

# Triggering Death

Quantifying the true human cost of global fishing

---

RESEARCH REPORT

NOVEMBER 2022



---

FISH Safety Foundation



## Report Authors

Lead Author:

Sam Willis (FISH Safety Foundation)

Co-Author:

Eric Holliday (FISH Safety Foundation)

## Images

Cover Image: Berbera Port, Somaliland. Image Credit: Mahad Ahmed / FISH Safety Associate

All uncited images in this document are property of the FISH Safety Foundation and subject to copyright<sup>©</sup>

Thanks to our team members, FISH Safety Associates and supporters who contributed to our imagery:

Robert Heaps  
Cas Holliday  
Alex Wall  
M. Hasan Joy  
Dr. Md. Sazedul Hoque

## Disclaimer:

This study was funded by The Pew Charitable Trusts with additional support provided by the Walmart Foundation. The views expressed herein are those of the authors and do not necessarily reflect the views of these organizations. Any errors are the responsibility of the authors.

## Caveat Statement

Given the lack of available official information around fisher fatalities, the data in this report has certain caveats and limitations that must be taken into account when considering the research findings.

For more information on any aspect of this report, please contact:

**Eric Holliday**

**FISH Safety Foundation**

[eric.holliday@fishsafety.org](mailto:eric.holliday@fishsafety.org)

[www.fishsafety.org](http://www.fishsafety.org)

+64 27 7333 611



# Foreword

We've always known that fishing is one of the most hazardous occupations in the world. What we didn't realise when we started this research, was just how dangerous it actually is. Ultimately, after 18 months of in-depth research, we are left with two crucial findings: one, the number of annual fatalities in the global fishing sector is significantly higher than previously thought, and two, we still don't know just how many lives are lost every year! We need better data.

This Report highlights the results of our latest and, in many ways, our most difficult research project yet. It has been challenging for two reasons – firstly, sourcing the information. In most cases, there was simply no official data available from the appropriate local Government departments, and where there was, this data was often at odds with the information we gleaned from other sources. Secondly, we realized our findings would come as a shock to the fishing sector – the death toll is simply so much higher than what we had previously thought.

As we will show, we've ended up with a global fisher fatality number of more than 100,000 people per year. There will no doubt be much debate about this number. And there should be! After all, our research shows the annual death toll to be some three to four times higher than the numbers we've worked with for the past two decades. But an important point needs to be highlighted in this debate: There are still massive data gaps, which have a direct impact on determining the true severity of the fishing safety problem, as well as on the interventions needed to try and improve this situation. It's all about the data.

In this regard, there is some good news. The FISH Safety Foundation has long recognised the problem of a lack of adequate and accurate data, and has advocated for, and is working, together with our partners (the International Maritime Organization, The Pew Charitable Trusts and the Lloyd's Register Foundation), on the conceptualisation of a global database of fisher fatality information [see: [www.fisherproject.org](http://www.fisherproject.org)]. This initiative has now progressed somewhat with the FAO COFI Committee (under Agenda Item 11) agreeing on the following (draft extract at the time of writing) statement at their latest meeting (5 to 9 September 2022):

[The Committee: i\) ...requested FAO to ... take a lead on the establishment of a repository for fishing safety data and accident and mortality information](#)

Finally, I want to acknowledge the efforts of our lead researcher, Sam Willis, in this work. It has been a truly herculean effort. Thank you, Sam, and the rest of the team who supported her throughout. I also want to thank The Pew Charitable Trusts and the Walmart Foundation for their financial support, and for the personal support by Pew's project team (Peter Horn, Katherine Hanly and Emily Klein). We thank all our contributors and supporters in this project. We couldn't have done this without you.

We of course welcome any, and all input here.

**Eric Holliday**

CEO, FISH Safety Foundation [[www.fishsafety.org](http://www.fishsafety.org)]

1 November 2022

# Executive Overview

Food security is one of the world's biggest challenges, particularly since the COVID-19 pandemic, which has seen the prevalence of undernourishment increase significantly [1]. With global consumption of seafood increasing consistently since the 1960s, millions of fishers are working to meet these demands. Their role in providing safe and nutritious food to billions of people and their contribution to the Sustainable Development Goals, including Zero Hunger, have prompted the United Nations General Assembly to name 2022 the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022).

Maintaining a safe, sustainable supply of fish products – for a global population expected to reach 10 billion by 2050 [2] – is crucially important, and a daunting challenge. Yet, there is much we don't know about the fishers who provide for their families, communities, and the world, as they work in a sector that has long been acknowledged as one of the most dangerous [3]. While the positive global contribution of fisheries is known and understood, the true human cost of fishing remains elusive.

This report highlights the recent research by the FISH Safety Foundation which aimed to confirm or update the 1999 estimate of 24,000 fisher fatalities per year [4], and if possible, identify any contributing drivers to these fatalities.

Analysing thousands of pieces of information from all available sources revealed that the formal information on fatalities currently available is often inconsistent or missing, with existing recording systems seriously fragmented. There are currently no statutory requirements to report accidents and fatalities in most countries, with little or no recording or formal investigations of these events taking place. We shed light on why it was so difficult to estimate the number of fisher fatalities globally and propose what should be done to improve the situation.

The presented research clearly shows that the annual global fisher fatality numbers are well in excess of 100,000 per year – considerably higher than any previous estimates. Ongoing work is needed to understand the drivers behind these unacceptably high fatality figures and address the data gaps to allow for the development of targeted effective safety initiatives to make the critical work of fishing possible without such a dramatic loss of life.

# Contents

Background Information	6
<b>Part 1</b>	<b>7</b>
Introduction	7
Previous Industry Approach	8
Our Approach	13
<b>Part 2</b>	<b>21</b>
Results	21
<b>Part 3</b>	<b>29</b>
Case Studies	29
Divers of Central America	30
Marine Fishers, West Coast of Africa	40
Mangrove fishers of the Sundarbans Mangrove Forests	47
Africa’s Inland Fishers	60
The EU	69
<b>Part 4</b>	<b>76</b>
The Drivers	76
Governance	77
IUU	92
Sustainability	103
Climate Change	111
Poverty	119
<b>Part 5</b>	<b>126</b>
The Next Steps	126
Reference List	128

## Background Information

With a complex topic like fatalities in fishing communities, context is essential. The information in this report is sobering and often confronting. We present the “numbers” portion of a much larger investigation, including both the background and the analysis of our research, and clearly outline the justification behind the statement that in excess of 100,000 fishers are dying each year.

Without careful consideration of the parameters of statements within this paper, it would be easy to take results out of context.

We want to be clear that we are well aware of the data challenges and the uncertainty in this work – in fact, the need for data and consistent reporting is a fundamental finding of our work and one of our most important messages. We strongly recommend avoiding focusing on the individual numbers within the paper, and instead considering the results as part of the bigger picture.

In addition, while we may speak more about certain geographical regions, this is not due to the fact that these areas are any worse or more dangerous than other regions. It is critical to recognize this more likely indicates that this region had more information available. This is demonstrated in our particular focus on African fisheries, where fatality rates in some communities are devastatingly high. Given this, it must be clearly stated that individual countries should not be penalised for providing data, as it indicates a willingness to look at these problems directly and be part of the solution. Given the similarity of the drivers explored throughout the investigation, it is likely that we would see similar challenges in many other fishing communities around the globe.

Instead, a greater focus should be on the sheer lack of information available – from high- and low-income countries. In order to collectively move forward to find solutions to this global challenge, it is essential that we are able to quantify it.

We need more data.

# Part 1

## Introduction

### The Importance of Fisheries

Fisheries form an essential role in the global food supply chain and support the livelihoods of millions of people. Yet surprisingly, we lack insight on some critically important aspects. Throughout this report, we will discuss what we know, and highlight the key gaps in information that need to be addressed.

Fisheries reports typically start with the latest published figures, which suggest there are some 60 million people engaged in the primary fishing sector – about two-thirds in capture fisheries, and the remaining third in aquaculture [5]. Of those employed in capture fisheries, about 90 percent of them are engaged in the small-scale sector [6].

Following this, figures highlight the importance of fisheries for global food security, stating that the global consumption rates of fisheries continue to increase, and fish now provide some 3.3 billion people with over 20 percent of their animal protein [5].

While these figures aren't necessarily incorrect, we argue that we are significantly underestimating the importance of fisheries to both food and social security. Throughout this report we will highlight the challenges to fishers around the world and demonstrate how this is impacting on the safety of fishers – and the survival and sustainability of fishing communities.

### Safety in the Fisheries Sector

This report outlines our attempts to quantify the number of fisher fatalities, investigates the availability and accuracy of data, and explores the relationship between several identified drivers contributing to the risks faced by fishers. Our results indicate that the number of fatalities occurring across the sector was likely to be significantly higher than currently accepted estimates. Ultimately, **we find fatalities among fishing communities worldwide surpass 100,000 annually.**

While this number initially seems implausible, it is likely still an underestimate.

We have learned that fishers are dying in almost unbelievable numbers across the world, and that many of these fatalities are never recorded. We also discovered that, to understand what is killing these fishermen, we need data to develop a clear grasp on the contributing drivers, their individual and synergistic effects, and their overall contribution to fisher safety.

This report will highlight our progress in the matter.

# Previous Industry Approach

## Previous Statistics

The figure of 24,000 fatalities per year had originally been estimated through work carried out by FAO in 1987, which was later confirmed through a study done by ILO and published in the document *Safety and health in the fishing industry. Report for discussion at the Tripartite Meeting on Safety and Health in the Fishing Industry, Geneva, 1999* [3]. Despite our best efforts, we have not been able to locate the original work by John Fitzpatrick (FAO) to determine what methodology or figures were used as the basis of the calculations in 1987.

The ILO figure was determined using a compilation of data provided by a selection of countries which had accident reporting and data analysis systems in place. This data produced an average fatality rate of 80 deaths per 100,000 fishers. This was multiplied by the estimated number of fishermen at the time – 30 million – and resulted in an estimate of 24,000 fatalities [3, 7].

In December 1999, the ILO published their findings in a press release stating that “As many as 24,000 fishermen and persons engaged in fish farming and processing are killed every year putting fishing and related occupations among the most dangerous of all professions” [4].

The ILO were clear from the onset that their figure was a tentative calculation, with the *Safety and health in the fishing industry* report disclosing the concern that “fatality statistics may only be partially representative” due to several factors which included:

- Only using a small sample size from a global industry;
- Lack of consistency in reporting requirements (including both number of fishers and occupational injury or fatality information);
- Definitions of terms – such as fisher or fishermen – differed between countries;
- Sources of information tended to only include the formal sector, so the informal sector activities were excluded;
- Coverage of small businesses or the self-employed was deemed “partial, at best”;
- ILO statistics covered between 50 and 90 percent of total employment for most countries, and as little as 10 percent for some others.

It is therefore, in some ways rather unfortunate that the resulting fatalities estimate became the accepted industry figure for the next 20 years. As with the FAO work, the methodology and figures used to calculate this fatality rate were never published.

Statistics listed in the *Report* included those from Canada, Colombia, Estonia, Finland, Greece, Iceland, Italy, the Republic of Korea, Lithuania, Panama, Poland, Portugal, Spain, Sweden, and New Zealand, with further mention made of Australia, China, Denmark, China, Guinea, Oceania, Tunisia and the United States.

As it remains unclear what information was used for the calculation, we decided to explore what statistics regarding fisher fatalities were available or published at the time. We found the following figures:

Country	Fatality rate / 100,000	Year	Source
USA	160	1998	FAO Programme on Fishermen's Safety at Sea (2001) [8]
Australia	143	1982–1984	FAO Programme on Fishermen's Safety at Sea (2001) [8]
UK	77	1995/1996	FAO Programme on Fishermen's Safety at Sea (2001) [8]
Samoa	850	1997	FAO Programme on Fishermen's Safety at Sea (2001) [8]
Samoa	350	1998	FAO Programme on Fishermen's Safety at Sea (2001) [8]
Nigeria	999 -3,329	1991–1994	Occupation and Health Hazards in Nigerian Coastal Artisanal Fisheries [9]
West Africa	300 –1,000	1991–1994	FAO State of the World Fisheries and Aquaculture (2000) * Coastal Canoe Fisheries [10]
Guinea	500	1991–1994	FAO State of the World Fisheries and Aquaculture (2000) [10]
Canada	53	Mid to Late 1990s	Occupational injuries to fisheries workers in Norway reported to insurance companies from 1991 to 1996 [11]
Iceland	89	Mid to Late 1990s	Occupational injuries to fisheries workers in Norway reported to insurance companies from 1991 to 1996 [11]
Australia	143	Mid to Late 1990s	Occupational injuries to fisheries workers in Norway reported to insurance companies from 1991 to 1996 [11]
UK	170	Mid to Late 1990s	Occupational injuries to fisheries workers in Norway reported to insurance companies from 1991 to 1996 [11]
New Zealand	260	Mid to late 1990s	Occupational injuries to fisheries workers in Norway reported to insurance companies from 1991 to 1996 [11]

In addition, the following figures were published in the *Report*:

**Table 2: Industry Statistics Published in the *Report* [3]**

Country	Fatality rate / 100,000 *	Year
Canada	25.14	1997
Rep. of Korea	517	1997
Estonia	80	1997
Finland	207.3	1995
Italy	21.1	1997
Lithuania	58.8	1997
Poland	5.7	1997
Spain	64.96	1997
Sweden	100	1997

\*Sourced from ILO: Yearbook of Labour Statistics (Geneva, 1998)

It was also noted by the ILO *Report* that data for the fishing industry may include shore workers, which, unless consistent for all countries, could skew the data significantly. While this is in line with the press release statement which included shore workers and fish farmers, it remains unclear which countries included them in their initial calculations.

Regardless, as demonstrated by the range of values above, we questioned the inclusion criteria for the data selection process used by the ILO to generate a figure as low as 80 per 100,000 fishermen.

Again, the ILO statement indicated that the data was taken from countries which had accident reporting and data analysis systems in place. As many National accident reporting requirements only apply to registered fishing vessels in the formal sector [5], the data used almost certainly does not represent those countries' total fatalities. The *Report* itself alludes to the significantly higher number of fatalities in the small-scale and artisanal sectors, which seem to have been excluded from the calculations.

A more accurate statement from the ILO would have been along the lines of "According to available data, there is a fatality rate of approximately 80 fishermen per 100,000 on fishing vessels 24m and above."

## Industry Data Review

Despite our inability to ascertain calculations done decades previously, our work shows the depth of the challenge the FAO and ILO were (and continue to be) up against. Undoubtedly one of the biggest challenges in this project has been the unavailability of accurate and comprehensive data.

The FAO has served as the primary source of fisheries data between intergovernmental agencies since well before the publication of the 24,000 annual fatalities figure. In 1960, the FAO Coordinating Working Party on Fishery Statistics (CWP) was developed to provide a mechanism to coordinate the statistical programmes conducted by regional fisheries bodies and other intergovernmental organisations with a remit for fisheries statistics [12]. Since its introduction, the direct statement from the FAO on the purpose of the CWP has been to:

- Continually review fishery statistics requirements for research, policy making and management.
- Agree on standardised concepts, definitions, classifications and methodologies for the collection and collation of fishery statistics.
- Submit proposals for the coordination and streamlining of statistical activities among the relevant intergovernmental organisations.

Given the reference to the collaboration between the FAO, ILO and IMO Working Group for the fishing industry in the 1999 report, one can assume that the ILO had access to the same information presented in earlier FAO reports.

Small-scale and inland fisheries can be – and often are – ignored in data collection, despite their key contributions to society. Resulting data discrepancies exist through all realms of fisheries data, from employment numbers and reported catch volumes, to the occurrence rates of accidents and fatalities. Key management decisions are based on these statistics, which are wildly variable, potentially undermining the effectiveness of the policies designed around them.



Figure 2: Coastal Fisher, Africa. Image Credit: Melvin Ankrach / Unsplash

This has been demonstrated, for example, in household surveys on fish consumption in Africa which showed that actual fish consumption in these communities was as much as 500 percent higher than estimates generated from official landing data [13]. As a result, the social importance of the fisheries in that area was severely underestimated, as were the resulting pressures on these resources.

As this information forms the basis of quota or sustainability guidelines, it could be argued anything based off the initial information is potentially flawed. This is a pattern that has been demonstrated in almost every region and fishery subsector around the world [13, 14]. While data was not an initial focus point of our project, it quickly became apparent that the topic of data quality was a key discussion to include.

**THESE FINDINGS ALSO MEAN ANY FIGURES USED FOR STUDIES –  
INCLUDING THIS REPORT – MUST BE USED WITH CAUTION,  
ACKNOWLEDGING THAT THE FIGURES USED IN CALCULATIONS WERE THE  
BEST INFORMATION AVAILABLE AT THE TIME.**

# Our Approach

## Data Gathering

All data collected was from between the years 2000 and 2020, but in some rare cases, older information was used if no later information was available, and if nothing indicated any dramatic changes in that country or fishing industry. In addition, we also included some articles published since 2020 for discussion purposes.

It became clear early on in our work that if we only used typical industry and academic data in our searches, our results may not include all fishers due to the limitations in available data. In Africa, for example, insufficient human and financial resources for data collection has often resulted in poor quality information which have limited statistical use. FAO reported that, for the 2009 statistical inquiry, “21 (39%) out of 54 African countries were unable to provide national fisheries statistics, and for another 12 countries (22%), the data submitted was considered inadequate in relation to the relative importance of fisheries in the countries” [15].

We initiated our search for data by attempting to directly approach all fisheries and maritime authorities worldwide, outlining our project, and asking for fisher fatality data. While we had some responses to our request, many countries simply stated that they were unable to assist as they did not collect the information sought by us. Other countries only provided information after repeated requests, and in some cases, this information was of little value, and did not match the data found by us using other methods.

The issue of data availability, reliability, and consistency became a greater concern as this project progressed, and ultimately changed the direction of our research. It quickly became apparent that *official* information did not necessarily mean *accurate* information, and therefore, should not be the only information source considered.

One of the fundamental problems with data in this industry is lack of consistency. Each country has its own reporting methods, requirements, and inclusions for reporting, with even fundamental terminology varying between countries [14], limiting the accuracy of analysis within the industry.

To address these limitations, we expanded our research to include news articles, investigative journalism, social media posts, and private communications from individuals and organisations across the globe. The information reported through the media proved to be particularly useful. Not only has it become increasingly easy to access information from almost all countries, but it proved to be one of our most significant sources of data.

In many cases, news articles from local media allowed us to confirm or update the fatality number provided by that country’s regulatory authority. We were also able to demonstrate that even some high-income countries, with the best reporting systems in place, may use a limited set of recording criteria which seemingly excludes some fatalities from its records, as demonstrated in Exhibit 1.



## Exhibit 1

### Case Study: The Devil's in the Details – A High-Income Nation's Reporting

As we found out, the national development status of a country was not necessarily an indication of data recording ability, nor the openness in disclosing accident data.

An example here is a Pacific nation – regarded as a high-income country with a developed fishing sector – that had reported a fatality rate of 167 / 100,000 fishers for the years 1985–2000 in a 2001 study. Prior to that, studies had indicated a rate of 226 per 100,000 (1985–1994) and 260 per 100,000 (1975–1984) [16].

At the time of the 2001 study, there was a real willingness to work with industry and openly investigate and report accidents, and some good work was done to try and bring down the high fatality rate in the industry. But in recent years the method of public reporting of accident investigations and fatality calculations in this nation has changed. This appears to be consistent with other messaging, with the Regulator stating on their website that they “[seldom produce accident investigation reports for public publication. It was determined these were not widely read, particularly by parts of the community for whom safety was not a priority](#)”.

Accurate statistics on the fishing industry in this country are now hard to find, and repeated requests by the authors of this report for relevant information were not responded to during the research period. Using the information available in the latest Annual Reports it appears that only Domestic Fishing is routinely included in data reporting, with numerous incidents seemingly not fully recorded, including data on:

- Distant water fishing by [nation's] flagged vessels.
- Foreign-flagged vessels fishing under contract to [nation's] companies.
- Suicides and health-related fatalities on domestic / distant water vessels.

What data is presented can be problematic, especially when trying to compare accident rates to other fishing countries. The 2016/2017 Annual Report stated that “[Maritime fatalities and notifiable injuries or illnesses rates are currently reported per 100,000 \[nation's\] population](#)” [17]. Note the rate is reported against the *total national population*, not the number of people in the industry, as is standard practice globally. This method of fatality rate calculation is unique and misleading.

Following the 2017/2018 [18] Annual Report, fatality reporting became even more obscure, with all maritime fatality figures now combined, and no specific fishing sector figures recorded in neither the 2018/2019 nor 2019/2020 Annual Reports.

We were, however, able to calculate a fatality rate for this country's fishing sector using a compilation of local media reports and information from local insurance organisations over the period of 2010–2020, and this was used in our overall calculations.

## Further Methodology

For our work, we also had to establish clear thresholds and definitions on what to include in this study. We expanded our definition of fisher to include aquaculture workers. While wild catch and farmed fisheries may be two very different sectors in some high-income countries, this is not the case in other regions. In many fisheries across Asia, South America and Africa, the interplay between the two sectors is significant and they cannot be separated.

In addition, instead of using Full Time Equivalents (FTEs) as seen in many labour statistics, we chose to use the number of industry participants as a basis of our figures, as calculating a FTE of fishers in many lower-income countries is not possible.

We concluded with defining fishers as:

*All artisanal, small-scale, industrial, commercial, municipal, diving, inshore, shore based (including shellfish or crustacean gathering), inland or riverine fishing, as well as aquaculture workers are included under the blanket term of fisher.*

*Processors and recreational fishers are excluded from this data set.*

Following our agreed definition of fisher, we attempted to categorise each country's fishers by general subsector. In yet another data challenge – the lack of consistency between industry definitions of each subsector across the world made this almost impossible to do based off one singular definition. Instead, we were guided by each country's own definitions and classifications. To compare across countries, we assigned fishers to one of the following categories (when possible):

- Marine Commercial / Industrial
- Mariner Small-Scale / Artisanal / Subsistence
- Inland
- Aquaculture
- Total (where sector breakdown wasn't available)



## Data Selection Justifications

Our initial figures on the number of fishers were gathered from the FAO Fishery and Aquaculture Country Profiles [19]. While this is considered a reliable source, we did have some issues finding figures that fit within the parameters we had set for a “fisher,” which was not unexpected given discrepancies in how this is defined.

Following this, we expanded our search to include further sources and collated that information in targeted spreadsheets. As we did so, we found several substantial inconsistencies in this process. For example, Madagascar recorded five different number of fisher figures, ranging from 40,000 to 400,000 fishers [20, 21]. In India, we saw numbers between 900,000 and 25,000,000, and Nigeria ranged from 1,490,000 [19] to over 6,000,000 [22].

To further complicate this process, the reasons behind these inconsistencies also varied. Examples of this variation we encountered included:

- Differing figures within a singular document due to a mistype – with no clarity on which was correct.
- Figures cited from reports published by different departments or members of the same organisation, with vastly different quantities – likely due to the inclusion criteria or source of data used in each report.
- Varying definitions and interplay between fishing communities. For example, there is often a dynamic relationship between marine fisheries and aquaculture, for example in low-income countries where larvae or juvenile wild-caught fish are used to populate fish farms, making it almost impossible to distinguish between marine fishers and fish farmers without a clear and inclusive definition. Similarly, brackish water fishers could fall into the category of both marine and inland fishers.
- Due to inconsistent and often unavailable fisher number statistics, many fishers are then **excluded** from official figures, the implications of which are discussed in detail throughout this report.

In the cases where we had multiple figures for a country, we conducted further research into the source and methodology behind the numbers to decide which data source would provide the most accurate figure for our dataset.

## Number of fishers

Once we made the decision to include aquaculture workers, we had to calculate the estimated number of fishers around the world. As highlighted previously, this is a challenging task due to lack of consistency in methodology and fragmented data.



The FAO State of World Fisheries and Aquaculture (SOFIA) 2020 publication [5] provided the latest (at the time of the study) estimate on industry participation numbers at 59,509,000. However, our research suggests that this is likely an underestimate.

We have chosen not to disclose our total estimated number of fishers in this paper, due to the discrepancies outlined above, as it does not influence our results on fisher fatalities, although it does preclude the reporting of a global per capita rate. Further work on the number of fishers is currently being developed for submission to peer review and will be released when published. The critical point here is the fundamental uncertainties in how many fishers there are.

## The use of data

In our research, we attempted to record national statistics by a general category of fishing sector, e.g., commercial, small-scale, inland or aquaculture. The rationale for this is that we began to identify significant differences in both the risks and fatality rates for subsectors within each country's overall fishery sector. In many cases, the variation of numbers of fishers between these subsectors was significant. If this information is available, it is essential it be considered.

We have been able to do this on a regional or national basis for some countries, either for the whole industry or partial subsectors. In these cases, we have ensured that we only apply a fatality rate to the number of fishers it directly applies to.

In essence, if we have a fatality rate and number of fishers for a country's small-scale sector, then the number of fatalities has been calculated based only on the number of small-scale fishers and not across the entire country's number of fishers.

In some cases, we have a "blanket rate" which encompasses all sectors, which is the only time we include all fishers in that calculation.

Additionally, we have examples where we have fatality rates developed on a regional basis (i.e., across multiple countries), which resulted in the fatality rate being applied across that region.

## Exhibit 2

### The importance of fish consumption data

As with other areas of data, we found several inconsistencies with fish consumption data. While its links to fisher safety may not initially be obvious, it is an important dataset to consider when discussing fisheries management as it is a useful tool in monitoring the pressures that will be placed on local fisheries – and fishers – as the populations grows.

Global fish consumption rates have been increased at almost double the rate of population growth. While preliminary estimates indicated that fish consumption sat at 20.5kg per capita in 2018 [5], there is growing evidence that this too could be a significant underestimate.

Consider:

- Fish consumption per capita surpasses 150kg in Tokelau, while Kiribati, the Solomon Islands and Tuvalu all sit above 100kg [23].
- Some consumption estimates are based on *apparent* consumption – which is determined from reported catch as opposed to actual catch. When calculated based off actual landing data, figures can alter significantly, as demonstrated in some West African countries where fish consumption figures were as much as 500 percent higher [13].
- Brazil's annual fish consumption is listed as 9.1kg per person per year, while some inland communities are consuming as much as 182kg per person per year [24].

Inaccurate or incomplete fish consumption information has the potential to undermine the importance of the fishers in local communities, contribute to the underestimation of the number of fishers in an area, and may alter the accuracy of estimated catch numbers.



Due to this lack of consistent information, we have purposely excluded our results as to the total number of fishers as it holds no benefit to the context of this paper.

The second issue presents a greater challenge – the misinterpretation of data. Fundamentally, the issue is that data quality and availability can potentially produce skewed comparisons of greater or lesser risk, concerns that apply to fisher fatalities as well, which is the focus on the remainder of this report.

For example, if Country A provides all its fatalities data, we may end up with a high, but accurate, rate of fisher death. Country B then provides a lower rate of death, but with high uncertainty – and we know from other sources that Country B is not safer than Country A. Instead, it is simply that the information we have from Country B is misleading.

Regardless, providing both statistics as the best available gives the impression that the fisheries sector in Country B is significantly safer than in Country A – which we know is not the case. Instead, we need to make clear it is a difference in data quality.

Finally, we found significant data inconsistencies among other divisions of the industry, such as capture statistics and fish consumption levels [Exhibit 2]. While these may not reflect directly on fatality numbers, their contribution or impact on legislation and some of the key drivers of risk should not be underestimated. This will be addressed in further work by the FISH Safety Foundation.

“EVERY YEAR A SERIES OF CALCULATIONS, ESTIMATES AND FORECASTS WERE MADE THAT NORMALLY FAIL, AND BY FAR; HOWEVER, PROPOSALS ARE RE-ENUNCIATED WITH THE SAME METHODOLOGY AND SIMILAR OR GREATER MISTAKES”

FORMER VICE MINISTER OF FISHERIES, PERU [211]



On location with the FISH Safety Foundation.  
Image above: Darren Mitchell with FISH Safety Associates M. Hasan Joy and  
Dr. Md. Sazedul Hoque in Bangladesh  
Image below: small vessels in the Pacific Islands



## Part 2

### Results

Work on this project remains ongoing due to our constantly expanding information database. While we have chosen not to attempt to determine a global fisher fatality rate, our work is already shedding critical light on how many fishers die around the world each year. By exploring over 30 regional and national sector examples across the globe, our calculations suggest **in excess of 100,000 fishers die annually**.

Yet, this estimate excludes some of the world's most populous fishing communities where we were unable to quantify fatalities due to lack of data. That is, much of the world is not counted in that number *at all*.

The following tables demonstrate the global and industry breakdown of our gathered data.

The information has been sourced through both public resources and private communications from numerous industry contacts. At this time, country names have been removed for privacy reasons and to encourage the consideration of results on a global scale.

A reminder that these numbers **are estimates with large uncertainties** and that while they appear precise, they should not be considered as such. All facts, figures and calculations have been through a full independent fact-check process for verification before final results were determined.

Despite significant uncertainties, the fact that our estimate here is for only selected countries is evidence that even the 100,000 deaths is likely a significant underestimate.

Table 3: Subsectors (Refers to a country with only partial sector information)

Subsector	Location	Continent	Number of fishers	Fatality rate / 100,000	Number of fatalities
All Marine	Country 1	Africa	165,000	155	256
All Marine	Country 2	Africa	600,000	87	522
Artisanal	Country 3	Asia	900,000	190	1710
All Marine	Country 4	Asia	9,484,000	214	20,296
All Marine	Country 5	Asia	141,000	107	151
Commercial	Country 6	Americas	40,000	112	45
Artisanal	Country 7	Africa	8,250	182	15
All Marine	Country 8	Africa	45,000	549	247
All Marine	Country 9	Americas	102,000	296	302
All Marine	Country 10	Asia	404,000	36	146
All Marine	Country 11	Asia	420,000	140	588
Marine	Country 12	Asia	2,241,800	140	3,139
Small Scale	Country 13	Asia	20,000	140	28
Aquaculture	Country 14	Asia	500	380	2
All Marine	Country 15	Europe	1,870	139	3
Artisanal	Country 16	Africa	1,810	92	2
<b>Total Fatalities</b>					<b>27,452</b>

Subsector breakdowns were used in all cases where we were able to identify two key pieces of information for a specific fishery:

1. The number of fishers in that individual subsector
2. The fatality rate specific to the above subsector

This allowed us to develop a more accurate understanding of each subsector and prevented us from applying fatality rates to sectors where they were not accurate or relevant.

Table 4: Regional\* Calculations

Subsector	Location	Continent	Number of fishers	Fatality rate / 100,000	Number of fatalities
Artisanal	Region 1	Africa	3,500,000	1,000	35,000
Commercial	Region 1	Africa	47,000	1,000	470
All Marine	Region 2	Europe	106,000	85	90
Inland	Region 3	Africa	3,500,000	1,800	63,000
<b>Total Fatalities</b>					<b>98,560</b>

\*Regions do not include countries from Table 3; i.e., we have been careful to avoid double counting.

Africa was the only region where we potentially had enough information to predict the number of fatalities occurring in the inland sector.

We chose to include these figures for inland fisheries, and for Africa as a region, for two reasons. Firstly, we had an estimated number of inland fishers for the continent as a whole [25] and it was clear that information for the individual nations within this region is non-existent. Secondly, we were able to calculate an estimation for the number of fatalities on Lake Victoria, which came to approximately 1,800 fatalities per 100,000 fishers on the lake [see Exhibit 3].

We explored the drivers of the fatalities for Lake Victoria as well as other fatalities across inland Africa to see if the drivers were comparable, and if we could justify the extrapolation of the 1,800 fatalities per 100,000 fishers across all inland African fisheries. Ultimately, we decided that the qualitative data supported the extrapolation.

A case study on Africa’s inland fisheries can be found in Part 3 of this paper.

Table 5: Blanket Rates (refers to all fishing sectors within a particular country)

Subsector	Location	Continent	Number of fishers	Fatality rate / 100,000	Number of fatalities
Blanket Rate	Country 17	Africa	28,000	50	14
Blanket Rate	Country 18	Asia	195,000	45	88
Blanket Rate	Country 19	Asia	314,000	75	236
Blanket Rate	Country 20	Americas	54,500	23	13
Blanket Rate	Country 21	Americas	2,500	10	<1
Blanket Rate	Country 22	Americas	8,000	242	19
Blanket Rate	Country 23	Americas	39,000	114	44
Blanket Rate	Country 24	Americas	3,400	134	5
Blanket Rate	Country 25	Oceania	9,700	69	7
Blanket Rate	Country 26	Oceania	42,000	105	44
Blanket Rate	Country 27	Oceania	3,000	288	9
Blanket Rate	Country 28	Oceania	4,000	159	6
Blanket Rate	Country 29	Europe	7,000	18	1
<b>Total Fatalities</b>					<b>486</b>

Blanket rates were provided to fisheries where a generic rate was provided or supplied for *an entire country's fisheries sector*. Typically, we found these rates were only available for nations with smaller sectors.

It may be noted that the number of fatalities that are mentioned in some of the case studies outlined in this report are not included within these results tables. This is an intentional omission as we are not able to confidently verify that we have not already included these fatalities or results in previous numbers.

## Next Steps

Considering the limited data and additional uncertainties into key information such as the total number of fishers, we are unable to produce a global fatality rate as there are simply too many variables.

As stated previously, the fact that a country or region has more information available (as shown for example in the case of both marine and inland fisheries in West Africa) does not necessarily mean that Africa has a higher fatality rate than Asia. It simply means that more information is available in Africa at this time.

To further highlight the importance of recognising this point, consider the fact that the FAO [5] estimates that 85 percent of the world's fishers come from Asia. Yet publically available, credible information from this region is limited. At this stage, fatality estimates do not represent an indicative snapshot of the global industry as a whole and have been excluded.

The secondary challenge we recognised was the serious lack of accuracy in what has typically been considered the primary industry data. Fundamental information – such as the number of fishermen – is based off fragmented data and sometimes questionable methodology. This is not limited to just the fishing industry, but the drivers of risk too.

**There is simply too much we do not know.**

In order to develop a reliable calculation method, we are continuing efforts to gather more information. However, our work to this point has provided case studies that illuminate why fishing is so dangerous – and these give further evidence that our estimate of over 100,000 deaths per year globally is underestimated. We turn to these in our next section.



## Exhibit 3

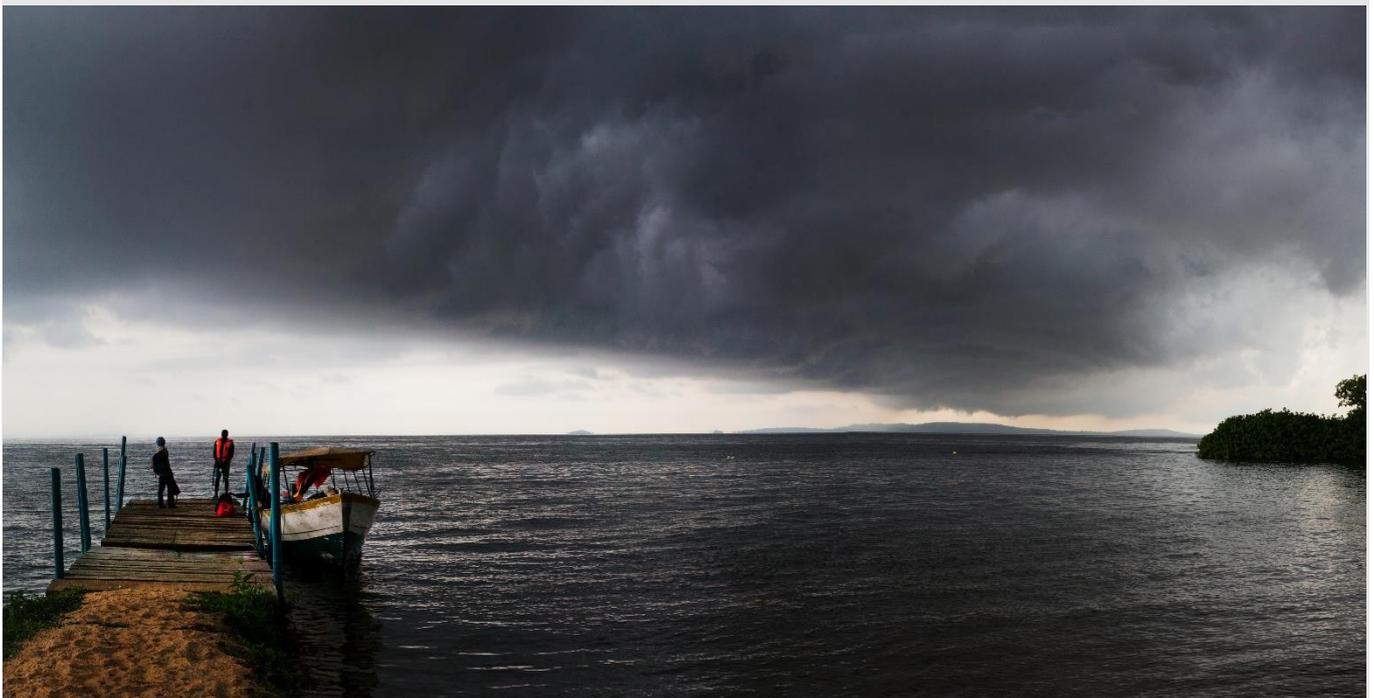
### Lake Victoria Calculations and Justifications

Lake Victoria dominates the inland fishing industry in Africa, with the lake surface area shared by Tanzania (51 percent), Kenya (6 percent) and Uganda (43 percent). We were able to find more information on fishers in this area than in almost any other fishery. While the information has typically been qualitative in nature, we were able to extract enough quantitative data to allow us to develop an estimated fatality rate for the fishers on the Lake.

The first key piece of information we used was that, according to local officials, 5,000 people died on the Lake each year [26]. As we explored this statement, we noted that some media outlets reported that 5,000 *fishermen* died on the Lake each year, while others simply said *people*. Due to this uncertainty, we decided to continue our research until we were able to confirm the nature of these fatalities or find enough information to generate our own calculations.

According to the Lake Victoria Fisheries Organization, there are approximately 220,000 fishers on the Lake [27]. As there is not an even split between the size of each country's fishing sector on the lake, the ratio of fishers from each country was utilised [28] and applied to the total number of fishers to generate an estimated number of fishers for each country.

Figure 6: A storm approaches the Ugandan shore of Lake Victoria. Image Credit: Bill Wegener / Unsplash



Following this, we used a second study that specified that 5 fishers drown every day in the Tanzanian sector of Lake Victoria [29]. When we applied the rate of 5 fatalities per day with the estimated number of fishermen in the Tanzanian sector, it produced a fatality rate of approximately 1,800 per 100,000 fishers.

When we applied this fatality rate to the total number of fishers in the Lake, it suggested just over 4,000 fatalities per year. While this was below the initial statement of 5,000 fatalities, we felt it was justified for use due to the lack of clarity over whether they were exclusively fishing-related deaths or general population.

This statement is further supported by a secondary article which stated that “at least 5,000 people die in major lakes and rivers across [Uganda] every year” [30].

“THIS NUMBER COULD BE HIGHER GIVEN THAT MOST CASES OF DROWNING HAPPEN IN REMOTE DAMS AND SWAMPS AND OFTEN GO UNNOTICED AND ARE NOT DOCUMENTED.”

STATE MINISTER FOR TOURISM GODFREY KIWANDA



On location with the FISH Safety Foundation.

Darren Mitchell running a safety briefing with local fishers in Bangladesh



## Part 3

### Case Studies

The following studies represent just some of the striking individual cases we encountered in our research. In each of these case studies we take a deeper look into the individual drivers that contribute to the challenges within that fishery and attempt to understand what makes fishing so dangerous in these communities.

These examples are essential to demonstrate the interplay and connectivity between the different drivers acting on fisher safety, and how each fishery is vastly different from the next, yet the fundamental issues faced are the same.

As these case studies were developed using information that is publicly available, we have chosen to leave names and identifying features in place. To reiterate, – we do not wish to lay undue blame on countries simply because they have been more transparent.



## Case Study 1 – Divers of Central America Diving Deeper

<b>Location</b>	Central America, Caribbean, and South America
<b>Subsector</b>	Small-Scale, Artisanal, Subsistence, Diving
<b>Number of Fishers</b> [31, 32]	Estimated 33,000 (including 12,000 in OSPESCA region, 13,000 in Chile)
<b>Estimated Fatality Rates</b> [32, 33]	200–2,700 per 100,000
<b>Drivers</b>	Poverty, IUU, Sustainability, Governance

When we explored the case of the Central American divers, it became apparent that there were two very different narratives appearing on the topic, depending on the source of the information. As such, we used this example to demonstrate the importance of utilising a wide range of data sources when investigating these topics.

Across Central and South America, thousands of fishers are being disabled or killed as they dive to catch lobster, sea cucumber and queen conch – much of which is destined for export.

One country of note is Honduras, where almost half the population live below the poverty line – classing it as one of the poorest countries in Central America [34]. Lobster fishing dominates the industry here, with Honduras exporting more than a million kilograms of lobster to the U.S. per year [35].



Lobsters are typically caught using traps or by divers – and both methods are rife with illegal activities. The legal requirements surrounding the use of sustainable traps are ultimately ignored for a better catch, but it is the use of divers in this industry that we feel warrants further attention.

Figure 8: A fisherman shows off his freshly caught lobster. Image credit: © Can Stock Photo / ccalvarez

Many of the men in Indigenous communities here rely on lobster for their livelihood – they say it is their only option. Years of high demand, overfishing, and damage to marine ecosystems have all contributed to reduced stock levels. Best practise diving techniques are ignored in order to dive more often while the divers descend to greater depths to secure their catch.

Local law dictates that divers must not perform more than two deeper-than-60-foot dives per day, but an investigation by WWF witnessed divers performing up to 13 dives per day, some as deep as 150 feet [33, 35, 37]. Decompression sickness, which occurs when divers surface too quickly especially from greater depths or perform multiple dives in a short period of time, is a very real danger.



Figure 9: A Nicaraguan Fisherman heads to sea. Image credit: © Can Stock Photo / cfalvarez

While decompression sickness can be treated with sessions in hyperbaric chambers, they should begin within 24 hours of the incident. However, due to lack of facilities and increased local demand, divers often have to wait several days before receiving treatment, reducing their chances of recovery. Further ongoing treatment is unusually required for between three and 12 months, but the cost is far beyond the means of these communities, further reducing their chances of recovery [36, 38].

**DRIVEN BY POVERTY, DIVERS – EVEN IF INJURED – RETURN TO THEIR BOATS. WHEN YOU ASK THEM WHY – THEY SAY THEIR KIDS ARE HUNGRY. WHEN SOMEONE TELLS YOU THAT THEIR KIDS ARE HUNGRY, THERE’S NO NEED TO ASK ANOTHER QUESTION. [214]**

Based on information obtained for this region, fatality rates may be as high as 800 per 100,000 fishermen [33].

Unfortunately, this case in Honduras is by no means unique. An almost identical situation has been reported further along the poverty-ridden coast in the Nicaraguan lobster fishery.

As lobster populations decline in the nearshore shallower waters due to overfishing, fishers here too are forced into deeper waters, relying on old or broken diving gear such as recycled compressed air tanks or breathing hoses attached to air compressors on the surface. Local fishing advocates say this equipment is poorly maintained, with masks often leaking, and sediment and oil filling the tanks and clogging the hoses, causing fishers to quickly ascend from depths of up to 180 feet.

Divers usually make 12–16 trips a day – with up to 20 submersions on days when they are on large lobster numbers. Nearly all divers in this region show symptoms of decompression sickness [39].

As witnessed in Honduras, treatment options for these fishers are limited and usually delayed, often contributing to permanent disability or death.

## Exhibit 4

### LEGISLATION IN THE NICARAGUAN DIVING INDUSTRY

#### **The investigative journalism view**

Bowing to international pressure in 2007, Nicaragua's National Assembly approved legislation with a three-year window to phase out diving in the lobster industry and shift to the exclusive use of traps.

Following industry pushback – stating that the cost of converting operations was too high – the government agreed to postpone the implementation of the new legislation to give the industry more time.

In 2021, lobster diving continued, unchanged and unregulated. Workplace regulations – including international conventions – are flouted and not enforced.

“THERE ARE MANY LOGICAL REASONS TO REPLACE DIVING WITH TRAPS, BUT THERE ISN'T THE POLITICAL WILL TO DO IT.”

RENFRED PAISANO, ASSOCIATE DEAN OF THE FACULTY OF LAW AND SOCIAL SCIENCE,  
BLUEFIELDS INDIAN AND CARIBBEAN UNIVERSITY

Evidence of corruption exists, with officials at high levels financially invested in the industry [40].

#### **The industry publication view**

According to Article 13 of the Regulation OSP-02-09 for the regional management of the Caribbean lobster fishery (*Panulirus argus*), all member countries were to establish the culmination of autonomous diving in this fishery by the year 2011.

While this date passed without achieving the outlined objective due to the complexity of the diving problems, further extensions and adjustments were granted, with the latest update to regulation 13 stating in December 2019 that “*The Member States shall take the necessary measures to prohibit autonomous diving in lobster fishing in accordance with national plans for that purpose*” [41].

According to lobster diver Edmundo Stanley Antonio, they don't have any other option: There's no other work. At age 33, he continues to dive against medical advice – knowing his next dive could kill him. A previous accident left him partially paralysed for a year with decompression sickness.

His wife, Linda, has already lost her brother and a son-in-law to diving accidents. She begs him to stop but admits, "Because of our economic need, there's no other way. The reality is very sad" [40].

The numbers of fishers, injuries and fatalities in these Nicaraguan communities, and many others, are not recorded.

### A Global Issue

Research by Bassett [32] identified 118 diving communities across 60 countries, highlighting the global spread of dive fisheries. In the fisheries where stocks are monitored, more than half were reported to be depleted, with trends indicating both fatality rates and stock depletion were consistently lower in high-income countries.

While the exact number of dive fishers is unknown, previous investigations in the 1990s indicated some 33,000 operating in Central and South America, 10,000 in the Philippines and thousands more across Indonesia [42].

Modern-day numbers of fishers are likely to be considerably higher.

<b>Table 6: International Incident and Fatality Rates [32]</b>	
Marinduque, Philippines	Fatality rate of 5,000 per 100,000
Thai Urak Lawoi people	Fatality rate of 3,000 per 100,000 97.9% of divers experiencing symptoms consistent with decompression illness
Grenada, lobster and conch	Fatality rate of 2,700 per 100,000
Miskito Keys	Decompression illness – 128 incidents from 123 divers interviewed
Taiwan dive fishery	Decompression Sickness incidence up to 72.6%
Sri Lanka, sea cucumber	As divers increased submersion distances, accidents became more frequent, however morbidity and mortality rates are not quantified.
Tuvalu	Deaths led to closure of fishery
Tanzania, sea cucumber	Several serious cases of paralysis; death not uncommon

## Challenges and Drivers

This situation demonstrates a complex web of intertwined drivers which all contribute to the risks faced by local fishers. For divers in Central and South America, these include the lack of baseline data, illegal fishing, lack of government interventions, corruption, environmental degradation, overfishing, economic stability, and poverty.

### Data

There are obvious concerns with data on the diving communities around the world. Due to the typically unreported nature of the subsector, efforts to develop safety measures are hampered. The recently released FAO *The Reference guidelines to legislate or regulate diving in artisanal or small-scale fishing in the Latin American and Caribbean region* [43] states: “The States should, as a first step, recognise the actual artisanal or small-scale fishing effort exerted in fisheries. For this reason, the States should design the Registry system in such a way that it allows the progressive regularization and formalization of the artisanal or small-scale fishermen who operate in the various national fisheries” [as translated].

### IUU

Illegal fishing practices plague diving and related industries around the globe, including unregulated diving methods, fishing in closed seasons and protected areas, fishing for endangered species, and exceeding catch quotas. These illegal practices directly contribute to all aspects of the data challenges, including mortality numbers. In Brazil, for example, it was highlighted that injured or disabled fishers often don't report their accidents as most accidents occurred during the times of fishing bans [44]. Thus, despite the local fisheries groups being aware of the event, they are not recorded.

## Exhibit 5

### **MEXICO'S SEA CUCUMBER FISHERY [45, 46]**

Mexico's fishing industry is rife with illegal fishing. While precise figures are unknown, it is estimated that IUU accounts for between 45 percent and 90 percent of official fish production in Mexico; 59 percent of it gets exported to the United States.

The harvesting of sea cucumber off Yucatan was heavily promoted in the early 2000s. Driven by middlemen trafficking the expensive delicacy to China, harvesting took off at an unprecedented pace around 2012, with existing regulatory or management practices failing to keep up.

In the years since, the industry has been marred by illegal fishing and violent conflict, even contributing to piracy and the rise of local militias. Injuries and deaths due to decompression sickness are common.

Sea cucumber numbers in the region dropped dramatically as overfishing led to the collapse of this ecologically vital species, with 20,000 tons available in 2009, to 1,900 tonnes in 2013, with the number said to have continued to drop since.

In 2017, U.S. Federal courts charged a small group of people with smuggling over \$17 million worth of sea cucumbers from Yucatan through the U.S. and then on to markets in Asia, demonstrating that the demand for the product continues.

By 2018, approximately 1,000 poachers were still operating in this area.



### SUCCESSFUL LEGISLATIVE APPROACHES [32]

#### Governance

Weakness in governance, resource management and/or legislation has been noted as a contributing factor to overfishing and other illegal behaviours in this region.

Workers have raised the issue of labour exploitation, but there remains a lack of government oversight. 2004 saw a local divers association claim that some bosses had threatened workers with a gun to perform dives of up to 130 feet without suitable equipment [37, 40].

In many places, law enforcement has not been able to overcome resource, enforcement and corruption problems. Evidence of corruption exists at a local level too. This was demonstrated with a failed attempt to open a diving school to help solve the problems of the local industry as reported by the director of an NGO. The school failed for a number of reasons, including leaders from some of the regions allegedly illegally appropriating their fellow divers' quotas [38].

There have been some successful efforts to reducing fatalities in the industry, including:

- The British Columbia geoduck fishery – a 66% reduction in fatalities after the implementation of catch quotas.
- Western Australia wild pearl oyster fishery – an estimated 4,000% decrease in decompression sickness events with new regulations (including mandatory medical examinations).
- Vietnam – a 75% reduction in decompression illness incidence following interventions, although no reporting into the social or economic impacts of these interventions was completed.

In recent times there has been some action into developing intervention measures [43, 41]. The FAO *The Reference guidelines to legislate or regulate diving in artisanal or small-scale fishing in Latin America and Caribbean region* [43] were created following the request from a number of local countries for assistance to address the problem of accidents within the dive industry. According to the FAO the main purpose of these guidelines is to “provide legal elements that help to sensitize fishing communities about the importance of complying with the rules, and also create inter-institutional articulation mechanisms for the application of those rules” [41].

While these measures serve as the beginning of a solid framework, they may fail to consider the social and economic aspects of diving – such as the absence of other income options, poverty and the lack of access to finance which would be needed to improve the safety of equipment. Essentially, they address why the practise is unsafe, but may not consider that in many cases – the divers perceive they have no other choice.

## Poverty

Many of these fishers are geographically, socially and politically marginalised [33]. As with many artisanal fishing communities, their ability to influence the policy changes that directly impact their future and livelihoods is minimal. If a diver is disabled, he is further marginalized from society, relying heavily on friends and family for both physical and financial support until he recovers, if he ever does [39]. Driven by poverty, they have no choice but to fish.

“NO WORK. JUST THE DIVING. [WITHOUT IT] WE DIE OF HUNGER.”

CLIFFORD PINER, 68, VETERAN FISHERMAN [40]



Figure 11: A disabled man patrols a beach in Nicaragua. Image credit: © Can Stock Photo / cfalvarez

## Exhibit 7

### A DIFFERENT PERSPECTIVE

In April 2022 the FAO Western Central Atlantic Fishery Commission published a paper entitled *Health and safety in the dive fisheries of key species in the WECAFC region* [41]. This report took a different approach to the safety of these diving communities than the other resources we had explored.

According to this report, the fishers themselves are also to blame for the high fatality rate. Their reluctance to follow guidelines developed by local governments to improve safety in the sector is then compounded by other contributing factors, such as the use of divers instead of traps, poor access to medical treatment, and in some cases, a lack of coordinated approach to governance at a national or regional level. As divers typically lack specific diving training or experience, their “ignorance and performance of dangerously unsafe practices” form the crux of the problem.

In addition, little to no training, improper equipment, poor maintenance, and strenuous working conditions further contribute to the incident rates in the region.

The Executive Director of the Caribbean Regional Fisheries Mechanism (CRFM) indicated that autonomous diving has not represented a major problem in most countries in the region with the exception of Jamaica. In some isolated incidents, divers disappeared or had decompression accidents.

There have been numerous regulatory measures put in place across the region to improve the safety of the industry, with varying levels of success, highlighting the complexity of the challenge.

- In Honduras, size limits on sea cucumbers have been introduced, and local divers are blamed for aggravating overexploitation by collecting sea cucumbers well below their legal size. While these sea cucumbers aren't (or shouldn't be) processed in local processing plants, international buyers frequent fishing areas and purchase this catch for its high export value.
- In the Dominican Republic, regulators find it incredibly hard to enforce rules as the coastal communities refuse to follow them. The sea cucumber fishery was closed in 2019, yet over 1,500kg of it was exported to the United States that year, followed by over 1,000kg in the period to July 2020. This indicates that despite it being an illegal fishery, exports are still occurring without necessary controls.
- Mexico has a greater range of regulatory framework to protect the safety of fishers, yet in many cases the fisher is unaware of this. Here, fatalities are put down to increased numbers of fishers in the sea cucumber season, weak regulatory enforcement, and lack of access to first aid or medical treatment.

Due to various economic and technical reasons, banning fisheries would not be effective, and governments may instead aim to promote safety measures and education within the industry, resulting in the previously mentioned FAO *Reference guidelines to legislate or regulate diving in artisanal or small-scale fishing in Latin America and Caribbean region*.

The report similarly notes excessive submersions by divers, stating that “it is common to hear that captains force fishermen to dive more than 5 times per day, diving up to 90 feet deep to search [for] lobsters, and even under the influence of drugs,” but argues that the interviews conducted in the study suggest that captains dispute this, because “if a diver refuses to fish, there is no way to force him”. This is a point raised in both the Honduras and Nicaragua sections of the paper.

In Honduras – as the initial focus region of this FSF case study – the barriers to achieving the goal of ending autonomous diving are listed as:

- A lack of training. An estimated 90percent of divers are aware of the dangers, but only 20 percent have received formal training.
- Miskito divers insist there is no economic alternative, and that diving is the only profitable activity. Several governments and non-governmental organisation proposals have been implemented, though none have been successful as local communities do not consider them viable.
- Their vocation as fisherfolk motivates them to consider fishing as the only viable activity. Other fishery options in the area either do not have capacity or come with increased transportation costs.
- The state needs to increase capacity and efficiency to enforce existing regulatory frameworks and focus on decent working conditions and social security for fishers.

## Case Study 2 – Marine Fishers, West Coast of Africa

<b>Location</b>	West Coast of Africa
<b>Subsector</b>	Artisanal, Small-Scale, Subsistence, Industrial
<b>Number of Fishers [47]</b>	3,500,000
<b>Estimated Fatality Rates [48]</b>	1,000 per 100,000
<b>Drivers</b>	IUU, Climate Change, Sustainability, Governance, Poverty

The Ministerial Conference on Fisheries Cooperation among African States Bordering the Atlantic Ocean (COMHAFAT ATLAFCO) consists of 22 member states along the west coast of Africa [49]. In 2018, it outlined that the yearly fatality rate for fishers in the region was about 10 times higher than that in higher-income countries – around 1,000 per 100,000 [48].

The report outlined that the challenges faced by fishers in these countries differ from those in developed ones, including:

- Most of the fleet consists of small and often non-motorized vessels.
- Resources are lacking across multiple sectors, including trained crew members, trainers and inspectors; search and rescue operations are costly and need a coordinated approach among multiple organisations; and there is limited infrastructure to support enforcement initiatives.
- The perception that the value of human life is culturally determined (low societal value of life).

The safety of fishermen in this region is being compromised by a combination of factors. Climate change and IUU contribute to the rapidly declining fish stocks in the area – thus forcing the fishers to expand their operations in both times and distance. This is done in vessels ill equipped for the longer journeys, increasing their risks of vessel-related incidents. At the same time, they are at risk of collision or conflict with industrial fleets, piracy, and boundary disputes. Compounding this further still are the effects of climate change on the weather, making the fishers vulnerable to sudden weather extremes and changeable patterns.

Many of the West African countries have opened the EEZs to foreign industrial fleets, and unfortunately, illegal fishing practices are rife in all sectors, with as much as 40 percent of all fish caught in the region said to originate from illegal fishing [50].

The industrial fishing fleets are often associated with abuses of human rights. According to Ghanaian crew members working on foreign-owned industrial trawlers, abuse was a common issue [51, 50] with instances of inadequate food and water, hazardous working conditions, lack of shelter or toilet facilities, physical abuse and underpayment all recorded. It is estimated that 47,000 African workers work on board these industrial trawlers [52].

In addition, with high levels of industrial fishing taking place along this coast, artisanal fishers often find themselves in direct conflict with larger vessels as they intrude into inshore areas reserved for small-scale fishing communities [50, 53].

**IN WEST AFRICA, COLLISIONS WITH INDUSTRIAL VESSELS KILL OVER 250 ARTISANAL FISHERS ANNUALLY. ACROSS AFRICA, THE TOLL MAY BE AS HIGH AS 1000 DEATHS PER YEAR.**

ECOTRUST CANADA [53]

Collisions between industrial vessels (both legal and otherwise) and artisanal fishing vessels are common. In Sierra Leone [54], a 34-year-old mackerel fisherman describes the aggression local fishers have faced when protesting industrial fishers trawling illegally in prohibited areas, including having boiling water thrown at him.

Figure 12: Fishers in Ghana performing prayer rituals as they head out to sea at dusk. Image Credit: Efe Kurnaz / Unsplash



## Exhibit 8

### LOCAL BENEFIT ... QUESTIONABLE AT BEST

Even when foreign vessels are licenced to fish in African waters, locals often fail to benefit. Vessel sizes and catches are frequently misreported, and vessels use environmentally damaging fishing methods, intrude into prohibited fishing zones, damage local fishers' gear and compromise the fisheries stocks that are essential to food security for millions of people in the regions.

Official figures show that between 2000 and 2010, boats from China and Europe caught fish valued at \$8.3 billion from the waters off West Africa, yet only \$0.5 billion made its way back to local economies [55]. It is estimated that an additional \$2 billion worth of fish is extracted from local waters through IUU fishing.

Many governments simply lack the capacity or resources to monitor fishing activities or collect revenue from these foreign parties.

**“BEFORE, THE TRAWLERS WEREN'T IN OUR ZONES, NOW THEY ARE. THE DIFFERENCE [IN CATCH] IS SO GREAT COMPARED WITH BEFORE, I'M STRUGGLING TO FEED MY CHILDREN.”**

LOCAL FISHER [54]

### Drivers and Challenges

In 2020, in a virtual conference, *Capacity building for communicators on the sustainable management of fishery resources and the fight against IUU fishing*, Mohamed Sadiki (head of the Department of Programs and Projects at ATLAFCO) offered a presentation titled “The sustainable development of the fishing sector in the ATLAFCO area: assets and threats” [56]. In this, he outlined some of the threats to the fishing sector in the region [direct from his presentation]:

- The worrying preponderance of piracy and IUU fishing, exacerbated by the lack of means for coastal surveillance.
- Institutional weaknesses and inadequate governance of national and shared fisheries resources.
- Low adherence to relevant international legal instruments and their integration into national legislation.
- The consultative mandate of the RFOs does not allow their decisions to be binding.
- Low resilience to the effects of climate change.
- Low socioeconomic resilience to epidemics and pandemics, which are rampant in the regions.
- Precarious working conditions, safety, and security of seafarers.
- Population growth and strong coastal development and urbanization put pressure on capture fishing and accentuate overexploitation and pollution of the marine environment.

## Governance

There are a broad range of issues connected with governance, legislation, and enforcement across the various countries in this region. While these apply to each country at individual rates, they are all applicable in the regional outcomes.

Enforcement and monitoring options are limited across the lower-income countries, which leaves them vulnerable to illegal fishing as they simple do not have the capacity to prevent it.

Unintended consequences of legislation must be considered – as demonstrated by an increase in illegal fishing activity occurring as a direct result of restrictions to the legal fishing fleet in Senegal, which drives the migration of artisanal fishers [52]. There is a dire need for the increased involvement of the local fishers in the development of any fisheries management approaches to avoid these situations.

While there have been various efforts and initiatives introduced to attempt to manage the sector across West Africa, these have produced limited results, due to capacity constraints, policing and funding efforts, and allegations of corruption on various levels.

## Exhibit 9

### THE CASE OF THE MISSING FISHERIES OBSERVER – GHANA [51]

A report by the Environmental Justice Foundation (EJF) recently explored the case of a missing fisheries observer who disappeared from his cabin on a Chinese-owned fishing vessel operating off the coast of Ghana.

According to his family, Emmanuel Essien had video evidence of illegal fishing onboard the trawler he was working on, which he handed to police on shore. Two weeks later, he went missing.

The police investigation brought up no signs of anything to suggest anything sinister had occurred, but his family believe he was murdered.

The report further supports accounts of fisheries observers and crew members being offered bribes, or even being threatened, starved, or beaten.

#### Government Response

In response to these claims, Ghanaian officials report none of these abuses have been reported to authorities. However, both crew members and observers highlight their fear of the consequences of making official complaints.

## Corruption

Multiple African political leaders are alleged to have direct financial interests with foreign fishing companies, with accompanying information such as quotas and payment structures, hidden from public view [57, 58].

Ghanaian law prohibits foreign fishing vessels from operating in its waters, yet investigations by EJF suggest that many of the Ghanaian industrial trawlers are actually owned by Chinese companies using Ghanaian front companies to get around these requirements [51].

While these Ghanaian vessels are required to have a fisheries observer on board, these observers are paid by the Ghana Industrial Trawlers Association, rather than by the government.

## IUU

Increased piracy has been recorded in the area, likely as a direct result of poverty and the lack of alternative employment options. According to Christian Bueger, a professor of international relations at the University of Copenhagen:

“ILLEGAL FISHING BASICALLY UNDERMINES THE WELFARE OF COASTAL POPULATIONS, AND IT ALSO UNDERMINES THEIR FOOD SECURITY, LEADS TO A LACK OF EMPLOYMENT OPPORTUNITIES. THIS, IN TURN, MAY ENCOURAGE SOME UNEMPLOYED INDIVIDUALS TO TURN TO CRIME AT SEA, INCLUDING PIRACY OR SMUGGLING.” [51]

In some cases, the artisanal “IUU” fishing could be considered to be *IUU by necessity*. In one example, Senegalese waters are being overfished by foreign vessels – many of which too are operating illegally – causing the local Senegalese fishers, who land 80 percent of the country’s catch, to extend further into foreign waters, thus classifying them as IUU fishers.

At the same time, artisanal fishers do have to bear some responsibility for ignoring regulations. A fish processor in [name removed] compares the fishermen to the fish, stating that “Once in the water, he does what he wants.” This is confirmed by the vice president of a local fishing association, who said that “once the fish get scarce, some local fishermen will use the most destructive and desperate means to secure their catch, for instance using nets with very small mesh, not to mention the dynamite...”

The use of destructive fishing methods or equipment – such as the fine, mono-filament nets – is a very real problem across the African continent in both marine and inland fishing. As much as 90 percent of the nets used in these areas are nylon nets, which despite being illegal, are readily available [59, 50].

## Fish Stocks and Environmental Degradation

Evidence demonstrates that the fisheries stocks of Africa's coasts are declining at a rapid rate due to the impacts of climate change and massive overexploitation of the region's resources. Habitat degradation from trawlers contributes to the decline of fish stocks, both through excessive bycatch and the damage to essential fish nurseries from trawling gear [52]. In Sierra Leone's Tombo waterfront, fishermen are reporting a drastic decline in fish stocks due to continued overfishing from industrial vessels – a pattern again replicated across the African coast [54].

The volumes of trawl bycatch should not be underestimated. In the deep-water shrimp fisheries off Senegal, for example, a shrimp vessel can catch a variety of species, but only the pink shrimp are kept. The remaining species are returned to the ocean, though by that point they are usually dead. A boat capable of catching 5 tonnes of fish per load is reported to keep as little as 200kg of the catch [60].

In other areas of the coast, local fishers are having to adjust their fishing practises to target different fish species – such as shark – to survive as industrial fleets continue to fish off their coast [61]. While shark fishing is not a new practise, the increased demand may cause it to become unsustainable.

## Poverty

The impact of IUU, declining stock and weak management regimes contribute directly to poverty, causing significant loss of economic revenue and resulting in the deteriorating conditions of the fisheries-dependent communities. In six of these countries alone (Mauritania, Senegal, The Gambia, Guinea Bissau, Guinea, and Sierra Leone), illegal fishing is estimated to reduce the number of jobs in the artisanal sector by 300,000 [50].

“THE CHINESE FLEET HAS BEEN TAKING THE PROFITS OF THE FISHERIES FOR 30 YEARS AND THE IMPACT ON FISH STOCKS HAS BEEN TERRIBLE. THE RESOURCES ARE DISAPPEARING, FISHERMEN ARE SUFFERING, FAMILIES ARE STARVING. MANY HAVE JUST ONE MEAL A DAY.”

STEPHEN AKESTER, ADVISER TO SIERRA LEONE'S MINISTRY OF FISHERIES AND MARINE RESOURCES 2009-2021 [54]

## Data

The recording of catches in this region is fragmented at best and is closely entwined in IUU activities in both industrial and artisanal sectors. Senegalese fishers, for example, often fish in the waters of neighbouring countries, with some 40 percent of their artisanal catches coming from foreign waters. These catches, however, are often not recorded, or allocated to their rightful EEZ, and are instead classified as IUU [50].

### THE LACK OF KNOWLEDGE AND CAPACITY TO EFFECTIVELY MONITOR TERRITORIAL WATERS AND FISHING VESSELS CONTRIBUTES TO THE EXPANSION OF THIS ILLEGAL ACTIVITY.

NAJI LAAMRICH – COMHAFT [56]

In Ghana, official catch data from trawlers is self-reported to the Fisheries Commission, who concede that it is not reliable. In addition, the practice of *saiko* – where fish caught by trawlers (often illegally) is sold back to artisanal fishers, is commonplace, with volumes not reported or recorded [62]. The alleged underreporting by industrial vessels is a common theme in our research, with similar allegations made in all the countries we investigated.

Similarly, the lack of accident reporting and recording has been highlighted as a notable issue – with fatalities only reported if they happen in urban centres. This limits the ability to use the data to identify and address key issues [9].

## Case Study 3 – Mangrove Fishers of the Sundarbans Mangrove Forests

<b>Location</b>	Bangladesh and India
<b>Subsector</b>	Small-Scale, Artisanal, Subsistence, Aquaculture
<b>Number of Fishers</b>	Unknown
<b>Estimated Fatality Rate</b>	Unknown
<b>Drivers</b>	Climate Change, IUU, Sustainability, Poverty, Governance, Piracy

Our ongoing work has highlighted the many challenges facing the fishers in the Bay of Bengal Region, including India, Bangladesh, Sri Lanka and Myanmar. Here, we focus on the fishers in the Sundarbans Mangrove Forests.

The Sundarbans Mangrove Forests form the world’s largest mangrove forests, shared between India (38 percent) and Bangladesh (62 percent) and directly supporting the livelihoods of over 4 million people. It is also a UNESCO World Heritage Site, which includes specific zones that require with the appropriate permit for access [63, 64].

It should be noted here that we were unable to quantify the number of fishers in the area or fatality rates among their communities – the numbers of people living and fishing within the mangrove forests are unknown due to the constant migration [65, 66]. Despite this, we can still highlight some of the drivers of risk the fishers in the area experience. As with all the case studies, none of the drivers is independent, instead operating in a unique relationship with each other, based on a multitude of other factors.

### Climate Change

Climate change is one of the single biggest challenges faced by those living and working in the mangroves, contributing to a number of individual and cumulative problems. Eighty-eight percent of fishers interviewed across two districts of Bangladesh said that climate change has caused a decrease in their family’s income over recent years [67].

Bangladesh is particularly vulnerable to climate change due to its height above sea level. South-Central Bangladesh, averaging only 3–6m above sea level, is considered one of the most disaster-prone areas in the world [68]. Analysis of over a century of data indicates that the Sundarbans region has seen a 26 percent rise in the number of tropical storms, with that rate accelerating in the last decade [69].

SEVERAL HUNDRED THOUSAND COASTAL BANGLADESHIS — MANY OF WHOM WERE FISHERIES DEPENDENT — HAVE DIED DUE TO CLIMATIC HAZARDS OVER THE LAST FEW DECADES [68].



Figure 13: Crab Collectors boats, where three fishers will spend between 7 and 10 days living on board while collecting crabs. Photo Credit: Megnaa Mehta

One of the factors contributing to this vulnerability is clearance of over 5,000 square kilometres of mangroves over the last two centuries, limiting the mangrove forest's ability to stall the progress of the storms as they make landfall. The impacts of these storms, such as Cyclone Aila in 2009, then contribute to the change in land use towards illegal aquaculture. Frequent cyclones and altered land use allow salt water to penetrate embankments and flood agricultural land, making it infertile for crops. In some places, even nine years after the cyclone, the increased salinity in the land remained [63, 68, 70, 71]. This issue of salinity also impacts the brackish water of the mangroves, which serve as the spawning grounds for multiple fish species, which then results in changes to fish breeding patterns and reduced fish diversity.

Climate change in the region has a significant knock-on effect. The impacts of cyclones on land, infrastructure and communities contribute to poverty and drive migration. Poverty, however, has been shown to increase one's vulnerability to slavery, with traffickers targeting those desperate to find work with the promise of income opportunities in other areas. Child labour is also commonly seen in various regions of the Sundarbans [70, 72].

The ecological importance of the mangroves must not be underestimated as they support a range of critical interconnected food webs which directly sustain fisheries – and life [73]. They act as a nursery for almost 90 percent of aquatic species in the region, and the increase of water salinity has changed the behaviours of fish and other aquatic species, causing them – and fishers – to move into different parts of the forests [66, 74].

## Human-Animal Conflict

The increase in human-animal conflict occurs simultaneously with the impacts of climate change, due to the changes in the environment forcing both people and animals, such as tigers, to adapt their behaviours [75].

An unknown number of people fall victim to tiger attacks while fishing in the mangroves, but due to inaccurate – or even non-existent – recording methods, the true number has never been determined [63, 76, 77, 78].

Evidence suggests that the number of attacks is increasing as both countries experience an increase in the number of people entering the forests due to the COVID-19 pandemic.

While local officials in West Bengal (India) state that the total number of tiger attacks in the region for the entire 2021 period was 11, local activists in the region recorded as many as 40 tiger attacks between October and December 2021 alone. The majority of attacks are not reported, and the reasoning behind this may be influenced by the various regulations that apply within the two countries. Local newspapers in West Bengal only report on attacks which happen in areas where entry into the forest is allowed, while several cases in both India and Bangladesh highlight that only a small percentage of attacks are ever formally recorded. It appears – in both countries — that in order for a person to be formally recognised as a victim of a tiger attack, certain criteria need to be met. Families are also reluctant to report the attacks due to fear of consequences, as they often occur in areas where access is not permitted [69, 77, 78].

Compensation to victims' families is said to be available by the Forest and Fisheries Departments within the Sundarbans, however the criteria for this compensation, and the bureaucratic process of the application, means it is seldom received. Victims must be licenced, fishing within the permitted area, and have their bodies recovered for post-mortems to be eligible [78, 79] – and in the rare cases that these criteria are met, compensation is not always granted.

Government officials in West Bengal stated that 100 people had been killed by tigers in the Sundarbans over the previous seven years. In this time, only 5 families applied for compensation, and of those, only three were granted. This leaves potentially hundreds of families without compensation for their loss each year [78, 80].

## Human conflict

Not only are there risks of attacks from tigers, but humans pose a very real threat too. *Dacoits* (armed robbers or pirates) are known to prowl the mangroves, kidnapping locals, or stealing their boats or catch. Violent attacks are not uncommon. In one study, a respondent stated that:

“THE PIRATES ARE VERY CRUEL. IF THE VICTIM FISHER’S FAMILY CANNOT GIVE THEM RANSOM, THE PIRATES TORTURED THE VICTIM [FISHERMAN] AND SOMETIMES KILLED AND THREW THEM IN THE RIVER” [68].

These ransoms can be the equivalent of over two years’ income for the victims’ families, causing them to sell livestock and borrow from loan sharks in order to free the fisher – but ultimately pushing them deeper into poverty [68, 70, 81, 82].

This is a problem beyond the mangrove fisheries, also affecting deeper-water fisheries in the Bay of Bengal. There does seem to be a hesitancy to report these attacks to law enforcement, though the reasoning for this depends on whom you talk to. Some reports indicate that victims feel like their chances of rescue are lower if the attacks are reported, some fear conviction for entering the illegal core areas of the mangrove forests, while others imply that law enforcement agencies simply ignore the issue [78, 82, 83].

Figure 14: Crab collecting in the mangrove creeks. Image credit: Megnaa Mehta

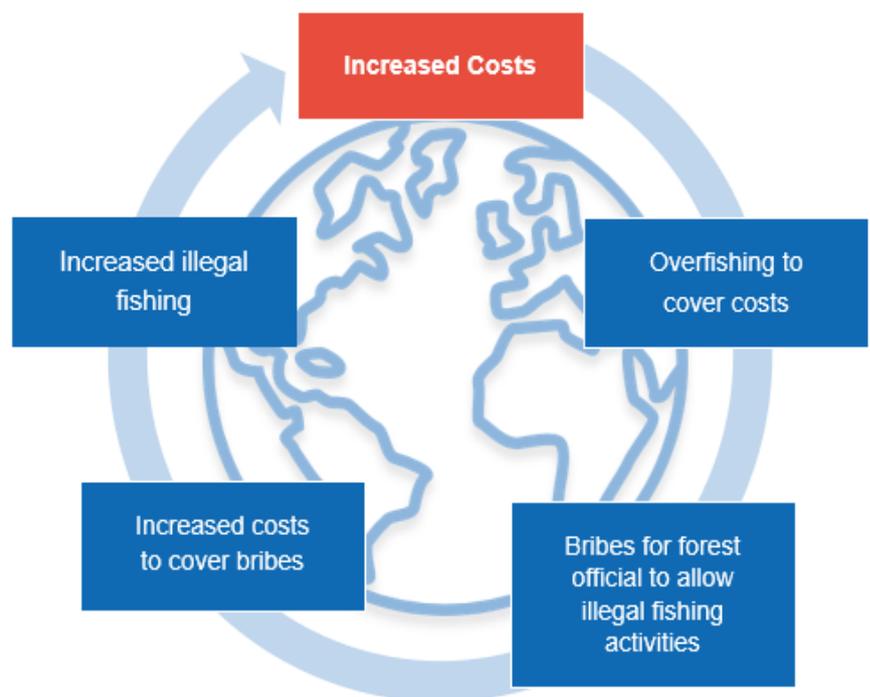


## Governance

Despite its status as a World Heritage Site, and the fact that millions of people are directly reliant on the forests as their only livelihood source, there has been a consistent lack of governance input into the management of both coastal and mangrove fisheries [72, 82].

“WE ARE FISHERS IN THE CHADPAI RANGE OF SUNDARBAN. WE MUST COLLECT A PERMIT FOR FISHING BY PAYING A CERTAIN AMOUNT OF FEES. BUT PERMIT-ISSUING FISHERIES OFFICIALS ALWAYS CHARGE EXTRA MONEY. OUR INCOME FOR FISHING PER WEEK IS ABOUT TAKA 1000 (€10) PER PERSON. SO, WE MUST HAVE SOME SAVINGS FOR PAYING THE CUSTOMARY FEES AS WELL AS THE EXTRA MONEY CHARGED BY CIVIL SERVANTS. BUT IN THE SUNDARBANS AREA, THERE ARE SOME ACTIVE ILLEGAL ELEMENTS. THEY DIVIDE THE TOTAL AREA INTO DIFFERENT ZONES FOR COLLECTING EXTORTION. WE MUST PAY TAKA 500 (€5) PER WEEK AS EXTORTION. MOREOVER, SOME CORRUPT FOREST OFFICIALS ALSO CHARGE EXTRA MONEY DURING FISHING.

IN THIS WAY, MOST OF OUR INCOMES GOES INTO THE POCKETS OF OTHERS. BUT WE MUST SURVIVE. SO, WE COMPENSATE OUR LOSS BY CATCHING MORE FISH THAN LIMITED BY THE PERMITS; KEEP THOSE HIDDEN UNDER THE DECK OF OUR BOAT.”



GROUP DISCUSSION – FOZOL MIA, JOYNAL, AND SAJIB DAS [72]

In an emerging trend, the paper *Barriers to Climate Change Adaptation: Insights from the Sundarbans Mangrove-Based Fisheries of Bangladesh* highlighted the negative impact some regulations can have on fishers' livelihoods. All interviewed fishers from the Mathurapur and Datinakhali districts stated that the two-month fishing bans in the Sundarbans affected their livelihoods negatively [68]. As fishing is their only income, the ban reinforces their poverty and drives illegal and/or unsafe behaviours, including fishing in extreme weather conditions.

We found this issue repeated in other areas around the world – where fishers, particularly small-scale fishers, have no voice in the development of legislation. In India, fishers are considered of low status, resulting in them being “left behind” in politics based very much on power and standing.

### **Boat Licencing and Fishing Permits**

In Bangladesh, the government has made some attempt to manage the demand placed on the mangrove ecosystems through the use of a licence systems which requires the possession of a licence to gain access to the forest. However, it is reported that some local fishers feel the government is prioritising nature over their lives, with one local fisher stating “There are maybe 100 licences at a time, and 10,000 people needing to go to the forest. In the name of saving nature, they put our lives at risk.” Other reports imply corruption could be occurring within this process too, as fishers report having to pay in reality 10 to 15 times the stated amount of fishing permits in order to secure them [70, 75].

Further laws and regulations do exist but are similarly ignored due to lack of enforcement or corruption within various agencies. The collection of shrimp fry (for aquaculture) is prohibited, yet collectors simply bribe enforcers and continue their activities. Similarly, fishing during off seasons, in banned areas and for protected species is commonplace [68, 73, 81].

## Exhibit 10

### The Boat Licence Certificates (BLCs) of India

The injustice of the fishing licencing system in India is something that came up regularly during our research into the area. The management of this system is reportedly so poor that even the essential information – such as the number of permits available, seems to be unknown with figures varying wildly. Related corruption has led some to contend forest officials are more dangerous than tigers [84].

In 1973, with the establishment of the Sundarbans Tiger Reserve, 923 BLCs were issued to local fishers in the Indian Sundarbans, in a process that has remained unchanged since. To demonstrate the uncertainty of the situations, various claims state that currently between 706, 924, and 13,000–15,000 permits or documents are active, for either 60,000, 80,000 or 140,000 fishers [66, 79, 84].



Figure 15: Certificates of registration and measurement of boats, issued by the West Bengal Forest Department. Image Credit: Megnaa Mehta [66]

These certificates are usually held by those who live in other regions and are not fishers themselves, resulting in them leasing their licences – often through the use of brokers — to desperate fishers for exorbitant costs. These leases cost significantly more than most fishers can afford, which usually results in fishers grouping together and taking loans from middlemen, who then control the sale of their catch. When added to the various other costs the fishers encounter – rent of the boat, bait and fines for “trespassing” – a nine-month season can cost between Rs100,000 and 150,000.

The BLCs are required to legally fish in the “buffer area,” yet even those with the appropriate permits report being fined and harassed by forest officials. This shortage of licences, combined with the impacts of overfishing, poverty and climate change, results in more fishers fishing “illegally” unlicensed within the buffer zone, or fishers entering the vast prohibited areas of the estuary and core zones of the forest, in search of bigger catches [66, 80, 84].

## The Industrial Impact

Some fishers feel that the promotion of large-scale fisheries projects, which focus on increasing fisheries production and productivity through both aquaculture and fisheries resources, is detrimental to local fishers. In addition, the modernisation and development of ports, allowance for large vessels (often transporting toxic goods through the regions), and the construction of concrete embankments, dams and even the development of a coal plant in Bangladesh Sundarbans all have significant environmental and ecological impacts [64, 85].

## Poverty

In these areas, absolute poverty – where the ability to meet basic needs is extremely difficult — is high [81]. Poverty can drive the exploitation of a resource out of sheer necessity. Many will continue to put pressure on natural resources due to the lack of alternative options. More people have become engaged in fishing and shrimp fry / larva collection as last resort, particularly since the start of the COVID-19 pandemic, driven by poverty, and resulting in further ecological damage.

“IF I DON’T GO INTO THE JUNGLE, I WON’T HAVE ENOUGH FOOD TO EAT.”  
PARUL HADER, FISHING WIDOW [69]

Poverty alleviation may reduce environment degradation, and the reduction in environmental degradation would alleviate poverty [72, 81].

Figure 16: Industrial vessels transporting toxic chemicals navigate the same waters as the local fishers. Image Credit: Megnaa Mehta



## Illegal and Unsustainable Fishing

According to Bangladesh Fisheries Statistics [67], production from the Sundarbans increased by 274 percent between 2016–2017 and 2017-2018.

Across the Sundarbans, catches are decreasing due to the combined effects of increasing numbers of fishers, industrial trawlers, illegal gear (such as nets with smaller mesh), fishers catching smaller fish, increased bycatch, climate change, siltation, salination, and industrialisation.

“I HAVE SEVEN FAMILY MEMBERS. EARLIER, WHEN I CAUGHT CRABS, I ALWAYS LET THE JUVENILE CRABS FREE. BUT NOW SIZABLE CRABS ARE DWINDLING. MY CURRENT AVERAGE INCOME IS AROUND TAKA 195 PER DAY (€2). THEREFORE, NOW I DON'T ALLOW YOUNG CRABS BACK TO THE WATER. I RETAIN THEM AND THUS SUPPLEMENT OUR DAILY FOOD. WE KNOW THAT WE ARE DESTROYING OUR FUTURE LIVELIHOODS THROUGH THIS PRACTISE, BUT I HAVE NO OTHER CHOICES.”

SULTAN MIA, 55, CRAB COLLECTOR [72]

Extensive fishing in the outer “buffer” zones – where fishing is legal with a permit – has resulted in dwindling catch numbers across a range of species, resulting in increased entry into the core or sanctuary zones in hopes of securing a higher catch.

However, crossing these boundaries comes with increased risks — from both forest officials and tigers [84].

“FISHES AND CRABS ARE NO LONGER FOUND AT THE PLACE WHERE WE USED TO CATCH THEM PREVIOUSLY, SO WE HAVE TO GO TWO-THREE KILOMETRES DEEPER INTO THE JUNGLE.”

GAUR TARAFDAR, TIGER WIDOW [80]

## Exhibit 11

### Illegal Aquaculture

Due to the international demand for fisheries products, the impacts of climate change and increased costs associated with traditional agriculture, illegal aquaculture activities have become widespread in the region [63, 77]. As a World Heritage Site, and through multiple pieces of legislation, the conversion of agricultural and forest land for aquaculture is prohibited in the Sundarbans, yet it still occurs at a drastic rate.

These areas demonstrate the interplay between aquaculture and wild catch fisheries that can take place in many low-income countries. The shrimp farming industry is reliant on the collection of wild fry (larvae) throughout rivers and creeks in the region — usually by women. Not only does this expose the collectors to human–animal conflict and various other risks, but it can also have a devastating effect on hundreds of species within the mangroves, including prawns, fish, crabs and molluscs, as many thousands of fish and other species can be discarded as waste in the process [63, 71, 72, 74, 77, 81].

As a critical part of the economic development of coastal communities, this activity is so prevalent that about 70 percent of households in the area are involved in the process, making it one of the most widespread fishing activities here in terms of the number of people involved [66, 86].

The conversion of mangrove forest to aquaculture farms violates the UN Sustainable Development Goal (SDG) 15, which aims to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, reverse land degradation and halt biodiversity loss. Secondary contradictions also occur to SDG 14, through pollution to the environment due to the release of antibiotics and other pollutants into the environment. [63, 76].

“...THE DEGRADATION OF THE NATURAL LANDSCAPE AND INDUSTRIAL-SCALE GROWTH OF AQUACULTURE PLOTS HAVE LED TO A SUBSTANTIAL INCREASE IN GLOBAL GREENHOUSE GAS EMISSIONS” [64].



## Exhibit 12

### Further examples: Bangladesh (all sectors)

The number of fishers was difficult to determine in Bangladesh, with the FAO Fishery and Aquaculture Profile stating that in 2010 there were 2,180,000 fishers, yet in 2005 a Bangladesh Department of Fisheries report stated that the sector provided employment for about 1.3 million full-time professional fishermen and 12 million part-time fisherfolk, corresponding to about 10 percent of the total population [87]. In 2016, the Department of Forest [88] stated the sector employed more than 17 million people (full time and part time), which corresponded to around 11 percent of the total population.

#### Figures and information and extracts for Bangladesh included: [82, 83, 88, 89]

- The fishing sector in Bangladesh is considered the most vulnerable to climate change in the whole world due to its height above sea level, rising waters and increasing number of storms. Over the past 20 years, at least 3,500 fishers have died and 10,000 are missing here (Trawler Owners' Association of Barguna).
- In the Boga community (Bagerhat District), 27 fishermen were lost in cyclones in 2016. As a country, the total (not just fishermen) death toll from Cyclone Bulbul was reported to be 12, with an additional five fishermen missing. However, a study indicates that two villages alone reported 25 fisher fatalities from the event, demonstrating significant under-reporting of fatalities in these communities.
- Pirate attacks are another serious threat to fishermen in the region. Boats, equipment and catches are often stolen; fishermen are held for massive ransom and in some cases killed.
- A single pirate attack in 2013 saw 32 fishermen killed, while in another report a local described that at least 70 fishermen from the Chittagong district had been killed by pirates in the last two years.

Multiple sources indicate that there is a reluctance to report pirate attacks to law enforcement due to inaction and corruption.

## Piracy [75, 82, 90]

The frequency and severity of pirate attacks in the region differ according to the source. First-hand and local accounts describe a much more troubling situation than that portrayed in mainstream media. Pirates, said to be from India, Myanmar and Bangladeshi regions, loot the fishermen's catch, nets and machinery. Kidnappings are also recorded, and if the resulting ransom demands are not met, the victim may be killed. In a period of two years, over 2,000 incidents of piracy were reported in Bangladeshi waters, but due to reluctance to report these events, the true rate is likely significantly higher.

“WHEN WE URGE THE POLICE TO ACT AGAINST THE PIRATES, WE HAVE TO BRIBE THEM. BUT, FROM THE PIRATES, THEY TAKE DOUBLE THAT AMOUNT IN BRIBES TO REFRAIN FROM TAKING ANY ACTION AGAINST THEM.”

FISHERMEN UNION MEMBER, 2013

## Overfishing [75, 91, 92]

In Bangladesh, fishing communities are extremely vulnerable. Frequent shocks, such as those associated with climate and weather events, alongside a lack of other employment options leave them unable to earn enough income to meet basic needs. This increases the likelihood of fishers more aggressively exploiting available resources in order to support themselves and their families. Hundreds of industrial vessels fish in the Bay of Bengal, able to catch 20 times more in a single trip than the average artisanal vessel. Local fishermen feel the government is ignoring the problem, and the area lacks an appropriate recording system. Numerous species in the region are declining, and the larger – and most valuable – species in the area are almost completely gone.

A LOCAL FISHERMAN WITH 35 YEARS FISHING IN THE AREA SAID THAT, UNTIL AS RECENTLY AS A FEW YEARS PRIOR, TRAVEL TIME TO CATCH FISH WAS ONLY A COUPLE OF HOURS. NOW IT CAN TAKE UP TO 20 HOURS TO FIND FISH [92].

Figure 17: Industrial vessels in Bangladesh. Image Credit: Dr. Md. Sazedul Hoque



Industrial-scale fishing also has an impact on traditional fishers. Recently it has been reported that four super trawlers – capable of catching double that of existing industrial vessels — were purchased by Bangladeshi operators, who claim they have the rights to use them for fishing. They have recently started targeting hilsa – and this is particularly problematic because the species is central for artisanal fishers’ livelihoods and to food security in Bangladesh.

In addition, two of these vessels, the *Sea View* and *Sea Wind*, have been cited for illegally fishing in Somalia and have been tracked to Chittagong via satellite imagery by international monitoring organisations OceanMind and the International Justice Mission (IJM). Under international law Bangladesh must notify the government of Somalia about the presence of these vessels in its water.

When questioned by the BBC, a senior official at the Naval Trade Department said they “are not aware of the presence of *Sea View* and *Sea Wind* vessels. They first entered Bangladesh with the excuse of repair work, but they were later expelled.” The BBC also asked the Bangladeshi government to comment but were rebuffed – supposedly because the fisheries department was closed due to the COVID-19 outbreak.

“THESE SUPER TRAWLERS ARE A THREAT TO MARINE RESOURCES. IF SUCH ILLEGAL VESSELS CAN ENTER BANGLADESHI WATERS AND GET REGISTERED WITHOUT ANY OBSTACLES, THEN IT COULD BE SUGGESTED THAT BANGLADESH HAS BECOME A SAFE HAVEN FOR BLACKLISTED VESSELS”

BBC REPORT AUTHOR [92]

Figure18: Industrial vessels in Bangladesh. Image Credit: Dr. Md. Sazedul Hoque



## Case Study 4 – Africa’s Inland Fishers

<b>Location</b>	Inland Africa
<b>Subsector</b>	Inland, Artisanal, Subsistence, Small-Scale
<b>Number of Fishers [25]</b>	3.5 million
<b>Estimated Fatality Rate</b>	1,800
<b>Drivers</b>	Climate Change, IUU, Boundary Disputes, Sustainability, Governance, Poverty

Initially, we focused on the fishers of Lake Victoria as a case study, exploring the number of fishers on the Lake, the risks to their safety and the challenges the fishers face in relation to several political, economic, environmental, and social factors.

The main risks to their safety were highlighted as:

- Weather
- Vessel conditions
- Intoxication
- Poverty and Unemployment
- Theft
- Wild Animals
- Boundary Disputes

Figure 19: A lone fisher pulls in his net. Image Credit: © Can Stock Photo / zanzibar



Based on our investigations, we calculated an estimated fatality rate of 1,800 per 100,000 fishers

Attempting to find fatality rates on other inland water bodies in Africa proved to be impossible – there simply isn't the information available. In our attempts to do this, we began to investigate each country, each region and each lake or river individually to find information that would be relevant in this challenge. While in many cases we couldn't find numbers, we were able to find a significant amount of information on the drivers to risk faced by the fishers.

Across almost all inland waters of Africa, challenges, such as intensive fishing, occur synergistically with other drivers. As each region is exposed to its own unique combination of factors, the impacts of these drivers on the ecosystems, economies and human populations are poorly documented.

Note that not all drivers are discussed. Factors like some human behaviours and illness (drinking / substance abuse, HIV, etc.) require further research to determine their impacts on fisher fatality numbers.

## Weather & Climate Change

Weather is often a contributing factor to accidents on the lakes in Africa. While there have always been storms, weather patterns have become unpredictable or more frequent and often more severe due to the impacts of climate change. Due to the combined impacts of food insecurity, poverty and falling fish stocks, fishermen are frequently having to travel into deeper water, or fish in bad weather, increasing the risks to their safety.

In yet another example of interlinked drivers, Lake Chad now sits at nearly a twentieth of its original size due to the combined effects of unsustainable water management and climate change [93] [94] while other lakes in the region have dried out completely.

**“THIS LAKE IS DYING ... AND WE ARE ALL DYING WITH IT.” MUHAMMADU BELLO,  
LOCAL FISHERMAN [95]**

Figure 20: Lake Kariba Shoreline.  
Image Credit: © Can Stock Photo / janinearnold





Figure 21: A hippopotamus, Tanzania. Image credit: Sofia Zubiria / Unsplash

## Environmental & Ecological

Wildlife attacks are not uncommon as human populations and pressures on resources increase. In Africa, the biggest risks come from hippopotamus and crocodiles. As seen in the Sundarbans Mangrove Forests, reports of human-wildlife conflicts are said to be increasing, with foot fishers and illegal fishers being most vulnerable.

In the first 3 months of 2020 alone, hippopotamus killed 9 people in the South Lake area of Lake Naivasha [96].

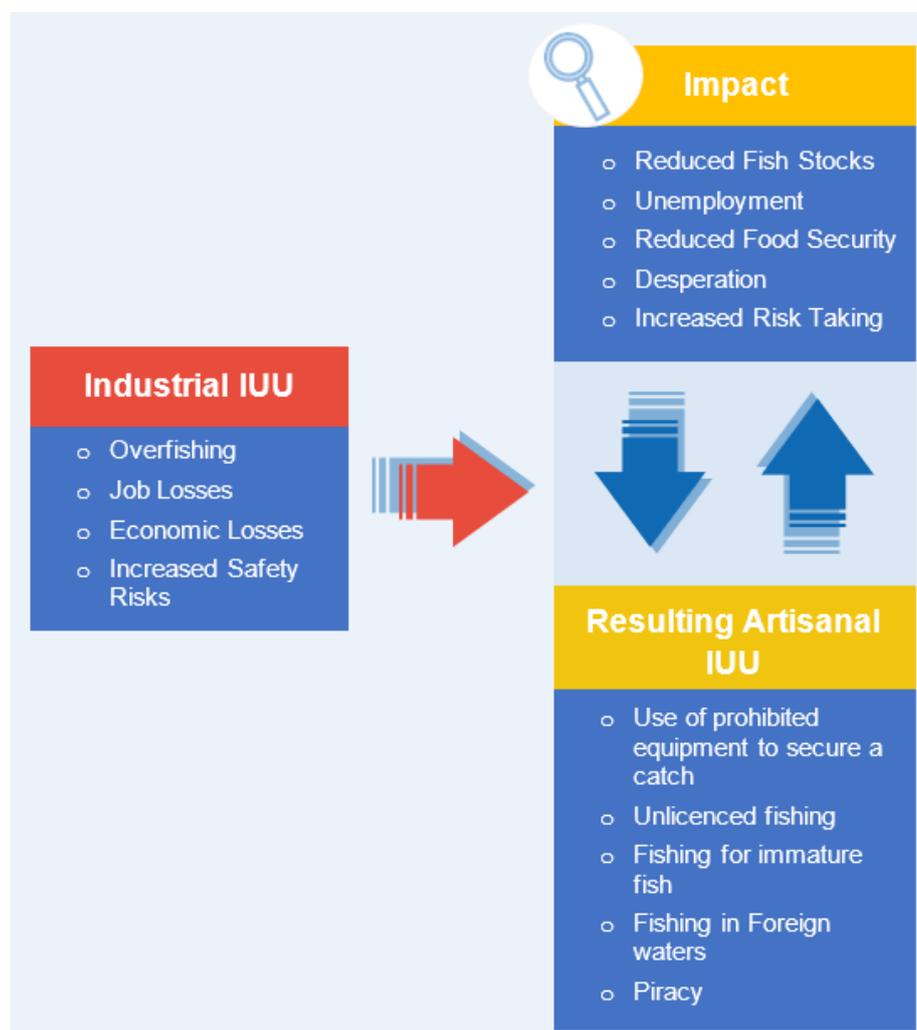
Other observations included:

- Pollution from both urbanisation and dramatic increases in human population has been seen to have a devastating effect on local environments. Fishers in Benin indicated that water quality was a constraint to their fishing activities, encompassing factors such as pollution, salinity, poor quality and an overgrowth of water hyacinth [97].
- Almost the entire lakeside population of Lake Albert in Uganda relies on fisheries for their livelihoods, and, like many other large inland water bodies, it is heavily overfished [98].
- In Lake Kariba, 80 percent of fishermen report that their fish catches have been declining over recent years and believe that the declining catches will negatively impact their livelihoods, incomes, and food security [93].
- In Benin, the numbers of fishers rose from 10,000 in 1950 to 62,000 in 2016. The annual catch per fisher fell from 1.1 to 0.3 to 0.4 ton. The demand for fish still surpasses supply, which means that fishers would still be able to sell their catch if they were catching larger volumes, indicating that the lakes are being overfished. A study in the area suggested that overfishing was a constraint to over three quarters of fishermen, and more than half of the overfishing was done deliberately [97].
- Lake Naivasha too has seen a dramatic downturn in its condition in recent years. Deforestation in bordering forests has led to reduced water levels, fish stocks show sign of reductions due to overfishing and pollution, and neighbouring farms are discharging effluent directly into its waters [99].

## Poverty

The rapid increases of the human population in recent decades has increased the demands on natural resources and challenged the traditional regulations among fishing communities [97]. In many areas, lakeside development is limited, farming hampered by erratic rainfall, and most of the populations depend on fisheries at some point along its value chain. Unfortunately, this dependence is therefore reliant on the status of the fish stocks, and thus making communities keenly vulnerable to the effects of overfishing [98, 100].

In order to combat the reduced catch, fishers often engage in illegal behaviours, such as fishing in breeding grounds, catching juvenile fish, or using illegal nets, directly contributing to overfishing and creating a cyclic effect.



Overfishing has the potential to have direct and severe impacts on the health of human populations, with those in lower-income countries, such as much of Africa, at the greatest risk [101]. Multiple reports indicate that this is already apparent; in one, 32 percent of the interviewed fishermen reporting having no meal (5 percent) or only one meal (28 percent) per day over the previous month [97], while another noted 79 percent of Lake Kariba fishers' households are facing food insecurity due to declining catches [93].

## Data

Contrary to official catch statistics for Lake Albert [through the period to early 2000s], fishermen highlighted a significant decrease in available catch. One fisherman stated that:

“TODAY YOU CAN CATCH 30 FISH WITH SEVEN FLEETS, BUT IN THE 1980S FIVE OR SIX FLEETS WOULD CATCH 500-600 FISH!” [98]

In Gambia the lack of adequate data on the nature of local fishing accidents has been highlighted as a key barrier to the prevention of injuries and fatalities [102]. Fatalities are often not reported to, or recorded by, local police forces for any number of reasons, such as the identity of the fisherman being unknown, or the person fishing illegally [103, 104].

## Regulations

While regulatory guidelines are in place in some of these communities, there remains inadequate resources to enforce them, while corruption can severely limit their effectiveness.

There are incidents which demonstrate fast and proactive action from local bodies, though, such as in Lake Naivasha, where five fishers died in the space of a week in 2015. Within days, the Nakuru government began talks to formally ban night fishing and reduce the number of deaths and provide 100 life jackets to local fishermen. They also indicated that any fishermen found fishing without a life jacket would be arrested. While this approach is beneficial in theory, the reality is that it can add financial pressures to fishers, who as a result turn to illegal or dangerous fishing practises to survive.

The challenge of unintended side effects of such regulatory approaches is discussed later in the report.

Lack of coordination between the authorities that are responsible for regulatory enforcement forms another barrier to effectiveness which has been highlighted across the continent [100, 105, 93, 98].

## Exhibit 13

### **The Cause that Killed Her – Joan Root [215, 99]**

Noticing the simultaneous effects of industrial flower farms and overfishing on Lake Naivasha, famed conservationist and filmmaker Joan Root - who lived on the lake's shore – funded a 'task force' composed of government officials, reformed poachers and unemployed youth to help tackle the problems of overfishing on the Lake. Despite some early success, the task force fell into corruption and became a law unto itself. Following the alleged murder of a subsistence fisherman by the group in 2004, Ms. Root withdrew her funding for the group. Despite harassment and death threats, she refused to leave her farm, and was shot dead in 2006.



## Exhibit 14

### Further Examples: Africa's Lakes

Our research has highlighted a concerning trend regarding the frequency of fatalities occurring on and around the other inland lakes in Africa, and the similarities these had with obstacles faced in the Lake Victoria region.

The following examples demonstrate the issues of weather, wild animals, boundary disputes and illegal fishing:

#### Lake Naivasha [96, 106, 107, 108, 109, 110]

- 2015 – The local government explored options to ban night fishing on Lake Naivasha after five fishermen died in one week. Officials attributed the deaths to ignorance and failure to obey set rules and regulations, such as wearing life jackets, while a rescued fisherman blamed strong winds and currents.
- 2017 – Two fishermen died after the boat capsized on Lake Naivasha – likely due to weather conditions.
- 2020 – Four fishermen were killed by hippopotamuses in January, with the death toll reaching nine by March.
- 2020 – Multiple fishermen died in less than a month in various incidents after their boats capsized. Beach management appealed to fishermen to ensure they used protective gear whilst fishing.
- 2020 – At least 10 illegal fishermen went missing after their boat capsized.

Figure 22: Image Credit: Hennie Stander / Unsplash



### **Lake Edward** [112, 113, 114]

- 2018 – The Democratic Republic of Congo (DRC) accused Uganda of killing four fishermen on the shared lake, after their bodies were found bound and bullet riddled.
- 2020 – Ugandan Fisheries Protection Unit shot two people, killing one, and arrested five others for fishing with illegal nets on Lake Edward.

### **Lake Albert** [113, 115]

- 2017 – One fisher killed, another injured. Attacks by hippos are common – in a previous year, increased attacks stopped fishing at some landing sites.
- 2018 – Over several months, attempts to address illegal fishing, driven by declining fish stocks, increased tensions in lakes between the Democratic Republic of Congo and Uganda. Uganda deployed its military; hundreds of fishers from the DRC were arrested, and the Congolese militia shot seven fishers from Uganda. Armed DRC groups also robbed fishermen on their boats, stealing engines and catches.
- 12 fishers were killed in one week, including seven shot by Congolese militia.

### **Lake Chad** [116, 117]

- 2014 – 48 fishers were killed by Boko Haram militants.
- 2015 – 19 fishers were killed in a region on Lake Chad, 10 during a Boko Haram attack on three villages.
- 2017 – A Nigerian military ban on fishing on the Nigerian side of the lake was lifted, and 31 fishers were killed by Boko Haram. The ban had been in place because of accusations that Boko Haram was using fishing profits to fund its campaign.
- 2018 – Boko Haram increased attacks on fishermen and farms, killing 10 fishers after accusing them of leaking information to the military. Locals reported farming and fishing to be near impossible in the region out of fear of Boko Haram.

## Further Observations

### Corruption

- Allegations of corruption at a local level has been highlighted across Africa. In Lake Albert, fishers highlight that local politicians frequently use illegal fishing gear and are the first to pay bribes to fisheries officers [98].
- A local practice referred to as *mawe* in Lake Malawi sees local leaders permit the use of illegal fishing gear in exchange for a weekly gift from the fisher in the form of money or fish [118].

### Lack of Enforcement

- While there are laws in place to protect the fish stocks on some of these waterways, the lack of resources and personnel and the corruption of fisheries officers are significant barriers to enforcement [98, 118].

### Piracy and Violence

- Theft of gillnets that are left overnight on Lake Albert is common – this has been seen to cause fishers to shift to illegal fishing practices that are faster in order to minimise the risk of gear loss [98]. This trend is replicated in Benin, where canoes, nets, and fish are often stolen [97].
- Conflicts over the use of water resources are fairly common in all of the countries we investigated. Fishers in Benin indicated that half of the conflicts with other fishers escalated to violence at a level where someone needed medical attention, or someone was killed [97].



Figure 23: A despondent child paddles alone. Image Credit: © Can Stock Photo / kuzeayo

## Exhibit 15

### **Child Slavery on Lake Volta [119, 120]**

Lake Volta (Ghana, West Africa) is one of the world's largest human-made lakes. It is also considered one of Africa's most dangerous — especially for children. At one point, almost 50,000 child slaves, most under the age of 10, are estimated to have worked on the lake.

Driven by desperation, poor families from around Ghana sell their children to human traffickers, or directly to fishermen.

The children are so sought after for a number of reasons; they are small and take up less room in the boats, they are less likely to resist when treated badly, and most importantly – they have small and nimble hands. Despite not knowing how to swim, these children are tasked with the deadly role of diving overboard and untangling fishing gear when it gets entangled in the submerged tree branches of the forest that once stood here before the creation of the lake.

From as young as 5, these child slaves are forced to work up to 18 hours a day in dangerous conditions with little to no food. Reports of beatings, sexual abuse and fatalities are common.

## Case Study 5 – The EU

<b>Location</b>	Europe
<b>Subsector</b>	Industrial, Commercial, Small-Scale, Artisanal
<b>Number of Fishers [121]</b>	106,000
<b>Estimated Fatality Rates</b>	85 per 100,000
<b>Drivers</b>	Governance, Quotas, Human Behaviour

To demonstrate the diversity of the factors at play within the various regions and fisheries around the world, we also include here our initial exploration into the safety, and drivers of safety, in the European Union and UK fishing fleets (which we combine as much of our work discussed here predates Brexit). This will serve to highlight the situation seen in many of the more developed fisheries, and which of the drivers have the most significant impact.

First, perhaps surprisingly, the lack of basic information on fisheries and fisher fatalities was evident in this region as well. We struggled to find consistent or accurate figures for the number of fishers by country.

According to the European Union Country Profile [121] in 2018, there was the equivalent of 105,851 full-time fishers employed across the region. The majority of this employment was within the smaller vessels in the fleet. In 2017, the European Commission [122] indicated that small-scale fishers represented approximately 48 percent of employment, with almost 80,000 fishers employed.

0–11m	44%
12–23m	31%
24–39m	18%
>40m	7%

Due to the lack of consistency in figure breakdowns, we decided to use the most recent source of fisher numbers for our calculations, and while the size breakdown differs, 48 percent of fishers being employed in small-scale fishing – in this case classified at vessels below 15m – seems to be in line with the EU Country Profile figures.

Using this we broke down the estimated number of fishers in the 0–15m category, and 15m+ category, resulting in 50,808 and 55,043 FTE fishers respectively.

European Maritime Safety Agency (EMSA) [123] fatality data indicates that there are on average 27 deaths per year in EU fishing vessels over 15m. Both the total number of fishers and fatalities on smaller vessels are not published.

The United Kingdom Marine Accident Investigation Branch (MAIB) [124] indicated that:

- 70 percent of fatalities occurred on vessels under 15m.
- 23.3 percent of fatalities occurred on vessels 15–24m.
- 6.7 percent of fatalities occurred on vessels 24m and over.



Figure 24: Spain. Image Credit: Francisco Blaha [125]

While this breakdown was for the United Kingdom, it was consistent with breakdowns for other countries in the EU where the information was available [126] [127] indicating that approximately only 30 percent of the fatalities are occurring on larger vessels, and thus being included in many official reports.

This suggests that 27 fatalities – representing some 30 percent of total fatalities — occur among a fleet of approximately 55,043 fishers on vessels >15m, while the remaining 70 percent of fatalities – suggesting approximately 63 fatalities – occur among the approximately 50,808 fishers on vessels smaller than 15m.

By our estimates given the information available, this would provide a fatality rate of 28/100,000 fishers on vessels over 15m, or 124/100,000 on vessels <15m.

Across all EU countries and vessel sizes, an average fatality rate of 85/100,000 has been estimated.

While these estimates have been based on the most recent and official information available, the individual country data does indicate the potential for a different ratio of vessel sizes across fleets. Ireland, for example, reported in 2015 that 90 percent of its fleet was below 15m, Finland's has vessels under 12m representing as much as 97 percent in 2014, and 80 percent of Denmark's fleet were below 12m in length. In Estonia, the large fleet had reduced from 200 to 36 active vessels, while there were still over 1,000 vessels under 12m actively fishing [127, 128].

Despite these differences and uncertainties in our estimates, a main takeaway is the increased risk faced by small-scale fishers, which likely represents a large proportion of the EU and UK fleets. The causes for fatalities in the fisheries of these higher-income nations is something that is often discussed, and usually attributed to a combination of vessel safety and human behaviour. However, we demonstrate the risks faced by those in the small-scale sector may be possibly much higher. This leads to the obvious question – why?

In larger vessels, we found most fatalities occurred as a result of a *vessel incident* such as the vessel capsizing, where there are usually multiple fatalities. In the smaller-scale fisheries, *individual* accidents led more often to death – such as equipment or machinery entanglements or falls overboard [123, 129].

Regulations for vessels differ based on size, and the requirements for vessels below 15m are significantly lower than for larger vessels. Given the disproportionate rates of fatalities in the small-scale sector, this should be a clear area of focus even in high-income countries [130]. Moreover, by a global standard, EU fisheries are heavily regulated, but even these demonstrate some significant gaps, particularly around smaller vessels. For example, vessel safety regulations — such as vessel condition and stability requirements — only apply to vessels above 15m, which effectively excludes the majority of the sector. Given the disproportionate rates of fatalities in the small-scale sector, this should be a clear area of focus.

The condition of the vessel too is particularly relevant to small-scale fisheries, where vessels are often modified or adapted to suit different types of fishing. This can diminish its stability and cause it to become more vulnerable to another major concern highlighted for the small-scale fisher: the weather [127, 131, 132]. Extreme weather conditions are particularly concerning for fishers on smaller craft, given they are generally more exposed, have less protection from the elements, and operate on vessels with less safety features. This can be exacerbated when combined with a further causal factor – vessel maintenance.

The need for increased regulations, monitoring, and enforcement in vessels under 15 meters has been highlighted across almost all countries in the EU and UK. Only a third of EU vessels are covered by legislation that addresses the health and safety, and working time, of fishers, and extreme working conditions and sleep deprivation contribute to mistakes and unnecessary risk-taking behaviour. These elements suggest that simply increasing legislation and enforcement on small-scale vessels would improve the situation [128, 132, 133].

Herein lies the challenge: In some cases, fisheries management initiatives have had an unintended impact on safety [131].

Governance, or regulations, has been argued to have ties with another contributing factor – human behaviour. Severe levels of fatigue and risk-taking behaviour are considered a norm in the industry, yet the factors that drive these behaviours in captains and crew should be discussed and understood.

At both the individual and overall crew level, there is often a degree of financial motivation for the choices people make. As demonstrated in Poland and Portugal, traditional payment systems — where a fisher receives a percentage of the vessel total based on their role or function onboard – have been seen to drive fishers to work longer hours or accept higher risk in order to capture more fish or increase their percentage share of the catch. When stocks are low, or increased economic pressure is felt, skippers may reduce the number of crew on board to mitigate the lower income, though this strategy increases the demands on remaining crew and increases the risk of accidents. [131, 134].

The increased costs of implementing regulations, changes to fisheries quotas – particularly as stock levels fall – and improving the working conditions of crew all contribute to financial pressures, which can inadvertently lead to an increase in risk-taking behaviour. Thus, these changes must be adequately thought out with input from industry players for effective implementation.

Further, neither the EU nor the UK is immune from the other issues highlighted across the global sector.

Sustainability remains a major concern, with even the latest quotas set above the sustainable limits identified by the International Council for the Exploration of the Sea, and accusations that the number of fish stocks available in EU waters has been overestimated by 16 percent since 2015 [135, 136]. Climate change is also likely to impact many fisheries in the EU region, and multiple serious concerns also need to be addressed, including examples of forced labour within local vessels, significant habitat destruction by trawlers, allegations of significant illegal fishing off the coast of Africa, and the use of capacity-enhancing subsidies.



## Exhibit 16

### Exploitation of workers, and IUU fishing In Europe

The European region is highly developed but is not immune to the challenges of labour exploitation and IUU fishing [132, 137, 138].

Over the past decade, there have been reports highlighting the exploitation of foreign workings in the fishing sectors of Scotland and Ireland. Workers, predominantly from the Philippines, Indonesia, Ghana, Lithuania and Romania, are being used as cheap labour on fishing vessels, being paid as little as £100 for two-and-a-half months of work.

In 2015, *The Guardian* published a report on a yearlong investigation into the Irish prawn and whitefish sectors. They uncovered what they described as a catalogue of abuse, including fishers being confined to the vessel, pay rates well below the legal minimum wage, extreme sleep deprivation and most concerningly, evidence that some of these fishers were the victims of human trafficking.

**SOME WORKERS SAID THEY WERE CONTROLLED BY DEBT TO THE AGENCIES THAT RECRUITED THEM AND CHARGED THEM SUBSTANTIAL AND ILLEGAL PLACEMENT FEES TO ARRANGE VISAS, JOBS AND ITINERARIES [132].**

Industry experts voiced their concerns regarding the use of migrant workers, where language barriers and lack of safety training can contribute to accidents. In 2012 an Irish fishing trawler sank with four Egyptian and two (including the skipper) Irish crew on board. One of the Egyptian fishermen was the sole survivor after the vessel veered off course and crashed into rocks.

Figure 25: Irish Coastguard Rescue operations underway. Image Credit: © Can Stock Photo / morrbyte



The official report highlighted the severe lack of sleep as a causal factor, with crew only getting four to five hours rest in the 40 hours prior. Three of the men had not completed the mandatory Irish safety training.

It was also found that “crew appeared not to have been familiar with the operation of the radio equipment as no radio message was sent. Apart from the main radio installation, which appears to have stopped working, the vessel was fitted with a SART, and EPIRB and hand-held emergency VHF radios”. Any of these could have been used to send a radio signal and aid rescue. It was determined that none of the required safety drills in the months leading up to the accident had been done. In addition, the trawler was not carrying enough lifesaving equipment for all on board.

**Desperation or Greed?** *Text below extracted in large part directly from [132]*

Owners of trawling vessels report being under pressure, resulting from stocks declining due to overfishing and competition over quotas. The cheap labour of undocumented migrant workers provided them a way to shore up failing profit margins.

These owners also worked to fish illegally and avoid detection. As one Filipino worker described, some vessel owners would sail to an area where there were no prawns and pretended to fish by steaming up and down – all the while transmitting a tracking signal for the authorities. Then they would move to a fishing ground with good prawns but strict quotas and catch double their quotas, simply marking additional prawns as coming from the first fishing bank where, in reality, they had caught nothing.

**The Government’s response [132]**

[THE INTERNATIONAL TRANSPORT FEDERATION \(ITF\), THE UNION WHO FIRST RAISED CONCERNS ABOUT THE CONDITIONS FOR MIGRANTS IN THE IRISH AND SCOTTISH FISHING FLEETS IN 2008, ACCUSED THE IRISH GOVERNMENT OF “TURNING A BLIND EYE”.](#)

The government denied the ITF statement, asserting it took all human trafficking concerns seriously. The courts, however, seemed to demonstrate a lenient approach to the lack of safety compliance. In 2015, a prawn trawler owner pleaded guilty to taking a migrant fisherman out without completing the required safety training. He was not convicted, with the judge dismissing the case as he was providing employment and had a clear record, instead ordering him to pay €1,000 to a local charity.

## 5 years of progress?

Five years after the *Guardian* investigation was published – and 12 years after the ITF first raised the issue – accusations were still aimed at the Irish government, for failing to prosecute those who continue to exploit migrant fishers. The ITF has given the government an F grade for the third year running, following the publication of the US “Trafficking in Persons” report, which saw Ireland become the only country in Western Europe downgraded to the Tier 2 watch list for not doing enough to combat human trafficking.

“AT EVERY POINT SINCE 2008 WHEN THE ITF HAS RAISED ISSUES WITH THE RELEVANT GOVERNMENT DEPARTMENT, OR STATE AGENCY, THEY HAVE ONLY RESPONDED WHEN CONFRONTED WITH IRREFUTABLE EVIDENCE AND THEN DID SO RELUCTANTLY AND IN A MINIMALIST WAY.”

KEN FLEMING, ITF COORDINATOR FOR IRELAND AND BRITAIN [139]

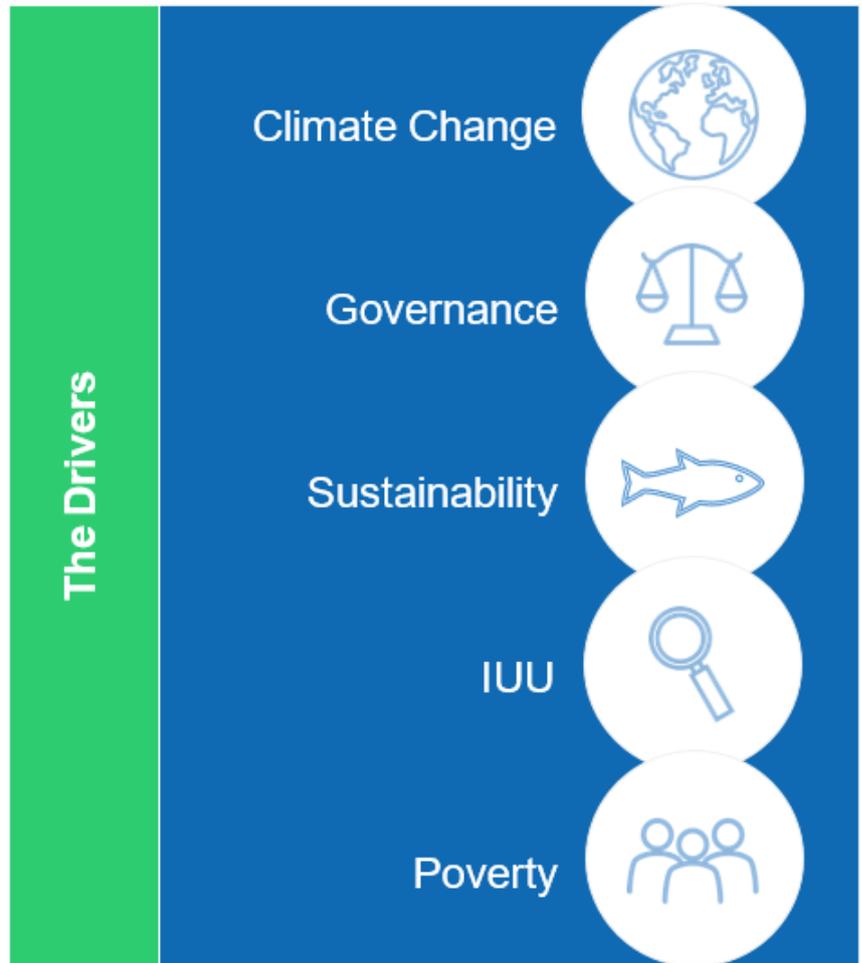
# PART 4

## The Drivers

As demonstrated across the case studies, each fisheries region faces its own unique set of challenges, yet the central drivers are often similar, if not the same.

While we explore the facets of each driver individually, we also demonstrate the interconnectivity of the drivers, and how in many cases there is no singular cause. Each driver is connected and amplified by the next, resulting in a cumulative impact that results in the current status of each of these fisheries.

In each situation, the impact and weight of each driver will differ, as each driver in itself is formed through the accumulation of many individual inputs.



The size of each driver description and order in which they are addressed here bear no indication to their relevance or importance. Due to the described interconnectivity, some drivers are so closely linked that they are addressed multiple times through the discussions. If we felt the importance and implications of a driver has been suitably addressed in other sections, the decision was made not to repeat it again due to the size of this paper.

We note another reason to consider marine and inland fisheries collectively, as we have done, is that what makes fishing so dangerous is similar for both communities – suggesting the opportunity for similar solutions.

## GOVERNANCE

Weakness in governance is a factor that acts individually as well as simultaneously, and underpins all other primary drivers. Ineffective governance, poor policies, and unenforced legal frameworks have resulted in widespread environmental degradation and the depletion of resources – driving poverty and reducing food security for millions of people.

The governance of fisheries, including inland fisheries, is extraordinarily complex due to the interaction of multiple drivers and multiple stakeholders.

The topic itself has many facets, including data collection, analysis, legislation and regulations, resource management, enforcement, corruption, and unintended consequences.

As part of this discussion, we have chosen to explore the topics which we feel as the most relevant to the safety of fishers – both directly and indirectly – and support our discussion with examples gathered from fishing communities, organisations, and intergovernmental bodies. While the links between these issues and fisher fatalities may not be immediately clear, these topics need to be considered in a macro sense and as all contribute to the marginalization of fishers, or one (or more) of the primary drivers.

It must be reiterated that this is by no means a complete collation of all the influential governing factors, rather an excerpt of particularly relevant issues, such as fisheries management in developing regions and small-scale fisheries.



## An Economic Investment

Recent decades have seen fishing industries boom through the investment of both national and international financial support aimed at increasing capitalisation of global fishing fleets. The concept was that by boosting the capacity and production of industrial fleets, nations would improve the welfare of small-scale fishers through job creation, higher incomes, increased food supply and therefore food security [14, 140, 141].

INCREASED PRODUCTION DOES NOT NECESSARILY LEAD TO FOOD OR LIVELIHOOD SECURITY. WHAT IS NEEDED IS ACCESS TO THE FOOD [142].

Unfortunately, in many countries, this goal was not achieved – and action came with consequences. For example, in the 1960s, Western aid encouraged the growth of the Indian prawn trawling industry, which ultimately resulted in significant damage to the seafloor and local ecosystems, and decimated stocks in the Bay of Bengal. As stock dropped, Indian fishers had to expand their range and fishing areas into disputed territorial waters, driving an increase in conflict with Sri Lankan fishers, who too had modernised their fleet with the help of government subsidies. The 1970s saw nearby Indonesia invest \$US59 million to develop their tuna industry [140]. Collectively, such investments have overcapitalized fisheries around the world, without concurrent social and economic benefits, and with ecological costs. Currently, the global fishing fleet is 2 to 3 times larger than needed to generate the amount of catch that would be considered sustainably viable, contributing to both the environmental damage and overexploitation of fish stocks [24].



### The Hidden Sector

The impact this has had on the small-scale fishers was the opposite of what was intended. Investment and modernisation in the industrial fleet only served to drive overfishing, in many cases at the expense of the small-scale fisher. As mentioned many times here, these are the people most likely excluded from reporting and consideration.



Figure 27 above: Fishers in Thailand. Image Credit: Serg Zhukov / Unsplash.  
Figure 28 below: Fishers in the Amazon River. Image Credit: Deb Dowd / Unsplash

### IN SOUTH INDIA, FLEET MODERNISATION REDUCED THE INCOME OF TRADITIONAL FISHERS BY 50 PERCENT AND LED TO A REDUCTION IN FOOD SECURITY [140].

In the absence of effective management, the modernisation of fleets became associated with environmental degradation and loss of access to traditional fishing grounds for fishers, which served to further marginalize these communities, undermining traditional management practices and reducing incentives for these fishers to invest effort into managing their local fisheries [143]. The inland artisanal fisheries aren't exempt from these challenges, as traditional fishing grounds are frequently threatened by large infrastructural developments, agriculture and aquaculture [144]. These threats are directly related to government policies designed to generate economic growth.



In many nations, lack of resources is a serious constraint to fishing safety. Despite the crucial role of small-scale fisheries in global food security, national policies are still skewed, providing inadequate protection to the people and resources in this often-invisible industry.

Challenges with climate change, overfishing, poverty and safety are compounded by weak governance. Without adequate funding or resources, any new or existing management measures will continue to be compromised, and the fishers' lives and livelihoods will remain at risk.

Examples we have found include:

- Political leaders from numerous locations have been shown to have been involved in financial ventures with foreign fishing companies, allowing international industrial fleets access to national resources with minimal management — directly reducing food security and driving poverty of those reliant on the resource [57, 58, 67].
- Due to the cost of fuel in Madagascar, the two organisations responsible for search and rescue operations, the Coast Guard and Navy, rarely send vessels out on rescue missions. This is particularly relevant to small-scale fishers, as there is very little chance of rescue from one of these authorities unless they are close to one of the relevant bases [20].
- In Cameroon [58] fisheries inspectors are aware that they don't have the power or capacity to control the industrial fisheries occurring off its shores, resulting to them turning their attention to the already vulnerable artisanal fishers. In a combination of marginalization and corruption, these fishers are harassed by all levels of authority in the ports including the fisheries officers, customs officers, and merchant mariners. It is not unusual for them to be coerced to give bribes before being able to licence their vessel or process their catch.
- In 2015, the Brazilian government had cancelled nearly all monitoring programmes for artisanal fisheries in its Amazon region [145].
- On Lake Albert, there are rules regarding net sizes, which remain unenforced due to insufficient resources of the fisheries department – and corrupt fisheries officers [98].
- Indonesian government officials made no effort to enforce laws against blast fishing or cyanide fishing on coral reefs despite the clearly devastating impact on both the environment and fish stocks [35].
- In Vietnam, patrols happen too infrequently to pose any threat to illegal fishers, as they simply move their vessels during the patrols [35].
- Indonesia stated that lack of resources to patrol coastal waters hindered the state's ability to tackle piracy and associated crimes [146].

## Exhibit 17

### **Fisheries Governance in South and Central America – Capacity and Corruption**

Early work in the project indicated a large presence of illegal activity in South and Central America. While the issues do fall entirely under the category of IUU, much of the issues are tied to weaknesses in governance [147, 148].

In both Peru and Colombia, different institutions are involved with fisheries management, in a system that lacks a coordinated approach. Francisco Arias, director of the Institute of Marine and Coastal Research, describes the situation in Colombia: “Park [managers] make one decision, the mayor makes a different one, the national government a different one, and they don’t reach an agreement; the issue reaches the judge and he makes a completely different decision” [149].

Chile, Colombia, Ecuador, and Mexico have introduced Marine Protected Areas (MPAs) in their territories – but lack the budget or resources to protect them. In the four areas analysed, none of the surveillance budgets for these areas was adequate. In some cases, management plans or strategies had not even been developed yet.

“IN OTHER WORDS, MANY MARINE PROTECTED AREAS ARE CURRENTLY PARKS IN NAME ONLY, MAKING THEM MORE VULNERABLE TO ILLEGAL FISHING...” [147]

According to an investigation by Global Fishing Watch, numerous vessels (both national and foreign) demonstrated movements that were consistent with fishing in these sanctuaries, yet convictions for illegal fishing were rare.

In Ecuador, targeted shark fishing is illegal, and any shark capture must be accidental (bycatch), yet a study in 2015 revealed that the small-scale fishery alone caught at least 250,000 sharks per year for export to the Asian markets. Even more concerningly, this targeted shark fishing is known to occur around the edges of the Galapagos marine reserve – as small-scale fishers don’t have satellite monitoring systems, there is no way of knowing if they enter the reserve. The government, however, continues to insist there is no shark fishing [99].

In many countries within this region, there have been allegations of corruption within the political parties involved in fisheries management.

Chile, for example, has had to review the fisheries laws approved in 2012, as it was proven that the fishing industry had paid bribes to members of parliament to pass a law which allocated fishing rights to seven large companies ... forever.

## Unintended consequences

In any industry as complex as fisheries, there will always be risks of unintended consequences with new guidelines, approaches, or legislation. The FAO alluded to this challenge in a report called *International Commercial Fishing Management Regime Safety Study: Synthesis of Case Reports* [150], which explored potential outcomes of management policies, or changes in them, for safety at sea.

“MULTIPLE STUDIES SUGGEST THAT ALTHOUGH FISHERIES MANAGEMENT POLICIES ARE NOT MEANT TO REGULATE SAFETY AT SEA, THEY DO SOMETIMES CONTRIBUTE TO SAFETY PROBLEMS” [151].

This report explored four different hypotheses: (1) Fisheries management policies have wide-ranging indirect effects on fishing safety; (2) quota-based fisheries systems are safer than competitive fisheries systems; (3) fisheries management policies that are unsuccessful in protecting resources or limiting numbers of fishers competing for limited resources negatively affect safety; and (4) fisheries management can contribute to safety of fisheries directly by integrating safety policies with fishery management policies.

The following extracts from the report serve to highlight some of the country responses to these hypotheses in both high- and low-income countries.

**Iceland:** Special line dispensation — *“The special line dispensation is a rule under which small vessels fishing with baited hooks and lines rather than nets can catch 16% more than their allocated ITQ limit without incurring any penalty ... The potential for disaster lay in the requirement that the vessel return to the same port from which it sailed within 24 hours. In the event of a sudden change in weather, this would in theory place pressure on the captain of the vessel to attempt to make the original port rather than a closer, safer one. This concern was raised by fishermen early on, but was mitigated somewhat by unofficial assurances of government officials that “consideration of weather conditions” would be made in any ruling. No legal provisions were made for this however, and there are no known cases where an exception of this type was made or refused.”*

**Lake Malawi:** *“Although licenses are required for fishing operations, people have licenses in practice very few ... The government centre management system ... has not been effective in small-scale fisheries. Like in many countries, this basic regulatory framework has failed to prevent over-exploitation of the target inshore fisheries resources due to non-compliance to regulations. Non-compliance to management regulations is mainly attributed to weak enforcement and lack of understanding of the socio-economic characteristics of fishers.”*

*“Fishing seasons when it is risky to fish due to mwera (southeasterly) and mpoto (southwesterly) winds.”*

**Spain:** Engine power limits — “... the State determines a maximum power for the engines of vessels, which is too low for shell-fishing out at sea, inshore fishing and the harvesting of goose barnacles in Galicia, as a higher-power engine is necessary to escape from storms and manoeuvre better among rocks, etc.”

**Thailand:** Race for fish — “Due to these seasonal closures and the open access nature of the fisheries there is high competition to get to and from the fishing ground as fast as possible and return to port with the largest possible catch. Often important factors such as weather are not given due consideration. Some of the operators are increasing engine power and gear efficiency, fishing longer, and hiring more foreigners with lower labour cost. Under these conditions risks are higher for accidents.”

**Ghana:** “I have been fishing with drift gill net for the past twenty-two years. Our fishing grounds have dramatically changed due to the operations of other fishers. We are now fishing in higher seas ... Now we spend between four and five days at sea for each trip.”

“An open access system in the dominant artisanal fishery in Ghana results in various conflicts even within the same artisanal fishers and among the various sub-sectors of the industry hunting for the same resources (Sardinellas and Anchovy)... Incidences of using light attractors in fishing and paired trawling has increased dangers at sea and with the weak enforcement capacities of the Monitoring Control and Surveillance Division (MCSD) of the Ministry of Fisheries, this negative trend (disrupted biological cycle of fish habitat) has further affected their livelihoods making them move into deeper waters on search for fish. Originally their crafts were not designed to fish in deep waters but with this trend they are forced to risk their lives.”

**Pacific Islands:** “Although Pacific Island countries have some of the highest sea safety accident rates in the world, most government fisheries agencies have limited involvement with safety issues (FAO 2004). There is a large range in the types of sea accidents in the various tuna fisheries of the region. Data are insufficient to statistically demonstrate which activities are particularly risky, but there is a general perception that offshore tuna trolling in small outboard powered skiffs is responsible for many, if not most, of sea safety incidents.”

There are likely to always be unintended consequences from the implementation of any new legislation, which is why we raised this point.

Some of the primary questions that need to be considered if the development of new regulations include:

- What is the purpose or target of the legislation?
- Is there adequate industry input to provide firsthand information on challenges and protentional consequences?
- Is the data or information used to form the basis of these decisions accurate and fit for purpose?

## Exhibit 18

### **The Management of Lake Albert [218, 209]**

Lake Albert provides us with a particularly effective example of the interplay between various drivers, and the management challenges that result.

In August 2021, a fisherman drowned while hiding from the Fisheries Protection Unit (FPU).

Within three weeks prior, the FPU had destroyed over 2,300 boats and almost 16,000 illegal nets across various locations in an operation designed to eliminate illegal fishing on the lake.

However, various interviews with local fishers highlighted some issues with the operations. According to them, the government was trying to remove them from the lake and drive them further into poverty, and only allow rich people to benefit from fishing on the lake. The vessels and equipment recommended by authorities cost over Shs12 million, placing them well above what most fishermen would ever be able to afford.

In many cases, those that have had their vessels destroyed have now lost their only source of income and food security.

## Exhibit 19

### **Lake Kariba**

On Lake Kariba, nets may be cast after 6 p.m. and retrieved before 6 a.m. to avoid fines, arrest or seizure of the net. Replacing nets is a costly affair as they have to be imported and cannot be purchased locally. As it's too risky to leave nets in the water if weather gets bad. Fishers sometimes take the chance and retrieve their nets or go fishing at night in bad weather and risk being injured or killed [165].

## Exhibit 20

### **Lake Kyoga**

A two-year fishing ban on the lake to help replenish fish stocks resulted in over 2,500 fishermen turning to charcoal burning as an alternative source of income. This practice involves the cutting down of trees and burning them to form charcoal, a practice that has significant environmental impacts. At the same time, locals reported the forces manning the operations on the lake were involved in both torture and illegal fishing activities themselves [210].

EVERY CHANGE WITHIN A FISHERIES MANAGEMENT SYSTEM WILL AFFECT SAFETY FOR FISHERMEN IN SOME WAY [48].

In 2019, the Ministry of Fisheries and Livestock of the Government of Bangladesh announced a 65-day ban on fishing in the country's marine areas aimed at conserving fish stocks. During what would normally be considered peak fishing season, the ban was announced at short notice, leaving many fishers without any source of income. While the yearly hilsa ban in October carries some compensation schemes, information on the new ban was contradictory – some newspapers reported that compensation of rice was made available from the start of the ban period, while fishers reported receiving no information or compensation. In the cases where fishers did receive compensation, they indicated it was not sufficient to cover their losses.



Of even more concern is that only 1 in 4 fishers reported that their families had access to social security, and two-thirds reported relying on loans to cover basic expenses, driving them into a greater cycle of debt.

In 2020, the ban was repeated in May, some six weeks after the first Covid-19 lockdown, producing two simultaneous economic shocks to poor fishing families who were no longer able to sustain themselves. While this time the fishers had access to a social security scheme of 43kg of rice per fisherman, many suggested this was inadequate. Additional reports suggested that some received allowances smaller than indicated – receiving as little as 10kg, while other had to wait over a month before the rice was available [67, 68].

## Corruption

Corruption is a challenging issue to tackle, as by its very nature means it is mostly hidden and unable to be quantified. It is deeply intertwined with all the primary drivers and undermines the effectiveness of any safety, social, economic or environmental initiatives developed. It can occur in multiple forms, and through any level of organisation or government, making it exceptionally challenging to address.

This said, our research has uncovered evidence of corruption, or potential corruption, at all levels of industry. The sheer scale of this means it would be impossible to discuss in full in this report; our discussion and case studies provide examples of the practice throughout this report.

At an international level, corruption can occur through bribery, obscure contracts and access arrangements between high- and low-income countries, and failure to meet a nation's obligations under international agreements [152].

In the early 2000s, faced with a severe food crisis, thousands of Senegalese tried to flee to Europe, assisted by local fishermen and their pirogues. An estimated 6,000 people died during the peak of this mass migration in 2006.

In an effort to revive local fisheries and improve food security for the Senegalese people, deals with EU fleets fishing off the coast were cancelled. However, this proved largely ineffective as European companies found loopholes in the legislation, and simply partnered with local businesses so they could continue fishing [153].

On a national or policy level, corruption occurs in politics [67], throughout the vessel / fisher licencing systems with registration of vessels at the incorrect size, the acceptance of bribes, human trafficking and intentionally altered statistic submissions.

**WHEN INTERCEPTING FISHERS-TURNED-PEOPLE SMUGGLERS, THE COAST GUARD CAN OFTEN BE PERSUADED TO TURN A BLIND EYE FOR THE RIGHT PRICE [154].**

Finally, at the level of the fishers, corruption frequently involves the use of bribes, illegal fishing (including banned species, or in excess of quotas), fake licences, mislabelling and the procurement of cheap labour [155].

## Exhibit 21

### The Poverty-Corruption Link

It is no surprise that corruption usually has a degree of financial motivation. However, it is easy to disregard the rationale behind the action of the officers or policymakers involved in the practice. In Cameroon [58] it is suggested that the activity is driven by poverty on both sides.

Fisheries officers are under-resourced and underpaid, making them inclined to illegal behaviours to supplement their meager incomes. In many other cases, the officials are paid or bribed using fish or a portion of the fisher's catch, which suggests this exchange may be supporting the food security of these families.

## Exhibit 22

### **“Their Greed Is Killing Them” [64, 100, 218, 209]**

Greed. This is an argument that was raised by fisheries officials in both Africa and Asia and could form the basis of a very interesting discussion.

*“Mobility and livelihood flexibility of the fishing families making their living on the shores of Lake Chilwa in the 1970’s and Lake Chad in the 1990’s has enabled them to respond to the extreme fluctuations observed. These are not mere ‘coping strategies’ but represent active opportunism adaptations aimed at maximising the contribution of fishing to household incomes.” – Africa*

And:

*[Directed towards crab collectors] “Don’t be greedy. So many people are dying because of tiger attacks and yet you go deeper into the forest creeks. Don’t you value your lives? Those of you who go out of greed want to collect the biggest crabs... if you can live off 4,000 rupees a month, why are you trying to make 20,000?” – India*

In many countries, there seems to be an underlying belief that these fishers “belong in poverty” and don’t deserve the opportunity to better their livelihoods or status. This directly ties into the marginalization of the small-scale fisher discussion and should be explored further.

## Exhibit 23

### **Foreign Labour in the Thai Industry**

Of the estimated 150,000 men working on Thai fishing boats, about 40 percent of them are foreign [221]. While some of them are recruited legally, many are not.

A complex network of people on both the Cambodian and Thai sides of the border are involved in this web of human trafficking. Malai’s district chief, Tep Khunnal, says he wants to “address the problem, but too many people profit from human smuggling.”

According to Human Rights Watch, every segment of Thai officers benefits from human smuggling, including the province, police and labour officers – they all get bribes.

Many of these fishermen will remain at sea for months, even years, and face the horrors of the industry. Reports of abuse, 20-hour working days, minimal fresh food or water, unsafe conditions, abuse and murder are all too common.

About 20 percent of these catches will be directed for the American market.

## Effective initiatives

While much of this report focuses on the dangers to fishers, it is important that we highlight some of the measures that have been effective, or at least partially so, that have been implemented by various governing bodies to serve as an educational tool.

- In the Seychelles, passages through the reef have been cleared and marked with leading lights to allow for safer boat passage to the ports, particularly at night and in poor weather [20].
- Lake Albert and Lake Edward are initiating a cloud-based application to allow continuous Catch Assessment Surveys across the two lakes. As it has been locally developed, it takes into account all of the relevant challenges to the fisher, including lack of connectivity to the internet and language barriers [57].
- In a diving community in Chile, over the last 30 years locals have been working together with a rural health paramedic, local maritime authorities, specialists in underwater medicine, health authorities and stakeholders to implement preventive measures for decompression sickness. This education-focused approach centers on training the divers and targeted treatment protocol for medical personnel [156].
- In some cases, such as women's self-help groups in India, a sustainable livelihoods approach has been trialled and applied to small-scale fishers, demonstrating the importance of both financial support and human and social capital. Financial aid was insufficient for alleviating poverty without community leadership and social cohesion [140].



## Boundary Disputes and Geopolitical Conflict

Boundary disputes have the potential to fall into the category of IUU, climate change and governance depending on the situation. Usually, it is a combination of the three drivers.

As fish stocks diminish across globe, fishers travel further afield to secure fish. Not only does this further travel increase the risks associated with ill-equipped vessels, changeable weather patterns and collisions with industrial vessels, but it increases the risks of human violence.

In Senegal [153], this issue is at the forefront of the fishers' challenges. Overfishing, by both local and international fishers, has resulted in a dramatic decline in stock. This has serious implications for food security in the region, when climate change not only contributes to a decline in fish stocks but also reduces the amount of food that is grown on land.

[“STICK TO SENEGALESE WATERS AND RISK COMING BACK EMPTY-HANDED, OR TRESPASS INTO MAURITANIAN WATERS AND RISK GETTING SHOT?” \[153\]](#)

As a results, many Senegalese fishers crossed the boundary into the rich Mauritanian waters. In 2016, the Mauritanian government put an end to this and banned international vessels from fishing in their waters. Armed warships began patrolling the water with a clear message: Keep out.

In South America, industrial marine vessels clash with the small-scale fishermen, generating territorial conflicts which directly impact the safety and food security of local communities. At the same time, the small-scale fishers are facing further conflicts with the state, as the development of marine protected areas effectively prohibits their access to traditional fishing grounds. In many cases, governing bodies have created these protected areas without consulting local communities or encouraging their participation [145, 157].

In the inland fisheries, conflicts occur between fishers trying to take advantage of better sale prices and fish stocks in neighbouring countries. Bolivian and Brazilian fishers have been involved in several arguments as Bolivian fishers sell their fish in Brazilian markets for a lower price, thus lowering the value of the Brazilian fishers' catch. Simultaneously, Bolivian fishers resent Brazilian fishers encroaching into their waters as they are better equipped and able to catch more fish [24].

Thousands of fishers are also facing the dangers of political disputes between neighbouring countries. Ongoing conflict between Israel and Gaza has had dire effects on Gaza's fishers. Between 2000 and 2019, fishers were only permitted to fish up to 6 nautical miles (NM) off the Gaza coast, which was eventually increased to 15NM in April 2019. In the 6 months following, changes to the fishing limits were made 14 times. Not only has this resulted in a dramatic drop in the number of fishers in the area, but their catch volume as dropped significantly. The situation remains precarious, with the Israeli navy enforcing the bans using live fire at the fishing boats, injuring – sometimes fatally – fishers and their children [158].



Figure 31: Fishers in the Indian Ocean. Image Credit: Egle Sidaraviciute / Unsplash

Boundary disputes are common between Indian and Sri Lankan fishers. In 2012 the Indian Government stated that there had been 167 shootings on Indian fishermen within Indian waters by the Sri Lankan Navy between 1991 and 2011. This resulted in 180 injuries and as many as 85 fatalities. However, Sri Lanka argued that there had been no attacks in Indian territory, and the clashes had occurred when Indian fishers ventured into Sri Lankan waters.

**THE SRI LANKAN NAVY REPORTED 282,000 TRESPASSES OF INDIAN TRAWLERS BETWEEN 2009 AND 2016 – APPROXIMATELY 40,400 PER YEAR.**

More recently, Sri Lanka is fighting against thousands of Indian trawlers which allegedly fish illegally in Sri Lankan waters on a regular basis. According to the FAO Asia-Pacific Commission, the Sri Lankan territorial waters in and around the Palk Strait are the fifth largest IUU hotspot in Asia [159].



## Exhibit 24

### Case Study – Madagascar

“IN RECENT YEARS, FISH HAVE BECOME SCARCE. YOU HAVE TO GO FURTHER AND FURTHER OUT TO BE ABLE TO FISH. IT IS CERTAINLY MORE DANGEROUS TO VENTURE OFFSHORE, BUT IF WE DON’T, WE WOULD COME BACK EMPTY-HANDED.”

GÉRARD, LOCAL FISHER [160]

Fishing plays a leading role in Madagascar’s economy, and a decrease in catches is felt deeply along Madagascar’s coastal region [160, 161].

Illegal catches represent as much as half of the country’s total production. On average, only 1 in 5 canoes are registered with authorities, and catches are generally not reported. As a result, stocks are overexploited, and the catch decreases each season.

Local fishermen are being pushed further out to sea in order to secure a catch, significantly increasing the risks to them.

At the same time as developing a new plan aimed at fighting against illegal fishing in the region, the Malagasy government has been found to have signed two protocols allowing some 28 Chinese fishing vessels access to local waters.

The Coalition for Fair Fisheries Arrangements describes how authorities invite investors to come and fish when they do not have a fishing licence. Authorities then legalise the situation by setting up a joint venture, followed by flagging the Chinese vessels under the national flag and issuing an appropriate fishing licence.

Following this, in exchange for a minimal annual fee, these vessels have free access to Madagascar’s high-value fisheries – representing significant revenue loss of the government.

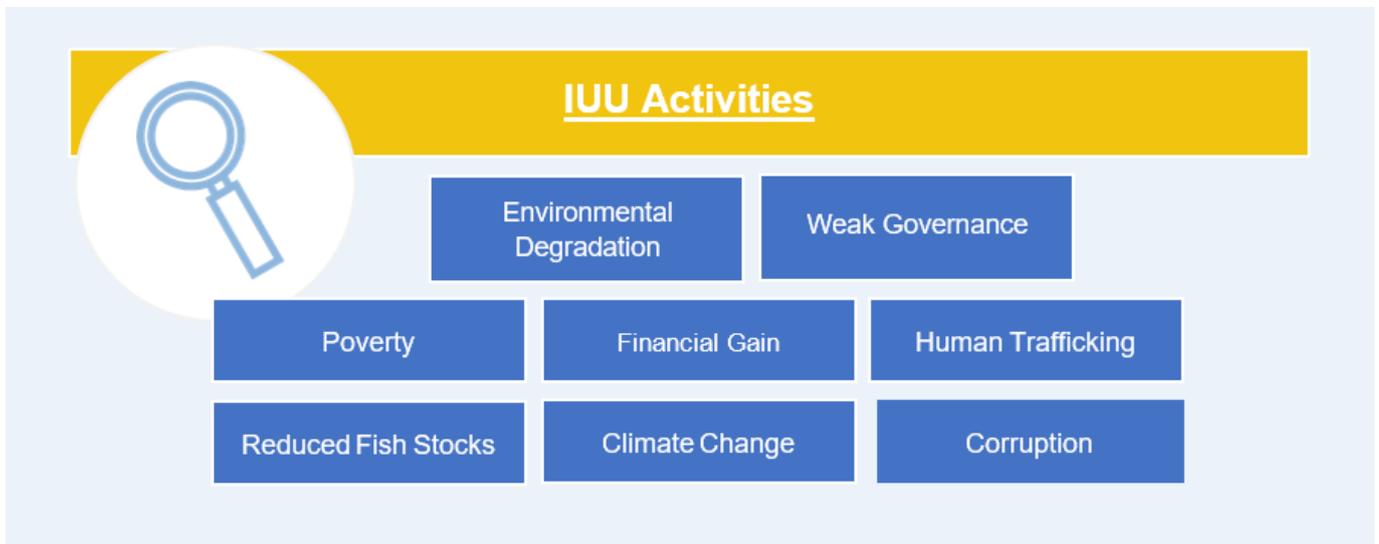
The result is increased pressure on the already vulnerable coastal fishing communities as fishing yields drop further and marine environments are destroyed.

## ILLEGAL, UNREPORTED AND UNREGULATED FISHING

The blanket term “Illegal, Unreported and Unregulated (IUU) fishing” should be used with caution at the risk of further marginalization of small-scale fishers.

Through no fault of their own, small-scale fisheries are generally not included in national reporting or regulatory frameworks, thus technically including them in the all-encompassing criminality of IUU and yet again undermining their critical role in global food security.

Not only can one not compare the industrial fleets fishing off the coasts of Africa or South America to a family trying to sustain themselves in the rivers of the Amazon, but the drivers and resulting impacts of these activities are vastly different and need to be addressed individually.



In order to provide some context here, we chose to distinguish IUU activities by three distinct categories in order to address each issue more clearly.

### **Organised Industrial IUU**

Industrial IUU refers to the type of illegal fishing typically seen in the distant water fleets. These are vessels which take deliberate steps to avoid detection, disregarding local and international requirements to make a profit.

The risks associated with commercial fishing will be amplified by illegal behaviours with a disregard for legislation and safety. It can be assumed that fatalities that occur on industrial vessels operating illegally are not reported, and therefore, under the scope of this project, we remain unable to quantify the fatality rate for the illegal industrial fishing fleet.

### **Organised Small-Scale IUU**

In this case, organised small-scale IUU refers to organised illegal, unrecorded or unreported fishing activities occurring between multiple parties in small-scale or artisanal networks. These can involve intentional violations of a country's laws, transshipments of catch with industrial fleets illegally operating in an area, and the catch of prohibited marine (or inland) products for illegal export.

All forms of piracy and corruption occurring within the small-scale, subsistence or artisanal sectors will fall into this category.

### **IUU by Necessity**

IUU by necessity is an interesting concept. As demonstrated throughout our case studies, many small-scale fishers participate in intentional illegal activities out of desperation.

Driven by the impacts of poverty, industrial-scale illegal fishing, reduced fish stocks, climate change, lack of food security and the absence of any other livelihood alternative, millions of fishers rely on their local resources to survive.

## The Cause

IUU fishing activity is so widespread that it encompasses the industry as a whole, but also affects each individual fisherman in their own unique way. Understanding the contributing factors that drive the behaviour of fishers is essential for effective fisheries management.

The reasons behind IUU are hard to isolate as there are so many variables behind the behaviour and the activity itself. Industrial fleets operating in foreign waters are not comparable to a fisher sustaining his family and not reporting his catch to the relevant authority, yet technically they are both involved in IUU fishing activities and therefore get covered by the blanket term and associated criminality

Each component of IUU — the illegal, the unreported, and the unregulated — needs to be considered on an individual basis relevant to the appropriate fishery to be addressed effectively.

“THERE ARE DIFFERENT SOLUTIONS TO EACH PROBLEM. IF THESE WERE THREE ILLNESSES, THERE MUST BE DIFFERENT TREATMENTS, BECAUSE IF YOU COMPOUND [THEM] AND THINK OF THESE FISHERIES ISSUES ONLY AS ILLEGAL FISHING, YOU WON’T CURE THE PROBLEM.”

NYGIEL ARMADA, FISH RIGHT PROGRAM [162]

All components of IUU are more likely to happen in countries that have weak governance and lack the capacity to police their waters. This is usually in lower-income countries, where poor socio-economic conditions, lack of employment options and food insecurity increase both the impact of IUU and the likelihood of it occurring [155, 163].

Over recent decades, our reliance on fisheries has increased dramatically. Industrial fleets have expanded rapidly, become more efficient, and able to travel further, allowing us to fish well above limits that would be considered sustainable. As the human reliance on fish as an animal protein is increasing year by year, and the global population continues to increase, the pressure we are placing on these resources becomes greater.

These issues are enabled by weak regulatory framework on a global scale.

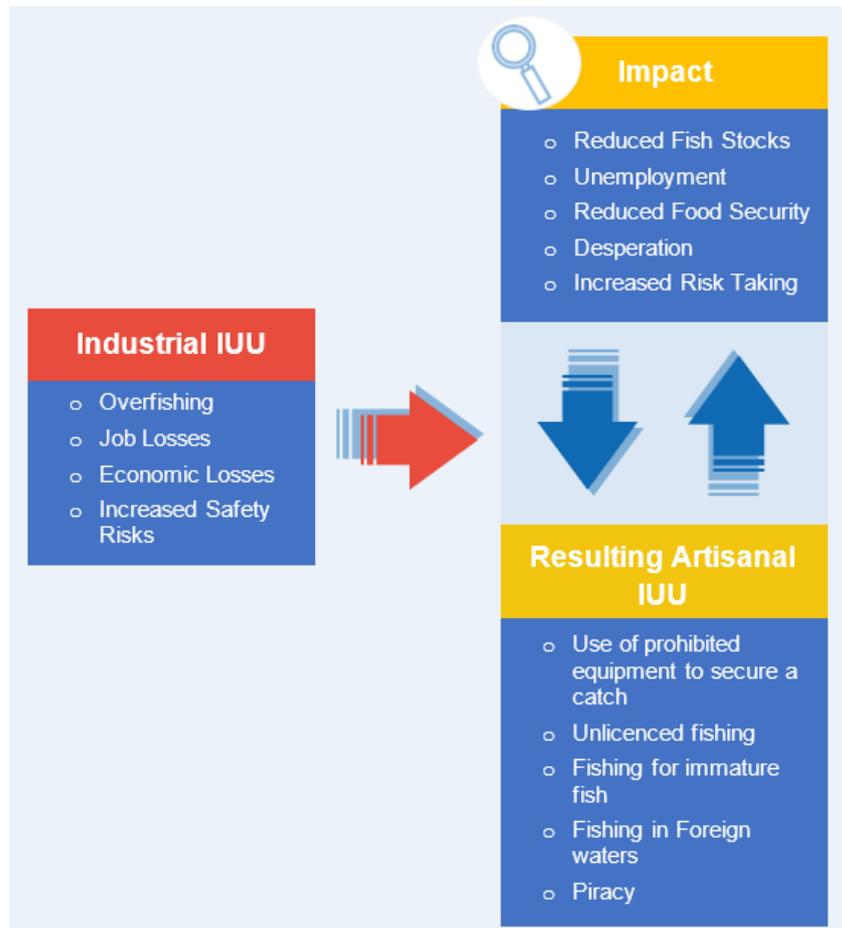
Overexploitation by the large-scale sector, who face minimal intervention despite often blatant illegal practices, is often responsible for increased pressure on small-scale fishers.

For example, in marine fishing off Africa’s West Coast, many local governments lack the capacity or resources to prevent these actions from occurring. As the impacts of overexploitation are compounded by climate change, the volume of fish available to local fishers has seen a dramatic decline.

As stocks fall and small-scale fishers are no longer able to make a living, many respond to the crisis by turning to illegal measures to compete with industrial fleets.

In the Philippines and Indonesia this includes the use of illegal nets, cyanide, spearfishing and blast fishing. Cyanide and blast fishing are particularly damaging to the marine environment, damaging reefs and killing non target species and coral reef organisms. Over time, this can lead to the collapse of entire reef ecosystems.

Fine nets catch indiscriminately, and their use results in the depletion of juvenile fish and breeding stock; this has been seen to be a problem in all locations we explored. While it may solve the immediate issue by providing food and income, the use of these nets drives further depletion of local stocks.



As IUU has been discussed extensively throughout the report, we did not feel it necessary to expand on it in too much more detail — as it stands it is currently discussed in all case studies.

In addition to the previously stated examples, we provide the following extracts for further consideration:

- Illegal fishing activities account for an estimated 40 percent of all catches off West Africa [155].
- Lake Kivu has seen a 28 percent drop in fish production over two years as illegal fishing rates continue to increase [163].
- It has been argued that in Africa, the main forms of illegal activities are licenced vessels underreporting their catches, fishers using banned fishing methods, and substantial fraud in the misreporting of vessel sizes [57].
- Penalties on companies are often minimal or ineffective. To deter illegal activities, studies suggest punishments need to be drastically increased, with penalties as much as 24 times greater [155].
- Lack of enforcement means 93 percent of fishing off the coast of Somalia is in the area reserved for artisanal fishers [53].
- The Canaticu River in the Amazon basin has provided the main source of livelihoods for its population for decades. Locals, however, say that fish and crustacean stocks have fallen dramatically over the last 10 years [164].
- 76 percent of fish species (including shrimp and crab) in Lake Victoria currently face extinction due to IUU fishing [157].

“IN THE PAST, WE ATE FISH ALMOST EVERY DAY. NOW WE HAVE TO BUY CHICKEN TO CONSUME ANIMAL PROTEIN”

MARCIO DOS SANTOS [164]

## Exhibit 25

### Primary Drivers – The Perfect Storm

By early in April 2020, more than 10 people had died in Lake Kyoga (Uganda) while fishing, despite a fishing ban that had been imposed in April 2019.

One district, with over 140,000 residents, was beset with famine due to a prolonged dry spell that reduced supply and increased costs for essential food items.

Poverty and hunger resulted in them turning to the lake to provide.

**“SOME PEOPLE DON’T HAVE FOOD IN THEIR HOUSES, SOME ARE NOW RISKING THEIR LIVES TO GO LOOK FOR FOOD.”**

ROGGERS AKENA, LOCAL RESIDENT

Local authorities, however, claim to only know of one incident on the lake, although admit that there are likely more as residents fear reporting accidents on the lake due to their illegal activities [165].

## Exhibit 26

### Piracy

There is growing acceptance that a link exists between marine resources and economic shocks (poverty) and piracy.

Destructive fishing methods, high bycatch and discards and illegal encroachments generate significant economic losses for coastal communities.

**THE AUTHORS OF [195] FIND THESE LOSSES ARE “ESTIMATED TO EXCEED THE TOTAL ANNUAL CONTRIBUTION OF SMALL-SCALE FISHERIES TO THE GLOBAL ECONOMY”.**

These economic losses, climate changes, declining fish stocks and poor governance all further contribute to challenges faced by these communities.

In some cases, “local fishers have been known to hire or join pirate gangs to deter foreign industrial fleets from fishing in their territorial waters” when national maritime enforcement is lacking [166].

That begs for the question: Should we be viewing piracy as a contributor to IUU – or the result of IUU?



## Exhibit 27

### Case Study – IUU on Lake Victoria

In 2018, the International Union for Conservation of Nature (IUCN) stated that climate change, pollution and inappropriate fishing practices were destroying the Lake Victoria ecosystem [167] with 20 percent of species facing extinction due to the combined effects of climate change, industrial and agricultural pollution, and poor fishing practices. Others reported the number to be as high as 76 percent of species in danger of extinction [157, 168].

As the fishing population on Lake Victoria increases, so do the illegal activities. Between 2006 and 2016, records showed significant increases in the use of illegal fishing equipment [168], including:

- Illegal small hooks (which mainly target Nile Perch) increased 302 percent from 3 million to 14 million.
- Monofilament nets (which are illegal) increased by 3,044 percent from 2,293 to 72,101.
- Illegal small seines, which target Dagaa, increased by 170 percent from 4,370 to 11,805.

Illegal fishing occurs on both small and large scale in the lake. Small mesh and monofilament nets, despite being prohibited and destructive, are some of the primary types of fishing equipment used by fishers in the region. Banned fishing practises, including the use of firearms, explosives, electrical shock devices and toxic substances, are also frequently used by organised crime syndicates.

These illegal fishing methods contribute to the depletion of species, driving the continuation of illegal fishing, and increased disputes and clashes between fishermen and authorities.

**THE VOLUME OF UNDECLARED AND ILLEGALLY CAUGHT FISH IS REPORTEDLY ALMOST DOUBLE THE DECLARED TONNAGE.**

**ANONYMOUS KENYAN FISHERIES OFFICIAL**

Corruption has been reported to be a significant enabler of illegalities.

Interviewed fishermen described enforcement officers demanding bribes instead of taking offenders to court, or the arrangement of regular payments in exchange for allowing the use of illegal gear. On a larger scale, a Kenyan State Official said crime syndicates would usually mix legal and illegal catches and ship it out using local waterways. Custom officials would then be bribed to allow consignments to pass without being inspected [169, 170].



## Exhibit 28

### Case Study – The Raft Fisheries of Myanmar

Producing as much as 80 percent of the country's ngapi (fish paste) and dried prawns, Myanmar's Pyapon district's raft fishing industry is booming — along with the human rights violations that sustain it.

In August every year, thousands of men are recruited for the work on the rafts from around Myanmar. Most raft owners rely on “brokers” or employment agents, who get paid a fee of just under US\$20 by the raft owner for each worker they recruit. In addition, each employee pays the broker a fee for securing them employment due to local labour shortages.

The bulk of their wages are paid in advance (US\$425–\$485), so the brokers approach the most vulnerable – poverty stricken, criminals and addicts – where the chance of instantly receiving enough money to support their families for a few months is enough to convince them to sign a contract and committing themselves to the rafts for a few months. It is not uncommon, however, for brokers to misappropriate the advance payment, and not pay it to the workers' families.



Figure 33: Those stricken by poverty are often an easy target for brokers. Image Credit: © Can Stock Photo / sytilin

Once contracts are signed, workers are transported to their raft – a small bamboo platform floating atop foam blocks, anchored as far as 100km off the coast – with two to three other men consisting of a raft head or foreman and assistants.

For the next eight months, nets must be lowered into the water every six hours. They are raised and cleared before the catch is sorted and processed. When fishing is good, it is not unusual for workers to go several days without sleeping. Carrier vessels collect the catch on a regular basis (reports vary from daily to every three to five days) and bring supplies of fresh food and water.

### **Working conditions**

According to researchers Yin Nyein and Sebastian Mathew, 349 bamboo rafts were registered in Myanmar in 2017, yet local authorities in the village of Naukme estimated the number of rafts – in their area alone – was as high as 1,500 [172].

Many workers are disabled or die each year due to a lack of sufficient food and medical care. An article looking into the enslaved fishery workers near Pyapon City [173] explained that many fishery workers do not get sufficient food. Sometimes workers die because they run out of fresh water or because they become malnourished. Lower-body disabilities are common, caused by a condition called beriberi (vitamin B1 deficiency) due to the lack of fresh food.

“DURING THE MONTHS THAT I WORKED, I DIDN’T GET TO EAT REGULARLY. SOMETIMES I DIDN’T EAT FOR TWO OR THREE DAYS. SO I’D RINSE THE SALTED FISH AND EAT IT. SINCE THERE WASN’T ENOUGH FRESH WATER, I HAD TO RINSE IT WITH SALT WATER.”

MAUNG NAY LIN HTET. RAFT WORKER [173].

If fishers become unwell or injured, access to medical care is dependent on the raft owner and on the frequency of visits by the carrier vessels. Multiple interviews have highlighted raft owners’ hesitancy to transport unwell workers to hospital at the risk that their workers will run away.

“MOST WORKERS HAVE DIED DUE TO BURST ARTERIES IN THEIR STOMACHS, TUBERCULOSIS, LIVER DISEASE, OR WATER ON THEIR HEARTS, KIDNEYS OR INTESTINES. THEY BECOME MALNOURISHED, THEY GET STOMACH ULCERS, THEIR BODIES BECOME BLOATED DUE TO EATING MOSTLY SEAFOOD, WHICH IS HEAVY IN SALT, AND WATER ENTERS THEIR LUNGS AND LIVERS.”

LOCAL DOCTOR DESCRIBING THE RESULTS OF AUTOPSIES OF RAFT VICTIMS

Violence — even reports of torture — on the rafts is common. Enforcers who travel between rafts on the carrier vessels, known as oo zee gyoke, or the foremen onboard are known to beat workers when they aren't working to the expected standard. In some cases, these beatings are so severe that the fisher is crippled, or killed, and their bodies are dumped at sea.

Violence between workers on board is also common as the isolation and working conditions take their toll. In the first two months of the 2017 season, the Amar Township saw 30 raft workers die of malnourishment, and a further four due to violence onboard [174].

### **Enslaved to the raft**

Once workers are on the raft, they have little option of escape. Raft owners are so desperate to avoid desertion by the workers that people from the same villages are not placed on a raft together in case of an escape attempt. They are not supplied with life jackets or paddles – as this would make it too easy to leave.

A chairman of one raft association stated in an interview that of the 8,000 workers employed on their rafts, they lose about 2,000 of them within the first two months, including people that run away, people who get sick, and those that can't endure the work [175]. He made no mention of fatalities. Once on board, they cannot leave due to their advanced pay – they are bonded to the raft. There have been some reports of families having to pay back the money if a worker becomes injured on board and is unable to complete their contract.

### **Calculating Fatalities**

Calculating the exact number of fatalities is impossible until such time as the industry is regulated. Some of the figures we recorded include:

- A small government hospital at Daw Nyein village recorded 102 raft worker deaths at sea in 2017, 82 in 2018 and 80 in the first three months of the 2019 season [174]. They only count the bodies of people that are returned to shore — not those whose bodies are dumped at sea.
- Amar Township police station recorded 34 fatalities in the first two months of 2017 [175].
- A local hospital stated that in March 2017, up to 30 workers died due to malnutrition or lack of medical care, and another six from injuries that month [175].
- According to Pyapon MP Thein Swe, 57 people were lost at sea between 1 September and 7 October 2019 [176].
- 2017 season saw 276 fatalities, according to Pyapon District Police [177].

While none of these articles were able to give us exact figures, we produced a number of tentative calculations, producing a fatality rate between 1,700 and 6,900 per 100,000 fishermen. As the total number of fishers working on the rafts is estimated to be 40,000, fatality numbers could be as high as 2,760 per season.

### **Compensation and government intervention**

Victims' families, by law, are entitled to compensation – as long as they can produce a death certificate, which can only be issued if a body is found. In many cases, raft owners offer the families more than legally required – a total of K600,000 (US\$364 at the time of writing). They simply say their loved one died while trying to escape, which prevents the death from being officially registered.

“WE INVESTIGATED SOME COMPLAINTS WE RECEIVED FROM FISHING FAMILIES. IT’S VERY CHALLENGING. THE EMPLOYERS HAVE GOOD RELATIONS WITH GOVERNMENT AUTHORITIES. THEY PAY THEM. WHEN WE ASKED THE OFFICIAL AUTHORITY TO TAKE ACTION AND PROTECT PEOPLE FROM WORKING TILL DEATH, THEIR REPLY WAS: ‘THAT’S NATURE, PEOPLE ARE BEING KILLED EVERY YEAR. YOU HAVE TO FORGET IT.’”

REPORTER [172]

Myanmar has a long history of corruption within its fishing sector. Fishing rules, such as those forbidding raft owners to own more than eight rafts, are frequently flouted, with some owning up to 50 rafts, as they know the government will not conduct inspections or take action against those who do not comply.

After a well-publicised case brought attention to the raft fishing industry, the Myanmar National Human Rights Commission was forced to take action. Their raft inspections, however, did not take place due to rough weather, and they left the region after interviewing only raft owners, supervisors and workers in the village on shore.

It is further reported that human trafficking police in Myanmar will only respond to cases with “exact information.” As a result, nothing is done. Of significant concern is the fact that when social security laws were adopted in 2012, those involved in seasonal fishing operations were not included in meeting the obligations, leaving these workers unprotected and vulnerable.

Depending on the stance of the reporter, some interviews appeared to be carefully worded to absolve the raft owners and government of responsibility, placing the blame on brokers and the victims themselves.

# SUSTAINABILITY

## Environmental and Ecological Drivers

### **Fish Stocks and Reduced Catches**

According to FAO [5] the proportion of marine fish stocks that are within biologically sustainable levels decreased from 90 percent in 1974 to 65.8 percent in 2017. The corresponding figure for inland fisheries is not produced.

However, given the limitations of the available data, this percentage tells us very little. Without the inclusion of further information such as catch per unit effort, the size and quality of stock caught, and the ratio of catch by subsector, the level of stock decline can be easily hidden [52, 178]. In inland waters where fishery statistics are even more limited, the risk of this occurring is even greater.

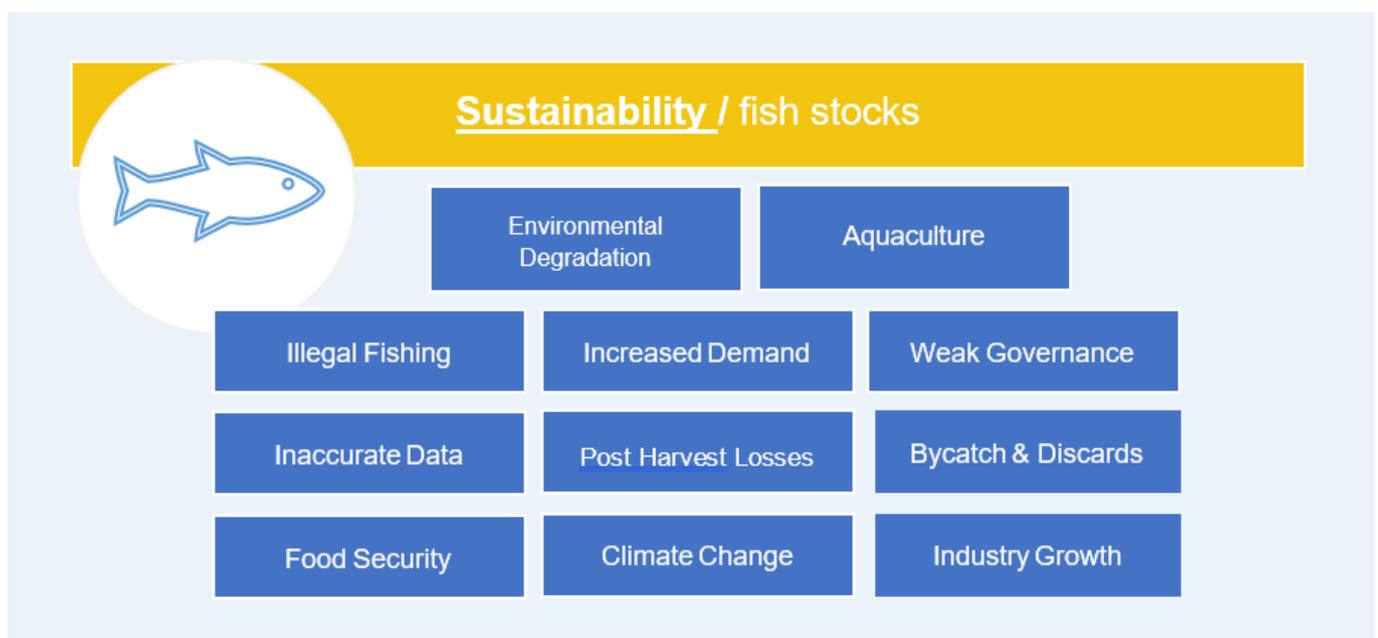


The factors contributing to reduced fish stocks include (but are not limited to):

- Data inaccuracy
- IUU
- Climate change
- Poverty
- Increased global populations and reliance on fish
- Foreign fleets
- Weaknesses in governance – including limited legislation, enforcement, corruption and the use of fleet-enhancing subsidies
- Environmentally damaging fishing methods
- The use of wild-caught fish for aquaculture feed

Instead of relying solely on the official statistics, we provide numerous case studies from all fisheries regions and subsectors which clearly highlight the challenges and effects of reduced fish biomass – even if the published figures fail to recognise the severity.

In many regions, fishing communities, particularly small-scale fishing communities, are struggling with significant reductions of fish stocks – and the results are catastrophic.



Reduced catches and food insecurity directly contribute to increased levels of poverty. When marine (or freshwater) ecosystems are overexploited, their capacity to sustain food security, nutritional and livelihood functions are reduced [178]. We have highlighted the struggles of fishers around the world who are no longer able to support their families and livelihoods in the way they had previously due to a reduction in fish. The resulting changes in activities and behaviours are widespread, many of which pose an increased risk to the fisher's life. This may include:

- Travelling greater distances from shore / fishing for longer periods of time. In many cases, their vessels are not equipped or safe for trips of this duration, which increases the risk of capsizing, sinking, or mechanical breakdowns. Additional further threats are then added by increased exposure to weather and weather extremes as a result of climate change, increased piracy risks, and conflict between industrial / artisanal sectors.
- Fishing in restricted areas. This includes prohibited areas (as demonstrated in the Sundarbans Mangrove Forests case study), fishing off season or during bans, or crossing (intentionally or not) into neighbouring countries' waters. Cross-boundary conflict has been noted in all regions of the world, including inland South America, Africa, the Bay of Bengal and Oceania.
- Ignoring fishing bans. This poses an increased risk for different reasons based on the type of fishery and the reason for the ban. In some cases, ban have been imposed to reduce the level of wildlife-fisher conflict, while others have been implemented due to unpredictable weather. In many countries, it is not unusual to read reports of fisheries enforcement personal allegedly shootings fishers who ignore fishing bans.
- Piracy and human trafficking [142]. We were able to find cases in several countries which demonstrated the level of desperation that the loss of fisheries livelihoods induced on fishers. Some turned to piracy to sustain their livelihoods, while other reports highlighted fishers' using their vessels to smuggle people to higher-income countries.
- Illegal fishing methods. The use of dangerous and destructive fishing methods is not unusual. Dynamite fishing remains popular despite the risk of losing a limb due to a slight timing miscalculation, while fishing at night to avoid detection is common practise on many African lakes. The other fishing method that directly impacts a fisher's safety is highlighted in the Divers of Central and South America case study, where increasingly dangerous submersions are taking place as a direct consequence to the decline in fish stocks.

## Exhibit 29

### Senegal

The fishing industry in Saint-Louis (Senegal) dropped by more than 80% between 2016 and 2017. In five years, the fishing hub went from producing enough fish to feed 650,000 people to only enough for 70,000. The flow-on effect of this was a dramatic increase in the price of fish, which made it impossible for locals to afford [153].

## Exhibit 30

### Southeast Asia

Impoverishment of fishers due to declining catches has been seen as a factor driving fishers to supplement their incomes by conducting pirate attacks themselves [142].

## Exhibit 31

### Seychelles

An FAO report into the safety at sea for small-scale fisheries in the Southwest Indian Ocean [20] highlighted in its case study on the Seychelles that small artisanal vessels have had to move further out to sea due to the overexploitation of coastal resources. This becomes a serious issue, as strong winds and poor vessel condition and design are highlighted as some of the biggest contributors to accidents in this fleet.

## Destructive Fishing Methods

The effects of overfishing are apparent not only from an economic standpoint (in the form of reduced catches) but have devastating impacts on the biodiversity of waterways and changes to ecosystem structures. Industrial exploitation of fish stocks often occurs in tandem with long-term degradation of marine habitats. Bottom trawlers drag nets across the ocean floor, damaging critical ecosystems and breeding grounds, which contributes to the progressive decline of fish stock [52]. In areas where trawling disturbs the muddy seabed, significant shifts in the marine ecosystem takes place, resulting in a reduction in biomass that is 10 times greater than that in an area that hasn't been trawled [179].



Figure 35: Guatemala shrimp trawler. Image is for illustrative purposes only and not taken in the context of IUU. Image Credit Francisco Blaha [125]

Similar to mangroves, coral reefs and seagrass beds form essential parts of marine ecosystems, both in terms of carbon sequestration and as breeding grounds and nurseries to many commercially important species of fish. Bottom trawling causes significant damage to these habitats. A study on corals brought up by trawlers off the coast of Ireland showed the age of one coral to be 4,550 years, while one in Norway was dated as an incredible 8,500 years old. Also in Norway, reports indicate that between 30 percent and 50 percent of the nation's reefs have already been damaged by trawling. As a vessel can drag 2,200 pounds of coral in a single haul, the long-term implications to these habitats are devastating [179].

This damage is particularly concerning when one considers the behaviours of the international trawlers fishing off the coast of Africa. These vessels are known to regularly encroach into the inshore areas reserved for local artisanal fishers, causing severe damage to the very ecosystems that provide millions of people with food security, and reducing the resilience of the ocean to adapt to climate change.

## Bycatch

Bycatch and discards are yet another aspect of the industry where little reliable data exists.

Typically, small-scale fisheries have been considered to have a lower environmental impact due to the usage of a higher percentage of their catch. Some reports indicate that many inland fisheries in developing countries use 100 percent of their catch [180, 181] though this is not necessarily true for all fisheries.

The collection of tiger shrimp fry, for example, is known to involve the removal of as many as 12–551 post larvae of other shrimp, 5–152 fish larvae and 26–1636 macro zooplankton for a single larva, while affecting 400 species [63, 81], making this practice a significant threat to coastal ecosystems.



In the industrial fleet, crustacean trawlers in tropical waters are recorded of having the highest levels of reported discards at over 12kg per kilogram landed [179], while in Senegal some vessels only keep 200kg per 5-tonne haul [60].

Some global estimates state that as much as 40 percent of global catch is discarded [182], though due to the lack of regulatory control and enforcement capacity, it is unlikely that we will ever be able to determine the true number.

While post-harvest losses are not explored in this paper, they further contribute to the volume of wasted catch in the artisanal and small-scale fleets and display ties to poverty, governance and IUU factors.

## Exhibit 32

### **Mangrove Degradation, Climate Change and Poverty**

Despite only covering a small percentage of the Earth's surface, mangroves' role in ecological systems and fisheries sustainability is critical. Mangroves provide an ideal breeding ground for many species of fish and provide food security for millions of people who rely on them in over 100 countries [183]. Many of the countries that rely heavily on fisheries as a source of protein and are most vulnerable to micronutrient malnutrition and food insecurity have significant mangrove forests which support these fishers.

Mangrove forests act as a carbon sink – absorbing more carbon from the atmosphere than they produce, with some studies suggesting that, pound for pound, mangroves can hold as much as four times more carbon than rainforest can – making these forests critical in the fight against climate change [184]. Simultaneously, mangroves form a barrier to some of the effects of climate change, including storm surges, sea level rise, riverbank erosion and salinity intrusion [68].

Despite their benefits, mangrove forests continue to be destroyed by human activity at alarming rates. Between 1980 and 2000, an estimated 35 percent of global mangrove forests were destroyed — at a destruction rate faster than that of the tropical rainforests. The years between 2000 and 2015 may have seen up to 122 million tons of carbon released back into the atmosphere due to mangrove forest loss [184, 185].

In Ecuador, a 2011 study calculated that nearly 90 percent of mangrove deforestation resulted from the development of aquaculture shrimp farms — a pattern similarly described in the Sundarbans Mangrove Forests of India and Bangladesh. Research indicates that the degradation of these natural landscapes for the industrial-scale growth of aquaculture plots has led to an increase in global greenhouse gas emissions [63, 185].

The conversion of mangrove forests to aquaculture farms diminishes the mangroves' protection ability, resulting in increased salinity intrusion. Not only does this alter the salinity of the spawning grounds for many fish species – reducing fish diversity – but there are indications that a healthy mangrove system can support up to 10 families for every one family a shrimp farm supports.

## Exhibit 33

### **Invasive Weeds** [94, 186, 187]

Freshwater ecosystems around the world are facing a losing battle with alien plant species taking over their waterways. In Africa, multiple lakes are fighting with various plant species, including Salvinia, water hyacinth and water lettuce.

The impact of these species should not be underestimated. In Cameroon's Lake Ossa, 40 percent of the lake's surface is covered by Salvinia, which forms a thick blanket, preventing light from entering the water. This not only reduces photosynthesis by phytoplankton (on which the fish feed) but depletes oxygen levels in the water and asphyxiates aquatic life – including fish.

While Lake Ossa once supported hundreds of fishermen, the few that remain today report a drop of income of over 80 percent due to the weed.

These plants are capable at spreading at rapid speed – water hyacinth and water lettuce are known to double their size every five days.



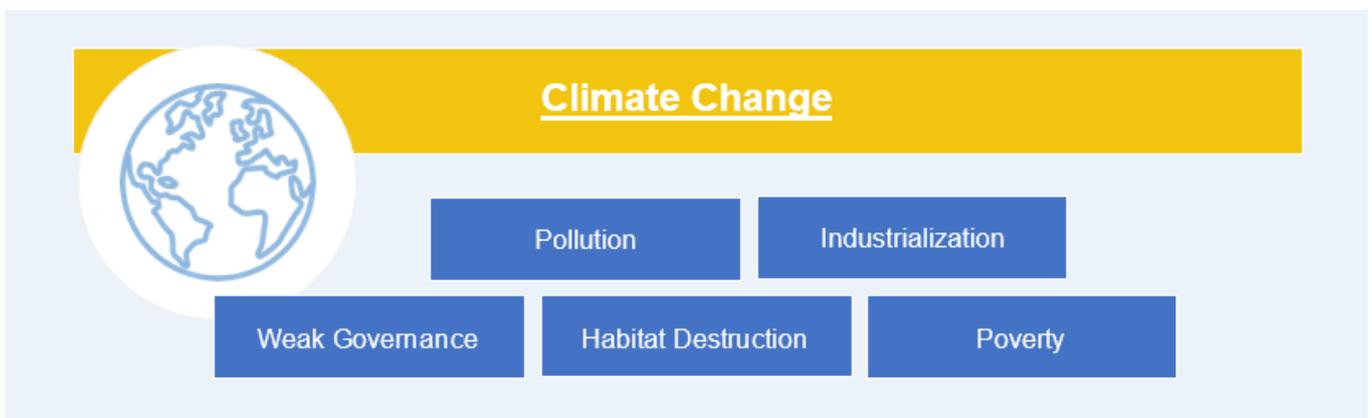
Figure 37: A Ugandan fisherman attempts to fish among the greenery. Image Credit: © Can Stock Photo / imagex

The increased weed growth has been directly attributed to increased human activity in the regions, with the nutrient run-off from agriculture and human waste forming nitrogen-rich environments in which the plants thrive. Furthermore, these plants then contribute to the destruction of wetlands due to their excessive water consumption, which ultimately contributes to shrinkage of the water bodies.

## CLIMATE CHANGE

The ocean plays a major role in climate dynamics. Increased amounts of greenhouse gasses from human activities cause more energy from the sun to get trapped within our atmosphere while the oceans absorb this extra heat. In fact, they have absorbed over 90 percent of the excess heat caused by greenhouse gas emissions since the 1970s [189], resulting in increased water temperatures and rising sea levels. However, the problems go much further than this.

The oceans help reduce climate change by storing large amounts of carbon dioxide, thus making oceans more acidic. The changes in ocean chemistry then have flow-on effects to marine ecosystems, and the effects are already being felt [190].





### **What this means for the marine ecosystems**

As ocean temperatures rise and the ocean chemistry changes, less oxygen becomes available in the water and oceans become even more acidic, having dramatic impacts on marine animals, plants and microbes. This is expected to affect the physiology, biology, ecology and behaviour of all marine organisms to some extent.

Tropical and warm-water coral reefs are particularly vulnerable. Increases in temperature above 1–2°C result in a process called coral bleaching – where coral animals reject the algal partners they depend on, resulting in mass coral deaths. According to experts at the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [191] half of the world’s coral reefs have been destroyed since the late 1800s, with loss of life accelerating in recent decades, a concerning trend when considering coral reefs are essential in sustaining the life of 25 percent of all marine species [192].

## Fish Migration

Fish are strongly influenced by fluctuations in environmental and climatic conditions. Therefore, fisheries are likely to be affected by changes in water temperature, nutrient levels, water levels, precipitation, and seasonal patterns. As climate change alters sea conditions and currents, the distribution of fish will change with fish moving towards colder, deeper, or further offshore waters to find their preferred environment [189, 193].

Essentially, many fish are moving away from their typical habitats in search of cooler water. For some countries, this has the potential to increase yields and create new opportunities, while for others, it may be enough to trigger the collapse of entire ecosystems, driving millions more people into poverty and food insecurity.

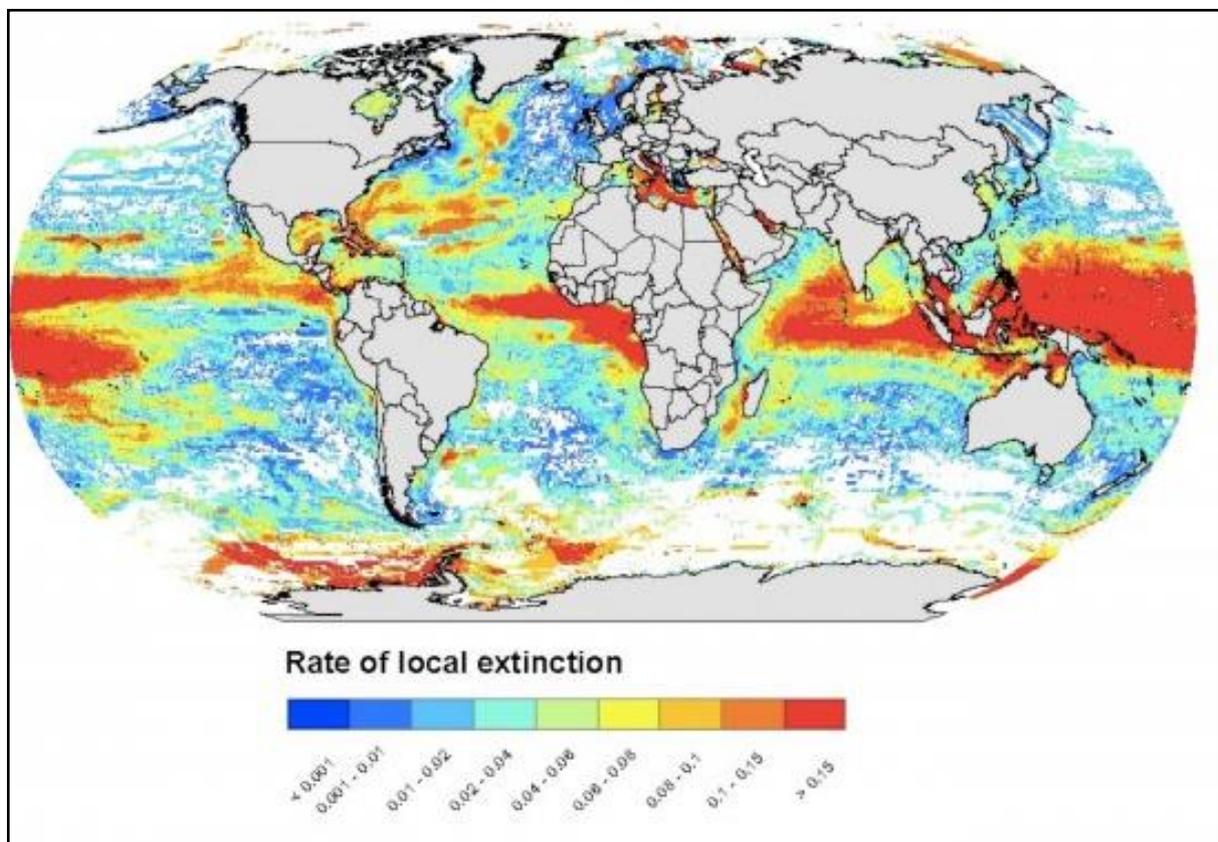


Figure 39: Predicted impact on fish distribution. Image Credit: Nerus Program [219]

The impacts of climate change are not linear or consistent across all ecosystems due to the cumulative impacts of the other drivers. In the East and South China Seas, the ocean has experienced warming at 10x the global average, while simultaneously feeling the effects of severe overexploitation of marine stocks [194].

Concerningly, many of the communities already grappling with food insecurity and poverty are the same communities that rely most heavily on fish, and are most likely to be negatively impacted by climate change and fish migration. See figures 44 and 45 on page 121.

The countries along the equator will be particularly hard hit, particularly those in shallower water where the effects will be most noticeable.

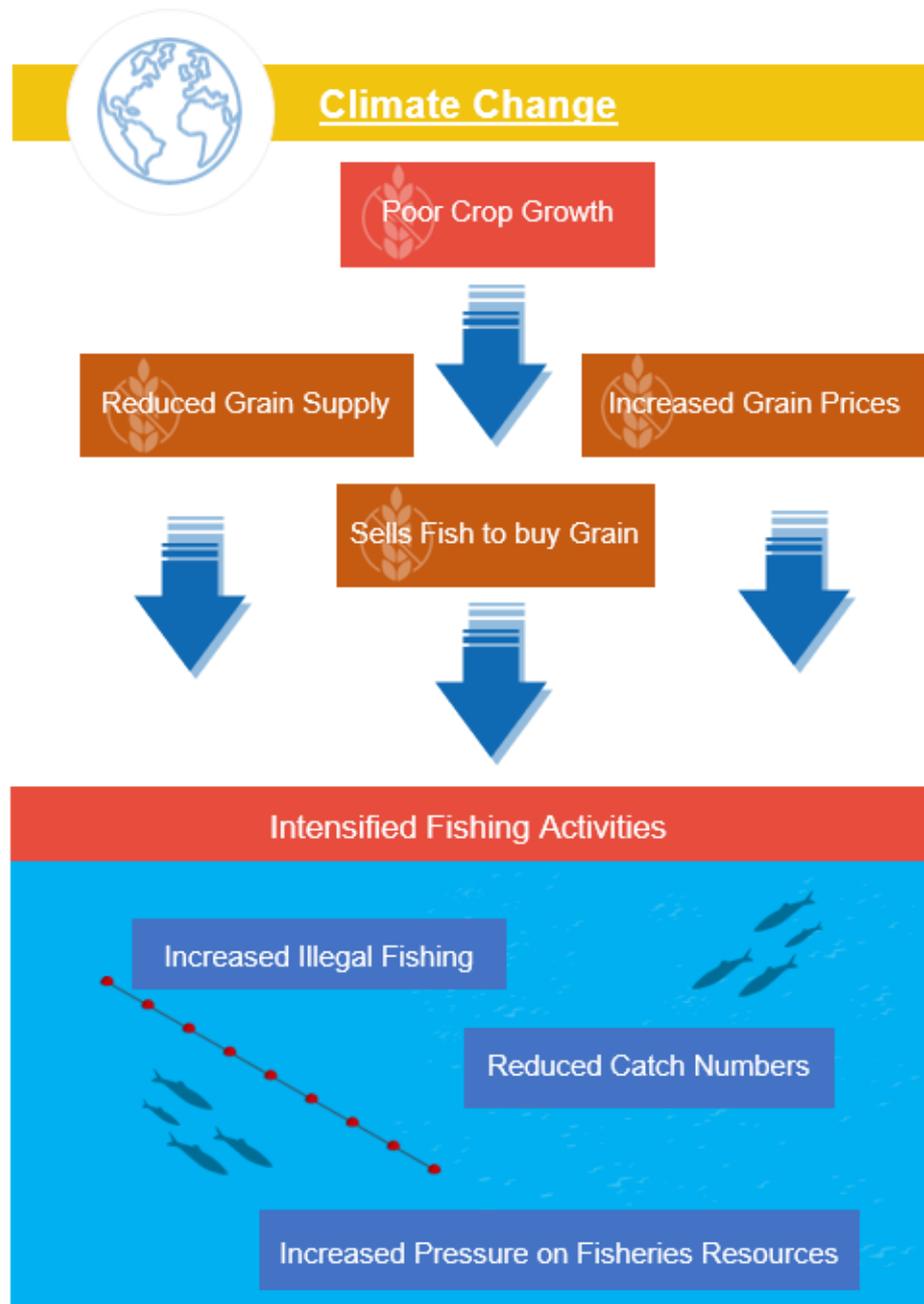
IN ONE SUCH CASE, NIGERIA IS EXPECTED TO HAVE A 53 PERCENT REDUCTION IN FISH RESOURCES BY 2050 DUE TO WARMING OCEANS. FISH ACCOUNT FOR ABOUT 40 PERCENT OF THE COUNTRY'S ANIMAL PROTEIN. IF THAT CHALLENGE WEREN'T ENOUGH, THE POPULATION IS EXPECTED TO DOUBLE AND REACH SOME 400 MILLION PEOPLE BY 2050 [195].



## Climate Change and Inland Fisheries

The impacts of climate change are not reserved for marine fisheries, with these changes likely to impact inland fisheries just as much – if not more. As aquatic environments warm, fish are less able to adapt to these changes due to the limited surface areas of inland water bodies. In larger lakes, they will begin to move further from the shore to deeper water, while in shallower environments the impacts of the increased temperature will alter spawning patterns, metabolism and growth — reducing fish biomass. Simultaneously, the higher temperatures will increase evaporation rates — Lake Abijatta, for example, loses 372 million cubic meters of water through evaporation each year while groundwater outflow sits at just 1 million cubic meters [196].

Any alterations in seasonal rain may affect crop production and the agriculture industry, increasing pressure on fishing resources as people turn to fishing to sustain food security [197].



Ethiopia is one inland region experiencing significant challenges due to the combined impacts of climate change and misuse of water resources. In its peak, Lake Haramaya was 7 kilometres long, and almost 14 meters deep, yet it dried up in 2005 due to excessive use of its waters for crop irrigation, environmental degradation and climate change. 2014 saw some progress after two years of conservation work as the lake began to fill again – reaching some 20 percent of capacity. But the relief for local communities didn't last long – within the year, the lake was dry again. [196, 198].

In 2020, after two years of significant rainfall, the waters have returned once again as levels rose by 61 percent — but for how long? [199]

The effects of climate change are being felt in Africa's other lakes, including changes in wind patterns and the heating of the lakes' surface waters.

**38 MILLION PEOPLE IN THE LAKE VICTORIA BASIN WILL EXPERIENCE CLIMATE CHANGE-INDUCED MIGRATION BY 2050 [200].**

Catches in Lake Tanganyika too have decline by almost half in the last three decades due to a combination of overfishing and climate change [201]. It is not clear which poses a greater threat.

Figure 41: A fisherman casts his net on Lake Victoria. Image Credit: Hennie Stander/Unsplash [202]



## Boundary Disputes – Climate Change Perspective

As fish species migrate, there is a very real chance that the changing distribution of fish will generate increased conflict between countries [203]. Current quota allocations may not be fit for purpose and may drive an increase in IUU activities in industrial fishing as fleets shift outside of prescribed boundaries to follow fish.

On a small-scale level, we have already seen fishers around the world experiencing the impacts of climate change, demonstrated by the frequency of cross-boundary fishing, violence between countries or communities, and reports of altered fish availability.

### Exhibit 34

#### Bangladesh

Fishers are considered some of the most vulnerable in Bangladesh, with some groups' annual income 70% lower than that of the national average. These struggles are amplified by season bans on hilsa (target fish) and frequent storms and seasonality. With fishers unable to earn enough to meet their basic needs, they then exploit available resources to support their livelihoods. One fishing village reported 75.6% of interviewed fishermen had been physically injured by cyclones [68, 91].

### Exhibit 35

#### Lake Chad

On Lake Chad – an area hit extremely hard by the effects of climate change – one local explained that his income has dropped from around \$100 a day to just \$6. He indicated that some locals have given up on fishing due to this drop in income but have been unsuccessful in their ventures due to the lack of rain [95].

### Exhibit 36

#### Senegal

Reports from Senegal indicate that there has been an increase in the number of fishers dying at sea, which officials attribute to climate change and crews having to travel much further than before. [153].

## Exhibit 37

### Pakistan

80 percent of the population of Pakistan's coastal belt depend on fisheries for livelihoods - representing between 500,000 and 1 million people.

A 2015 stock assessment found that the biomass of many local fish species had already reduced by 50-90 percent [217].

Figure 42 Below: Fishermen off the City of Karachi, Pakistan.  
Image Credit: © Can Stock Photo / muha04

## Exhibit 38

### Tunisia

In Tunisia, fishers describe how their fishing behaviour has had to adapt to severe changes brought on from the impacts of climate change. "We used to have to go out between four and ten miles to fish, now we have to go further, maybe even up to 150 miles" [154]. Many in the area are now looking for second jobs to earn extra money – some even resort to people smuggling.

## Exhibit 39

### India

In India, fishermen have been observing the change in weather patterns over the last decade. These changes contradict their traditional knowledge and increase their vulnerability and chances of accidents [216].

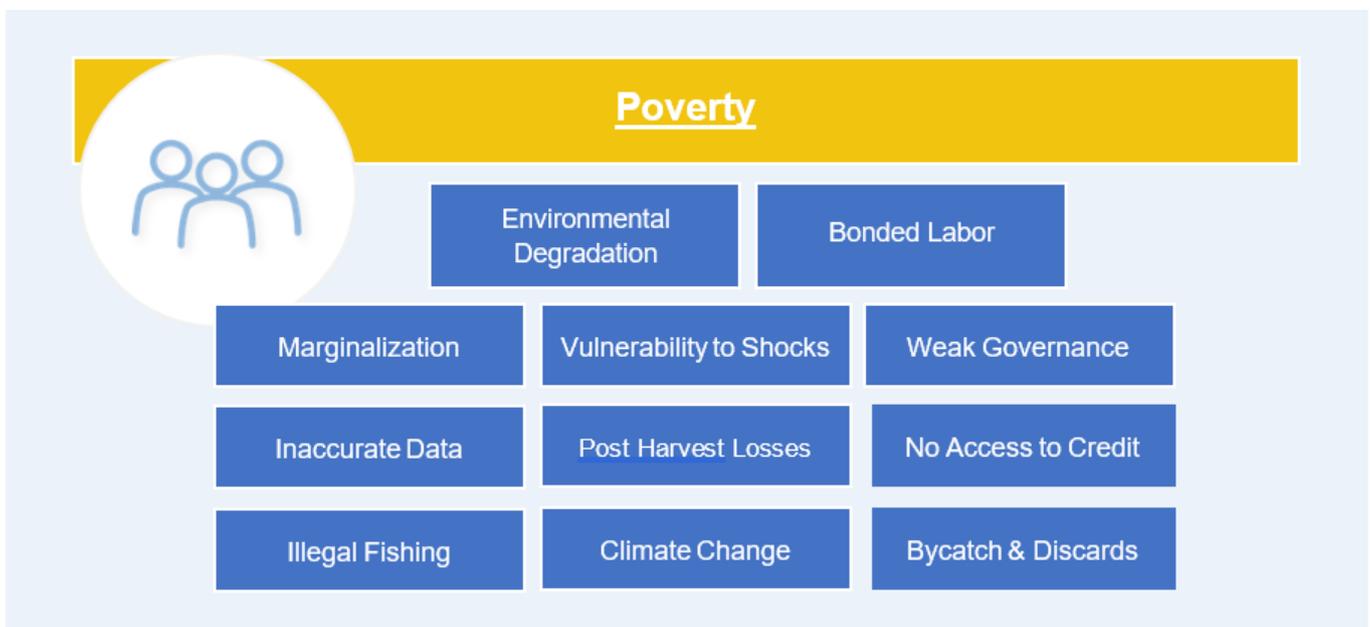


## POVERTY

Poverty is in many ways a strong risk factor for the safety of fishers, but in a more complex and indirect way.

Being poor isn't going to kill you as such, but it's likely to contribute to:

- An increased reliance on fishing and decreased tolerance to shocks
- Increased risk-taking behaviour
- Increased likelihood of illegal or dangerous fishing practices
- Decreased chances of having lifesaving equipment or a safe vessel
- Increased chances of human trafficking or bonded labour
- Increased vulnerability to piracy
- Increased rates of marginalization
- Increased rates of corruption
- Increased impact of other drivers
- Increased post-harvest losses



## Food Security

Fish is essential for global food security. According to official figures, over 3.3 billion people get more than 20 percent of their animal protein from fish, and this number is only set to grow — global fish consumption has risen by over 120 percent in the last 30 years [204]. The world's population is set to reach a staggering 10 billion by 2050, and the resulting food production requirement will need to double to sustain us [2, 205].

Per-capita fish consumption data for 2017 is given as an estimated 20.3kg per person, yet these figures may mask the true importance of fish to low-income, rural or coastal communities.

Across Africa, fish provide between 32 and 75 percent of animal protein, while it can reach as high as 90 percent in some Pacific Island communities [5, 153].

The FAO stated that in 2020, 768 million people were undernourished, 418 million of whom resided in Asia, while a further 282 million were in Africa [1]. Fish is considered one of the most affordable sources of animal protein, making it particularly crucial for the food and nutritional security of low-income, food-deficient countries where it forms a staple part of their diets [206].

The impacts of fish migration and reduced biomass due to climate change, overfishing and IUU activities are likely to be felt simultaneously and harm the people that rely on fish the most.



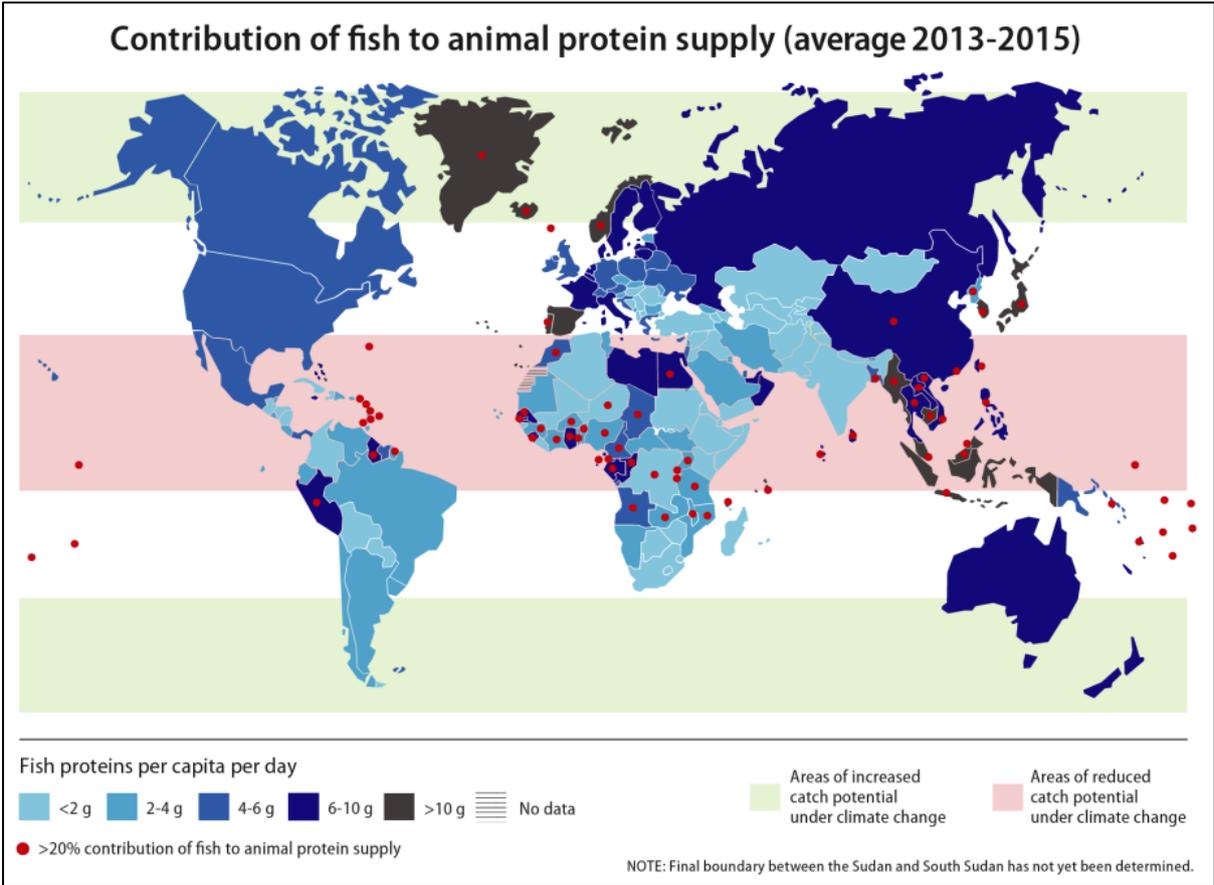


Figure 44: Contribution of fish to animal protein intake. [220]

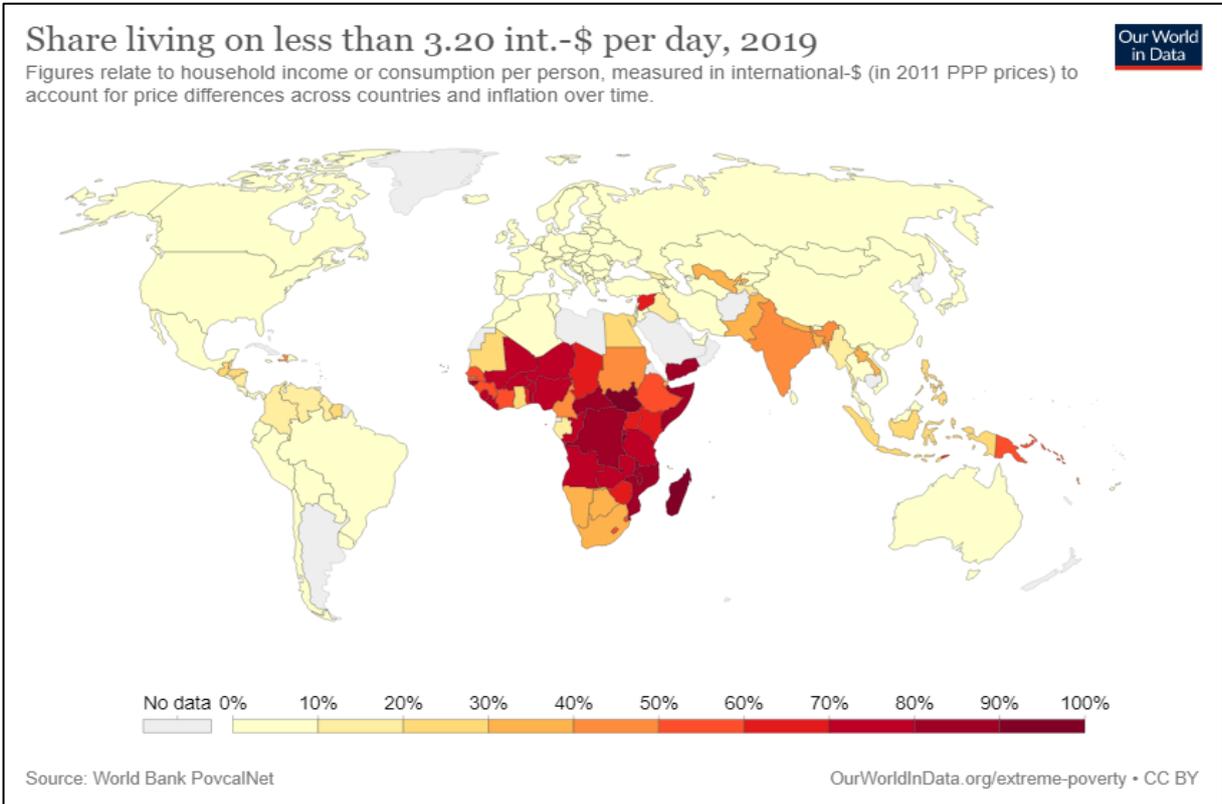


Figure 45: Share of population living below \$3.20 per day. Image Credit: Our World in Data [213]

Consider the two maps above. *Figure 44* shows the nations where fish represents at least 20 percent of their animal-based protein (represented by the red dots), and secondly, the areas most likely to face reduced catch potential (represented by the red band) due to the impacts of climate change.

*Figure 45* then displays the areas of the world where poverty rates are elevated, defined by the share of the population living on less than \$3.20 per day.

When comparing the two images, there is a defined pattern across the tropics, demonstrating that those who are most reliant on fisheries are likely to have the biggest drop in catch potential.

This doesn't mean, however, that other areas aren't about to face severe issues in food security and be pushed further into poverty.



## Exhibit 40

### Climate Change and Food Security in the Pacific Islands [23]

The importance of fish for food security in the Pacific Islands is often underestimated. Unfortunately, so is the Pacific Islands' vulnerability to climate change.

The effects of rising temperatures, sea-level rise, coastal erosion, saltwater intrusion, coral reef bleaching and extreme weather events are likely to disproportionately impact these regions due to existing resource and poverty challenges.

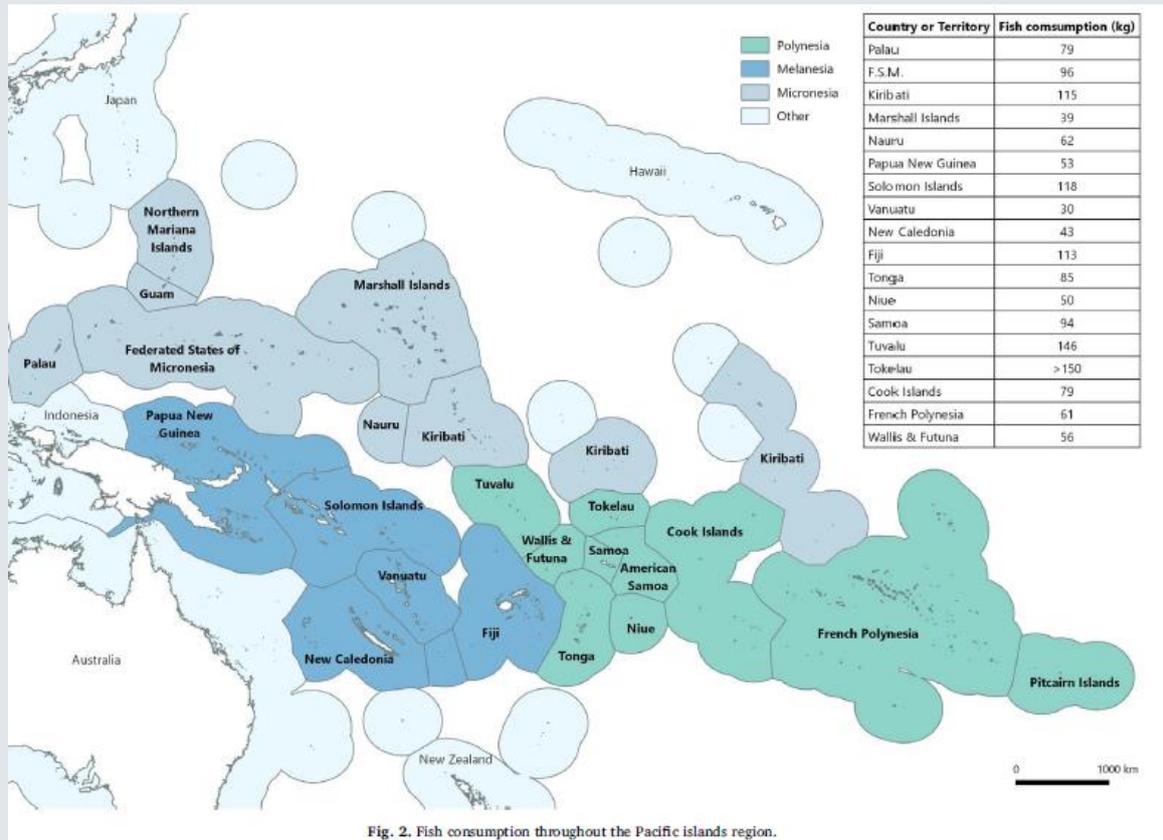


Fig. 2. Fish consumption throughout the Pacific islands region.

Due to rapid population growth, inadequate local distribution networks and climate change exacerbated by overfishing:

**It has been estimated that 75 per cent of Pacific Island Countries' and Territories' coastal fisheries will not be able to meet their food security needs by 2030.**

## Marginalization

The importance of small-scale fishers is routinely ignored, with them and their communities marginalized. In low-income countries in particular, fishers provide an essential role in providing food security, yet governments regularly fail to include their needs or inputs into the development of new policies.

THE LACK OF INFORMATION, WHEN COMBINED WITH THE COMPLEX SOCIO-ECONOMIC CONDITIONS OF SMALL-SCALE FISHING COMMUNITIES, CAN RESULT IN THEIR MARGINALISATION, LEADING TO DISREGARD BY GOVERNMENT AGENCIES [180].

Large numbers of fishers find themselves deep in a poverty trap, with many of the driving factors being beyond their control. Across all regions and fishery sectors, we see a pattern behind these factors.

The industrialisation of the world's fishing fleets has had dramatic negative effects on fishers, resulting in reduced income and food security. The licencing of international trawlers to fish in EEZ waters has seen direct consequences in all communities we have explored, including Brazil, Peru, Madagascar, Senegal, Ghana, Nigeria, India, Bangladesh, Malaysia and the Pacific Islands, yet this practise continues, often under opaque international agreements and allegations of corruption.

In some communities, fishers are considered to be of lower caste or status [64, 207] which results in discrimination at both a local and a governmental level. In India, for instance, those at the bottom of the hierarchy may be limited in their fishing practises, access and equipment due to local rules.

The lack of data and policies relating to the sustainability, development and security of small-scale fisheries demonstrate a disregard for this sector, while there have been accusations that the development of marine protected areas and marine parks prioritises sectors such as tourism and conservation over the lives of traditional fishers [141, 207, 208].

The economic challenges such as access to credit or the capital needed to invest in new methods or equipment needed to remove oneself from the poverty cycle are a further barrier. The implementation of fisheries seasons or bans severely undermines local fishers' livelihoods, which increases their vulnerability to human trafficking, IUU practices and even piracy.

On location with the FISH Safety  
Foundation.

The Philippines



On location with the FISH Safety  
Foundation.

Trinidad and Tobago

# PART 5

## The Next Steps

By now it is clear that the fishing industry is facing a significant number of challenges.

Our research clearly demonstrates that the dangers and fatalities associated with fishing are considerably worse than previously thought, yet fishing remains a vital component of the global food chain. Providing meaningful, targeted interventions to simultaneously safeguard both the people involved and this critical food source requires evidence.

The topics of data and legislation are heavily intertwined. There is currently a lack of reliable data on the true human cost of fishing – and this data is essential for driving regulatory reform.

### Addressing the data gaps

There are several facets of this data challenge that need to be addressed, including definitions of key terms, identifying the true number of fishermen, and the reporting, recording and analysis of accidents.

**THERE ARE CURRENTLY NO STATUTORY REQUIREMENTS TO REPORT AND RECORD ACCIDENTS AND FATALITIES IN MOST COUNTRIES.**

There is an urgent need for work in these areas, including the need to establish a consistent data collection system and repository on fisher accidents and mortality.

### Regulatory reforms

This report clearly shows problems with reporting, recording, investigation and analysis of fishing accidents at both the national and international levels. Much of this stems from the lack of a formal regulatory framework. Despite the integral role these fishers play in maintaining global food security, there is very little international legislation aimed at keeping fishers safe.

The approach to safety in the fisheries sector, and its related activities, has historically been fragmented at a local level between different administrative departments and bodies (e.g., fisheries, agriculture, coast guard, etc.), seriously hampering a coordinated effort to improve the situation. At an international level, organisations such as the FAO, ILO and IMO, while following their mandates, replicate this disjunction and competences which affect coordination in legislative / standards development and effective implementation. In short – responsibilities for safety in the fisheries sector are spread at national and international levels, which affects the effectiveness of safety and fisheries managements.

For real change in the current global fisher accident and mortality instances, there is a clear need to develop and promote proper legal standards and remits by which national authorities can operate and make governance and policy shifts toward a safer world for fishers.

There is a need to investigate country- (and fishery-) specific regulations to better understand which gaps are adding to non-compliance with safety measures, non-reporting of incidents and other such regulatory and reporting gaps, or breaches which add to there being a lack of both data and action, but where policy measures can be reasonably applied.

Further, the development of local or national legislation should have clear industry input from local fishers and communities to address the specific needs of these subsectors and mitigate the risk of unintended consequences of these regulations. It is argued that specific emphasis should be focused on those best placed to improve safety standards in the fishing sector (Port State regulators, Maritime / Fisheries Departments, and Compliance and Enforcement officials). They have the most direct contact with most fishers, vessel owners, associations, etc., and are therefore an important link in this work.

# References

- [1] Food and Agriculture Organization of the United Nations (FAO), "The State of Food Security and Nutrition in the World," FAO, 2021.
- [2] United Nations, "UN World Population Prospects 2019," United Nations, 2019.
- [3] International Labour Organization (ILO), "Safety and health in the fishing industry. Report for discussion at the Tripartite Meeting on Safety and Health in the Fishing Industry," ILO, Geneva, 1999.
- [4] International Labour Organization, "Fishing amongst the most dangerous of all professions, says ILO," 13 December 1999. [Online]. Available: [https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS\\_071324/lang--en/index.htm#:~:text=GENEVA](https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_071324/lang--en/index.htm#:~:text=GENEVA).
- [5] FAO, "The State of World Fisheries and Aquaculture. Sustainability in Action," FAO, Rome, 2020.
- [6] FAO, "Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication," FAO, 30 November 2021. [Online]. Available: <https://www.fao.org/voluntary-guidelines-small-scale-fisheries/resources/detail/en/c/1457961/>. [Accessed 2022].
- [7] Private Communications, 2016.
- [8] FAO, "FAO programme on fishermen's safety at sea," Noumea, New Caledonia 23-27 July 2001.
- [9] R. Udolisa, A. Akinyemi and O. Olaoye, "Occupation and health hazards on Nigerian Coastal Artisanal fisheries," Fisheries Society of Nigeria, 2010.
- [10] FAO, "The State of World Fisheries and Aquaculture. Part 2," 2000.
- [11] N. Bull, T. Riise and T. Moen. B, "Occupational injuries to fisheries workers in Norway reported to insurance companies from 1991 ro 1996," *Occupational Medicine*, vol. 51, no. 5, pp. 299-304, 2001.
- [12] FAO, "Coordinating Working Party on Fishery Statistics (CWP)," FAO, [Online]. Available: <https://www.fao.org/cwp-on-fishery-statistics/handbook>.
- [13] D. Belhabib, U. Sumalia and D. Pauly, "Feeding the Poor: Contribution of West African fisheries to employment and food security," *Ocean and Coastal Management*, 2015.
- [14] L. C. L. Teh and D. Pauly, "Who brings in the fish? The relative contribution of small-scale and industrial fisheries to food security in Southeast Asia," *Frontiers in Marine Science*, vol. 5, no. 44, 2018.
- [15] NEPAD-FAO, AU-IBAR, "A pan-African Strategy on the improvement of fisheries and aquaculture data collection, analaysis and dissemination," FAO, 2014.
- [16] [REDACTED]  
[REDACTED]  
[REDACTED] Citation redacted
- [17] [REDACTED] Citation redacted
- [18] [REDACTED] Citation redacted
- [19] FAO, "FAO fishery and aquaculture country profiles," FAO, [Online]. Available: <https://www.fao.org/fishery/en/facp/search>.
- [20] FAO, "Study on safety at sea for small-scale fisheries. 1 South West Indian Ocean," Rome, 2007.

- [21] G. de Graaf and L. Garibaldi, "The value of African fisheries," FAO, Rome, 2014.
- [22] B. T. Frenge, *The profile of Fishermen migration in Nigeria and implications for a sustainable livelihood*.
- [23] Q. Hanich, C. C. Wabnitz, Y. Ota, M. Amos, C. Donato-Hunt and A. Hunt, "Small-scale fisheries under climate change in the Pacific Islands region," *Marine Policy*, vol. 88, pp. 279-284, 2018.
- [24] C. Doria, S. Athayde, J. Dutka-Gianelli, H. Melo De Lima and F. M. Carvajal-Vallejos, "Challenges for the governance of small-scale fisheries on the Brazil-Bolivia transboundary region," *Society and Natural Resources*, vol. 33, no. 10, 2020.
- [25] Too Big To Ignore, "Small-Scale Fisheries in Africa: A regional Portrait," TBTI Global Publication Series, St. John's, NL, Canada.
- [26] E. Barnett, "Leathal weather on 'world's most dangerous lake'," CNN, 17 January 2013. [Online]. Available: <https://edition.cnn.com/2013/01/17/world/africa/lake-victoria-weather-deaths/index.html>. [Accessed 2019].
- [27] FAO, "The status of Lake Victoria fisheries under limited access fisheries," Rome, 2019.
- [28] S. Heack, J. Ikwaput, C. Kirema-Mukasa, D. Murakwa, K. Odongkara, P. Onyango and F. Sobo, "Cross-boarder fishing and fish trade on Lake Victoria," 2004.
- [29] RNLI, "Drowning deaths amonth fishing communities of Lake Victoria, Tanzania," 2018.
- [30] Monitor , "5,000 Ugandans die in rivers, lakes yearly," Monitor, 26 September 2020. [Online]. Available: <https://www.monitor.co.ug/uganda/news/national/5-000-ugandans-die-in-rivers-lakes-yearly-1816808>. [Accessed August 2022].
- [31] FAO, "West African Central Atlantic Fishery Commission: Study on "health and safety in the dive fisheries in WECAFC region"," 2022.
- [32] H. Bassett., "Great Risk, Great Reward," 2019.
- [33] B. Best, "Lobsters, reefs and livelihoods," US AID, September & October 2013. [Online]. Available: <https://2012-2017.usaid.gov/news-information/frontlines/open-development-development-defense/lobsters-reefs-and-livelihoods>. [Accessed 2021].
- [34] The World Bank, "The World Bank In Honduras," The World Bank, 25 April 2022. [Online]. Available: <https://www.worldbank.org/en/country/honduras/overview>. [Accessed August 2022].
- [35] G. R. Temm, R. Marshood and P. Stedman-Edwards, "The global fisheries crisis, poverty and coastal small-scale fisheries," World Wildlife Fund, 2008.
- [36] Blue Reef Explorers Diving Centre, "Dying for lobster diving," Blue Reef Explorers Diving Centre, 17 March 2020. [Online]. Available: <https://bluereefexplorers.com/about-us/blog/28-dying-for-lobster-diving>. [Accessed 2021].
- [37] France 24, "Lobster fishing in Honduras: A poisoned chalice," France 24, 13 July 2019. [Online]. Available: <https://www.france24.com/en/20190713-lobster-fishing-honduras-poisoned-chalice>. [Accessed 2021].
- [38] G. Tassi, "Honduras: Death looms over Miskito lobster divers," IPS News, 3 Feb 2004. [Online]. Available: <https://www.ipsnews.net/2004/02/honduras-death-looms-over-miskito-lobster-divers/>.
- [39] "32 stunning photos that take you inside the dangerous, deadly, and never-before-seen world of Nicaraguan Lobster Divers," Business Insider India, 26 July 2021. [Online]. Available: <https://www.businessinsider.in/thelife/32-stunning-photos-that-take-you-inside-the-dangerous-deadly-and-never-before-seen-world-of-nicaraguan-lobster-divers/slidelist/52657852.cms>.

- [40] K. Semple, "'There's no other way' Nicaragua's lobstermen dive deep to feed their families," Independent, 30 January 2021. [Online]. Available: <https://www.independent.co.uk/world/nicaragua-diving-sea-lobster-b1792156.html>. [Accessed 2021].
- [41] Western Central Atlantic Fishery Commission, "Study on "health and safety in the dive fisheries of key species in the WECAFC region" Technical report," 2022.
- [42] D. Gold, S. Aiyarak, S. Wongcharoenyong, A. Geater, W. Juengprasert and W. A. Gerth, "The indigenous fisherman divers of Thailand: Diving practices," *International Journal of Occupational Safety and Ergonomics*, vol. 6, no. 1, pp. 89-112, 2000.
- [43] FAO, "Reference guidelines to legislate or regulate diving in artisanal or small-scale fishing in the Latin American and the Caribbean region," FAO, Panama, 2020.
- [44] E. S. Cavalcante, P. J.M, I. Freire, A. C. M. Faro, G. V. Torres and F. A. N. deMiranda, "Spinal cord injury due to diving accidents and stress among artisanal fishers," *Texto & Contexto - Enfermagem*, vol. 26, no. 2, 2017.
- [45] V. Felbab-Brown, "Illegal fishing in Mexico and Policy Responses," Brookings, 14 September 2020. [Online]. Available: <https://www.brookings.edu/blog/order-from-chaos/2020/09/14/illegal-fishing-in-mexico-and-policy-responses/>.
- [46] E. Airhart, "A Mexican nature reserve hopes to get sea cucumbers out of a pickle.," Atlas Obscura, 7 May 2021. [Online]. Available: <https://www.atlasobscura.com/articles/sea-cucumbers-mexico>. [Accessed 2021].
- [47] M. Makoni, "Coastal science and societies," Hakai Magazine, 26 May 2017. [Online]. Available: <https://hakaimagazine.com/news/west-africas-artisanal-fishers-rival-industrial-fleet/>. [Accessed 2022].
- [48] A. Laamrich, "Fisheries and safety for fishermen in ATLAFCO zone," COMHAFAT ATLAFCO, 2018.
- [49] Ministerial Conference on Fisheries Cooperation Among African States Bordering the Atlantic Ocean, "Member States," Ministerial Conference on Fisheries Cooperation Among African States Bordering the Atlantic Ocean, 2022. [Online]. Available: <https://www.comhafat.org/en/etats-membres.php>. [Accessed 2020].
- [50] D. Belhabib, "West Africa: illegal fishing, the black hole in the seas," *Samudra Report*, no. 77, pp. 20-25, 2017.
- [51] E. C. Alberts, "On board Ghana's trawlers, claims of human rights abuses and illegal fishing," Mongabay, 25 August 2021. [Online]. Available: <https://news.mongabay.com/2021/08/on-board-ghanas-trawlers-claims-of-human-rights-abuses-and-illegal-fishing/>.
- [52] D. Belhabib, K. Greer and D. Pauly, "Trends in industrial and artisanal catch per effort in West African fisheries," *Conservation Letters*, vol. 11, no. 1, pp. 1-10, 2018.
- [53] K. Riskas, "The African coastline is a battleground for foreign fleets and artisanal fishers," Hakai Magazine, 5 February 2020. [Online]. Available: <https://hakaimagazine.com/news/the-african-coastline-is-a-battleground-for-foreign-fleets-and-artisanal-fishers/>. [Accessed 2020].
- [54] P. Yeung, "Illegal overfishing by Chinese Trawlers leave Sierra Leone locals 'starving'," The Guardian, 1 February 2022. [Online]. Available: <https://www.theguardian.com/environment/2022/feb/01/sierra-leone-families-starving-chinese-trawlers-industrial-overfishing-destroying-lives>. [Accessed 2022].
- [55] K. Ighobor, "Overfishing destroying livelihoods," United Nations - Africa Renewal, 2017. [Online]. Available: <https://www.un.org/africarenewal/magazine/may-july-2017/overfishing-destroying-livelihoods>.
- [56] ATLAFCO, "Capacity building for communicators on the sustainable management of fishery resources and the fight against IUU fishing.," 2020.

- [57] A. Standing, "Criminality in Africa's fishing Industry: A threat to Human security," Africa Centre for Strategic Studies, 2017.
- [58] M. Beseng, "Cameroon's choppy waters: The anatomy of fisheries crime in the maritime fisheries sector," *Marine Policy*, no. 108, 2019.
- [59] S. Frocklin, "Voices from African Artisanal Fishermen. The Confédération Africaine des Organisations de Pêche Artisanale (CAOPA)," Stockholm, 2016.
- [60] B. Blede, P. Compaore and A. Diouf, "Threats to Senegal's fishing sector: A case study from the Ziguinchor region," Institute for Security Studies - West Africa Report, 2015.
- [61] M. Simoncelli, "In Pictures: The rise of shark fishing off the Congolese coast," Al Jazeera, 22 November 2021. [Online]. Available: <https://www.aljazeera.com/gallery/2021/11/22/in-pictures-sharks-and-artisanal-fishermen-struggle-to-survive>. [Accessed 2022].
- [62] D. Belhabib, V. Koutob, A. Sall, V. W. Lam and D. Pauly, "Fisheries catch misreporting and its implications: the case of Senegal," *Fisheries Research*, vol. 151, pp. 1-11, 2014.
- [63] S. Das and S. Hazra, "[Commentary] Is expansion of aquaculture in the Indian Sundarbans an ecological threat or a pathway to sustainable development," Mongabay, 20 April 2022. [Online]. Available: <https://india.mongabay.com/2022/04/commentary-is-expansion-of-aquaculture-in-the-indian-sundarbans-an-ecological-threat-or-a-pathway-to-sustainable-development/>. [Accessed 1 May 2022].
- [64] M. Mehta, "Crab antics: The moral and political economy of greed accusations in the submerging Sundarbans delta of India," *Journal of the Royal Anthropological Institute*, no. 27, pp. 534-558, 2021.
- [65] S. Bhattacharya, "With depleting fish catch, Sundarbans fishers migrate to other coastal states," Mongabay India, 28 August 2020. [Online]. Available: <https://india.mongabay.com/2020/08/with-depleting-fish-catch-sundarbans-fishers-migrate-to-other-coastal-states/>. [Accessed June 2021].
- [66] M. Mehta, "A 'licence' to kill in the Sundarbans," The India Forum, 10 November 2021. [Online]. Available: <https://www.theindiaforum.in/article/licence-kill-sundarbans>. [Accessed 2021].
- [67] Manusher Jonno Foundation; Bangladesh Institute of Labour Studies; COAST Trust; Danish Institute for Human Rights, "Sector-wide Human Rights Impact Assessment (SWIA) in small-scale artisanal fishing communities in Barguna and Cox's Bazar district of Bangladesh," Coast Trust, Dhaka, 2021.
- [68] M. M. Islam, M. A. Rahman, B. Paul and M. I. Khan, "Barriers to climate change adaptation: Insights from the Sundarbans mangrove-based fisheries of Bangladesh," *Asian Fisheries Science*, no. 33, pp. 175-186, 2020.
- [69] Reuters, "Tigers, worsening storms and Covid-19: People forced into Indian mangroves," Radio New Zealand, 14 January 2021. [Online]. Available: <https://www.rnz.co.nz/news/world/434542/tigers-worsening-storms-and-covid-19-people-forced-into-indian-mangroves>. [Accessed 2021].
- [70] K. Ahmed, "'We live and die by it': Climate crisis threatens Bangladesh's Sundarbans," The Guardian, 18 January 2022. [Online]. Available: <https://www.theguardian.com/global-development/2022/jan/18/live-and-die-by-bangladesh-sundarbans-mangrove-forest-climate-crisis-threat-resources-cyclones>. [Accessed Jan 2022].
- [71] D. Dasgupta, "Fish population declining in the Sundarbans," The Third Pole, 17 December 2018. [Online]. Available: <https://www.thethirdpole.net/en/climate/fish-population-declining-in-the-sundarbans>.
- [72] M. M. H. Mozumder, M. Shamsuzzaman, R. U. Nabi and A. Harun-Al-Rashid, "Socio-economic characteristics and fishing operation activities of the artisanal fishers in the Sundarbans Mangrove Forest, Bangladesh," *Turkish Journal of Fisheries and Aquatic Sciences*, vol. 18, pp. 789-799, 2018.
- [73] S. Banerjee, "The tragedy of fishing communities: A story from Vetka Village, Odisha," *Economic & Political Weekly*, vol. 52, no. 41, 2017.

- [74] G. Chandra and L. R. Sagar, "Fisheries in Sundarbans: Problems and prospects," *SSRN*, 2003.
- [75] M. M. Islam and R. Chuenpagdee, "Negotiating risk and poverty in mangrove fishing communities of the Bangladesh Sundarbans," *Maritime Studies*, vol. 12, 2013.
- [76] S. Chakraborty, "Poverty, state apathy, and resource exploitation afflicts Indian Sundarbans," NewsClick India, 21 Feb 2022. [Online]. Available: <https://www.newsclick.in/Poverty-State-Apathy-Resource-Exploitation-Afflicts-Indian-Sunderbans>. [Accessed Feb 2022].
- [77] S. Goswami and S. Naskar, "The Shifting Sundarban," *Himal South Asian*, 7 March 2022. [Online]. Available: <https://www.himalmag.com/the-shifting-sundarban-photo-essay-2022/>. [Accessed March 2022].
- [78] A. Bhattacharya, "Indian fishermen in the Sundarbans risk tiger attacks in battle for survival," *The National*, 21 September 2016. [Online]. Available: <https://www.thenationalnews.com/arts/indian-fishermen-in-the-sundarbans-risk-tiger-attacks-in-battle-for-survival>. [Accessed 2020].
- [79] J. Thakur, "In Sundarbans, no one cares about villagers who go missing in animal attacks," *Hindustan Times*, 03 Feb 2017. [Online]. Available: <https://www.hindustantimes.com/india-news/in-sunderbans-no-one-cares-about-villagers-who-go-missing-in-animal-attacks/story-qBfi3zcR9OnU0EZxNgGNyJ.html>. [Accessed 2020].
- [80] U. K. Ray, "The vulnerable fishermen and the 'tiger widows' of Sundarbans," *Gaom Connection*, 25 May 2020. [Online]. Available: <https://en.gaonconnection.com/the-vulnerable-fishermen-and-the-tiger-widows-of-sundarbans/>. [Accessed 2021].
- [81] M. M. H. Mozumder, M. M. Shamsuzzaman, M. Rashed-Un-Nabi and E. Karim, "Social ecological dynamics of the small-scale fisheries in Sundarban Mangrove Forest, Bangladesh," *Aquaculture and Fisheries*, vol. 3, pp. 38-49, 2018.
- [82] S. Pandey, "Pirates of the Bay of Bengal," *Al Jazeera*, 16 September 2015. [Online]. Available: <https://www.aljazeera.com/features/2015/9/16/pirates-of-the-bay-of-bengal>. [Accessed 2020].
- [83] The Financial Express, "Safety of coastal fishermen," *The Financial Express*, 19 August 2018. [Online]. Available: <https://thefinancialexpress.com.bd/public/editorial/safety-of-coastal-fishermen>. [Accessed 2020].
- [84] R. Ghosh, "Ethos of a sinking space: Fishers in Sundarbans surmount tiger attacks, bureaucracy to earn livelihoods," *Down to Earth*, 29 July 2021. [Online]. Available: <https://www.downtoearth.org.in/blog/environment/ethos-of-a-sinking-space-fishers-in-sundarbans-surmount-tiger-attacks-bureaucracy-to-earn-livelihoods-78175>. [Accessed April 2022].
- [85] S. Chakraborty, "Centre's Blue Revolution, SagarMala projects promote only corporate giants: Sundarbans fishermen," *NewsClick*, 18 February 2022. [Online]. Available: <https://www.newsclick.in/Centre-Blue-Revolution-SagarMala-Projects-Promote-Corporate-Giants-Sundarbans-Fishermen>. [Accessed February 2022].
- [86] M. S. Rahman, M. K. Majumder, M. H. K. Sujana and S. Manjira, "Livelihood status of coastal shrimp farmers in Bangladesh: Comparison before and during Covid-19," *Aquaculture Reports*, vol. 21, 2021.
- [87] M. A. Mome, "The potential of the Artisanal Hilsa fishery in Bangladesh: An economically efficient fisheries policy," *The United Nations University Fisheries Training Program*, Reykjavik, 2007.
- [88] M. M. Rahman, M. A. Alam, M. M. Rahman, M. Mamun and A. Alam, "Knowledge Management, Governance and Sustainable Development: Lessons and Insights from Developing Countries. Challenges of the artisanal fishermen: A case study from Bangladesh," *Routledge*, India, 2020.
- [89] M. R. Islam, T. Cansse, M. S. Islam and A. R. Sunny, "Climate change and its impacts: The case of coastal fishing communities if the Meghna river in south central Bangladesh," *International Journal of Marine and Environmental Sciences*, vol. 12, no. 10, 2018.

- [90] FISH Safety Foundation, "Fishermen occupational health and safety, Bangladesh household survey," 2021.
- [91] A. Sunny, G. Ahamed, M. Mithun, M. Islam, B. Das, A. Rahman, M. Rahman, M. Hasan and M. Chowdhury, "Livelihood status of the Hilsa (*Tenualosa ilisha*) fishers: The case of coastal fishing community of the Padma river: Bangladesh," *Journal of Coastal Management*, vol. 22, no. 2, 2019.
- [92] A. K. Azad and C. Pamment, "Bangladesh overfishing: Almost all species pushed to brink," BBC, 16 April 2020. [Online]. Available: <https://www.bbc.com/news/world-asia-52227735>.
- [93] R. T. Muringai, D. Naidoo and P. Mafongoya, "The challenges experienced by small-scale fishing communities of Lake Kariba, Zimbabwe," *The Journal for Transdisciplinary Research in Southern Africa*, vol. 16, no. 1, 2020.
- [94] O. Khelifi, "Displaced refugees fear more loss as Lake Chad shrinks," Al Jazeera, 23 November 2016. [Online]. Available: <https://www.aljazeera.com/gallery/2016/11/23/displaced-refugees-fear-more-loss-as-lake-chad-shrinks>. [Accessed 2022].
- [95] S. Murray, "Lake Chad fishermen pack up their nets," BBC News, 15 January 2007. [Online]. Available: <http://news.bbc.co.uk/2/hi/africa/6261447.stm>. [Accessed 2019].
- [96] A. Gitonga, "Calls to cull hippos after man is killed," The Standard Kenya, 30 March 2020. [Online]. Available: <https://www.standardmedia.co.ke/rift-valley/article/2001366164/calls-to-cull-hippos-as-more-are-killed>. [Accessed 2020].
- [97] B. Sonneveld, F. Thoto, D. Houessou and L. van Wesenbeeck, "The tragedy of the inland lakes," *International Journal of the Commons*, vol. 13, no. 1, pp. 609-636, 2019.
- [98] A. von Sarnowski, "The artisanal fisheries of Lake Albert and the problem of overfishing," in *Conference on International Agricultural Research for Development*, Berlin, 2004.
- [99] Daily Nation, "Kenya: Fishermans quest to earn a living on lake costs him his life," All Africa, 2 April 2007. [Online]. Available: <https://allafrica.com/stories/200704020528.html>. [Accessed 2019].
- [100] M. T. Sarch and E. H. Allison, "Fluctuating fisheries in Africa's inland waters," in *International Institute of Fisheries Economics and Trade*, Oregon, 2000.
- [101] J. D. Allan, R. Abell, Z. Hogan, C. Revenga, B. W. Taylor, R. L. Welcomme and K. Winemiller, "Overfishing of inland waters," *Bioscience*, vol. 55, no. 12, pp. 1041-1051, 2005.
- [102] S. Camara, "Injuries to fishermen in Tanji, the Gambia," *International Journal of Science and Research*, vol. 10, no. 10, pp. 398-403, 2021.
- [103] B. Oduor, "Kenya: Why so many fishermen are dying in Homa Bay," All Africa, 26 February 2018. [Online]. Available: <https://allafrica.com/stories/201802270444.html>. [Accessed 2020].
- [104] W. Ochieng, "Kenya: Masambweni fisherman dies as boats capsize," All Africa, 17 April 2012. [Online]. Available: <https://allafrica.com/stories/201204190223.html>. [Accessed 2021].
- [105] J. Scullion, "Inland fisheries co-management in East Africa," 2007.
- [106] KTN News Kenya, "Nakuru government to introduce bill to outlaw night fishing in Lake Naivasha in wake of deaths," KTN News Kenya, 26 August 2015. [Online]. Available: [https://www.youtube.com/watch?v=KN\\_gAuCyWXA](https://www.youtube.com/watch?v=KN_gAuCyWXA). [Accessed 2020].
- [107] A. Gitonga, "Another fisherman killed by hippo in Lake Naivasha," The Standard, 21 January 2020. [Online]. Available: <https://www.standardmedia.co.ke/rift-valley/article/2001358684/another-fisherman-killed-by-a-hippo-in-l-naivasha>. [Accessed 2020].

- [108] S. Otieno, "Two fishermen drown as boat capsizes," 4 April 2016. [Online]. Available: <https://www.standardmedia.co.ke/nyanza/article/2000197073/two-fishermen-drown-as-boat-capsizes>. [Accessed 2020].
- [109] A. Gitonga, "Over 10 missing after boat capsized in Lake Naivasha," The Standard, 24 August 2020. [Online]. Available: <https://www.standardmedia.co.ke/business/index.php/rift-valley/article/2001383790/over-10-missing-after-boat-capsizes-in-lake-naivasha>. [Accessed 2020].
- [110] M. Mwangi, "Kenya: Tragedy as fishermen drown in Lake Naivasha," All Africa, 4 April 2017. [Online]. Available: <https://allafrica.com/stories/201704050098.html>. [Accessed 2020].
- [111] A. Meale, "County Increases Boat Patrols In Lake Naivasha To Curb Fish Poaching," Kenya News Agency, 25 April 2020. [Online]. Available: <https://www.kenyanews.go.ke/county-increases-boat-patrols-in-lake-naivasha-to-curb-fish-poaching>. [Accessed 2020].
- [112] AFP, "DR Congo accuses Uganda of killing 4 fishermen on shared lake," The Eastern Africa, 13 September 2018. [Online]. Available: <https://www.theeastafrican.co.ke/tea/news/east-africa/dr-congo-accuses-uganda-of-killing-4-fishermen-on-shared-lake-1402306>. [Accessed 2020].
- [113] Daily Monitor, "Congolese militiamen kill 7 Ugandan fishermen," The East African, 18 November 2018. [Online]. Available: <https://www.theeastafrican.co.ke/tea/news/east-africa/congolese-militiamen-kill-7-ugandan-fishermen-1406902>. [Accessed 2020].
- [114] Monitor, "One dead, five arrested in UPDF illegal fishing operation in Lake Edward," Monitor, 17 February 2020. [Online]. Available: <https://www.monitor.co.ug/uganda/news/national/one-dead-five-arrested-in-updf-illegal-fishing-operation-on-lake-edward-1875690>. [Accessed 2020].
- [115] T. Kahungu, "Hippo kills fisherman, injures another on Lake Albert," Uganda Radio Network, 9 January 2017. [Online]. Available: <https://ugandaradionetwork.net/story/hippopotamus-kills-fisherman-on-lake-albert>. [Accessed 2020].
- [116] I. Vita, "Terrorists slit throats of 10 fishermen near Baga," Odogwu Blog, July 2015. [Online]. Available: <https://blog.odogwublog.com/2015/07/terrorists-slit-throats-of-10-fishermen.html>. [Accessed 2020].
- [117] Xinhua News Agency, "Boko Haram militants kills 10 fishermen in NE Nigeria," Xinhua News Agency, 18 May 2019. [Online]. Available: <https://brudirect.com/news.php?id=68907>. [Accessed 2020].
- [118] A. M. Song and R. Chuenpagdee, "Conservation Principle: A Normative Imperative in addressing illegal fishing in Lake Malawi," *MAST*, vol. 10, no. 1, pp. 5-30, 2011.
- [119] Compassion Canada, "Escaping slavery on the most dangerous lake in Africa," Compassion Canada, 2018. [Online]. Available: <https://www.compassion.ca/blog/escaping-slavery-on-the-most-dangerous-lake/>. [Accessed 2022].
- [120] L. Kristine, "On Ghanas Lake Volta, child slavery is in plain sight," CNN, 3 July 2021. [Online]. Available: <https://edition.cnn.com/2021/07/03/opinions/lisa-kristine-lake-volta-spc-intl/index.html>. [Accessed 2022].
- [121] European Union, "EU Country Profile. European market observatory for fisheries and aquaculture," 2020.
- [122] European Commission, "Ocean and Fisheries Small-Scale Fisheries".
- [123] European Maritime Safety Authority, "Annual overview of marine casualties and incidents 2021," European Maritime Safety Authority, 2021.
- [124] Marine Accident Investigation Branch, "Marine accident recommendations and statistics 2020".
- [125] F. Blaha, "Francisco Blaha," 2022. [Online]. Available: <http://www.franciscoblaha.info/>.

- [126] E. McGuinness, "Safety in the Norwegian fishing fleet: Analysis and measures for improvement," Norwegian University of Science and Technology (NTNU), 2016.
- [127] A. Mentés, M. Yetkin and H. Akyildis, "Safety barriers for risk management of fishing vessels off the coast and in open seas of Turkey," in *International Conference on Maritime Technology and Engineering*, Lisbon, 2016.
- [128] European Commission, "Baltic Sea Region Strategy Report".
- [129] Health and Safety Authority, "Fatal Accident Statistics," Health and Safety Authority, Ireland, 2020. [Online]. Available: [https://www.hsa.ie/eng/your\\_industry/fishing/accidents\\_and\\_ill\\_health/statistics/](https://www.hsa.ie/eng/your_industry/fishing/accidents_and_ill_health/statistics/). [Accessed 2021].
- [130] UK Maritime and Coastguard Agency, "Small Fishing Vessel Code 2020. Impact Assessment," 2018.
- [131] Ifremer (coord), "Small-scale coastal fisheries in Europe, Final report of the contract No. FISH/2005/10, 447p," 2007.
- [132] F. Lawrence, E. Mcsweeney, A. Kelly, M. Haywood, D. Susman, K. Chris and J. Domokos, "Revealed: Trafficked migrant workers abused in Irish fishing industry," *The Guardian*, November 2015. [Online]. Available: <https://www.theguardian.com/global-development/2015/nov/02/revealed-trafficked-migrant-workers-abused-in-irish-fishing-industry>. [Accessed 2020].
- [133] H. L. Aasjord, "Tools for improving safety management in the Norwegian fishing fleet occupational accidents analysis period of 1998-2016," *International Maritime Health*, vol. 57, no. 1-4, pp. 76-84, 2006.
- [134] J. M. Cabecas and I. L. Nunes, "Fisheries Safety Management," *Enterprise Work Innovation Studies*, vol. 1, 2005.
- [135] E. Sanchez Nicolas, "EU's 2021 fishing quotas to exceed scientific advice," *EU Observer*, 18 December 2020. [Online]. Available: <https://euobserver.com/green-economy/150420>. [Accessed April 2022].
- [136] Seas at Risk, "European Commission overestimates number of fish stocks at sustainable levels," *Seas at Risk*, 13 June 2019. [Online]. Available: <https://seas-at-risk.org/press-releases/european-commission-overestimates-numbers-of-fish-stocks-at-sustainable-levels/>. [Accessed Feb 2022].
- [137] P. Murray, "Boat slave shame of fishing industry," *Express UK*, 25 January 2014. [Online]. Available: <https://www.express.co.uk/news/uk/456085/Boat-slave-shame-of-fishing-industry>. [Accessed 2020].
- [138] B. Roach, "Five fishermen missing after boat sinks off Cork coast," *The Irish Times*, 15 January 2012. [Online]. Available: <https://www.irishtimes.com/news/five-fishermen-missing-after-boat-sinks-off-cork-coast-1.692709>. [Accessed 2021].
- [139] M. Fagan, "Ireland fails to tackle exploitation of fishermen - ITF," *The Irish Examiner*, 30 June 2020. [Online]. Available: <https://www.irishexaminer.com/news/arid-31008392.html>.
- [140] R. J. Stanford, B. Wiryawan, D. G. Bengen, R. Febriamansyah and J. Haluan, "Improving Livelihoods in fishing communities of West Sumatra. More than just boats and machines," *Marine Policy*, no. 45, pp. 16-25, 2014.
- [141] R. I. Arthur, D. J. Skerritt, A. Schuhbauer, N. Ebrahim, R. M. Friend and U. R. Sumaila, "Small scale fisheries and local food systems: Transformations, threats and opportunities," *Fish and Fisheries*, vol. 23, pp. 109-124, 2022.
- [142] Nautilus Institute, "The roots of piracy in Southeast Asia," *APSNet Policy Forum*, 22 October 2007. [Online]. Available: <https://nautilus.org/apsnet/the-roots-of-piracy-in-southeast-asia/>. [Accessed 2019].
- [143] A. Ghosh and A. Savio Lobo, "Bay of Bengal: Depleted fish stocks and huge dead zone signal tipping point," *The Guardian*, 31 January 2017. [Online]. Available:

<https://www.theguardian.com/environment/2017/jan/31/bay-bengal-depleted-fish-stocks-pollution-climate-change-migration>.

- [144] A. C. Diegues, "Marine protected areas and Artisanal fisheries in Brazil," International Collective in Support of Fishworkers, Chennai, 2008.
- [145] V. Isaac, M. Almeida, R. Cruz and L. Nunes, "Artisanal fisheries of the Xingu River Basin in Brazilian Amazon," *Brazilian Journal of Biology*, vol. 75, no. 3, pp. 125-137, 2015.
- [146] L. J. Morris and G. P. Paoli, "A preliminary assessment of Indonesia's Maritime Security threats and capabilities," RAND Corporation, Santa Monica , 2018.
- [147] M. Carrere, "Illegal fishing: The great threat to Latin America's marine sanctuaries," Mongabay, 5 March 2021. [Online]. Available: <https://news.mongabay.com/2021/03/illegal-fishing-the-great-threat-to-latin-americas-marine-sanctuaries/>. [Accessed December 2021].
- [148] Marine Insight News Network, "Fisheries death, attempted coverup sparks Uruguayan union fury," Marine Insight, 20 November 2020. [Online]. Available: <https://www.marineinsight.com/shipping-news/fisheries-death-attempted-cover-up-sparks-uruguayan-union-fury/>. [Accessed 2021].
- [149] M. Carrere, "Weak governance undermines South America's ocean ecosystem," Mongabay, 26 April 2019. [Online]. Available: <https://news.mongabay.com/2019/04/weak-governance-undermines-south-americas-ocean-ecosystems/>.
- [150] G. Knapp, "International commercial fishing management regime safety study: synthesis of case reports," FAO, Rome, 2016.
- [151] T. Antao, C. Almeida and C. Guedes Soares, "Causes of occupational accidents in the fishing sector of Portugal," *Safety Science*, vol. 46, pp. 885-899, 2008.
- [152] U. R. Sumaila and J. Jacquet, "When bad gets worse: Corruption and fisheries," Sea Around Us.
- [153] M. Beatley and S. Edwards, "Overfished: In Senegal, empty nets lead to hunger and violence," Global Post, 30 May 2018. [Online]. Available: <https://theworld.org/stories/2018-05-30/overfished-senegal-empty-nets-lead-hunger-and-violence>.
- [154] R. Michaelson, "Climate crisis drives Tunisia fishing trade into troubled waters," The Guardian, 9 September 2019. [Online]. Available: <https://www.theguardian.com/environment/2019/sep/09/climate-crisis-drives-tunisia-fishing-trade-into-troubled-waters>.
- [155] M. Martini, "Illegal, unreported and unregulated fishing and corruption," U4 Anti-Corruption Resource Centre, Norway, 2013.
- [156] Y. Rousseau, R. A. Watson, J. L. Blanchard and E. A. Fulton, "Evolution of global marine fishing fleets and the response of fished resources," *Proceedings of the National Academy of Sciences*, vol. 116, no. 25, pp. 12238-12243, 2019.
- [157] M. Daghar, "Saving Lake Victoria means going after the big fish," Institute for Security Studies, Africa, 2019.
- [158] United Nations Office for the Coordination of Humanitarian Affairs, "Gaza's fisheries: record expansion of fishing limit and relative increase in fish catch; shooting and detention incidents at sea continue," United Nations Office for the Coordination of Humanitarian Affairs, 19 November 2019. [Online]. Available: <https://www.ochaopt.org/content/gaza-s-fisheries-record-expansion-fishing-limit-and-relative-increase-fish-catch-shooting>. [Accessed 2022].
- [159] C. White, "Sri Lanka fighting IUU violations by Indian Trawlers," Seafood Source, 16 July 2016. [Online]. Available: <https://www.seafoodsource.com/news/environment-sustainability/sri-lanka-fighting-iuu-violations-by-indian-trawlers>. [Accessed 2019].
- [160] World Bank, "Madagascar: Balancing conservation and exploitation of fisheries resources," World Bank, 8 June 2020. [Online]. Available:

<https://www.worldbank.org/en/news/feature/2020/06/08/madagascar-balancing-conservation-and-exploitation-of-fisheries-resources>. [Accessed 2022].

- [161] B. Gorez, "Small scale fisheries at risk: Madagascar signs destructive fishing agreements with Chinese Investors," CFFA - Coalition for Fair Fisheries Arrangements, 17 November 2020. [Online]. Available: <https://www.cffacape.org/publications-blog/small-scale-fisheries-at-risk-madagascar-signs-destructive-fishing-agreements-with-chinese-investors>. [Accessed 2021].
- [162] R. Bello, "Illegal, unreported and unregulated fishing in the Philippines," Rappler, 8 December 2021. [Online]. Available: <https://www.rappler.com/environment/numbers-illegal-unreported-unregulated-fishing-philippines/>. [Accessed 2022].
- [163] O. Ojewale, "Illicit fishing threatens to diminish entire ecosystems and local economies around Lake Kivu," Daily Maverick, 02 February 2022. [Online]. Available: <https://www.dailymaverick.co.za/article/2022-02-02-illicit-fishing-threatening-to-diminish-entire-ecosystems-and-local-economies-around-lake-kivu/>. [Accessed 2022].
- [164] J. Gonzales, "Managing fish stock - and fishermen- along Brazil's Canaticu River," Mongabay, 2 Feb 2016. [Online]. Available: <https://news.mongabay.com/2016/02/managing-fish-stock-and-fishermen-along-brazils-canaticu-river/>.
- [165] The Monitor, "Uganda: Food shortage - locals resort to illegal fishing," The Monitor, 14 April 2020. [Online]. Available: <https://www.monitor.co.ug/uganda/news/national/food-shortage-locals-resort-to-illegal-fishing-1885218>. [Accessed 2021].
- [166] R. M. Desai and G. E. Shambaugh, "Measuring the global impact of destructive and illegal fishing on maritime piracy: A spatial analysis," *PLoS ONE*, vol. 16, no. 2, 2021.
- [167] C. Sayer, L. Maiz-Tome and W. Darwell, "Freshwater biodiversity in the Lake Victoria Basin: Guidance for species conservation, site protection, climate resilience and sustainable livelihoods," International Union for Conservation of Nature (IUCN), 2018.
- [168] R. Tumwebaze, "The Status of Lake Victoria Fisheries under limited access fisheries," in *Global Conference of Tenure and User Rights in fisheries 2018*, Yeosu, 2018.
- [169] AFP, "4 killed as Tanzania police clash with illegal fishermen," Business Standard , 29 July 2019. [Online]. Available: [https://www.business-standard.com/article/pti-stories/4-killed-as-tanzania-police-clash-with-illegal-fishermen-119072301589\\_1.html](https://www.business-standard.com/article/pti-stories/4-killed-as-tanzania-police-clash-with-illegal-fishermen-119072301589_1.html). [Accessed 2021].
- [170] F. Nunan, "How corruption encourages illegal fishing on Lake Victoria," The Conversation, 12 September 2018. [Online]. Available: <https://theconversation.com/how-corruption-encourages-illegal-fishing-on-lake-victoria-97812>. [Accessed 2020].
- [171] The Irrawaddy, "Abuse cases spotlight exploitation, brutal conditions in Myanmar fishing industry," The Irrawaddy, 14 December 2019. [Online]. Available: <https://www.irrawaddy.com/datetime/abuse-cases-spotlight-exploitation-brutal-conditions-myanmar-fishing-industry.html>. [Accessed 2021].
- [172] A. Chan, "Fishy business," Myanmar Insider, 28 August 2018. [Online]. Available: <https://www.myanmarinsider.com/fishy-business/>. [Accessed 2021].
- [173] K. M. M. Wai, "Enslaved fishery workers near Pyapon City," The Voice, May 2017. [Online]. Available: [https://www.academia.edu/37284179/Enslaved\\_fishery\\_workers\\_near\\_Pyapon\\_City\\_by\\_Khin\\_Myat\\_Myat\\_Wai](https://www.academia.edu/37284179/Enslaved_fishery_workers_near_Pyapon_City_by_Khin_Myat_Myat_Wai). [Accessed 2020].
- [174] H. Thar, "The abuse behind Myanmar's fish paste industry," Frontier, 20 January 2020. [Online]. Available: <https://www.frontiermyanmar.net/en/the-abuse-behind-myanmars-fish-paste-industry/>. [Accessed 2021].
- [175] K. M. M. Wai, "Burma's enslaved fishermen," Chiang Mai City Life, 1 October 2018. [Online]. Available: <https://www.chiangmaicitylife.com/clg/our-city/opinion/burmas-enslaved-fishermen/>. [Accessed 2021].

- [176] K. M. M. Lwin, "Fishing boat captive barely survives daring escape," Myanmar Now , 19 December 2019. [Online]. Available: <https://myanmar-now.org/en/news/fishing-boat-captive-barely-survives-daring-escape?page=37>. [Accessed 2020].
- [177] S. S. Tun, "Hell's burning over Burmese Sea," BBC News , 1 October 2018. [Online]. [Accessed 2020].
- [178] R. Pomeroy, M. Parks, K. L. Mrakovcich and C. LaMonica, "Drivers and impacts of fisheries scarcity, competition and conflict on Maritime security," 2016.
- [179] Oceana, "European trawlers are destroying the oceans," Oceana, 2004.
- [180] J. Alfaro-Shigueto, J. C. Mangel, M. Pajuelo, P. H. Dutton, J. A. Seminoff and B. J. Godley, "Where small can have a large impact: Structure and characterization of small-scale fisheries in Peru," *Fisheries Research*, no. 106, pp. 8-17, 2010.
- [181] G. D. Raby, A. H. Colotelo, G. Blouin-Demers and S. J. Cooke, "Freshwater commercial bycatch an understated problem," *Bio Science*, vol. 61, no. 4, 2011.
- [182] A. Keledjian, G. Brogan, B. Lowell, J. Warrenchuck, B. Enticknap, G. Shester, M. Hirshfield and D. Cano-Stocco, "Wasted Catch: Unsolved problems in US fisheries," Oceana, 2014.
- [183] P. S. E. z. Ermgassen and et.al, "Fishers who rely on Mangroves: Modelling and mapping the global intensity of mangrove associated fishers," *Estuarine, Coastal and Shelf Science*, vol. 248, 2021.
- [184] M. E. Davis, "New study finds mangroves may store way more carbon than we thought," Mongabay, 2 May 2018. [Online]. Available: <https://news.mongabay.com/2018/05/new-study-finds-mangroves-may-store-way-more-carbon-than-we-thought/>. [Accessed 2022].
- [185] P. Burgess, S. Quin and X. Li, "Mangroves in Ecuador: an application and comparison of ecosystem services valuation models," 2015.
- [186] N. Akua, "A race against time: The giant weeds taking over Lake Ossa in Cameroon," Euro News, 12 May 2021. [Online]. Available: <https://www.euronews.com/green/2021/05/11/race-against-time-the-giant-weeds-taking-over-lake-ossa-cameroon>. [Accessed 2021].
- [187] T. Zekarias, V. Govindu, Y. Kebede and A. Gelaw, "Degradation of wetlands and livelihood benefits of Lake Abaya -Chamo wetland, Southern Ethiopia," *Current Research in Environmental Sustainability*, vol. 3, 2021.
- [188] Rhodes University, "The humble beetle that could rescue a town," Rhodes University, 31 March 2021. [Online]. Available: <https://www.ru.ac.za/latestnews/thehumblebeetlethatcouldrescueatown.html>. [Accessed 2022].
- [189] Marine Stewardship Council, "Climate change and fishing," Marine Stewardship Council, 2022. [Online]. Available: <https://www.msc.org/what-we-are-doing/oceans-at-risk/climate-change-and-fishing>.
- [190] United States Environmental Protection Agency, "Climate change indicators: Oceans," United States Environmental Protection Agency, 12 May 2021. [Online]. Available: <https://www.epa.gov/climate-indicators/oceans>. [Accessed 2022].
- [191] J. Bongaarts, "Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the intergovernmental science policy platform on biodiversity and ecosystem services," Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), 2019.
- [192] WWF, "Small-scale fisheries in a warming ocean: Exploring adaptation to climate change," WWF, Berlin, 2020.
- [193] The Intergovernmental Panel on Climate Change, "FAQ 5.1: How is life in the sea affected by climate change," The Intergovernmental Panel on Climate Change, 2022.

- [194] ADM Capital Foundation, "Sink or swim: Asia's marine fisheries at risk of collapse, leading scientists warn," Taiwan News, 03 November 2021. [Online]. Available: <https://www.taiwannews.com.tw/en/news/4333521>.
- [195] I. Okafor-Yarwood, "Nigeria's depleting fish stocks may pose a threat to regional security," The Conversation, 8 December 2018. [Online]. Available: <https://theconversation.com/nigerias-depleting-fish-stocks-may-pose-a-threat-to-regional-security-105168>. [Accessed 2021].
- [196] K. Teshome, "The resurrection of Lake Haramaya: Hope and Challenges," Water Journalists Africa, 15 January 2020. [Online]. Available: <https://waterjournalistsafrica.com/2020/01/the-resurrection-of-lake-haramaya-hope-and-challenges/>. [Accessed 2022].
- [197] S. Karmakar, S. Purkait, A. Das and R. Samanta, "Climate change and inland fisheries: Impacts and mitigation strategies," *Journal of Experimental Zoology, India*, vol. 21, no. 1, pp. 329-335, 2018.
- [198] M. T. Tollera, "Climate change, overutilisation dry up Ethiopian Lakes," Down To Earth, 29 May 2018. [Online]. Available: <https://www.downtoearth.org.in/news/climate-change/climate-change-overutilization-dry-up-ethiopian-lakes-60684>.
- [199] Ethiopia Observer, "Lake Haramaya is back. But for how long?," Ethiopia Observer, 13 September 2021. [Online]. Available: <https://www.ethiopiaobserver.com/2020/09/13/lake-haramaya-is-back-but-for-how-long/>. [Accessed 2022].
- [200] D. Willima, "Africa's inland blue economies are in deep water.," Institute for Security Studies, 16 Feb 2022. [Online]. Available: <https://issafrica.org/iss-today/africas-inland-blue-economies-are-in-deep-water>.
- [201] R. Mirondo, "Factors behind declining fish catches in Lake Tanganyika," The Citizen, 18 November 2021. [Online]. Available: <https://www.thecitizen.co.tz/tanzania/magazines/factors-behind-declining-fish-catches-in-lake-tanganyika-3623046>. [Accessed 2021].
- [202] Unsplash, 2022. [Online]. Available: <https://unsplash.com/>.
- [203] European Parliament, "EU climate action in ocean governance and fisheries policy," European Parliamentary Research Centre, April 2021. [Online]. Available: [https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2021\)690572](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)690572).
- [204] Marine Stewardship Council, "World missing out on nutrition for 72 million due to overfishing," Marine Stewardship Council, 7 January 2021. [Online]. Available: <https://www.msc.org/media-centre/press-releases/press-release/world-missing-out-on-nutrition-for-72-million-due-to-overfishing>.
- [205] S. Gibbens, "Climate Change is depleting our essential fisheries," National Geographic, 1 March 2019. [Online]. Available: <https://www.nationalgeographic.com/environment/article/climate-change-is-shrinking-essential-fisheries>.
- [206] L. S. Teh, V. W. Y. Lam, W. W. L. Cheung, L. C. L. Teh and U. R. Sumaila, "Impact of high seas closure on food security in low income fish dependent countries," *PLoS ONE*, vol. 11, no. 12, 2016.
- [207] P. Nayak, L. E. Oliveira and F. Berkes, "Resource degradation, marginalization and poverty in small scale fisheries, threats to social-ecological resilience in India and Brazil," *Ecology and Society*, vol. 19, no. 2, 2014.
- [208] R. Makwinja, E. Kaunda, S. Mengistou, T. Alemiew, F. Njaya, I. B. Kosamu and C. C. Kaonga, "Lake Malombe fishing communities livelihoods, vulnerability and adaptation strategies," *Current Research in Environmental Sustainability*, vol. 3, 2021.
- [209] O. Emmanuel, "Fisheries protection unit burns over 200 illegal boats," Uganda Radio Network, 26 August 2021. [Online]. Available: <https://ugandaradionetwork.net/story/fisheries-protection-unit-burns-over-200-illegal-boats>. [Accessed 2021].

- [210] The Independent, "Evicted fishermen at Wanyoso landing site resort to charcoal burning," The Independent, 18 August 2021. [Online]. Available: <https://www.independent.co.ug/evicted-fishermen-at-wanyoso-landing-site-resort-to-charcoal-burning/>. [Accessed 2021].
- [211] P. Communication, *Peru: Industrialists and fishermen request restitution from Ministry of Fisheries*.
- [212] K. Lamb, "The Bangladeshi crab farmers battling climate crisis - and pirates," The Guardian, 18 October 2019. [Online]. Available: <https://www.theguardian.com/environment/2019/oct/18/the-sundarbans-crab-farmers-battling-climate-crisis-and-pirates-bangladesh>. [Accessed 2022].
- [213] Our World in Data, "Poverty: Share of population living on less than \$3.20 a day, 2019," Our World in Data, 2022. [Online]. Available: <https://ourworldindata.org/grapher/share-living-with-less-than-320-int-per-day?time=2019&country=EST~TTO~CAN>. [Accessed 2022].
- [214] R. Abd and M. Castillo, "Lobster divers risk injury, death in Honduras," AP Blog, 26 December 2018. [Online]. Available: <https://apimagesblog.com/blog/2018/12/26/lobster-divers-risk-injury-death-in-honduras>. [Accessed 2021].
- [215] J. Tomlinson, "Guns 'n' roses: The murder of Joan Root," January 2006. [Online]. Available: <https://janetomlinson.com/joan-root/>. [Accessed 2022].
- [216] G. Ortiz de Souza and D. P. Bitencourt, "Safety and Health of shrimp fishermen in Beroia São Paulo/Brazil: A study focused on atmospheric risk factors," *Sociedade & Natureza*, vol. 31, no. 38120, pp. 1-21, 2019.
- [217] A. Idrees, "Sweat, tears and sea," Tribune Magazine, December 2021. [Online]. Available: <https://tribune.com.pk/story/2333497/sweat-tears-and-the-sea>. [Accessed 2022].
- [218] A. Mugati and A. Ashaba, "Fisherman drowns in Lake Albert while hiding from soldiers," Monitor, 27 August 2021. [Online]. Available: <https://www.monitor.co.ug/uganda/news/national/fisherman-drowns-in-lake-albert-while-hiding-from-soldiers-3526814>. [Accessed 2021].
- [219] Nereus Program, "Where have all the fish gone? How climate change is displacing marine species," University of British Columbia, 3 December 2015. [Online]. Available: <https://archives.nereusprogram.org/cop21-where-have-all-the-fish-gone-how-climate-change-is-displacing-marine-species/>. [Accessed 2022].
- [220] M. Troell, M. Jonell and B. Crona, "Scoping report: The role of seafood in sustainable and healthy diets," Stockholm Resilience Centre, 2019.
- [221] S. Service and B. Palmstrom, "Confined to a Thai fishing boat for three years," NPR, 19 June 2012. [Online]. Available: <https://www.npr.org/2012/06/19/155045295/confined-to-a-thai-fishing-boat-for-three-years>. [Accessed 2020].