



# THE SCALE OF ILLICIT TRADE IN PACIFIC OCEAN MARINE RESOURCES

MANASWITA KONAR, ERIN GRAY, LAUREN THURINGER, AND U. RASHID SUMAILA

## EXECUTIVE SUMMARY

### Highlights

- The Pacific Ocean’s six major fishing areas produce about 62 million tonnes of marine catch per year, but 24 percent of that (15 million tonnes) is unreported. The share of the unreported catch that is traded illegally (3.7 million–7.2 million tonnes) constitutes about 50 percent of all marine resources that enter illegal international trading networks. This has far-reaching economic and social consequences for many developing and developed economies.
- This working paper analyzes the costs to Pacific countries of illegal trade in marine resources by looking at the loss in gross revenues from unreported catch, the impact across the fish value chain (economic impact), the loss to household incomes (income impact), and the loss in tax revenues (tax impact).
- Overall, results indicate that while the estimated loss in gross revenues to the formal economy is substantial (US\$4.3 billion–\$8.3 billion per year), the losses are substantially higher when the economic impact (\$10.8 billion–\$21.1 billion per year), income impact (\$2.8 billion–\$5.4 billion per year), and tax revenue impact (\$0.2 billion–\$1.6 billion per year) are considered.
- The Western Central Pacific area (which includes the key exclusive economic zones of Cambodia, Indonesia, Malaysia, Palau, Papua New Guinea, Philippines, Thailand, and Vietnam) is the worst hit by illegal trade in marine resources.

## CONTENTS

Executive Summary .....	1
1. Introduction.....	3
2. Methodology .....	5
3. The Results .....	8
4. Limitations and Areas for Further Research.....	12
5. Discussion .....	12
6. Conclusions.....	13
Endnotes.....	14
References .....	14
Acknowledgments.....	16
About the Authors .....	16

*Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues. Working papers may eventually be published in another form and their content may be revised.*

**Suggested Citation:** Konar, M., E. Gray, L. Thuringer, and U.R. Sumaila. 2019. “The Scale of Illicit Trade in Pacific Ocean Marine Resources.” Working Paper. Washington, DC: World Resources Institute. Available online at [www.wri.org/publication/scale-illicit-trade-pacific-ocean](http://www.wri.org/publication/scale-illicit-trade-pacific-ocean).

- When additional social and environmental costs are considered, the losses to the formal economy are still higher.
- Given the scale of the impact identified, there is an urgent need to accelerate effective action to eliminate the illegal trade in marine resources.

**Illicit trading in the Pacific Ocean’s marine resources undermines economies by reducing business profits and household incomes, depriving governments of tax revenue, and depleting fish stocks.**

**The Pacific Ocean’s six major fishing areas produce about 62 million tonnes of marine catch per year (reported and unreported)—but 24 percent of that (15 million tonnes) is unreported (Pauly and Zeller 2015), and between 6 percent and 12 percent (3.7–7.2 million tonnes) is traded illegally (Pauly and Zeller 2016).** The Pacific Ocean’s marine resources are a source of income, foreign exchange, employment, and nutrition to many countries. Illicit trading—defined as trade that involves money, goods, or value gained from illegal and unreported fishing of fish stocks by domestic industrial fishing fleets and artisanal fishing vessels that catch fish for commercial purposes (Sumaila 2018)—is reducing these benefits and thus undermining Pacific Ocean economies.

**Tracking and valuing these losses is essential for ending illicit trading.** The Pacific Ocean is a major hotspot for illegal trade in marine resources—around 50 percent of all marine resources illegally traded globally originate from there. Given the scale of the problem, urgent action is needed to ensure the ocean’s long-term health and the well-being and prosperity of societies. To date, however, no comprehensive studies have analyzed the scale of illegal and unreported fishing across the entire Pacific Ocean in terms of its economic and social impacts.

**About This Working Paper**

**This paper addresses this gap and calculates the wider economic and income impacts of illicit trading of marine resources across the fish value chain.** The methodology for estimating these impacts is based on a study by Sumaila (2018) that estimated the impacts of illicit fishing in West Africa. This paper estimates impacts through four dimensions that together provide a broad picture of the scale of economic losses:

- **Gross revenue loss** measures lost revenues from direct catch that could be earned legally and would have contributed to national income.
- **Economic impact** measures the loss in added value through the fish value chain from unreported catch not entering the legitimate formal economy. It includes impacts on economic activities such as boat building and maintenance, equipment, supplies, and restaurants.
- **Income impact** measures the loss of household income that could have been earned through the fish value chain if the same quantity of fish had been caught and sold legally in the market.
- **Tax revenue loss** measures tax revenue that countries could have earned (at the point of catch) if the illicitly traded marine resources had been traded legally—revenues that could have been used to generate public benefits.

This study analyzes the impact of illegal fishing across the entire Pacific, focusing on six Food and Agriculture Organization (FAO) major fishing areas that represent about 90 percent of the unreported catch in the Pacific: Eastern Central (area 77), Northeast (area 67), Northwest (area 61), Southeast (area 87), Southwest (area 81), and Western Central (area 71). The analysis also looks across all the marine species that are caught and enter illegal trading networks.

**Impacts of Illicit Trading in the Pacific: Results**

**Overall, the effects of illicit trade in marine catch in the Pacific region are substantial and constitute a risk for national and local economies.** Table ES-1 summarizes the range of regional results for each impact dimension, where low and high estimates represent different scenarios for the proportion of unreported catch assumed to be illegally traded by artisanal fishers and industrial enterprises. The loss in gross revenues to the formal economy is estimated to be \$4.3 billion to \$8.3 billion per year, which is equivalent to 6 percent to 11 percent of the total value of reported catch for the Pacific region (based on Pauly and Zeller 2015). While this is a substantial loss to the formal economy, the economic impact or added cost through the value supply chain (\$10.8 billion to \$21.1 billion) is between 2.5 and 5 times higher than gross revenue loss in the region. The loss of income impact

Table ES-1 | Summary of Regional Impacts (2010 US\$)

	LOW ESTIMATE (\$, BILLIONS PER YEAR)	HIGH ESTIMATE (\$, BILLION PER YEAR)
Gross revenue loss	4.3	8.3
Economic impact	10.8	21.1
Income impact	2.8	5.4
Tax revenue loss	0.2	1.6

Source: Authors.

is estimated to be \$2.8 billion to \$5.4 billion, which represents about 20 percent of all wages from reported catches (wages from reported catch estimated to be \$14 billion to \$27 billion per year). Tax revenue losses are estimated to be \$0.2 billion to \$1.6 billion per year, which means this money is not available for public spending on, for example, infrastructure, education, or health care.

**The Western Central Pacific region has the highest annual loss in gross revenue (\$2.4 billion to \$4.5 billion), economic impact (\$6 billion to \$10 billion), and income impact (\$1.3 billion to \$2.4 billion).** The key exclusive economic zones (EEZs) in this region include Cambodia, Indonesia, Malaysia, Palau, Papua New Guinea, Philippines, Thailand, and Vietnam. Figure ES-1 shows the tonnage of marine resources traded in each FAO area and the associated economic and income impact. It is estimated that in the extreme case one of every five fish caught in the region is illegally traded.

**When additional social and environmental costs are considered, the losses to the formal economy are still higher.** The costs presented here only tell a partial story: costs do not represent the lost value from depleted stocks, the risk of species extinction, the impact on marine food webs, and the reduction in climate resilience from depleted stock. Some of the socioeconomic costs consist of loss in employment and income for legitimate fishers, loss of tourism, increased food security risks, and potential disruption of coastal communities' social cohesion. In addition, the socioeconomic loss is greater when we consider that illegal fishing has been found to be linked to modern slavery, labor violations, and corruption.

## 1. INTRODUCTION

The fisheries sector in the Pacific Ocean is of vital importance to many economies in the region. The Pacific Ocean is a source of about 60 percent of the reported global marine capture, and the Northwest Pacific<sup>1</sup> is the most productive fishing area in the world (Sea Around Us n.d.). The total reported catch in the Northwest Pacific in 2014 was estimated to be 23 million tonnes out of a global reported catch of 79 million tonnes<sup>2</sup> (Sea Around Us n.d.). The catch from the Pacific Ocean is thus a significant source of income, foreign exchange, employment, and nutrition for many developing and developed economies, rendering them vulnerable to the far-reaching economic and social consequences of illegal, unreported, and unregulated (IUU) fishing.

Addressing this issue will be central to attaining a sustainable ocean economy. By quantifying the scale of impacts and losses across the fish value chain, we hope to demonstrate the need for countries in the region to take urgent action. The analysis was also developed to help inform discussions at the Asia Pacific Economic (APEC) summit in November 2019, with the aim of galvanizing international action to end IUU fishing in the Pacific Ocean.

### 1.1 Existing Literature on the Scale of the Problem

Over 85 percent of global fish stocks can be considered at significant risk of IUU fishing (WWF 2015). Estimation of the loss to society from IUU is challenging, however, and there is considerable uncertainty about the scale and volume of IUU fishing happening globally and the threat it poses to economic, social, and environmental well-being (Clark 2006; Greenpeace Australia Pacific 2006; Lungren et al. 2006). When demonstrating the extent of illegal fishing in the whole of the Pacific Ocean, existing literature tends to use analysis that dates back as far as 2008 and 2009 or focus on estimates that pertain to specific countries in the region. Estimates by Agnew et al. (2009) show the Western Central Pacific and Northwest Pacific to have the highest percentage of IUU fishing as a proportion of catch (34 and 33 percent, respectively) after West Africa. MRAG and UCB (2008) put the quantity of fish taken by IUU fishing at between 3.4 million and 8.1 million tonnes per year for the Asia Pacific region. Lungren et al. (2006) estimate that IUU fishing in the Asia Pacific region costs around \$5.8 billion annually.

Figure ES-1 | **Map of Pacific FAO Regions with Tonnage of Illegal Fish Traded and Summary of Monetary Impacts (Economic Impact and Income Impact)**



FAO Region	Volume Traded Illegally (Million Tonnes)	Gross Revenue Loss (Billion USD)	Economic Impact (Billion USD)	Income Impact (Billion USD)
<b>Pacific, Southeast (87)</b>	0.8-1.4	0.6-1.1	1.7-3.1	0.5-0.9
<b>Pacific, Northwest (61)</b>	0.9-1.9	1.1-2.25	3.1-6.4	0.9-1.8
<b>Pacific, Northeast (67)</b>	0.015-0.02	0.04-0.06	0.1-0.2	0.04-0.06
<b>Pacific, Southwest (81)</b>	0.02-0.04	0.04-0.08	0.1-0.2	0.03-0.06
<b>Pacific, Eastern Central (77)</b>	0.04-0.2	0.06-0.36	0.2-0.9	0.04-0.2
<b>Pacific, Western Central (71)</b>	1.9-3.6	2.4-4.5	5.5-10.3	1.3-2.4
<b>TOTAL</b>	<b>3.7-7.2</b>	<b>4.3-8.3</b>	<b>10.8-21.1</b>	<b>2.75-5.4</b>

Note: Due to rounding, numbers presented may not add up precisely to the totals indicated.

Other studies analyze the impact of illegal fishing in the Asia Pacific region by focusing either on specific countries or communities or on particular species illegally fished in the region. For example, a study estimates the financial loss from IUU to local communities on the east coast of peninsular Malaysia to be at least 72 million Malaysian ringgit (approximately \$17 million) per year, in addition to other losses such as wasted subsidized fuel, artificially inflated fish prices in local markets, and lost fishing boat provisioning business (Sea Resources Management Sdn Bhd 2008). MRAG Asia Pacific (2016) estimates the total volume of IUU activity in Pacific tuna fisheries to be 306,440 tonnes for the Pacific Island region, with an estimated catch value of \$616.11 million (90 percent confidence range is between \$517.91 million and \$740.17 million). These studies have helped address a major evidence gap, but there is still insufficient understanding of the overall impact that illegal trade in marine resources can have across the whole of the Pacific, especially when we take into account the ripple or multiplier effect through the fish value chain.

No recent analyses or studies estimate the direct and indirect cost to countries of illegal fishing in the Pacific Ocean. The objective of this working paper is to address this gap by determining the loss of revenues to economies from illegal trade in marine resources and the impact on the fish value chain and the wider economy.

## 1.2 Definition of *Illicit Trade*

Following Sumaila (2018), we define *illicit trade* to be trade that involves money, goods, or value gained from illegal and unreported fishing of fish stocks by foreign and domestic industrial fishing fleets and by artisanal fishing vessels that catch fish for commercial purposes. Based on this definition, we assume that only a portion of “unreported” marine catches enters illegal trading networks.

- Unreported catches by the subsistence sector, often legal, are consumed by the fisher or the community or used for local barter (Sumaila 2018). Hence, we do not consider these catches to be a part of the illegal trading sector, and we exclude them from our analysis.
- We also exclude unreported catches by the recreational sector, since we assume these activities to be driven more by the pursuit of pleasure than by an economic incentive to trade on illegal markets (Sumaila 2018).
- In addition, we exclude unreported discards and assume these nontargeted catches to be discarded into the ocean and hence not landed or traded illegally.
- Unreported catches in the artisanal fishing sector are often driven by the need to meet basic human requirements such as food for direct consumption (Meere and Lack 2008). However, a small proportion of the unreported catch can be traded illegally and often consists of catches of highly valuable and poorly monitored species, such as tuna or invertebrates (e.g., sea cucumbers). We assume the proportion illegally traded to be smaller than that of the industrial fishing sector. We provide further details on our assumptions in the methodology section.
- We assume half or more of industrial unreported catches to be illegally traded. The methodology section provides further detail on the proportion used in the analysis.

## 2. METHODOLOGY

Our methodology is based on the analysis used by Sumaila (2018) to estimate the impact of illegal fishing in West Africa. For the majority of nations, the fishing industry contributes less than 1 percent to their gross domestic product (GDP) (Dyck and Sumaila 2010). However, its total impact on the economy is considerably greater when we combine the impact of other sectors linked to fisheries and dependent on marine resources for income or inputs (Dyck and Sumaila 2010; Béné et al. 2007). Except for subsistence fishing, where fish is caught for household consumption, the value chain for fish rarely ends when the fish is caught (Dyck and Sumaila 2010). Instead, fish are sold to markets where they are again resold to consumers or to an intermediary who purchases larger quantities for processing. Each time fish changes hands, whether canned, tinned, or in another form, a portion of the value can be attributed to the capture fisheries (Dyck and Sumaila 2010).

By accounting for these wider impacts through the fish value chain, we can estimate the “downstream effect” that the illegal trade can have across the economy. In addition to estimating the direct economic loss from illegally trading marine resources at the point of catch, we also estimate the potential loss in economic impact across the fish value chain, the lost income for households working across the fish value chain, and the lost tax revenue for governments (Figure 1).

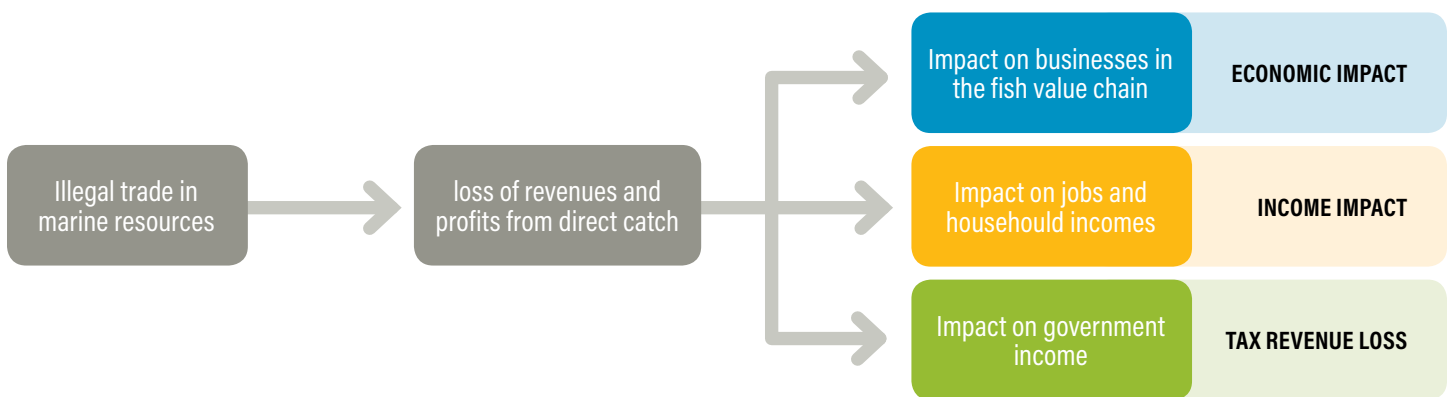
1. **Gross revenue loss** measures the revenues lost from direct catch that could be earned legally and would have contributed to national income if the fish resource had not been stolen.
2. **Economic impact** measures the loss of added value across the fish value chain, value that would have been generated if the fish were caught legally. The economic activities in the fish value chain include boat building and maintenance, equipment, supplies, food processing, and restaurants (Pontecorvo et al. 1980; Roy et al. 2009).
3. **Income impact** measures the loss of household income that would have been otherwise generated through the fish value chain if the same quantity of fish were caught and sold legally in the market.
4. **Tax revenue loss** measures the tax revenue that country governments could have earned if the marine resources had not been sold illicitly. These revenues could have been spent, for example, on public services. Here we only account for loss in tax revenues from direct catch and do not consider tax revenue losses across the value chain.

While even properly reported catches may end up being traded outside the legal system, to remain conservative we assume that only unreported catch contributes to illicit trade. The analysis does not focus on the impact of catches

from unregulated fisheries per se. Unregulated fisheries could result in reported or unreported catches, and as our analysis only focuses on the latter, we only account for a portion of catches coming from unregulated fisheries. Further, we recognize that a part of the unreported catch might get traded illegally within the Pacific region. As a result, it may enter the fish value chain and result in the partial recovery of the losses estimated. These impacts arising from the illegal trading activities themselves are not considered, as our study only looks at the losses to the legitimate formal economy. Similarly, the study does not consider the income and expenditures of individual companies participating in activities related to illegal fishing. Any impact from increased household income of these fishers is likely to be low. This is due to the fact that in order to maintain profits and reduce operating costs, fishing companies engaged in illegal activities are likely to employ migrants and pay them low wages, increasing their work hours and ignoring their health and safety (ILO 2013; Tickler et al. 2018).

We conducted our analysis across six FAO major fishing areas of the Pacific Ocean: Eastern Central (area 77), Northeast (area 67), Northwest (area 61), Southeast (area 87), Southwest (area 81), and Western Central (area 71). These areas account for more than 90 percent of the unreported and reported fisheries catch. We do not include the Pacific Antarctic (area 88), which accounted for less than 10 percent of total catch in 2014 ([www.seaaroundus.org](http://www.seaaroundus.org)).

Figure 1 | **Assessment of Impacts of Illegal Trade in Marine Resources**



Source: Adapted from Sumaila 2018.

## 2.1 Loss in Gross Revenues to the Formal Economy

The quantity or volume of unreported catches was taken from Pauly and Zeller (2016) and the Sea around Us (see Box 1). As discussed previously, we do not include discards and unreported catches by subsistence and recreational fishers.

There is a lack of data on the proportion of the unreported catch that is illegally traded by artisanal fishers and industrial enterprises. For our analysis, we therefore look at a range of scenarios. To remain conservative, we assume that 50–80 percent of unreported industrial catches contribute to illicit trade. This assumption corresponds to similar estimates for illegal logging in tropical countries; namely, that it accounts for 50–90 percent of the volume of all forestry in these countries (UNEP and INTERPOL 2016; TRACIT 2019). Another study estimated that 10 percent of the total timber production in Cameroon in 2000 was small-scale and illegal, but that this had grown to 50 percent by 2012. This study also found high levels of illegal small-scale logging in Brazil, the Democratic Republic of the Congo, Ghana, Indonesia, Papua New Guinea, and the Republic of the Congo (Hoare 2015). Thus, we consider two scenarios when estimating the proportion of unreported artisanal catch illegally traded. In scenario 1, we assume a range of 30–50 percent of unreported artisanal catch entering the illicit market. Scenario 2, more conservative, assumes a range of 0–30 percent of unreported artisanal catch being traded illicitly.

To estimate the gross revenue attributable to illegal fishing, we use the following equation:

$$\text{Gross revenue lost } (GR_{pac}) = Vpac (L_i \times T + L_a \times P)$$

$$L_i = \frac{\text{Unreported industrial landing (excluding discards)}}{\text{All unreported catch}}$$

$$L_a = \frac{\text{Unreported artisanal landing (excluding discards)}}{\text{All unreported catch}}$$

### Box 1 | Description of Data Sources and Methodology

Pauly and Zeller (2016) and the Sea around Us database ([www.seaaroundus.org](http://www.seaaroundus.org)) present data collected over more than a decade by more than 400 international collaborators to complement officially reported catch statistics with the best and most comprehensive estimates of unreported catches of marine fish for every country in the world. These data combine official reported data and reconstructed estimates of unreported data (including major discards), with reference to individual exclusive economic zones.

Official reported catch data were mainly extracted from the Food and Agriculture Organization of the United Nations (FAO) FishStat database. For reconstructed estimates of unreported catch, the major initial sources of information were the websites and publications of government departments of fisheries (or equivalent agencies), both online and in print. Also major sources of information on national catches were international research organizations such as FAO, the International Council for the Exploration of the Sea, the Secretariat of the Pacific Community, and regional fishery management organizations such as the Northwest Atlantic Fisheries Organization and the Commission for the Conservation of Antarctic Marine Living Resources (Cullis-Suzuki and Pauly 2010), or current or past regional fisheries development and/or management projects (many of them launched and supported by FAO), such as the Bay of Bengal Large Marine Ecosystem Project (Pauly and Zeller 2015). Information was also sourced from relevant academic literature. For missing data, anchor points were developed, and data were interpolated for time periods between data anchor points, either linearly or assumption-based for commercial fisheries, and generally via per capita (or per fisher) catch rates for noncommercial sectors.

The total catch time series was estimated combining reported catches and interpolated, countrywide expanded missing data series. To quantify the uncertainty, authors adopted the approach used by the Intergovernmental Panel on Climate Change to quantify the uncertainty in its assessments (Mastrandrea et al. 2010).

Where  $V_{pac}$  is the value of unreported catch in 2010 prices (based on ex-vessel price data from Tai et al. 2017 and Sumaila et al. 2007; catch data from Pauly and Zeller 2015),  $T$  is the proportion of industrial unreported catch illegally traded, and  $P$  is the proportion of unreported artisanal catch that is traded illegally. To smooth out any fluctuations in catch levels across the years, the value of unreported catch is taken as a five-year average (2010–14), except for catches in FAO area 67 (Northeast Pacific), where we take a four-year average (2011–14), given missing unreported artisanal catch data for 2010. Both  $Li$  and  $La$  are calculated using five-year average catch data, except for FAO area 67, where we take a four-year average, and we assume there is a proportionate relationship between value and volume.

Using average variable cost estimates for fisheries provided by Lam et al. (2011), \$928 (weighted mean 2005 prices) or \$1,036 (weighted mean 2010 prices) (CPI inflation calculator),<sup>3</sup> we estimate the loss in value in terms of gross profits.

## 2.2 Economic, Income, and Tax Impact

We estimate the economic, income, and tax impact with the following equations:

$$\text{Economic impact} = GR_{pac} \times m$$

$$\text{Income impact} = GR_{pac} \times w$$

Where  $m$  and  $w$  represent the economic multiplier and the income multiplier, following Dyck and Sumaila (2010). These multipliers are estimated using an input-output methodology. An output multiplier,  $m$ , shows the indirect and induced impact of marine capture fisheries in a country. The indirect and the induced impacts represent the secondary economic activities (boat building, international transport, etc.) that are supported by the fisheries sector. On that point, Dyck and Sumaila (2010) suggest that indirect and induced effects can make the total economic impact of capture fisheries as much as three times the sum of the initial activity.

$$\text{Tax impact} = \text{Gross Profits} / \text{Gross Revenues} \times t$$

We calculate the tax revenue impact by multiplying corporate tax rates times the gross profits and revenues lost from illegal trade in marine resources. The variable  $t$  is the corporate tax rate, which in the region ranges from 15 to 30 percent (Deloitte 2019). Taxes can be applied on annual turnover or profits depending on the size of the business (Deloitte 2019); hence we calculate the lower estimate of tax impact using gross profit lost from unreported catch and the upper estimate using gross revenue lost from unreported catch entering illegal trading networks.

## 3. THE RESULTS

### 3.1 Volume of Catch Illegally Traded

We find that 4.4 million to 7.2 million tonnes of unreported catch from the Pacific Ocean are estimated to be traded illegally each year under scenario 1, which assumes that 30–50 percent of unreported artisanal catch enters the illicit market. For scenario 2, which assumes this percentage to be lower (0–30 percent), we estimate the volume of catch entering the illicit market to be 3.7 million to 6.7 million tonnes per year.

Loss of unreported catch varies across the Pacific, with the Western Central estimated to have the largest proportion of the total unreported catch that is traded illegally in the whole of the Pacific region (50 percent). Exclusive economic zones in this region include Cambodia, Indonesia, Malaysia, Palau, Papua New Guinea, the Philippines, Thailand, and Vietnam. The volume of illicit trade in unreported catch in this region is estimated to be 1.9 million to 3.6 million tonnes per year, constituting 11–20 percent of all fish caught in the area. In other words, in the most extreme scenario, one of every five fish caught is traded illegally in the region.

As a proportion of total regional catch, the Pacific South-east (including the EEZs of Peru, Chile, and Ecuador) has the second-highest volume of catch that is illegally traded, constituting 7 to 12 percent of the region's total catch.

Table 1 | Quantity of Fisheries Illegally Traded in the Pacific Region

FAO REGION	CATCH LOSS <sup>a</sup> (MILLION TONNES)		% OF TOTAL REGIONAL CATCH <sup>b</sup>	
	SCENARIO 1	SCENARIO 2	SCENARIO 1	SCENARIO 2
Pacific, Southeast (87)	0.9–1.4	0.8–1.4	7.8–12.6%	6.9–12.0%
Pacific, Northwest (61)	1.2–1.9	0.9–1.7	4.2–6.8%	3.3–6.2%
Pacific, Northeast (67)	0.015–0.02	0.015–0.02	0.6–1.0%	0.6–1.0%
Pacific, Southwest (81)	0.02–0.04	0.02–0.04	3.2–5.1%	2.8–4.8%
Pacific, Eastern Central (77)	0.1–0.2	0.04–0.1	3.9–6.4%	1.1–4.6%
Pacific, Western Central (71)	2.2–3.6	1.9–3.4	12.7–20.4%	11.0–19.3%
<b>TOTAL</b>	<b>4.4–7.2</b>	<b>3.7–6.7</b>		

*Notes:*

a. This represents total unreported catch that enters the illicit market for each FAO major fishing area. It is an average of five-year catch data (2010–2014). For FAO area 67, we present a four-year average (2011–14), as there were no unreported artisanal catch data for 2010.

b. Reports what proportion of the total catch (unreported and reported) in major FAO areas is illegal. Analysis is based on five-year average catch data for all regions except 67, where a four-year average is used.

Due to rounding, numbers presented may not add up precisely to the totals indicated.

Source: Authors.

### 3.2 Gross Revenue Losses

For the whole Pacific region, the gross revenue losses from illicit trade are estimated to be \$5.2 billion to \$8.3 billion per year under scenario 1 and \$4.3 billion to \$7.7 billion per year under scenario 2. In Table 2, we present the ranges for each of the FAO major fishing areas of the Pacific. As for the volume of illegal trade, Western Central has the highest value of illicit trade in the region, estimated to be \$2.4 billion to \$4.5 billion annually.

The net loss in revenues or loss in gross profits is estimated to be \$685 million per year.

### 3.3. Economic, Income, and Tax impact

Under scenario 1, the estimated annual losses are \$13.1 billion to \$21.1 billion in economic impact and \$3.4 billion to \$5.4 billion in household income. Under scenario 2, the estimated annual losses are \$10.8 billion to \$19.6 billion in economic impact and \$2.7 billion to \$5 billion in household income. Table 3 provides the breakdown of income and economic impact for each of the FAO major fishing areas. The loss of tax revenues across the two scenarios is estimated to be \$0.15 billion to \$1.6 billion per year. The latter has not been disaggregated across each of the FAO regions, as the cost estimates used to calculate the profits (and consequently lower estimate for tax revenue losses) were only available at an aggregate global level.

Table 2 | **Gross Revenue Losses for Pacific Region from Illegal Trade in Marine Resources**

FAO REGION	LOSS OF REVENUE (\$, MILLIONS, 2010 PRICES) SCENARIO 1	LOSS OF REVENUE (\$, MILLIONS, 2010 PRICES) SCENARIO 2
Pacific, Southeast (87)	694-1,117	609-1,060
Pacific, Northwest (61)	1,399-2,258	1,111-2,066
Pacific, Northeast (67)	39-63	38-62
Pacific, Southwest (81)	47-76	42-72
Pacific, Eastern Central (77)	218-358	64-256
Pacific, Western Central (71)	2,781-4,474	2,405-4,224
<b>TOTAL</b>	<b>5,179-8,347</b>	<b>4,269-7,740</b>

Note: Due to rounding, numbers presented may not add up precisely to the totals indicated.

Source: Authors.

Table 3 | Annual Economic Impact, Income Impact, and Tax Revenue Losses for the Pacific Region

PACIFIC REGION	ECONOMIC IMPACT (\$, BILLIONS, 2010 PRICES)	INCOME IMPACT (\$, BILLIONS, 2010 PRICES)
<b>Scenario 1: 50–80% unreported industrial catch and 30–50% of unreported artisanal catch enter illicit trade</b>		
Pacific, Southeast (87)	1.9–3.1	0.6–0.9
Pacific, Northwest (61)	4–6.4	1.1–1.8
Pacific, Northeast (67)	0.1–0.2	0.04–0.06
Pacific, Southwest (81)	0.15–0.2	0.04–0.06
Pacific, Eastern Central (77)	0.55–0.9	0.15–0.2
Pacific, Western Central (71)	6.4–10.3	1.5–2.4
<b>TOTAL</b>	<b>13.1–21.1</b>	<b>3.4–5.4</b>
<b>Scenario 2: 50–80% unreported industrial catch and 0–30% of unreported artisanal catch enter illicit trade</b>		
Pacific, Southeast (87)	1.7–2.9	0.5–0.8
Pacific, Northwest (61)	3.1–5.8	0.9–1.6
Pacific, Northeast (67)	0.1–0.2	0.04–0.06
Pacific, Southwest (81)	0.1–0.2	0.03–0.05
Pacific, Eastern Central (77)	0.2–0.65	0.04–0.2
Pacific, Western Central (71)	5.5–9.7	1.3–2.3
<b>TOTAL</b>	<b>10.8–19.6</b>	<b>2.7–5</b>

Note: Due to rounding, numbers presented may not add up precisely to the totals indicated.

Source: Authors.

These estimates show that the wider effects of illicit trade in Pacific marine resources, in terms of economic and income impacts, are substantially higher than the estimated loss in revenues. When we compare Tables 2 and 3 we can see that the economic impact, which accounts

for the economic loss across the whole fish value chain, is more than twice the estimated gross revenue losses across most of the fishing areas. For the Western Central Pacific, the economic impact loss is estimated to be \$6 billion to \$10 billion, which is equivalent to the GDP of Fiji in 2018.

---

## 4. LIMITATIONS AND AREAS FOR FURTHER RESEARCH

Our economic and income multipliers are based on Dyck and Sumaila (2010), the only study that has analyzed in depth both the economic impacts of the commercial fishing industry per country and the geographical patterns of fishery impacts. As these estimates have not been recently updated, we acknowledge that these multipliers would be less reliable if there were significant changes in production techniques over time (such as technological improvements in fishing methods). Future methodological approaches and further updated information on multipliers will improve this estimate.

Our analysis does not look at the wider environmental cost of illegal trade in marine resources. Already, critical stocks have been decimated by IUU fishing, and efforts to protect and manage marine species have been undermined (Pew Environment Group 2008). There is also the risk of extinction of target or bycatch species, such as sharks and rays; wider ecological impacts, such as knock-on effects on the stock's prey, predators, and competitors (Tinch et al. 2008); and reduction of the ocean's resilience to climate change (Sumaila and Tai 2019; Gattuso et al. 2018). Our analysis also does not assess the social cost of illegal fishing. While in the short term, IUU fishing may help maintain employment in fisheries, the resulting stock depletion and catch reduction reduces employment opportunities in the legitimate fishing sector and its related industries. This impact will be felt most in communities that are heavily dependent on fishing. Other potential social costs include increased food insecurity and stressors on the cohesion of fishing communities (Sumaila 2018; Tinch et al. 2008), as well as negative impacts from crimes related to fisheries.

Further analysis of both the environmental and social costs of illegal trade in marine resources, including further assessment of Pacific coastal communities, which are hardest hit by illicit exploitation of marine resources, will provide a more holistic picture of the losses.

## 5. DISCUSSION

The Pacific Ocean's six major fishing areas produce about 62 million tonnes of marine catch per year, but 24 percent of that (15 million tonnes) is unreported (Pauly and Zeller 2015), and around 50 percent (3.7–7.2 million tonnes) of all illegally traded marine resources in the world are from the Pacific (Sumaila et al. forthcoming).

Overall, the volume of illicit trade in marine catch in the Pacific region is substantial and represents a risk to national and local economies. For the formal economy, the loss in gross revenues is estimated to be \$4.3 billion to \$8.3 billion per year, which is equivalent to 6 to 11 percent of the total value of the region's reported catch (based on Pauly and Zeller 2015). While this is a substantial loss for the formal economy, the economic impact or added cost through the fish value chain (\$10.8 billion–\$21.1 billion) is about 2.5 to 5 times higher than gross revenue loss.

Our analysis also shows that illegal fishing costs the economy in terms of jobs and household income. The loss of household income across the value chain is estimated to be \$2.8 billion to \$5.4 billion, which represents about 20 percent of total wages earned from reported catches. The total wages (or labor cost) from all reported catches in the region is roughly \$14 billion to \$27 billion per year (based on labor cost estimates in Lam et al. 2011), whereas total estimated wages from illegally traded catch would be \$1.1 billion to \$4.1 billion per year—or 4 to 30 percent of wages from reported catches. The tax revenue losses simply represent money that could be used to benefit the public through provision of goods and services, such as marine infrastructure, health care, or education.

The severity of illegal and unreported fishing varies across the region. The Northwest Pacific region, which includes EEZs belonging to Japan, China, Korea, Russia, Vietnam, and the Philippines, has the highest volume of catches in the Pacific Ocean, accounting for 46 percent of the total catches (reported and unreported) in the Pacific. The proportion of marine resources illegally traded in this region is low, but discards are greater here than in other Pacific FAO major fishing areas. About half of the unreported catch in the region consists of discards, which account for 11 percent of the total catch in the Northwest Pacific.

The Western Central Pacific region—which includes the EEZs of Cambodia, Indonesia, Malaysia, Palau, Papua New Guinea, the Philippines, Thailand, and Vietnam—accounts for the largest volume (50 percent) and value (54 percent) of illegal trade in marine resources in the Pacific Ocean. In the extreme scenario, one of every five fish landed in the Western Central Pacific is illegally sold. The economic and income impact losses, an estimated \$5.5 billion to \$10.3 billion and \$1.3 billion to \$2.4 billion per year, respectively, are the largest for this area as well. We estimate the economic impact of illegal trade in marine resources in the Western Central Pacific to be four times the economic impact that Sumaila (2018) found in West Africa. Figure ES-1 maps the value of losses across the regions.

Our analysis estimates the loss to the legitimate economy from trading in marine resources. As they do not capture environmental and other social costs to the economy, the figures we present are an underestimate of the impacts. Environmental costs include lost value of depleted stocks, risk of species extinction, impact on marine food webs, and reduced ocean resilience to adapt to climate change (Tinch et al. 2008; Sumaila and Tai 2019; Gattuso et al. 2018). The value of each of these components is likely to be significant; for example, for the European Union, Tinch et al. (2008) estimate the cost of depleted stocks from illegal fishing between 2008 and 2020 to be 9 billion euros.

The social costs consist of loss in employment and income for legitimate fishers, economic losses for the tourism sector, increased food security risks, and negative impact on fishing communities (Zimmerhackel et al. 2018; Tinch et al. 2008; Sumaila 2018). There is also a link between IUU fishing and transnational crimes (Bondaroff et al. 2015). The socioeconomic loss may be even greater, given that IUU fishing is linked with modern slavery, labor violations, and corruption.

## 6. CONCLUSIONS

This working paper estimates the costs to Pacific countries from illegal trade in marine resources to be tens of billions of dollars every year. The scale of impacts is estimated to be higher when we account for impact across the fish value chain on household income and across tax revenues. These estimates, already quite high, do not represent the full costs of illegal fishing, since they do not account for the environmental and social impacts from illegal trade in marine resources. A part of these losses would be offset by the portion of unreported catch that might get traded illegally within the Pacific region (consequently entering the fish supply chain). However, given the significant risk IUU fishing poses to the ocean's ecosystems, we can conclude that the cost figures presented in this paper are a lower boundary on the possible costs to society.

Given the scale of the impact identified, there is an urgent need to accelerate action to eliminate the illegal trade in marine resources. Taking measures to curtail IUU fishing has the potential to generate an increase in catch and profit, often at little or no cost to local economies or in terms of food provision (Cabral et al. 2018). Such measures will also be important to ensure that a few entities are not benefiting at the expense of legitimate industries, hardworking communities, and fishing nations that experience a consequent reduction in revenues and income, as well as damage to their reputation.

## ENDNOTES

1. "The Northwest Pacific includes all marine waters bounded by a line commencing from a point on the mainland coast of Russia in the western Bering Sea at 175°00'W longitude and running due south along this meridian to 20°00'N latitude; thence running due west along this parallel to 115°00'E longitude; thence due south to 15°00'N latitude; thence due west to a point on the southeast coast of Asian Mainland at 15°00'N latitude; thence in a northeasterly direction along the coasts of Asian and Russian Mainland to the point of departure" (FAO n.d.).
2. The reported world catch stated in FAO 2018 State of Fisheries and Aquaculture report is about 91 million tonnes, which is higher than the Sea Around Us 2014 estimate.
3. To review the calculator, go to: [https://www.bls.gov/data/inflation\\_calculator.htm](https://www.bls.gov/data/inflation_calculator.htm).

## REFERENCES

- Agnew, D.J., J. Pearce, G. Pramod, T. Peatman, R. Watson, J.R. Beddington, and T.J. Pitcher. 2009. "Estimating the Worldwide Extent of Illegal Fishing." *PLoS ONE* 4 (2).
- Béné, C., G. Macfadyen, and E.H. Allison. 2007. "Increasing the Contribution of Small-Scale Fisheries to Poverty Alleviation and Food Security." Rome: Food and Agriculture Organization of the United Nations.
- Bondaroff, T.N.P., W. van der Werf, and T. Reitano. 2015. *The Illegal Fishing and Organized Crime Nexus: Illegal Fishing as Transnational Organized Crime*. Geneva: Global Initiative against Transnational Organized Crime; Amsterdam: Black Fish.
- Cabral, R.B., J. Mayorga, M. Clemence, J. Lynham, S. Koeshendrajana, U. Muawanah, D. Nugroho, et al. 2018. "Rapid and Lasting Gains from Solving Illegal Fishing." *Nature, Ecology & Evolution* 4 (2): 650–58.
- Clark, L. 2006. "Pacific 2020 Background Paper: Fisheries." Canberra, Australia: AUSAID.
- Cullis-Suzuki, S., and D. Pauly. 2010. "Failing the High Seas: A Global Evaluation of Regional Fisheries Management Organizations." *Marine Policy* 34 (5): 1036–42.
- Deloitte. 2019. Corporate Tax Rate 2019 (international tax). <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-corporate-tax-rates.pdf>.
- Dyck, A.J., and U.R. Sumaila. 2010. "Economic Impact of Ocean Fish Populations in the Global Fishery." *Journal of Bioeconomics* 12 (3): 227–43.
- FAO (Food and Agriculture Organization of the United Nations). n.d. "Pacific, Northwest (Major Fishing Area 61)." Fisheries and Aquaculture Department. <http://www.fao.org/fishery/area/Area61/en>. Accessed on September 2019.
- Gattuso, J.-P., A.K. Magnan, L. Bopp, W.W.L. Cheung, C.M. Duarte, J. Hinkel, E. Mcleod, et al. 2018. "Ocean Solutions to Address Climate Change and Its Effects on Marine Ecosystems." *Frontiers in Marine Science* 5: 337. doi.10.3389/fmars.2018.00337.
- Greenpeace Australia Pacific. 2006. *Scientific Report on Effort Reduction Measures in the Western and Central Pacific Ocean Tuna Fishery*. <http://www.greenpeace.org/raw/content/australia/news-and-events/news/science-report2006.pdf>.
- Hoare, A. 2015. "Tackling Illegal Logging and the Related Trade: What Progress and Where Next?" Chatham House Report. <https://www.chathamhouse.org/sites/default/files/publications/research/20150715IllegalLoggingHoareFinal.pdf>.
- ILO (International Labour Office). 2013. *Caught at Sea, Forced Labour and Trafficking in Fisheries*. Geneva: ILO.
- Lam, V.W.Y., U.R. Sumaila, A. Dyck, D. Pauly, and R. Watson. 2011. "Construction and First Applications of a Global Cost of Fishing Database." *ICES Journal of Marine Science* 68: 1996–2004.

- Lungren, R., D. Staples, S. Funge-Smith, and J. Clausen. 2006. *Status and Potential of Fisheries and Aquaculture in Asia and the Pacific 2006*. Bangkok: FAO Regional Office for Asia and the Pacific.
- Mastrandrea, M.D., C.B. Field, T.F. Stocker, O. Edenhofer, K.L. Ebi, D.J. Frame, H. Held, et al. 2010. "Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties." Intergovernmental Panel on Climate Change (IPCC). [www.ipcc.ch/pdf/supporting-material/uncertainty-guidancenote.pdf](http://www.ipcc.ch/pdf/supporting-material/uncertainty-guidancenote.pdf).
- Meere, F., and M. Lack. 2008. *Assessment of Impacts of Illegal, Unreported and Unregulated (IUU) Fishing in the Asia Pacific*. Singapore: Asia-Pacific Economic Cooperation Secretariat.
- MRAG (Marine Resources Assessment Group) Asia Pacific. 2016. *Towards the Quantification of Illegal, Unreported and Unregulated (IUU) Fishing in the Pacific Islands Region*. Toowong, Australia: MRAG Asia Pacific.
- MRAG and UBC (University of British Columbia). 2008. "The Global Extent of Illegal Fishing." <http://www.illegal-fishing.info/uploads/MRAGExtentGlobalIllegalFishing.pdf>.
- Pauly, D., and D. Zeller. 2016. "Catch Reconstructions Reveal That Global Marine Fisheries Catches Are Higher than 308 Reported and Declining." *Nature Communications* 7 (10244).
- Pauly, D., and D. Zeller, eds. 2015. "Sea around Us Concepts, Design and Data." [Searoundus.org](http://searoundus.org).
- Pew Environment Group. 2008. "The Costs of IUU Fishing to the EU." Briefing. Brussels: Pew Environment Group.
- Pontecorvo, G., M. Wilkinson, R. Anderson, and M. Holdowsky. 1980. "Contribution of the Ocean Sector to the United States Economy." *Science* 208 (May): 1000–1006.
- Roy, N., R. Arnason, and W.E. Schrank. 2009. "The Identification of Economic Base Industries, with an Application to the Newfoundland Fishing Industry." *Land Economics* 4 (November).
- Sea Around Us. <http://www.searoundus.org/>. Accessed October 20, 2019
- Sea Resources Management Sdn Bhd. 2008. "Case Study on Illegal, Unreported and Unregulated (IUU) Fishing off the East Coast of Peninsular Malaysia." <https://www.apec.org/Publications/2008/10/Case-Study-on-Illegal-Unreported-and-Unregulated-IUU-Fishing-off-the-East-Coast-of-Peninsular-Malays>.
- Sumaila, U.R. 2018. "Illicit Trade in the Marine Resources of West Africa." *Ghanaian Journal of Economics* 6 (December): 108–16.
- Sumaila, U.R., D. Marsden, R. Watson, and D. Pauly. 2007. "Global Ex-vessel Fish Price Database: Construction and Applications." *Journal of Bioeconomics* 9: 39–51.
- Sumaila, U.R., and T.C. Tai. 2019. "Ending Overfishing Can Mitigate Impacts of Climate Change." University of British Columbia. Working Paper no. 2019-5. [https://our.fish/wp-content/uploads/2019/09/2019-05-Sumaila\\_Ending\\_](https://our.fish/wp-content/uploads/2019/09/2019-05-Sumaila_Ending_overfishing_can_mitigate_impacts_of_climate_change.pdf)
- overfishing\_can\_mitigate\_impacts\_of\_climate\_change.pdf.
- Sumaila, U.R., D. Zeller, L. Hood, M.D.L. Palomares, Y. Li, and D. Pauly. Forthcoming. "Illicit Trade in Marine Fisheries Resources and Their Effects on Ecosystems and People Worldwide." *Science Advances*.
- Tai, T.C., T. Cashion, V.W.Y. Lam, W. Swartz, and U.R. Sumaila. 2017. "Ex-vessel Fish Price Database: Disaggregating Prices for Low-Priced Species from Reduction Fisheries." *Frontiers in Marine Science* 4 (November).
- Tickler, D., J.J. Meeuwig, K. Bryant, F. David, J.A.H. Forrest, E. Gordon, J.J. Larsen, et al. 2018. "Modern Slavery and the Race to Fish." *Nature Communications* 9 (November).
- Tinch, R., I. Dickie, and B. Lanz. 2008. *Costs of Illegal, Unreported and Unregulated (IUU) Fishing in EU Fisheries*. London: Economics for the Environment Consultancy.
- TRACIT (Transnational Alliance to Combat Illicit Trade). 2019. "Mapping the Impact of Illicit Trade on the Sustainable Development Goals." [www.tracit.org/publications.html](http://www.tracit.org/publications.html).
- UNEP (United Nations Environment Programme) and INTERPOL (International Criminal Police Organization). 2016. "The Rise of Environmental Crime: A Growing Threat to Natural Resources, Peace, Development and Security." [www.rhpto.org](http://www.rhpto.org).
- WWF (World Wildlife Fund). 2015. "Illegal Fishing: Which Fish Species Are at Highest Risk from Illegal and Unreported Fishing?" <https://www.worldwildlife.org/publications/illegal-fishing-which-fish-species-are-at-highest-risk-from-illegal-and-unreported-fishing>.
- Zimmerhackel, J.S., A.A. Rogers, M.G. Meekan, K. Ali, D. Pannell, and M.E. Kragt. 2018. "How Shark Conservation in the Maldives Affects Demand for Dive Tourism." *Tourism Management* 69: 263–71.

---

## ACKNOWLEDGMENTS

We are pleased to acknowledge our institutional strategic partners, who provide core funding to WRI: Netherlands Ministry of Foreign Affairs, Royal Danish Ministry of Foreign Affairs, and Swedish International Development Cooperation Agency.

We would like to thank the following people for their review, feedback, and input: Charles Barber, Dawn Borg Costanzi, Bronwen Golder, Peter Horn, Jim Leape, Laura Malaguzzi Valeri, Tezza Napitupulu, Dr. Mari Elka Pangestu, and Gerard Pozzi. While these collaborators were generous with their time and input, the report reflects the views of the authors alone.

Graphics and layout of this report were provided by Carni Klirs. The text was copyedited by Alex Martin.

## ABOUT THE AUTHORS

**Manaswita Konar** is an Economist at World Resources Institute's Sustainable Ocean Initiative.

Contact: [manaswita.konar@wri.org](mailto:manaswita.konar@wri.org)

**Erin Gray** is an Economist with World Resources Institute's Economics Center.

Contact: [egray@wri.org](mailto:egray@wri.org)

**Lauren Thuringer** is a Finance Specialist at World Resources Institute's Sustainable Ocean Initiative.

Contact: [lauren.thuringer@wri.org](mailto:lauren.thuringer@wri.org)

**U. Rashid Sumaila** is Professor and Director of the Fisheries Economics Research Unit at UBC's Institute for the Oceans and Fisheries.

## ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

### Our Challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

### Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

### Our Approach

#### COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

#### CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

#### SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

Maps are for illustrative purposes and do not imply the expression of any opinion on the part of WRI, concerning the legal status of any country or territory or concerning the delimitation of frontiers or boundaries.



Copyright 2019 World Resources Institute. This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of the license, visit <http://creativecommons.org/licenses/by/4.0/>