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Global Fisheries Landings V3.0 [ARCHIVED VERSION]

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Title	Global Fisheries Landings V3.0 [ARCHIVED VERSION]
Date	2018-01-19
Date type	Creation
Abstract	NOTE THIS IS AN ARCHIVED VERSION OF THE GLOBAL FISHERIES LANDING DATA. The current version of the data is available from https://metadata.imas.utas.edu.au/geonetwork/srv/en/metadata.show?uuid=5c4590d3-a45a-4d37-bf8b-ecd145cb356d and should be used for all future analyses from 16/01/2019. For any questions about version changes to this dataset, please contact the Point of Contact nominated in this record. Global fisheries landings supplied by a number of agencies (FAO/UN, CCAMLR, NAFO, ICES etc) are mapped to 30-min spatial cells based on the range/gradient of the reported taxon, the spatial access of the reporting country's fleets, and the original reporting area. This data is separated to industrial and non-industrial fishing and associated with types of fishing gears. Estimates of illegal, unreported and unallocated landings are included as are estimates of the weight of fisheries products discarded at sea. For appropriate records, spatial information from tuna regional management organisations and satellite-based vessel Automatic Identification System (AIS) were used to allow greater precision. Mapping the source of fisheries capture allows investigation of the impacts of fishing and the vulnerability of fishing (with its associate food security implications) to climate change impacts.

Unique resource identifier	doi:10.4226/77/5a65572655f73
Metadata language	eng
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Hierarchy level	Dataset

OnLine resource

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Protocol	WWW:LINK-1.0-http--metadata-URL

Point of contact

Individual name	Watson, Reginald
Organisation name	Institute for Marine and Antarctic Studies (IMAS), University of Tasmania (UTAS)
Role	Principal investigator

Topic category	Biota

Keyword

Type	Theme
Keyword	Landings
Keyword	Global
Keyword	Fishing
Keyword	Discards
Keyword	Illegal Fishing
Type	taxon
Keyword	Pelagic
Keyword	Shark

Keyword	Tuna
Keyword	Crustacean
Keyword	Mollusc
Keyword	Cephalopod
Keyword	Fish
Type	Theme
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Keyword	EARTH SCIENCE | BIOSPHERE | ECOSYSTEMS | MARINE ECOSYSTEMS
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Keyword	Marine and Estuarine Ecology (incl. Marine Ichthyology)
Keyword	http://metadata.imas.utas.edu.au:/geonetwork/srv/eng/xml.keyword.get?thesaurus=external.theme.ANZSRC_FOR_Codes&id=http://purl.org/au-research/vocabulary/anzsrc-for/2008/070402
Keyword	Aquatic Ecosystem Studies and Stock Assessment
Type	Discipline

Extent

Geographic bounding box

West bound	-180
East bound	180
South bound	-90
North bound	90

Lineage

Statement	1.1 Data sources, scope and overview Input data was sourced from publicly available websites (Table 1.). All sources but the tuna regional management organization's (tuna rFMO) data and Global Fishing Watch's (GFW) vessel Automatic Identification System (AIS)-based data[1] were used initially in a similar fashion to [2] and summarised below to map reported landings to candidate 30-min spatial cells with a global grid (Supplementary Fig. 1). This included a separation of deemed industrial from non-industrial reported landings. Following this there was reevaluation and filtering of reported landings initially assigned to candidate spatial cells through the use of distributional information related to the associated fishing gear used, and where applicable, the tuna rFMO and AIS positional data (Table 1.) Subsequently this map of reported landings was extended through estimates for reported, Illegal, Unreported and Unregulated (IUU) catch and associated discards for both the industrial and non-industrial sectors. The global Human Development Index (HDI) [3] was used to assist estimation of IUU associated with non-industrial fisheries, and served as a simple available proxy for reporting likelihood.

Only records of taxa with a marine origin were used - although some are found in other habitats. Where possible aquaculture production was excluded as were records describing shells, coral, amphibians, reptiles, birds and mammals.

1.2 Initial mapping

As described in [2], FAO data for the period 1950 to 2015 was combined and coded with a range of other input sources for reported fisheries landings (Table 1.). Overlapping records were removed, and only the most spatially specific data was retained. Mapping involved using all means to identify the most specific taxonomy of the reported landing datum because this established both the potential range of fished spatial cells but also a gradient based on the rough abundance of the fished taxa related to critical habitats, ocean depths etc. [4]. Within the statistical area reported in source databases, usually only a subset of spatial cells were accessible to the fishing fleets of the reporting country [5]. This is because most global catch is taken within the claimed exclusive economic zone (EEZ) waters of countries where the access of foreign fishing fleets is regulated and usually documented.

1.3 Separation to industrial and non-industrial sectors

The separation of landings from industrial and non-industrial fishing was based on a number of factors. The first was whether the taxa had a clear association to fishing gear not typically used in non-industrial fishing such as with tuna purse seine operations. Additionally, for each country the division was further derived by the relative association of the taxon described as landing by the two fishing sectors during the period of fishing by published catch reconstructions [6]. In addition, where the fishing occurred was considered important to the likely association with a fishing sector. Non-industrial fishing is typically accepted to occur within 200 km of shore and within 50 m of depth [7]. Division to sectors is acknowledged to be an imperfect science without detailed and specific data such as from logbooks, surveys etc. which unfortunately are not available for a global treatment.

1.4 Estimation of IUU and associated discards

As in [2], estimates of IUU and associated discards were made for each record of reported landings. For the industrial sector records the current procedure was largely unchanged. The relative association of landings with a range of fishing gears was made based on the fishing country, the year of fishing and the fished taxa [8]. This allowed published data on rates of IUU and discarding to be used [9, 10] to guide estimation of the missing components so that catch, and not simply reported landings, could be estimated.

For the non-industrial sector it was clear that in order to achieve the published catch rates [7], as well as the national estimates for this sector published as country reconstructions [6], that the unreported component (IUU) of non-industrial fishing was significant. It was decided that the level of non-reporting in this sector to FAO and other parties was influenced by the national resources available for government monitoring. Therefore, the estimation of IUU for this sector was adjusted by country HDI [3], with poorer countries having relatively a larger portion of unreported landings. This expected association was verified by examining the breakdowns within country reconstructions [6] where we found a significant relationship with R2 = 0.29.

1.5 Adjustment for associated fishing gear logistics

As described in [2, 8] it possible to associate each fishing record with a range of fishing gears using the fishing year, country and the fished taxon. Each fishing gear was deemed to have a general global pattern of probable spatial distribution largely based on distance offshore, depth of water and the distributions of target taxa as summarised from previous mapping of catch and fishing effort [2, 11]. For non-industrial fishing, a single distribution was considered, which favoured the published association with nearshore and shallow areas [7].

The fishing gear logistics distribution was used to filter and redistribute catch associated with spatial cells in earlier processing. This further processing would, for example, rule out sites far off shore for non-industrial fishing by proportionately increasing landings associated with nearshore candidate cells. The purpose was to enforce some rational and realistic consideration of gear-based logistic cost/benefit constraints on mapped solutions which has been missing in previous mapped database versions [2, 6].

1.6 Adjustment for tuna fisheries

For tuna fisheries, there exits greater mapping challenges and opportunities than for most other fisheries which are largely inshore. Tuna fisheries encompass all tropical and sub-tropical seas but each year, depending on the oceanographic conditions and any fishing access agreements negotiated by roving fleets, the focus of fishing can be in vastly different areas within the broad range of the fished taxa. Data from FAO and other sources has always been instructive to focus catch mapping to specific locations, as is the data made available by tuna rFMOs (Table 1.). Annual distributions, often in 1-degree or 5-degree spatial areas were used to improve the redistribution of spatial mapping from initial processing for the appropriate tuna taxa and associated fishing gears.

1.7 Adjustment using satellite data

Most recently it has been possible to track the movement of large vessels at sea from satellites. Though there are dedicated systems such as satellite vessel monitoring systems (VMS) used extensively in fisheries management, these data are not widely available nor do they cover most global fishing operations. Most recently the use of AIS positional vessel tracking has shown promise. With considerable processing, it has even been possible to determine not only if the vessel is a fishing vessel but even something about the associated fishing gears in used and possibly vessel size [1]. Unfortunately, the AIS coverage has only become good in 2016 and is still weak in some areas such as SE Asia due to many factors [12]. Where possible, however, especially for offshore fishing for tuna, these data can add another valuable source of information about fishing distributions. AIS data from 2016 was used to constrain the mapping of relevant catches for 2015 and, with reducing effect, for fishing years back to 2010. Before 2010 it was considered that recent AIS data could not improve mapping procedures.

1.8 Mapping historical data (pre-1950)

A number of data sources describe country fisheries landings, sometimes by taxa, as early as Roman times. In limited cases, reconstructions exist for some stocks such as Atlantic herring and cod for nearly 1000 years[13]. Here the sources described in Table 1 were used as the basis for extending mapped reported landings to 1869. The procedure used was similar to that described for more recent (post-1950) industrial fisheries (above). The spatial guide used was based on the same reporting country and fished taxon in 1950. If there was no such matching record then the time period used was generalized to any fishing in the 1950s. If this failed then the fished taxon was generalized to a broader taxonomic range. Using this method, it was possible to map all available historical records.

Table 1. Data sources
Source Description Link
FAO FAO Global Fishery and Aquaculture Production Statistics v2017.1.0 Global Capture Production (Release date: March 7th 2017) www.fao.org
ICES International Committee for the Exploration of the Sea 1950-2015 Historical data 1903-1949 www.ices.dk
NAFO Northwest Atlantic Fisheries Organisation Catch and Effort 21B 1960-2015 (Updated 1 June 2017) www.nafo.int
SEAFO Southeast Atlantic Capture Production 1975-2015 (FAO Regional Capture Fisheries Statistics v2017.2.0 Release date: 15 June 2017) www.seafo.org
GFCM General Fisheries Commission for the Mediterranean Capture production 1970-2015 STATLANT 37A
(Release date: Sept 2017) http://www.fao.org/gfcm/data/capture-production-statistics/en/
CECAF Fishery Committee for the Eastern Central Atlantic Capture production 1970-2015 (FAO Regional Capture Fisheries Statistics v2017.2.0
Release date: 15 June 2017) www.fao.org/fishery/rfb/ecaf
CCAMLR Commission for the Conservation of Antarctic Marine Living Resources Statistical Bulletin 2017 Vol. 29 1970-2015 www.ccamlr.org
SAUP Sea Around Us project - records for FAO area 18 (Arctic) v2 1950-2014 (extrapolated to 2015) www.seaaroundus.org[6]
WCPFC Western & Central Pacific Fisheries Commission 1950-2014 (Data accessed June 2017) https://www.wcpfc.int/
IOTC Indian Ocean Tuna Commission 1952-2015 (Data accessed June 2017) http://www.iotc.org/
ICCAT International Commission for the Conservation of Atlantic Tunas 1956-2015 (Data accessed June 2017) https://www.iccat.int/en/
IAATC Inter-American Tropical Tuna Commission 1954-2015 (Data accessed June 2017) https://www.iattc.org/HomeENG.htm
CCSBT Commission for the Conservation of Southern Bluefin Tuna 1965-2015 (Data accessed June 2017) https://www.ccsbt.org/

	GFW Global Fishing Watch AIS global data 2016 http://globalfishingwatch.org/[1, 12] Mitchell, B.R. International Historical Statistics: The Americas 1750-1988 International Historical Statistics: Africa, Asia & Oceania, 1750-1993[14][15] References [1] E.N. de Souza, K. Boerder, S. Matwin, B. Worm, Improving Fishing Pattern Detection from Satellite AIS Using Data Mining and Machine Learning, PLOS ONE 11(9) (2016) e0163760. [2] R. Watson, A database of global marine commercial, small-scale, illegal and unreported fisheries catch 1950-2014., Nature Scientific Data 4(170039) (2017). [3] UNDP, Human Development Index (HDI), 2017. http://hdr.undp.org/en/content/human-development-index-hdi. (Accessed 12 January 2018 2018). [4] C. Close, W.L. Cheung, S. Hodgson, V. Lam, R. Watson, D. Pauly, Distribution ranges of commercial fishes and invertebrates., in: M.L.D. Palomares, K.I. Stergiou, D. Pauly (Eds.) Fisheries Centre Research Reports, Fisheries Centre, University of British Columbia, Vancouver, Canada, 2006, pp. 27-37. [5] R. Watson, A. Kitchingman, A. Gelchu, D. Pauly, Mapping global fisheries: sharpening our focus, Fish and Fisheries 5(2) (2004) 168-177. [6] D. Pauly, D. Zeller, Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining, Nature communications (2016). [7] R. Chuenpagdee, L. Liguori, M.L.D. Palomares, D. Pauly, Bottom up, global estimates of small-scale marine fisheries catches, in: T.J. Pitcher (Ed.) Fisheries Centre Research Reports, University of British Columbia, Vancouver, Canada, 2006, p. 105pp. [8] R. Watson, C. Revenga, Y. Kura, Fishing gear associated with global marine catches: I Database development., Fisheries Research 79 (2006) 97-102. [9] D.J. Agnew, J. Pearce, G. Pramod, T. Peatman, R. Watson, J.R. Beddington, T.J. Pitcher, Estimating the worldwide extent of illegal fishing, PLoS One 4(2) (2009) e4570. [10] K. Kelleher, Discards in the world's marine fisheries. An update., FAO Fisheries Technical Paper, FAO, Rome, 2005, p. 131. [11] R.A. Watson, W.W.L. Cheung, J.A. Anticamara, R.U. Sumaila, D. Zeller, D. Pauly, Global marine yield halved as fishing intensity redoubles, Fish and Fisheries 14 (2013) 493-503. [12] M. Robards, G.K. Silber, J.D. Adams, J. Arroyo, D. Lorenzini, K. Schwehr, J. Amos, Conservation science and policy applications of the marine vessel Automatic Identification System (AIS)-a review, Bulletin of Marine Science 92(1) (2016) 75-103. [13] R.A. Watson, T.J. Pitcher, S. Jennings, Plenty more fish in the sea?, Fish and Fisheries 18 (2017) 105-113. [14] B.R. Mitchell, International Historical Statistics: The Americas 1750-1988, 2nd ed., Palgrave MacMillian, UK, 1993. [15] B.R. Mitchell, International Historical Statistics: Africa, Asia & Oceania, 1750-1993, 3rd ed., Palgrave Macmillan, UK, 1998.

Resource constraints

Use limitation	The data described in this record are the intellectual property of the University of Tasmania through the Institute for Marine and Antarctic Studies.
Classification	Unclassified

File identifier	ff1274e1-c0ab-411b-a8a2-5a12eb27f2c0
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Metadata author

Individual name	Watson, Reginald
Individual name	IMAS Data Manager
Organisation name	Institute for Marine and Antarctic Studies (IMAS), University of Tasmania (UTAS)
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Role	Author
Role	metadataContact

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