SUPPLEMENTAL INFORMATION

Bottom trawl fishing footprints on the world's continental shelves, Amoroso *et al*. (2018)
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Text S1. Estimating bottom-trawl landings from FAO data

The weight and proportion of global landings caught with towed bottom gears were estimated from FAO data. Since the FAO Fisheries Statistics (FishStat) compile annual landings by species or species groups (reference S1) but not by fishing gear, we developed an approach to assign landings by species to gear types from 2011 – 2013. We (a) removed from the total landings all pelagic species not predominantly caught by towed bottom gears, (b) removed from the total landings all species with mean landings over the three-year period of less than 1000 tonnes, (c) estimated the proportion of the remaining species likely to be caught by towed bottom gear based on fisheries information for these species and (d) multiplied the proportion caught by towed bottom gear by the landings for each species and summed across species. This approach produced an initial estimate of mean landings for the years 2011 – 2013 of 12.8 million tonnes. This estimate, however, does not account for 11 million tonnes of landings of fish and shellfish, which are reported as "marine fishes not identified". Most of these landings come from Asia and are a combination of unclassified landings from industrial fisheries but also include largely unknown artisanal catches. To estimate the proportion of these landings taken with mobile bottom gear we first assumed that 20 – 30% of the total landings in this region came from artisanal fisheries (references S2-S4) and the remaining 70 – 80% (7.7 – 8.8 million tonnes) from "industrial" trawl and purse seine fisheries. We then assumed that 80% of these industrial landings were taken by bottom trawl (references S5, S6). This is consistent with the observation that the bottom trawl is the predominant industrial gear in the region and the observation that the bottom trawl fishery has a tendency to produce unidentified mixed species catches whereas purse seine landings include rather few pelagic species. Thus the mean annual landings of "marine fishes not identified" (these may be fish and shellfish) taken by towed bottom gears were estimated as 6.1 – 7.0 million tonnes and total mean annual landings of all species as 18.9 – 19.8 million tonnes. Landings are less than total catches in mobile bottom fishing gears because not all landings are included in the FAO fisheries statistics and part of the catch is discarded.

Text S2. Trawling footprints: data sources and processing

We collated high-resolution spatial data on the distribution of fishing activity by vessels using towed bottom contact gears (dredges, otter trawling, beam trawling and shrimp trawling; hereafter 'bottom trawls') at depths of less than 1000 m in 31 regions around the world (Fig. S1). For most regions we collated data from the period 2008 – 2012. The specific years from which data were collated are reported by region in Figs. S3-S34.

Data included both Vessel Monitoring System (VMS) records (position, speed and heading) and tow-by-tow information obtained from fisheries logbook programs (start and end positions, catch composition). Both sources of information allow the distribution of fishing activity to be mapped and, when gear width information is available, for the area swept by the fishing gear (hereafter 'swept area') to be calculated. For this analysis we defined gear width as the door spread or the width of the mouth of the net, depending on whether the gear used warps between the trawl doors and the mouth of the net to herd fish (typically otter trawls) or whether it did not (beam trawls, dredges). The analyses we present use data processed by regional or national management agencies (usually supplied in the form of gridded

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maps) and data processed by the authors. Consequently, the methods vary slightly among regions, although they follow the general principles detailed below.

Logbook records usually provide the start and end position of individual fishing tows, making it possible to directly use these data to map the distribution of fishing activity. Each individual tow is assumed to follow a straight trajectory between the start and end positions. Information on gear dimensions is then used to estimate the area swept by the gear during the tow. In most cases information on gear dimensions is provided for the fishery, but it may also be recorded for the individual fishing trip or tow. Consequently, different approaches were used to assign gear width. The most common approach was to divide fishing activities into "métiers" (fishing activities that share similar practices and characteristics) and assume the same gear width for the entire métier. The gear width to assign to each métier was determined in one of two ways; either by averaging reported data on gear dimensions or taking estimates from experts with direct regional knowledge of the operation of the métiers.

VMS data provide information on the position, speed and heading of fishing vessels at regular time intervals (typically sending this information to geostationary satellites as 'pings' at intervals of one or two hours) but do not indicate when a vessel is fishing or not fishing. To estimate fishing activity and footprint using VMS pings, fishing operations need to be inferred from available data. This may be achieved by analyzing vessel speeds: the frequency distribution of the vessel speeds usually occurs in three modes, with the first mode (low speed) corresponding to docking or anchoring and vessels underway but not making way, the second mode (intermediate speeds) to fishing activities and the third mode (high speed) to steaming. In some cases, a statistical approach was applied to decompose the distribution of speeds and in other cases the lower and upper limits of the vessel speed linked to fishing operations were obtained from scientists with direct regional knowledge of the métiers. Once pings associated with fishing operations were identified, the swept area between pings was computed from the vessel's speed, time elapsed between pings and gear width.

High-resolution grids were constructed to span each region, in most cases at a resolution of 1 km^2. However, in some cases, we used 0.01-degrees or 1-minute grids (and adjusted all calculations to account for changes in cell area with latitude) because these were the scales at which data were provided and/or because they provided consistency with existing regional data processing protocols.

We calculated the total swept area within each grid cell by year. The most accurate way to calculate area impacted by trawling constructs individual geo-referenced polygons for each tow. The topological union of individual polygons (where each polygon represents a tow) can then be computed using standard GIS software; and the area impacted by trawling is simply the area occupied by the polygons union ("polygons approach"). This approach accounts for any overlap between trawling passes (Fig. S2). Unfortunately, this process is computationally expensive, and was not always feasible when dealing with large databases and some pre-processed data. To address this, we adopted three alternative methods to calculate the area impacted by fishing within a cell. All the methods rely on the calculation of the swept area ratio for each cell (SAR = total swept area within the cell/area of the cell) in any defined grid (and see main text):

Approach A, based on the cell assumption, involves summing the area of any grid cells in which any trawling activity is recorded in a defined time period (usually one year), even though some of the area within a grid cell may not have been trawled in that time period. This is the most conservative approach (least likely to underestimate trawl footprint) and assumes that all cells with any recorded trawling activity in a given year are entirely trawled.

Approach B, based on the Poisson assumption, involves summing the area trawled within each grid cell in a defined time period, where the area trawled is estimated based on the assumption that the number of times any point within the cell is trawled is randomly (Poisson) distributed.

Approach C, based on the Uniform assumption, involves summing the area trawled within each grid cell in a defined time period, where the area trawled is estimated based on the assumption trawling is uniformly spread within the cell.

As individual fishing tracks usually cross several grid cells in any region, the calculation of the total swept area in any given cell requires that the total area swept by one fishing track is allocated to several cells. To achieve this, individual fishing tracks were divided in a large number of equidistant points (1000 points) and the number of points falling within each cell was counted. The swept area within any given cell was then calculated in direct proportion to the fraction of the points on the fishing track falling within that cell. This process was repeated for all fishing tracks to generate swept area by cell for all activity in any defined region. In three regions (numeric region codes= 17, 20, 22), an alternate approach was adopted where reconstructed tracks were mapped as polygons and the polygons were segmented at grid cells boundaries.

For each region we computed the total swept area in two depth strata: 0 – 200 m and 201 – 1000 m. A global elevation grid of 1-minute resolution (ETOPO1, www.ngdc.noaa.gov/mgg/global) was the source of bathymetric data. As our grids used projections and resolutions that differed from the ETOPO1 grid, it was necessary to re-project the original raster. New values of mean depth for each cell were calculated using a bilinear interpolation. In regions where local bathymetric data of higher resolution than ETOPO1 were available we compared the effect of re-projecting ETOPO1 data on estimates of total area for each depth strata. Although the use of re-projected and interpolated grids resulted in classification errors for individual cells, the estimates of total area using both sources of information was negligible (lower than 5%).

To assess the effect of grid resolution on trawling footprint by region (Fig. 1, main text) we repeated the process of allocating swept area to grid cells using lower-resolution grids. In cases where the scale of the grid changed with latitude (i.e. grids based on equal increments of latitude), the nominal resolution in km^2 was calculated as mean grid cell area in any defined region.

Information on data processing specific to each region, or group of regions, is provided below and further details of data processing by region, and outputs by region, are summarized in Figs. S3 – S34. Coverage of trawling activity in each region was estimated from the proportion of total landings or effort attributed to vessels providing VMS or logbook data, based on landings or effort data provided by regional assessment and management agencies.

Europe (numeric region codes= 1 – 6, 8 – 10, 25 – 30, 32)
Data on the trawling footprint in European waters were gathered and analyzed by the BENTHIS project (https://www.benthis.eu). VMS data and logbook data were used to calculate the area impacted by bottom trawling during the period 2010 – 2012. The grid used has a 1-minute resolution. For full details of data processing and calculation of activity and footprint see reference (S7).

Namibia and South Africa (numeric region codes= 7, 11, 13)
Tow-by-tow data were collated from the hake (*Merluccius paradoxus, Merluccius capensis*), monkfish (*Lophius vomerinus*) and orange roughy (*Hoplostethus atlanticus*) fisheries in Namibia and South Africa

for the period 2008 – 2013. The Department of Agriculture, Forestry and Fisheries from South Africa and the Ministry of Fisheries and Marine Resources from Namibia provided the data. For each fishing tow the catch composition was available and it was used to assign individuals tows to a métier. The fishing industry provided records of the gear width for each métier. A small number of records were excluded from the analyses due to errors in the recorded start or end position of the track. A crustacean bottom trawl fishery takes place in the east coast of South Africa, but logbook data were not available and it could not be included in our analyses. This fishery is minor, contributing less than 3% of the total catches from the bottom trawl industry.

Argentina (numeric region code= 12)
The main fleets included in the analysis were: the scallop (*Zygochlamys patagonica*) factory trawlers, the hake (*Merluccius hubbsi*) frozen and fresh trawlers, the shrimp (*Pleoticus muelleri*) coastal and factory trawlers, a mixed-stock coastal trawling fleet and a fleet that targets a few southern species like Patagonian grenadier (*Macruronus magellanicus*) and the southern blue whiting (*Micromesistius australis*). Catch compositions by trip for the years 2010 and 2013 were provided by the Argentina Fisheries and Aquaculture Sub-Secretary. All trips targeting southern blue whiting were excluded because they mainly used mid-water trawls. The gear width of each métier was obtained from interviews with skippers from different fleets and fishing net experts. All vessels in the fleets were equipped with VMS. During a fishing trip some vessels switch the fishing gear or change gear configuration depending on the species targeted. This can lead to substantial variations in gear width. To assign a fishing trip to a métier we matched the VMS data with the trip catch records per trip and treated the species with the highest catch as an indicator of the main species targeted during the trip. We only included data that were recorded during daylight hours, with the exception of the scallop fleet that is known to operate at night.

While all trawling vessels are equipped with VMS devices, the ping frequency for some coastal vessels in the Chubut Province was very low (6 hours). This low ping frequency, is insufficient to allow the application of the usual methods of analysis and these vessels were not included in the footprint estimation. However, we estimated the total swept area impacted by this fleet because the low ping frequency still supports the calculation of broad swept-area estimates (ie. at the scale of the region or depth strata). The area impacted by this fleet was small and its exclusion only reduced the estimate of total swept area by 3%.

Australia (numeric region codes= 14, 15, 19, 21, 23)
Data on bottom fishing activities around Australia were collated from different sources and estimates of the swept area were obtained using different methods according to the data availability and fishery type. The resolution of the grid used for the analysis of Australian trawling effort was 0.01 degrees. Data were gathered, analyzed and gridded by the Commonwealth, Scientific and Industrial Research Organisation (CSIRO).

Logbook data containing start and end positions of each tow were used to calculate the total swept area for the Commonwealth fishery management sectors around Australia (2009 – 2011), the Northern Territories (2010 – 2012), the Queensland fish trawl fishery (2011 – 2013), the Torres Strait prawn fishery (2010 – 2012), the Western Australia fish trawl fishery (2004 – 2009) and the Western Australia prawn and scallop fisheries (2008 – 2012). In most cases the information about the gear width used in each fishery was obtained by seeking expert opinion. Queensland and Northern territories trawl fisheries use "semi-demersal" gears and they were estimated to contact the bottom less than 20% of the time.

Logbook data were also used to estimate the area swept by the Bass Strait Central Zone Scallop fishery (2009 – 2011) and the Western Australia prawn and scallop fisheries (2008 – 2012), but the logbook data only recorded one position in these cases. For these fisheries, the total effort was spread around the recorded position by assuming typical tow lengths, fishing speeds and gear widths, as estimated by scientists working with these fisheries.

VMS data were used to estimate swept area for the Northern prawn trawl fishery, and the Tasmania scallop dredge fishery (2003 – 2013, although the fishery was closed 2009 – 2010), the Torres Strait prawn fishery (2010 – 2012) and the Queensland East Coast prawn trawl fishery (2007 – 2009).

In some cases national confidentiality rules prevented the analysis and presentation of data, because there were very low numbers of vessels operating in some of these Australian fisheries and location data would have highlighted the choice of fishing locations by individual fishers. In cases where confidentiality had to be assured, the data received were aggregated/ averaged over several years and/ or gridded to a lower resolution to minimize the exclusion of data. For the New South Wales's fish and prawn trawl fisheries, data were aggregated to provide total fishing activity for the period 2009 – 2014 in 0.1 degrees cells. For the Victorian fisheries (inshore fish trawl, prawn trawl and scallop dredge) and the South Australia prawn fisheries the data available was an average of the total activity for the period 2002 – 2012 and 2008 – 2012 respectively. High-resolution maps of swept area are not presented in Figs. S16, S17, S21, S23, S25 to ensure the required confidentiality for individual fishers.

New Zealand (numeric region code= 16)
Tow-by-tow data for fisheries using bottom-contact gear were provided by the National Institute of Water and Atmospheric Research (2008 – 2012). Records were obtained from two commercial fishing returns forms; the Trawl Catch Effort Processing Returns and the Trawl Catch Effort Landing Returns. The data covers trawling operations in the inshore and offshore waters, but does not include dredging, Danish seining and coastal trawling activities. Detailed descriptions of processing methods are provided in references (S8, S9). Briefly, the trawl tracks are calculated from the start and end location of tows and the track is buffered using generic door spread values (based on species targeted) to generate a polygon for each tow. These areas were overlaid and summed on a 5km by 5km grid. The fraction of the catch or effort included in tow-by-tow records is very high for the most commonly caught species (>90%). Contribution of trawling and Danish seining to total catch is 84% while dredging contributes 0.6%. While we could not discriminate the catch attributable to Danish seiners, we assume, based on knowledge of these fisheries, that their contribution to the total catch is low in comparison with bottom trawling.

West Coast United States (North California Current) (numeric region code= 18)
Tow-by-tow data for the West Coast ground fish trawl fishery from Washington to California for the period 2002 – 2012 were obtained from the observers program. Since the inception of the ITQs system observer coverage has changed substantially, from around 20% before 2010 to 100 % since 2011. Given the dramatic changes in coverage only data for 2011 and 2012 were used for the footprint calculations reported in the main paper.

Alaska (numeric region codes= 17, 20, 22)
Data consisted of swept area by 1 km^2 grid cells for the period 2008 – 2010. Data were processed at the NOAA Alaska Fisheries Science Center. The swept area by cell was calculated using VMS records of the trawling fleet operating in the Alaska region, including both bottom and pelagic trawls using the polygon approach. Pelagic trawl operations were included because in this region because they are known to contact the sea bottom for part of the duration of the tow (mean 44%, reference S13). All vessels

operating in the area were equipped with VMS. The selection of the geographical boundaries is a factor that can affect the calculations of the trawling intensity in region. The regional SAR for the Alaska region was calculated both using the Large Marine Ecosystem (LME) boundaries (Gulf of Alaska, Bering Sea and Aleutian Islands) and the regional management United States boundaries, which exclude Canadian waters. LME boundaries occupy a larger area than the regional management areas but the area of interest (0 – 1000 m depth) remained relatively stable. Regional SAR in the Alaska region was 0.025 for the Aleutian Islands, 0.07 for the Bering Sea and 0.032 for the Gulf of Alaska if the regional management boundaries are used. The difference between the calculated SAR using the LME boundaries and regional management units is about 20% but these differences have a minimal impact on relative footprint comparisons at a global scale as presented in the main text.

South Chile and North Chile (numeric region codes= 24, 31)
Tow by tow data provided by the Instituto de Fomento Pesquero (IFOP) and the Chilean fishing industry covering the period 2009 – 2013. Both IFOP and the industry have scientific observers programs to monitor the major fisheries in the country. Both sources of information were combined for this analysis. The Chilean EEZ was divided in two areas, South and North of 41°S. Three distinctive fleets conduct trawling activities in the northern region; two crustacean fleets (artisanal and industrial) mostly targeting *Heterocarpus reedi*, *Cervimnida johni* and *Pleuroncodes monodon* and a demersal fleet that targets both crustaceans and whitefish (mainly *Merluccius gayi gayi*). Fleets operating in the northern region always use bottom contact gear. In the southern region two trawling fleets (composed of freezer and factory vessels) capture a diverse group of species, switching between pelagic and bottom trawling depending on the target species (*Macruronus magellanicus, Micromesistius australis, Merluccius australis and Brama australis*). The gear associated with each tow is not systematically recorded and we inferred it based on the catch composition. Expert opinion was used to distinguish between pelagic and bottom trawling tows, based on the proportions of the three most abundant species of the catch. To assess data coverage we used ‘per trip’ information provided by the Servicio Nacional de Pesca to estimate the total number of fishing days per métier and compare it with the number of fishing days recorded in the logbook program.

Gear dimensions
Gear dimensions were assigned to individual tows, using different approaches in different regions. The selection of approaches relied on regional knowledge of the fisheries and the approaches used to classify fleets. In some regions observer programs provided vessel-by-vessel data for a large fraction of the fleet (e.g South Africa or the West Coast of the US groundfish fishery) and these data were applied to the fleet. However, for most regions, vessel by vessel data were not available and fleets with similar characteristics were identified (in relation to the gear type, type of fishing operation and target species) and regional observations of gears or gear and vessel size relationships were used to assign or estimate the gear width (e.g. reference S12). For example, in Argentina and Chile, we held workshops with fishers and fishing gear experts to define fleet strata and obtain average gear width values for each fleet. Similar approaches to obtain generic values for vessel/fleet groups were used in Australia, Alaska and New Zealand (e.g. reference S9). Gear dimensions were highly variable between regions and fisheries (Table S1) reflecting the diversity of fisheries using towed bottom gears and included in our analysis and emphasizing the importance of obtaining information on gear dimensions when seeking to estimate trawling footprints.

Table S1: Gear dimensions by fleet. We provide either mean values or a range by fleet, depending on data availability and the method used to assign a gear dimensions to individual tows (see also Text S2).

Region	**Fleet**	**Gear width (m)**
Argentina	hake and mixed-fish trawlers	135 – 160
Argentina	hake freezer trawlers	235
Argentina	mixed-fish coastal trawlers	50
Argentina	prawn trawlers	30
Argentina	prawn coastal trawlers	8 – 16
Argentina	scallop trawlers	40
Argentina	southern demersal trawlers	200
Australia	fish trawlers	100
Australia	prawn trawlers	20 – 32
Australia	scallop dredgers	4.5
Australia	scallop trawlers	26
Chile	crustaceans artisanal trawlers	24
Chile	crustaceans industrial trawlers	24 – 36
Chile	demersal large trawlers	92
Chile	demersal small trawlers	53
Chile	southern demersal trawlers	92 – 95
Europe	cod, plaice and Norway pout trawlers	50 – 200
Europe	sea-snail beam trawlers	3 – 6
Europe	*Crangon* beam trawlers	14 – 20
Europe	crustaceans otter trawlers	25 – 150
Europe	Danish seiners	5 – 7
Europe	mixed benthic species trawlers	110 – 220
Europe	mixed bentho-pelagic otter trawlers	25 – 120
Europe	mixed-miscellaneous trawlers	75 – 120
Europe	mixed-shrimp otter trawlers	60 – 120
Europe	*Nephrops* and demersal otter trawlers	60 – 200
Europe	scallop and mussel dredges	5 – 30
Europe	Scottish seiners	5
Europe	sole and plaice beam trawlers	10 – 25
Europe	sprat and sandeel otter trawlers	75 – 110
Namibia	monk and hake bottom trawl	160
New Zealand	barracouta, oreo, orange roughy and southern blue whiting trawlers	150
New Zealand	bluenose, alfonsino and red cod trawlers	100
New Zealand	hoki and hake trawlers	200
New Zealand	scampi and ling trawlers	70
South Africa	hake trawlers	60 – 170
United States	Alaska bottom trawlers	90 – 166
United States	Alaska pelagic trawlers	75 – 136
United States	Alaska rough bottom trawlers	50
United States	West Coast groundfish trawlers	30 – 130

Text S3. Areas with low coverage

We excluded eight regions from the main analysis due to low coverage of total bottom fishing activity (<70%, Table S2). These regions were almost exclusively in Europe where a few major fishing nations, including France and Spain, did not report VMS data. The only region we studied outside Europe and where coverage was <70% was Chile, where low observer coverage in most fleets led to limited information on fishing locations. Despite the low coverage of total activity the percentage of the area of regions impacted by trawling was still relatively high in the English Channel (38%), the Ionian Sea (26%), the Celtic Sea (33%) and the Western Shelf (31%); Table S2, uniform assumption). In the remaining regions the estimated fraction of the region trawled ranged from 1 – 13%.

Table S2. Summaries of trawling footprint and fisheries data, by region, for depths of 0 – 1000 m, in those regions where coverage of total bottom fishing activity was estimated to be less than 70%. Information in brackets following region names indicates when regions largely follow existing fishery management areas (excluding areas deeper than 1000 m). Region codes are used to identify regions in the figures. Regional swept area ratio (SAR) is the mean annual total area swept by trawls divided by the area of the region to 1000 m depth. Trawling footprints are expressed using the three approaches described in the text: Approach A, cell assumption: summing the area of any grid cells in which any trawling activity is recorded, Approach B, random assumption: assuming Poisson distribution of effort within cells and Approach C, uniform assumption: that trawling is uniformly spread within cells. The percentage of the region accounting for 90% of activity is the sum of the area of the most intensively trawled areas accounting for 90% of total activity divided by the area of the region, with the footprint based, in this calculation, on the uniform assumption. Coverage of trawling activity in each region is estimated from the proportion of total landings or effort attributed to vessels providing VMS or logbook data. The acronyms GFCM and ICES are General Fisheries Commission for the Mediterranean and International Council for the Exploration of the Sea respectively.

Region	Region code	Coverage of total bottom trawling effort (%)	Method to assess coverage	Years included	Area 0-1000 m (10^3 km^2)	Area 0-200 m (10^3 km^2)	Regional swept area ratio (km^2 km^{-2} yr^{-1})	% Area of region trawled (approach A, cell assumption)	% Area of region trawled (approach B, random assumption)	% Area of region trawled (approach C, uniform assumption)	% Area of region accounting for 90% of trawling activity
English Channel (ICES 7d)	25	31	Landings	2010-12	36	36	1.60	70.22	32.67	37.58	22.92
Ionian Sea (GFCM 2.2)	26	50	Landings	2010-12	371	183	0.94	47.38	22.90	26.34	17.18
Celtic Sea (ICES 7e-h)	27	45	Landings	2010-12	174	172	0.80	75.79	27.12	32.71	24.70
Western Shelf (ICES 7b, c, j, k)	28	42	Landings	2010-12	163	83	0.64	72.64	25.72	31.27	24.83
Norwegian Sea (ICES 2a)	29	66	Landings	2010-12	427	90	0.57	26.56	11.24	13.05	7.46
Barents Sea (ICES 1)	30	35	Landings	2010-12	1363	681	0.04	3.51	0.93	1.09	0.73
North Chile	31	35	Effort	2009-13	84	39	0.03	24.90	2.70	3.20	2.86
Bay of Biscay (ICES 8a-d)	32	1.3	Landings	2010-12	123	96	0.02	13.16	1.53	1.81	1.63

Text S4. Swept-area ratios in the Gulf of Mexico

The Gulf of Mexico region was defined as the region to a depth of 1000 m (as determined with GEBCO bathymetry) between 81° W and 97° W which included all 21 Gulf of Mexico statistical subareas (which extend south to 24° N to the east and 26° N to the west). The total management area (sum of areas of subareas) was estimated as 3.09×10^{11} m^2, with the region to 1000 m depth extending to 4.32×10^{11} m^2.

Fishing effort data in days for each of three seasons by depth zone (depths from 0 to >50 fathoms (91.4m) in 5 fathom (9.14m) increments) in each of the 21 Gulf of Mexico statistical subareas were provided by James Nance from NOAA Fisheries. The mean number of trawls pulled by each boat at one time is estimated to be 3.1 (range 2 – 4), with each trawl having a headrope of 42 ft (12.8m). The area of each depth zone was determined from data in reference S10. Information on headrope dimensions was scaled by effort and vessel speed to estimate swept area by subarea. Overall annual mean swept area for the years 2007 – 2009 was 2.78×10^{11} m^2, giving a swept area ratio for the entire region of 0.64 yr^{-1}.

Text S5. Relationship between trawling footprint and fishing intensity on fish stocks

For all regions where stock assessment data were available for species targeted by bottom trawl fisheries we attempted to estimate the sustainability of fishing rates on those stocks. A fished stock is usually defined as subject to overfishing if it is exploited at a rate that jeopardizes its ability to produce high and sustainable yield over the long-term (Maximum Sustainable Yield, MSY). Exploitation intensity can be expressed both as an instantaneous fishing mortality rate (F, yr^{-1}) and as a harvest rate (catch/ biomass, dimensionless). Although management strategies based on F_{MSY} have been widely adopted by fisheries agencies the estimation of MSY-based reference points can be challenging. Consequently, scientific advice may rely on F_{MSY} proxies. The relative magnitude of F relative to the target fishing mortality (F/F_{MSY} or a proxy) is widely accepted and used as an indicator of exploitation status. This relationship between exploitation status and trawling intensity was assessed for 87 stocks (Table S3). In most cases (n=59) the indicator of fishing mortality was a harvest rate (U).

For each one of the 23 areas with high coverage of trawling activity (>70%), data on the intensity of the fishing pressure for stocks targeted by bottom contact fishing gears was obtained from the RAM Legacy database (Version 4.30; http://ramlegacy.org; reference S11). RAM Legacy is currently the most comprehensive repository of stock assessment data containing time series of biomass, catches, fishing mortality, recruitment and management reference points for more than 1000 stocks of marine and anadromous fishes. Stocks were included in the analyses when: (1) both trawl footprint data and a fishing mortality reference point were available for the period 2008 – 2010; (2) the spatial distribution of the stock matched at least one of the regions with high coverage (>70%) of trawling activity; (3) the largest proportion of landings from the stock, by gear, is taken with bottom trawls.

Stock assessments are conducted at geographic scales that span the spatial distribution of the stock or for well-defined jurisdictional management areas which do not necessarily match our spatial definition of study regions. In those cases where the geographic extension of the assessment was larger than the pre-defined regions used for the analysis of bottom trawling activity the stock was assigned to one of our study regions based on location of the majority of the catches and/ or information on the spatial distribution of the population. The criteria followed to assign a stock to a study region are not unambiguous owing to seasonal changes in distribution and differing scales and resolutions of catch reporting and stock assessment. However, adjacent regions used in the trawling activity analysis did tend to have similar SAR (Table 1, Fig. 2 main paper), and this would substantially reduce the impact of any classification errors on the overall relationship between trawling intensity and exploitation status. Two examples where stock assessments are conducted at larger spatial scales than our study regions are Alaska and Europe, where mean swept area ratios were among the lowest and largest respectively. Considering the large variability in the stock status at the continent level (y-axis), errors in spatial classification (x-axis) do not affect our conclusion that the regions where fishing mortalities are closer to target rates have lower swept area ratios. Alternatively, stocks have a distribution area smaller than the reporting area. In those cases the SAR for the entire region may not be representative of the fishing intensity exerted on individual stocks. A GIS database containing RAM stocks boundaries compiled by Christopher M. Free is available online (Rutgers University; https://marine.rutgers.edu/~cfree/ram-legacy-stock-boundary-database). Although this database is comprehensive, we worked with the latest update of the RAM legacy database, so not all the stocks included in our analysis have geographic distribution data (4 of 68 with no distribution data). We calculated the proportion of the total reporting area (0 – 1000 m depth) occupied for each stock. To test the sensitivity of our conclusions to geographical mismatches we repeated the analysis only for those stocks for which the overlap between the distribution range and the reporting area was higher than 50% of 70 %. When we set these constraints on overlap, the overall relationships between exploitation status and SAR (Fig. S40, S41) or exploitation status and footprint (Fig. S42, S43) do not change substantially and the thresholds for SAR or footprint, beyond which relatively few stocks met international sustainability benchmarks for fish stocks, remain close to 0.25 and 0.11 respectively.

Table S3. Stocks included in the analysis of relationships between relative fishing mortality rates (F/F_{MSY}), regional swept area ratio (SAR), trawling footprint (FP, estimated with the uniform approach C, main paper) and spatial overlap (SO).

Region	Stock	Latin binomial	F/F_{msy}	SAR	FP (%)	SO (%)
Adriatic Sea (GFCM 2.1)	common sole	*Solea solea*	4.14	7.93	80.7	42.2
Adriatic Sea (GFCM 2.1)	hake	*Merluccius merluccius*	8.48	7.93	80.7	28.3
Adriatic Sea (GFCM 2.1)	red mullet	*Mullus barbatus*	1.75	7.93	80.7	28.3
Skagerrak and Kattegat (ICES 3a)	Atlantic cod	*Gadus morhua*	3.86	3.33	54.4	NA
Skagerrak and Kattegat (ICES 3a)	Atlantic cod	*Gadus morhua*	1.60	3.33	54.4	NA
North Sea (ICES 4a, b, c)	common sole	*Solea solea*	2.21	1.19	51.7	NA
North Sea (ICES 4a, b, c)	European Plaice	*Pleuronectes platessa*	1.24	1.19	51.7	NA
North Sea (ICES 4a, b, c)	hake	*Merluccius merluccius*	1.67	1.19	51.7	NA
North Sea (ICES 4a, b, c)	Norway lobster	*Nephrops norvegicus*	1.04	1.19	51.7	NA
North Sea (ICES 4a, b, c)	Norway lobster	*Nephrops norvegicus*	1.36	1.19	51.7	NA
North Sea (ICES 4a, b, c)	Norway lobster	*Nephrops norvegicus*	1.13	1.19	51.7	NA
Tyrrhenian Sea (GFCM 1.3)	blue whiting	*Micromesistius poutassou*	1.71	2.29	49.9	69.1
Tyrrhenian Sea (GFCM 1.3)	giant red shrimp	*Aristaeomorpha foliacea*	0.37	2.29	49.9	27.8
Tyrrhenian Sea (GFCM 1.3)	giant red shrimp	*Aristaeomorpha foliacea*	2.13	2.29	49.9	19.9
Tyrrhenian Sea (GFCM 1.3)	giant red shrimp	*Aristaeomorpha foliacea*	1.34	2.29	49.9	69.1
Tyrrhenian Sea (GFCM 1.3)	hake	*Merluccius merluccius*	5.00	2.29	49.9	31.0
Tyrrhenian Sea (GFCM 1.3)	Norway lobster	*Nephrops norvegicus*	1.81	2.29	49.9	69.1
Tyrrhenian Sea (GFCM 1.3)	red mullet	*Mullus barbatus*	5.40	2.29	49.9	NA
Tyrrhenian Sea (GFCM 1.3)	red mullet	*Mullus barbatus*	1.15	2.29	49.9	69.1
Tyrrhenian Sea (GFCM 1.3)	red mullet	*Mullus barbatus*	2.74	2.29	49.9	27.8
Tyrrhenian Sea (GFCM 1.3)	spottail mantis shrimp	*Squilla mantis*	2.31	2.29	49.9	69.1
Tyrrhenian Sea (GFCM 1.3)	surmullet	*Mullus surmuletus*	2.10	2.29	49.9	69.1
Irish Sea (ICES 7a)	Atlantic cod	*Gadus morhua*	3.29	1.46	28.5	99.4
Irish Sea (ICES 7a)	common sole	*Solea solea*	1.64	1.46	28.5	99.4
Irish Sea (ICES 7a)	Norway lobster	*Nephrops norvegicus*	0.61	1.46	28.5	NA
Irish Sea (ICES 7a)	Norway lobster	*Nephrops norvegicus*	1.07	1.46	28.5	NA
Argentina	Argentine hake	*Merluccius hubbsi*	2.23	0.28	17.6	79.8
Argentina	Patagonian grenadier	*Macruronus magellanicus*	1.31	0.28	17.6	78.6
South Benguela Current	shallow-water cape hake	*Merluccius capensis*	0.25	0.44	13.8	20.2
East Agulhas Current	deep-water cape hake	*Merluccius paradoxus*	0.70	0.25	11.1	16.7
East Bering Sea	Alaska plaice	*Pleuronectes quadrituberculatus*	0.20	0.09	7.9	91.4
East Bering Sea	arrowtooth flounder	*Reinhardtius stomias*	0.08	0.09	7.9	81.0
East Bering Sea	Atka mackerel	*Pleurogrammus monopterygius*	0.61	0.09	7.9	38.3
East Bering Sea	Dover sole	*Microstomus pacificus*	0.06	0.09	7.9	NA
East Bering Sea	flathead sole	*Hippoglossoides elassodon*	0.18	0.09	7.9	88.7
East Bering Sea	northern rock sole	*Lepidopsetta polyxystra*	0.35	0.09	7.9	87.8
East Bering Sea	northern rockfish	*Sebastes polyspinis*	0.31	0.09	7.9	38.5
East Bering Sea	Pacific Ocean perch	*Sebastes alutus*	0.39	0.09	7.9	47.6
East Bering Sea	rougheye rockfish	*Sebastes aleutianus*	0.46	0.09	7.9	35.1
East Bering Sea	walleye pollock	*Theragra chalcogramma*	0.39	0.09	7.9	78.1
East Bering Sea	yellowfin sole	*Limanda aspera*	0.73	0.09	7.9	94.7
North California Current	arrowtooth flounder	*Reinhardtius stomias*	0.50	0.08	6.9	25.2
North California Current	aurora rockfish	*Sebastes aurora*	0.72	0.08	6.9	NA
North California Current	black rockfish	*Sebastes melanops*	1.16	0.08	6.9	NA

North California Current	black rockfish	*Sebastes melanops*	0.73	0.08	6.9	NA
North California Current	black rockfish	*Sebastes melanops*	0.91	0.08	6.9	NA
North California Current	blackgill rockfish	*Sebastes melanostomus*	0.42	0.08	6.9	37.9
North California Current	bocaccio	*Sebastes paucispinis*	0.12	0.08	6.9	28.8
North California Current	brown rockfish	*Sebastes auriculatus*	0.63	0.08	6.9	NA
North California Current	California scorpionfish	*Scorpaena guttata*	0.31	0.08	6.9	41.3
North California Current	Canary rockfish	*Sebastes pinniger*	0.07	0.08	6.9	37.9
North California Current	chilipepper	*Sebastes goodei*	0.15	0.08	6.9	25.2
North California Current	China rockfish	*Sebastes nebulosus*	0.74	0.08	6.9	NA
North California Current	China rockfish	*Sebastes nebulosus*	0.51	0.08	6.9	NA
North California Current	China rockfish	*Sebastes nebulosus*	1.30	0.08	6.9	NA
North California Current	copper rockfish	*Sebastes caurinus*	0.24	0.08	6.9	NA
North California Current	cowcod	*Sebastes levis*	0.00	0.08	6.9	41.3
North California Current	darkblotched rockfish	*Sebastes crameri*	0.73	0.08	6.9	37.9
North California Current	Dover sole	*Microstomus pacificus*	0.13	0.08	6.9	37.9
North California Current	English sole	*Parophrys vetulus*	0.09	0.08	6.9	37.9
North California Current	greenspotted rockfish	*Sebastes chlorostictus*	0.01	0.08	6.9	26.4
North California Current	greenspotted rockfish	*Sebastes chlorostictus*	0.13	0.08	6.9	41.3
North California Current	greenstriped rockfish	*Sebastes elongatus*	0.01	0.08	6.9	41.3
North California Current	lingcod	*Ophiodon elongatus*	0.25	0.08	6.9	16.8
North California Current	lingcod	*Ophiodon elongatus*	0.09	0.08	6.9	31.8
North California Current	longspine thornyhead	*Sebastolobus altivelis*	0.29	0.08	6.9	41.3
North California Current	Pacific hake	*Merluccius productus*	0.70	0.08	6.9	41.3
North California Current	Pacific ocean perch	*Sebastes alutus*	0.31	0.08	6.9	41.3
North California Current	petrale sole	*Eopsetta jordani*	1.12	0.08	6.9	41.3
North California Current	rex sole	*Glyptocephalus zachirus*	0.26	0.08	6.9	NA
North California Current	sablefish	*Anoplopoma fimbria*	0.97	0.08	6.9	41.3
North California Current	sharpchin rockfish	*Sebastes zacentrus*	0.01	0.08	6.9	NA
North California Current	shortspine thornyhead	*Sebastolobus alascanus*	0.60	0.08	6.9	37.9
North California Current	splitnose Rockfish	*Sebastes diploproa*	0.06	0.08	6.9	37.9
North California Current	widow rockfish	*Sebastes entomelas*	0.04	0.08	6.9	37.9
North California Current	yelloweye rockfish	*Sebastes ruberrimus*	0.32	0.08	6.9	37.9
North California Current	yellowtail rockfish	*Sebastes flavidus*	0.20	0.08	6.9	16.1
Aleutian Islands	walleye pollock	*Theragra chalcogramma*	0.03	0.03	2.1	31.4
Gulf of Alaska	arrowtooth flounder	*Atheresthes stomias*	0.05	0.02	1.7	69.8
Gulf of Alaska	dusky rockfish	*Sebastes variabilis*	0.61	0.02	1.7	73.9
Gulf of Alaska	flathead sole	*Hippoglossoides elassodon*	0.04	0.02	1.7	73.9
Gulf of Alaska	northern rockfish	*Sebastes polyspinis*	0.38	0.02	1.7	71.8
Gulf of Alaska	Pacific cod	*Gadus macrocephalus*	0.49	0.02	1.7	76.5
Gulf of Alaska	Pacific ocean perch	*Sebastes alutus*	0.47	0.02	1.7	74.6
Gulf of Alaska	rex sole	*Glyptocephalus zachirus*	0.68	0.02	1.7	86.1
Gulf of Alaska	rougheye rockfish	*Sebastes aleutianus*	0.21	0.02	1.7	75.8
Gulf of Alaska	walleye pollock	*Theragra chalcogramma*	0.29	0.02	1.7	68.7

S6. Supplemental references

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S9. Black J et al. (2013) *Monitoring New Zealand's trawl footprint for deepwater fisheries*: 1989-90 to 2009-2010. New Zealand Aquatic Environment and Biodiversity Report No. 110. 57 p.

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S13. National Marine Fisheries Service (2005) *Final environmental impact statement for essential fish habitat identification and conservation in Alaska*. US National Marine Fisheries Service, Alaska Region (Appendix B), 150pp.

Supplemental Figures

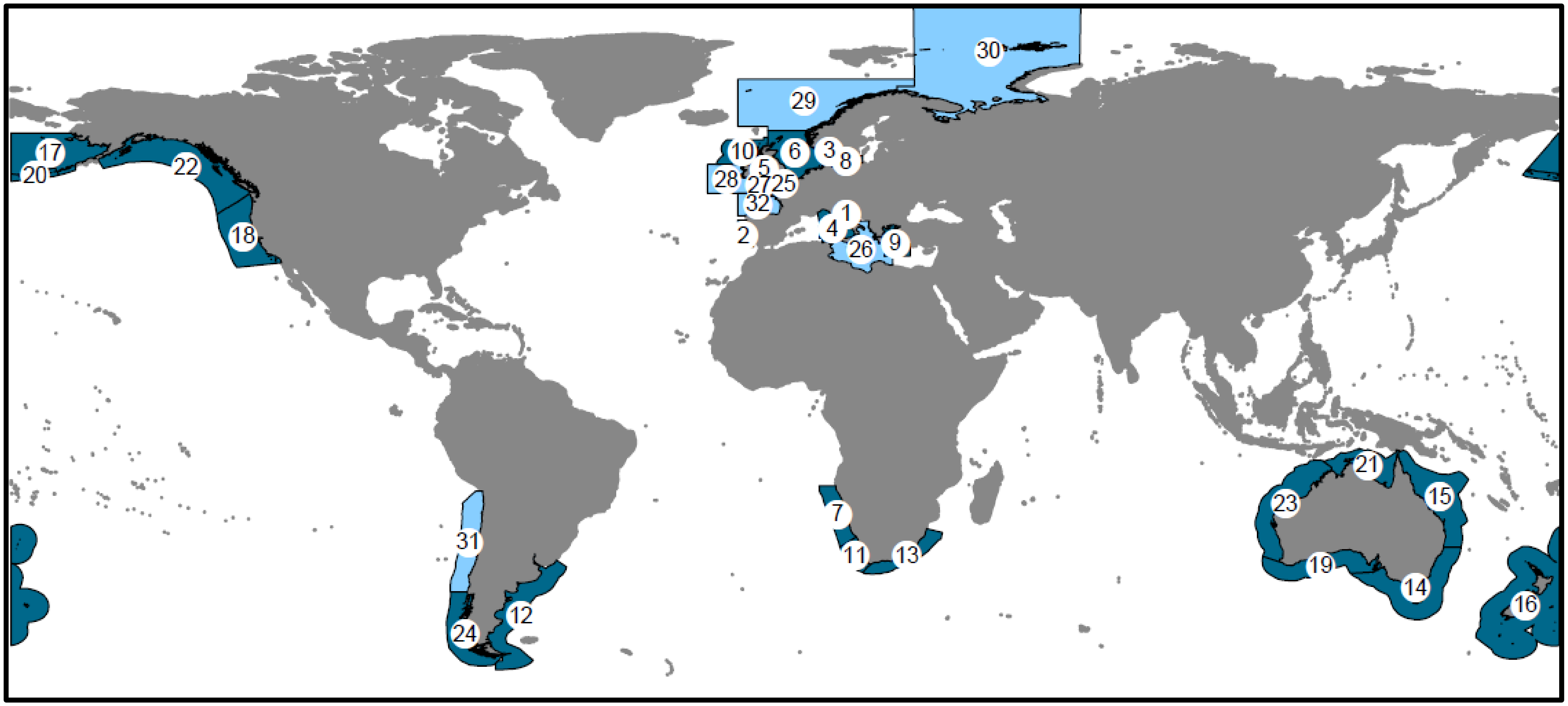


Fig. S1. Location of the 32 regions where high-resolution trawling data were collected: light blue indicates areas with low coverage of activity (≤70%) and dark blue indicates areas where coverage exceeded 70%. Regions are 1: Adriatic Sea (GFCM 2.1), 2: West of Iberia (ICES 9a), 3: Skagerrak and Kattegat (ICES 3a), 4: Tyrrhenian Sea (GFCM 1.3), 5: Irish Sea (ICES 7a), 6: North Sea (ICES 4a,b,c), 7: North Benguela Current, 8: Western Baltic Sea (ICES 23 – 25), 9: Aegean Sea (GFCM 3.1), 10: West of Scotland (ICES 6a), 11: South Benguela Current, 12: Argentina, 13: East Agulhas Current, 14: Southeast Australian Shelf, 15: Northeast Australian Shelf, 16: New Zealand, 17: East Bering Sea, 18: North California Current, 19: Southwest Australian Shelf, 20: Aleutian Islands, 21: North Australian Shelf, 22: Gulf of Alaska, 23: Northwest Australian Shelf, 24: South Chile, 25: English Channel (ICES 7d), 26: Ionian Sea (GFCM 2.2), 27: Celtic Sea (ICES 7e-h), 28: Western Shelf (ICES 7b, c, j, k), 29: Norwegian Sea (ICES 2a), 30: Barents Sea (ICES 1), 31: North Chile, 32: Bay of Biscay (ICES 8a-d) (see Table 1, main paper, and Table S2 for further information). The acronyms GFCM and ICES are General Fisheries Commission for the Mediterranean and International Council for the Exploration of the Sea respectively.

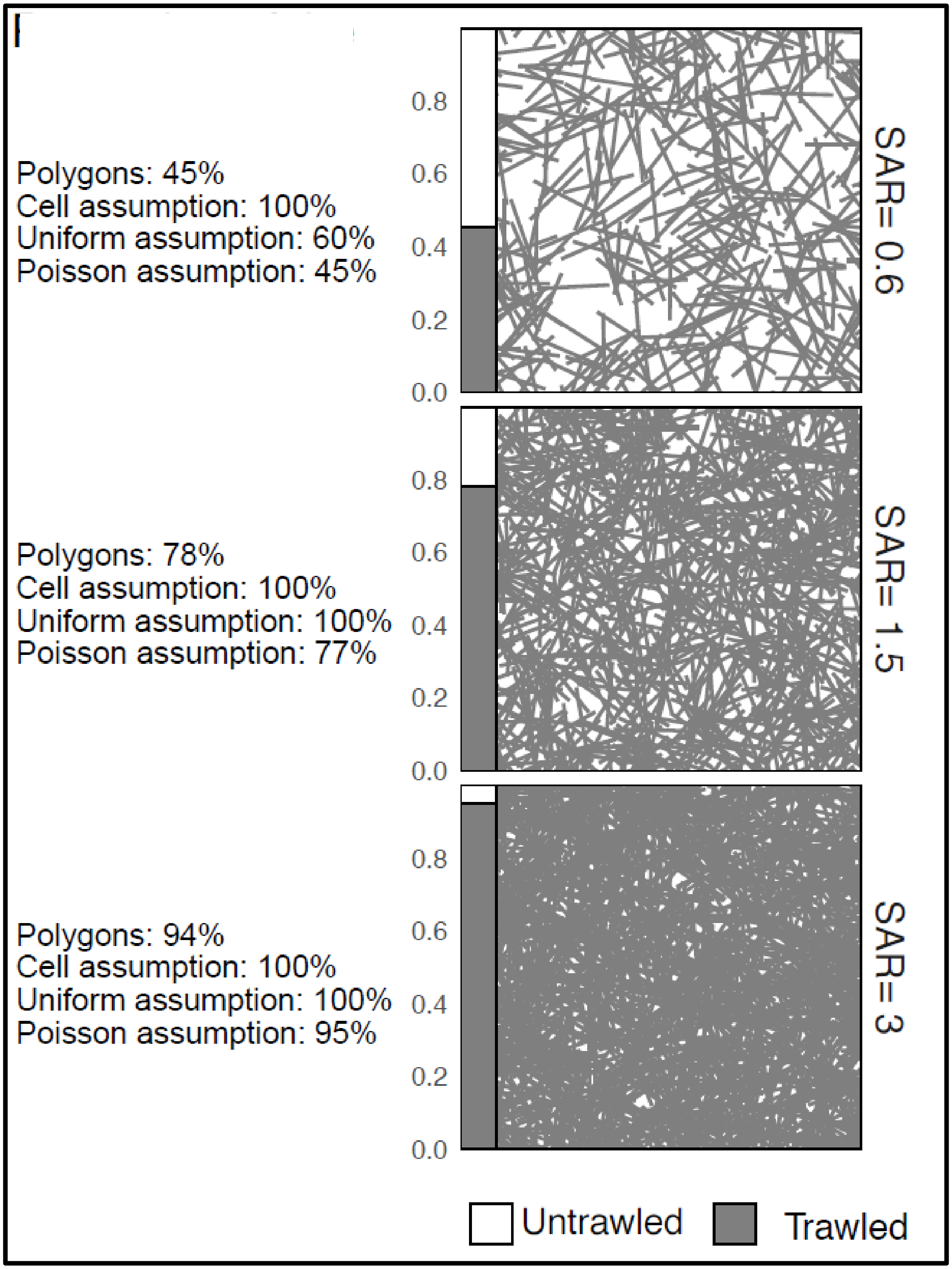


Fig. S2. Simulated randomly distributed tows for three different levels of fishing intensity (as Swept Area Ratio, SAR= 0.6, 1.5 or 3.0). Grey lines are trawl tracks and the bar on the left of each panel indicates the actual area trawled in each cell. The percentage values to the left of the panels indicate the percentage of the area estimated as “trawled” when using the polygon, cell, uniform and Poisson assumptions

Adriatic Sea (GFCM 2.1)
Numeric code 1

Region	Europe
Area 0-200 m (Km^2)	37297
Area 200-1000 m (Km^2)	1869

Years	2010-2012
Percentage of coverage	72%
Contributing countries	Italy
Data type	VMS data. Coverage expressed in landings.

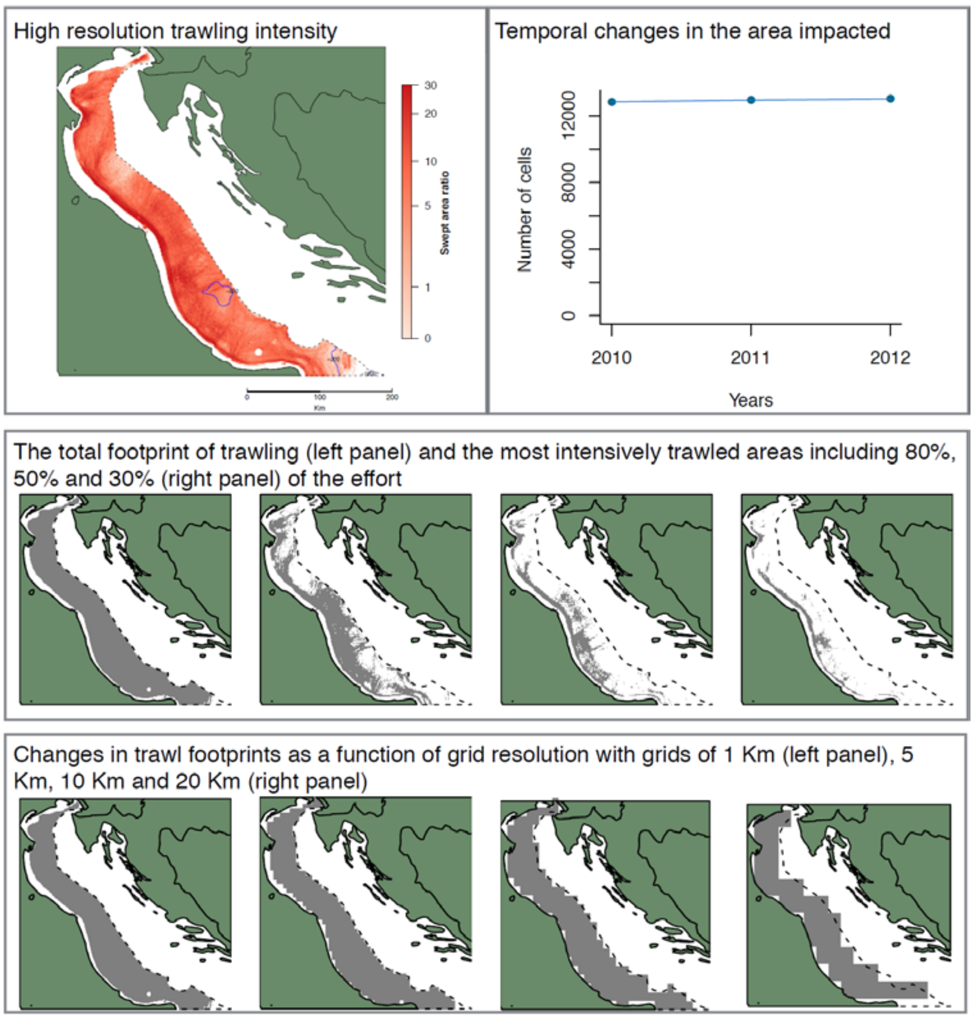


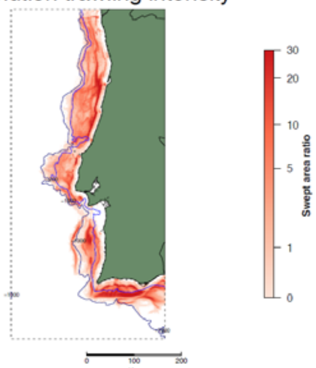
Fig. S3. Distribution and analyses of trawling activity data for the Adriatic Sea (GFCM 2.1; region code=1). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

West of Iberia (ICES 9a)
Numeric code 2

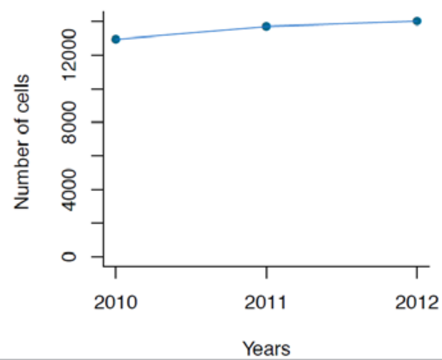
Region	Europe
Area 0-200 m (Km^2)	23238
Area 200-1000 m (Km^2)	17064

Years	2010-2012
Percentage of coverage	81%
Contributing countries	Portugal
Data type	VMS data. Coverage expressed in effort.

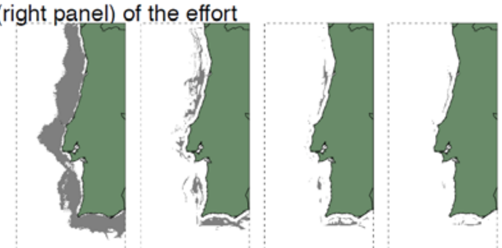
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

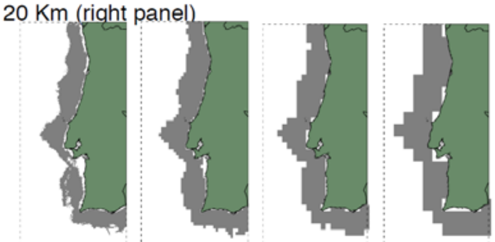


Fig. S4. Distribution and analyses of trawling activity data for West of Iberia (ICES 9a; region code=2). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Skagerrak and Kattegat (ICES 3a)
Numeric code 3

Region	Europe	**Years**	2010-2012
Area 0-200 m (Km²)	41389	**Percentage of coverage**	100%
Area 200-1000 m (Km²)	13743	**Contributing countries**	Norway, Sweden, Belgium, Netherlands, and Denmark
		Data type	VMS data. Coverage expressed in landings.

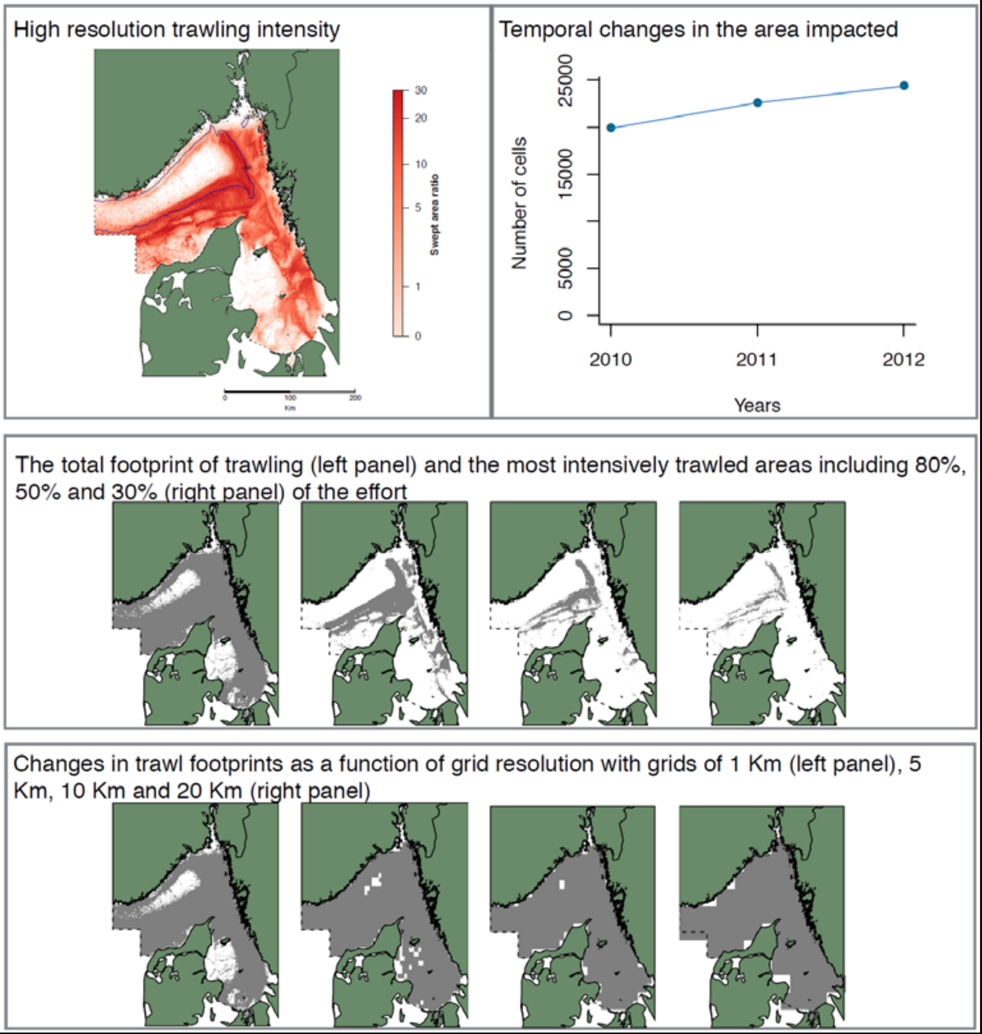


Fig. S5. Distribution and analyses of trawling activity data for the Skagerrak and Kattegat (ICES 3a; region code=3). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Tyrrhenian Sea (GFCM 1.3)
Numeric code 4

Region	Europe
Area 0-200 m (Km²)	53281
Area 200-1000 m (Km²)	85379

Years	2010-2012
Percentage of coverage	82%
Contributing countries	Italy
Data type	VMS data. Coverage expressed in effort.

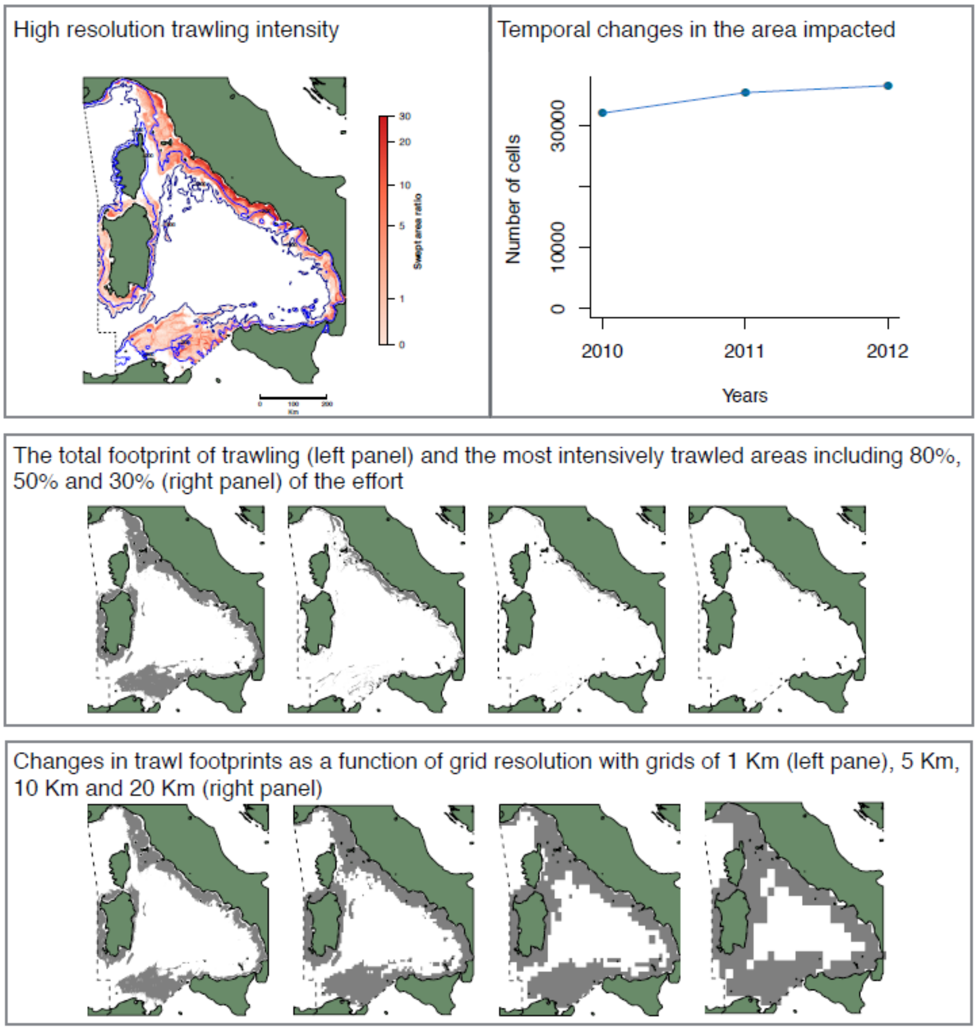


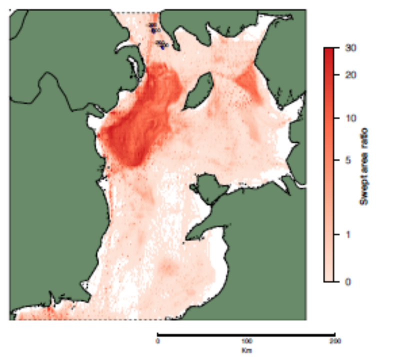
Fig. S6. Distribution and analyses of trawling activity data for the Tyrrhenian Sea (GFCM 1.3; region code=4). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Irish Sea (ICES 7a)
Numeric code 5

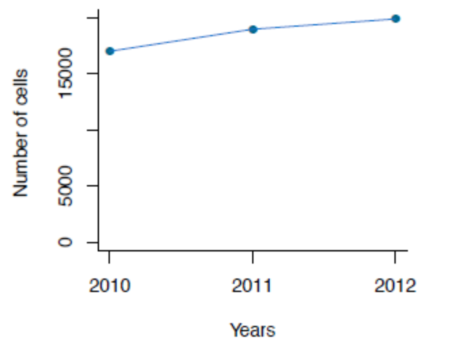
Region	Europe
Area 0-200 m (Km²)	48391
Area 200-1000 m (Km²)	25

Years	2010-2012
Percentage of coverage	83%
Contributing countries	United Kingdom and Republic of Ireland.
Data type	VMS data. Coverage expressed in effort.

High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

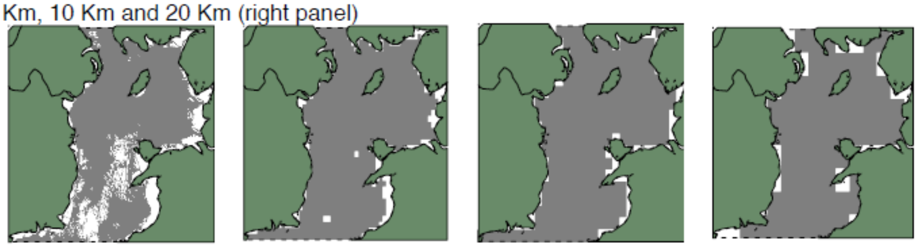


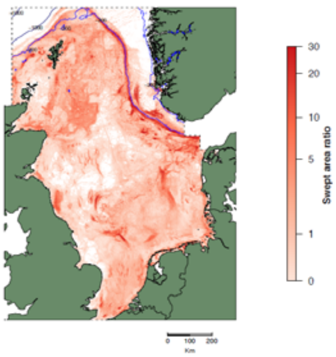
Fig. S7. Distribution and analyses of trawling activity data for the Irish Sea (ICES 7a; region code=5). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

North Sea (ICES 4a,b,c)
Numeric code 6

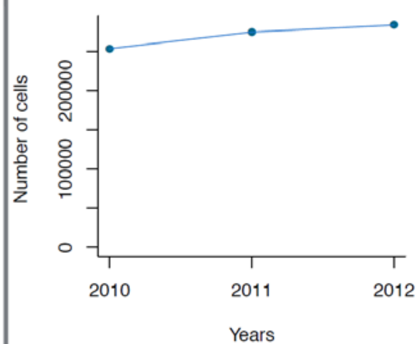
Region	Europe
Area 0-200 m (Km²)	526250
Area 200-1000 m (Km²)	63372

Years	2010-2012
Percentage of coverage	85.5%
Contributing countries	United Kingdom, Norway,Denmark, Netherlands, Belgium and Germany
Data type	VMS data. Coverage expressed in catch

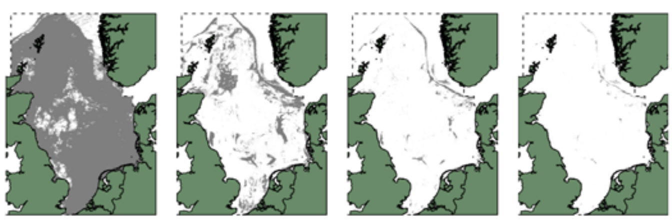
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

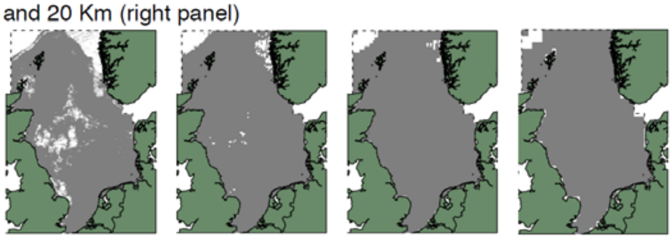


Fig. S8. Distribution and analyses of trawling activity data for the North Sea (ICES 4a,b,c; region code=6). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

North Benguela Current
Numeric code 7

Region	Africa
Area 0-200 m (Km²)	92064
Area 200-1000 m (Km²)	110938

Years	2008-2010
Percentage of coverage	95%
Contributing countries	Namibia
Data type	Logbook data. Coverage expressed in effort.

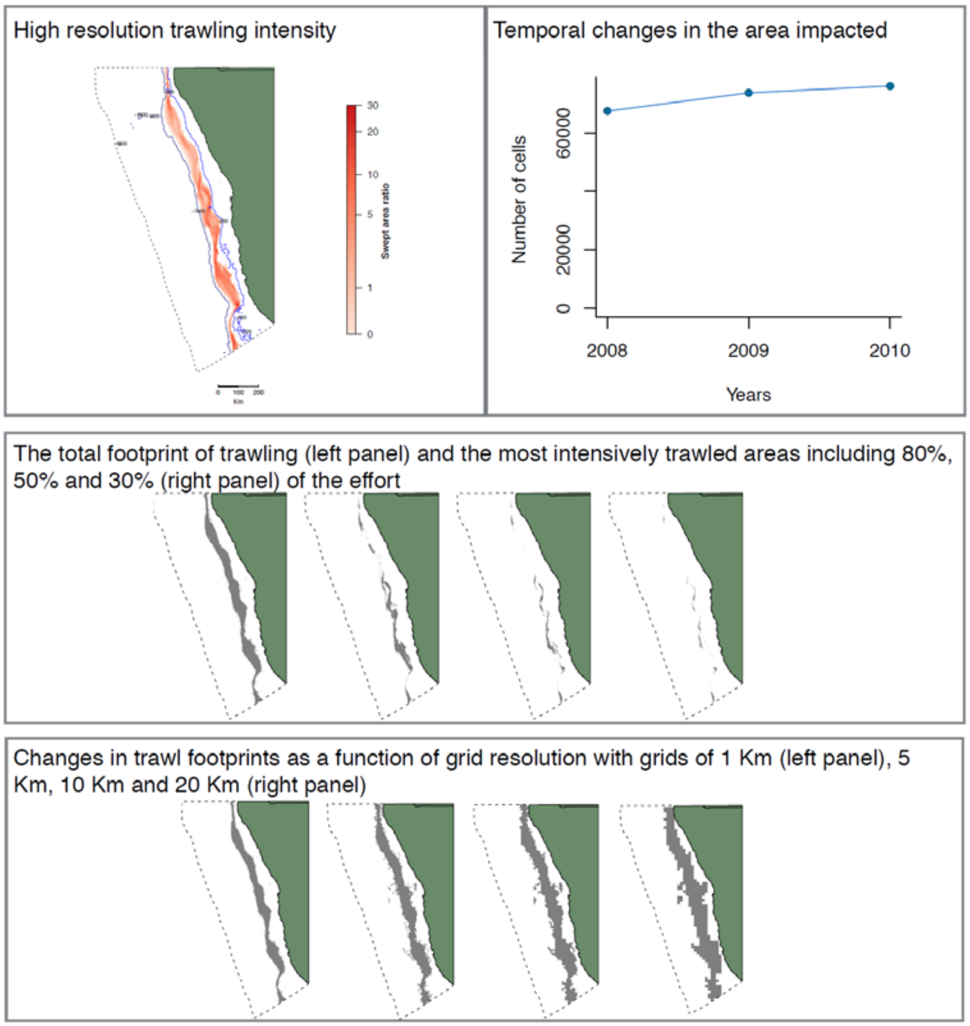


Fig. S9. Distribution and analyses of trawling activity data for the North Benguela Current (region code=7). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

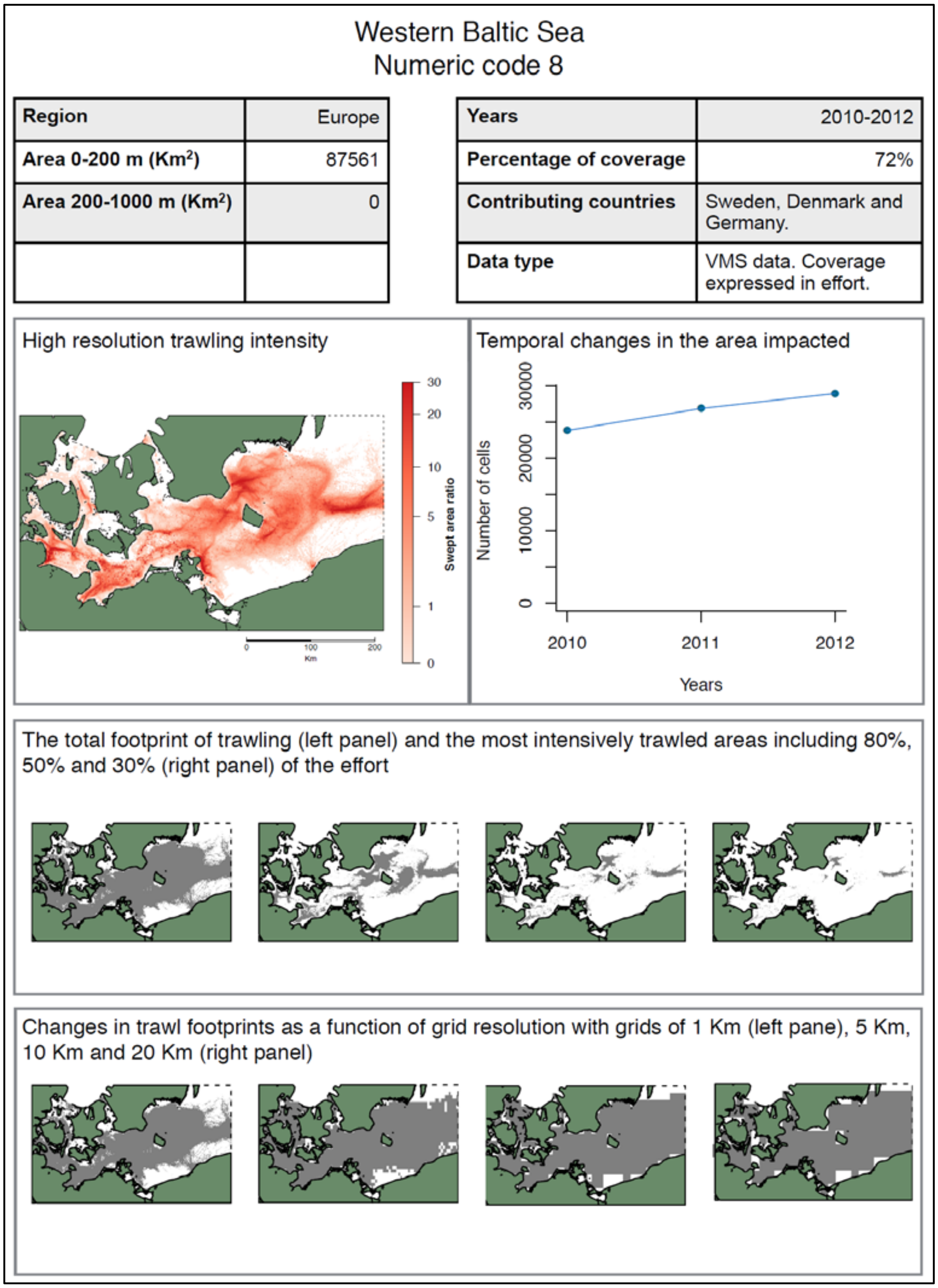


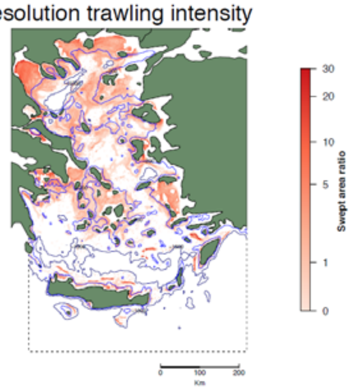
Fig. S10. Distribution and analyses of trawling activity data for the Western Baltic Sea (ICES 23 – 25; region code=8). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Aegean Sea (GFCM 3.1)
Numeric code 9

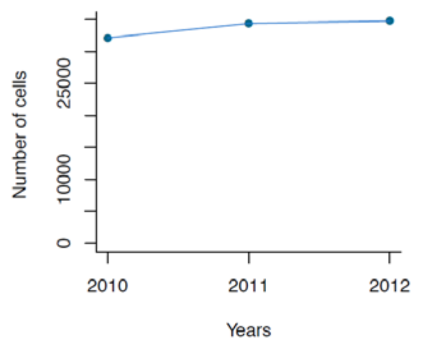
Region	Europe
Area 0-200 m (Km²)	64711
Area 200-1000 m (Km²)	188129

Years	2010-2012
Percentage of coverage	75%
Contributing countries	Greece
Data type	VMS data. Coverage expressed in landings.

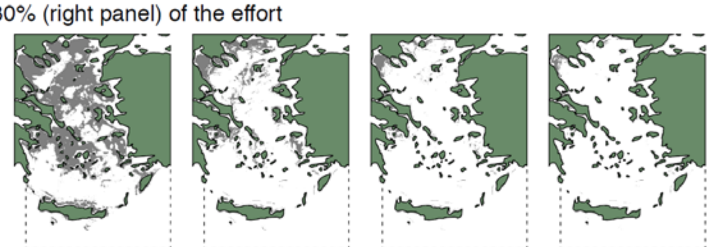
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

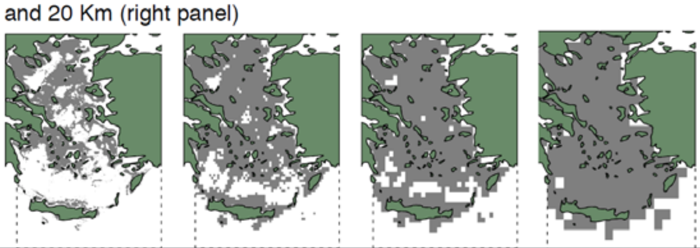


Fig. S11. Distribution and analyses of trawling activity data for the Aegean Sea (GFCM 3.1; region code=9). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

West of Scotland (ICES 6a)
Numeric code 10

Region	Europe
Area 0-200 m (Km²)	114511
Area 200-1000 m (Km²)	46826

Years	2010-2012
Percentage of coverage	81%
Contributing countries	United Kingdom and Ireland
Data type	VMS data. Coverage expressed in effort.

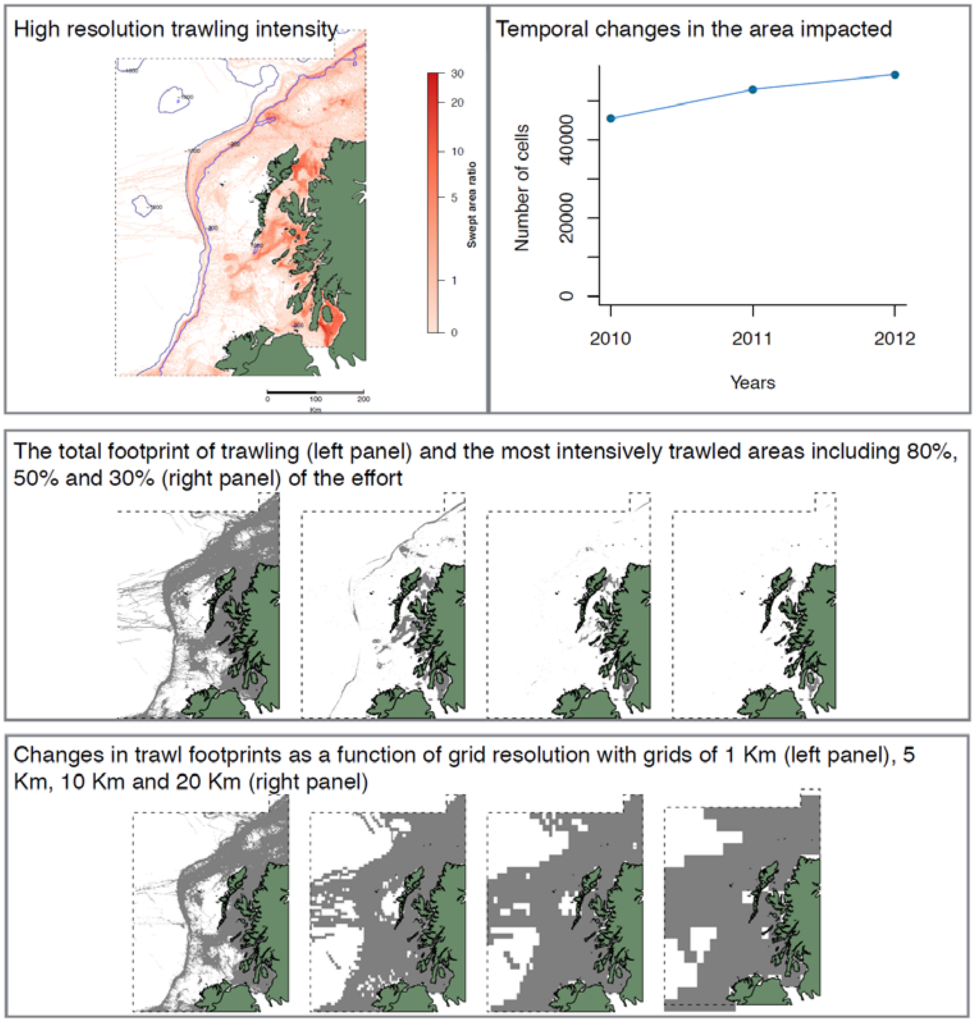


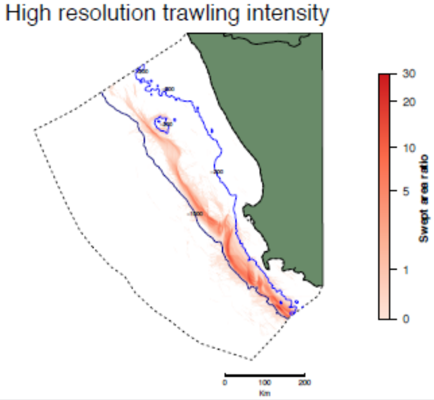
Fig. S12. Distribution and analyses of trawling activity data for the West of Scotland (ICES 6a; region code=10). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

South Benguela Current
Numeric code 11

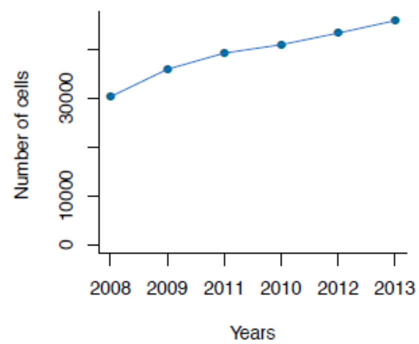
Region	Africa
Area 0-200 m (Km²)	56067
Area 200-1000 m (Km²)	66337

Years	2008-2013
Percentage of coverage	97%
Contributing countries	South Africa
Data type	Logbook data. Coverage expressed in effort.

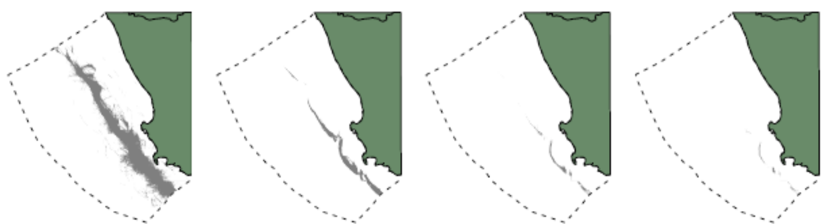
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

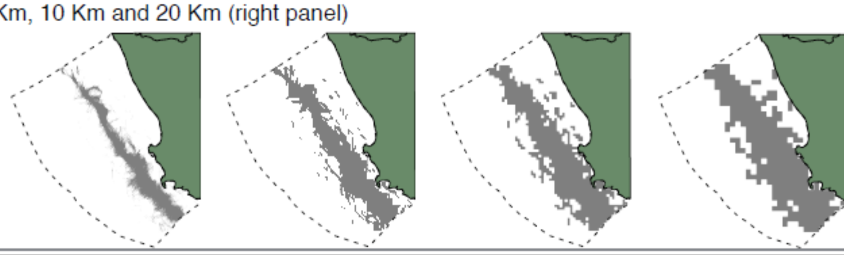


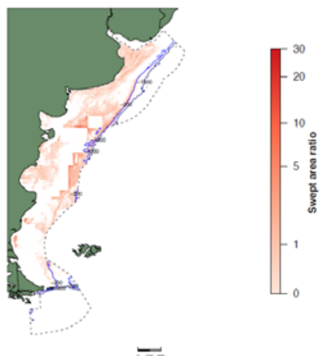
Fig. S13. Distribution and analyses of trawling activity data for the South Benguela Current (region code=11). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Argentina
Numeric code 12

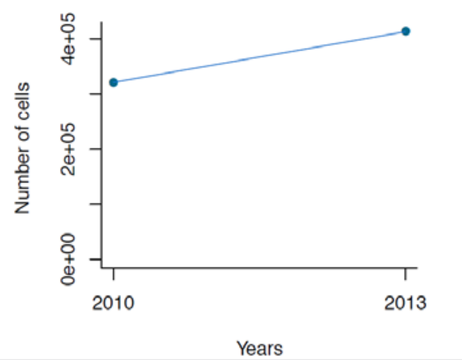
Region	Americas
Area 0-200 m (Km^2)	837043
Area 200-1000 m (Km^2)	73406

Years	2010 and 2013
Percentage of coverage	96%
Contributing countries	Argentina
Data type	VMS data. Coverage expressed in effort

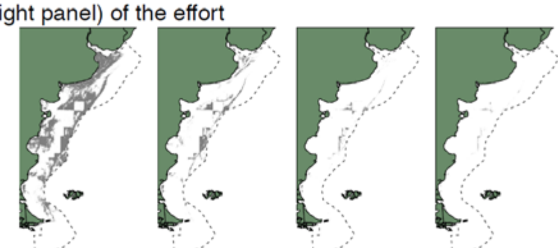
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

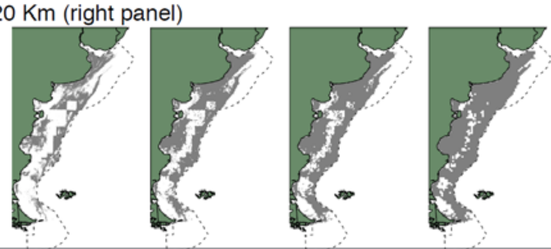


Fig. S14. Distribution and analyses of trawling activity data for Argentina (region code=12). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

East Agulhas Current
Numeric code 13

Region	Africa
Area 0-200 m (Km²)	96470
Area 200-1000 m (Km²)	43082

Years	2008-2013
Percentage of coverage	93%
Contributing countries	South Africa
Data type	Logbook data. Coverage expressed in effort.

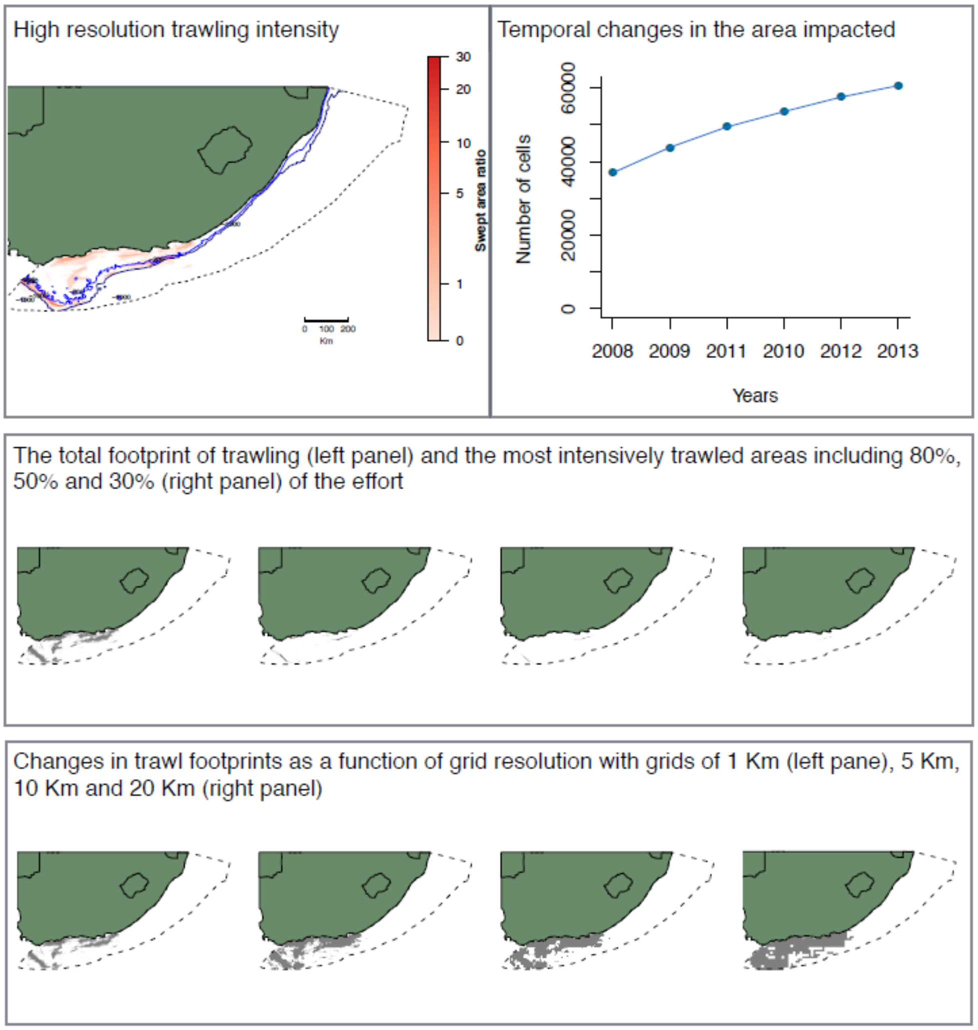


Fig. S15. Distribution and analyses of trawling activity data for the East Agulhas Current (region code=13). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Southeast Australian Shelf
Numeric code 14

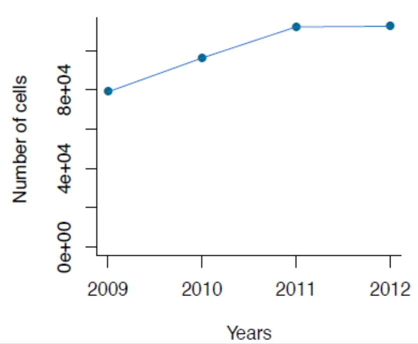
Region	Australasia
Area 0-200 m (Km²)	229945
Area 200-1000 m (Km²)	37841

Years	2009-2012
Percentage of coverage	100
Contributing countries	Australia
Data type	Logbook data and VMS. Coverage expressed in effort

High resolution trawling intensity

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Fig. S16. Distribution and analyses of trawling activity data for the Southeast Australian Shelf (region code=14). The panel beneath the area and methods summary table shows the accumulation of the number of cells where trawling activity was recorded through time. Other information is not presented owing to confidentiality restrictions.

Northeast Australian Shelf
Numeric code 15

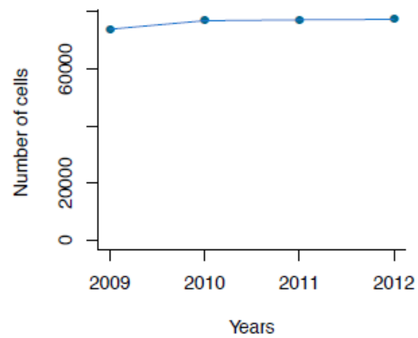
Region	Australasia
Area 0-200 m (Km²)	336530
Area 200-1000 m (Km²)	220092

Years	2009-2012
Percentage of coverage	100
Contributing countries	Australia
Data type	Logbook data. Coverage expressed in catch

High resolution trawling intensity

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Fig. S17. Distribution and analyses of trawling activity data for the Northeast Australian Shelf (region code=15). The panel beneath the area and methods summary table shows the accumulation of the number of cells where trawling activity was recorded through time. Other information is not presented owing to confidentiality restrictions.

New Zealand
Numeric code 16

Region	Australasia	**Years**	2008-2012
Area 0-200 m (Km²)	259701	**Percentage of coverage**	90%
Area 200-1000 m (Km²)	793021	**Contributing countries**	New Zealand
		Data type	Logbook data. Coverage expressed in landings/ effort depending on the depth strata

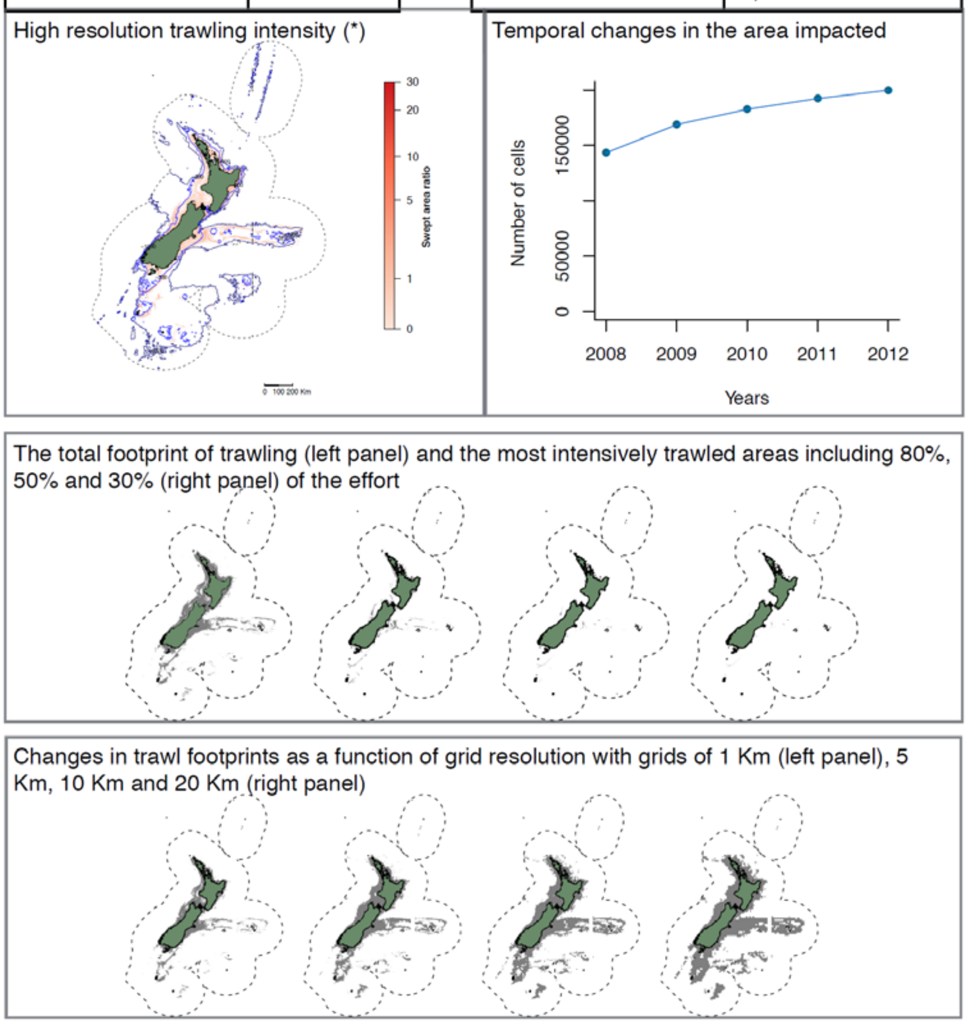


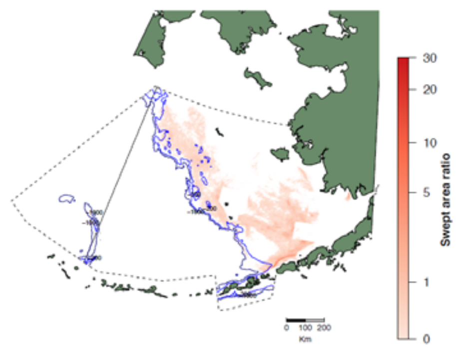
Fig. S18. Distribution and analyses of trawling activity data for the New Zealand (region code=16). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper. Note that the smallest resolution used in the high resolution map is 5 km to meet requirements for data confidentiality.

East Bering Sea
Numeric code 17

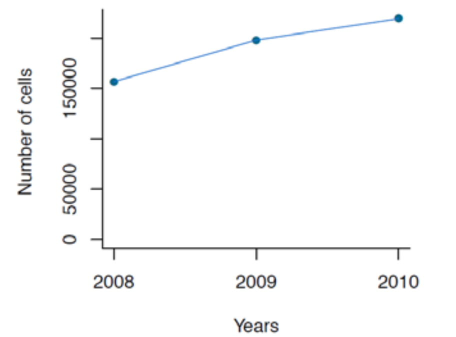
Region	Americas
Area 0-200 m (Km²)	574799
Area 200-1000 m (Km²)	59307

Years	2008-2010
Percentage of coverage	97%
Contributing countries	United States
Data type	VMS data. Coverage expressed in effort.

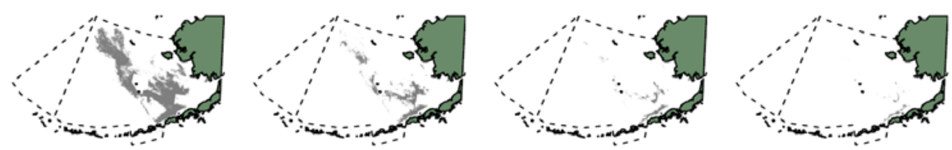
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel s), 5 Km, 10 Km and 20 Km (right panel)

Fig. S19. Distribution and analyses of trawling activity data for the East Bering Sea (region code=17). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

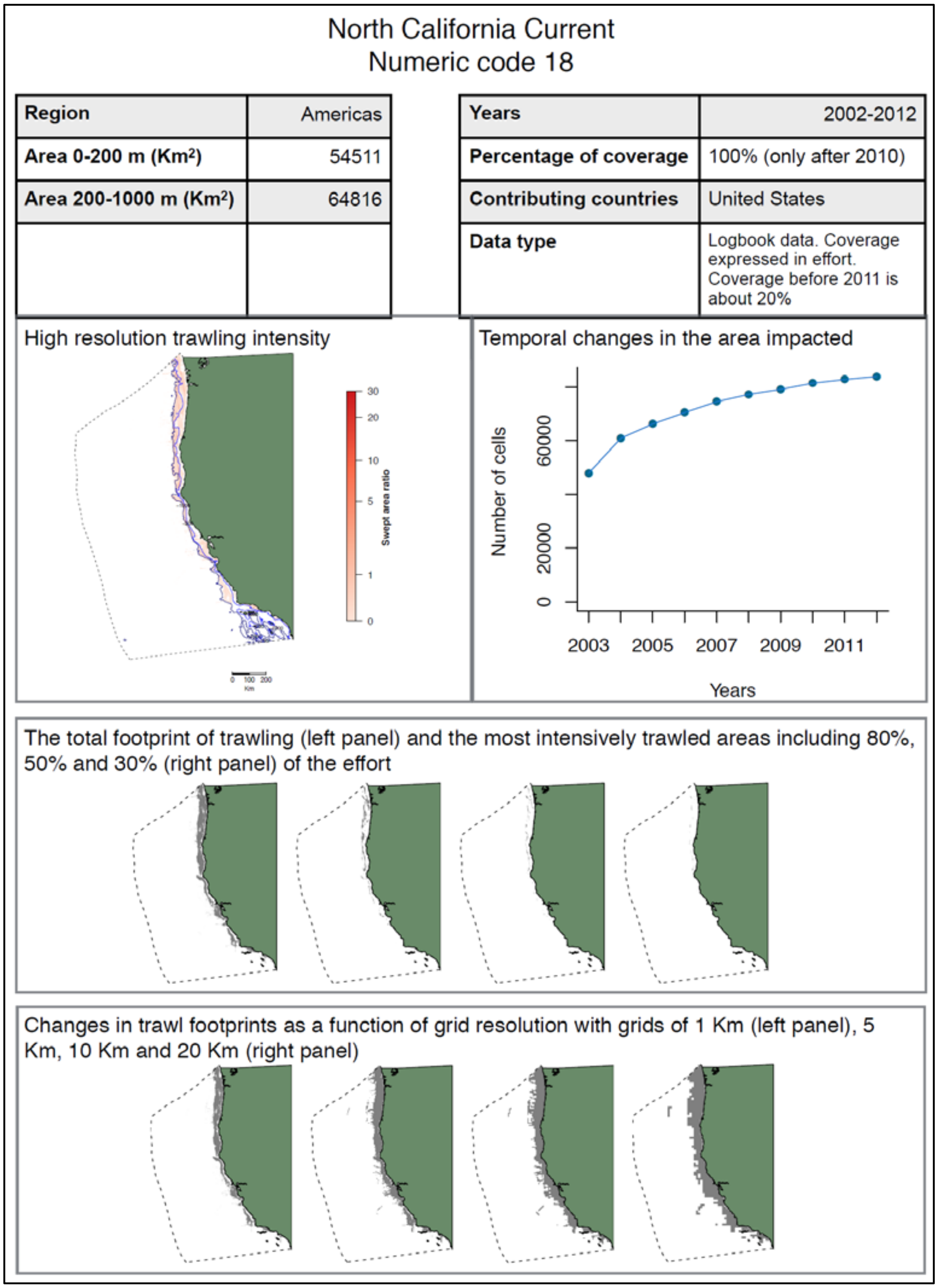


Fig. S20. Distribution and analyses of trawling activity data for the North California Current (region code=18). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Southwest Australian Shelf
Numeric code 19

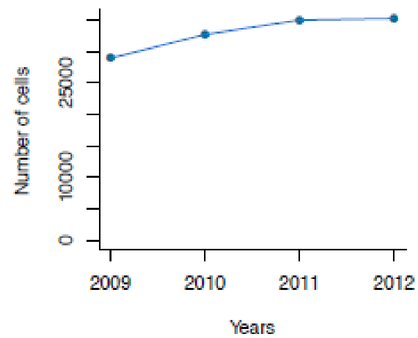
Region	Australasia
Area 0-200 m (Km²)	283117
Area 200-1000 m (Km²)	54887

Years	2009-2012
Percentage of coverage	100%
Contributing countries	Australia
Data type	Logbook data. Coverage expressed in effort.

High resolution trawling intensity

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Fig. S21. Distribution and analyses of trawling activity data for the Southwest Australian Shelf (region code=19). The panel beneath the area and methods summary table shows the accumulation of the number of cells where trawling activity was recorded through time. Other information is not presented owing to confidentiality restrictions.

Aleutian Islands
Numeric code 20

Region	Americas
Area 0-200 m (Km²)	34650
Area 200-1000 m (Km²)	48873

Years	2008-2010
Percentage of coverage	100%
Contributing countries	United States
Data type	VMS data. Coverage expressed in effort.

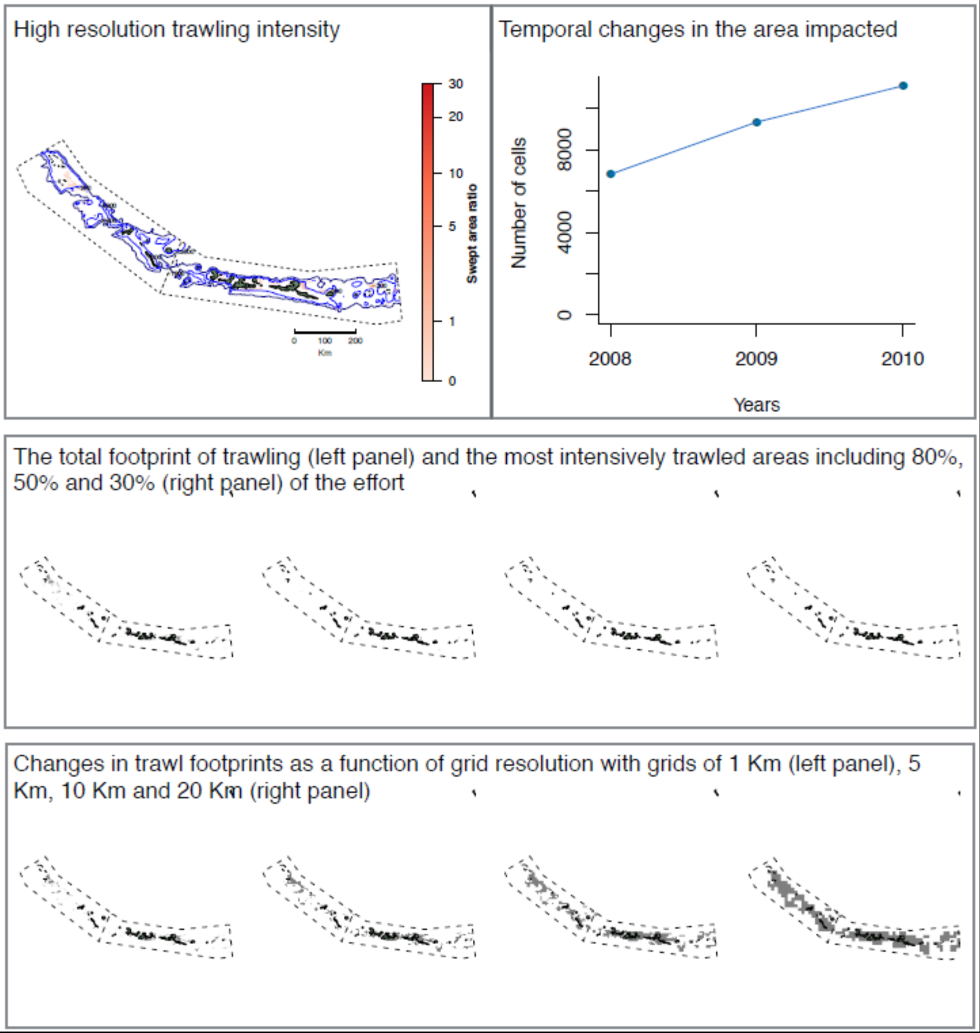


Fig. S22. Distribution and analyses of trawling activity data for the Aleutian Islands (region code=20). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

North Australian Shelf
Numeric code 21

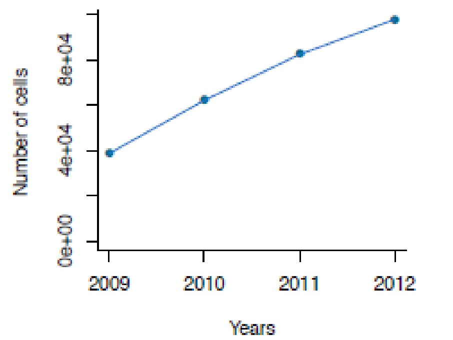
Region	Australasia
Area 0-200 m (Km²)	791827
Area 200-1000 m (Km²)	2534

Years	2009-2012
Percentage of coverage	100%
Contributing countries	Australia
Data type	VMS data. Coverage expressed in effort

High resolution trawling intensity

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

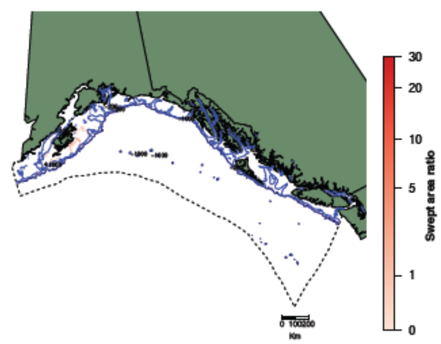
Fig. S23. Distribution and analyses of trawling activity data for the North Australian Shelf (region code=21). The panel beneath the area and methods summary table shows the accumulation of the number of cells where trawling activity was recorded through time. Other information is not presented owing to confidentiality restrictions.

Gulf of Alaska
Numeric code 22

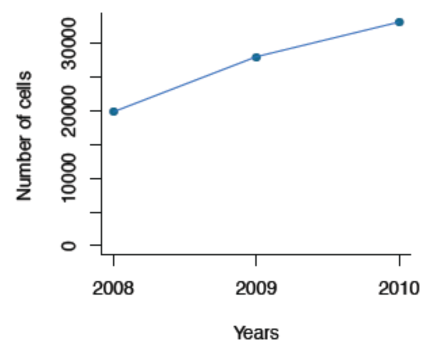
Region	Americas
Area 0-200 m (Km²)	294024
Area 200-1000 m (Km²)	104424

Years	2008-2010
Percentage of coverage	85%
Contributing countries	United States
Data type	VMS data. Coverage expressed in effort.

High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Fig. S24. Distribution and analyses of trawling activity data for the Gulf of Alaska (region code=22). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper). Area estimates derived from these calculations provided inputs to Fig. 1 in the accompanying paper.

Northwest Australian Shelf
Numeric code 23

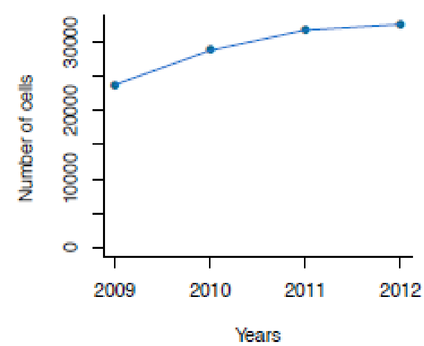
Region	Australasia
Area 0-200 m (Km²)	473937
Area 200-1000 m (Km²)	212113

Years	2009-2012
Percentage of coverage	100%
Contributing countries	Australia
Data type	Logbook data. Coverage expressed in effort.

High resolution trawling intensity

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Owing to the low numbers of vessels operating in this region we cannot plot high resolution data on these maps without breaching confidentiality of fishers, but all the data required to replicate the published analyses in the main paper (without high resolution positional information) are provided in the supplementary data object

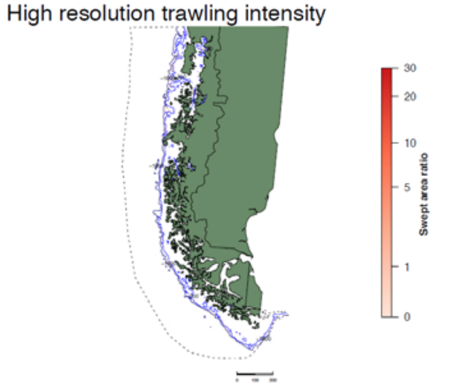
Fig. S25. Distribution and analyses of trawling activity data for the Northwest Australian Shelf (region code=23). The panel beneath the area and methods summary table shows the accumulation of the number of cells where trawling activity was recorded through time. Other information is not presented owing to confidentiality restrictions.

South Chile
Numeric code 24

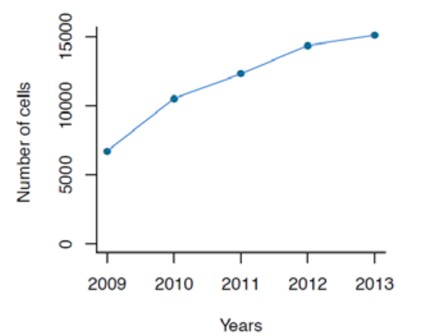
Region	Americas
Area 0-200 m (Km²)	148969
Area 200-1000 m (Km²)	39941

Years	2009-2013
Percentage of coverage	85%
Contributing countries	Chile
Data type	Logbook data. Coverage expressed in effort.

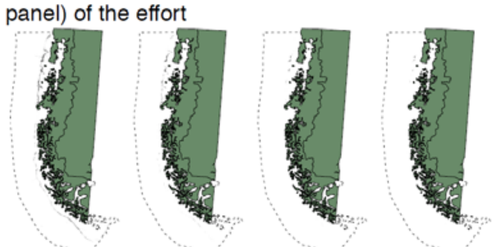
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

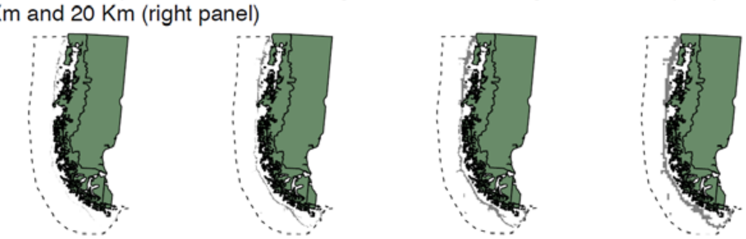


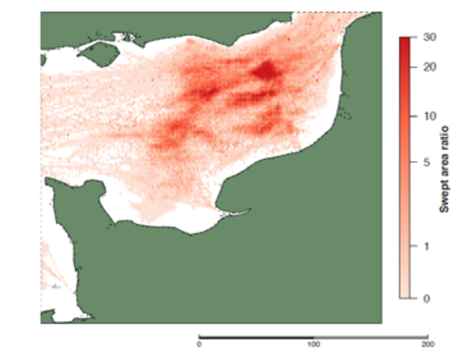
Fig. S26. Distribution and analyses of trawling activity data for South Chile (region code=24). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

English Channel
Numeric code 25

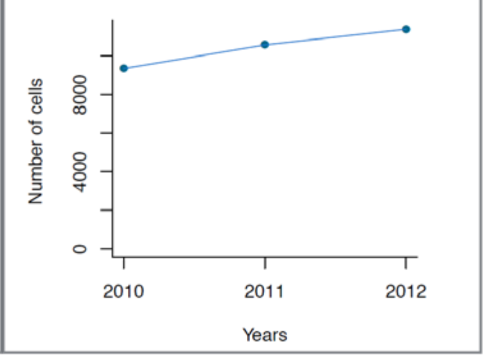
Region	Europe
Area 0-200 m (Km^2)	36686
Area 200-1000 m (Km^2)	0

Years	2010-2012
Percentage of coverage	30.8%
Contributing countries	United Kingdom, Belgium and Netherlands
Data type	VMS data. Coverage expressed in landings.

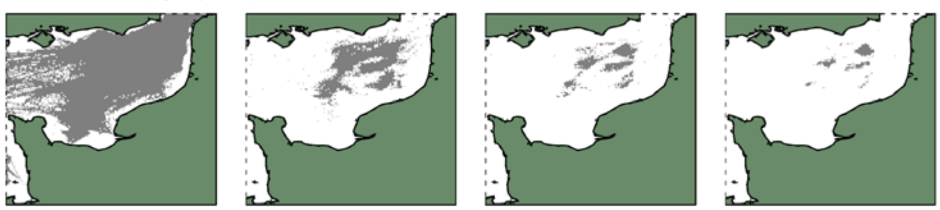
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Fig. S27. Distribution and analyses of trawling activity data for the English Channel (region code=25). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

Ionian Sea (GFCM 2.2)
Numeric code 26

Region	Europe
Area 0-200 m (Km²)	182509
Area 200-1000 m (Km²)	188129

Years	2010-2012
Percentage of coverage	50%
Contributing countries	Italy and Greece
Data type	VMS data. Coverage expressed in landings

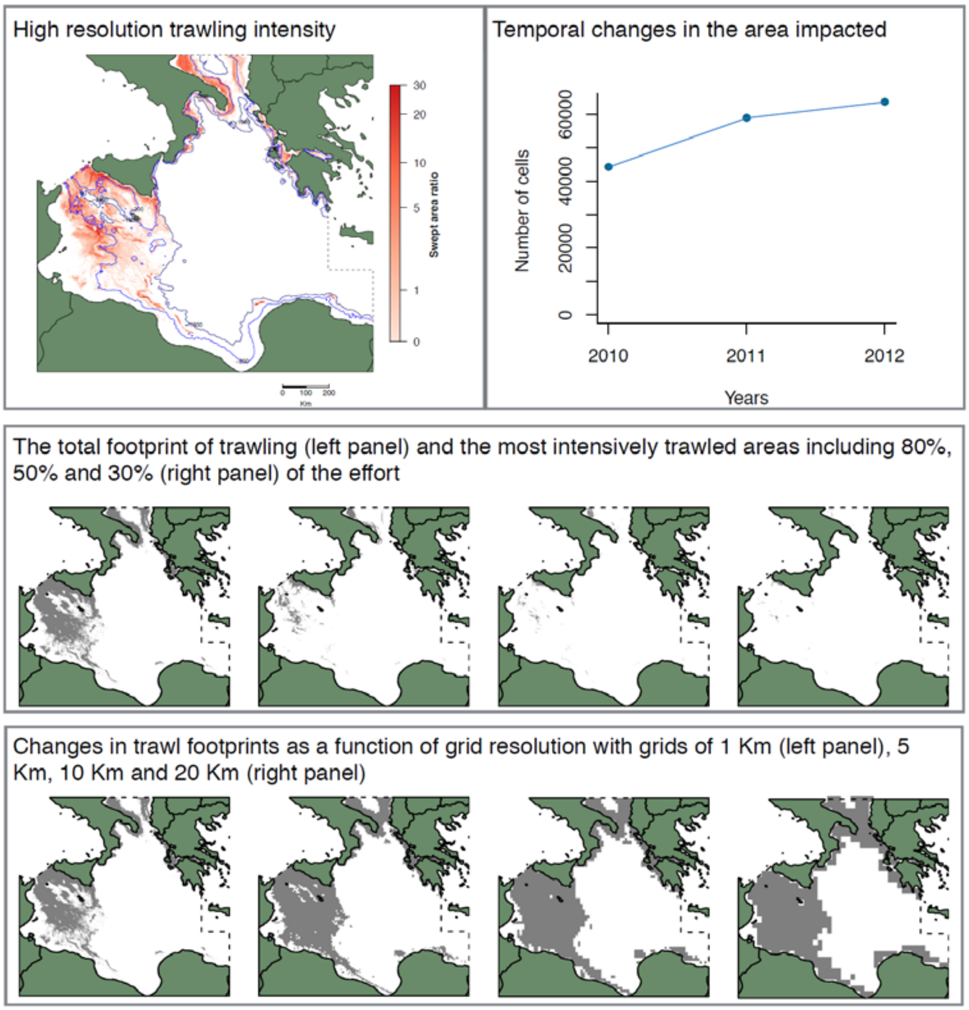


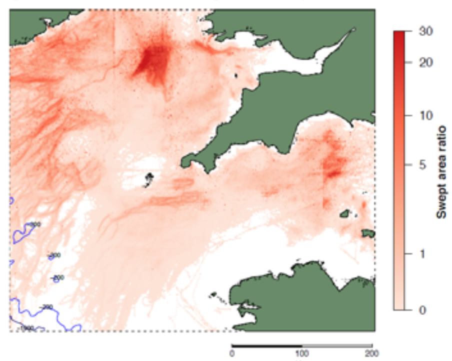
Fig. S28. Distribution and analyses of trawling activity data for the Ionian Sea (region code=26). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

Celtic Sea
Numeric code 27

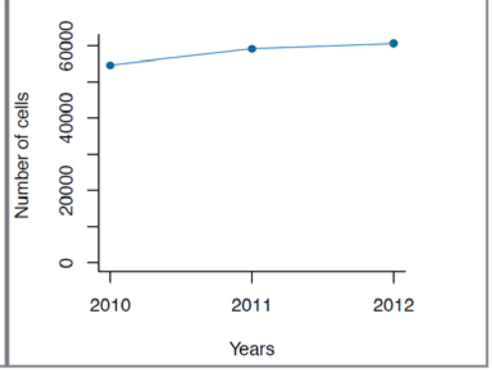
Region	Europe
Area 0-200 m (Km^2)	171939
Area 200-1000 m (Km^2)	2368

Years	2010-2012
Percentage of coverage	45
Contributing countries	Ireland, Belgium and United Kingdom.
Data type	VMS data. Coverage expressed in landings.

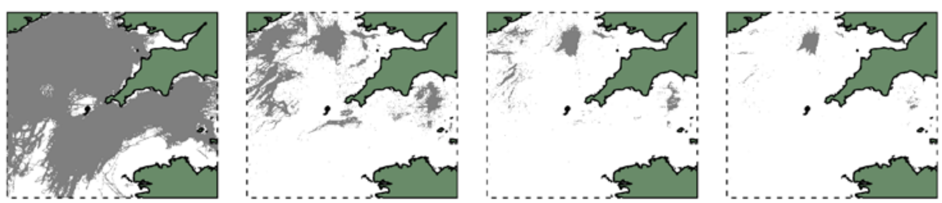
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

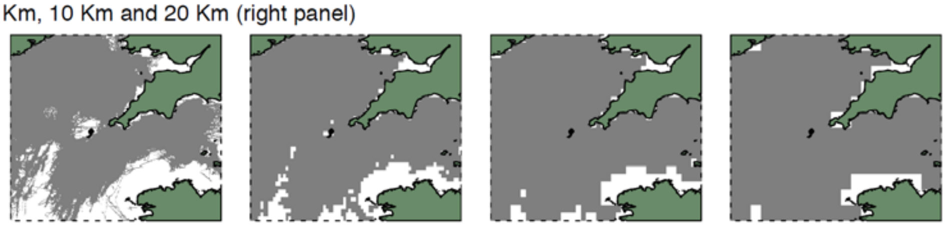


Fig. S29. Distribution and analyses of trawling activity data for the Celtic Sea (region code=27). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

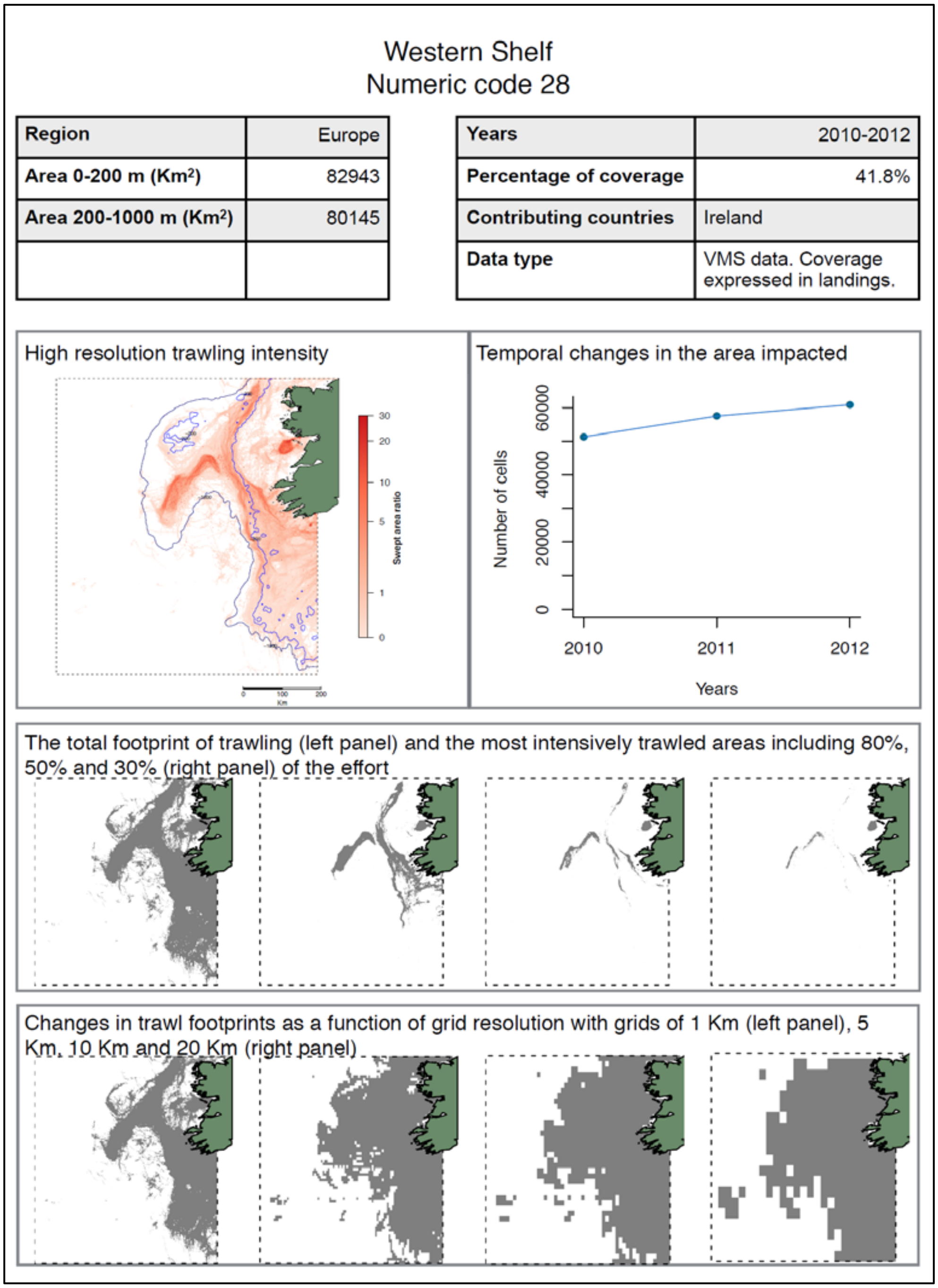


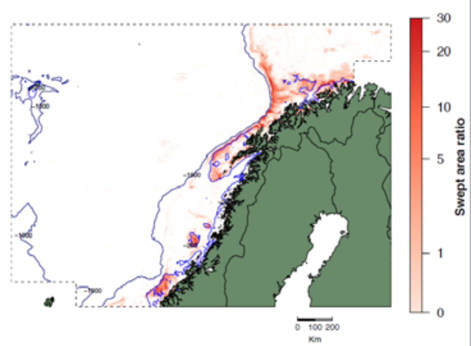
Fig. S30. Distribution and analyses of trawling activity data for the Western Shelf (region code=28). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

Norwegian Sea (ICES 2)
Numeric code 29

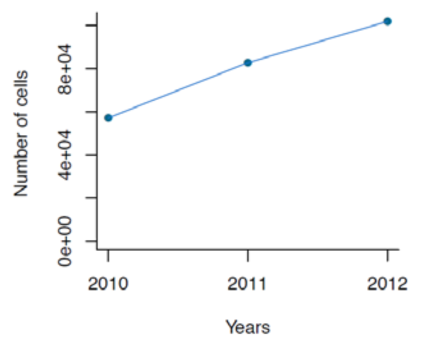
Region	Europe
Area 0-200 m (Km²)	90388
Area 200-1000 m (Km²)	336757

Years	2010-2012
Percentage of coverage	66%
Contributing countries	Norway
Data type	VMS data. Coverage expressed in landings.

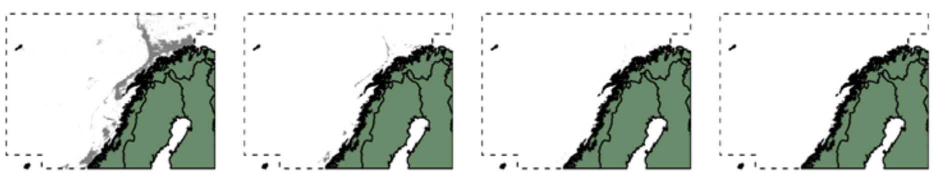
High resolution trawling intensity



Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort



Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

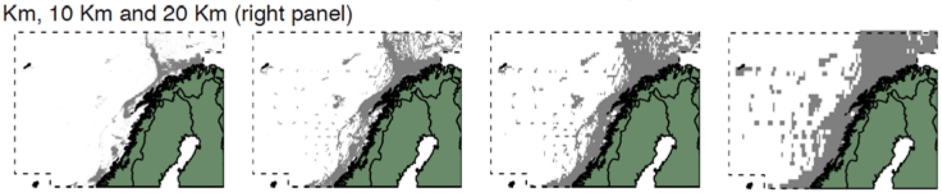


Fig. S31. Distribution and analyses of trawling activity data for the Norwegian Sea (ICES 2a; region code=29). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

Barents Sea (ICES 1)
Numeric code 30

Region	Europe
Area 0-200 m (Km²)	682297
Area 200-1000 m (Km²)	681467

Years	2010-2012
Percentage of coverage	29
Contributing countries	Norway
Data type	VMS data. Coverage expressed in landings.

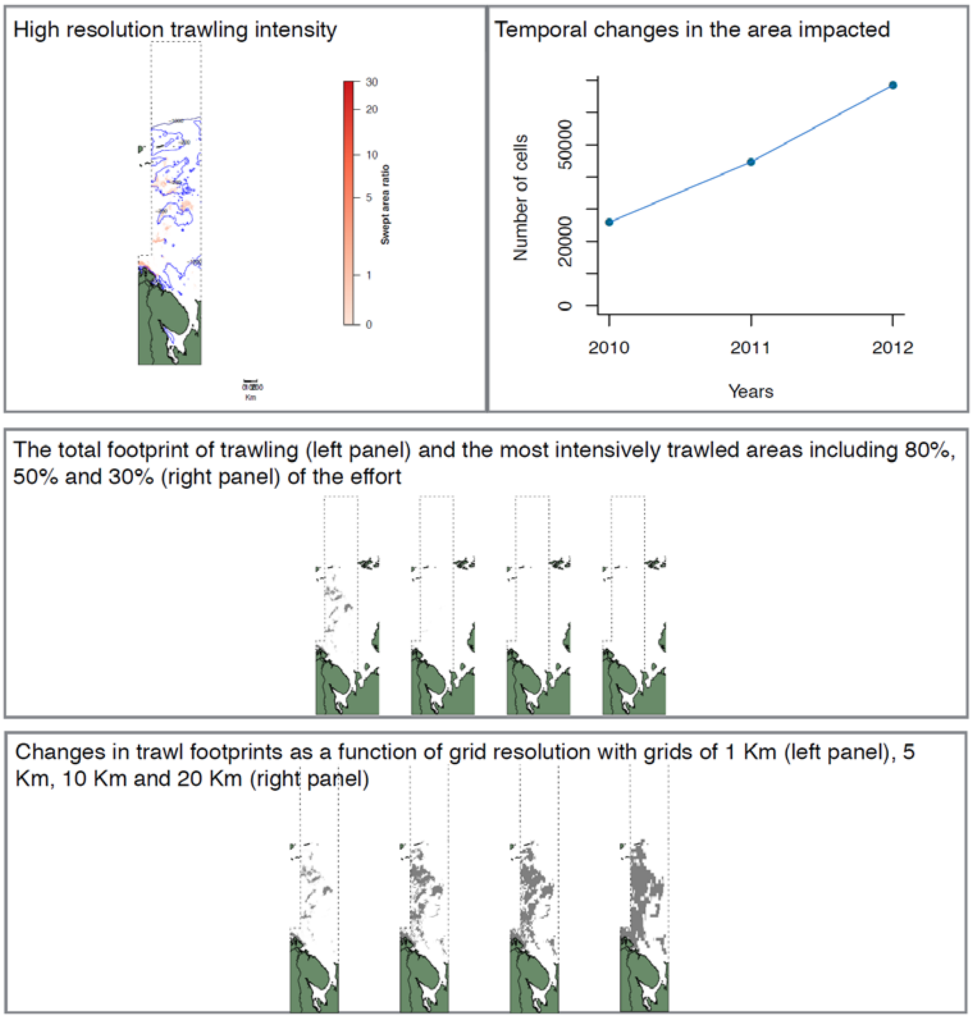


Fig. S32. Distribution and analyses of trawling activity data for the Barents Sea (ICES 1; region code=30). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

North Chile
Numeric code 31

Region	Americas
Area 0-200 m (Km^2)	39484
Area 200-1000 m (Km^2)	45018

Years	2009-2013
Percentage of coverage	35%
Contributing countries	Chile
Data type	Logbook data. Coverage expressed in effort.

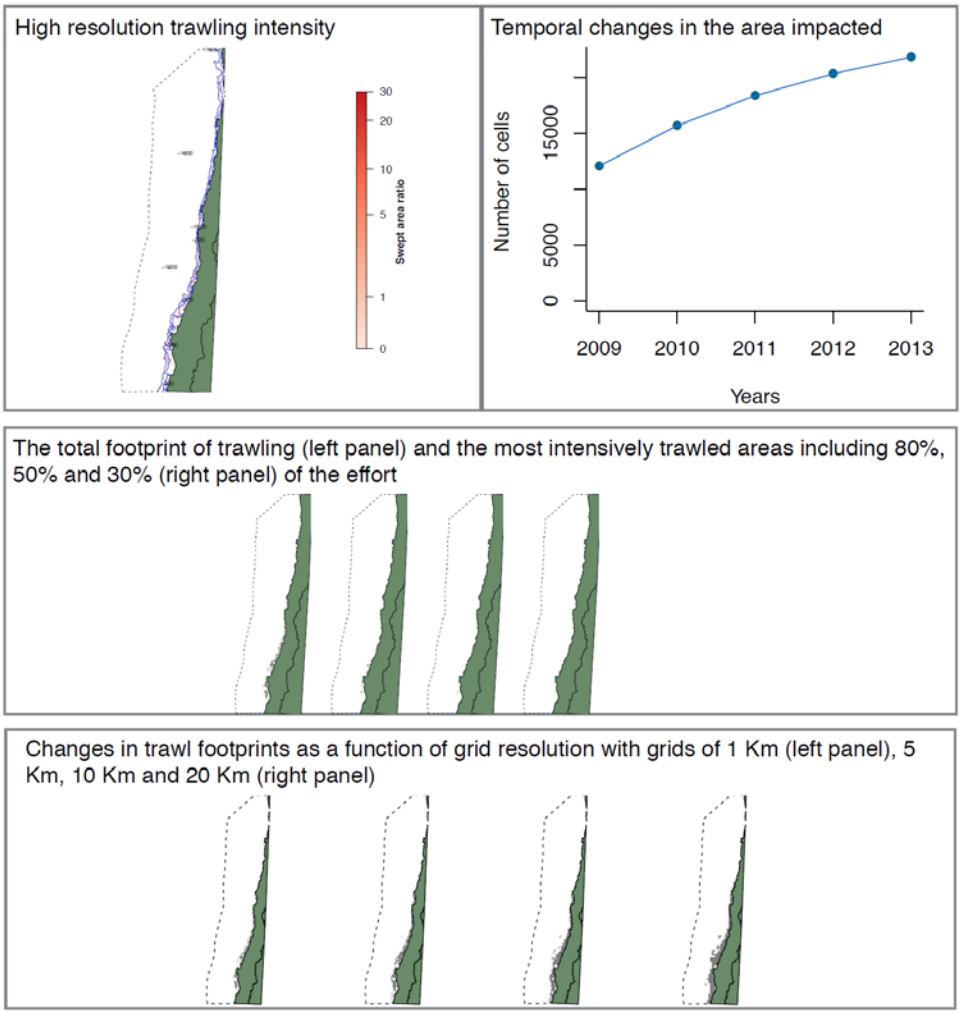


Fig. S33. Distribution and analyses of trawling activity data for North Chile (region code=31). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

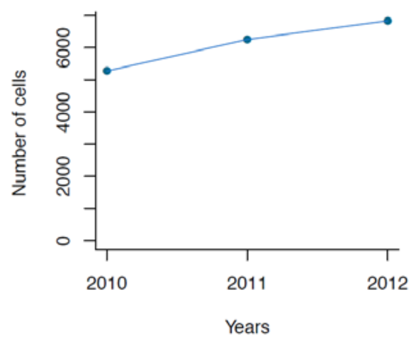
Bay of Biscay
Numeric code 32

Region	Europe
Area 0-200 m (Km^2)	96177
Area 200-1000 m (Km^2)	26698

Years	2010-2012
Percentage of coverage	1.3%
Contributing countries	Ireland, United Kingdom, Belgium.
Data type	VMS data. Coverage expressed in landings.

High resolution trawling intensity

Temporal changes in the area impacted



The total footprint of trawling (left panel) and the most intensively trawled areas including 80%, 50% and 30% (right panel) of the effort

Changes in trawl footprints as a function of grid resolution with grids of 1 Km (left panel), 5 Km, 10 Km and 20 Km (right panel)

Fig. S34. Distribution and analyses of trawling activity data for Bay of Biscay (region code=32). The panels beneath the area and methods summary table shows the swept area ratio, by cell, for the entire regional grid (left), and the accumulation of the number of cells where trawling activity was recorded through time (right). The central panel of figures shows the concentration of bottom trawling by shading grid cells based on the rank contribution of activity in these cells to total activity. The lower panel of figures shows the effects of changing analytical resolution on the footprint of bottom trawling, based on the cell-based method (approach A, accompanying paper).

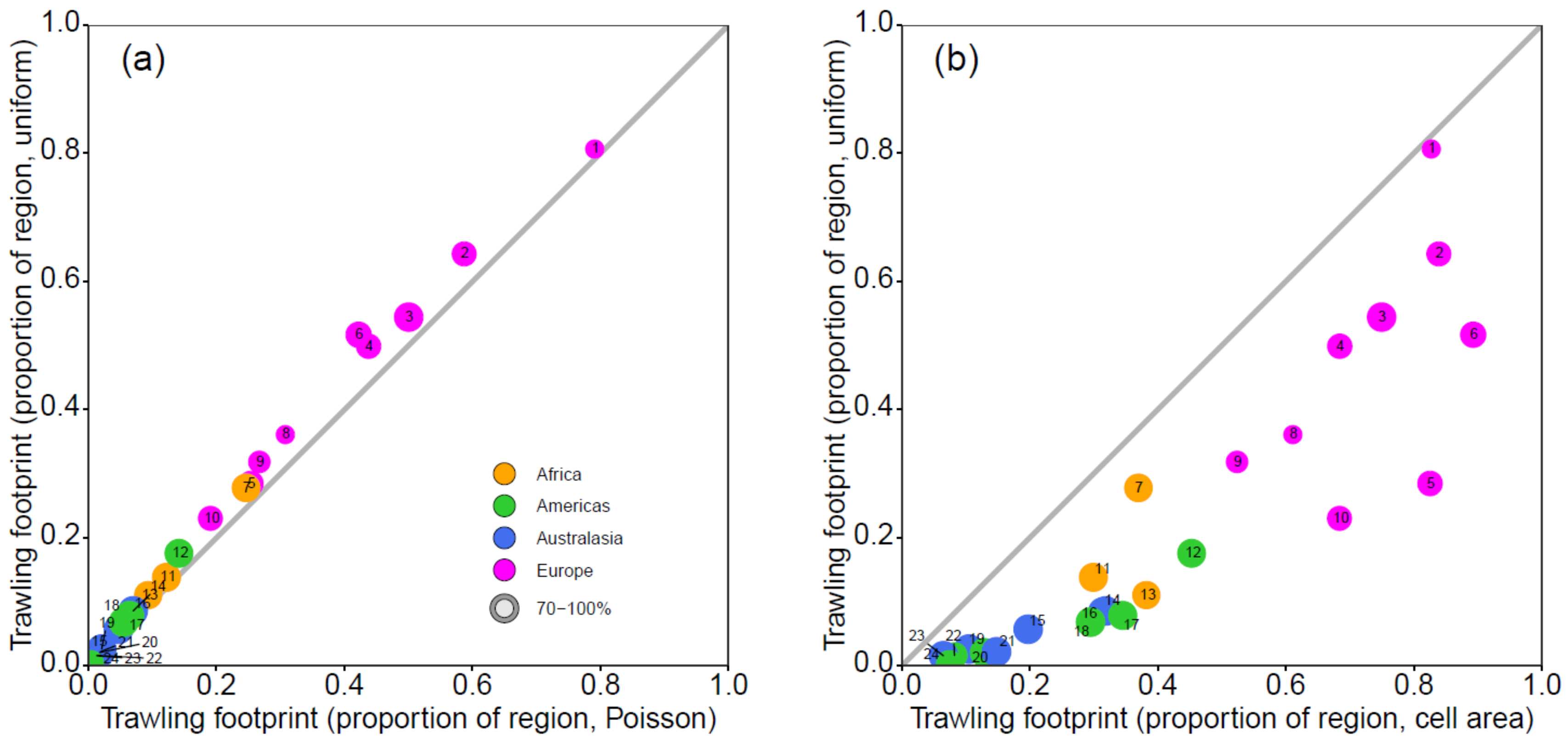


Fig. S35. Relationships (a) between the calculated total proportions of a region trawled when footprint was calculated assuming a random (approach B, accompanying paper) or uniform (approach C, accompanying paper) distribution of trawling activity within cells and (b) between the total proportions of a region trawled when footprint was measured by summing the area of grid cells within which any trawling was recorded (approach A, accompanying paper) or by estimating the proportion trawled in each cell assuming a uniform distribution of activity within cells (approach C, accompanying paper). Symbol sizes indicate the proportion of total fishing activity recorded in each region (all > 70%), numbers in symbols identify regions listed in Table 1 (main paper) and grey lines indicate a 1:1 relationship between variables.

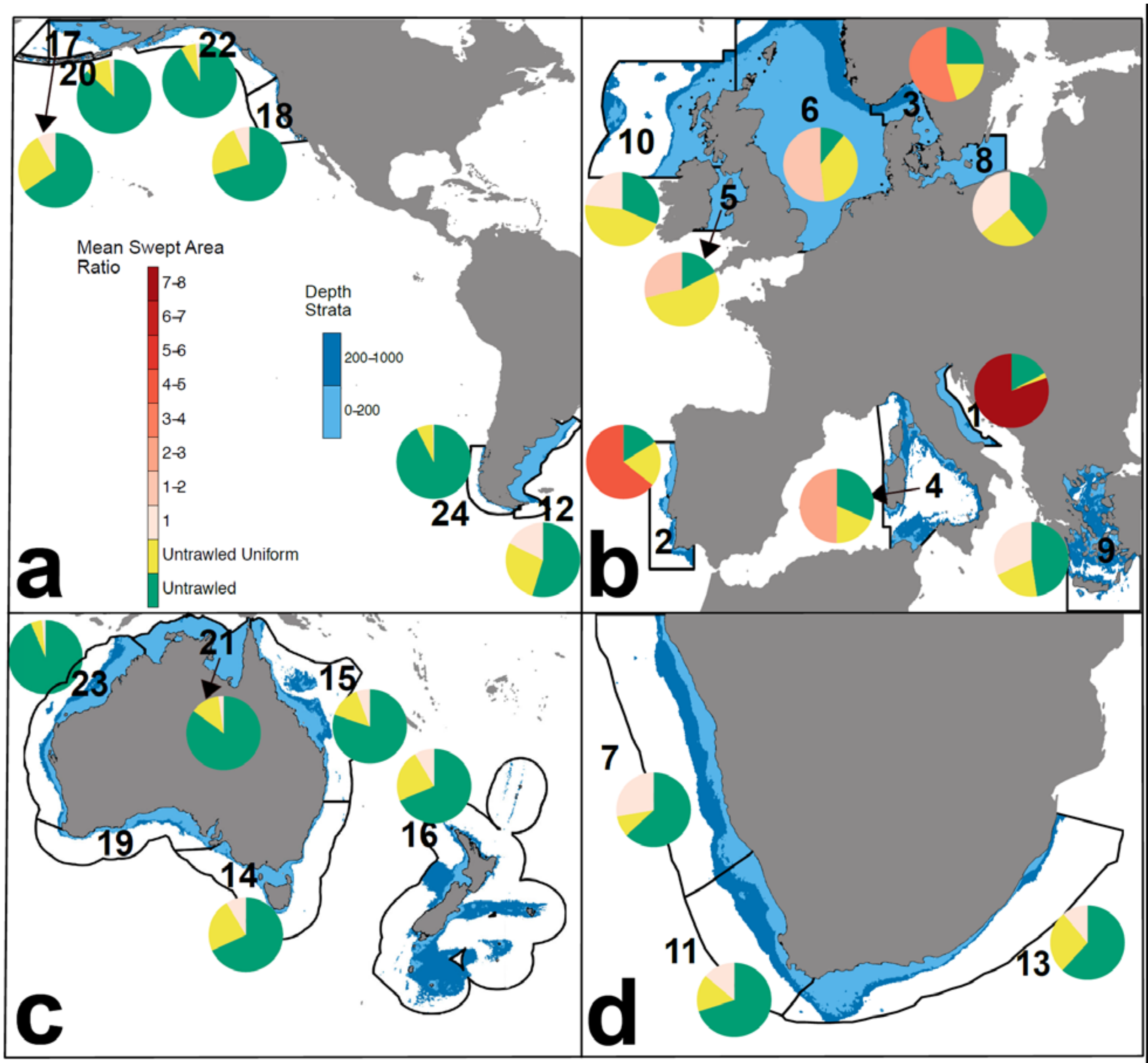


Fig. S36. Bottom trawling intensity and the proportion of untrawled areas at depths 0 – 1000 m for regions in (a) Americas, (b) Europe, (c) Australasia and (d) Africa. Black lines indicate boundaries of study regions, pale blue tones depths 0 – 200 m in the study regions, darker blue tones depths 200 – 1000 m in the study regions. All areas deeper than 1000 m and areas outside study regions are shown in white. The green portion of each pie indicates the proportion of the area of each region comprising cells that were never trawled during the study years, yellow indicates the additional proportion of the area not trawled within those cells where some trawling was recorded and assuming a uniform trawling distribution (approach C, see accompanying paper). Red tones indicate the proportion of area trawled and the associated regional swept area ratio (SAR). In all regions, the proportion of bottom trawling activity included in this analysis is expected to exceed 70% of total activity (Table 1, main paper).

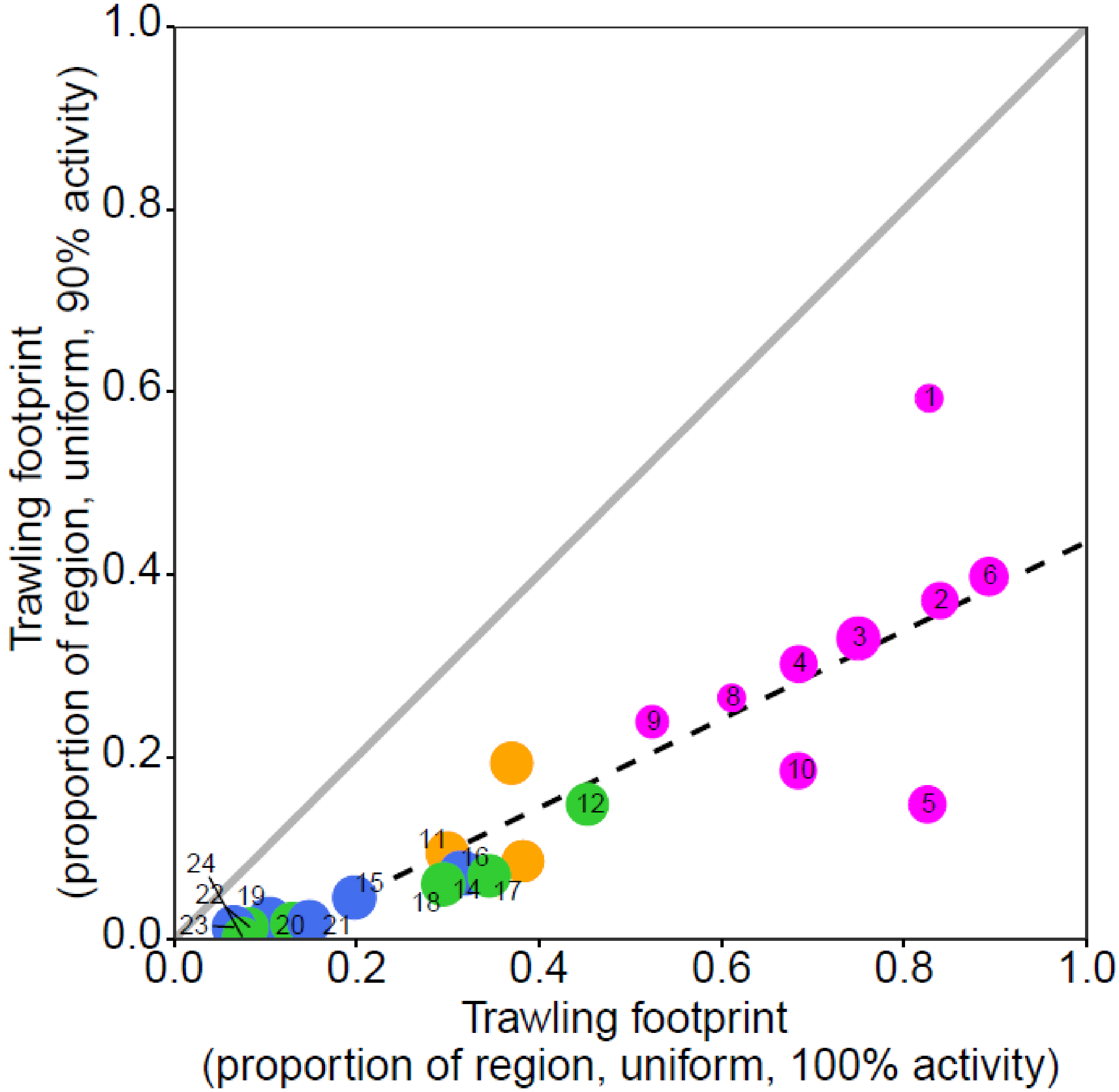


Fig. S37. Relationships between the proportions of the area of each region accounting for 90% of total trawling activity and the proportion of the area accounting for all trawling activity. Both estimates of the proportion of the region trawled were based on the uniform assumption (approach C, see accompanying paper). Symbol sizes indicate the proportion of total fishing activity recorded in each region (all > 70%), numbers in symbols identify regions listed in Table 1 (main paper), grey lines indicate a 1:1 relationship between variables and the black broken line is the fitted relationship between the proportion of the area trawled when calculated with 100% and 90% of total activity.

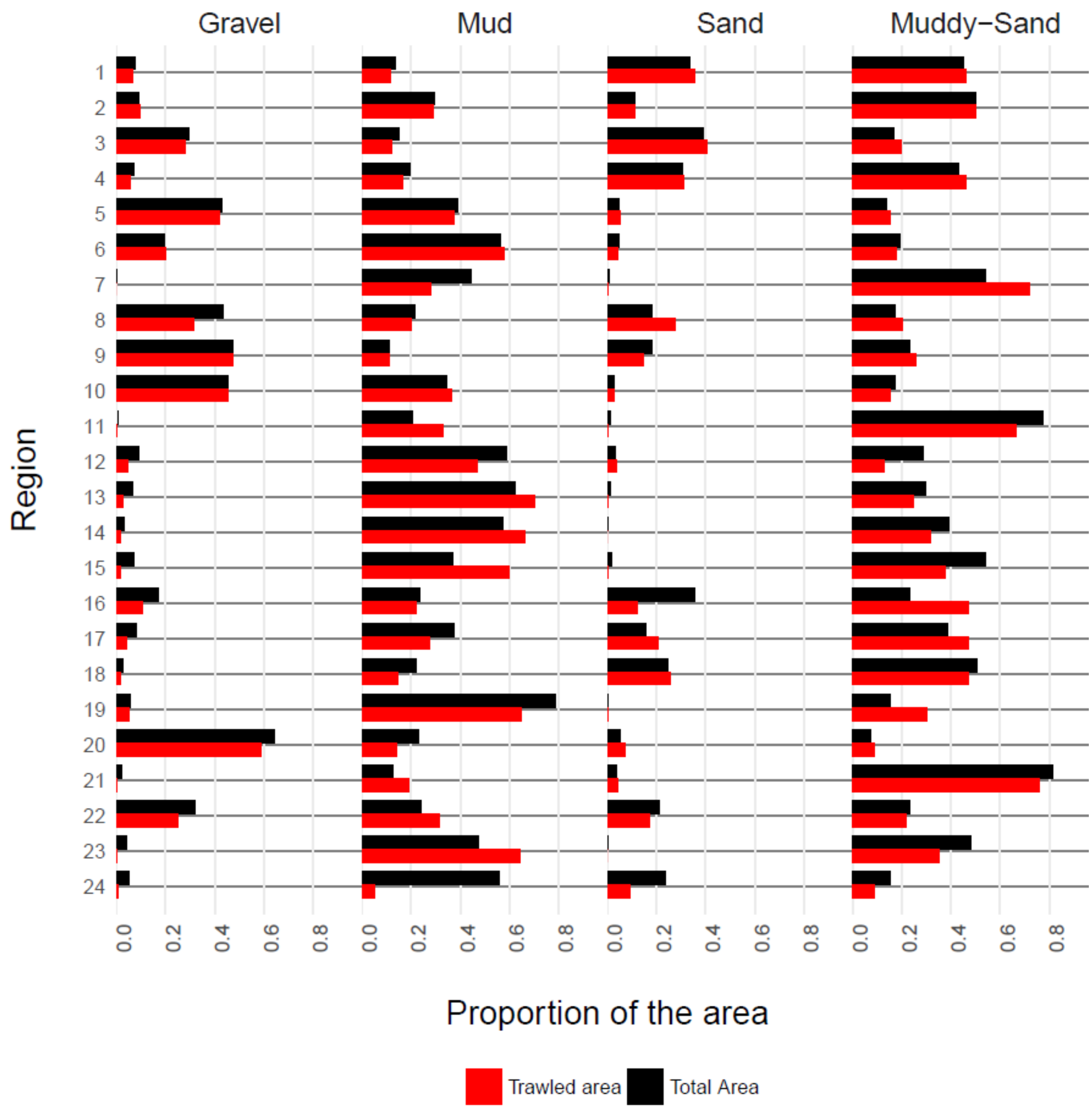


Fig. S38. Relationship between the trawled area and total area by sediment types and region (depths 0–1000 m). Region codes follow Table 1 (main paper), with code numbers increasing as regional Swept Area Ratio (SAR) decrease.

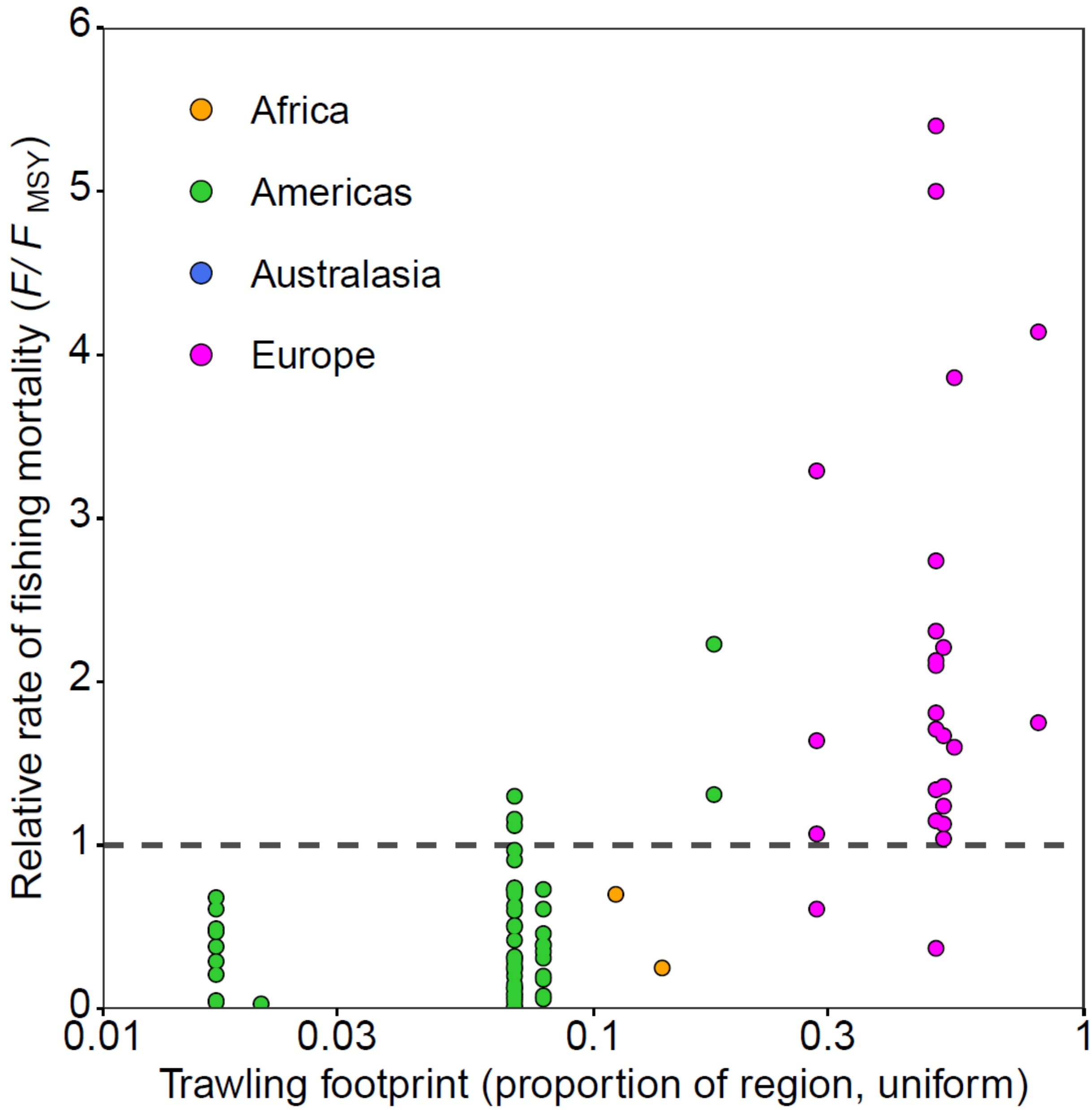


Fig. S39. Relationships between the relative rate of fishing mortality and the footprint of trawling estimated with the uniform approach (approach C, see accompanying paper) by region. Circles denote the median ratio of fishing mortality (*F*, mean 2008 – 2010) to the F_{MSY} reference point for individual bottom dwelling stocks. The black horizontal dashed line indicates $F/F_{MSY}=1$, usually treated as a desirable upper limit on fishing rates by managers. One value of $F/F_{MSY}>8$, for a Mediterranean stock, and in a region where the regional swept area ratio is 7.93, is excluded from the figure for clarity. This general relationship is unaffected by including only those stocks with distributions spanning at least 50% or 70% of the regions to which they were assigned (Fig. S42, S43).

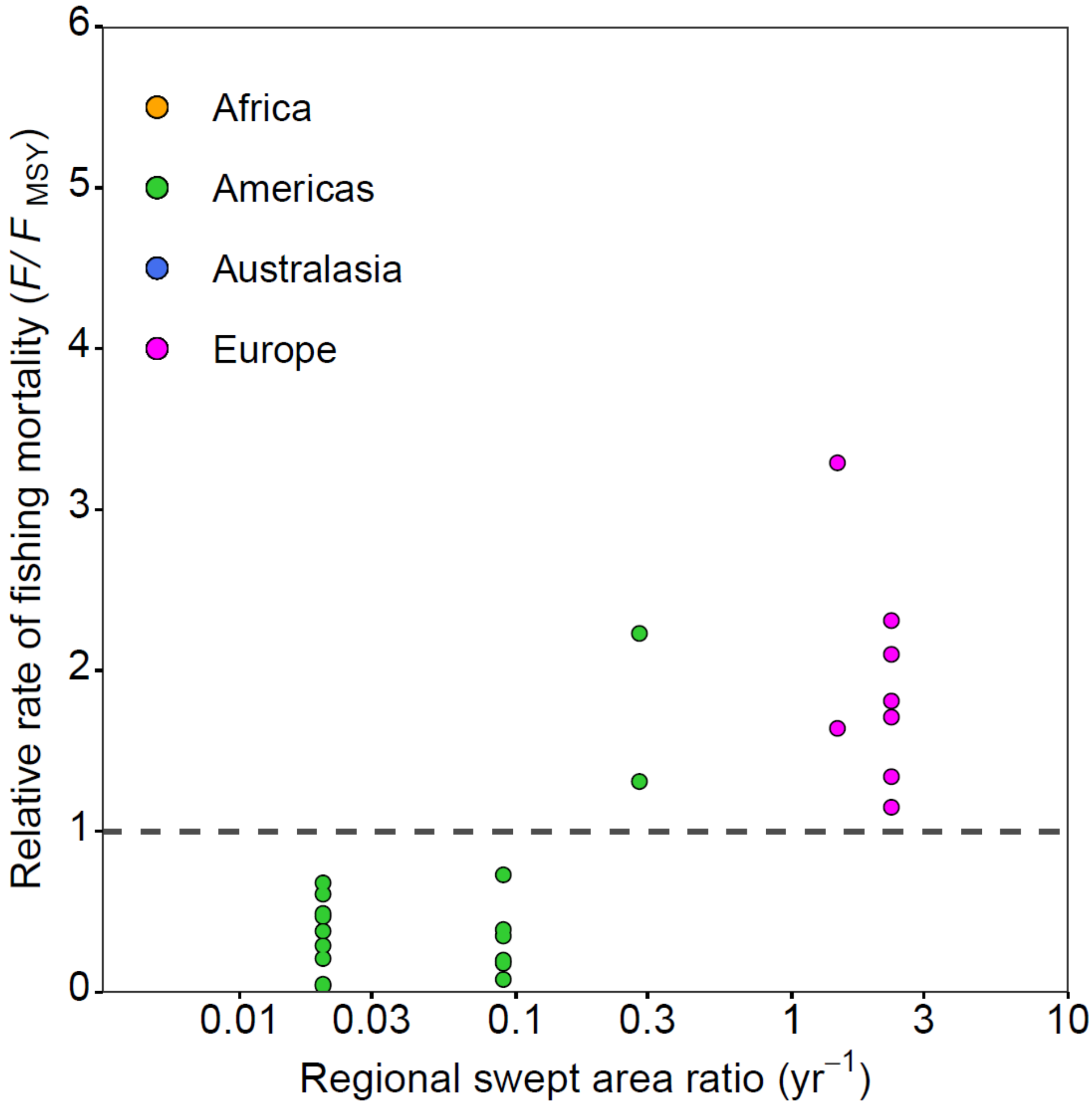


Fig. S40. Relationships between the relative rate of fishing mortality and the regional swept area ratio (SAR) by region, including only those stocks with distributions spanning at least 50% of the region to which they were assigned. Circles denote the ratio of fishing mortality (*F*, mean 2010 – 2012) to the F_{MSY} reference point for individual bottom dwelling stocks. The black horizontal dashed line indicates F/F_{MSY}= 1, usually treated as a desirable upper limit on fishing rates by managers.

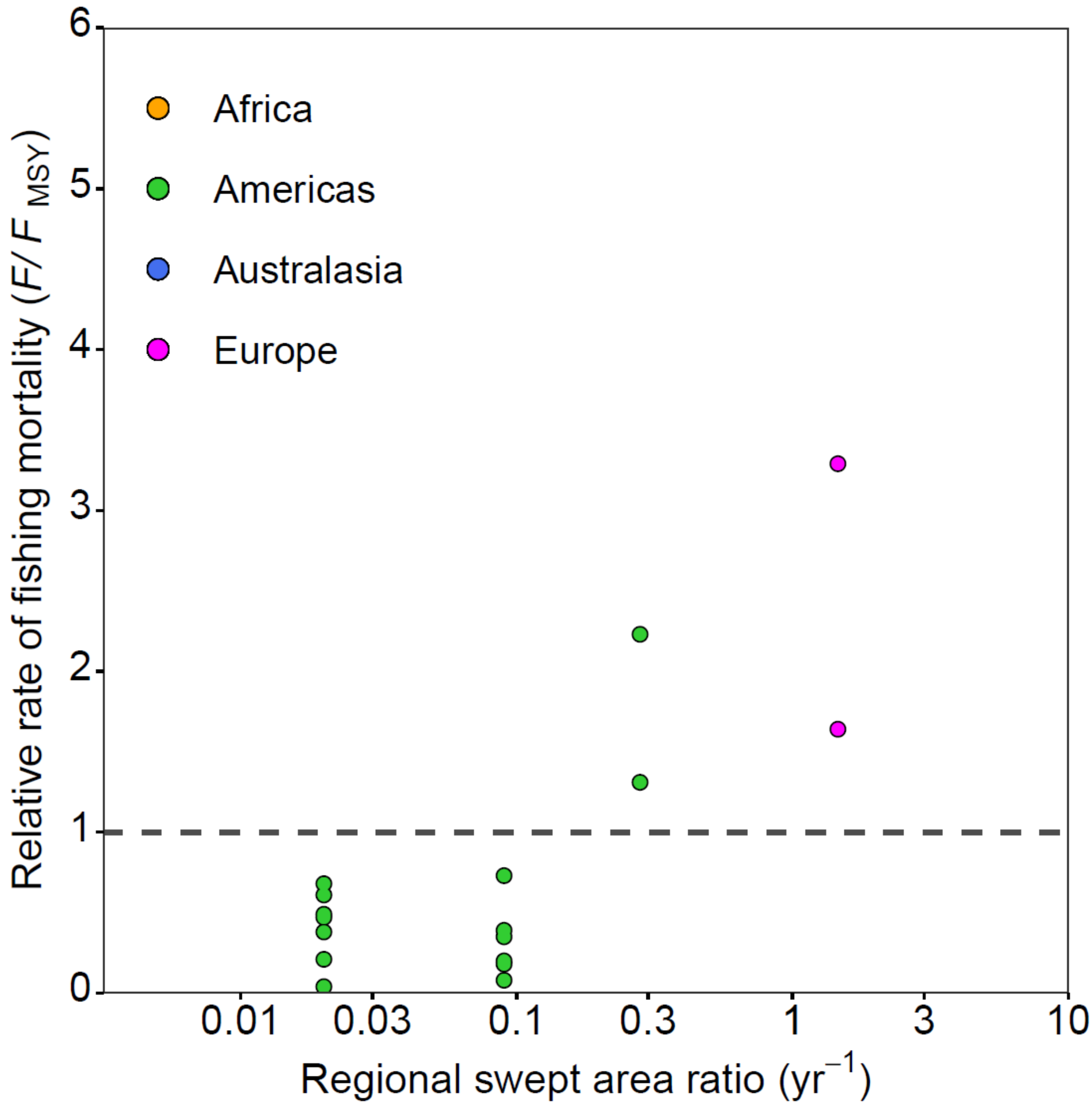


Fig. S41. Relationships between the relative rate of fishing mortality and the regional swept area ratio (SAR) by region, including only those stocks with distributions spanning at least 70% of the region to which they were assigned. Circles denote the ratio of fishing mortality (*F*, mean 2010 – 2012) to the F_{MSY} reference point for individual bottom dwelling stocks. The black horizontal dashed line indicates F/ F_{MSY}= 1, usually treated as a desirable upper limit on fishing rates by managers.

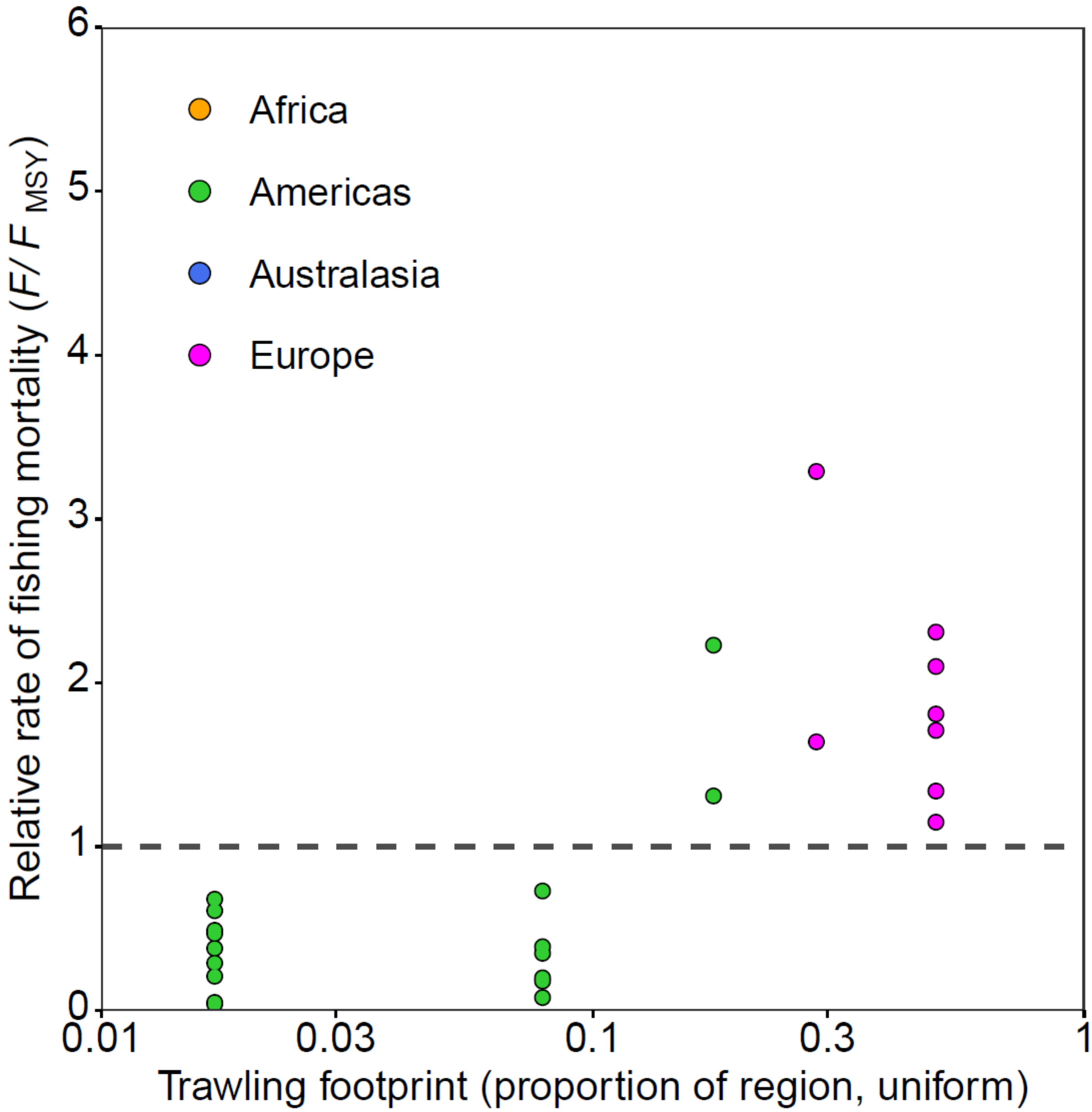


Fig. S42. Relationships between the relative rate of fishing mortality and the footprint of trawling estimated with the uniform approach (approach C, see accompanying paper) by region, including only those stocks with distributions spanning at least 50% of the region to which they were assigned. Circles denote the median ratio of fishing mortality (*F*, mean 2008 – 2010) to the F_{MSY} reference point for individual bottom dwelling stocks. The black horizontal dashed line indicates $F/F_{MSY} = 1$, usually treated as a desirable upper limit on fishing rates by managers. For the relationship for all stocks intersecting with the study regions see Fig. S39.

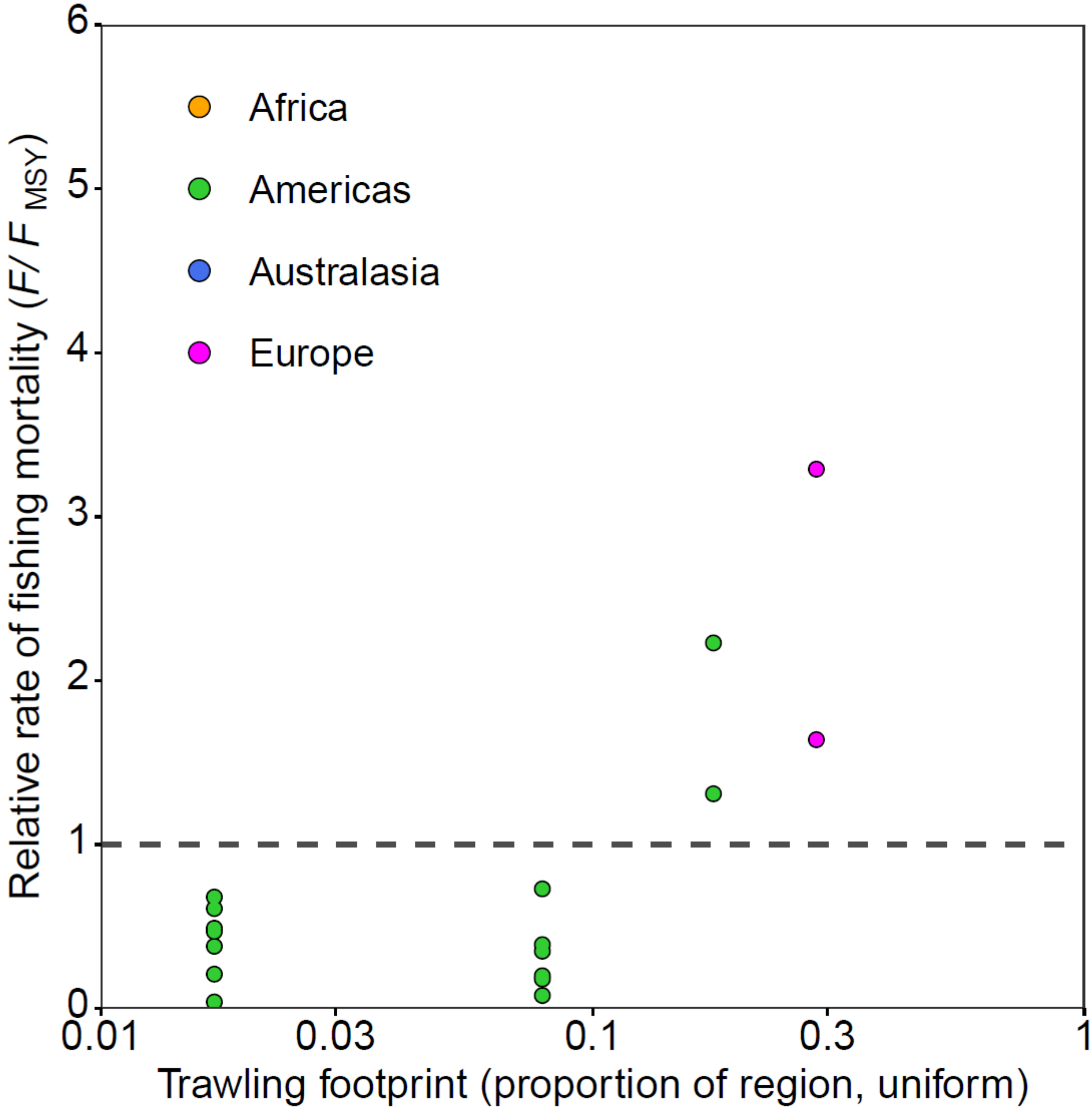


Fig. S43. Relationships between the relative rate of fishing mortality and the footprint of trawling estimated with the uniform approach (approach C, see accompanying paper) by region, including only those stocks with distributions spanning at least 70% of the region to which they were assigned. Circles denote the median ratio of fishing mortality (*F*, mean 2008 – 2010) to the F_{MSY} reference point for individual bottom dwelling stocks. The black horizontal dashed line indicates $F/F_{MSY} = 1$, usually treated as a desirable upper limit on fishing rates by managers. For the relationship for all stocks intersecting with the study regions see Fig. S39.