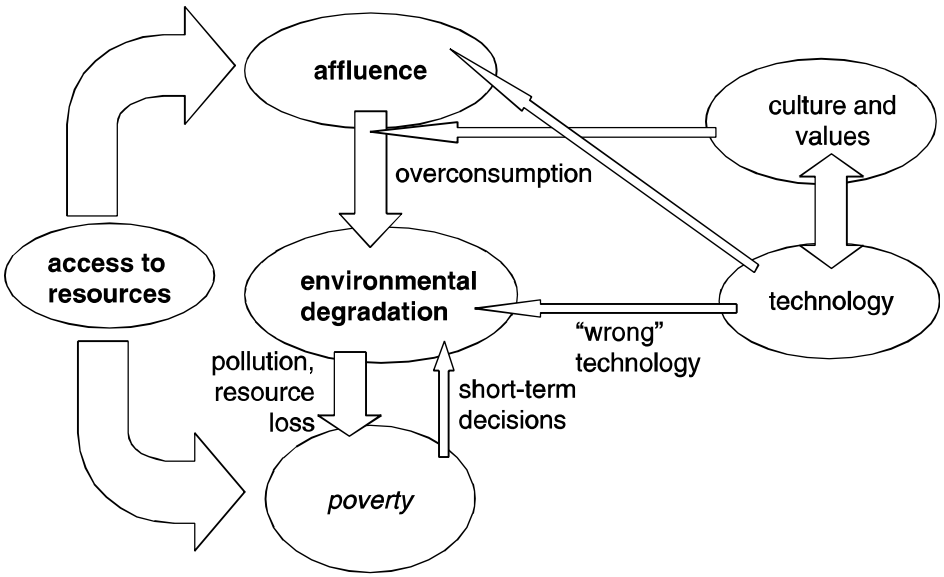


Figure 30.1 A more realistic modelling of sustainable development (*Source*: Lélé 1991)

The concept of unsustainable tendencies readily translates into the context of Lake Victoria's fisheries. Examples of interventions that have only served to reinforce unsustainable tendencies are attempts to control exploitation of undersized fish. Whilst there is in existence a plethora of fisheries ordinances directed at this problem, they appear to have failed. The measures adopted have had little impact because in this case there is a market for undersized fish that cannot be controlled by gear regulations. The consumption of undersized fish is an unsustainable tendency that is a function of culture, social values and demography. It is a growing problem that the current regulatory interventions cannot address. There are indicators that, at least in part, show the damage caused by harvesting of immature individuals of commercially-targeted fish populations. In Uganda, for example, fishermen comment that there is less fish now than 5 years ago; more time has to be spent in the capture of fish; species diversity has been reduced; there are more boats than 5 years ago; the average size of fish is smaller than that landed 5 years ago; illegal fishing techniques are still in use; fishing pays less now than it did 5 years ago. As a result of the widespread theft of passive fishing gears, such as gill nets, fishermen are adopting fishing methods where the gear can be more readily monitored and protected. Thus, many fishing groups are switching to the use of beach seines which are much less vulnerable to theft, but are more damaging to the stock base in terms of their take up of undersized (juvenile) fish and damage to nesting areas (Craig 1992).

30.4 Conclusions

The models described by Drummond & Symes (1996) and Lélé (1991) are useful tools in explaining the complex of problems that confront attempts to establish sustainable development of the fisheries of Lake Victoria. They expose the weakness of interventions by government that are usually technical or fiscal in nature and take little account of trans-sectoral conditions. Overall the processes shown in the Lélé

model cannot readily be equilibrated, as the forces involved tend to short-circuit with a tendency to poverty, driven by some or all of the main functions of the model. Whilst the Lélé model is a generic representation of key elements that drive the unsustainable exploitation of resources, it has a relevance to the Lake Victoria situation. The open access status of the lake's fisheries resources coupled with a lack of alternative employment options for the peoples of the catchment area are powerful forces that have fuelled the process of environmental degradation. There are clear examples of the link between poverty–inappropriate technology–culture–environmental degradation.

What the LVFRP has identified to date is that the role of economic growth in fisheries, in relation to the dispersion of benefits between user groups, is not fully understood and further analysis is required. Yet it is apparent that economic growth *per se* is not a means of poverty removal and may well entrain environmental sustainability. The evidence appears to show that affluence associated with the user groups that prosecute the fisheries is skewed towards those that deal with the international trade in Nile perch and there is so far a lack of evidence to show that the benefits are more widely distributed (Jansen, Abila & Owino 1999). Inequitably access to the resource as a result of the distorted accumulation of capital reinforces affluence for a minority. The situation with respect to the distribution of benefits is dynamic and will be responding to the build-up of population in the lakeside communities through 'normal' demographic trends and a shift towards immigration of peoples who have previously not been regarded as stakeholders.

The problems of the lake are deeply embedded in its social fabric, and interact not only at the level of the lakeside communities but also at regional and international levels. The vertical discordance in culture and values between these levels, and also horizontally at a given level, is the source of the unsustainable tendencies that adversely affect the lake's fisheries. What is clear is that sustainable development, if and when attained, will be reached by a route, which starts with the acceptance that there are structural, technological and cultural causes of both poverty and environmental degradation. Thereafter the stakeholders at all levels will have to come to terms with the concept that solutions will require radical change in the structure, function and relationships between the myriad institutions that influence the lake's fisheries economy.

Acknowledgements

The financial support for the project was provided by European Union under the Lake Victoria Fisheries Research Project (Ref.: ACP-RPR 227).

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