International Food and Agribusiness Management Review
Volume 7, Issue 4, 2004

Market-Driven International Fish Supply Chains: The Case of Nile Perch from Africa's Lake Victoria[1]

Andy Thorpe [a]ⓘ and Elizabeth Bennett [b]

[a] *Principle Lecturer, Department of Economics, University of Portsmouth, Portsmouth, UK.*
[b] *Researcher, Department of Economics, University of Portsmouth,Portsmouth, UK.*

Abstract

This paper analyses the organisation of the post-harvest Nile perch supply chain centred on Lake Victoria in East Africa to test the practical relevance of the market-driven supply chain thesis proposed by Folkerts and Koehorst (1998). It finds that while international consumer demand, particularly in demanding improved quality standards according to HACCP principles, is having profound local organisational ramifications, the evolving supply chain is presently best characterised as being a hybrid one – neither exclusively production, nor market-driven.

Keywords: supply chain, fish chain, Nile perch, Lake Victoria, HACCP, quality assurance

ⓘ Corresponding author: Tel: + 44(0)-239284-4251
Email: andy.thorpe@port.ac.uk
Other contact information: E. Bennett: bennett@thebluespace.co.uk

[1] This paper is partially based on the findings of the EU-funded, IDDRA-executed study entitled Policy Analysis Programme for Lake Victoria (2002). The authors would like to thank participants in the EU Thematic Network FISHGOVFOOD for comments made upon an earlier draft of this paper which was presented in Dakar, Senegal (15-21 September 2002) and comments on specific points - as indicated within the text - from M.Medard (Socio-economist, Tanzanian Fisheries Institute, Mwanza) and P.Borel (Managing Director, Greenfields Uganda Ltd, Entebbe, Uganda). Comments from two anonymous IAMA referees also proved useful in helping us complete this final version.

Introduction

"If it is hard to track down the complexities of social and economic relations between fishermen, ...it is even more complicated to discern the patterns of exchange between catch and market (van der Schans *et al.*, 1999:120).

The journey from trawler to table can be swift or extended. In many developing countries the path is usually short with the catch being sold fresh, either from the quayside or beach or in an adjacent market. The fish chain is extended however when curing - smoking, pickling, salting, drying, freezing or burying - is undertaken, although the destination of the final transformed product may remain local. Canning - preserving and protecting the product - affords additional commercial opportunities, while the despatch of fish to inland or overseas markets further lengthens the chain. Significantly, the chain provides a means of subsistence for many, with the numbers involved in the post-harvest operations of processing and distribution sharply outweighing those involved in the capture of the resource.[2]

As humans consume over 1,000 species of fish extracted from a variety of ecological habitats across the world - the ensuing fish chains are inevitably disparate, being a reflection (to varying degrees) of local, national, regional and global market arrangements and the socio-cultural settings in which harvesting, processing, distributing and consuming take place. Moreover, the complexity of the chain has evolved over time. One of the consequences of the establishment of Extended Fisheries Jurisdiction (EFJ) within Economic Exclusion Zones (EEZ) in the 1980s was a marked growth in the national fleet of coastal nations, often aided and abetted by a favourable macroeconomic policy environment, particularly regarding subsidies (Thorpe *et al.* 2000, Milazzo, 1999). This was paralleled by an increased integration of markets, with the international fish trade growing exponentially from 4.5 million metric tonnes [export value US$1.3 billion] in 1960 to 42.9 million metric tonnes [export value US$52.9 billion] in 1999 (Ruckes, 1995:1; FAO, 1999: Table A4).

This growth has highlighted the symbiotic relationship between fishery management decisions and events in seafood markets (Johnston and Wilson, 1987). While regulatory policies may be associated with lost market opportunities if fishers are prevented or dissuaded from extracting high quality products (case with the growth of 'no-take' fishing reserves, for example), it is equally true that changes in market conditions may have undesirable implications for those boat owners, shellfish collectors or aquaculturists at the beginning of the supply chain (case with the US embargos on Mexican tuna imports during the eighties[3]). In other words, as market events may reverberate

[2] Macfadyen (2002:Box 1) suggests that while those directly involved in marine and inland capture fisheries was of the order of 5.8 million in 2001, the numbers employed in related activities [input supply chain and post-harvest operations] ascended to 64.2 million.
[3] Details of this dispute can be found in Rosendahl (1984), Cicin-Sain *et al.* (1986), Nadal Egea (1996), de Andrade (1999), and Thorpe *et al.* (2000).

throughout the chain in the same detrimental way that a collapse in fish stocks will, it is as necessary to understand the governance mechanisms operating in the post-harvest supply chain as it is those at the point of resource capture.[4] Moreover, given the highly perishable and fragile nature of the product, quality considerations are an imperative element of the distributional equation. As spoilage is an irreversible process, quality control and assurance systems are an obligatory part of the chain, ensuring the delivery of fish products of an acceptable standard for human consumption.

This paper, through recourse to a fish chain that extends from Lake Victoria in East Africa to the supermarkets of Europe, illustrates the complex nature of - and multiple actors within - contemporary fish chains. First, the paper clarifies what is understood in the context of this article by a fish chain, before proposing a framework that permits a more detailed analysis of the nature of such chains. Second, it applies this analytical framework to the Nile perch fish supply chain. The third section examines how the issue of quality assurance is central to understanding the evolving Nile perch supply chain, and identifies the governance mechanisms which have/are emerging entrusted with improving/upholding these standards. A conclusion summarises our findings.

The Fish Supply Chain

While the complete fish chain could be construed as extending from the ocean to the oven, this paper concentrates solely upon human involvement in the chain (from 'trawler to table' as it were). The fish supply chain then can be defined as a set of interdependent agents (fishers, processors, and distributors) that work together, consciously or unconsciously, to convey a fish derived product to the eventual consumer.

The management of this distributional process has provoked an enormous general supply chain literature (see Handfield and Nichols Jr. [1996] and Poirier [1999], amongst others), a literature that principally focuses on managing the logistics of the process (see Hahn and Ribeiro [1999] and van der Vorst *et al.* [2000] as recent examples of this). However, such literature invariably takes for granted that, by conceptualising the process as a chain, the interdependence of the constituent parts (or links) is implicitly recognised. Yet no participant in the chain is an island, and livelihoods are affected by the actions of others within the chain as much (if not more so) than by one's own individual actions. Consequently, as trading relationships grow and supply chains are progressively fine-tuned, effective governance mechanisms are evermore important to ensure that profits/returns are maximised at the chain level.[5] Moreover, particularly

[4] A governance mechanism is a means by which chain members and/or exogenous parties are able to act so as to change either the chain strategy, or the context within which chain activities take place. Governance mechanisms can compel, coerce or encourage chain members to endorse/comply with proposed changes in chain strategy.

[5] See, for example, the paper by Stank *et al.* (1999) which finds that inter-firm supply chain coordination is a significant explanatory factor for a series of performance outcome measures.

within the food sector, ethical and health concerns are demanding new (quality-conscious) governance mechanisms, as the recent controversies over *Bovine Spongiform Encephalopathy* (BSE) and Genetically Modified (GM) foods have only too clearly demonstrated.

In response, a 1998 paper in the *British Food Journal* by Folkerts and Koehorst (FK) advocated an analytical approach to chain management that focuses on improved governance of chain strategy and activities. They identify nine key fields of interest, distinguishing between the participants involved, the activities undertaken, and the final outcome (Figure 1).

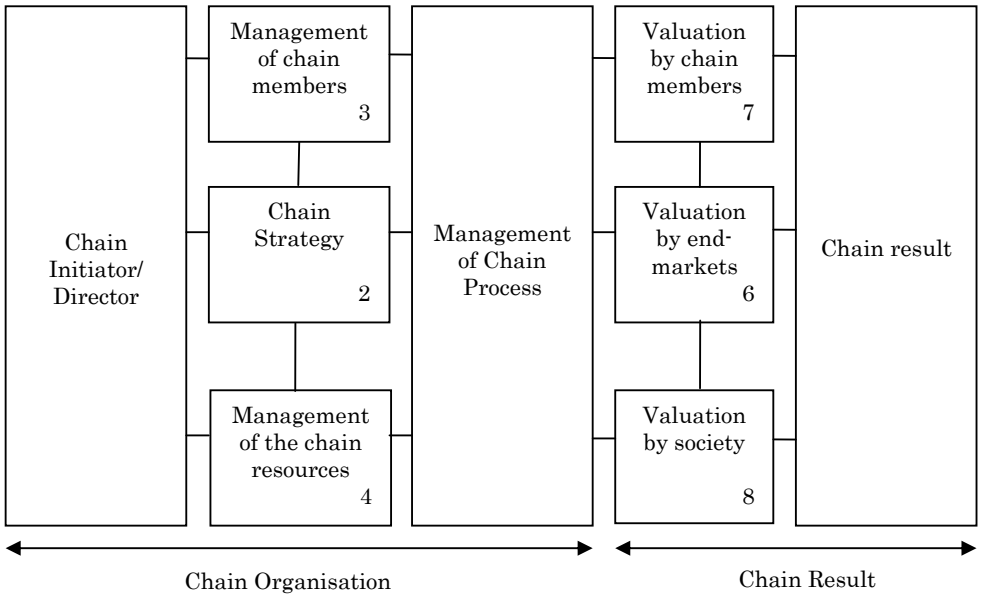

Figure 1: The Chain Management Model
Source: Folkerts and Koehorst (1998).

In the FK model, the chain strategy [box 2] can be determined exclusively by an individual, company or association, or in conjunction with other chain members (the chain initiator or 'director'). Management of the chain process - and members and resources therein - can be somewhat restrictive, with a regulatory body emerging to ensure that participants adhere to certain agreed rules[6], or relatively autonomous - where chain members are largely at liberty to make their own decisions or pursue their own goals.[7] The consequence of these

[6] For example, in accessing the UK market, third world producers of a specified number of crops can only label their products as 'Fairtrade' if they satisfy the minimum requirements laid down in the relevant set of generic producer standards devised by the Fair Trade Foundation (see http://www.fairtrade.org.uk/standards.htm). In return for surrendering a degree of autonomy in decision-making at the level of production, the signatory is rewarded with improved [=fair] commodity prices.

[7] An example here would be in the case of small-holders or peasants with a marketable surplus of basic grains. By choosing to sell this surplus to the intermediary who arrives at the farm-gate

decisions - the chain outcome - can be evaluated in both monetary (valuation by end-markets) and non-monetary (valuation by chain members and society) terms. More effective chain integration, perhaps via the introduction of a new chain strategy or new management arrangements, affords the opportunity to augment market, participant or societal returns.

The FK model then is a potentially useful tool for analysing the myriad fish supply chains that prevail across the globe. Past work on the theme is certainly sparse, with most fisheries researchers simply electing to estimate the consumer demand for fish products (see Wessells and Anderson [1992], Kirman [1994], Graham *et al.* [1998] for example), or describe the processing techniques involved (see Ali [1964], FAO [1985], and Essuman [1992]), rather than examining the operation of the underlying supply chain. One notable exception is Neilsen (2000:62), who argues that;

"... it is of relevance to know whether seafood consumers now pay more, whether fishmongers face increasing competition from retail sales regarding the sale of fresh fish, whether primary producers [fisherman and aquaculture producers] attain lower prices, or whether fish processors may absorb these lower prices caused by retailer's possible use of market power, and whether the establishment of food corporations affect supply and demand."

Moreover, as information technology developments have allowed retailers to capture ever more detailed information about consumer preferences and desires, there is a suggestion that primary commodity chains that transcend national boundaries have exhibited an increasing degree of 'buyer-drivenness' (Dolan *et al.*, 1999)[8] - 'chain reversal' in FK parlance. One consequence of this is that supply chains once dominated by small commodity producers have gradually been transformed, the need to promptly 'deliver phytosanitary tested, prepared, and packaged products' provoking a chain 'shake-out' (Gibbon, 2000:6), with production becoming concentrated in fewer hands and more vertically-organised chains emerging. Topik and Samper (2001), for example, have shown how coffee commodity chain direction was wrested away from peasants by local merchants, subsequently becoming the prerogative of importers, roasters, the state and then transnationals in Latin America. We employ the FK model and terminology to examine whether similar transformations may be occurring within the global fish chain that extends from Lake Victoria in East Africa to the supermarkets of Europe, the Middle East, Australia and Japan. Is 'chain reversal' taking place? Are traditional fishers, fish-processors and fish distributors being marginalized

they become part of the local food supply chain, albeit with no input into the management of the ensuing chain process.

[8] Gereffi (1994, 1999), for example, argues that commodity chains are either "producer-driven" or "buyer-driven". The former flourish in capital- and technology-intensive sectors and see large transnational corporations directing the chain strategy, the latter is more common-place in labour-intensive consumer goods industries where third world contractors make finished goods to overseas buyer's specifications.

(in terms of both chain organisation and results)? And what role do quality assurance procedures play in the process?

The Case of Nile Perch Exports from Africa's Lake Victoria

Although African nations export a variety of fish (ranging from low-value pelagic species to high value tuna and swordfish) to global markets, details on the nature of such extended supply chains are sparse. The exception relates to exports of Nile perch (*Lates niloticus*) from Lake Victoria, the world's second largest freshwater lake (after Lake Superior). While the introduction of the perch into the lake in the 1950s triggered dramatic changes in the lake's eco-system (Achieng, 1990; Kaufman, 1992; Witte *et al.*, 1992), it also spawned a whole new industry related to the capture, processing and subsequent export of perch fillets. Approximately 25,000 metric tonnes were landed in 1982 and, by 2000, the three countries bordering the lake (Uganda, Tanzania and Kenya) were extracting an estimated 220,000 metric tonnes worth between US$280-400 million annually in export revenues (Revenga *et al.*, 2000:13, Bwathondi *et al.*, 2001)[9], compared to an estimated sustainable yield of between 250,000-300,0000 metric tonnes (Kayombo and Jorgensen, 2003:22). Annual benefits, simply on the Kenyan side of the lake, from the fishery have been estimated at over 7.1 billion Kenyan shillings – about US$97.6 million (Bokea and Ikiara, 2000:17). This boom had profound implications for both the management of chain resources, as well as chain structure and organisation.

As fishing activities flourished - the number of chain participants (fishers) swelled from 11,000 in 1971 to 124,639 in March 2000 with an estimated 41,091 fishing boats in operation on the lake in the same year - there was a significant investment in nets and associated technology (Reynolds and Greboval, 1988; Jansen *et al.*, 1999:10; Bwathondi *et al.*, 2001). The distributional emphasis had initially been on local markets, the surfeit of fish causing a marked decline in local prices over the period 1975-85, and encouraged local consumers to supplant consumption of preferred native species with the freely available and cheap Nile perch (Reynolds *et al.,* 1992; Bokea and Ikiara, 2000:5). The boom also enhanced earnings of those involved in traditional fish processing activities (extra volumes offsetting declining prices), and encouraged a sharp influx of individuals - principally women - into the sector[10].

There was a major structural transformation within the chain however after the first processing factories were established along the Kenyan shoreline in the mid 1980s. The fresh and frozen perch fillets produced by these new chain entrants were air-freighted to overseas markets in the EU, Israel, Australia and Japan

[9] Ntiba (2001:1) suggests earnings from the fishery and associated industries could be as high as US$600 million, with between US$240-460 million being paid directly to fishers.
[10] Jansen *et al.* (1999:11) suggest that as many as 180,000 individuals may have been employed in harvesting, processing or distribution activities within the Nile perch supply chain during the 1980s. Medard and Wilson (1996) go further – suggesting total fisheries-related employment had risen to around 422,000 by 1992.

where there was a highly elastic demand for such white-fish fillets. Kenyan fish exports, for example, grew at an annual average rate of 36.5 per cent between 1985 and 1995 (Bokea and Ikiara, 2000:6). By the late 1990s, there were 44 factories scattered around the lake (22 in Kenya, with 12 located in Kisumu, the historic centre of the trade, 12 in Uganda and 10 around Mwanza in Tanzania), with strong national industrial processing organisations emerging to lobby governments on the processor's behalf (Megapesca, 1997:2, Borel, 2002, pers. comm.). Ownership of the factories – and control, in FK parlance, over the ensuing chain strategy - was increasingly concentrated within a small local Asian elite in East Africa (Gibbon, 1997:87; Mitullah, nd:5), an elite whose control was determined by their access to financial capital and international trading circuits rather than any underlying or historic interest in the fishery itself. Excess industrial capacity spawned competition between processors for the underlying unprocessed resource by the late 1980s. As such competition caused perch prices to rise, local demand dwindled and local chain participants - fishmongers and traditional processors - were squeezed out of the chain (Henson *et al.*, 2000:1161, Jansen, 1999:8). Abila and Jansen (1997), for example, have suggested that every one job created in the factory sector led to the loss of 6-8 work places in the traditional sector.

Furthermore, such competition provoked vertical integration as factories strove to establish greater control over chain resources. Initially the chosen chain strategy was to acquire trawlers that could deliver large quantities (500-1,500 kg per trip) of perch to the quay from whence they were directly transported by factory-owned trucks to the processing plant. After regional authorities banned trawler fishing due to its adverse ecological effects at the end of 1995, the factories adopted a new strategy. Now factories in Tanzania and Kenya elected to 'sponsor' artisanal *matajiri* (fishing vessel proprietors), generally by supplying nets and engines, the *matajiri* in return being obliged to deliver their catch to the factory. This new strategy triggered two changes in the chain management process. First, it effectively tied the *matajiri* to a specific processor - Gibbon (1997:51) suggests up to 600 of the lake's larger vessels were tied in this manner (one factory having 113 tied vessels) - with the precise nature of the agreement also serving to exacerbate concentration in the harvesting sector over time. Factories supplemented tied supplies through a decentralised collection system of agents, field agents and sub-agents[11], with the processed fillets being either transported to Mombasa (Kenya) or Dar-es-Salaam (Tanzania) by refrigerated road transport for onward shipment to international destinations, or being air-freighted out from Kisumu (Kenya), Mwanza (Tanzania) or Entebbe (Uganda) directly to European and other markets. Second, it facilitated further differentiation of chain members as more wealthy *matajiri* graduated to become trader/agents – purchasing fish from other fishermen to supplement their own catch before on-selling to the factories (Mitullah, nd:16).

[11] The agent was generally based at the company jetty and was responsible for strategic coordination of the supply network and price-setting. Field agents operated from the different fishing ports and were often equipped with large collector boats and ice. Sub-agents were responsible for directly procuring the catch - from both tied and non-tied vessels.

The Nile perch supply chain is probably one of the best fisheries exemplars of Folkerts and Koehorst's 'chain reversal' thesis - whereby consumer demands exert a strong influence over chain structure and operation (van Vliet and Friis, 1999:208). Not only did burgeoning Western consumer demands for whitefish (fillets) underpin the establishment of perch processing factories in East Africa, but the local processing elites have adapted product transformation processes to accommodate subtle differences in consumer tastes - fillets destined for the Japanese market are despatched skin-on and scaled whilst those delivered to the North European, US and Australian markets are deeply skinned and have the dark flesh removed (Megapesca, 1997:2). This external dynamism is also, paradoxically, the Achilles heel of the chain insofar as a dependence upon external markets can have unpleasant implications for chain participants if trade is unexpectedly curtailed [either due to an abrupt change in consumers tastes and/or due to governmental edicts] - a point we elaborate upon further in the subsequent section. Furthermore, whilst the chain does exhibit a degree of oligopolistic competitiveness, the chain management structure that has evolved is extremely exclusionary - 34 factories have, by capturing 90%+ of perch landings, provoked the demise of many local fishmongers and traditional processors and hastened concentration at the harvesting level via the propagation of tied contracts. It also largely removed the perch from domestic dinner-plates, although a sub-industry processing skeletons (*punks* in the local language) and other waste discarded by the factories did evolve with a domestic market focus. Yet, even this sub-industry is now being squeezed out as a newly emergent secondary fish chain sees such discards either being diverted into newly constructed fishmeal plants, or disappearing altogether due to improved processing techniques which leave no meat on the skeletons (Mitullah, nd:21; Bokea and Ikiara, 2000:8).

This case study serves to illustrate the dynamic nature of fish supply chains - where new internal governance mechanisms (tied-contracts in the Lake Victoria example) have emerged to overcome identified chain shortcomings. The most common ongoing defects appear to relate to shortfalls in resource provision (SEDAWOG, 1999:3), a direct consequence of which has been excessive price volatility in end-markets. Improved vertical coordination of the chain could allow profits to be augmented at the chain level, fisher returns and/or societal benefits improving through the promotion of more open, quayside, auctions. A very real problem however, is that that the growing competition for the underlying resource has not only forced up entry barriers (the *tembea* boat preferred by participants in the Nile perch fishery can cost up to US$10,000 according to Jansen *et al.*, (1999:14) for example) for new entrants, but that the strategies pursued by some current chain members[12] ensures aggregate benefits are disproportionately distributed within the chain. One possible remedy to this is to establish (and more crucially, enforce) counterveiling governance mechanisms, the banning of trawlers on Lake Victoria is one instance of this, which induce a

[12] One is thinking particularly here of the trawler operators who continue to fish - despite the regional ban on such activities, and the growth of trader-agents (Mitullah, nd:13, 26, note 8).

more equitable participation in the chain without necessarily compromising its operational effectiveness. Governance mechanisms are not simply limited to issues of intra-chain equity however. Their presence may be equally warranted if other objectives - such as quality assurance - are considered imperative.

Governance Mechanisms to ensure Quality Standards in Fish Supply Chains

Quality assurance mechanisms are imperative in fisheries given the latent perishability of the product. Although traditional sensory inspection of gill coloration, colour, shine and texture of skin/flesh, thickness and colour of the slime on the skin, and smell affords a consumer some indication as to freshness (Fraser and Sumar, 1998:275), such inspection is unable to necessarily discern the initial breakdown of various components present in the fish which trigger its subsequent decomposition (see Plahar *et al.* [1999:20/1] and Poli *et al.* [2001:311/2], for example). Equally, sensory inspection is unlikely to disclose whether the product is contaminated with bio-toxins and heavy metals, residues of veterinary medicines (aquaculture products), *salmonellae* etc., or has been irradiated (Woolston, 2000). The issue of quality assurance/control consequently encompasses the entire post-harvest chain; 'fishermen take care to land fresh and undamaged fish' (van Vliet and Friis, 1999:208), whilst caterers, fishmongers and other retail outlets expect their suppliers to meet exigent quality standards. A failure to do so results in visible deterioration/contamination of the commodity to the obvious detriment of downstream chain participants, as quality assurance failings early on in the chain process cannot be rectified at a later stage (van der Schans *et al.* 1999:121).

Self-interest then encourages the emergence of endogenous policing/governance mechanisms, so as to ensure the product meets accepted strategic quality norms as it transits its way down the supply chain. In the wake of the UK BSE crisis for example, the strategic response of the sector was to introduce retailer- and manufacturer-led assurance schemes intended to reduce product category and product specific risk and thereby return consumer's overall risk perceptions related to the consumption of beef to its pre-crisis level (Fearne *et al.*, 2001). Similarly, van der Schans *et al.* (1999:123ff) have indicated that producer's organisations in Vigo (Spain), Peterhead and Lerwick (Scotland) and Holland are well-placed to assume rather higher, pro-active quality control roles vis-a-vis the fish harvested by their members.

However, endogenous control mechanisms - whether in the form of trade/producer associations and/or proprietary quality control schemes[13] - have increasingly been seen as insufficient to allay consumer preoccupations/fears

[13] In the UK, for example, many large supermarket chains have formulated their own private quality assurance schemes in recent years. One of the higher-profile cases has been Iceland's [the company] pledge not to knowingly source GM products.

over the safety or origins of a particular product at the national or international level. In such instances, exogenously implanted assurance or quality improvement mechanisms may be necessary. These may be either national in character, as with the US Food and Drug Act - 'which assures consumers that the products of a nation are produced in a prescribed manner (Zaibet, 2000:313)' - or the French *appellation d'origine contrôlée* and *Label Rouge* (Mariojouls and Wessells, 2002:176), or international. The HACCP (Hazard Analysis and Critical Control Point) system, originally developed by the Pillsbury Company in the early 1970s to ensure the safety of food destined to the US Space Program for example, was given global credence when the Codex Alimentarius Commission (CAC)[14] adopted a revised version of the HACCP system as the basis for its food hygiene texts and guidelines in the 1990s (Tall, nd:1). HACCP schemes increasingly focus upon the conditions of production, in the case of fish products - the vessels engaged, the landing facilities used, and the export processing plants employed - rather than simply the analysis and certification of the end product itself[15]. HACCP based legislation is 'a powerful weapon in the pursuit of improved international hygiene levels (Thorpe and Bennett, 2001:157)' and such schemes now underpin food safety legislation across the developed world. They also threaten the modality of international food chains, as HACCP-compliant countries invariably expect sourced inputs from overseas to comply with domestic standards[16].

Nile perch exports are no exception. In November 1996 the Spanish and Italian governments prohibited perch imports from Kenya amidst fears of *salmonellae* - causing Kenya's foreign exchange earnings to drop by 13.1% (total exports to Spain falling by 86%). A year later, the failure to fully satisfy an EU fishery product inspection team (3-9 December 1997) saw Kenya left off the list of authorised importing countries[17], the decision causing Kenya's export earnings to slump by a further 32%. A rapid response by the national competent authority (the Ministry of Health, in conjunction with the Fisheries Department) to the inspection team's criticisms (CUTS, 2001:4), however, saw Kenya re-instated on List II of importing countries to the EU with effect from 1 July 1998.

---

[14] The CAC is a joint body of the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) whose mission (essentially) is to protect the health of consumers and to facilitate the international food trade through harmonisation of science based standards. The Codex Alimentarius has 200+ food standards, which detail codes of practice, limits for pesticide residues etc.

[15] As a consequence, potential exporting countries are best advised to ensure that all local chain members – and not just the exporter - have implemented HACCP acceptable hygiene standards.

[16] While we recognize the imperative of compliance, documenting compliance procedures and methods for evaluating same within the Nile perch chain is beyond the scope of this particular article.

[17] Countries intending to export fish products to the EU must satisfy an EU quality control inspection team to gain accession to an 'approved' list of importing countries (List I). Until 31 December 2000 the EU also operated a second 'temporary' list (List II) – access to which was limited to those countries that either had an EU inspection pending, or had failed to fully satisfy an earlier EU inspection team. List II countries could solely export their products to those member states prepared to accept such imports (Sanz, 1999:4).

Significantly, the national governance failings exposed by the above embargoes on the quality control front prompted a more timely, pro-active, response after the EU announced a new embargo in March 1999 on the basis that poisons were being used to harvest fish in Lake Victoria - the national government simply banned all night-time fishing activity for a period of two weeks. While this drastic action failed to win immediate European approval (the EU suspended the import of all fish products originating from Lake Victoria on 12 April), it did make all domestic participants in the chain acutely aware of the imperative need to employ acceptable harvesting strategies (Langat and Rey, 1999:11ff). This manifested itself in a number of ways. First, it triggered the formation of a new producer's organisation, the Kenyan Association of Fish Exporters and Processors, to represent the collective interest of members in discussions with both national government and the EU on quality (and other) issues. Second, it encouraged an individualistic response by each processor to raise quality standards within their own supply chain. Investment in cold stores on the landing beaches and the provision of ice were two of the more common elements - measures which tied the fishermen ever more closely to their upstream processor (Henson *et al.*, 2000:1164ff; Medard, 2002, pers. comm.) – while two processing factories purchased rapid transport vessels with refrigeration facilities (Mitullah, nd:22). These chain-induced responses were complemented by state support schemes, in particular, governmental commitment to; (i) establish 511 beach management committees whom were to be entrusted with ensuring beach cleanliness and sanitation (in conjunction with the World Bank/GEF funded Lake Victoria Environmental Management Project), (ii) provide instruction for chain participants on improved fish handling and processing techniques, whilst fisheries inspectors were scheduled to receive advanced training in quality control issues, and (iii) approve new legislation designed to harmonize hygiene requirements in the processing factories with EU guidelines (Hoza, 1999). This bi-partite assault on deficiencies in local quality control proved sufficient to overturn the ban, exports to the EU resuming in March 2000. However, the cost of meeting such standards – establishing in-house laboratories, renovating filleting plant, enhanced staff hygiene training - proved exclusionary, and contributed to further consolidation within the sector[18].

The above episode shows how a complex web of interlocking governance mechanisms (redesigned national legislation, new lobby groups to promote the interests of certain stakeholder groupings within the chain, development of extended clientilistic relationships between chain members, etc.) may emerge/evolve to satisfy the increasingly stringent qualitative demands invoked by international fish supply chains. Contrarily, in instances where FK's 'chain reversal' thesis is not so pronounced, and consumer pressures for high (or improved) quality standards are correspondingly weak – as in the domestically-oriented tilapia and *dagaa* [sardine] fish chains (Thorpe *et al.*, 2004) - there is much less compunction for chain members to either collectively or individually impose strictures to raise product quality. Although chain management

[18] Nimrod (2000), for example, mentions that the latter embargo resulted in the closure of three of the eleven existing Ugandan fish processing plants.

arrangements may still evolve within such fish chains, they are unlikely to be motivated primarily by quality considerations.

Conclusion

This paper has explored the post-harvest nature of the Nile perch supply chain, illustrating how the journey from 'trawler to table' involves a series of disparate stakeholders who have both competing and complementary interests. The most numerous – the fishermen themselves – are located at the base of the chain, whilst design and management of the ensuing national chain strategy largely rests in the hands of a small number of industrial processing plants. Increasingly, however, this strategy is oriented to the satiation of specific international consumer preferences – whether it be for a skin-on scaled fillet for the Japanese market, or a deep skinned, white and boneless fillet for the European market (Megapesca, 1997:2) – 'chain reversal' in the parlance of Folkerts and Koehorst (1998). Such specific product attributes, as Young and Muir (2002) have also shown with respect to the international market for tilapia, are helping to both segment, and thence drive, international fish supply chains. As a consequence;

"The small scale traders and artisanal processors who dominated the industry until the early 1980s have become small players trading mainly within the cluster and surrounding areas. *Industrial processors have become the industry's driving force* (Mitullah, nd:5, the italics are ours)."

Yet, while the Nile perch supply chain is undoubtedly (international) market driven, industrial processing activities remain under national elite control and the rise of tied contracts and artisanal *matajiri* who are strongly linked to these locally based (but transnationally networked) elites suggests a hybrid chain has emerged[19] which is structured similarly to the global clothing commodity chains identified by Gereffi (1994, 1999) and (Hassler 2003).

Chain evolution has – in recent years – been, furthermore, strongly conditioned by food safety/quality developments in the international arena. Around 60% of international fish markets presently require imported fish and fish products to conform to HACCP standards[20] (Lupin, 1999:267), and the failure to introduce appropriate governance mechanisms at the local level to ensure compliance with such standards can lead to the sudden loss of export markets. The Nile perch example is a case in point. The 1998 EU embargo had severe macroeconomic repercussions for Kenya, Tanzania and Uganda, repercussions that reverberated back down the chain to devastate the livelihoods of both fisherfolk and ancillary workers in the local lakeside communities. Paradoxically however, this catastrophe - beach prices for perch in Tanzania fell from Tshs 306.3 per kg in

[19] We are grateful to an anonymous reviewer for alerting us to this possibility.
[20] Japan, which accounts for a further 34% of the international trade in fish, is presently the only major country not to have demanded full HACCP compliance.

1998 to Tshs 126.3 per kg. in 1999 after the ban was implemented (Hoza, 1999) - made the industrial processors (the local 'chain directors' in FK parlance) more receptive to embracing the chain re-organisation necessary to meet HACCP standards. In this instance successful chain strategy modification occurred as a consequence of the disastrous short-term results emanating from the ban, prompted broad stakeholder agreement as to the appropriate response measures required, and led to a chain 'shake-out' - with those processors unable to meet the exacting consumption standards now expected exiting the industry.

More generally, this paper has raised the question of how widespread 'chain reversal' is within the agri-food sector? Wessells (2002:161) suggests that, in the seafood market at least, competitive pressures are likely to ensure that the market for 'seafood with desired attributes' will continue to evolve. Hopefully this paper will prove catalytic in stimulating other researchers to examine the extent to which production-driven supply chains are being transformed into market-driven supply chains within the wider agri-food sector.

References

Abila,R.O., Jansen, E.G.1997. From Local to Global Markets: The Fish Processing and Exporting Industry on the Kenyan part of Lake Victoria - Its Structure, Strategies and Socio-Economic Impacts, University of Oslo Working Paper 1997.8, Oslo.

Achieng, A.P.1990. 'The Impact of the Introduction of the Nile Perch, Lates niloticus (L.) on the Fisheries of Lake Victoria, *Journal of Fish Biology 37* (Supplement A):17-23.

Ali,S.A. 1964. Increased Fish Consumption through Improved Fish Handling and Distribution. Symposium on Increasing Fish Consumption through Improved Fish Handling and Distribution, 16-31 October, FAO: Rome.

Bokea, C., Ikiara,M. 2000. Fishery Commercialization and the Local Economy: The Case of Lake Victoria, Paper presented at the Second International Conference on Environment and Development, The Royal Swedish Academy of Sciences, Stockholm, September 6th-8th, http://www.york.ac.uk/depts/eeem/publish/edeconf.htm, (Accessed 12 December 2003).

Bwathondi,P.O.J., Ogutu-Ohwayo,R., Ogari,J. 2001. Lake Victoria Fisheries Management Plan, LVFRP: Uganda.

Cicin-Sain,B., Orbach,M.K., Sellers,S.J., Manzanilla,E. 1986. Conflictual Interdependence:United States-Mexican Relations on Fishery Resources', *Natural Resources Journal*, 26:769-92.

CUTS (Consumer Unity and Trust Society). 2001. Standards and Market Access. http://cuts.org/sps-analysis-sps_case_kny.htm (Accessed 15/7/2002).

de Andrade,R. 1999. Fisheries Disputes in Latin America, ECLAC Environment and Development Series Paper No.5., ECLAC: Santiago.

Dolan,C., Humphrey,J., Harris-Pascal,C. 1999. 'Horticultural Commodity Chains: The Impact of the UK Market on the African Fresh Vegetable Industry', IDS Working Paper No.96, Institute for Development Studies, University of Sussex.

Essuman,K.M 1992. Fermented Fish in Africa: A Study on Processing, Marketing and Consumption (T329), FAO: Rome.

Fairtrade Foundation. http://www.fairtrade.org.uk/standards.htm (Accessed 2 January 2003).

FAO. 1999. *Yearbook of Fisheries Statistics: Commodities*, FAO: Rome.

FAO. 1985. Fish Processing in Africa, Proceedings of the FAO Expert Consultation on Fish Technology in Africa (R329 Suppl.), FAO:Rome.

Fearne,A., Hornibrook,S., Dedman,S. 2001. The Management of Perceived Risk in the Food Supply Chain: A Comparative Study of Retailer-Led Beef Quality Assurance Schemes in Germany and Italy', *International Food and Agribusiness Management Review*, 4:19-36.

Folkerts,H., Koehorst,H. 1998. 'Challenges in International Food Supply Chains: Vertical Co-ordination in the European Agribusiness and Food Industries, *British Food Journal*, 100(8):385-8.

Fraser,O., Sumar,S. 1998. 'Compositional Changes and Spoilage in Fish - An Introduction', *Nutrition and Food Science*, 5:275-9.

Gereffi,G. 1999. 'International Trade and Upgrading in the Apparel Commodity Chain', *Journal of International Economics*, 48:37-70.

Gereffi,G. 1994. 'The Organisation of Buyer-Driven Global Commodity Chains: How US Retailers Shape Overseas Production Networks', in *Commodity Chains and Global Capitalism*, Gereffi,G., and Korzeniewicz,M.(Eds), Praeger: Westport (Conn.).

Gibbon, P. 2000. 'Global Commodity Chains and Economic Upgrading in Less Developed Countries, CDR Working Paper No.2., Centre for Development Research, Copenhagen.

Gibbon, P. 1997. Of Saviours and Punks: The Political Economy of the Nile Perch Marketing Chain in Tanzania, Centre for Development Research Working Paper 97.3, Copenhagen.

Graham, P., Klijn, N., Cox, A., Stokes, A., Hartmann, J. 1998. 'Modelling Seafood Trade Liberalism in the APEC Region', in *Proceedings of the Nineth Biennial Conference of the International Institute of Fisheries Economics and Trade (IIFET) [Vol.2*], Eide,A., Vassdal,T.(Eds), Tromso.

Hahn,M.H., Ribeiro,R.V. 1999. 'Heuristic Guided Simulator for the Operational Planning of the Transport of Sugar Cane', *Journal of the Operational Research Society*, 50(5):451-60.

Handfield, R.B., Nichols Jr., E.L. 1996. *Introduction to Supply Chain Management*, Prentice Hall: New Jersey.

Hassler, M. 2003. 'The Global Clothing Production System: Commodity Chains and Business Networks', *Global Networks*, 3(4):513-31.

Henson, S., Brouder, A-M., Mitullah, W. 2000. 'Food Safety Requirements and Food Exports from Developing Countries: The Case of Fish Exports from Kenya to the European Union', *American Journal of Agricultural Economics*, 82(5):1159-69.

Hoza, R.B.1999. Study on the Impact of the EU-ban of 1999 to Nile Perch Fish Exports from Lake Victoria, Lake Victoria Environmental Management Project http://www.lvemp.org/L_News-articles-events/Tanzania/articles/eu_fish__ban1999.htm (Accessed 19 August 2002).

Jansen, 1999. 'Out of a Lake', *Samudra,* September:7-8.

Jansen,E.G., Abila,R.O., Owino,J.P. 1999. Constraints and Opportunities for 'Community Participation' in the Management of the Lake Victoria Fisheries, IUCN Eastern Africa programme, http://www.iucn.org/places/lakevictoria/6.htm, (Accessed 19/8/2002).

Johnston,R.S., Wilson,J.R. 1987. 'Interdependencies among Fisheries Management, Fisheries Trade, and Fisheries Development: Experiences with Extended Jurisdiction', *Marine Fisheries Review*, 49(3):45-55.

Kaufman, L.1992. 'Catastrophic Change in Species-Rich Freshwater Ecosystems: The Lessons from Lake Victoria', *Bioscience*, 42(11):846-58.

Kayombo,S., Jorgensen,S.E. 2003. Experience and Lessons Learned brief for Lake Victoria, http://www.worldlakes.org/uploa.pdf, (Accessed 24 January 2004).

Kirman, A.. 1994. Market Structure and Prices: the Marseille Fish Market, Proceedings of the Sixth Conference of the International Institute of Fisheries Economics and Trade, IIFET Paris 92 (Tome II).

Langat,A.K., Rey,B. 1997. 'Kenya's Efforts to Secure Sanitary Standards of Fishery Products for Export', *EC Fisheries Cooperation Bulletin*, 12(2-3):11-3.

Lupin,H.M. 1999. 'Producing to Achieve HACCP Compliance of Fishery and Aquaculture Products for Export', *Food Control*, 10:267-75.

Macfadyen,G. 2002. Poverty Alleviation in Small-Scale Fishing Communities', Mimeo

Mariojouls,C. Wessells,C.R. 2002. 'Certification and Quality Signals in the Aquaculture Sector in France', *Marine Resource Economics*, 17:175-80.

Megapesca. 1997. Nile Perch - Marketing Success or Ecological Disaster? Http://www.gisl.co.uk/Megapesca/nileperch.html (Accessed 19/8/2002).

Milazzo,M. 1999. Subsidies in World Fisheries: A Reexamination, World Bank Technical Paper (Fisheries Series) No.406, World Bank: Washington.

Mitullah,W. nd. Lake Victoria's Nile Perch Fish Cluster: Institutions, Politics and Joint Action, IDS Working Paper No.87., Brighton.

Nadal Egea,A. 1996. *Esfuerzo y Captura*, Mexico D.F.: El Colegio de M xico..

Neilsen,M. 2000. A Review of Research of Market Outlets for Nordic Fishermen, TemaNord 2000:524.

Nimrod. 2000. Impact of SPS Measures: Uganda Fish Exports, Paper Presented at UNCTAD Sponsored Workshop on Standards and Trade, Kampala, 13 September.

Ntiba,M. 2001. Capacity Development in the Lake Victoria Basin, East Africa, MSW Conference, http://www.pollutionprobe.org/managing.shared.waters/victoria.pdf, (Accessed 15 February 2004).

Plahar,W.A. Nerquaye-Tetteh,G.A., Annan,N.T 1999. 'Development of an Integrated Quality Assurance System for the Traditional *Sardinella sp.* and Anchovy Fish Smoking Industry in Ghana, *Food Control,* 10:15-25.

Poirier,C.C. 1999. *Advanced Supply Chain Management: How to Build a Sustained Competition*, Publishers Group West: San Francisco.

Poli,B.M., Parisi,G., Zampacavallo,G., Mecatti,M., Lupi,P., Gualtieri,M., Franci,O. 2001. 'Quality Outline of European Sea Bass (*Dicentrarchus labrax*) Reared in Italy: Shelf Life, Edible Yield, Nutritional and Dietetic Traits', *Aquaculture,* 202:303-15.

Revenga,C., Brunner,J., Henninger,N., Kassem,K., Payne,R. 2000. Pilot Analysis of Global Ecosystems: Freshwater Systems' http://www.wri.org/wr2000/freshwater (Accessed 16/7/2002).

Reynolds, J.E, Greboval,D.F., Mannini,P. 1992. Thirty Years On: Observations on the Development of the Nile Perch Fishery in Lake Victoria, Paper Presented at the Symposium on Impact of Species Changes in African Lakes, 27-31 March, Imperial College, London.

Reynolds, J.E., Greboval, D.F. 1988. Socio-Economic Effects of the Evolution of Nile Perch Fisheries in Lake Victoria: A Review', CIFA Technical Paper No.17., FAO:Rome.

Rosendahl,R.W. 1984. 'The Development of Mexican Fisheries and Its Effect on United States-Mexican Relations', *Pacific Basin Law Journal*, 3(1):1-20.

Ruckes, E. 1995. World Trade in Fish and Fishery Products: Review and Outlook, International Cooperation for Fisheries and Aquaculture Development, . Liao, D. S. (Ed), Proceedings of the 7th Biennial Conference of the International Institute of Fisheries Economics and Trade, Keelung, Taiwan.

Sanz, I. 1999. 'Imports of Fisheries Products into the EC: Sanitary Approval for Third Countries', *EC Fisheries Cooperation Bulletin*, 12(2-3):4-6.

SEDAWOG (Socio-Economic Data Working Group). 1999. Marketing Study, LVFRP: Uganda.

Stank,T., Crum,M., Arango,M. 1999. 'Benefits of Inter-Firm Co-Ordination in Food Industry Supply Chains', *Journal of Business Logistics*, 20(2):21-42.

Tall,A. Improvement in Quality Assurance Systems Based on HACCP Application, http://r0.unctad.org/infocomm/c.PDF, (Accessed 21 January 2004).

Thorpe,A, Williams,S., van der Zilj,J. D. 2004. 'The Fish Supply Chain', in *Fish for Life*, Bavinck,M., Kooiman,J., Jentoft,S. (Eds), forthcoming.

Thorpe,A,Ibarra,A.A., Reid,C. 2000. 'The New Economic Model and Fisheries Development in Latin America', *World Development*, 28(9):1689-1702.

Thorpe,A., Bennett,E. 2001. 'Globalisation and the Sustainability of World Fisheries: A View from Latin America', *Marine Resource Economics*, 16:143-64.

Topik,S., Samper K.,M. 2001. The Latin American Coffee Commodity Chain, http://sshi.stanford.edu/Global.PDF, (Accessed 24 January 2004).

van der Schans, J.W., Metuzals,K.I., Venema, N., Malvido,C.I. 1999. 'Adding Quality to the Fish Chain: How Institutions Matter', in *Creative Governance: Opportunities for Fisheries in Europe*, Kooiman,J., van Vliet,M., Jentoft,S. (Eds), Ashgate Publishing Company: Aldershot.

van der Voorst,J.G.A.J., Beulens,A.J.M., van Beek,P. 2000. 'Modelling and Simulating Multi-Echelon Food Systems', *European Journal of Operational Research*, 122(2):354-67.

van Vliet, M., Friis, P. 1999. 'Creating Co-operation in the Chain: Options for Integrating 'Catch' and Market', in *Creative Governance: Opportunities for Fisheries in Europe*, Kooiman,J., van Vliet,M., Jentoft,S. (Eds), Ashgate Publishing Company: Aldershot.

Wessells,C.R. 2002. 'The Economics of Information: Markets for seafood Attributes', *Marine Resource Economics*, 17:153-62.

Wessells,C.R., Anderson,J.L. 1992. Innovations and Progress in Seafood Demand and Market Analysis', *Marine Resource Economics*, 7(4):209-28.

Witte,F., Goldschmidt,T., Wanink,J., van Oijen,M., Goudswaard,K., Witte-Mass,E., Bouton,N. 1992. 'The Destruction of an Endemic Species Flock: Quantitative Data on the Decline of the Haplochromine Cichlids of Lake Victoria', *Environmental Biology of Fishes*, 34:1-28.

Woolston,J. 2000. 'Food Irradiation in the UK and the European Directive', *Radiation Physics and Chemistry*, 57(3):245-7.

Young,J.A., Muir,J.F. 2002. 'Tilapia: Both Fish and Fowl?', *Marine Resource Economics*, 17:163-73.

Zaibet,L.2000. 'Compliance to HACCP and Competitiveness of Oman Fish Processing', *International Food and Agribusiness Management Review,* 3:311-21.

