THE "PEOPLE'S" FISHERY ON THE BRINK OF COLLAPSE

Small pelagics in landings of Ghana's industrial trawl fleet

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Contents

Glossary

Bottom trawl	a method of fishing that involves towing a cone-shaped net along the seabed to target fish living close to or on the bottom.
Demersal	term used to describe fish that live on or near the seabed (demersal zone). Examples include flat fish, as well as groupers, snappers and cephalopods.
Juvenile	a fish that has not reached reproductive maturity.
Pelagic	term used to describe fish that live in the water column (pelagic zone), as opposed to near or on the seabed. Coastal pelagic fish include species such as anchovies and sardines.
Saiko	the local name for illegal fish trans-shipments in Ghana, where industrial trawlers transfer frozen fish to specially adapted canoes out at sea.
Sardinella	a genus of small pelagic fish in the family Clupeidae often found in schools in the coastal waters of the tropics and subtropics.

EXECUTIVE SUMMARY

Background

Ghana's fisheries are a primary source of income for 186 coastal villages[1], providing livelihoods for over two million people[2] and food security for the nation. The mainstay of Ghana's fishing communities is the small pelagic fishery. Known as the 'people's fish', this includes the *Sardinella aurita* (Round Sardinella), *Sardinella maderensis* (Flat Sardinella), *Engraulis encrasicolus* (European Anchovy) and *Scomber colias* (Atlantic Chub Mackerel)[3].

Historically, *Sardinella* spp. –known locally as *Eban* –and, in particular, the Round Sardinella, have been the most important component of catches of the artisanal sector. However, populations have declined drastically over the past two decades, from landings of 135,628 metric tonnes in 1996, to landings of 29,111 tonnes in 2016[4]. Over the past two decades, income generated by local fishers has reduced[5], with increasing numbers of fishers returning from sea with no catch[6].

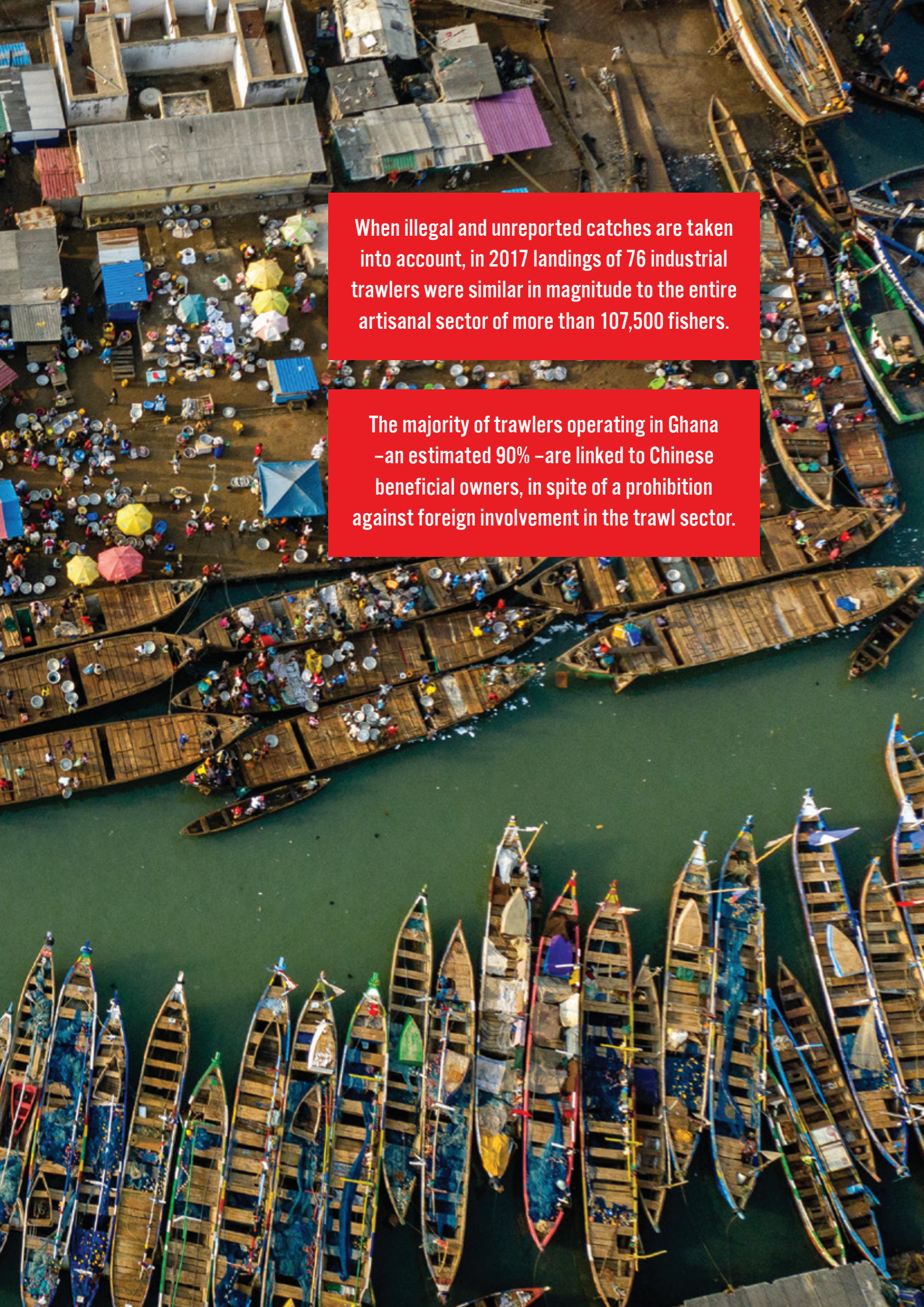
Scientists predict the collapse of Ghana's small pelagic fishery in less than five years in the absence of ambitious management interventions[7]. A recent assessment by the United Nations Food and Agriculture Organization (FAO) recommended the closure of the sardinella fishery shared between Côte d'Ivoire, Ghana, Togo and Benin to allow fish populations to recover[8].

As fishing communities have seen their catches plummet, industrial trawlers have been observed landing small pelagics –the fish reserved for artisanal fishers –in significant quantities[9]. Many of the fish landed are juveniles, harvested before they have had a chance to reproduce and contribute to rebuilding the fishery[10].

Trawlers land this fish both directly at port, and indirectly through the illegal 'saiko' trade. Saiko involves the trans-shipment of frozen blocks of fish to specially adapted canoes out at sea. These so-called 'saiko canoes' transport the fish back to ports such as Elmina, for onward sale to local markets. According to crew, trawlers illegally adapt their fishing gear to capture small pelagics specifically for the saiko trade[11].

In 2017, an estimated 100,000 tonnes of fish were traded illegally through saiko, with a landed value of over US$50 million[12]. When illegal and unreported catches are taken into account, in 2017 landings of 76 industrial trawlers were similar in magnitude to the entire artisanal sector of more than 107,500 fishers[13].

The majority of trawlers operating in Ghana –an estimated 90% –are linked to Chinese beneficial owners, in spite of a prohibition against foreign involvement in the trawl sector[14].



When illegal and unreported catches are taken into account, in 2017 landings of 76 industrial trawlers were similar in magnitude to the entire artisanal sector of more than 107,500 fishers.

The majority of trawlers operating in Ghana –an estimated 90% –are linked to Chinese beneficial owners, in spite of a prohibition against foreign involvement in the trawl sector.

Catching, trans-shipping or landing undersized fish is an offence in Ghana, attracting a minimum fine of US$1 million[15]. The use of prohibited fishing gear is likewise an offence punishable, on summary conviction, by a fine of not less than US$1 million[16].

In February 2019, EJF filmed the vessel Meng Xin 10 allegedly trans-shipping fish to a saiko canoe off the coast of Elmina.

Methodology

Since 2018, EJF has been monitoring landings of by-catch from the industrial trawl fleet, both in the form of 'official by-catch' landed by trawlers and sold in boxes at Tema port, and slabs of *saiko* fish landed by canoes at Elmina. This briefing sets out the results of one full year of monitoring, focusing on the presence of sardinella in the by-catch analysed.

Blocks of saiko fish landed at Elmina port were analysed to assess species composition and presence of juveniles against length at maturity indices. Analyses were carried out on an approximately fortnightly basis for a one-year period, from 27 September 2018 to 24 September 2019. When saiko fish was unavailable, 'official' by-catch landed by trawlers at Tema port was obtained and analysed. A total of 22 blocks of fish were analysed during this period, of which 18 were blocks of saiko fish, and 4 were boxes of by-catch landed at Tema port.

'Official' by-catch and slabs of saiko fish for sale at Elmina market.

Key findings

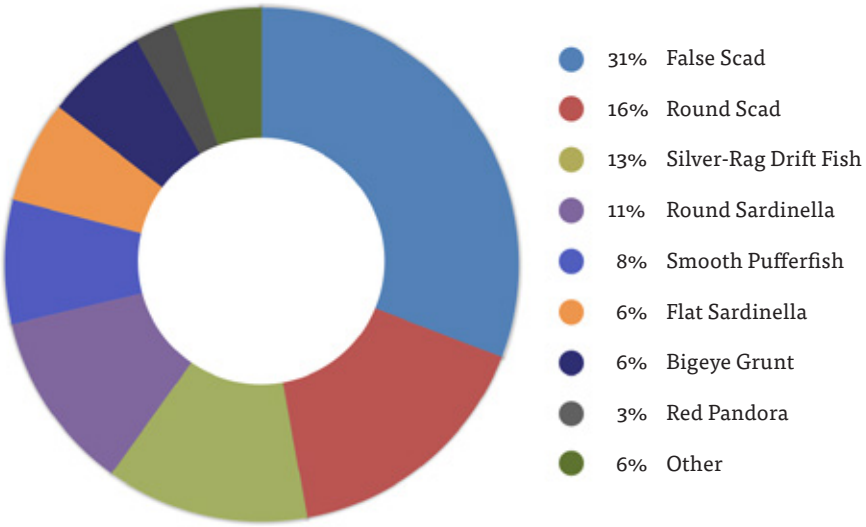
Of the individual fish of Sardinella spp. recorded in this study, 98.9% of individuals were below the minimum accepted landing size as stipulated in the 2010 Fisheries Regulations, LI 1968.

Block of saiko fish analysed in April 2019 - juvenile *Sardinella* spp. contributed 44.6% by weight.

Of the individual fish of *Sardinella* spp. recorded in this study, 98.9% of individuals were below the minimum accepted landing size as stipulated in the 2010 Fisheries Regulations, LI 1968. This figure was 99.0% for saiko fish landed at Elmina, and 98.7% for by-catch landed at Tema. The mean length (FL) of Round Sardinella analysed was 13.9 cm. The mean length (FL) of Flat Sardinella analysed was 12.4 cm. The minimum commercial landing size for both species in Ghana is 18 cm.

Sardinella spp. were present in 12 out of 18 blocks of saiko fish sampled (67%), and 2 out of 4 blocks of by-catch sampled from Tema port (50%). *Sardinella* spp. accounted for between 0.2% and 44.4% of individuals in the blocks of saiko fish sampled, and contributed between 0.3% and 44.6% by weight. In two blocks of by-catch landed at Tema port, juvenile sardinella accounted for over 97% of individual fish sampled, and contributed over 95% by weight.

Overview of species composition by weight in 22 blocks of trawler by-catch - saiko landings at Elmina and fish landed at Tema (sampled between 27 September 2018 and 24 September 2019).



Conclusions

The prevalence of juvenile sardinellas in trawler by-catch and scale of the saiko trade suggest that trawlers are a major driving force in the collapse of Ghana's small pelagic fishery. With much of this by-catch going unreported, official statistics likely vastly underestimate the impact of industrial trawlers on small pelagic fish populations in Ghana.

The quantities of small pelagics present in industrial trawl catches are indicative of targeted fishing rather than by-catch, supporting testimonies of crewmembers working on board the industrial trawl fleet.

This study recorded 540 individual sardinella, the vast majority juveniles, in 18 blocks of saiko fish analysed. A 2019 report by EJF and Hen Mpoano estimated that 9.24 million blocks of fish were landed through the saiko trade in 2017. This gives an idea of the sheer numbers of juvenile sardinella lost to the saiko trade – fish that could, and should, have been allowed to reproduce and replenish the fishery.

The prevalence of juvenile sardinellas in trawler by-catch and scale of the saiko trade suggest that trawlers are a major driving force in the collapse of Ghana's small pelagic fishery.

An industrial trawler fishing in Ghanaian waters.

Recommendations

If the collapse of the small pelagic fishery is to be averted, the activities of the industrial trawl fleet must be addressed and effectively regulated as a matter of urgency.

To this end, it is recommended that the Government of Ghana:

1. Investigates all suspected cases of illegal saiko fishing and prosecutes cases transparently through the court process, with a view to ensuring deterrent fines are imposed and paid in accordance with the law.

2. Upholds its commitment set out in the 2020 Budget Statement to ban all domestic or international vessels found to be engaging in saiko from operating in Ghanaian waters.

3. Maintains a clear prohibition against saiko in the ongoing revision of the 2002 Fisheries Act, including the possibility to suspend or withdraw a fishing licence in the case of a first saiko offence.

4. Carries out a detailed investigation into compliance of trawl gear with legal restrictions on mesh size and publishes the results. Ensures all cases of non-compliance are prosecuted transparently through the court process, with a view to ensuring deterrent fines are imposed and paid in accordance with the law.

5. Carries out routine inspections of landings of industrial trawlers to ensure they are only targeting species of the type and size dictated by their licence, and that minimum size restrictions set out in the 2010 Fisheries Regulations are respected.

6. In the future fisheries act, introduces strict conditions on by-catch, restrictions on the characteristics of fishing gear (mesh size) and an obligation to land all target and non-target catch in either Sekondi or Tema port. Ensures this information is accessible to the public.

7. Adopts a precautionary approach to the management of small pelagic stocks, and ensures fishing effort is in line with the recommendations of the FAO/ Fishery Committee for the Eastern Central Atlantic (CECAF) Working Group on Pelagic Resources.

8. Conducts a revised scientific assessment to determine the impact of the trawl fleet on small pelagic stocks, taking into account legal and illegal catches, and updates recommendations concerning the necessary reduction in fishing effort to achieve maximum sustainable yield (MSY).

9. Adopts all necessary measures, including a reduction in the number of licensed trawlers and fishing days, and implementation of closed seasons, to ensure the fishing effort of the industrial trawl fleet is brought down to sustainable levels.

10. Co-operates with neighbouring countries through the Fisheries Committee for the West Central Gulf of Guinea (FCWC) to ensure full implementation of the 2017 Strategy to Combat Illegal Transhipment at Sea, which requires that trans-shipments of fish in FCWC member states shall only take place in a designated port.

11. Implements measures to improve transparency in the industrial trawl sector, including routine publication of data on landings of target and non-target species, licensed vessels and fisheries-related infringements.

12. Takes all necessary steps to secure the transparent and robust operation of the fisheries observer programme, adopting a zero tolerance policy towards threats, bribery and abuse against observers and ensuring infringements are reported and acted upon.

EJF believes that the on-going failure of existing mechanisms for governance compel and require the direct intervention and oversight of President Akufo-Addo in order to prevent the imminent collapse of the small pelagic fishery and the resulting, devastating loss of livelihoods, food security and social well-being for millions of Ghanaians.

"Fishmongers are the hardest hit by this illegal trade as they carry their pans empty to and back from the shore. The fisheries laws must be enforced to ensure an end to this saiko fishing."

Fisherman, Sekondi.

As fishing communities have seen their catches plummet, industrial trawlers have been observed landing small pelagics –the fish reserved for artisanal fishers –in significant quantities. Many of the fish landed are juveniles, harvested before they have had a chance to reproduce and contribute to rebuilding the fishery.

INTRODUCTION

Ghana has one of the largest small-scale fishing fleets in West Africa[17]. The artisanal sector employs around 80% of fishers in the country[18], with over 11,500 canoes and 107,500 fishermen operating along the coast[19]. The mainstay of Ghana's fishing communities is the small pelagic fishery. Known as the 'people's fish', this includes the *Sardinella aurita* (Round Sardinella), *Sardinella maderensis* (Flat Sardinella), *Engraulis encrasicolus* (European Anchovy) and *Scomber colias* (Atlantic Chub Mackerel)[20]. Other small pelagic species caught by the artisanal fleet include the horse mackerels and other carangids (*Caranx* spp., *Trachurus trecae* and *Decapterus* spp.)[21].

Ghana's fisheries are a primary source of income for 186 coastal villages[22], providing livelihoods for over two million people[23], and food security for the nation. However, fish populations are in steep decline, with imports now making up around half of Ghana's domestic fish consumption[24]. Over the past two decades, incomes of local fishers have also declined[25], with increasing numbers of fishers returning from sea with no catch[26].

Alarmingly, scientists predict the collapse of Ghana's small pelagic fishery in less than five years[27] in the absence of ambitious management interventions. Historically, *Sardinella* spp. –known locally as *Eban* –and, in particular, the Round Sardinella, have been the most important component of catches of the artisanal sector (**Figure 1**).

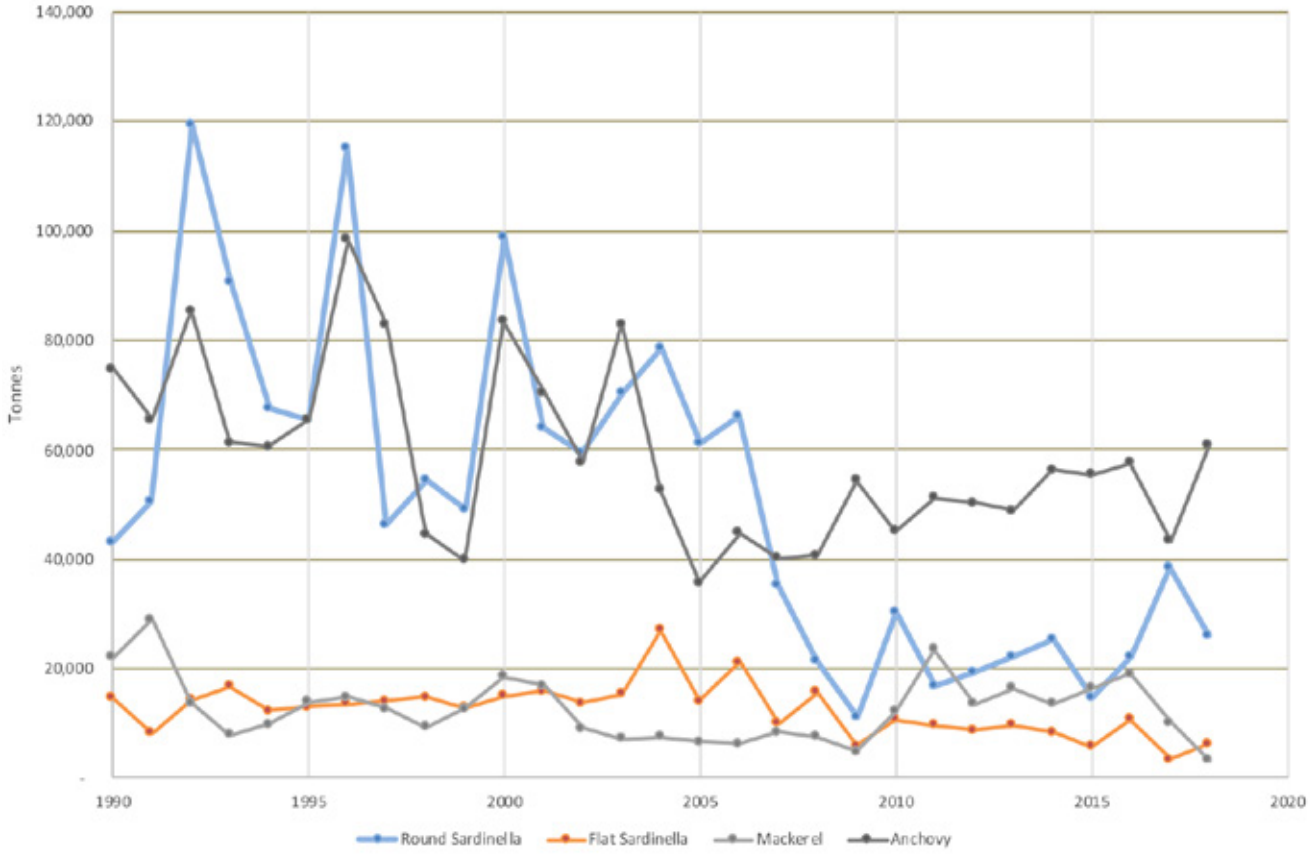
However, populations have declined drastically over the past two decades, from landings of 135,628 metric tonnes in 1996, to landings of 29,111 tonnes in 2016[28] (see **Appendix 1**). According to a recent assessment by the UN Food and Agriculture Organization (FAO), stocks of sardinella shared between Côte d'Ivoire, Ghana, Togo and Benin are over-exploited and near collapse. The assessment recommended the closure of the sardinella fishery to allow fish populations to recover[29].

"I have three canoes. I have docked all of them because I spend a lot of money before embarking on a fishing expedition but come back with nothing. Saiko has collapsed our fishery activities."

Fishmonger and canoe owner, Axim.

Artisanal canoe fishers haul their nets in Ghana's waters.

Figure 1: Small pelagic landings by major species (1990-2018, metric tonnes)



Source: Scientific and Technical Working Group (STWG) (2019, unpublished)

At the end of 2019, 75 industrial trawlers were licensed to fish in Ghana for demersal (bottom-dwelling) species such as cuttlefish, octopus and squid[30]. The majority of these vessels –an estimated 90% –are linked to Chinese beneficial owners[31], in spite of a prohibition against foreign involvement in the trawl sector[32]. In 2015, Chinese nationals captained over 95% of trawlers with active licences to fish in Ghanaian waters[33].

In December 2018, a vessel was filmed by an EJF film crew allegedly carrying out a saiko trans-shipment at sea off the coast of Elmina. At the time, the vessel was authorised to export seafood products to the European Union.

Image of an industrial trawler, the LU RONG YUAN YU 920, captured by artisanal fishers using a geotagged camera provided by EJF. Until 2019, the vessel was authorised to export seafood products to the European Union. In December 2018, the vessel was filmed by an EJF film crew allegedly carrying out a saiko trans-shipment at sea off the coast of Elmina (see below).

Slabs of saiko fish containing small pelagics © Hen Mpoano

As fishing communities have seen their catches plummet, industrial trawlers have been observed landing small pelagics –the fish reserved for artisanal fishers –in significant quantities[34]. Many of the fish landed are juveniles, harvested before they have had a chance to reproduce and contribute to rebuilding the fishery[35].

> ***"In the past, the Chinese were using bigger mesh nets but these days they use smaller nets and trawl everything in the sea. Because of that, there is nothing in the sea. We have to triple our efforts at sea and yet we get nothing".***
>
> Fisherman, Cape Coast

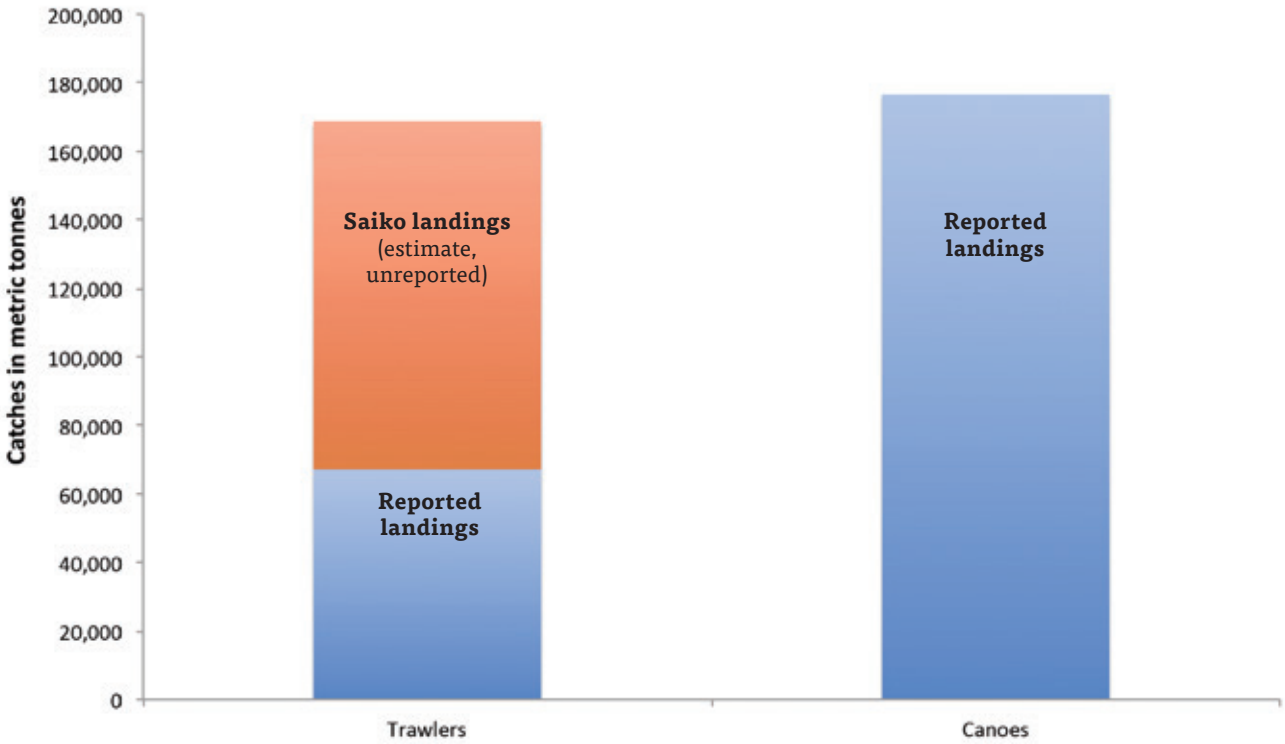
Trawlers land this fish both directly at port, and indirectly through the illegal 'saiko' trade. Saiko involves the trans-shipment of frozen blocks of fish to specially adapted canoes out at sea. These so-called 'saiko canoes' transport the fish back to ports such as Elmina, for onward sale to local markets. In 2017, an estimated 100,000 tonnes of fish were traded illegally through saiko, with a landed value of over US$50 million[36].

When illegal and unreported catches are taken into account, in 2017 landings of 76 industrial trawlers were similar in magnitude to the entire artisanal sector of more than 107,500 fishers[37] (**Figure 2**).

The Government of Ghana has committed to banning all vessels that are engaged in saiko fishing from operating in Ghanaian waters[38]. Yet saiko landings continue to take place, with 63 saiko canoes landing at Elmina port in December 2019[39].

Image of the vessel LU RONG YUAN YU 920 allegedly carrying out a saiko trans-shipment at sea off the coast of Elmina in December 2018.

Figure 2: Landings of the industrial trawl and artisanal sectors in 2017



Source: EJF and Hen Mpoano (2019)

Notes:

- Reported landings for the trawl and artisanal sectors are derived from the annual report of the Fisheries Commission for 2017 (unpublished)
- Estimate of unreported catches for the industrial trawl fleet excludes discards and other unreported catches.
- Artisanal landings do not include unreported catches not captured in official statistics.

Small pelagics are in high demand on local markets, and attract the highest prices[40]. With a ready market for their catches and low risk of sanction[41], trawlers have an incentive to fish for species traditionally caught by artisanal fishers. According to the crew of these industrial vessels, trawl nets are lined with illegal small mesh 'inner sacks', resulting in the capture of small pelagics for the saiko trade[42]. In addition to bottom trawl nets, pelagic nets are also deployed to target fish living in the mid-water column and near the sea surface[43].

"The pelagic net catches salmone [mackerel], anchovies, sardinella and some other small small fishes. The pelagic net is big so we have inner sack that we insert into the pelagic net, which helps us. The eye space of the net is too small, so if they found out at the harbour, they will seize it. So we hide it inside the hatch when we are reporting to the shore."

Ghanaian crewmember #1, industrial trawler

"The nets that we trawl with are the bigger size mesh nets but the captain wants to catch plenty fish so he puts small mesh size nets into it."

Ghanaian crewmember #2, industrial trawler

"The Chinese people are catching all our fish in the sea. Now, if you go to the cold store, all fish the local canoes were catching are now caught by the Chinese. They are catching all the surface fishes...."

Ghanaian crewmember #3, industrial trawler

Since 2019, all trawlers operating in Ghana have been required to have a human observer on board to report on illegal fishing infringements. These observers confirm the widespread use by trawlers of non-compliant fishing gear[44]:

"We have the approved net to be 60 mm in measurement. But some of them don't use those nets – they use mesh which is less than the 60 mm... If they use those nets, the fingerlings [juvenile fish] will not be able to go out. So, by the end of the day, they will bring [catch] everything."[45]

Fisheries observer #1, industrial trawler

"Some add another mesh to their normal [net] or they change the gears. Some would be 60 [mm] others would be 45 [mm] - it will be joined."

Fisheries observer #3, industrial trawler

"Sometimes I tell them [the captain] due to the net they are catching small small fish which is not good...so they have to change the net. But they won't mind me, they will do what they want to do."

Fisheries observer #2, industrial trawler

Frozen blocks of fish being prepared for trans-shipment from a trawler to a *saiko* canoe © Hen Mpoano

However, investigations by EJF and others indicate that the observer programme is compromised by threats, bribery and abuse[46].

Catching, trans-shipping or landing undersized fish is an offence in Ghana, attracting a minimum fine of US$1 million (see **Box 1**)[47]. Minimum landing sizes for commercially important fish species are set out in the Schedule to the 2010 Fisheries Regulations, LI 1968[48] (**Appendix 2**). Landing or sale of fish below the minimum landing size can result in a term of imprisonment of up to 12 months, in addition to any fine imposed[49]. The use of prohibited fishing gear is likewise an offence punishable, on summary conviction, by a fine of not less than US$1 million[50].

Box 1:

On 17 June 2019, the LU RONG YUAN YU 956 was apprehended with 405 boxes and 864 slabs of frozen mixed small pelagic fish species on board, generally below the minimum landing size. Other fisheries infractions that the vessel was found to have committed included non-reporting of catch on board, and use of under-sized mesh nets[i].

The Fisheries Commission confirmed that the vessel had docked at Tema port but failed to report a portion of its catch. It had then left Tema with the fish on board, with the intention of trans-shipping the fish at sea to a saiko canoe[ii].

In October 2019, an out of court settlement committee imposed a fine of US$1 million on the owner of the vessel, and an additional GHS 124,000 for the fish on board the vessel at the time of arrest[i]. However, the registered owner, Gyinam Fisheries and Sons Ltd, has since refused to pay, resulting in the matter reverting to court[iii].

This case is significant as one of very few instances in which the minimum statutory fine has been imposed on a trawler for use of prohibited fishing gears and targeting of under-sized fish. Other perpetrators have paid lower sums, in spite of the law[iv].

According to the website of the Chinese Ministry of Agriculture and Rural Affairs, the vessel LU RONG YUAN YU 956 is operated by the company Rongcheng Ocean Fishery Co Ltd. The company also operates the Ghanaian flagged trawler LU RONG YUAN YU 959, registered to a different local company in Ghana, Rockpoint Co. Ltd. LU RONG YUAN YU 959 was fined US$250,000 and GHS 47,980 in 2015 for taking on board under-sized fish –well below the US$1 million in the 2014 Act. That case was subsequently settled with payment of GHS 200,000 (US$36,000 approx.) accepted by the Ministry for Fisheries.

[i] Information on the case released by the Western Regional Office of the Fisheries Commission.
[ii] Director, Western Regional Directorate of the Fisheries Commission, speaking on ATL FM on 4 November 2019.
[iii] EJF (2020). 'Trawlers charged with illegal fishing continue to dodge fines in Ghana', 23 January 2020. https://www.ejfoundation.org/news-media/trawlers-charged-with-illegal-fishing-continue-to-dodge-fines-in-ghana
[iv] EJF (2018). *China's hidden fleet in West Africa: A spotlight on illegal practices within Ghana's industrial trawl sector.* https://ejfoundation.org/reports/chinas-hidden-fleet-in-west-africa-a-spotlight-on-illegal-practices-within-ghanas-industrial-trawl-sector

METHODOLOGY

Since 2018, EJF has been monitoring landings of by-catch from the industrial trawl fleet, both in the form of 'official by-catch' landed by trawlers and sold in boxes at Tema port, and slabs of saiko fish landed by canoes at Elmina. This briefing sets out the results of one full year of monitoring, focusing on the presence of sardinella in the by-catch analysed.

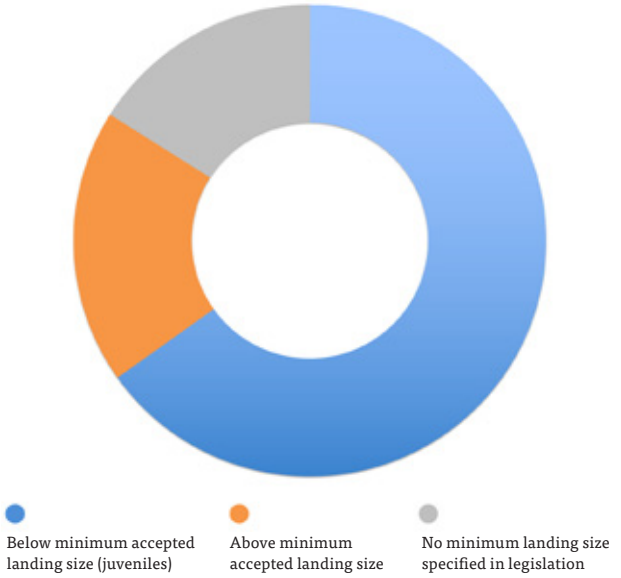
Blocks of saiko fish landed at Elmina port were analysed to assess species composition and presence of juveniles against length at maturity indices. Fishes were sorted by species and the number of individuals of each species counted. Wet body weights were measured using an electronic balance. Measurements of standard length (SL), fork length (FL) and total length (TL) were recorded using a fish measuring board, and FL compared to the minimum permitted landing sizes in the 2010 Fisheries Regulations, LI 1968 (**Appendix 2**)[51]. Species composition by weight was calculated for each block of by-catch.

Analyses were carried out on an approximately fortnightly basis for a one-year period, from 27 September 2018 to 24 September 2019. When saiko fish was unavailable, 'official' by-catch landed by trawlers at Tema port was obtained and analysed. In contrast to the saiko catches, this fish is packed in boxes marked with the registered owner of the trawler that caught the fish. A total of 22 blocks of fish were analysed during this period, of which 18 were blocks of saiko fish, and 4 were boxes of by-catch landed at Tema port.

FINDINGS

Results of this monitoring found that 65.1% of individual fish analysed were below the minimum sizes set out in the 2010 Fisheries Regulations, while 18.8% were compliant with these requirements (**Figure 3**). Other species were not considered 'commercially important' and had no size requirements prescribed by law.

Figure 3: Overview of length at maturity indices of fish in 22 blocks of trawler by-catch sampled between 27 September 2018 and 24 September 2019



Measuring *Sardinella aurita* for the study.

Sardinella spp. were present in 12 out of 18 blocks of saiko fish sampled (67%), and 2 out of 4 blocks of by-catch sampled from Tema port (50%).

Image of an industrial trawler in Ghana with its nets deployed.

Caranx rhonchus (False Scad) and *Decapterus punctatus* (Round Scad) were observed most frequently in by-catch, together making up 56.2% of total individuals sampled and contributing 47.2% by weight (**Table 1**)[52]. All individuals of the species False Scad were below the minimum size specified in the 2010 Fisheries Regulations (**Table 1**). Both species are also caught by the artisanal fleet[53].

Of the individual fish of *Sardinella* spp. recorded in this study, 98.9% of individuals were below the minimum accepted landing size. This figure was 99.0% for saiko fish landed at Elmina, and 98.7% for by-catch landed at Tema. The mean length (FL) of Round Sardinella analysed was 13.9 cm. The mean length (FL) of Flat Sardinella analysed was 12.4 cm. The minimum commercial landing size for both species in Ghana is 18 cm.

Sardinella spp. were present in 12 out of 18 blocks of saiko fish sampled (67%), and 2 out of 4 blocks of by-catch sampled from Tema port (50%) (**Table 2**). Together, *Sardinella aurita* (Round Sardinella) and *Sardinella maderensis* (Flat Sardinella) accounted for 17.2% of individual fish analysed in this study (**Table 1**).

Where *Sardinella* spp. were present, the number of individuals ranged widely, from 0.2% to 44.4% of individuals in blocks of saiko fish from Elmina, and over 97% of individual fish in blocks of by-catch landed at Tema (**Table 2**). The contribution of *Sardinella* spp. by weight ranged from 0.3% to 44.6% in blocks of saiko fish from Elmina, and from 95% to 96% in blocks of by-catch landed at Tema (**Table 2**).

Round Sardinella contributed 8% by weight of saiko fish sampled at Elmina (**Figure 4a**), and 21% by weight of by-catch sampled from Tema (**Figure 4b**). Flat Sardinella contributed less than 1% by weight of saiko fish sampled at Elmina, but 27% by weight of by-catch sampled from Tema (**Figure 4b**).

While this analysis recorded the presence of Flat Sardinella in trawler by-catch, the industrial trawl fleet has not reported landings of this species since 2007 (**Appendix 1**).

Block of saiko fish analysed in April 2019 - juvenile *Sardinella* spp. contributed 44.6% by weight.

Table 1: Results of analysis of trawler by-catch for species and presence of juveniles (22 blocks analysed, 27 September 2018-24 September 2019)

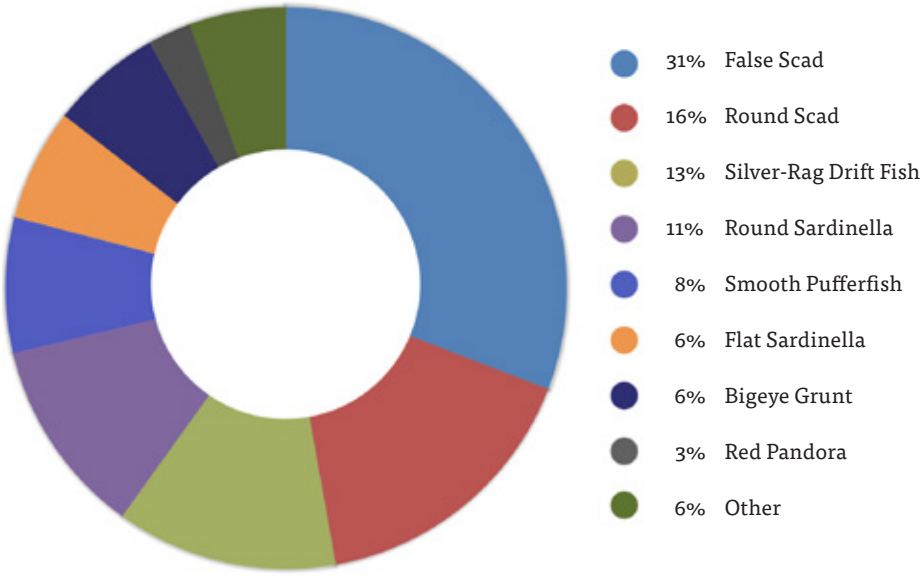
Species[i]	Total individuals	% of total	Number of juveniles[ii]	Juveniles as % of total individuals of species	Total weight (kg)	% total weight
Caranx rhonchus (False Scad)	3017	36.7	3017	100.0	67.2	30.9
Decapterus punctatus (Round Scad)	1602	19.5	223	13.9	35.5	16.3
Ariomma bondi (Silver-rag Driftfish)	1022	12.4	Not listed in LI 1968	N/A	27.8	12.8
Sardinella aurita (Round Sardinella)	881	10.7	867	98.4	24.7	11.3
Sardinella maderensis (Flat Sardinella)	534	6.5	532	99.6	14.0	6.4
Brachydeuterus auritus (Bigeye Grunt)	402	4.9	341	84.8	13.9	6.4
Pagellus bellottii (Red Pandora)	208	2.5	198	95.2	5.4	2.5
Scomber colias (Chub Mackerel)	150	1.8	149	99.3	3.3	1.5
Other	397	4.8			25.9	11.9
Total	**8213**	**100**	**5327**	**64.9**	**217.8**	**100**

Note:

[i] Species representing less than 1% of total individuals encountered are grouped in the category 'Other'.

[ii] As assessed against minimum commercial landing sizes set out in the Schedule to the 2010 Fisheries Regulations, LI 1968 (**Appendix 2**). No value provided for category 'Other' as not all species within the category had a minimum commercial landing size listed.

Figure 4: Overview of species composition by weight in 22 blocks of trawler by-catch - saiko landings at Elmina and fish landed at Tema (sampled between 27 September 2018 and 24 September 2019)



Notes:

[i] Species contributing less than 5kg by weight are grouped in the category 'Other'.

Figure 4a: Overview of species composition by weight in 18 blocks of saiko fish landed at Elmina (sampled between 27 September 2018 and 24 September 2019)

- 40% False Scad
- 20% Round Scad
- 9% Silver-Rag Drift Fish
- 8% Round Sardinella
- 8% Smooth Pufferfish
- 6% Bigeye Grunt
- 3% Red Pandora
- 6% Other

Notes:

[i] Species contributing less than 5kg by weight are grouped in the category 'Other'.

Figure 4b: Overview of species composition in four blocks of by-catch landed at Tema (sampled between 27 September 2018 and 24 September 2019)

- 27% Flat Sardinella
- 25% Silver-Rag Drift Fish
- 21% Round Sardinella
- 27% Other

Notes:

[i] Species contributing less than 5kg by weight are grouped in the category 'Other'.

Saiko canoe waiting to unload at Elmina port.

Table 2: Presence of *Sardinella* spp. in blocks of trawler by-catch analysed (14 out of 22 blocks sampled between 27 September 2018 and 24 September 2019)[i]

	Date of analysis	Landed through saiko or at Tema port	Number of individuals	% of total individuals in block	Weight (kg)	% of total weight of block	Number below minimum size specified in LI 1968	% of individuals below minimum size	Mean length of individuals analysed (FL in cm)
1	5.11.2018	Saiko	35	11.9	1.2	12.3	35	100	14.3
2	26.11.2018	Saiko	55	36.9	2.2	41.6	55	100	14.9
3	10.12.2018	Saiko	80	18.2	3.1	28.5	79	98.8	14.9
4	24.01.2019	Saiko	3	0.8	0.1	0.9	3	100	13.3
5	6.02.2019	Saiko	3	0.7	0.1	1.4	3	100	14.5
6	20.02.2019	Saiko	37	7.2	0.7	7.4	37	100	11.6
7	21.03.2019	Saiko	1	0.2	<0.1	0.3	1	100	13.1
8	17.04.2019	Saiko	235	44.4	3.6	44.6	235	100	10.4
9	3.05.2019	Saiko[ii]	17	3.3	0.4	3.5	17	100	12.2
10	20.05.2019	Saiko[ii]	29	8.5	0.9	8.8	29	100	13.6
11	3.06.2019	Saiko[ii]	9	1.8	0.3	3.4	9	100	14.4
12	2.07.2019	Saiko	36	14.0	2.1	20.2	32	88.9	16.7
13	10.09.2019	Tema[iii]	405	97.6	13.0	95.0	394	97.3	13.2
14	24.09.2019	Tema[iii]	470	97.1	10.9	96.0	470	100	12.0

Notes:

[i] *Sardinella* spp. were present in 12 out of 18 blocks of saiko fish sampled (67%), and 2 out of 4 blocks of by-catch sampled from Tema port (50%)

[ii] Saiko landings did not take place during the closed season for the artisanal and inshore fleets from 15 May-15 June 2019 as saiko canoes were unable to go to sea. During this period, blocks of saiko fish were purchased from cold stores in Elmina. It is not known how long the blocks were in storage prior to analysis.

[iii] Saiko landings did not take place during the closed season for the industrial trawl fleet in August-September 2019.

In two cases, *Sardinella* spp. accounted for 97% of fish in the individual blocks, nearly all of which were juveniles (**Tables 3 and 4**). As both of the blocks were landed at Tema, it was possible to discern information on the vessels that caught the fish:

- **10 September 2019**:
  Analysis of by-catch in a box marked with the name of the company LYEMYLFEN CO. LTD. This company is listed in the 2019 licence list[54] as the registered owner of two industrial trawl vessels operating in Ghana, LU RONG YUAN YU 928 and LU RONG YUAN YU 929. According to the website of the Chinese Ministry of Agriculture and Rural Affairs, the vessels LU RONG YUAN YU 928 and 929 are operated by the company Rongcheng Marine Fishery Co Ltd.

- **24 September 2019**:
  Analysis of by-catch in a box marked with the name of the company GAZIMPEX GHANA LTD. This company is listed in the 2019 licence list[55] as the registered owner of two industrial trawl vessels operating in Ghana, LU RONG YUAN YU 968 and LU RONG YUAN YU 969. According to the website of the Chinese Ministry of Agriculture and Rural Affairs, the vessels LU RONG YUAN YU 968 and 969 are operated by the company Rongcheng Marine Fishery Co Ltd.

Composition of fish in box of by-catch labelled with the company details LYEMYLFEN CO. LTD and analysed on 10 September 2019

Composition of fish in box of by-catch labelled with the company details GAZIMPEX GHANA LTD and analysed on 24 September 2019

Table 3: Size information for *Sardinella* spp. in by-catch analysed on 10 September 2019

Species	Number of individuals	% of total	% below minimum size in LI 1968	Average size (fork length)	Minimum size (fork length)	Maximum size (fork length)
Round Sardinella	93	22.4	90.3	13.7	10.9	19.6
Flat Sardinella	312	75.1	99.4	13.1	10.3	18.6

Table 4: Size information for *Sardinella* spp. in by-catch analysed on 24 September 2019

Species	Number of individuals	% of total	% below minimum size in LI 1968	Average size (fork length)	Minimum size (fork length)	Maximum size (fork length)
Round Sardinella	288	59.5	100.0	12.5	9.3	15.7
Flat Sardinella	182	37.6	100.0	11.2	9.3	12.5

EJF reported these cases to the Fisheries Commission in September and October 2019, respectively, but no outcome of any investigation has yet been reported.

Other small pelagic species observed in the analysis included *Scomber colias* (Chub Mackerel) and *Engraulis encrasicolus* (European Anchovy). These accounted for 1.8% and 0.9% of individuals analysed, respectively. Over 99% of individuals of the species Chub Mackerel analysed were below the minimum size requirements in the legislation.

Artisanal fishing canoes at Cape Coast.

CONCLUSIONS AND RECOMMENDATIONS

This study has recorded the presence of juvenile small pelagics in the landings of industrial trawlers in Ghana. *Sardinella* spp. –the majority juveniles –accounted for up to 44.4% of individuals in the blocks of saiko fish sampled, and contributed up to 44.6% by weight. In two blocks of by-catch landed at Tema port, juvenile sardinella accounted for over 97% of individual fish sampled, and contributed at least 95% by weight.

The prevalence of juvenile sardinellas in trawler by-catch and scale of the saiko trade suggest that trawlers are a major driving force in the collapse of Ghana's small pelagic fishery. With much of this by-catch going unreported, official statistics likely vastly underestimate the impact of industrial trawlers on small pelagic fish populations in Ghana.

This study recorded 540 individual sardinella, the vast majority juveniles, across the 18 blocks of saiko fish analysed[56]. A 2019 report by EJF and Hen Mpoano estimated that 9.24 million blocks of fish were landed through the saiko trade in 2017. This gives an idea of the sheer numbers of juvenile sardinella lost to the saiko trade – fish that could, and should, have been allowed to reproduce and replenish the fishery.

It is possible to surmise that over the past two decades there has been a gradual shift in resource allocation from the artisanal sector to the industrial trawl fleet. The quantities of small pelagics present in industrial trawl catches are indicative of targeted fishing rather than by-catch, supporting testimonies of crewmembers working on board the industrial trawl fleet.

If the collapse of the small pelagic fishery is to be averted, the activities of the industrial trawl fleet must be addressed and effectively regulated as a matter of urgency.

A 2019 report by EJF and Hen Mpoano estimated that 9.24 million blocks of fish were landed through the saiko trade in 2017.

An industrial trawler fishing off the coast of Cape Coast in Ghana's Central Region in December 2019. The vessel was observed with its nets allegedly deployed within the Inshore Exclusion Zone (IEZ) reserved for artisanal fishers. The image was captured by artisanal fishers using a geotagged camera provided by EJF.

To this end, it is recommended that the Government of Ghana:

1. Investigates all suspected cases of illegal saiko fishing and prosecutes cases transparently through the court process, with a view to ensuring deterrent fines are imposed and paid in accordance with the law.

2. Upholds its commitment set out in the 2020 Budget Statement to ban all domestic or international vessels found to be engaging in saiko from operating in Ghanaian waters.

3. Maintains a clear prohibition against saiko in the ongoing revision of the 2002 Fisheries Act, including the possibility to suspend or withdraw a fishing licence in the case of a first saiko offence.

4. Carries out a detailed investigation into compliance of trawl gear with legal restrictions on mesh size and publishes the results. Ensures all cases of non-compliance are prosecuted transparently through the court process, with a view to ensuring deterrent fines are imposed and paid in accordance with the law.

5. Carries out routine inspections of landings of industrial trawlers to ensure they are only targeting species of the type and size dictated by their licence, and that minimum size restrictions set out in the 2010 Fisheries Regulations are respected.

6. In the future fisheries act, introduces strict conditions on by-catch, restrictions on the characteristics of fishing gear (mesh size) and an obligation to land all target and non-target catch in either Sekondi or Tema port. Ensures this information is accessible to the public.

7. Adopts a precautionary approach to the management of small pelagic stocks, and ensures fishing effort is in line with the recommendations of the FAO/ Fishery Committee for the Eastern Central Atlantic (CECAF) Working Group on Pelagic Resources.

8. Conducts a revised scientific assessment to determine the impact of the trawl fleet on small pelagic stocks, taking into account legal and illegal catches, and updates recommendations concerning the necessary reduction in fishing effort to achieve maximum sustainable yield (MSY).

9. Adopts all necessary measures, including a reduction in the number of licensed trawlers and fishing days, and implementation of closed seasons, to ensure the fishing effort of the industrial trawl fleet is brought down to sustainable levels.

10. Co-operates with neighbouring countries through the Fisheries Committee for the West Central Gulf of Guinea (FCWC) to ensure full implementation of the 2017 Strategy to Combat Illegal Transhipment at Sea, which requires that trans-shipments of fish in FCWC member states shall only take place in a designated port.

11. Implements measures to improve transparency in the industrial trawl sector, including routine publication of data on landings of target and non-target species, licensed vessels and fisheries-related infringements[57].

12. Takes all necessary steps to secure the transparent and robust operation of the fisheries observer programme, adopting a zero tolerance policy towards threats, bribery and abuse against observers and ensuring infringements are reported and acted upon.

EJF believes that the on-going failure of existing mechanisms for governance compel and require the direct intervention and oversight of President Akufo-Addo in order to prevent the imminent collapse of the small pelagic fishery and the resulting, devastating loss of livelihoods, food security and social well-being for millions of Ghanaians.

Appendix 1

Catches (tonnes) of *Sardinella* spp. by Ghanaian fleets (artisanal, inshore and industrial), from 1990 to 2017 (FAO, 2019)

	Sardinella aurita			***Sardinella maderensis***			**Total (*Sardinella* spp.)**		
Year	Artisanal	Inshore	Industrial	Artisanal	Inshore	Industrial	Artisanal	Inshore	Industrial
1990	43167	2396	2377	14549	940	419	57716	3336	2796
1991	50447	2265	993	8207	242	175	58654	2507	1168
1992	119515	6268	581	14240	165	102	133755	6433	683
1993	90600	2134	613	16797	185	108	107397	2319	721
1994	67566	2327	3386	12310	156	597	79876	2483	3983
1995	65598	2143	1750	13092	119	309	78690	2262	2059
1996	115070	3331	3067	13501	118	541	128571	3449	3608
1997	46387	3010	1998	14070	113	353	60457	3123	2351
1998	54596	1369	541	14770	698	95	69366	2067	636
1999	39124	1256	800	12056	49	141	51180	1305	941
2000	98865	3178	2479	14935	35	438	113800	3213	2917
2001	64104	3209	7093	15853	530	1252	79957	3739	8345
2002	59400	3449	1320	13693	81	233	73093	3530	1553
2003	70314	8323	2396	15419	158	423	85733	8481	2819
2004	78454	3594	3608	27052	50	637	105506	3644	4245
2005	64389	2600	378	14241	72	67	78630	2672	445
2006	70672	4326	354	21384	2644	62	92056	6970	416
2007	40759	4712	377	10218	2320	66	50977	7032	443
2008	24904	2889	0	15772	128	0	40676	3017	0
2009	11198	7291	990	5994	274	0	17192	7565	990
2010	30195	5824	0	10745	566	0	40940	6390	0
2011	16749	4263	493	9643	1076	0	26392	5339	493
2012	22166	6560	0	11958	385	0	34124	6945	0
2013	19402	5252	1250	6506	351	0	25908	5603	1250
2014	15879	3403	1229	4876	20	0	20755	3423	1229
2015	14861	6535	2039	5830	201	0	20691	6736	2039
2016	18530	6749	1577	2104	151	0	20634	6900	1577
2017	38519	6518	1310	3531	614	0	42050	7132	1310

Appendix 2

Table 1 of the Schedule to the 2010 Fisheries Regulations, LI 1968

Minimum landing sizes of commercially important fish species

(Regulation 14 (1))

Scientific name	Common English name	Min. size
Penaeus notialis	Shrimp	1.5 cm CL
Panulirus regius	Spiny Lobster	12 cm CL
Pagellus bellotti	Red Pandora	14 cm
Dentex canariensis	Canary dentex	22 cm
Sparus caeruleostictus	Blue spotted seabream	18 cm
Sepia officinalis	Cuttlefish	14 cm ML
Lutjanus fulgens/ goreensis	Red snappers	16 cm
Galeoides decadacydus	Threadfin	16 cm
Pseudotolithus senegalensis	Cassava fish	18 cm
Pseudupeneus prayensis	Red Mullet	14 cm
Epinephelus aeneus	Grouper	42 cm
Sphyraenna spp	Barracudas	30 cm
Pomadasys incisus	Roncador	14 cm
Pomadasys jubelini	Burro	18 cm
Chloroscombrus chrysurus	Bumper	10 cm
Decapterus punctatus	False mackerel	10 cm
Sardinella aurita	Round sardine	18 cm
Sardinella maderensis	Flat sardine	18 cm
Brachydeuterus auritus	Burrito	14 cm
Scomber japonicus	Chub mackerel	18 cm
Caranx rhonchus/ crysos	Scad mackerel	21 cm
Engraulis encrasicolus	Anchovy	6 cm
Thunnus obesus	Bigeye tuna	55 cm
Thunnus albacares	Yellowfin	55 cm

(CL - carapace length, ML - mantle length, fish species measured in fork length)

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