

Fish to fight: does catching more fish increase conflicts in Indonesia?

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Violent conflict and natural resources

- Failures of natural resource management are a major source of social instability and civil conflict.
- For example.....
 - Weak state capacity to manage lucrative resource rents from **diamonds** has deepened ethnic fractionalization in Africa (Lujala et al 2005).
 - Windfalls from **oilfield discovery** have increased the risk of political violence in oil-producing countries (Lei and Michaels 2014).

Fish wars

- Fisheries-related conflicts have been documented globally.
- “... it is possible for the stock of fish to tend to extinction in the Cournot-Nash equilibrium.” (Levhari and Mirman 1980)
- Fishers are more likely to engage in sea piracy when their legal income opportunities are low (Flückiger & Ludwig 2015, Axbard 2016)



“Cod War between Iceland and the UK” (1975)



“Newfoundlanders protest cod moratorium” (1992)



“Indonesia sinks 13 Vietnamese Boats in War on Illegal Fishing” (2019)

Possible channels

1. Resource depletion increases resource **competition**.
 - (Collier 2004, Caselli et al. 2015, Koren 2018, Schollaert & van de Gaer 2009).
2. Rich natural resources make armed conflict more **feasible**.
 - (Collier et al. 2008, Nunn & Qian 2014, Dube & Naidu 2015)
3. **Inequalities** in resource allocation generate social tensions.
 - (Hodler 2006, Caselli & Coleman 2013)
4. Resource-driven income shocks increase the **opportunity cost** of fighting.
 - (Miguel et al. 2004, Dube & Vargas 2013, McGuirk & Burke 2020)

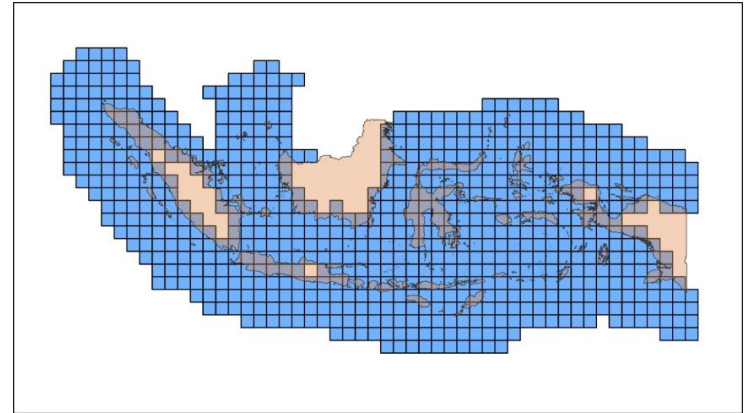
Challenges

Studying the impact of fisheries on conflict events is not easy:

- Marine- vs land-based events
- Unobserved regional differences
- Feedback effect of fisheries

This study

- Satellite data in Indonesia to conduct a geographically disaggregated analysis.
- A sample of 757 cells representing the spatial interaction of conflict and catch landings in 2015.
- Exogenous variation in oceanographic conditions to identify the causal relationship.



Conflict data

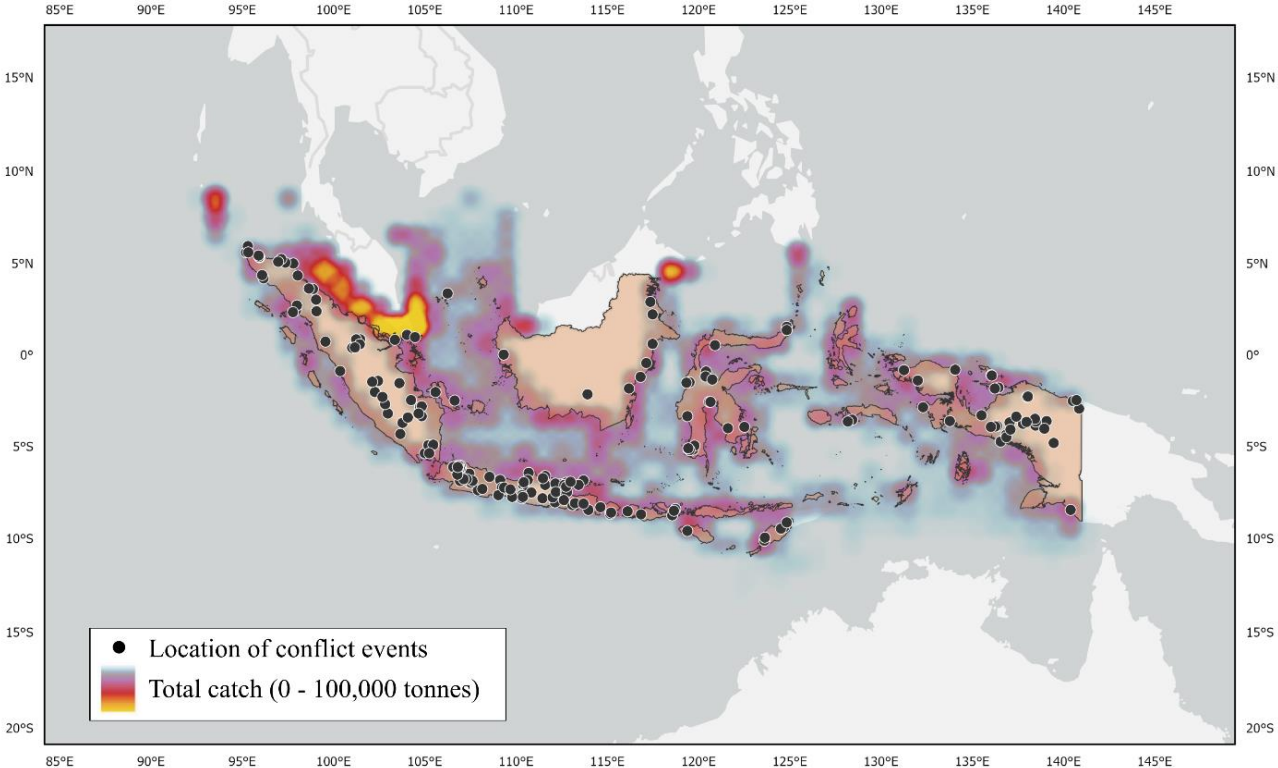
- Armed Conflict Location and Event Data (ACLED)

Type	Description	Number
Battles	A battle between two violent armed groups.	33
Remote violence	Events were engaging in conflict did not require the physical presence of the perpetrator. For example, bombings, IED attacks and missile attacks.	5
Protests	Protests are public demonstrations that participants do not engage in violence, though violence may be used against them. Often – though not always – protests are against a government institution.	380
Riots	Riots are violent form of public demonstrations. The participants engage in violent acts, including but not limited to rock throwing and property destruction.	99
Strategic development	Important activities of violent groups, but they are not violent in themselves. The inclusion of such events is limited, as its purpose is to capture pivotal events within campaigns of political violence.	17
Violence against civilians	Violence against civilians is violent groups commit violence against civilians who are not armed. Insurgents, governments, militias, external forces and rioters can all commit violence against civilians. Protesters are also civilians, and severe violence against protesters falls into this category.	65

Note: Total number of conflicts is 599.

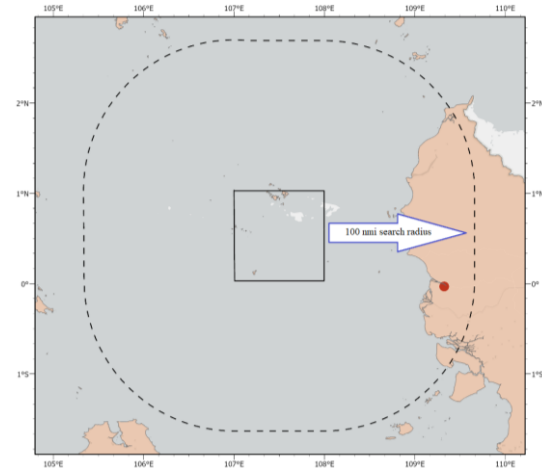
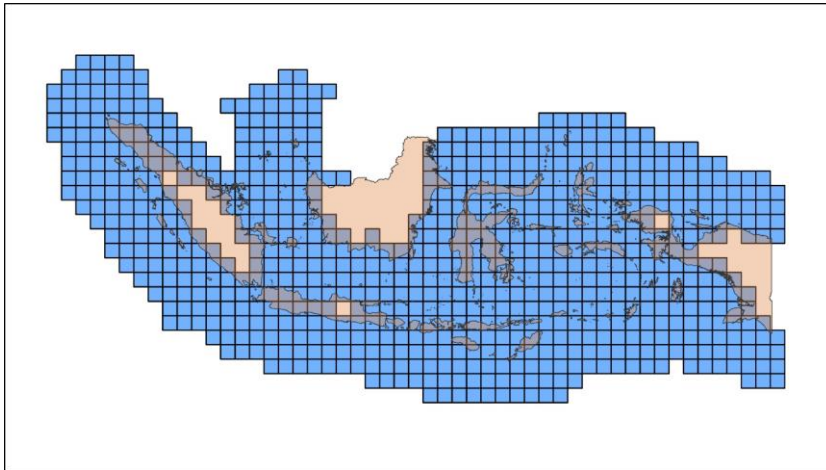
Fisheries data

- Global Fisheries Landings v4.0 (Watson 2017)



Sample construction

- Fisheries (sea) v.s. conflict (land).
- The unit of observation is a 1×1 degree cell within 200 nmi of the Indonesian shore.
- In total, we have 757 cells.
- The conflict variable is constructed using a ‘search-by-radius’ approach.



Empirical strategy

- The equation of interest:

$$conflict_{c,p} = \beta catch_c + \gamma_p + \varepsilon_{c,p}$$

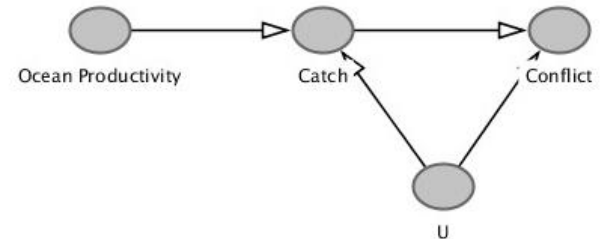
where c = cell and p = province

- Two possible sources of bias:
 1. **Omitted variables**; e.g., population and climatic conditions
 2. **Reverse causality**

Ocean productivity

- The chlorophyll-based ocean productivity (OP) is used to identify the causal relationship between fisheries and conflict.
- OP is the ideal instrument:
 - Driver of fisheries productivity.
 - Determined solely by exogenous environmental factors that include chlorophyll concentration and sea surface temperature.

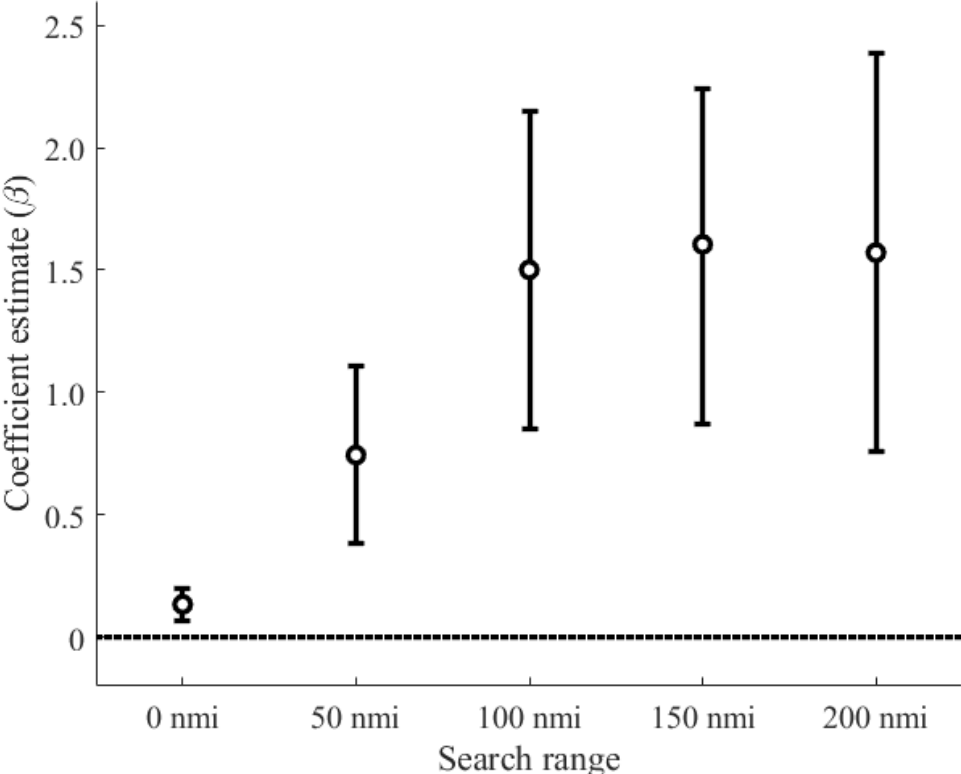
$$OP_{c,m} = chl_{c,m} \times SST_{c,m} \times daylight_{c,m} \times v_{c,m}$$



Fish catches and ocean productivity

	Dependent variable		
	(1)	(2)	(3)
	Industrial catch	Non-industrial catch	Total catch
Ocean productivity	0.0012*** (0.0003)	0.0052*** (0.0008)	0.0064*** (0.0011)
Observations	742	742	742
Province fixed effects	Yes	Yes	Yes
Kleibergen-Paap LM statistic for under-identification (p -value)	14.46 (0.000)	41.79 (0.000)	37.36 (0.000)
F statistics of excluded instruments (p -value)	11.68 (0.001)	37.92 (0.000)	32.42 (0.000)

Different search radiuses



Spatial correlation

$$\mathit{conflict}_{c,p} = \beta \mathit{catch}_c + \gamma_p + \lambda W \mathit{conflict}_{c,p} + u_{c,p}$$
$$u_{c,p} = \rho W u_{c,p} + \varepsilon_{c,p}$$

Dependent variable	(1) <i>Conflict</i>	(2) <i>Conflict</i>	(3) <i>Conflict</i>	(4) <i>Fatality</i>
Industrial catch	1.413*** (0.364)			
Non-industrial catch		0.984*** (0.183)		
Total catch			0.694*** (0.132)	0.102*** (0.022)
λ (spatial lag)	1.308*** (0.322)	1.332*** (0.284)	1.250*** (0.292)	2.429*** (0.249)
ρ (spatial error)	1.854*** (0.194)	2.147*** (0.288)	2.031*** (0.251)	1.481*** (0.078)
Province fixed effects	Yes	Yes	Yes	Yes
Instrumented	Yes	Yes	Yes	Yes
Observations	742	742	742	742

Level of violence

	Type I: Protests, riots and strategic development	Type II: Violence against citizens	Type III: Battles, explosions and remote violence
Total catch	1.203*** (0.276)	0.219*** (0.065)	0.079*** (0.026)
Observations	742	742	742
Fixed effects	Yes	Yes	Yes
Instrumented	Yes	Yes	Yes
F-statistics	9.72	7.52	8.57
(<i>p</i> -value)	(0.000)	(0.000)	(0.000)

Regional differences

		Western Indonesia		Eastern Indonesia	
		Region A	Region B	Region C	Region D
		(1)	(2)	(3)	(4)
<i>Panel A: Regression results</i>					
Total catch		2.037*** (0.490)	2.148*** (0.492)	1.782*** (0.378)	1.672*** (0.331)
Observations		273	474	500	526
Fixed effects		Yes	Yes	Yes	Yes
Instrumented		Yes	Yes	Yes	Yes
F-statistics		15.09	13.76	20.15	18.04
(<i>p</i> -value)		(0.000)	(0.000)	(0.000)	(0.000)
<i>Panel B: Development region</i>					
Region	Central city	Province			
Development Region A	Medan	Aceh, North Sumatra, West Sumatra, Riau, Riau Islands			
Development Region B	Jakarta	Jambi, South Sumatra, Bengkulu, Bangka Belitung Islands, Lampung, Banten, Special Capital Region of Jakarta, West Java, Central Java, Special Region of Yogyakarta, West Kalimantan			
Development Region C	Surabaya	East Java, Bali, Central Kalimantan, North Kalimantan, East Kalimantan, South Kalimantan			
Development Region D	Makassar	West Nusa Tenggara, East Nusa Tenggara, West Sulawesi, South Sulawesi, Southeast Sulawesi, Central Sulawesi, Gorontalo, North Sulawesi, Maluku, North Maluku, Papua, West Papua			

Illegal fishing

	(1)	(2)	(3)
Industrial IUU catch	8.336*** (2.638)		
Non-industrial IUU catch		6.397*** (1.335)	
Total IUU catch			3.620*** (0.852)
Observations	742	742	742
Fixed effects	Yes	Yes	Yes
Instrumented	Yes	Yes	Yes
F-statistics (<i>p</i> -value)	8.73 (0.000)	10.59 (0.000)	8.89 (0.000)

Summary

- Oceanographic conditions directly affect fisheries production in Indonesia.
- The resulting higher fish catches fuel violent conflict in coastal areas.
- This relationship is particularly strong for:
 - Industrial fisheries
 - Western regions (more industrialised and intensively exploited)
 - Illegal unreported and unregulated (IUU) fishing

Policy relevance

- Improved fisheries management offers benefits that extend beyond resource user groups to society as a whole.
- Indonesian government's current regulatory focus on large fishing vessels above 30 GT is imperative to break the link between fisheries and conflict.
- This study bolsters the case for monitoring and reducing illegal fishing in Indonesian waters, whether by industrial or small-scale operators.
- This aligns with recent evidence of a link between illegal fishing and maritime crimes that lead to social unrest, including piracy, trafficking and smuggling (Mackay et al. 2020, Vince et al. 2021).



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Thank you

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