



Supporting Online Material for

Closing Loopholes: Getting Illegal Fishing Under Control

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This PDF file includes

Materials and Methods
SOM Text
Figs. S1 and S2
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Other Supporting Online Material for this manuscript includes the following:
(available at www.sciencemag.org/cgi/content/full/science.1190245/DC1)

Data Set:

Overview of the sheets

- 1a. Master IUU vessel list, 1b. Policy for compiling the IUU vessel list,
1c. Legend for the IUU vessel list: Template and details
- 2a. Movements, 2b Policy for compiling the movements list, 2c Legend for
movements list: Template and details
- 3a. Movements according to location, 3b. Movements according to country,
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identification

Supporting Online Material for

Closing Loopholes: Getting Illegal Fishing Under Control

This research consolidates six years of movement data on IUU-listed vessels, tracking their port visits globally to evaluate port State performance in combating illegal, unregulated and unreported (IUU) fishing (see Box S1 for definition). We focused on the implementation of regional fisheries management organizations (RFMOs) conservation and management measures (CMM) in relation to the vessels on IUU vessel lists. While IUU-listed vessels represent only a small fraction of those operating illegally, they are the only officially recognised IUU vessels and therefore provide a basis for evaluating the willingness or capacity of States to implement port State measures, as well as the effectiveness of the current regulations.

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BOX S1.

According to the Food and Agriculture Organization of the United Nations' (FAO) International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) fishing (S1):

I Illegal fishing refers to activities:

- i conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
- ii conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization but operate in contravention of the conservation and management measures adopted by that organization and by which the States are bound, or relevant provisions of the applicable international law; or
- iii in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization.

II Unreported fishing refers to fishing activities:

- i which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
- ii undertaken in the area of competence of a relevant regional fisheries management organization which have not been reported or have been misreported, in contravention of the reporting procedures of that organization.

III Unregulated fishing refers to fishing activities:

- i in the area of application of a relevant regional fisheries management organization that

1. Materials and methods

1.1 Creation of the combined IUU vessel list

To date, eight RFMOs maintain or share lists of vessels that have been found to carry out or support IUU fishing within their own or adjacent convention areas. The RFMOs are:

- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- Inter-American Tropical Tuna Commission (IATTC)
- International Commission for the Conservation of Atlantic Tunas (ICCAT)
- Indian Ocean Tuna Commission (IOTC)

- Northwest Atlantic Fisheries Organisation (NAFO)
- North East Atlantic Fisheries Commission (NEAFC)
- South East Atlantic Fisheries Organisation (SEAFO)
- Western and Central Pacific Fisheries Commission (WCPFC).

The individual RFMOs have different procedures for listing IUU vessels. While e.g. NEAFC lists continuously throughout the year (using a provisional A-list), most RFMOs only update their IUU vessel lists at their annual general meetings.

The IUU-vessel lists of these eight RFMOs from January 2004 to December 2009 were merged into a single list and supplemented with information from the major commercial maritime online databases: Lloyd's Marine Intelligence Unit (MIU) (S2) and Lloyd's Register – Fairplay (S3). In one case, additional information was gathered from an industry source (S4) and from the Maltese Parliament. Information recorded on the combined IUU vessel list included each vessel's name and name history, flag and flag history, International Maritime Organization (IMO) number (S5), international radio call sign (IRCS) and call sign history, owner(s) and operator(s) information (where available), technical details (e.g., vessel type and tonnage), the RFMO listing the vessel as IUU, and dates and reasons for IUU-vessel listing and delisting. For all vessels that were not listed with an IMO number by the IUU-listing RFMO, we searched the Lloyd's register, the Lloyd's Marine Intelligence Unit, online ship and industry websites (www.shipspotting.com, www.atuna.com) to attempt to establish the vessel's identity and IMO number. If we found a record of the vessel with the same IRCS, name and/or flag as the one in the IUU vessel list, we concluded this was the same vessel and added the IMO number to that vessel's record in the combined IUU vessel list. The IMO number stays with the vessel throughout its entire life, regardless of name, owner or flag State. As the Lloyd's register - Fairplay keeps records of all name, flag, owner and operator changes of the vessels that have an IMO number, the name and flag history of these vessels could then be established (S6).

RFMO IUU vessel lists are based on decisions made by each RFMO's Contracting Parties (CPs) (S7) against established criteria. Vessels are added to the IUU list but, subject to sufficient proof of compliance or change of operation/ownership, they can also be delisted. An accurate listing date and delisting date of an IUU vessel was crucial to determining its relevant movements globally. To obtain the best information available, all RFMOs were contacted to verify information available on their websites, reports or meeting minutes.

1.2 Compiling Data on the Movement of IUU-Listed Vessels

Worldwide movement information for all vessels on the combined IUU vessel list was searched and compiled from the publicly available databases mentioned above, as well as additional databases (S8, S9), and from information provided by countries and RFMOs for the period they were on IUU vessel lists within the study period (S9).

We used the only currently available unique vessel identifier—IMO number—as a first parameter for searching the databases. For IUU vessels listed without an IMO number, only movements with two or more matched criteria (e.g., name, flag, call sign, etc.) were taken as valid movements of that vessel. Movement data recorded for each IUU vessel included reported flag, reported IRCS, country and location of visit, type of movement, date of arrival and departure and, when available, details of the visit (purpose, information on landings, etc.).

The majority of the port visits were found in the Lloyd’s MIU database. The other sources (which we used primarily to cross-check the Lloyd’s MIU movement records) were Sea-web, shipspotting.com and two online port logs (S8), as well as our communication with port States and RFMOs (S10). These in turn revealed additional movements, which were again verified with other sources, among them logs of the relevant ports.

The heavy dependence on the Lloyd’s MIU database as our main source of movements of IUU-listed vessels may have led to biases in our data as there are differences in the level of coverage in different regions. Lloyd’s MIU draws heavily on informers in the ports in addition to the electronic Automatic Identification Systems (AIS), whereas Sea-web uses only AIS.

1.3 Information-Gathering from Port States and RFMOs

From April to December 2009, letters were sent to relevant port State authorities where four or more movements of IUU-listed vessels were recorded (S10). The letters requested additional information on the nature of the port visits and measures taken by the port States to restrict port access or services to IUU-listed vessels. We also asked these authorities—ministries and agencies that we understand to have the responsibility for implementing the CMMs of the RFMO(s) in their respective countries, hereafter collectively referred to as “fisheries authorities”—to clarify any possible situation of non-compliance with RFMOs’ CMMs. In total, three rounds of letters were sent to each of the 32 port States that showed more than four IUU-listed vessel movements. In addition, one letter was sent to Latvia, where all port visits were followed by the scrapping of IUU-listed vessels, and one further letter to the European Commission (as a CP to a number of RFMOs), which summarised all port visits to 14 European Union Member States.

Letters were also sent to the secretariats of the eight relevant RFMOs (S10), which requested information on port visits of vessels on their IUU vessel lists, informed them about the preliminary

findings and, in some cases, sought clarification of the conditions set by CMMs that determine situations of non-compliance (see definition of violations below).

1.4 Analysis of Movement Data and Assessment of Compliance

For the purpose of the research, only port visits during the research period were analysed; movements through canal and strait passages were excluded, because there are no clear rules of international law governing such movements in the context of RFMO CMMs against IUU-listed vessels.

For each port visit made by an IUU-listed vessel, we assessed how far the port State complied with the applicable CMMs of the RFMO(s) to which it was a CP at the time of the visit. One of the following CMM violation categories was then assigned to the port State where the port visit occurred:

1. **Violation:** when the port entry and/or provision of port services to the IUU-listed vessel in the port is a clear violation of the CMMs of the RFMO to which the port State was a CP at the time of the port visit.
 - a. For countries that are CPs of **CCAMLR**, port entry of IUU-listed vessels after 1 July 2007 (*S11*) is considered a violation (CM10-06 [2006], CM10-07 [2006]) unless the vessel is allowed in for the purpose of enforcement action; for port entry before 1 July 2007, the landing or transshipment of fish products is considered a violation (CM10-06 [2002], CM10-07 [2002]).
 - b. For countries that are CPs of **IATTC**, the landing or transshipment of fish products is considered a violation after 18 June 2004 for Non-Contracting Parties (NCPs) vessels (Res. C-04-04) and after 24 June 2005 for vessels of CPs (Res. C-05-07).
 - c. For countries that are CPs of **ICCAT**, port entry of IUU-listed vessels after 13 June 2007 is considered a violation (Rec. 06-12); for port entry between 4 June 2003 and 13 June 2007, the landing and transshipment of fish products is considered a violation for NCP vessels (Rec. 02-23).
 - d. For countries that are CPs of **IOTC**, the landing or transshipment of fish products is considered a violation after 6 April 2003 for NCP vessels (Res. 02/04) and the provision of port services is considered a violation after 28 November 2006 for NCP vessels (Res. 06/01);
 - e. For countries that are CPs of **NAFO**, port entry of IUU-listed vessels after 4 December 2006 is considered a violation (Conservation and Enforcement Measure [CEM] 2007 Art. 50); for port visits after 12 December 2005, the landing or transshipment of fish products and/or provision of port services is considered a violation (CEM 2006 Art. 48).

- f. For countries that are CPs of **NEAFC**, port entry of IUU-listed vessels after 1 May 2007 is considered a violation (Scheme Art. 45); for port visits between 8 January 2004 and 1 May 2007, landing and transshipment of fish products and/or provision of port services is considered a violation.
 - g. For countries that are CPs of **SEAFO**, the landing or transshipment of fish products and/or provision of port services is considered to be a violation after December 2007 (CM08/06).
 - h. For countries that are CPs of **WCPFC**, the landing or transshipment of fish products and/or provision of port services is considered to be a violation after February 2007 for NCP vessels (Res. 06/09).
2. **Potential violation:** This applies when no further information is available and the port entry is not sufficient to determine whether it constitutes a violation (as defined above); the decision then depends on services that the vessel received in the port.
 3. **Non-violation:** This applies when the port visits are confirmed not to violate the CMMs of the relevant RFMO to which the port State is a CP or when the port visit was to a NCP of the RFMO.
 4. **Port State action:** In the context of this study, this refers to actions such as detention or sanctions that are taken by the port State against the vessel on the basis of the IUU listing.

Considering that a country can be a CP of more than one RFMO, a particular port visit by an IUU-listed vessel can be in violation of the port State measures of more than one RFMO. Vessels can also be listed by more than one RFMO. We have assigned one of the above-mentioned violation criteria to each port State's obligation related to a port visit. The average compliance rate for each RFMO was therefore calculated by looking at the port visits by a vessel that it had IUU listed, to port(s) in its CPs. The number of violations and potential violations were then divided by the total number of port visits.

2. Results

2.1 Distribution of port visits by IUU-listed vessels

Our research found a total of 425 port visits by 58 IUU-listed vessels in 71 countries (S12) during the research period (Figure S1).



Figure S1. Port visits by IUU-listed vessels. Countries where port visits were recorded are marked in light green.

2.2 Visibility of IUU-listed vessels

Between January 2004 and December 2009, this research identified 178 vessels that appeared on at least one of the IUU lists of the eight RFMOs included in this study. Of these 178 vessels, only 71 (40 percent) were listed with an IMO number. Two of those IMO numbers belonged to other vessels. RFMOs, national fisheries authorities and enforcement authorities (S13) on the ground had no IMO numbers for the remaining 107 vessels.

However, by cross referencing all data sources used in the research (cf. Sec 1.1) we were able to track down and assign an IMO number to 32 of the vessels that did not have an IMO number recorded on RFMO IUU-vessel lists. All except one of these 32 vessels were on the ICCAT or IATTC IUU-vessel lists (S14).

Of the 178 vessels on the combined IUU list, 151 were listed as fishing vessels, 10 were fishery support vessels (which we collectively term ‘reefers’ for this study) and 17 were unknown (Figure 1).

The 509 movements were made by just 58 of the 178 vessels on the combined IUU-vessel list. Thus, 120 vessels (67 percent) show no publicly available movement record. We consider it unlikely that all 120 vessels ceased operations while they were IUU-listed; it is more likely that most of them have continued to operate without being noticed, not only by the commercial databases used in this study but also by most fisheries and enforcement authorities.

2.3 Compliance of Contracting Parties to RFMO conservation and management measures on port State control

In order to assess compliance by port States with RFMOs' CMMs on port State control, port visits by IUU-listed vessels to ports in CPs of CCAMLR, IATTC, ICCAT, IOTC, NAFO, NEAFC, SEAFO and WCPFC were extracted for further analysis. One of the violation criteria outlined above was assigned to each port visit, and the percentage of violation, non-violation and port State action, grouped according to each RFMO, is shown in Figure S2. The percentage of violation and potential violation combined across RFMOs averaged 74 percent.

From the 22 country responses received, we identified five major reasons for non-compliance.

1. Enforcement authorities were not aware of the port visits of the IUU-listed vessel or wrongly identified it. IUU operators can benefit from the neglectful practices of some RFMOs if their vessel's IMO numbers are not recorded on the RFMO's IUU-vessel list. Japan offers one example of how gaps in documentation and communication were a major reason for the low visibility of IUU-listed vessels, making it difficult for the port State to identify them and take action. The ICCAT IUU-listed fishing vessel *Melilla No. 101* was listed without an IMO number. However, the vessel has an IMO number (added to the combined IUU vessel list). Later the name was changed to *Dong Won No. 630*. When the vessel visited Shimizu, Japan, in 2006, Japanese authorities had no way of knowing that the vessel was IUU-listed, which was also confirmed by our correspondence with Japan.
2. Our correspondence with 22 countries revealed a lack of cooperation between national fisheries authorities and enforcement authorities. These domestic authorities do not consistently share the responsibility and a common understanding of the importance of port State measures against IUU fishing activities to achieve their effective implementation. Only on a few occasions could the fisheries authorities provide all requested information on national policies and on visits made by IUU-listed vessels to their ports. In nearly all cases, regular information exchange processes between relevant bodies were not demonstrated and our requests prompted fisheries authorities to seek information from enforcement authorities. In one case, it was explicitly stated that no notice was received from any national body with regard to IUU-listed vessels or vessels believed to be engaged in IUU activities. This implied that the fisheries authority did not consider itself responsible for failing to have such knowledge and ensuring enforcement of port measures. Yet, their correspondence provided no information on notification procedures from enforcement authorities.

3. In a number of examples, the measures adopted by RFMOs have not been fully translated into national law. In some cases, this transitional situation lasted a long time, even through the end of the research period, leaving the port State unable to take action against IUU-listed vessels.
4. The denial of port access and port services to vessels on an IUU vessel list is subject to broad interpretation by port States. Some countries feel obliged to deny access to any vessel on an IUU vessel list, while others indicate such denial is only required if the vessel, when requesting port access, is carrying fish or fisheries products that have been caught in contravention of CMMs. Japan offers an example of the latter: The NEAFC IUU-listed reefer *Polestar* was permitted to enter the port of Kobe and landed pumpkin imported from Tonga.
5. RFMOs have not been active enough in supporting their CPs in effectively implementing port State measures. They did not generally request information on visits by IUU-listed vessels to the ports of their CPs, nor did they consistently assess the compliance of their Parties with port State measures. Non-compliance was not generally followed by sanctions. In some cases, there were ambiguities over the date that relevant CMMs entered into force, so port States were unclear about their obligations. As it stands, not all RFMOs played an active role in ensuring that port States were held responsible for the effective implementation of port State measures.

On the other hand, there are examples of the effectiveness of port State measures in combating IUU fishing when correctly implemented. Disguising vessels by changing names or hiding IMO numbers does not always dupe authorities. In a case where an IUU operator gave the wrong IMO number to conceal the identity of a vessel, the country (Norway) uncovered the vessel's true identity and took action: the vessel was made to leave the port.

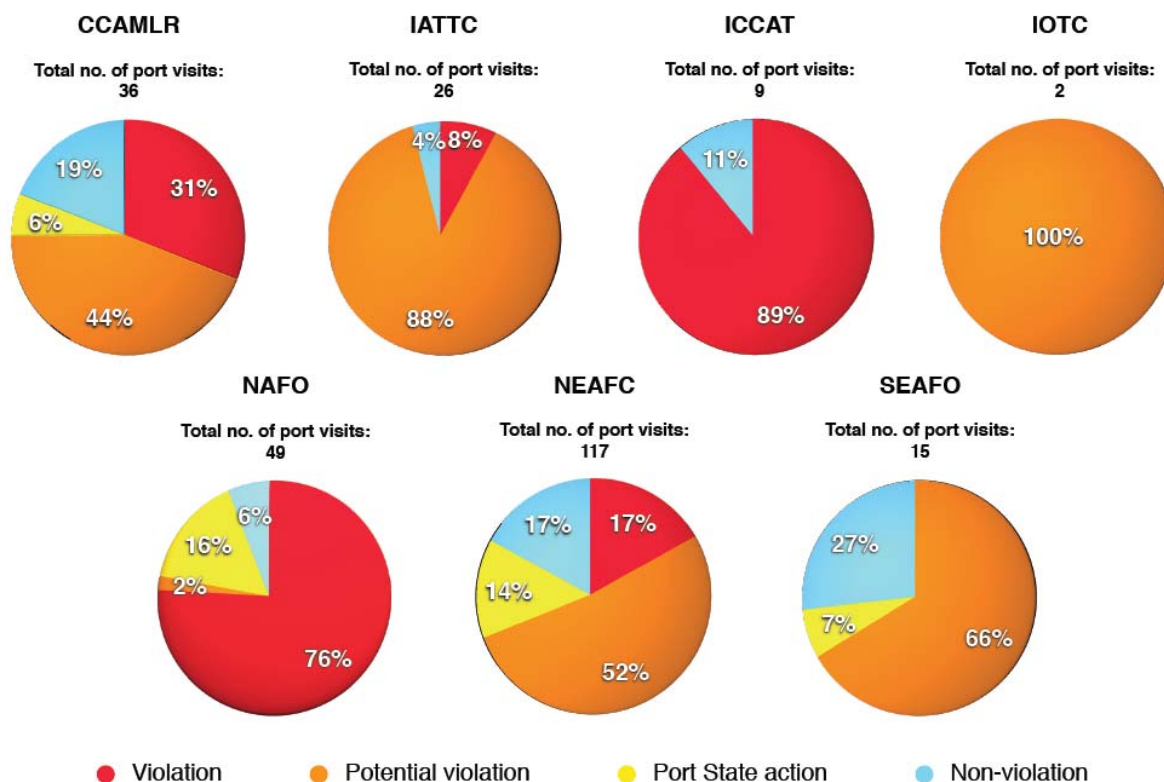


Figure S2. Proportion of violation, potential violation, port state action and non-violation of each RFMO's conservation and management measures on port State control of IUU-listed vessels. Total number of port visits reflects the recorded number of visits by vessels listed by the RFMO to ports in its CP. All port visits by WCPFC IUU-listed vessels were to NCPs and are therefore not shown here. Numbers may not add up to 100 percent due to rounding.

2.4 Effect of strengthened port State measures on the movements of IUU-listed vessels

To assess what effect denial of port entry to IUU-listed vessels may have on the movements of these vessels, the port visits of IUU vessels listed by NEAFC to CPs and NCPs were further analyzed (Table S1). These RFMOs had already established IUU vessel lists at the beginning of the research period (2004-2009), and introduced CMMs requiring the denial of port access in 2007.

In the case of NEAFC, the percentage of port visits by NEAFC IUU-listed vessels to NCPs almost doubled after the strengthening of CMMs denying port access to NEAFC IUU-listed vessels among NEAFC CPs.

Table S1. Number and percentage of port visits by NEAFC IUU-listed vessels to Contracting Parties (CPs) and Non-Contracting Parties (NCPs) of NEAFC before and after the strengthened CMM (denial of port access to IUU-listed vessels) entered into force in May 2007.

BEFORE the strengthened measure (denial of port access) entered into force	
Number of port visits to CPs	99
Number of port visits to NCPs	72
Total number of port visits	171
Percent of port visits to NCPs	42%
AFTER the strengthened measure (denial of port access) entered into force (1st May 2007)	
Number of port visits to CPs	20
Number of port visits to NCPs	82
Total number of port visits	102
Percent of port visits to NCPs	80%

Annex : Data

The combined IUU vessel list with comprehensive vessel information, as well as the movement file covering all recorded port visits of vessels listed by the eight RFMOs between January 2004 and December 2009, including details, methods, and procedure can be accessed in the file: [www.sciencemag.org/cgi/content/full/science.1190245/DC1].

References and Notes

- S1. FAO, International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing (2001).
- S2. Lloyd's Marine Intelligence Unit at www.lloydsmiu.com.
- S3. Lloyd's Register of Ships online, recently changed name to IHS Fairplay and accessed at www.sea-web.com.
- S4. www.atuna.com.
- S5. All merchant vessels are required to have an International Maritime Organization unique vessel identifier (IMO number). Fishing vessels are exempt from this requirement, but may register if they wish. As a result not all fishing vessels have IMO vessel identification numbers.
- S6. For further information regarding the details, methods and sources of the combined IUU vessel list, see data www.sciencemag.org/cgi/content/full/science.1190245/DC1, sheets 1a and 1b.
- S7. In the context of this present research, "Contracting Party" refers to States or international organizations that have ratified the treaty that creates the RFMO and that are bound by the obligations of this treaty; "member" refers to States or international organizations that are part of the RFMO and participate in the RFMO's decision-making bodies. All members are Contracting Parties to the RFMO's constitutive treaty, and often both

- terms can be used interchangeably. However, some RFMOs foresee different obligations for Contracting Parties than for members, giving to the latter the possibility of participating in the decision-making process.
- S8. The online logs used are the port Gibraltar (www.gibraltarport.com) and the port of Manta (www.dimar.mil.co); the online ship photo community at www.shipspotting.com.
- S9. For details on vessel movements, including port visits, sources, and details on the analysis of movement data, see movement file www.sciencemag.org/cgi/content/full/science.1190245/DC1, sheets 2a and 2b.
- S10. The official correspondence with the port States' fisheries authorities and the RFMO secretariats is available on request. In the correspondence we requested information on port visits by IUU-listed vessels, on port State actions, on applicable port State measures, on the specific authorities responsible, as well as on methods and procedures used, to determine whether an approaching vessel was on the an IUU vessel list. These requests were preceded by a description of the research undertaken by the Pew Environment Group. Moreover, country or RFMO-specific preliminary findings were provided.
- S11. The formal date of entry into force of a conservation measure is 180 days after its notification to CPs (CCAMLR Convention, Art. IX.6). The conservation measures were adopted at the annual meeting in November 2006. Taking into account the time required for notification, the date of entry into force was determined as 1 July 2007 at the latest.
- S12. For a detailed breakdown of port visits by countries, see movement file www.sciencemag.org/cgi/content/full/science.1190245/DC1, sheet 2a.
- S13. A general term we gave to various domestic authorities with the responsibility to enforce port State measures and/or other shipping, customs and labour regulations, such as the Coast Guard in the United States or the Maritime Captaincy (Capitanía Marítima) in Spain.
- S14. For list of IUU-vessels with IMO number assigned by our research, see IMO identification data www.sciencemag.org/cgi/content/full/science.1190245/DC1, sheet 5a.