

## SUSTAINABILITY

# Closing Loopholes: Getting Illegal Fishing Under Control

Stefan Flothmann,<sup>1</sup> Kristín von Kistowski,<sup>1\*</sup> Emily Dolan,<sup>2</sup> Elsa Lee,<sup>1</sup> Frank Meere,<sup>1</sup> Gunnar Album<sup>3</sup>

Decreasing numbers of fish caught in global fisheries, overcapacity of fishing fleets (1–5), and rising demand for fish (6) heighten the negative impacts of illegal, unreported, and unregulated (IUU) fishing and make it increasingly widespread and profitable for those involved (7–9). This practice undermines sustainable fisheries management (1, 3, 5, 9), particularly on the high seas (international waters beyond the jurisdiction of coastal states) and in coastal waters of developing countries, and has substantial social and economic ramifications (9, 10). Eighty percent of the world's marine fish stocks are fully or overexploited (11). Illegal and unreported fishing alone accounts for catches worth as much as \$23.5 billion annually; this represents an estimated 11 to 26 million tons of fish, equivalent to about one-fifth of the global reported catch (9). Crucially, the more fish stocks are exploited, the more the proportion of illegal catch appears to increase (9).

Impacts of fishing activities on the health of fish stocks and their supporting marine ecosystems (3, 12, 13) have spurred new efforts in fisheries management, but their positive effects remain largely unknown (14). We will describe an analysis of the global movements of IUU-listed vessels to evaluate the effectiveness of “port state” measures to combat IUU fishing activities.

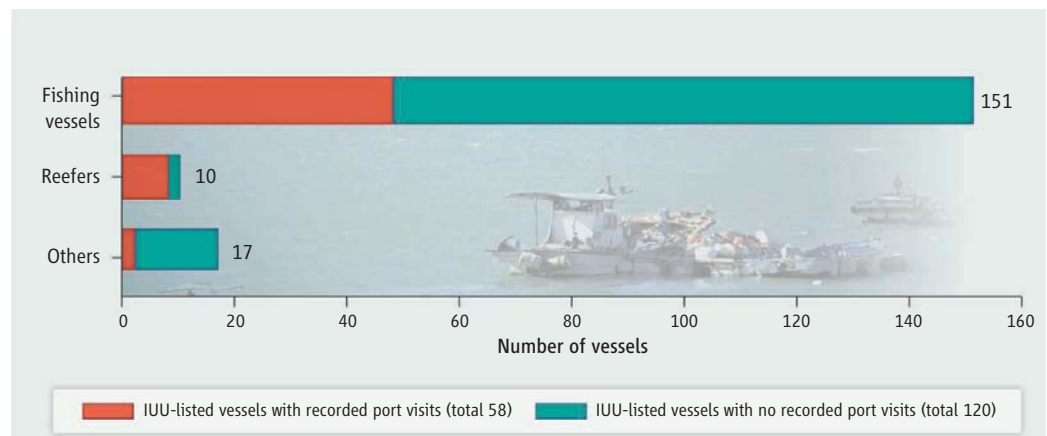
Under the United Nations Convention on the Law of the Sea, control of a vessel's activities is the responsibility of the “flag state” to which that vessel is registered (15). When flag states are unable or unwilling to exert such control, other instruments need to be put in place to combat IUU fishing (16). Effective monitoring and control of

fishing activities—requiring identification of IUU fishing and support vessels, sharing of information beyond national borders, and enforcement and sanction—are essential and complementary tools against IUU fishing. International governance bodies have recently turned to port states to help prevent IUU-caught fish from entering international trade and key markets. These port states have the opportunity to reduce substantially the profitability of IUU fishing operations by denying port entry and services to IUU vessels. After agreeing to voluntary port state measures in 2004 (17),

The current system of port state control lacks transparency, accountability, and the global reach to punish fishers who are illegally emptying our oceans.

some RFMOs had already adopted port state obligations for member countries. Although some RFMOs require denial of port services or the landing of fish, others go further and require denial of entry into port for vessels known to have been engaged in IUU fishing. In addition, eight RFMOs [supporting online material (SOM), § 1.1] maintain lists of vessels that have been found to carry out or support IUU fishing within the RFMO regulatory area, with the aim of exposing offenders and applying restrictions.

To gauge whether the PSMA could, once in force, lead to a substantial reduction in



**Composition and visibility of IUU-listed vessels.** Only 33% (58) of the 178 vessels on the combined IUU vessel list show up in any of the port visit sources available to this research. “Reefers” are support vessels that transport fish. “Others” were originally fishing vessels, IUU-listed, but then rebuilt to other functions (e.g., military, tugboats, and petroleum supply vessels).

the United Nations Food and Agriculture Organization (FAO) approved a legally binding Port State Measures Agreement (PSMA) in November 2009 (18). Under the PSMA, port states would be required to close their ports, to prohibit the landing of IUU fish, and to deny port services to vessels that have been engaged in and supporting IUU fishing activities. The question now is whether the PSMA, if signed and ratified by FAO members, will be effective in reducing IUU fishing.

Regional fisheries management organizations (RFMOs), made up of coastal states and fishing nations that work under international agreements to manage specific high seas fisheries or areas, have a central role to play in the fight against IUU fishing. Before the PSMA,

IUU fishing, we evaluated the implementation and effectiveness of port state measures adopted by RFMOs and directed at vessels on the RFMO IUU vessel lists (19). We compiled data on port visits of RFMO IUU-listed vessels from 2004 through 2009, as tracked by publicly available commercial databases (SOM, § 1.2). These data were supplemented with publicly available information from port logs, national fisheries authorities, and RFMOs. Although IUU-listed vessels represent only a small fraction of those operating illegally, they are the only officially recognized IUU vessels and, therefore, provide a basis for evaluating the willingness or capacity of states to implement port state measures and the effectiveness of the current regulations. Our results show that (i) insufficient

<sup>1</sup>The Pew Charitable Trusts, The Pew Environment Group, International Ocean Governance, Washington, DC 20004, USA. <sup>2</sup>Marine Biology Section, Biology Department, Ghent University, Ghent, B-9000, Belgium. <sup>3</sup>Trygg Mat Foundation, Barents Sea Office, Leines, 8285, Norway.

\*Author for correspondence. E-mail: kristin@kistowski.de

vessel information, (ii) a lack of compliance by port states, and (iii) the absence of consistent port state measures across regions pose challenges to port state performance.

#### Insufficient Vessel Information

Port visits of only one-third of the vessels on the IUU vessel lists could be tracked over the six-year period (see the figure on page 1235). It is improbable that this is because the vast majority of IUU-listed vessels ceased operations while listed. It is more likely that many continued to operate unnoticed by not only the commercial databases but also by most national fisheries and port authorities. Many fishing vessels lack unique identifiers, enabling operators of IUU fishing vessels to disguise their identity by renaming vessels or by switching to a different International Radio Call Sign or flag under which to sail. We found that some IUU-listed vessels had changed names up to nine times or flags up to seven times throughout their lifetimes (SOM, § 1.1). The only unique vessel identifier globally available is the International Maritime Organization (IMO) number. However, IMO numbers are not mandatory for fishing vessels, as they are for merchant vessels. Even when vessels had an IMO number, many RFMOs failed to record it on their IUU vessel lists. Without IMO numbers and regularly updated vessel details, IUU vessel lists are rendered largely ineffective when vessels change name or flag.

#### Lack of Compliance Among Port States

Of the 425 port visits by IUU-listed vessels, 219 were to states that were members of the RFMO that listed the vessel. These vessels should have been identified by port officials and subjected to port state measures. However, port states only fulfilled their obligations in one out of every four cases (fig. S2). Communications with port state officials revealed cases where (i) port officials were not aware of the IUU status of vessels visiting their ports (20); (ii) port officials did not consistently report information on visits by IUU-listed vessels or port state actions to national fisheries authorities; or (iii) measures adopted by RFMOs were not translated into national law, which limited the ability of the authorities to legally execute measures (SOM, § 2.3). Moreover, at the regional level, most RFMOs did not request any information on visits by IUU-listed vessels to the ports of their member states, nor did they consistently assess the compliance of their members with port state measures. They lacked measures to sanction members for failing to meet their obligations.

#### Regional Focus of Port State Measures

The regional application of current port state measures allows IUU-listed vessels simply to move to other regions when measures are enforced. The North East Atlantic Fisheries Commission (NEAFC) is an RFMO that maintains a comprehensive IUU vessel list (including good record-keeping of IMO numbers), has adopted strict port state measures that extend to fishery support vessels in addition to fishing vessels, and has actively assisted port states in taking action against IUU-listed vessels (21). When NEAFC, in May 2007, included a provision that denied NEAFC IUU-listed vessels entry to the ports of its member states, the proportion of such vessels visiting ports of non-NEAFC-member states doubled (table S1). Although this indicates the desired impact of strengthened port state measures, it also illustrates that, if port state measures remain regional, the problem will shift elsewhere.

#### Transparent, Accountable, Global

Although port state measures have potential for deterring IUU fishing and eliminating some illegal and unregulated activities in an RFMO's jurisdiction, the PSMA will not have the desired effect unless implemented universally and effectively by port states. Should the PSMA not achieve broad ratification and instead follow the fate of prior international agreements (22, 23), then implementation of port state measures will remain patchy. This will provide continued loopholes for illegal operators.

Accountability requires transparency (24, 25). The inability or unwillingness of port states to share data on port visits and inspection records means that it will be hard to verify whether states that ratified the PSMA go on to implement the agreement effectively. In the absence of a global vessel register and the mandatory use of IMO numbers, or a similar scheme, illegal operators will continue to disguise their vessels easily.

Although port state measures represent only one of a suite of tools to tackle IUU fishing, they can enhance the effectiveness of other monitoring, control, and surveillance mechanisms and market-related measures. Many RFMOs are taking steps in the right direction by establishing or improving port state measures to meet the minimum standards of the PSMA. Nevertheless, most species under the management of the world's RFMOs are declining in biomass. This can be explained in part by ongoing IUU fishing (26) and can only be addressed if all port, flag, and market states make use of a global information sharing system and intensify enforcement.

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19. Most RFMOs base fisheries management on lists of authorized vessels, and in most cases, these precede IUU vessel lists. These two lists are not mutually exclusive. Our analysis focused on IUU vessel lists because more meaningful and comparable data were available on port state measures applicable to IUU-listed vessels.
20. For example, vessels were recorded without their IMO number on IUU vessel lists; vessels changed name, flag, and/or call sign; or vessel lists were not kept up to date.
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#### Supporting Online Material

[www.sciencemag.org/cgi/content/full/science.1190245/DC1](http://www.sciencemag.org/cgi/content/full/science.1190245/DC1)

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