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ORIGINAL ARTICLE

Aligning small indigenous fish species (SIS) in policy and management for enhanced food security and nutrition: The case of the Kenyan Lake Victoria Omena fishery

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Abstract

Fisheries governance uses policy and statutory documents to improve governance on fish ecology, harvesting, trade and consumption by identifying and addressing gaps regarding inefficiencies, inequity and post-harvest losses. The current study examines existing policies and institutional documents on fisheries, health and trade to assess the level of inclusion of small indigenous fish species (SIS), especially Omena, as a means of guiding governance interventions for sustained livelihoods of fishing communities in Lake Victoria. A content-analysis review was conducted on all the fisheries and nutritional policy documents related to Lake Victoria fishery to ascertain the need for their integration into fisheries governance. From the scoring scale, where zero (0) implies no integration and three (3) implies high integration, the study results indicated very low levels of integration across health, fisheries and trade relating to small fish species. Further, the management plans and regulations/guidelines exhibited a relatively higher level of integration than did policies and laws. There is need for a more targeted approach for streamlining the existing policy documents to realize the untapped potential contribution of SIS towards food and nutritional security.

KEYWORDS
governance, lake, policy, small-sized fish, sustainability

1 | INTRODUCTION

Fisheries occupy a significant place in the socioeconomic development of many countries (Kimani et al., 2020; Njiru et al., 2012; Woodhead et al., 2018) because they are an important income and employment generator (FAO, 2020). Capture fisheries have been able to stimulate the growth of a number of subsidiary industries and are source of a high quality, affordable and nutritious food, in addition to being a foreign exchange earner for riparian communities and lacustrine stakeholders (Aura et al., 2019; Hamerlynck et al., 2011; Nyamweya et al., 2020). Kenya's fishery sector, for example, generally contributes about 4.7% of the country's Gross Domestic Product (GDP) (Mulatu et al., 2018). Further, fish are an important source of comparatively affordable animal protein for people in the tropics, especially the most vulnerable groups, with sufficient water to sustain fisheries being an obvious need (Marshall & Mkumbo, 2011; Shannon et al., 2008). Fish provide amino-acids, vitamins, minerals and omega-3 fatty acids essential for a balanced diet and vital to early foetal development (FAO, 2016).

In spite of the numerous benefits of fisheries to national development, small-scale fisheries still face many challenges that limit full realization of their economic and livelihood potential. Most fishers

in riparian communities in the African Great Lakes region face many obstacles, including reduced fish stocks, inadequate livelihood alternatives and political marginalization (Dugan et al., 2006; Gangadhar, 2011; Njiru et al., 2012). The endowment of the African Great Lakes region with rich fisheries resources represents a myriad of opportunities for economic and social transformation of the local people (Béné & Friend, 2011; Kolding & van Zwieten, 2012), with the majority of this population being in rural communities that rely on fish for food (Abila et al., 2012; Hickley et al., 2008).

Ecology and management of the African Great Lake fisheries face increased fishing pressures, low fish-food diversification, stigmas in utilizing small indigenous species (SIS) and a poor flow of fisheries market information attributable to unharmonized policies and governance structures (Aura et al., 2019; Béné & Friend, 2011; LVFO, 2015). These issues warrant the important need to develop and implement specific polices targeting SIS, including development plans and guidelines on fish harvesting, handling and marketing. The SIS in this case include *Rastrineobola argentea* (Pellegrin) (Omena), *Caridina nilotica* (Linnaeus) (freshwater shrimp) and haplochromine fish species in Lake Victoria, *Limnothrissa* from Lake Kivu, *Dagaa* or *Ndagala* from Lake Tanganyika and *Chisense* from Lake Mweru. These SIS are increasingly dominating Lake Victoria and other lakes in the region, including Lakes Albert, Kivu, Tanganyika, Malawi and the marine environment. These fish are highly productive, easy to catch and amenable to preservation, with large quantities of the dried small pelagic fish being sold in local markets and transported by road over great distances for human and animal (feed industry) consumption (McGlue et al., 2020; Roest, 1992; Van der Knaap, 2013). Although these small-sized fish are generally ubiquitous, they are generally underrated because they are not considered in government regulations focusing on poor regulations.

Large fish species such as Nile Perch and Tilapia are in decline because of increasing fishing pressures and high market demand (Aura et al., 2019; Hickley et al., 2008). Accordingly, SIS are increasingly being targeted by highly-capitalized middlemen, thereby disadvantaging the women and majority of the small-scale traders (Crona et al., 2010), a situation largely attributable to a policy framework that does not consider account equity, food security or small-scale livelihoods (Kolding & van Zwieten, 2012). Such social, economic and legal barriers often act as hindrances to improving small-scale fishers' livelihoods, thereby limiting their food and income security (Béné et al., 2010), including considerations of what quantity, price and when and where to sell or buy, factors that could facilitate enhanced fish-food diversification for food and nutritional security (Béné et al., 2010; Rajeev & Nagendran, 2020).

Although more abundant and productive than larger fish, the SIS are viewed as a low-value commodity largely reduced to fishmeal and oil or used in animal feed (Aura et al., 2019; Kolding et al., 2016). Clearly-defined policies and governance structures with non-biased information on SIS that could be shared across fisheries value chains could diminish the exploitation of disadvantaged rural populations such as women, children and youth who play a dominant role in SIS trade by middlemen (Kolding et al., 2016). This would promote their utilization beyond the poor and reduce wastage and volatility of fish prices (Béné et al., 2010; Gangadhar, 2011).

While stock assessment data have indicated an increase in haplochromines, thereby suggesting an improving situation for Nile perch recovery, there also have been large quantities of both haplochromines and caridina caught as bycatch in the Omena fishery of Lake Victoria which are then processed and marketed (Gichuru et al., 2018; LVFO, 2020). The increased catch of these supportive species, which play a triple role of biodiversity conservation, fishery and as Nile perch food, could be counterproductive, requiring regulations to maintain an ecological balance. Since Omena catches are already high and its utilization as fish food is still partial, increased exploitation of other small fish species in the lake requires considerable caution. On the contrary, because much of the Omena landed (up to 40%) are lost through poor processing, and up to 80% goes into animal feed rather than human food thereby depriving local communities of this highly nutritious fish (and deprives the region of achieving SDGs), regulations promoting its utilization for human consumption by balancing Omena proportions available between industry and household consumers is strongly warranted (Odoli et al., 2019). SIS are generally environmentally efficient. They are sun-dried (Van Zweiten, 2020) and eaten whole, as well as being high in protein, essential micronutrients, including calcium, iron and zinc considered essential for healthy living, and none of their content is wasted. Accordingly, they are very suitable for use as both food and feed (Ogonda et al., 2014).

In addition to the food security and nutritional benefits of Omena as human food among local communities, with better processing they exhibit prospects for it trade in the international market similar to other larger commercial species from Lake Victoria such as Nile perch. Sun-drying Omena on bare beach sand, unhygienic handling during processing, and lack of value-addition techniques are some factors limiting access to this small fish food in international markets (Muma, 2015). Poor processing and value-addition practices could also be the cause of the relatively high post-harvest losses in the fishery (Odoli et al., 2019). Thus, policies favouring development of suitable processing, value-addition infrastructure at fish landing sites and promotion of hygienic handling of Omena would definitely facilitate achievement of international standards required for this fish to be traded for human consumption.

To this end, limited information is available for the African Great Lakes region on needed policy analyses for improved management and governance of major commercial fisheries versus SIS to guide intervention measures (Freduah et al., 2017). Although the Kenyan part of Lake Victoria covers only 6% of the lake's surface area, its fishers land more than 35% of all fish harvested from the lake (LVFO, 2015). There is now an increasing demand for fish to feed a growing population, while capture fisheries at the same time have been declining due to overfishing, pollution and proliferation of water hyacinth (Aura et al., 2020; Lwenya et al., 2006). These problems are adversely affecting food security and preventing development of a sustainable blue economy (Agboola et al., 2018). There is a clear need, therefore, diversify fish-food for the sustainability of capture fisheries. Accordingly, the primary objective of the present study was to examine the level of integration of existing policy and

institutional documents, and also to determine SIS governance and utilization gaps, in order to guide interventions to sustain livelihoods of fishing communities. It is also expected that the findings from this assessment can also provide adequate background and justification for further studies focusing on supporting fair competition in local and global markets (Aura et al., 2018; Smith & Basurto, 2019).

2 | METHODOLOGY

2.1 | Study area and scope

Policy analyses were undertaken on governance and management documentations relating to Lake Victoria, Kenya (Figure 1), for possible adoption in other SIS systems. Lake Victoria is the second largest freshwater lake in the world, supporting the largest inland freshwater fishery (Natugonza et al., 2016; Nyamweya et al., 2018). The lake fisheries are important livelihood sources that provide food and employment (Ntiba et al., 2001). Lake Victoria is the principal inland fishery, with a five-year cycle average production of about 90,000 tonnes landed and valued at about US$ 90 million in Kenya alone (Aura et al., 2020; Njiru et al., 2018).

Because of human-induced pressures (e.g. overfishing; pollution), however, economically important major commercial fish stocks are declining at an alarming rate (LVFO, 2016), a situation that can exacerbate poverty and food insecurity in the region. However, there is a paradigm shift from large–sized fish to small-sized fish such as Omena, *Caridina* and haplochromines whose re-emergence has been reported (Aura et al., 2019). Omena currently accounts for 57% of the total fish catch from Lake Victoria (Aura et al., 2020). Like other lakes, Lake Victoria is facing various challenges, and has undergone various disjointed management

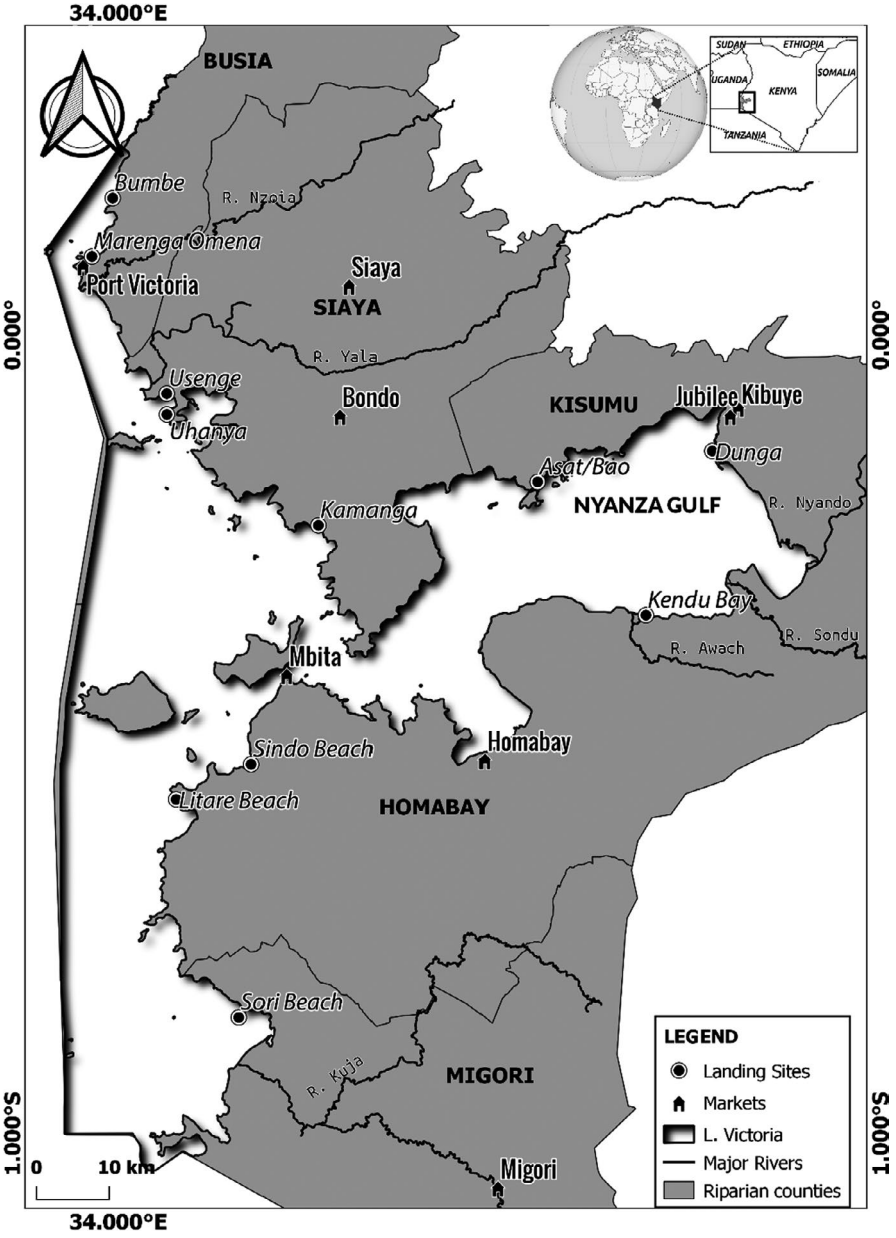

FIGURE 1 Major landing sites and markets of small indigenous fish species (SIS; consisting of Omena, Caridina and haplochromine fish species) in Lake Victoria, Kenya

and governance interventions over time. At the same time, understanding local secondary data and information, experiences and perceptions have important implications for people's responses to governance risks, and can help to inform effective policy (Pyhälä et al., 2016). Documented local knowledge at a base level can also provide information on bias and efficacy of policies at a local level, considering various challenges that can differently and unevenly affect each context (Crona et al., 2013).

2.2 | Data sourcing

The main data needs for the present study include published and unpublished policy documents on fisheries, health (food and nutritional security) and trade across local and international policy landscapes such as the Ministry of Agriculture, Livestock and Fisheries, the Ministry of Health, the Ministry of Trade and Industrialization, the Food and Agriculture Organization (FAO), the Lake Victoria Fisheries Organization (LVFO), the World Health Organization (WHO), the World Trade Organization (WTO) and EACs departments of Health and Trade, respectively. A database listing sources to search for policy materials related to small indigenous fish was developed for the present study, including statutory organizations related to fisheries governance in Lake Victoria, government websites, collections and archives of public and private institutions, all being acquired electronically through Internet-based searches. An Internet search for laws and policies was conducted across websites and databases, with the sources including websites for the EAC and LVFO, government ministries in Kenya, Uganda and Tanzania focusing on fisheries, environment, agriculture, trade, health and laws, FAO, WTO and WHO. Google, Google scholar and CiteSeerX were the main search engines used to source these documents. Search keywords included fisheries, health and trade in the title and abstract of the records. The records were screened to remove duplicates, with the eligibility of documents based mainly on the presence of the keywords. The mined data comprised policy documents on fisheries, health and trade, including plans, strategies, guidelines, regulations, policies, acts, directives and laws. The few cases for which policy materials were only available in hard copy (including classical documents) were sourced directly from authorized custodians. Given the primary objective of the present study being to assess the magnitude and degree of integration across fishery, health and trade policy documents, the approach employed herein was largely focused on the occurrence of indicative keywords within these policies which signalled integration, rather than a detailed content analysis of the policies themselves. This technique assumed the perspectives of other stakeholders were adequately incorporated in these documents and laws during their development process. A total of sixty (60) documents were purposefully selected and sorted into three main policy categories (Table 1). It is noted that considerable exclusion of some key policies that could compromise the present study is unforeseen.

2.3 | Policy information and data analyses and interpretation

The approaches involved in the SIS policy analyses for enhanced recognition in fisheries management and governance is summarized in Figure 2. The present study used a systematic complementary ex-post and ex-ante policy analysis to evaluate the level of recognition of SIS within the policy landscape (ETF, 2018; Weimer & Vining, 1999). The ex-post analysis investigated the level of recognition of SIS within sampled documents, while the ex-ante analysis highlighted possible policy gaps requiring improvements while also providing insights regarding their implications for food and nutritional security. The systematic analysis involved four main steps. The first step is identification and profiling of stakeholders involved in the governance of small fish foods, while the second step is categorization of existing policies in the realms of fisheries, health and trade. The third step is determination of the extent to which the policies were biased towards/against SIS using a policy scoring chart (Table 2), while the fourth step comprised an assessment of policy gaps and determination of possible improvements required to promote SIS for the benefit of poor households.

The present study also adopted an innovative policy analysis tool developed by Koehn (2019), modifying it to evaluate the level of SIS policy integration across the three thematic categories of fisheries, health and trade, using a scoring metric based on the presence or absence of specific keywords. The three sectoral policies were described using key indicators, with scores awarded on a scale of zero (0) to three (3), based on the presence or absence of the keywords (Table 2). A score of three, being the highest, included words denoting strong links with food security (fisheries policy in this case), a score of two suggested an intermediate depth of connections, while a score of one contained fewer specific connections, with no additional score for repetitions. On the other hand, the content analysis was a methodological approach for categorizing the documents on the basis of replicable coding protocols (e.g. year of enactment; adoption and intention of the policy), which provided substantial insight into how the narratives guiding the policies recognized the role of small fish for local food and nutritional security.

3 | RESULTS AND DISCUSSION

3.1 | Status of SIS in policy and governance

A total of 60 policies across three sectors (fisheries; health; trade) were analysed on the basis of their impacts and bias on SIS (Supplementary Material). Management Plans (7 out of 13), Guidelines (6 out of 12) and Acts and Laws (5 out 9) were ranked highest in the mention and inclusion of SIS aspects, despite their broad scope and interactions across governance sectors. Other policies, including Regulations (1 out 7) and Policy (4 out 12), performed poorly in the mention and inclusion of SIS issues in their content. Ironically, regulations and policies are expected to be specific in

TABLE 1 Document categorization across international and national levels based on type of policy document

Policy category	Fisheries	Health	Trade	Total
International	17	11	6	34
(a) Guidelines & Regulations	8	4	3	15
(b) Management Plan	3	3	2	8
(c) Policies and Laws	6	4	1	11
National/Local	9	8	9	26
(a) Guidelines & Regulations	2	4	2	8
(b) Management Plan	3	1	2	6
(c) Policies and Laws	4	3	5	12
Grand total	26	19	15	60

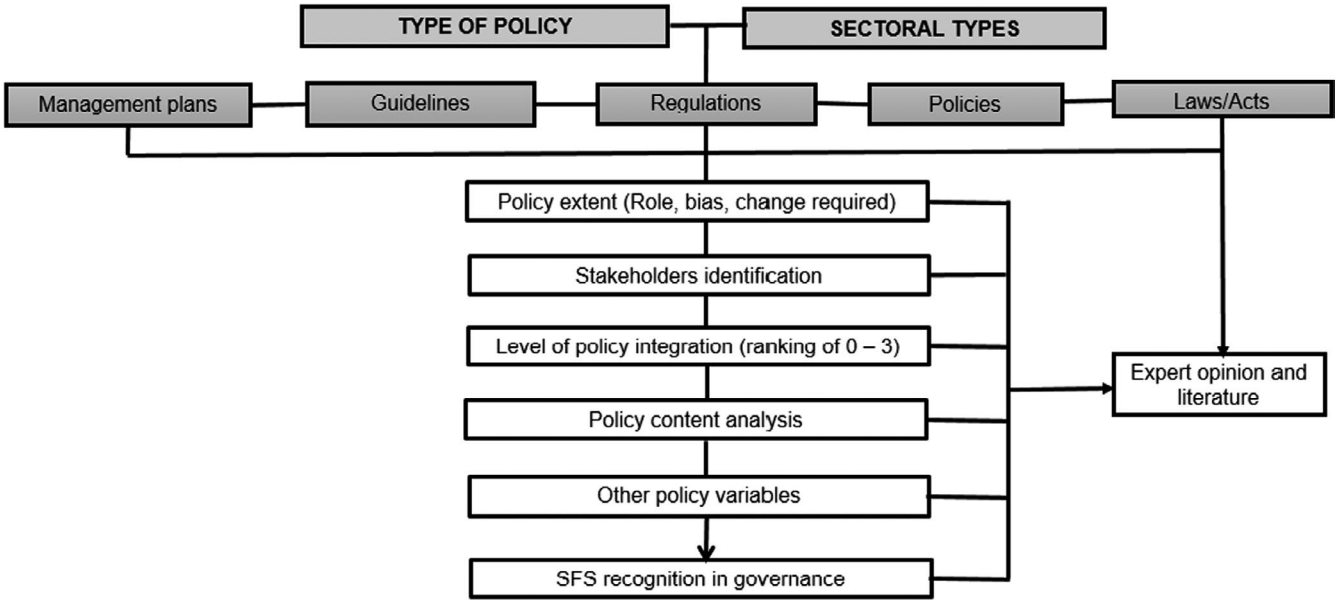

FIGURE 2 Schematic representation involved in policy analysis of small indigenous fish species (SIS) consisting of Omena, Caridina and haplochromine fish species for enhanced recognition in fisheries and lake governance

content and, therefore, should clearly outline and streamline SIS governance.

3.2 | Stakeholders involved in governance of small indigenous species

Small indigenous fish species governance involves several institutions across different nodes of the fisheries value chain. At the input level wherein boats, gears, lamps and other fishing accessories are required, there is a mixture of both formal and informal institutions involved, a majority being informal because of the artisanal nature of the SIS fishery (Kolding & van Zwieten, 2012). Further, SIS processing and trade is largely traditional, with a low capital outlay. Sun drying of SIS is affordable (with low environmental impact in terms of greenhouse gases), therefore being most attractive for small-scale processors, mainly marginalized women (Kolding et al., 2016). These women processors usually organize themselves into relatively small, informal micro-financial groups in order to cushion each other from rampant weather-related post-harvest losses primarily during processing (Aura et al., 2019). In contrast, the majority of traders originate from far-flung markets, mostly being itinerant across many landing sites in order to mobilize larger fish quantities, a feature that has resulted into a dearth of SIS trading associations at the local levels.

A significant proportion of SIS are also channelled to manufacturing industries for production of animal feeds and fortification of human food. These feed and food industries are usually well-organized and governed within the framework of national laws and associations of the trade. Growth in the animal feed industry has also resulted into importation of SIS, particularly Omena, from neighbouring Lake Victoria riparian states having surplus production as a means of filling local supply shortfalls (Kolding & van Zwieten, 2012).

Small indigenous species management is generally multi-institutional and multi-agency, relating to the socio-ecological mandate and scope of all stakeholders. Within the East African Community, LVFO facilitates the partner states in regional

TABLE 2 Policy scoring chart across three thematic categories of fisheries, health and trade

Score	Keywords
	Fisheries
3	K3 (Small fish; Inland/freshwater fisheries; Local food, Fish meal)
2	K2 (Small-scale/artisanal fisheries; Fish production; Fishing)
1	K1 (Fisheries; Aquaculture)
	Health
3	K3 (Food security; Food Safety; Omega 3-fatty acids; Malnutrition)
2	K2 (Food access; Food production; Protein)
1	K1 (Health; Nutrition)
	Trade
3	K3 (Small fish consumption; GDP; Value addition; Employment; Tarifs/customs/taxes)
2	K2 (Income; Exports; Imports; Processing, Subsidies)
1	K1 (Fish trade; License);

Note: (Scale: 0 = No integration; 1 = Low integration; 2 = Moderate integration; 3 = High integration).

TABLE 3 Priority stakeholders (formal or informal) in SIS governance at local, national and international level

Stakeholder	Category	Role	Scope
Kenya Association of Manufacturers (KAM)	Formal	Fishing input providers; Processors	National
Artisanal boat owners' associations	Informal	Input Providers Producers	Local
Fisher co-operative groups/associations	Formal/ Informal	Input Providers Producers	Local Local
Fish processors and traders groups/associations	Formal/ Informal	Value addition & trade	Local/ National
Kenya Fish Processors and Exporters Association (AFIPEK)	Formal	Value addition & trade	National
Transporters Associations	Formal/ Informal	Ancillary services	Local/ National/ International
Kenya Bankers Association (KBA)	Formal	Ancillary services	Local/ National/ International
Chamber of Commerce and Industry	Formal	Marketing	National
State Department of Fisheries, Aquaculture and Blue Economy (SDFA & BE)	Formal	Management	National
State Department of Trade (SDT)	Formal	Management	National
Kenya Bureau of Standards (KNBS)	Formal	Management	National
Kenya Revenue Authority (KRA)	Formal	Management	National
Kenya Maritime Authority (KMA)	Formal	Management	National
National Environment Management Authority	Formal	Management	National
Ministry of Health (MoH)	Formal	Management	National
Ministry of Interior	Formal	Management	National
Kenya Coast Guard Service	Formal	Management	National
County Fisheries Departments (FiDs)	Formal	Management	Local
Beach Management Units (BMUs)	Formal	Management	Local
Kenya Marine and Fisheries Research Institute (KMFRI)	Formal	Researchers	National
Universities	Formal	Researchers	National

governance, while Ministries, Departments and Agencies (MDAs) and counties' governments take the lead, respectively, at the national and local levels (LVFO, 2016). The Beach Management Units (BMUs), the main co-management organ, provide community representation and share responsibilities in SIS governance at the local level (Aura et al., 2020). Theus priority stakeholders in the SIS fishery governance can be categorized across their roles such as input providers, producers, manufacturers, processors and traders, marketers, importers, exporters and managers, among others (Table 3).

3.3 | Policy analyses of SIS

The results of the present study indicated that whereas all policy landscapes exhibited relatively low integration health-related policies exhibited more integration (1.6) on the international policy landscape, whereas fisheries policies showed a higher integration (0.9) on the national scope (Table 4). Based on a scoring scale whereby zero (0) implies no integration and three (3) implies high integration, the results depict very low levels of integration between fisheries, health and trade policies in relation to SIS. Management plans and regulations/guidelines also had a relatively higher level of integration than did policies and laws. These results lend credence to primary knowledge whereby management plans are viewed as more interlinking document frameworks across different stakeholder groups and sectors, than do policies and laws. Given that fisheries policies exhibited the least overall policy integration in the health-trade landscape implies these policies may not be sufficiently holistic to guarantee an Ecosystem Approach to Fisheries Management (EAFM). As a new frontier in fisheries management, EAFM provides overarching guidance and ensures consistency in integrating existing data and information for informing the management process (Nielsen et al., 2004).

Policy integration across the thematic sectors would imply consideration to cross-cutting issues transcending the boundaries of established policy fields and which do not correspond with the institutional responsibilities of individual departments (Meijer & Stead, 2004). According to Hawkins and Wang (2013), policy integration supports sustainable development and provides prospects for local adoption and benefit. Small indigenous species used as human and animal food relate directly to food, safety and nutritional aspects of health. Further, being ecosystem goods, they relate directly to consumption and income aspects of trade. There is widespread underdevelopment of small-scale artisanal fisheries, exhibiting notable health gaps in artisanal processing of SIS and implementation of standards, weights and measures in their trade. These issues could likely be attributed to the relatively low integration across health, trade and fisheries policies exhibited in the present study. Most fisheries policies also articulate fisheries generally without any specific focus on SIS.

Fisheries policies exhibited much more integration with trade and health policies than the two latter sector policies integrated with fisheries (Figure 3). Both health and trade policy guidelines, regulations and management plans exhibited more integration with fisheries policies. Since fishing is a labour-intensive, risky occupation there is a need for individual fishers and traders to maintain healthy livelihoods. Escalation of risky sexual behaviour (e.g. 'sex for trade' among fishers; high prevalence of HIV/AIDS) among the fisher communities is of concern (Allison & Seeley, 2004; Fiorella et al., 2015). In fact, there is generally a lack of understanding of the breadth of health issues affecting people associated with fishing, possibly attributable to the low integration of health and fisheries policies (Woodhead et al., 2018).

Since about one-third of fish commodities are traded in the international market with 50% of international trade in the commodities originating from developing countries, favourable fish trade policies could play an important role in revenue generation, employment and foreign exchange for these countries (FAO, 2009). Trade can improve food and nutritional security by increasing the availability of fish for human consumption in low-income food deficit countries and through monetary returns generated through trade (Kurien, 2005), whereas SIS accounts for the bulk (65%) of fish catches in

TABLE 4 Integration of policy types (n = 60) across sector indices on the basis of keywords scores of zero (0) to three (3)

	Health Integration	Fisheries Integration	Trade Integration
Guidelines and Regulations	1.7	1.0	1.5
Health	–	1.1	1.0
Fisheries	2.1	–	1.9
Trade	0.8	0.8	–
Management Plan	1.8	1.4	1.5
Health	–	1.5	1.3
Fisheries	1.8	–	1.7
Trade	1.8	1.3	–
Policies and Laws	*0.8*	*0.3*	*0.9*
Health	–	0.1	0.7
Fisheries	0.9	–	1.1
Trade	0.5	0.6	–
Grand Total	1.3	0.8	1.3

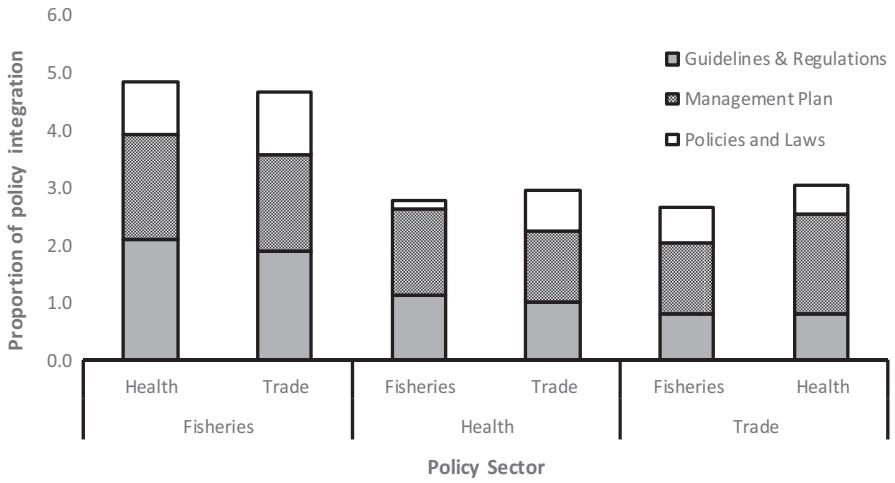

FIGURE 3 Cross-sectoral policy integration of small indigenous fish species (SIS) in Kenya

Lake Victoria, their value to the fishers is relatively low, being estimated at only 25% of the total catch.

Omena is generally less known in the international fish market, in spite of its massive production. Because various governments and traders have for so long perceived Omena as a local product, it has received minimal attention in targeted trade policies or product promotion in the international market. Consequently, although Omena has had little trading access in the international market, it is experiencing a growing demand, especially as an affordable protein supplement that could be enhanced through viable product promotion strategies. Recognition of Omena in international food and nutritional security dialogues and fisheries policies could improve its trade, thereby enhancing the welfare of poor rural communities in several developing countries. Thus, a need for better integration of small indigenous species in international trade, with special recognition for small-scale fish processors and traders who are mostly women, is warranted.

Depending on the circumstances, the consequences of fish trade on food security are sometimes favourable and sometimes harmful. Increasing fish trade between developing countries could result in better distribution of economic benefits in some cases (Coll et al., 2013). For poor people who rely heavily on fish in their diets, however, concern about fish food supply could put them in danger. Omena and other SIS are generally caught by part-time, small-scale artisanal fisheries, making them especially valuable for poverty alleviation in the regions where they are harvested (Kolding et al., 2019). When SIS supplies become few, and prices rise as a result of increased trade, poor and vulnerable populations within fishing communities are compelled to switch to lower-quality meals, putting them at danger of missing key micronutrients (Kent, 2003). Thus, government entities in charge of fisheries management, including SIS trade, should work to ensure trade activities contribute to food security, particularly for those most vulnerable to hunger.

With Tilapia and Nile perch prices tripling in the last years, SIS has grown in popularity and created demand for higher-quality products at lower prices, especially during the dry seasons when agricultural productivity is poor or non-existent (Muma, 2015). International SIS trade, therefore, should not be supported indiscriminately without concern for its nutritional, environmental or other consequences. Policies should incorporate mechanisms for assessing the likely consequences of specific proposed trading arrangements on food security to facilitate informed decisions (Kent, 2003). Because export-oriented fishing can have a significant impact on food supplies for the poor, particularly in fishing villages, trade promotions should also keep in mind national and regional food concerns (FAO, 2019).

3.4 | Other variables for policies associated with SIS

Eighteen policies closely related with SIS aspects were further assessed (Table 5), including guidelines and regulations (6), management plans (8) and policies and acts (4) that spanned the three major thematic sectors. Thirteen (13) of the policies were mainly international in nature with a wider management scope. International financial institutions usually influence the preparation and implementation of policies to support domestic reforms, as well as addressing common global concerns. Developing countries, however, are increasingly trying to direct their own development through a combination of processes, laws and practices dubbed 'new national planning', which could be a tool for establishing institutions, resources and risk management capacities needed to respond to sustainable development goals, as well as any local or global challenges they may confront (Chimhowu et al., 2019). Policies formulated at the national level are tailored to fit into the local context with better implementation strategies (Hudson et al., 2019).

The studied policies were enacted between 2011 and 2019, with the majority (8 out of 10) having long-term management measures that suggest decision makers are becoming more proactive in managing fisheries for food and nutritional security. A participatory approach involving various stakeholders in policy formulations also was considered for these policies, although there is a need to review them in order to align them with emerging aspects of SIS issues for improved governance, which could be done through monitoring plans that were also well incorporated in these policies in order to ensure proper implementation of the proposed management actions for the sustainable development of SIS issues. Policy development

TABLE 5 Other variables for policies closely associated with small indigenous fish species (SIS)

Policy Categories	Scope	Year Enacted	Participatory	Relationship with other policy documents	Monitoring Indicators	Short/long term
Guidelines and Regulations						
(a) Fisheries Beach Management Regulations	International	2019	Yes	Yes	Yes	Long-term
(b) FAO-Sustainable Healthy diets, guidelines	International	2019	Yes	Yes	Yes	Both
(c) FAO-Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries	International	2018	Yes	Yes	Yes	Both
(d) International Guidelines on by-catch Management	International	2011		Yes	Yes	Long-term
(e) USAID-Aquaculture guidelines	International	2013	Yes	Yes	Yes	Short-term
(f) Fish, fishery products and fish feed regulations	International	2019	Yes	Yes	Yes	Long-term
Management Plans						
(g) Management Plan for Small and Medium Sized Pelagic Fish	National	2013	Yes	Yes	Yes	Both
(h) LVFO - Nile Perch Fishery Management Plan ii (2015–2019)	International	2015	Yes	Yes	Yes	Short-term
(i) Fisheries Management Plan iii (FMP) For Lake Victoria Fisheries 2016 – 2020	International	2016	Yes	Yes	Yes	Short-term
(j) Sector Plan for Blue Economy, 2018–2022	National	2018	Yes	Yes	Yes	Short-term
(k) Kenya Health Sector Strategic and Investment Plan 2013–2017	National	2013	Yes	Yes	Yes	Short-term
(l) EAC- Strategic Action Plan (2012–2016)	International	2012	Yes	Yes	Yes	Short-term
(m) FAO-Aquaculture Development on Wild fish feed	International	2011	No	Yes	Yes	Both
(n) LVFO Regional Plan of Action to prevent, deter and Eliminate IUU in Lake Victoria Basin	International	2004	Yes	Yes	Yes	Long-term
Policies and Acts						
(o) Kenya Fisheries Policy	National	2005	Yes	Yes	Yes	Long-term
(p) National Oceans and Fisheries Policy	National	2008	Yes	Yes	Yes	Long-term
(q) The Fisheries Management and Development Act	International	2016	Yes	Yes	Yes	Long-term
(r) Convention for the Establishment of the LVFO	International	2016	Yes	Yes	Yes	Long-term

calls for ongoing collaboration with a diverse range of stakeholders at different political, policymaking, managerial and administrative levels, as well as engagement of such "downstream" implementation actors as end users, frontline workers and a variety of local service organizations (Hudson et al., 2019).

4 | CONCLUSION AND RECOMMENDATIONS

For international trade in SIS to be successful, favourable policies on trade, health and fisheries need to be developed in an integrated manner. A low integration level reveals gaps in the sector that provide good policy prospects for the SIS sector. Because the sector is currently characterized by artisanal production, processing and trade, while poor hygienic and sanitation standards also exist in their processing that limit their utilization in export countries with strict food standards, there is an urgent need for health policies targeting SIS processing to improve their international market appeal. Limited public awareness of the nutritional benefits of SIS also necessitates the development of policies that could facilitate viable product awareness and promotion strategies in the local and international fish markets. To transform SIS trade from artisanal to commercial, local governments would need to develop policies promoting capacity development in this sector for better market outcomes. They could include specific development plans, as well as guidelines on SIS harvesting,

handling and marketing. Government intervention, especially trade promotion aspects, could target the socio-cultural biases on SIS as a means of attempting to change local perceptions on their trade and utilization. Overall, including SIS in fisheries policy and governance through reviewing and streamlining all statutory documents would enhance food and nutrition security through the following activities:

1. *A holistic approach to strategy, policy development and planning in SIS governance*: The minimal integration in fisheries, trade and health policies relating to SIS could be a result of widespread under-development in SIS fisheries, as well as poor hygienic and sanitary standards in their processing and trade. Thus, a holistic approach to SIS governance should prioritize integration of these policies to guarantee sustainable SIS production and utilization;
2. *Faster rates of new technology, product and services development and deployment*: Recognition and implementation of SIS in governance and policy documents could increase the rate at which essential scientific information is shared among those involved in the sustainable development and regulation of the industry.
3. *Proof of concept project to establish technical and commercial viability*: Streamlining of SIS governance will provide interactive and informative statutory documents that could be implemented to enable fishers to improve their businesses. There is considerable opportunity for proof of a policy analysis concept system to be developed for operational use across other Kenyan lakes, the African Great Lakes Region and elsewhere in the world exhibiting rapidly expanding, but currently unregulated, SIS industries.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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