



Is there a ‘wicked problem’ of small-scale coastal fisheries in Sierra Leone?

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ABSTRACT

The situation of small-scale coastal fisheries in Sierra Leone is dire, with diminishing fish stocks and fish sizes due to massive industrial fishing and widespread use of banned nets by artisanal fishers. Repeated attempts have been made by fisheries management to improve the situation, but with little or no success. Superficially, it might seem that the two main causes of the problem - foreign industrial fishing and damaging artisanal nets - could be readily dealt with, but closer analysis reveals that tackling these causes is immensely complicated. This is because their roots lie deep in Sierra Leone's history, culture and politics, and any attempt to deal with them could lead to unintended consequences which might make the situation worse not better. Does this mean there is a ‘wicked problem’ here - i.e. a problem so intractable that it has no practicable solution? This is the issue which the present study addresses. The research is based on extensive fieldwork carried out in two large fishing coastal fishing communities in Sierra Leone (Tombo and Goderich) during April and May 2017 when 200 open-ended questionnaires (SQs) were administered and 51 key informant interviews (KIs) were conducted. The study concludes that the situation faced by small-scale fisheries in these communities meets several, but by no means all, of the criteria of a wicked problem, and that while a definitive solution to the problem is unfeasible, stakeholders could adopt strategies to alleviate its more harmful consequences.

1. Introduction

Threats to coastal fisheries are widespread across the world, none more so than in the region of west Africa, as [2] notes: “the region's marine resources are being depleted at alarming rates, mainly due to too many boats competing for too few fish. This ... is a threat to millions of people in the region who depend on the oceans for their food” [2]; p.1. Similar assertions have been made by Ref. [3]; Environmental Justice Foundation (EJF), 2009 [4,5]; and [6]. Many writers blame foreign industrial fishing, which includes illegal, unreported and unregulated (IUU) fishing, for the depletion of west African fish stocks [7–10]. [1]; p.1 note that IUU fishing, also called ‘pirate fishing’, not only undermines the sustainability of marine resources, but also threatens food security and the “socio-economic stability of fishing communities”. To safeguard the economy of coastal communities some countries have banned or reduced the number of foreign trawlers that fish within their jurisdictions. For example, recent research in Indonesia by Ref. [11] suggests that an outright ban on foreign trawlers could be the most sustainable way to reduce poverty and achieve food security in coastal communities. They report that Indonesia reduced fishing effort

in its waters by 25% as a result of forcibly curbing IUU fishing. Other writers blame the use of small mesh and monofilament nets by artisanal fishers for the decline in coastal fish stocks [12,13] and some countries have banned these nets [14,15]. The present study uses both primary and secondary data to investigate whether a ban on foreign industrial fishing and/or small mesh and monofilament nets are practicable measures that could reverse the decline in fish stocks, improve food security, and reduce poverty in Sierra Leone's coastal communities. Primary data for this study were collected from Tombo and Goderich, which are two major coastal fishing communities in Sierra Leone, while secondary data from the literature and documentary sources are used to provide the conceptual context (section 2: wicked problem) and the empirical context (section 4: case study) of the research. Section 3 explains the methods of data collection. The results of the primary data are presented in section 5. Sections 6 and 7 are the discussion and conclusions.

2. Conceptual analysis of ‘wicked problem’

Following [16]; [28]; 388) claims that the concept of wicked

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Table 1

Description of Tombo and Goderich in relation to other fishing communities/landing sites within the Western region.

Source: [19]. Ghana plank boats (which are defined as 'semi-industrial') have crews of 8–20; standard canoes have crews of 1–5; and Kru canoes are usually single-handed.

Location	No of vessels	No of Ghana plank boats	No of standard canoes	No of Kru canoes	Number of full time fishers	No of part-time fishers	No of migrant fishers
Tombo	205	70	133	2	1118	205	21
Goderich	190	26	138	26	1176	260	83
Rokupa	59	2	57	0	225	109	0
Old Wharf	55	0	47	1	180	24	1
Moa	48	0	48	0	151	0	0
Tokeh	43	5	38	0	129	0	0
John Thorpe	38	0	38	0	150	94	0
York	38	0	11	27	43	0	0
Mama Beach	36	0	23	13	91	5	64
Kent	31	0	25	6	30	0	0
Lumley	31	0	25	6	105	15	1
Total	774	103	583	81	3398	707	170

problems can be understood from the following ten characteristics:

- (1) “Wicked problems are difficult to define. There is no definitive formulation.
- (2) Wicked problems have no stopping rule.
- (3) Solutions to wicked problems are not true or false, but good or bad.
- (4) There is no immediate or ultimate test for solutions.
- (5) All attempts to solutions have effects that may not be reversible or forgettable.
- (6) These problems have no clear solution, and perhaps not even a set of possible solutions.
- (7) Every wicked problem is essentially unique.
- (8) Every wicked problem may be a symptom of another problem.
- (9) There are multiple explanations for the wicked problem.
- (10) The planner (policy-maker) has no right to be wrong”

[28]; 388) adds an 11th characteristic – about politics: “that wicked problems involve multiple actors and are socially and politically complex”. [28]; 388) also notes that the concept of a ‘super wicked’ problem adds a further four characteristics [17]:

- (12) “Time is running out.
- (13) There is no central authority, or only a weak central authority, to manage the problem.
- (14) The same actors causing the problem seem to solve it.
- (15) The future is discounted radically so that contemporary solutions become less valuable”.

In our view, the nine most salient of these 15 criteria are that wicked/super-wicked problems are complex and difficult to define; unique; symptoms of other problems; multi-caused; running out of time to be solved; have no clear solutions; or solutions that are impracticable or counter-productive; are faced by weak authorities; yet could be resolved by perpetrators. We shall argue that in the case of two coastal fisheries in Sierra Leone (Tombo and Goderich), three of these nine salient criteria do *not* apply: the nub of the problem is not difficult to pin down (diminishing fish stocks); the problem is not unique; and the situation is not so intractable that there is no clear solution. However, the other six salient criteria *do* apply: the problem is multi-caused; it is symptomatic of other problems in the country; there is a weak or indifferent or corrupt central authority; time is running out to deal with the problem; the most obvious solutions have serious side-effects; though a change in the behaviour by the perpetrators could help to alleviate the harm.

3. Methods

This study makes use of both qualitative and quantitative data. Between April and May 2017, 51 semi-structured key informant interviews (KIs) were conducted (26 in Tombo and 25 in Goderich); while 200 open-ended survey questionnaire (SQs) were administered of which 199 were returned (100 from Tombo and 99 from Goderich). All participants involved in the study were recruited through social networking. Because relying on social networking to recruit participants can be problematic as respondents are more likely to recommend people who hold similar views to themselves, to encourage heterogeneity and obtain a variety of perspectives, a wide range of respondents was recruited by researchers investing a considerable amount of time finding people with different views. The KI respondents included four academics; 36 fishermen (including executives of fishers' organizations; two councillors; three women fish sellers); three staff of the Ministry of Fisheries and Marine Resources (MFMR); and three executives of the Sierra Leone Amalgamated Fisher's Union (SLAFU). Out of the 36 fishers interviewed for this study, 18 were from Tombo and 18 from Goderich. All were artisanal fishers: regrettably, it was not possible to interview industrial fishers. Like the open-ended survey questions (SQs), interview questions probed into the nature of Sierra Leone's fisheries and its management, including respondents' perceptions of the current situation of SL fisheries, what has changed, and how this change happened over recent years. Interview questions for KIs were generally semi-structured to allow respondents the flexibility of reflection. Participants responded to these questions in their own ways, often through stories and ‘life’ examples, opening up further issues, thereby providing both an extensive and in-depth account of Sierra Leone's fisheries [18]. The choice of Tombo and Goderich communities within Sierra Leone's western region was made because of their importance and location: Tombo is rural and Goderich is urban; and they are the largest fishing communities in Sierra Leone. Table 1, which present results of the joint survey conducted by Sierra Leone's Institute of Marine Biology and Oceanography (IMBO) and the Ministry of Fisheries and Marine Resources (MFMRs) (cited in Ref. [19] shows that besides harboring more vessels when compared to other fishing communities, both Tombo and Goderich have more fishers, full-time, part-time and migrant.

The studies that describe small-scale fisheries (SSF) in Sierra Leone [19–24]; and [25] report that Tombo and Goderich are very important fishing communities in the western region. Small pelagics like Herring (*Sardinella maderensis*) and Bonga (*Ethmalosa Fimbriata*) are the most common species caught in nets by local fishers from these communities [20,25]. These fishers also use hook and line to exploit demersal species like Gwangwan (*Pseudotolithus* spp). Comments in the open-ended survey questionnaires (SQs), were studied carefully and copied into a

table according to themes, and into a second table based on the context in which these themes were used. Likewise, two types of tables were created from the KIs: the first to show the themes that were generated; and the second to show the context in which these themes were used. Data sets were analysed separately, and identified themes were then threaded together [26]. describes the method of qualitative analysis used in this study as ‘thematic content analysis’, entailing the reading, re-reading, scrutinizing, identifying themes, and threading up of themes. For more clarity, the frequency of themes was set out in percentages using Microsoft Excel.

4. Case study of small-scale coastal fisheries in Tombo and Goderich, Sierra Leone

Sierra Leone is a very poor country. Indeed, according to the 2015 United Nations Development Programme (UNDP) Report, Sierra Leone is one of the poorest countries in the world. In 2011, a UNDP report on the Human Development Index (HDI) ranked Sierra Leone 180 out of 187 countries [27]. In 2017, a USAID report said Sierra Leone faces “alarming hunger with nearly 38% of children younger than five years of age suffering from chronic malnutrition” [29]; p.1). In 2015, a UNDP report [30] concluded that although Sierra Leone had made steady progress in human development, poverty continued to increase, and nearly 80% (4,724,000 people) of the country's population were very poor (i.e., their families lived on no more than \$1.2 *per day*); health facilities were substandard or non-existent in some communities; life expectancy was less than 43 years; and the educational system was grossly deficient [31]. reported that the literacy rate was 43%; that school attendance rates were 40% for boys and 33% for girls; and that fewer than 60% of primary school teachers were trained.

In coastal areas, communities are becoming increasingly dependent on the fishing industry for food and employment. Sierra Leone's civil war in 1991–2002 contributed to the rise of population in these communities as a search for security, food and sources of income pushed families into these areas [32]. In these communities, interest in fishing has surpassed farming, partly because the civil war badly affected farming, but also because, as [33] said, poor roads discourage farmers as it is difficult to get their products to the market. A Republic of Sierra Leone report in 2009 about its poverty reduction strategy noted that farming is not popular among youths because of its labour intensive nature. Consequently, over 75% of coastal populations depend heavily on fishing [19]: fishing is the lifeblood of Sierra Leone's coastal communities [20,21]. However, although data on catches and landings are unreliable [8,19], it seems incontrovertible that fish stocks and sizes are declining. Most of the country's fish stocks are “already fully exploited” or over-exploited [34]; p.34; [35]. The main causes of this decline are the increased numbers of fishers; the mainly ‘open access’ mode of fishing in these areas [8]; the steady rise in the number of foreign trawlers [36]; and artisanal fishers' use of small mesh and monofilament nets.

On industrial fishing, Sierra Leone's foreign industrial fishing sector started during the 1950s when Italian vessels were the first to appear in the country's waters [19]. Between the 1950s and the 1980s, the number of foreign vessels fishing in the country's waters increased significantly [34], fuelled by an agreement signed between the Sierra Leone government and the USSR which allowed very large trawlers and factory vessels to fish in their waters [19]. Sierra Leone's industrial fishery is overseen by the MFMR, which manages vessels from the neighbouring countries of Senegal and Ghana as well as vessels from Europe (especially Spain and Italy) and from Asia (especially Korea and China). The Fisheries Management and Development Decree of 1994 bestowed on the Director of Fisheries the power to make decisions about foreign vessels fishing in Sierra Leone's waters. According to this Decree, before signing off foreign vessels, the Director has to take into account; (1) the total number of vessels already fishing; (2) the fish stock capacity; (3) the revenue to be derived from the contract and; (4)

whether the vessel employs Sierra Leonean workers. The intention of the Decree is to prevent foreign fishing agreements from damaging Sierra Leone's indigent fisheries. According to the 1994 Decree, if foreign vessels breach their contracts, their owners are liable to pay penalties, and the Director has the power to either suspend or cancel agreements. However, during the civil war (1991–2002), this 1994 Decree could not be enforced, and the country had to wait until the 2003 Fisheries Policy to take control over the industrial fisheries sector. The 2004 Local Government Act transferred the management of artisanal fisheries, including the issuing of licence rights, from the MFMR to local councils, though the MFMR remains the official manager of the country's fisheries including the artisanal sector and the industrial sector [5,19,37].

The current situation regarding industrial fishing is that, partly as a result of the Ebola outbreak in 2014–16 during which the enforcement authorities were quarantined [37], the amount of IUU fishing has been growing. According to Parminder Brar, World Bank (WB) Country Manager in Sierra Leone, despite efforts to curb them, the number of illegal industrial fishing vessels is continuing to increase [36]. Although the Environmental Justice Foundation (EJF) (2014) recorded that between 2010 and 2011 their efforts did help to reduce the number of IUU vessels, a later EJF report (2016, p.1) said the situation might now be out of control as “sanctions fail to deter illegal operators operating internationally under the flag of Sierra Leone without the fisheries authorities' knowledge”. For many writers, the priority of the government should be to protect the artisanal sector by drastically reducing or eliminating industrial fishing in Sierra Leone's waters. Part of the current study's aim is to assess the extent to which a reduction in the number of IUU vessels would indeed increase fish stocks, thereby improve food security and reduce poverty in Sierra Leone's coastal communities.

On artisanal fishing, there is an issue over what it comprises. Some writers doubt whether the current method of fishing used by local fishers in Sierra Leone can be classed as ‘artisanal’ because they use not only traditional vessels like dugout canoes with hand-lines, cast nets and paddles [34] but also more modern vessels like large canoes with outboard engines [19]. Moreover [38], report that like the industrial sector, SSFs now export their catch to several countries including neighbouring African countries. Nevertheless, while recognising that Sierra Leone's artisanal fishery is a combination of very different scales and types of fishing [35], it is legitimate to differentiate it from industrial fishing.

According to Ref. [38]; the artisanal fisheries sector contributes over 75% of the animal protein consumed in Sierra Leone. [21]; says it also provides about 500,000 full and part-time jobs for the country's coastal communities, and so it clearly has the potential to generate significant household income, ensure food security and alleviate poverty in coastal communities. But the artisanal sector faces serious problems which threaten to undermine this potential. Chief among these problems is the damaging gear employed by artisanal fishers, including small mesh nets (even mosquito nets) and monofilament nets [12,34]. Some reports single out foreign migrant fishers for particular blame. For example, [38]; noting that 20% of national artisanal fish production is carried out by foreign migrants, claim that Ghanaian migrants target shark species in the Western Area and small pelagics in the Southern Province; Liberian migrants target small pelagics in the Southern Province; and Guinean migrants target small pelagics in the Northern Province. The MFMR has inadequate resources to tackle the many problems facing its artisanal sector, while the two main fishers' organizations - Sierra Leone Artisanal Fishers Union (SLAFU) and Sierra Leone Amalgamated Fishers Union (SLAAFU) – lack the capacity to take part in a co-management system [21]; p.375). With very weak institutions, therefore, the problems facing Sierra Leone's artisanal sector look set to continue. .

5. Results

The results of the fieldwork are divided into three subsections – industrial fishing; artisanal fishing; and the role of government.

5.1. Industrial fishing

In both Tombo and Goderich communities, industrial fishing was mentioned by SQs as the biggest problem facing these communities, and all 199 survey questionnaire (SQ) respondents from Tombo and Goderich believe that the complete removal or drastic reduction in the number of legal and the illegal industrial trawlers in their coastal waters would restore fish stocks, boost food security, and reduce poverty in their communities. Many KIs hold that industrial fishers (legal and illegal) are to blame because “before these trawler people started coming to our water, we did not have this type of problem” (KI-11, a Tombo fisherman). KI-9, another Tombo fisherman, says industrial fishing vessels damage his nets and destroy breeding grounds:

“there are people in this country that benefit from industrial fishing. But we fishermen do not benefit from these industrial fishermen because they disturb us. They come inside the IEZ to fish and they destroy our nets. They are wicked and mad because they fish in estuaries where fish breeds: if the trawler comes trawling inside here it spoils the fish egg because this is a breeding zone. From Yoribar here to Kent up to Shenge is a breeding zone”

KI-44, a fisherman from Tombo claims that when industrial fishers cut their nets it is financially crippling: “every fisherman in this community is now a debtor ... if you do not borrow, how can you survive?” Most (80%) of KIs claim the activities of industrial fishers have reduced the quantity of fish in their waters forcing many of them (small-scale fishers) to travel far away from the EEZ (100% in Tombo) to look for fish (See Table 2).

KI-11, 16, 20 and 21 say that having to travel outside the EEZ means that small-scale fishers are forced to spend much more money on fuel: “I use more than 10 gallons of fuel plus the money for engine oil ... I travel far away to look for fish” (KI-21, fisherman from Goderich).

Surprisingly, respondents do not distinguish between legal and illegal industrial fishing. KIs-9, 4, 6 18, 31, 44, and 47 categorized legal and illegal industrial fishers as “these trawler people are the main problem that we are having here in Tombo. As of now we are getting so many complaints of these ‘Chika Chonkas [type of industrial fishing vessel]” (KI-39, an executive member of SLAFU. However, respondents do make a distinction between industrial and semi-industrial fishing vessels which include Ghana plank boats. Industrial vessels are large trawlers with inboard engines; whereas semi-industrial vessels are smaller boats with outboard engines. For example, Korean speed boats are categorized as semi-industrial, as are the 5–10 Ghana plank boats with-40 horse power outboard engines. Although the definition of a semi-industrial vessel is blurred - “this semi-industrial sector is not well defined because when you talk about the artisanal, it could be the canoe people depending on the size” (KI-14, a researcher) – the category is nevertheless important because semi-industrial vessels enable owners to escape the restrictions imposed on industrial vessels. The semi-industrial sector is not well-organized, and has several different stakeholders, including greedy/poor fishermen, foreigners, and government. Some of the

Table 2
Perceptions of artisanal fishers about industrial fishers.
Source: Author’s fieldwork (2017)

Communities	Total number of artisanal respondents	Bottom trawlers	Fish outside EEZ	Damage to nets
Tombo	18 KIs	100%	100%	100%
Goderich	18 KIs	83%	61%	100%

foreigners own cold-rooms where they preserve the fish that they buy from locals. There is an element of *trans*-shipment in their operations, which according to KI-6, can be done legally or illegally:

“when people come to fish in our waters normally we would allow them to do what we call offshore transshipment. This means that you catch your fish, and because you want to export it you transfer it since the fishing boat will not go with the fish, but with the carrier vessel. This carrier vessel comes round to collect the fish, but to this they must have applied to our government for transshipment-our government sends their representatives there. The fish for our local market will be left in the fishing boat and the transhipped fish leaves for another country”

According to KI-11, industrial fishers who are unable to access the EEZ, reincarnate themselves into semi-industrial fishers working with small-scale fishers who register and manage bigger boats for these foreigners: “Foreigners don’t put their names down, but can use our fishermen who work under them. Anything that comes in they [small-scale fishers] hand it over to the foreigners: this is how they operate” (KI-11). KI-16 (CMA executive) says the murky semi-industrial sector

“has only created more problems ... last year what I heard about them is that they have very large canoes operating between the industrial and artisanal. But it is a kind of fraud because their owners are still foreigners who go into arrangement with the local people to stand as the owners of the boat and then they [locals] pass their catch to the foreigners and they are paid. In the value chain that is another section that is unaccounted for”

Moreover, there are allegations that this semi-industrial sector is corrupt, as many owners of boats classified as semi-industrial have special relationships with members of the government: “let me tell you something, I am made to understand that a good number of these boats [semi-industrial] are from the presidency” (KI-14, an executive of SLAFU). KI-3 (fisherman and CMA executive) claims that MFMR officials collaborate with the illegal semi-industrial sector in violating monitoring regulations, which is a breach of Sierra Leone law:

“And you cannot believe that these Chika-Chonkas [illegal semi-industrial fishers] hold licences from the government, specifically from the Marine. These Chika-Chonkas are really disturbing us, we have been shouting, we have raised alarm times without number but it falls on deaf ears. It will interest you to know that even during the Ebola epidemic, a particular company was given the mandate to fish illegally from our water. If my memory can recollect well, X from MFMR was suspended indefinitely. X heads the corruption department in the marine ... X collaborates with the ‘Chika- Chonkas ... X knows about the systems in the ministry’s control office. X works hand in hand with foreign trawlers to switch off the devices in their vessels. Now when this is switched off, these vessels cannot be monitored from the Ministry because the Ministry will not receive any alarm. You can imagine such level of unfaithfulness and wickedness” (KI-3).

A separate source claimed that X was suspended for accepting a bribe to permit some foreign vessels to fish in Sierra Leone’s EEZ. Allegations of another form of corruption perpetrated by the industrial fishery are made by KIs-4, 5, 6, 9, 10, 12, 14, 16, and 17, who claim that it originated in the EU’s discriminatory policies to prevent industrial vessels in Sierra Leone from selling their fish in EU markets on food hygiene grounds. KI-6 (a researcher) explains how the industrial fishery used deceitful methods to get round this ban:

“one of the reasons that they say the fish from Sierra Leone is not allowed in the EU is very interesting. They said if the fish is caught at sea, not landed in Sierra Leone but taken straight to the EU, it is acceptable. But if you land it in Sierra Leone, it becomes Sierra Leone fish and they will not accept itthe latest development is that a company from Holland have come to Sierra Leone. They said that they can get us certification to sell our fish in the EU, if we pay 2.6 million Euros, but we do not know

whether that will be possible. Sometimes our fish get to the EU as fish from Ghana, Senegal or elsewhere”

KI-4 (a researcher) alleges that the Sierra Leone government was implicated in this scam: “They brought in one ... when I came back and met them, I instantly knew it was not going to work. They worked out how much Sierra Leone was going to make if they export their fish to the EU and this was how our government fell for this. That is how the song went and up till today there is nothing to show for it”.

Also, KIs claim that scientific observers on board industrial vessels are bribed to turn a blind eye to illegal fishing: “they [observers] depend on foreign companies to pay them ... it is a poor arrangement and this is the cause of this corruption that we are talking about” (KI-6, a researcher).

“[They] do not report the truth because if they do, foreign companies will no longer sustain them and remember they [observers] are also in ‘survival mode’. The observers leave ... foreign companies to do whatever they want for as long as they sustain them – give them money to support themselves and their families” (KI-14, a SLAFU executive).

However, some respondents defend the (legal) industrial sector. For example, KI-4 (a researcher) asserts that it is well-organized; keeps good records; and provides revenue for the government: “It is industrial fishing that gives revenue to this country. It is much better organized than the artisanal fishing. The industrial sector has people who take detailed records of the catch, the time it was caught, the species, everything is well documented”.

KI-6 (a researcher) says the contribution to the country's revenue made by the industrial fishery sector is considerable:

“the industrial sector is contributing foreign exchange for the country, we know for instance that a tuna vessel pays something like 45,000 dollars per year. From the time we started checking vessels with monitoring devices, in 2010 to last year, revenue collection for this sector has moved from 6 million Leones a year to 57 billion Leones per year, which is a very big jump in terms of money collected from the fisheries sector. So fisheries is now one of the three [highest] revenue earners for government”

5.2. Artisanal fishing

Artisanal fishing is also heavily criticized for contributing to the decline in fish stocks and sizes. Over 20% of KIs think poverty among fishers in Tombo and Goderich is mainly caused by small-scale fishers using illegal ‘mina’ (small) nets to catch baby fish, and monofilament nets which do not biodegrade when abandoned but continue to entangle fish. KI-15, an official at MFMR, says: “we have been trying to tackle illegal fishing in the industrial and artisanal sector. Before we were concentrating on the industrial, but later we discovered that the artisanal fishery is very bad here. Our fishermen do illegal fishing as much or even more than the industrial people”.

KI-4 (a researcher) complains that

“the management for now compared to the past is not good. Now fishing is not controlled, we have many irresponsible methods of fishing. Our fishermen fish baby fish, they use all manner of fishing gears and methods, there is no control. During my fishing days our fishermen fished with good nets but now our fishermen use any type of net”.

Some KIs allege that the government turns a blind eye to these breaches of regulations by artisanal fishers in return for their votes in elections. KI-7 (CMA executive from Goderich) states:

“you know it is bad fishing that sustains our people and should our government dare to stop it, I bet you, they [government] will lose during elections. Fishing is where everybody in Tombo earns their living. If government stop people and do not provide an alternative, our people will vote them out. The previous government because of votes encouraged channel fishing which destroys fish eggs” (KI-7)

KI-23, a fisherman, says “you can fish anything; all that our government want is your vote” (KI-23). KI-5, an official at MFMR, notes that this makes apprehending deviant artisanal fishers very difficult: “politicians have told people not to listen to the marine ... sometimes when vessels are impounded or canoes owned by artisanal fishermen or even gears, we [the marine], just get calls from the big men ordering you to release those things to their owners”.

Part of the problem is that there is very little monitoring of artisanal fishing activity. Although “managers collect records of how many boats are going out”, there is no attempt to “collect these information from them and encode them, interpret them and use them ... the question is if we do not use this information why then do we collect them?” (KI-4, a researcher). Moreover, neither catches nor landings are routinely recorded for the artisanal sector. KI-9 and KI-22, who are harbour masters for wharfs in Tombo and Goderich, note that their work is not to take stock of catches or landings, but to check details of boats that leave their wharfs and to resolve conflicts between fishers. KIs 5, 6, 13 and 15 say it is difficult to determine the amount of fish taken by small-scale fishers because there are no offices for enumerators to work in at these landing sites: “we have not got adequate funding to have a random distribution of enumerators, if not in all the landing sites, at least along the major landing sites, so that we are able to do the statistics that will show landing sites for catches” (KI-6, a researcher).

Another part of the problem of artisanal fishers is the failure of their fisher organizations, which are supposed to mediate between fishers and government. First, there is a bitter conflict between the original fishers' organization, SLAFU, and the breakaway rival fishers' organization, SLAAFU. Thirteen of the 18 KIs from Tombo and six of the 18 KIs from Goderich traced the establishment of SLAAFU to the ‘corruption in the SLAFU’. But according to KI-35, SLAAFU itself has achieved nothing:

“it is because of a clash of interest that they left SLAFU and then formed the SLAAFU. Everybody wants to be the number one, I should be the top, I should be the leader, and all these problems caused the division. Whenever fishermen want to do anything you can see how much people struggle to lead. I do not value the SLAAFU, they are just there doing nothing”. (KI-35, fisherman from Goderich).

Second, SLAFU has been accused of mismanagement in that it fails to inform its members how it is spending their subscriptions. KI-41, a fisher from Goderich, says “we pay dues but we do not know what the [SLAFU] leaders do with this money”. KI-15, an official at MFMR, explains that in Tombo, SLAFU are in charge of artisanal ‘manifesto’ fees given to the harbour master, but they have misappropriated the fees: “There is a clash right now at Tombo, you know if you want to go to the sea, as a fisherman there is a certain amount of money that you give to the harbour master and the SLAFU were in charge of the fund and so they misused it”.

A SLAFU executive (KI-1) refuted this charge, and instead accused SLAAFU of bribing MFMR to allow its members to fish illegally:

“Channel fishing is of course the most dangerous one, most illegal one that is not challengeable anywhere. The challenges against Channels are very great in this country. We (SLAFU) try to stop them, but the politicians will not agree. I am not here to talk about any other union, but our SLAFU. SLAAFU, the amalgamated union, said they were against illegal fishing, but their members were Ghanian and Channel fishermen ... If they [the government] were really fighting illegal fishing, would they back a group like SLAAFU? SLAAFU support Channel fishers because they pay their dues to them, they pay huge money and then SLAAFU gets enough to settle the people at the ministry and then they keep quiet”

An additional complication is the existence of the Community Management Associations (CMAs) which were established during the first phase of the West Africa Regional Fisheries Program (WARFP) to reform artisanal fisheries in Sierra Leone. Many respondents are highly critical of the CMAs, saying, for example, there are divisions between

executives and between members; there is discrimination against migrant fishers; there is little action taken against illegal fishing; and CMAs lack resources to fulfil their responsibilities. KI-3 (a CMA executive from Tombo), accuses some CMAs executives of illegal fishing. KIs- 1, 17, 22, 23, and 16 claim some CMA leaders are government agents using the CMA to lure artisanal fishers with bribes during electioneering periods. A SLAFU representative asserted that the CMA was created to undermine SLAFU:

“the CMA was formed to destroy our organization because most CMA members were already our members and now we cannot control the CMA executives that use bad fishing methods ... most sections of the CMA are not functioning because their leaders are bad fishermen and let me tell you, some of their leaders are government agents” (KI-1).

Nevertheless, many respondents affirm that the contribution made to food security by artisanal fisheries is huge – partly because of open access fishing:

“fish is affordable: accessible and affordable to all. I have been to places where people don't have money but every day the women can go to the streams, inland valley swamps and come home with something to cook. This is to say that every day, they deposit their fishing traps or they go with their scoop nets. Through this means, they always have fish for their homes. They are able to access fish because we have what we call ‘open access fishing’. You do not need to have a licence to be able to fish in those places” (KI-6, a researcher)

And partly because of handouts from generous fishers: *“the poorest person from our community eats fish every day, except when we [fishermen] do not catch fish. These poor people come to the wharf with plates and we give them fish ... they beg and we give them”* (KI-16, fisherman and CMA executive).

However, respondents like KI-22, 26, 37, 47, and 51 note that fishers only give out small-sized fish which are mostly leftovers - *“after selling whatever is remaining is what I give people. I first sell the fish that has more value like the bigger ones”* (KI-37, fisherman from Goderich) – and that while it is true that almost every family in Tombo and Goderich does have fish to eat, they remain in poverty: *“whether you like it or not we are still very poor ... in fact to the extent that our local fishermen cannot afford to pay [for a boat] licence fee. Where will money come from for development?”* (KI-7, a CMA executive).

5.3. Role of government

Respondents allege that the position adopted by the government is opaque. KI-3, a fisher and CMA executive from Tombo, claims that *“no organization understands what our government is doing”*. The government is constantly lobbied by both the industrial sector and the artisanal sector, and by foreign consultants who take opposing sides. For example, the World Bank (WB) takes the side of the industrial sector, emphasizing the government's responsibility to obtain revenue and foreign currency; whereas the UN Food and Agriculture Organization (FAO) takes the side of the artisanal sector, emphasizing the government's responsibility to guarantee food security. KIs-5, 6, 14 and 15 note that foreign consultancies differ about whether the country's fisheries should be channeled towards wealth creation or food security: *“as a nation we are concerned about creating wealth, but we are also concerned about food security and that is the perspective of the FAO. But the WB is saying that if people can make more money they can use the money to buy other sources of protein”* (KI-6).

The fact is that the government is pushed from pillar to post by external foreign experts (EFEs) who are criticized by respondents for preying on government; persuading government to fund failed projects; transmitting knowledge not consistent with the reality of fisheries in Sierra Leone (33% of KIs); creating discord between local researchers and experts (15% of KIs); making recommendations that leave the MFMR in a state of confusion; wasting valuable resources; and possibly

being part of illegal fishing agreements (55% of KIs). The MFMR is also criticised by respondents for being constantly in flux; failing to implement regulations at either industrial or artisanal levels; having inadequate power and resources to manage the country's fisheries (74% of KIs); and unaware of the future direction of its fisheries (60% of KIs).

6. Discussion

With regard to the problems faced by the SSF sector in Sierra Leone's coastal waters, while this study regards the responses expressed in interviews by fishers and other key informants as valuable records in themselves of stakeholders' subjective perceptions about the way the coastal fisheries are functioning, the researchers recognise that some respondents make factual claims that may be challenged. For example, several fishers claim that before the advent of the industrial fishery, their fishing was much more successful. From our research, it seems that this claim is valid. Also, some respondents allege there is corruption in the semi-industrial sector as vessel owners have personal links with members of the government. This allegation is hard to verify through official channels, but it appears to be common knowledge among fishers. Assertions about a food hygiene scam with the EU in which the SL government was involved were made by very experienced and knowledgeable KIs, who are in a position to know. Respondents' claims that observers on board large-scale fishing vessels turn a blind eye to breaches of fisheries regulations were so frequent that it is difficult to discount them. Likewise, accusations that the government allow artisanal fishers to use illegal nets in return for their votes for the ruling party at the next election were made by fishers with first-hand experience. Fishers' claims that both SLAFU and SLAAFU were guilty of corruption may owe something to bitter rivalry between these organizations, but there were some whistle-blowers within each organization. Finally, there were so many criticisms of CMAs for inefficiency, hypocrisy, and corruption, including from ex-members, that it is difficult to ignore them.

Turning to respondents' perceptions of ways to address these problems, as section 5 shows, the over-fishing caused by industrial fishing in the coastal waters of Sierra Leone is perceived by respondents as a major threat to the health of several important fish stocks. However, it is not at all clear that a ban on industrial fishing would eliminate that threat. It is true that there are claims that anti-industrial fishing polices have worked in other parts of the world [11,39], but the small-scale fisheries in Sierra Leone suffer from complex problems, and an outright ban on foreign trawlers that fish in its waters may be a knee-jerk, temporary, superficial or simplistic solution for a very intricate problem, and could worsen the situation. For example, a ban could lead to foreign companies transferring their investment to the artisanal sector and replacing foreign industrial vessels with indigent semi-industrial vessels, thereby continuing their unsustainable level of over-fishing. Or it could result in the banned vessels continuing to fish illegally without observers and with their monitoring systems turned off, as is the case in other West African countries. Moreover, there are already several semi-industrial vessels owned and run by Sierra Leoneans: are advocates of a ban on industrial fishing suggesting that these indigent vessels be banned along with foreign vessels? Such a move would be very difficult politically. Furthermore, the banning of legal industrial vessels would deprive the government of much-needed revenue in foreign currencies such as the EU euro, the Chinese yuan, and the South Korean won. Finally, the government has insufficient resources to enforce a ban on foreign industrial vessels.

Section 5 also shows that artisanal fishing methods are highly destructive of fish populations in the inshore waters of Sierra Leone. However, it is not at all clear that more effective enforcement of the bans on small mesh nets and monofilament nets would solve the problem, because although this might be necessary for the long-term survival of fish stocks, in the short-term it would jeopardise the livelihood and food security of thousands of artisanal fishers and their families in

the coastal regions of Sierra Leone. It would also have severe political consequences for the governing regime as disaffected fishers would desert the ruling party at the next election. In any case, it is a purely theoretical solution because the government does not have the resources to enforce such bans.

Do these considerations show that the problems small-scale fishers face in Tombo and Goderich are so deep-rooted and intractable that they constitute a wicked problem for which there is no practicable solution? The answer to this question is mixed, since three of the nine salient criteria of wicked/super-wicked problems listed in section 2 do not apply to the Tombo and Goderich cases, but the other six do apply. The three salient criteria that do not apply to Tombo and Goderich are, first, that the problem is difficult to define, which does not apply to Tombo or Goderich because there is clear evidence of a continuous decline in fish stock levels and sizes in both sites. Second, the criterion that the problem is unique does not apply to Tombo and Goderich because such declines in fish stock levels and sizes are experienced in many coastal areas in the region and across the globe. Third, the criterion that the situation is so intractable that there is no clear solution does not apply to Tombo and Goderich, since their situations (in our view) are not (yet) irredeemable.

The six salient criteria of wicked/super wicked problems that do apply to Tombo and Goderich are, first, that many factors contribute to the damage caused by industrial and artisanal fishing, including, in the case of industrial fishing, the power of foreign companies owning large trawlers supported by their own governments; and in the case of artisanal fishing, the lack of alternative forms of employment or of food sources. Second, the criterion that the problem is a symptom of another problem applies to Tombo and Goderich because harmful industrial fishing and artisanal fishing are symptomatic of endemic corruption in Sierra Leone. Third, the criterion of weak central government applies, because the Sierra Leonean government lacks the political will or authority to deal with the SSF problem. Fourth, the criterion that time is running out, applies to Tombo and Goderich since fish stocks are declining so fast that there is a danger of the economic extinction of some species. Fifth, the criterion of side effects applies to Tombo and Goderich because the most obvious solutions (banning industrial fishing and enforcing the bans on damaging artisanal gear) have major political consequences. Sixth, the criterion that the actors who cause the problem can solve it, applies to Tombo and Goderich in the sense that industrial fishers could stop their excessive fishing effort and illegal fishing, and artisanal fishers could stop using small mesh and monofilament nets.

7. Conclusion

The conclusion of this study is that the difficulties experienced by the small-scale coastal fisheries in Tombo and Goderich constitute a problem that satisfies six of the nine salient criteria for defining a wicked/super-wicked problem. The most worrying feature of 'wickedness' is that there seems to be no political will on the government's part to confront the perpetrators of the most damage to the fish stocks, including the owners of the foreign industrial vessels and the leaders of the artisanal fishers. However, some respondents are more optimistic than this, and have recommended some steps that might help to alleviate the situations in Tombo and Goderich. One such suggestion is for fishers' groups and other organizations to iron out their differences and work together: "*if we can put aside our grievances and differences, it will be good for us because our generations yet unborn will have something to fall back on. They will say we have worked for them. There is need for all organizations working around fisheries to come together to rebuild our fisheries*" (KI-20, a fisherman).

Another suggestion is for environmental education to teach both industrial and artisanal fishers that their current behaviour is not sustainable, and that they must acknowledge the need to give up the most destructive fishing techniques such as heavy trawling in inshore areas

and the use of small mesh nets. A third suggestion is for self-help initiatives by fishers to provide practical solutions to particular problems such as rotting fish. For example, fishers could appeal to international charities to fund solar-powered cold storage units which would keep surplus fish caught during good fishing days fresh for distribution on poor fishing days. There is an important role for the government in encouraging such moves, not by coercion or economic incentives, but by moral suasion, nudging, and leading by example. But the essence of these suggestions is that stakeholders take collective responsibility for the coastal fishery and stop blaming other people or organizations for the predicament that faces them. This approach is less to find a definitive solution to the problem than to chip away gradually at its most harmful consequences. Further research is needed into the practicability of such incremental steps.

Declaration of conflict of interest

None.

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Appendix A. Supplementary data

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