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Extent and intensity of bottom contact by commercial trawling and shellfish dredging in New Zealand waters, 1990–2021

New Zealand Aquatic Environment and Biodiversity Report No. 316

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ISSN 1179-6480 (online)
ISBN 978-1-991087-19-5 (online)

July 2023

Te Kāwanatanga o Aotearoa
New Zealand Government

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Please cite this report as:

MacGibbon, D.J.; Mules, R. (2023). Extent and intensity of bottom contact by commercial trawling and shellfish dredging in New Zealand waters, 1990–2021. *New Zealand Aquatic Environment and Biodiversity Report No. 316.* 174 p.

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EXECUTIVE SUMMARYAND

MacGibbon, D.J.[1]; Mules, R.[2] (2023). Extent and intensity of bottom contact by commercial trawling and shellfish dredging in New Zealand waters, 1990–2021.

New Zealand Aquatic Environment and Biodiversity Report No. 316. **174 p.**

This report presents the spatial analysis of bottom-contacting trawl effort by commercial trawlers within the New Zealand 200 n. mile Exclusive Economic Zone and Territorial Sea (EEZ+TS), in waters open to trawling down to 1600 m in depth (the 'fishable area'), for different time periods, based on available data.

The All Stocks (deepwater and inshore fishstocks) analysis was completed for the 1989–90 (1990) to 2020–21 (2021) fishing years, but the most comprehensive time period, when reporting of both inshore and deepwater effort was adequate, covers fishing years 2008–2021. During this latter period, the extent of area contacted by trawling for All Stocks was estimated to be between 70 300 and 94 600 km^2 each year, generally decreasing over the 14 years, with the lowest value estimated for 2020. Reported tow data reflect a decreasing amount of bottom-contacting trawl effort over the same period; the numbers of tows steadily dropped from 91 920 in 2010 to 64 764 in 2021. The annual aggregate area contacted by bottom trawl for the All Stocks analysis decreased from a peak of 162 887 km^2 in 2010 to a nadir of 129 594 km^2 in 2020. Over these years, the intensity of trawling within cells was reasonably steady despite the decrease in aggregate area, implying that the contact was concentrated over a smaller extent. Annually for all years between 2008 and 2021 the All Stocks footprint contacted about 2% of the EEZ+TS seafloor and about 6% of the fishable area each year.

In the 32-year time series for deepwater data, there was a steady increase in the footprint from under 48 000 km^2 in 1990 to a sustained period of contact ranging between 72 080 to 80 638 km^2 during 1998 to 2003, followed by a steady decrease to 40 238 km^2 in 2020. The estimated extent of contact by trawl was the lowest in the full 32-year time series in 2020, with decreasing footprints seen for most deepwater targets and the swept area data reflecting the drop in effort. The annual aggregated area contacted exceeded 149 922 km^2 in all years from 1997 to 2003. This reduced to under 100 000 km^2 from 2006 on, with a nadir in 2009 (78 949 km^2), another peak at 96 218 km^2 in 2018, and a drop to 80 997 km^2 in 2021, the third lowest in the time series. The deepwater analysis estimated a 32-year total aggregate area of 3 618 147 km^2 and footprint of 355 702 km^2, with this overall deepwater footprint representing 8.7% of the EEZ+TS and 25.4% of the fishable area. Between 1990 and 2007, the annual footprint contacted 1.2–2.0% of the EEZ+TS and 3.4–5.8% of the fishable area (peaks in 2002 and 2003); whereas, between 2008 and 2021, the annual footprint contacted 1.0–1.2% of the EEZ+TS and 2.9–3.6% of the fishable area (lowest values in 2020).

The 2008–2021 inshore footprint also decreased, from a peak of 53 273 km^2 in 2010 to a nadir of 35 400 km^2 in 2020. This contact was equivalent to 0.8–1.2% of the EEZ+TS seafloor area, and 2.5–3.7% of the fishable area, with the lowest values estimated for 2020. The aggregated area contacted during these years ranged from a low in 2020 (47 789 km^2) to a peak in 2014 (75 640 km^2).

These results are further discussed to indicate the intensity of contact, the frequency of contact (comparing annual data), and any areas contacted in one year but not in previous years. Overlap of the footprints with depth zones, the Benthic-Optimised Marine Environment Classification, Seafloor Community Classification System, surficial sediment layers, and probability of occurrence of some target species is presented by the broad fishery groups.

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[1] National Institute of Water and Atmospheric Research Limited.
[2] Ministry for Primary Industries.

Methods were developed to combine Geospatial Position Reporting (GPR) data with commercial catch effort data for the 2020 fishing year in an attempt to map more realistic trawl tracks rather than straight lines between start and end positions. Preliminary results were promising and show that both footprint and aggregate area estimates will be larger where GPR data have been used compared with the same tows where only reported start and end positions are used and straight lines are plotted. There are, however, issues with the frequency of reporting rates of GPR devices, particularly in the deepwater fleet, which resulted in a substantial proportion of tows not having any additional positions reported along their tow length. These tows were excluded from the analysis that compared estimates derived from different data sources.

Data inclusion and the effect of the methodology used are also discussed. The data behind these summaries are stored in a Ministry for Primary Industries Geographic Information System geodatabase at the level of each tow, with the potential to analyse data at regional or smaller scales by target or groups of targets, as well as at a 25-km^2 cell grid level for the broad analysis of the EEZ+TS given here.

Lastly, shellfish dredge data are presented as summaries of the effort by year and specific target fishery. For the oyster fishery in Foveaux Strait, swept area per 1-n. mile grid provides a finer resolution of this fishery based on ERS data from 2019 to 2021.

1. INTRODUCTION

Estimating the intensity and extent of bottom-contacting fishing activity within New Zealand waters is a research area that supports Fisheries New Zealand in working to meet fisheries management objectives relating to benthic habitats. The National Fisheries Plan for Deepwater and Middle-depth Fisheries (Fisheries New Zealand 2019a) includes an objective to "*Manage deepwater and middle-depth fisheries to avoid, remedy or mitigate the adverse effects of these fisheries on benthic habitats*" and the National Inshore Finfish Fisheries Plan includes an objective to "*Manage inshore finfish fisheries to avoid, remedy or mitigate adverse effects on benthic habitats*" (Fisheries New Zealand 2022). The primary bottom-contacting mobile fishing methods are trawling for finfish, squid, and scampi, as well as dredging for shellfish (oysters and scallops).

Bottom-contacting trawling has been conducted mainly in continental shelf waters at depths defined by the distribution of target species, generally in waters shallower than 1600 m (Baird et al. 2011). Trawl tows are considered to be bottom contacting where bottom trawl gear is used or where midwater trawl gear is used within one metre of the seafloor. Skippers of trawl vessels operating these gears reported their commercial fishing activity on different form types up until the Electronic Reporting System (ERS) was introduced and phased in between October 2017 and the end of 2019.

Trawl Catch Effort Processing Return (TCEPR) forms were introduced in October 1989 and were used if the vessel was over 28 m in overall length or if the vessel was required by the Director-General of Fisheries to do so (as required by the Fisheries (Reporting) Regulations 1990). The TCEPR was predominantly used to report data from vessels in the deepwater fleet (operating mainly in waters deeper than 200 m). From October 2017, the Electronic Reporting System (ERS) was introduced for data collection from deepwater vessels, to replace the TCEPR.

Daily trawl effort by vessels operating in inshore waters around New Zealand was primarily reported on Catch Effort Landing Return (CELR) forms from October 1989, although skippers of some small inshore trawl vessels also reported effort on TCEPRs from the mid-1990s (see Baird et al. 2011). The CELR form for trawl data was replaced in October 2007 by a more comprehensive form, the Trawl Catch Effort Return (TCER). From January 2019, the use of ERS for data collection was gradually implemented throughout other commercial fishing fleets, including the inshore trawl and dredge vessels.

The TCER, TCEPR, and ERS data provide tow-by-tow information that can be used to generate annual trawl footprints that represent the area of the seafloor contacted by trawl gear. Previously, trawl footprints have been determined using, where available, TCEPR and TCER data extracted from the Ministry for Primary Industries (MPI) database *warehou* (see for example, Baird et al. 2011, Black et al. 2013, Baird et al. 2015, Baird & Wood 2018, and Baird & Mules 2021a, b), generally for fishing years since 1989–90. In 2018, the trawl footprint analysis for deepwater vessels was re-run and updated, using the MPI CatchMapper software tool (Osbourne 2018) and data extracted from the Enterprise Data Warehouse (EDW) – a database that includes the *warehou* form-based data and the ERS data (Baird & Mules 2019). In 2019, the footprint analysis was extended to include the inshore fleet activity, based on data up to the end of the 2019 fishing year (Baird & Mules 2021b).

The overall research objective for the BEN2020-01 project reported in this document is to:
Estimate the extent and intensity of seabed contact by bottom fishing in New Zealand's Territorial Sea and Exclusive Economic Zone using fisher reported data and geospatial position (GPR) data.

The specific objectives addressed by this report are:

1. To assist MPI with grooming of fisher reported data and compile summary statistics for all deepwater (1989–2020) and inshore trawl and dredge fishing (2007–2020) by fishing year, depth zone, sediment categories, fishable area, and any other agreed habitat classifications or proxies, and to identify any trends or changes to meet management needs.

2. To develop methods to map the extent and intensity of bottom contact by bottom fisheries for 2018–19 using GPR data and compare the outputs to those derived in Objective 1.

Following discussions with MPI, it was agreed to delay the project until after the conclusion of the 2020–21 fishing year so that there would be two complete years of data to include in Objective 2. As a result, data from Objective 1 include data up to the end of the 2020–21 fishing year. Unfortunately GPR coverage in 2018–19 was low and was considered unsuitable for use, and data for the 2020–21 fishing year were not available in sufficient time to be processed and analysed. Hence, only data from the 2019–20 fishing year are presented for Objective 2.

1.1 Specific Objectives

Objective 1

Trawl swept area

Objective 1 requires analyses of the bottom-contacting trawling for deepwater Tier 1 and Tier 2 fishstocks (as defined by Fisheries New Zealand 2019a) and for inshore trawl fisheries with specific analyses of inshore fishstock groups defined by Fishery Management Area (FMA). Trawl footprint summaries are presented relative to the 'fishable' area (waters open to trawling down to 1600 m and to defined 200-m and 50-m (for inshore fishstocks only) depth zones within the fishable area); the 15-class Benthic-Optimised Marine Environment Classification (BOMEC) generated by Leathwick et al. (2012); predicted distribution of likely occurrence for the deepwater Tier 1 target species (Leathwick et al. 2006); and interpolated distribution of surficial sediments for the continental shelf, slope, and deep ocean (Bostock et al. 2019a, 2019b). Additional summaries are provided for some deepwater Tier 1 fishstock groups relative to areas used in analyses of the distribution of finfish bycatch (Anderson & Edwards 2018) or to specific orange roughy fishery areas relevant to Marine Stewardship Council certification assessment. Further, at the request of the Aquatic Environment Working Group (AEWG) the Seafloor Community Classification System (SCC) (Stephenson et al. 2020) was explored in this project as a possible alternative to the BOMEC classification.

The footprint analyses are presented by fishing year (1 October to 30 September) for the 1989–90 (1990) to 2020–21 (2021) fishing years for bottom-contacting effort based on deepwater and combined deepwater and inshore (total) effort and for 2007–08 (2008) to 2020–21 (2021) for inshore effort. These years cover the time period for which detailed tow-by-tow data have been available since the introduction of the TCEPR in the 1990 fishing year, primarily for the deepwater fleets.

Dredge swept area

The only measure of the extent and intensity of dredge effort in previous reports has been the number of tows per year in each fishery-specific area, as reported by oyster and scallop fishers. Actual seabed area contacted was not estimated due to the lack of fine-scale location data. The gradual implementation of ERS data collection for the Foveaux Strait Oyster fisheries during 2019 allowed for a preliminary spatial swept area coverage in the previous benthic footprint project, BEN2019-01 (Baird & Mules 2021b) and is updated here to include the 2020 and 2021 fishing years which had total ERS coverage. Note: the data, methods, and results for dredge effort are presented in Appendix F, separate from the trawl footprint analyses.

Objective 2

GPR trawl data

Objective 2 sought to develop methods to map the extent and intensity of trawl effort using GPR data and compare these with trawl outputs derived in Objective 1. The intent behind this was to see if it was possible to recreate more realistic trawl paths than using the straight line between start and end positions that is assumed using the methods in Objective 1. There are many reasons why fishers do *not* trawl in a straight line. Some (but not all) examples of reasons for this are to avoid foul ground that cannot be trawled on, avoid closed areas such as marine reserves or aquaculture farms, to follow mobile schools

of fish, and to remain on the correct depth contour to effectively target a particular species. By more accurately mapping the trawl paths of a fishery, the extent and intensity of bottom contacting tows should theoretically be more accurately estimated. The use of GPR data also provides an opportunity to further check the accuracy of ERS data and correct errors that may occur where the ERS data have been manually entered; for example, general typographical errors on the reported latitude or longitude, and corrections for Northern or Southern Hemisphere reporting errors.

2. METHODS

2.1 Trawl fishery analyses

The methods below describe the data exploration and grooming and the preparation for the trawl footprint spatial analysis. The methods used for the dredge spatial analyses are described in Section 2.6. These methods build on those developed and described by Baird et al. (2011), Black et al. (2013), and Baird & Wood (2018) for TCEPR data; Baird et al. (2015) and Baird & Wood (2018) for TCER data; and Baird & Mules (2019, 2021a, b) using the MPI spatial software CatchMapper.

2.1.1 Fishery data sources

The MPI Spatial Intelligence team accessed all TCEPR, TCER, and ERS trawl and dredge effort data from the Enterprise Data Warehouse (EDW) for 1990–2021 fishing years. The data extracts (RepLog 13793 for fishing years 1990–2020, RepLog 13978 for the 2021 fishing year after this was added to the project) included fishing event data and associated vessel data for trawl fisheries. The TCEPR data provided information about each fishing operation, with tow-by-tow records of latitude and longitude and date-time for the start and end of each tow, target species, tow duration, tow speed, and gear parameters, amongst others. The TCERs provided similar tow-by-tow data, but with start of the tow position information only which necessitates the generation of an endpoint (see Baird et al. 2015). The ERS collects data similar to the TCEPR; however, the position data are at a finer resolution – TCER and TCEPR data are generally recorded in degrees to one or two decimal places, whereas ERS data are recorded to four decimal places.

2.1.2 Fishery data grooming and treatment

Grooming routines followed those used in previous analyses (see references in Section 2.1) with some refinements where it was deemed improvements could be made. A complete extract of the commercial data going back to 1989 was made and were groomed again so that the latest grooming routines could be applied to all years in the data set and not just the most recent years since the last analyses. Summary data are given in Appendix A. Broad queries on all bottom and midwater trawl data were run using R statistical package (R Core Team 2021) to isolate duplicates or missing data. Particular attention in the grooming was given to variables required to characterise the effort: location/area fished, date and time, gear type, target species, number of tows, fishing duration, towing speed, vessel characteristics, and depth.

The deepwater component included the Tier 1 and Tier 2 deepwater fishstocks (Fisheries New Zealand 2019b) listed in Table 1. The estimation of the inshore footprint is based on reported effort for the inshore target stocks listed in Table 2. This list is based on requests from Fisheries New Zealand for the previous trawl footprint project (Baird & Mules 2021b) with stocks added where there has been more effort recently reported.

Table 1: Tier 1 and Tier 2 deepwater fishstocks with bottom-contacting trawl effort reported during fishing years 1990–2021 (see Fisheries New Zealand 2020 for fishstock boundaries).

Code: fishstock	Common name	Scientific name
Tier 1		
HAK: all	Hake	*Merluccius australis*
HOK: all	Hoki	*Macruronus novaezelandiae*
JMA: JMA 3, 7	Jack mackerels	*Trachurus declivis*, *T. murphyi*, *T. novaezealandiae*
LIN: LIN 3, 4, 5, 6, 7	Ling	*Genypterus blacodes*
OEO: all	Oreo species	*Allocyttus niger*, *Neocyttus rhomboidalis, Pseudocyttus*
ORH: all	Orange roughy	*Hoplostethus atlanticus*
SBW: all	Southern blue whiting	*Micromesistius australis*
SCI: all	Scampi	*Metanephrops challengeri*
SQU: all	Arrow squid	*Nototodarus sloanii*, *N. gouldi*
Tier 2		
BAR: BAR 4, 5, 7	Barracouta	*Thyrsites atun*
BYX: all	Alfonsino	*Beryx splendens*, *B. decadactylus*
CDL: all	Black cardinal fish	*Epigonus telescopus*
EMA: EMA 3, 7	English mackerel	*Scomber australasicus*
FRO: FRO 3, 4, 5, 6, 7, 8, 9	Frostfish	*Lepidopus caudatus*
GSH: GSH 4, 5, 6	Dark ghost shark	*Hydrolagus novaezelandiae*
LDO: all	Lookdown dory	*Cyttus traversi*
PRK: all	Prawn killer	*Ibacus alticrenatus*
PTO: all	Patagonian toothfish	*Dissostichus eleginoides*
RBT: all	Redbait	*Emmelichthys nitidus*
RBY: all	Rubyfish	*Plagiogeneion rubiginosum*
RIB: RIB 3, 4, 5, 6, 7, 8	Ribaldo	*Mora moro*
SKI: SKI 3, 7	Gemfish	*Rexea solandri*
SPD: SPD 4, 5	Spiny dogfish	*Squalus acanthias*
SPE: SPE 3, 4, 5, 6, 7	Sea perch	*Helicolenus percoides*
SWA: all	Silver warehou	*Seriolella punctata*
WWA: all	White warehou	*Seriolella caerulea*

Table 2: Inshore fishstocks for which there was trawl effort during fishing years 2008–2021 (see Fisheries New Zealand 2020 for fishstock boundaries). A full list of inshore targets is given in Table E2 (Appendix E).

Code: fishstock	Common name	Scientific name
BAR 1	Barracouta	*Thyrsites atun*
ELE 3, 5, 7	Elephantfish	*Callorhinus millii*
FLA 1,2,3,7	Flatfish	*Rhombosolea retiaria, R. plebeia, R. tapirina, Pelotretis flavilatus*
GSH 1, 2, 3, 7, 8, 9	Dark ghost shark	*Hydrolagus novaezealandiae*
GUR 1, 2, 3, 7, 8	Red gurnard	*Chelidonichthys kumu*
JDO 1, 2, 3, 7	John dory	*Zeus faber*
KAH 1, 2, 3, 8	Kahawai	*Arripis trutta*
LEA 1, 2, 3	Leatherjacket	*Parika scaber*
LIN 1, 2, 8, 9	Ling	*Genypterus blacodes*
MOK 1, 3	Moki	*Latridopsis ciliaris*
RCO 2, 3, 7	Red cod	*Pseudophycis bachus*
RSK 7,3	Rough skate	*Zearaja nasuta*
SCH 1, 2, 3, 5, 7, 8	School shark	*Galeorhinus galeus*
SKI 1, 2	Gemfish	*Rexea solandri*
SNA 1, 2, 3, 7, 8	Snapper	*Chrysophrys auratus*
SPD 1, 3, 7	Spiny dogfish	*Squalus acanthias*
SPO 2, 7, 8	Rig	*Mustelus lenticulatus*
SSK 3	Smooth skate	*Dipturus innominatus*
STA 2, 3, 4, 5	Giant stargazer	*Kathetostoma giganteum*
TAR 1, 2, 3, 4, 5, 7,	Tarakihi	*Nemadactylus macropterus*
TRE 1, 2, 3, 7	Trevally	*Pseudocaranx dentex*
WAR 1, 2, 3, 7, 8	Blue warehou	*Seriolella brama*

2.1.3 GIS layers for estimating the overlap of the bottom-contacting trawl footprint

The trawl footprint was overlaid with various spatial data layers to determine the extent of seabed contact by trawl gear in 200-m depth zones for All Stocks and deepwater fishstocks and for 50-m depth zones for inshore fishstocks, the potential 'fishable' area, and modelled environmental classification layers, as required in the project specifications. These layers are described below. Note that all the spatial overlap and area calculations were made from data in the following projection: Albers Equal Area Projection (central meridian at 175° E, standard parallels at 30° S and 50° S, and the latitude of origin at 40° S). Appendix B provides maps of the spatial distributions of these layers at the resolution they were generated in and the extent of the seafloor area of each layer (and divisions therein) within their full boundary within the New Zealand 200 n. mile Exclusive Economic Zone and Territorial Sea (EEZ+TS).

All the spatial layers described below were overlaid on a 5 km × 5 km analysis grid and a data value for each layer was assigned to the midpoint of each 25-km^2 cell.

Depth zone

Bathymetry sourced from the General Bathymetric Chart of the Oceans (GEBCO) was used to create both the inshore (50 m increments up to 250 m) and deepwater (200 m increments up to 1600 m) depth classifications used to describe depth-based patterns in those fisheries. The GEBCO data set was also used to limit the fishable area to a depth of 1600 m, the depth that is close to the depth limit of current trawling effort. Previous iterations of the trawl footprint analysis used the 2016 NIWA 250-m cell bathymetry data (Mitchell et al. 2012) to source the 1600 m depth contour. Some differences between the two depth sources exist with the largest difference located along the southwest Campbell Plateau; however, there was no trawl effort reported in this region. The regions with the largest amount of trawl effort removed through changing the 1600-m depth source were: FMA2 (~30 km^2); the shelf edge north of Auckland Island (~30 km^2); Chatham Rise (~17 km^2); and the Macquarie Ridge (~12 km^2). Overall, ~144 km^2 of the total footprint area was removed through the use of the GEBCO bathymetry source compared with the 2016 NIWA data set, all of which was located on the outer edge of the 1600 m depth

limit. The distribution of these zones is shown in Figure B1 in Appendix B. The depth zones are restricted to waters open to trawling, and thus the area of 0–1600 m depth has the same seafloor area as the 'fishable' area.

'Fishable' area

The 'fishable' area is used to display the trawl swept area values and represents waters in 0–1600 m depths that are open to trawling: that is, waters exclusive of Benthic Protection Areas (BPAs) that were introduced in 2007, closed areas to protect underwater features including seamounts (the first of which were closed in 2001), marine farms, and marine reserves, for example, around the Auckland Islands group (Figure B1, Appendix B). The area covered by the 'fishable' area was calculated as 1 391 680 km^2 using the equal area projection described above. The percent overlap of the footprint and the layers discussed in this section are based on the fishable area; the seafloor areas covered by the full extents of these layers (which vary by layer) are given in Table B1 of Appendix B.

Benthic-optimised marine environment classification (BOMEC)

This layer was created by Leathwick et al. (2012) and contains 15 classes that represent different environments generated from modelling the relationships between the distributions of relevant environmental variables to discriminate the distributions for eight taxonomic groups of benthic fish and invertebrates. The classification broadly describes three inshore classes (A, B, D), three shelf classes (C, E, F), and nine classes in deeper waters down to 3000 m (G–O) (see Figure B1 in Appendix B). Thus, it extends beyond the depths where fishing normally occurs. The area (square kilometres) of each class was calculated, as above, for the full extent of the predicted layer and the fishable area.

Seafloor Community Classification (SCC)

This layer was based on a classification system developed by Stephenson et al. (2020) and contains 75 classes (64 of which occur within the fishable area). The SCC is a numerical classification system created using Gradient Forest models to classify the seafloor environment and communities within the New Zealand EEZ+TS. Four biotic groups (demersal fish, reef fish, benthic invertebrates, and macroalgae) to inform the transformation of 33 gridded environmental variables to represent the turnover of taxa composition. As was done for the BOMEC system, the area in square kilometres of each class was calculated, with the SCC value of each cell being determined by the SCC value at the midpoint of the cell.

Probability of capture/annual distribution for the Tier 1 target species

For the seven fish target species in the deepwater Tier 1 group of fishstocks, Leathwick et al. (2006) predicted the distribution of the probability of capture during a standardised trawl in waters out to 1950 m within the outer EEZ boundary, based on presence/absence data and relevant modelled environmental variables (Figures B2a–B2b of Appendix B). For scampi and arrow squid, the annual distributions of the populations as mapped by MPI (www.nabis.govt.nz) are used as a proxy for the species distribution (see Figure B2c). The arrow squid and scampi areas match the extent of the EEZ+TS; the areas of unknown presence, hotspot, 90%, and 100% annual distribution for arrow squid and scampi were calculated, as above.

Surficial sediment distribution

Sediment analyses and observations from a comprehensive range of sources were collated into a database nzSEABED to characterise and map the surficial sediments of the New Zealand continental shelf, slope, and deep ocean by Bostock et al. (2019a, 2019b). The data were interpolated using kriging in GIS to yield percent mud, sand, and gravel (to total 100%) and carbonate content (% carbonate versus non-carbonate) to provide information about biological content. The distributions of these substrates are shown in Figure B3 in Appendix B).

2.2 Generation of trawl fishery spatial output

The reported trawl data include position and operational information that allow spatial analysis and presentation. However, each data type requires different treatment to generate swept area estimates.

TCEPR data include both start and end positions (generally to the nearest 1 minute of arc, or about 1.852 km). ERS data also include start and end positions, but to a finer resolution than TCEPR data. TCER data have tow start positions only, at the same resolution as TCEPR data. Thus, the groomed data are treated separately (by form type) before being combined to develop the swept area statistics. The methods described below follow those used and fully described by Baird et al. (2011) and Black et al. (2013) for TCEPR data and Baird et al. (2015) and Baird & Mules (2021a, b) for TCER data.

Where latitude and longitude data were truncated to the nearest minute of arc (TCEPR and TCER data) many tows appear to start at the same location because of the lower resolution of the data. To better represent and estimate the likely extent of seabed contact and limit the artificial patchiness of effort created by the resolution of the data, the start and finish positions were randomly jittered using an offset of ± 0.5 minute. The jittered values were stored as new fields in the data set. The finer resolution of ERS data meant that start and finish positions were not jittered as they were deemed to be sufficiently accurate. Note that the reported position data represent where the vessel was at the time the net was deemed to have reached (and left) fishing depth rather than the location of the net.

2.2.1 Preparation for estimating swept area from TCER forms

The TCER data provide only the start position of a tow—no end position is provided. Although a measure of swept area can be calculated, based on the duration of the tow and tow speed, the swept area cannot be spatially represented, other than as a circle centred on the start position. To create a trawl track, the methods described by Baird et al. (2015) were used, whereby, within a trip, a tow direction was generated from the bearing between the start position of a tow and the start position of the next tow. A distance measure (in kilometres) was estimated from tow speed and tow duration data and used with the estimated bearing to generate finish coordinates.

TCER data are characterised by a relatively small number of tows per trip (Baird et al. 2015) and a substantial number of tows on a given trip had no following tow to use as a bearing for the next tow as the final tow of a trip had no following tow. Thus, the last tows of a trip are identified, as are trips with only one tow, and, for each of these, a bearing was estimated based on the median estimated bearing values from other tows by the same vessel for the same target species within $1/30^{th}$ of a degree north/south or east/west, using a minimum number of two tows. This was used to generate finish coordinates (as above). Where this failed, tow end coordinates were generated by using the median estimated bearing values from tows of the same target species within $1/30^{th}$ of a degree north/south or east/west, using a minimum number of two tows.

2.2.2 Spatial allocation of tows

Several unreported variables were generated on a tow-by-tow basis to provide spatial representation of each tow:

Doorspread. The distance between the two trawl doors provides a measure of the width of the trawl path used to estimate the potential area of the seafloor contacted by the trawl gear, that is, the swept area. This measure is not reported on commercial data forms, so previous footprint studies have applied doorspread values (with agreement from the Fisheries New Zealand Aquatic Environment Working Group) to each tow, based on vessel size, target species, and known gear parameters, including the number of nets used to reflect differences in the spread of gear depending on vessel size (see, for example, Baird & Wood 2018). The estimated doorspread values used in this study were assigned according to vessel size (overall length), target, and the number of nets used (based on the "number of nets" data which were first collected on the TCER and TCEPR forms in the 2008 fishing year), informed further by observer data. Data from the HOK/HAK/LIN stock assessment projects (Sira Ballara, NIWA, pers. comm.) were used to identify those tows in the effort data that used twin trawls before 2008. Vessel categories and types are given Figure 15. The assigned doorspreads were the same as used by Baird & Mules 2021b:

- 70 m for category A vessels under 20 m in length, with a single net
- 100 m for category A vessels over 20 m (max. 28 m) in length, with single net
- 150 m for category B vessels, with a single net

- 50 m for scampi tows with two nets and 70 m for scampi tows using three nets for category A vessels
- 70 m for scampi tows with two nets and 90 m for scampi tows using three nets for category B vessels
- 150 m for all targets, except HAK/HOK/LIN/SWA, for category C vessels that used one net
- 200 m for category C vessels targeting HAK/HOK/LIN/SWA with a single net
- 400 m for category C vessels targeting HAK/HOK/LIN/SWA with two nets [bottom trawl, BT] and for a single category D vessel that used two nets [BT]
- 150 m for all category D BATM vessels [BT and midwater within 1 m seafloor]
- 200 m for remaining category D vessels with single net.

These estimates were again put before the AEWG to comment on prior to analyses beginning for this project and it was agreed that these were suitable.

Tow distance. A distance for each trawl track (kilometres) was calculated from the finalised start and fishing positions, assuming a straight-line tow.

Speed-time distance. A second distance value (kilometres) was calculated for each tow; this was based on the speed and the tow duration (the difference between the reported tow start and finish times) for use with the TCER data and for some deepwater target TCEPR tows where short tows on hills resulted in the coordinates of the start and finish location being the same.

Each tow was converted into a trackline (distance between the start and finish locations). Scampi, arrow squid, and hake tows were permitted a maximum length of 70 km and a maximum tow distance for other species was set at 55.56 km (after Black & Tilney 2017, Baird & Mules 2019). A median distance (calculated from the straight-line tow distance by target species) was applied to the start points of those tows that exceeded the prescribed maximum lengths, and new end points were generated in GIS by shortening the trackline to the median distance.

2.2.3 Assignment of tow data to cells

To aid in the categorisation and analysis of the data, a grid of approximately 25 km^2 cells was created as a database table and joined to the TCER, TCEPR, and ERS effort table. This 5×5 km cell size has been used in previous work and is considered reasonable, by successive Aquatic Environment Working Group meetings, as the unit of analysis for trawl swept areas on a broad scale such as the EEZ+TS. This grid was generated in the Albers Conic Equal Area Projection and re-projected to latitude and longitude degrees to overlay with groomed effort data as a basis for spatial analysis quantify the amount of effort per cell (intensity) over time and to generate an indicative 'footprint' of trawl effort on the seafloor. While all tows are assigned to cells, the estimation of the footprint and aggregate area is estimated based on the swept area of each tow, not the area of the cell. Only the portion of any particular cell that has been contacted contributes to the actual footprint or aggregate area. For example, a cell may be 25 km^2 in area, but if only half of it has been trawled, only half of its area is counted towards the footprint (12.5 km^2).

For area-based calculations, the data were re-projected to the Albers Conic Equal Area projection to minimise distortion caused by converging lines of longitude with increasing latitude using degrees as the coordinate units.

This study used the estimated *swept area* for each tow (in square kilometres), hereafter referred to as the *swept area*, to estimate the extent (the footprint) and intensity (aggregate swept area) of seabed contact by trawl fishing.

1. *Swept area* is the area derived from the tow distance as the straight-line measurement between start and finish positions and the assigned doorspread.

2. *Aggregate swept area* (Figure 1) is the total summed swept area for a particular period. This exceeds the footprint because it includes the swept areas of all tows, including those that overlap.
3. *Trawl footprint* is the area (square kilometres) that represents the seafloor area estimated to have been contacted by trawl gear (Figure 1).

For each cell, the sum of the area of all the portions of the estimated doorspread trawl polygons that lie within that cell was calculated. Thus, a cell in any given fishing year may have an aggregate swept area of 0 km^2 (no contact) or 25 km^2 (contacted area is equal to the cell size), or for example 100 km^2, suggesting that for that year, the swept contacted area was four times the cell area; whereas the maximum trawl *footprint* in a cell is 25 km^2 (i.e. the area of a cell).

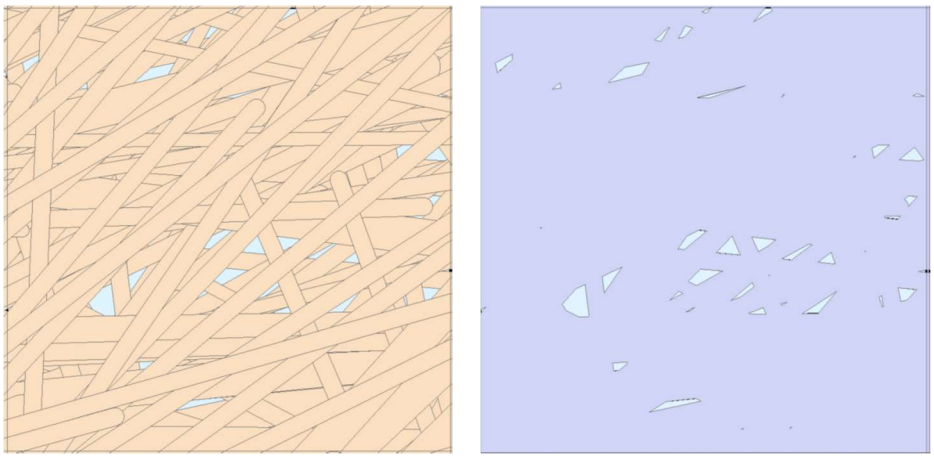

Figure 1: A 25-km^2 cell showing the trawl polygons representing the aggregate area (i.e., the sum of the swept areas of the bottom-contacting trawls) shown in the left panel and the footprint that represents the seafloor area estimated to have been contacted by those same trawls in that cell in the right panel. From Baird & Mules (2021b).

2.3 Estimation of newly trawled area using identification of 'new' cells contacted

The extent of the trawl footprint will vary in each footprint project analysis because: (i) a full set of data is extracted for each project and includes the most recent fishing year of data, as well as any updates to the underlying previous years of data; (ii) the use of random jittering (Section 2.2) will produce slight changes in the location of each jittered position in each analysis; (iii) refinements to grooming algorithms can produce slight changes in the location and distance of trawls. To identify areas that are newly contacted by the annual footprint in the most recent year, the footprint of the previous years (e.g., for the combined 1990–2019 fishing years) can be directly compared with the most recent year (e.g., 2019) in GIS. Baird & Mules (2019) showed that this method identified small slivers of footprint from the most recent year in areas of dense contact and concluded that because of the inherent uncertainty in the estimation of the swept area—from the resolution of the start and finish data, the treatment of the trawl trackline as a straight line, and the use of generic doorspread values—much of this 'new' area may not represent expansion of the footprint extent.

An alternative method to identify areas of expansion/exploration in the most recent year is a cell-based comparison, based on the 25-km^2 cell footprint. Thus, any cells in the most recent analysis year that were not identified as contacted in the combined previous years are identified as 'new' cells (Baird & Mules 2019): that is, cells with no previous trawl contact (within the time series of analysis) indicate newly trawled areas that represent an extension of bottom trawling. This method is used in this analysis.

2.4 Underlying assumptions in trawl fishery spatial analysis and representation

The effort data used here represent subsets of the total commercial trawl effort data reported during these years. First, data are for tows where bottom trawl gear was used or midwater trawl gear was used

within 1 m of the seafloor, and second, the data are restricted to three data sources (TCER (2008–2020 fishing years), TCEPR (1990–2018), and ERS (2018–2021).

Some underlying assumptions need to be stated.

1. Each time series has an artificial start and end. The study treats the first fishing year of data, for example, 1990 or 2008, as the start of fishing in each area, and thus any discussion of trends is relative to the fishing year at the beginning of the time series.
2. It is assumed that the paths (trackline) of all tows follow a straight line between the reported or estimated start and end positions. In reality, tows may follow contours and may include turns, but the trackline data do not allow any determination of actual tow path. The duration-speed distance measure provides some measure of a tow path distance and where this differs from the trackline distance it is assumed to be closer to the 'real' length of a tow.
3. It is assumed that the gear is in contact with the seafloor between the trawl doors and throughout the tow.
4. It is assumed that gear used by similar sized vessels fishing for the same target species has the same doorspread, and that there are no differences in the way in which skippers operate or rig their gear.
5. The resolution of most of the position data is to the nearest minute (about 1.852 km—assuming no allowance for latitudinal changes).
6. The measure of swept area will be indicative and may well be better estimated for certain target species where fishing effort is carried out by larger vessels with gear parameters that are better understood.
7. The irregular nature of the seafloor is ignored, and it is assumed that, within each cell, the seafloor is homogeneous.
8. The patchy distribution of fishing is in part due to avoidance of areas of the seafloor that are unfishable because of undersea formations or habitats such as sponge gardens that fishers may describe as 'foul ground'.

2.5 Mapping of trawl tracks using Geospatial Position Reporting (GPR) data

GPR data were extracted from the Enterprise Data Warehouse for the 2020 fishing year (RepLog 13757). The implementation of GPR devices into the fleet from the 2018–19 fishing year was gradual and coverage was low, and so this year of data was not included in these analyses. Coverage in 2019–20 was high and was deemed suitable for use. It had been intended to also use the 2020–21 fishing year as well but, by the time these data had become available, technical difficulties and the lengthy processing times required to generate the necessary spatial output meant that these data could not be included in this report. Hence, only the 2019–20 (2020) fishing year is presented here. However, this provides a sufficient 'proof of concept'.

To generate tow tracks using GPR data, bottom-contacting trawl events were identified that were present both in the commercial catch and effort data extract (as reported on ERS forms) and the GPR data. GPR devices report vessel position at whatever rate they are set to and with no regard to what activity they are engaged in (e.g., no distinction between steaming, searching, and trawling). The start and end positions of tows were identified from those reported by ERS forms, with successive locations of the vessel in between those positions determined by GPR. Grooming of GPR data was undertaken based on the speed and distance between adjacent locations to identify obvious errors.

The reporting or 'ping' rate of GPR devices varied within the fleet, from about once every ten minutes for inshore, to about once every half an hour to two hours in the deepwater fleet (most commonly once an hour). As some fishing events, particularly those focused on underwater topographic features (UTFs), can take less than one hour it is possible that some fishing events will not be captured by GPR because the event will have begun and ended in between pings. As such, for the purposes of comparing the footprints and aggregate areas generated from GPR data with the 'traditional straight-line method'

outlined in Sections 2.1–2.4 above, only fishing events present in both data sets (GPR and the commercial extract) were used.

The agreed doorspread values for various vessel classes used in Objective 1 were then applied to the GPR tow lines to give an estimate of the area swept for each fishing event. It should also be noted that because tow paths created using previously used methods are a straight line, an individual tow in isolation can only have a footprint, not an aggregate area. The aggregate area in a given data set created from straight-line tows can only be the result of individual tows that have crossed paths with other tows. Tow paths created from GPR data, however, can cross back over their own paths by, for example, going round in circles or doubling back in the direction they have just come from. This means that an individual tow can have an aggregate area using this method, and this is included in the total aggregate area estimate for the GPR data.

2.6 Shellfish dredge fishery analyses

The MPI Spatial Intelligence team accessed all dredge effort data from the Enterprise Data Warehouse for 1990–2021 fishing years (RepLog number 14620). The scallop and oyster dredge fishery data for 1990–2021 were extracted from MPI's EDW database were groomed according to rules used by Baird et al. (2011), based on information from fishers and researchers at the time. The methods used and the analysis results are presented in Appendix F.

3. RESULTS: ALL STOCKS TRAWL FOOTPRINT, 1990–2021

3.1 Number of tows

For the combined 1990–2021 fishing years, 2 117 792 bottom-contacting tows were retained for the spatial analyses: 67% were from TCEPRs; 25% from TCERs; and 8% from ERS data collection (Table A1 in Appendix A). Deepwater fishstocks accounted for about 58% of all tows and inshore fishstocks for about 42%. These forms were introduced in different years over the time series, with the TCEPR providing the first tow-by-tow data collection for vessels over 28 m that generally fished deeper waters within the New Zealand EEZ, with the first data collection year being 1 October 1989 to 30 September 1990 (referred to hereafter as the 1990 fishing year). It is this form that provides the backbone of the All Stocks data, and the deepwater component has been supplemented from the mid-1990s with inshore effort from *some* of the inshore fleet that voluntarily reported on TCEPR forms, primarily inshore vessels targeting snapper, but also other inshore target species that were likely fished by these same snapper vessels. Other inshore effort continued to be recorded on CELRs that collected data only at a daily resolution on a target-statistical area basis. The summary data for annual effort recorded on CELRs are given in Table A2, along with the annual TCER, TCEPR, and ERS tows. These data show that, before the 2008 fishing year, the amount of overall trawl effort (number of tows) each year is substantially higher than what is included in the TCEPR tow data; however, the resolution of CELR reporting means these data cannot be used for tow-by-tow spatial analysis. The CELR forms only recorded the number of trawls carried out each day for a given combination of target species and statistical area. Start and end positions, or other information that would allow for a track line to be created (and then swept area) were not recorded on this form type. From 2020, there has been no trawl effort recorded on CELR forms. In the most recent fishing year, 61 385 tows were used to inform the All Stocks analyses (Table A2), 109 tows were excluded from the analyses, 61 of these had coordinates that placed them on land, 31 were in closed areas, and 17 were deeper than 1600 metres in depth.

When the CELR form was superseded with the introduction of the TCER on 1 October 2007 (2008 fishing year), a new set of data was available for spatial analysis alongside the TCEPR data. Lastly, the move to ERS data away from TCEPR during 2018 for deepwater fishstocks and away from TCER in 2019 for inshore fishstocks has provided similar data but at a finer resolution and, for inshore data, an endpoint for each tow. The change of reporting form type and the data collected on each form during the time series needs to be considered when interpreting these data. For the All Stocks data set, the most comprehensive time period, where both deepwater and inshore effort was reported with tow location

data, is from 2008 to 2021 by which point both fleets were reporting data using ERS. There was an increase in the reported number of tows each year from 2008 for the All Stocks data set. Prior to this the number of tows has been declining from 1999 as effort from the deepwater fleet declined (see Section 4). The increase in tows from 2008 for All Stocks is driven by the inclusion of more inshore data with the introduction of the TCER form and from 2018, the ERS form. Most of this inshore effort was targeted at flatfish, tarakihi, and red gurnard, but there are a number of inshore species that are important (see Section 5).

3.2 Spatial coverage

The extent of the All Stocks seafloor contact is summarised by year in Table C1 in Appendix C. Overall, the data available for all stocks indicate that, within the fishable area (areas open to trawling shallower than 1600 m), 40 445 25-km^2 cells were contacted over the 32 years, with a total aggregate area of 4 886 573 km^2, and a footprint of 462 643 km^2. In the period 1990–2021, 98.3% of the aggregate area and 93.5% of the footprint area were within the fishable area. Other effort was excluded where coordinates placed effort on land or in closed areas (see Appendix C, including Tables C2 & C3 and Figure C1 in Appendix C). All further references to the aggregate and footprint in areas in this document are for the fishable area.

All Stocks footprint. Overall, the trawl footprint of 462 643 km^2 represents 11.3% of the EEZ+TS seafloor area and 33.5% of the fishable area (Table C1). The annual footprint shown in Figure 2 shows a steady increase from the start of the data collection in 1990, to a peak in 2002 and 2003 at about 96 000 km^2, followed by a decrease to about 67 000 km^2 in 2006 and 2007. The marked rise in the annual footprint from 2008 is a result of the addition of the TCER data from all the bottom-contacting inshore trawl activity. Effectively the footprint has extended from offshore to inshore with the addition of these TCER data, and the lack of a large increase in the annual number of cells in subsequent years, despite the addition of the inshore data, indicates a decrease in the extent (as measured by cells contacted) of the offshore component. The annual footprint after 2010 (at 94 500 km^2) shows a slight decrease overall, to a low (since 2008) in 2020 (at 70 300 km^2) and the most recent year increasing slightly again to 74 500 km^2). The spatial distribution of the All Stocks footprint for all years combined and for 2021 is shown in Figure 3.

All Stocks aggregate area. The aggregate area increased to a peak in 1998, at 200 572 km^2, then had a relatively steady period (range of 173 162–179 958 km^2) between 1999 and 2003 (Table C1, Figure 2). From 2004 to 2007, the aggregate area declined to levels similar to the early 1990s, to a low of 111 328 km^2. The availability of tow location data for much of the inshore fleet, made possible by the introduction of TCER forms, resulted in an increase to the aggregate area in 2008 to 154 337 km^2. Between 2008 and 2018 the aggregate area was relatively steady ranging between 146 112 km^2 and 162 886 km^2. There has been a declining pattern since 2019 with the 2020 and 2021 aggregate areas estimated at about 130 000 km^2, the lowest values seen since the beginning of the time series. Given that for the most part there were no inshore data contributing to the early aggregate areas, the fact that the most recent aggregate areas are smaller (and *do* include inshore data) than earlier estimates suggests that the true aggregate area has decreased substantially since the beginning of the time series. The spatial distribution of the All Stocks aggregate area for all years combined and for 2021 is shown in Figure 4.

All Stocks number of cells. Over the 32 years in this data set, 40 445 cells were contacted by the All Stocks footprint (Table C1). Pre 2008, when the data mainly represented the deepwater fleet effort, the number of cells increased to a peak of just under 20 000 cells in 2002 and then dropped to 15 756 cells in 2007 (similar to the number in 1994). With the addition of the TCER data, the number of cells contacted increased to 18 539 in 2008, then the number dropped to 16 311 in 2013. This was followed by a relatively steady period at about 17 200 to 17 600 until 2019 when the number of cells dropped to just under 16 000, then to 14 170 in 2020 (the lowest since 1991) with a slight increase to 14 757 in 2021 which is still substantially lower than the time series mean. For the entire time series, the mean number of cells contacted per year was 16 945. For the more comparable time period from 2008 (when most inshore fishing could be included), the mean number of cells contacted per year was 16 998. While

this appears to be only a slight increase, the fact that the latter period includes inshore fishing that was almost entirely absent from the former period suggests that the number of cells contacted each year has likely fallen considerably over the time period.

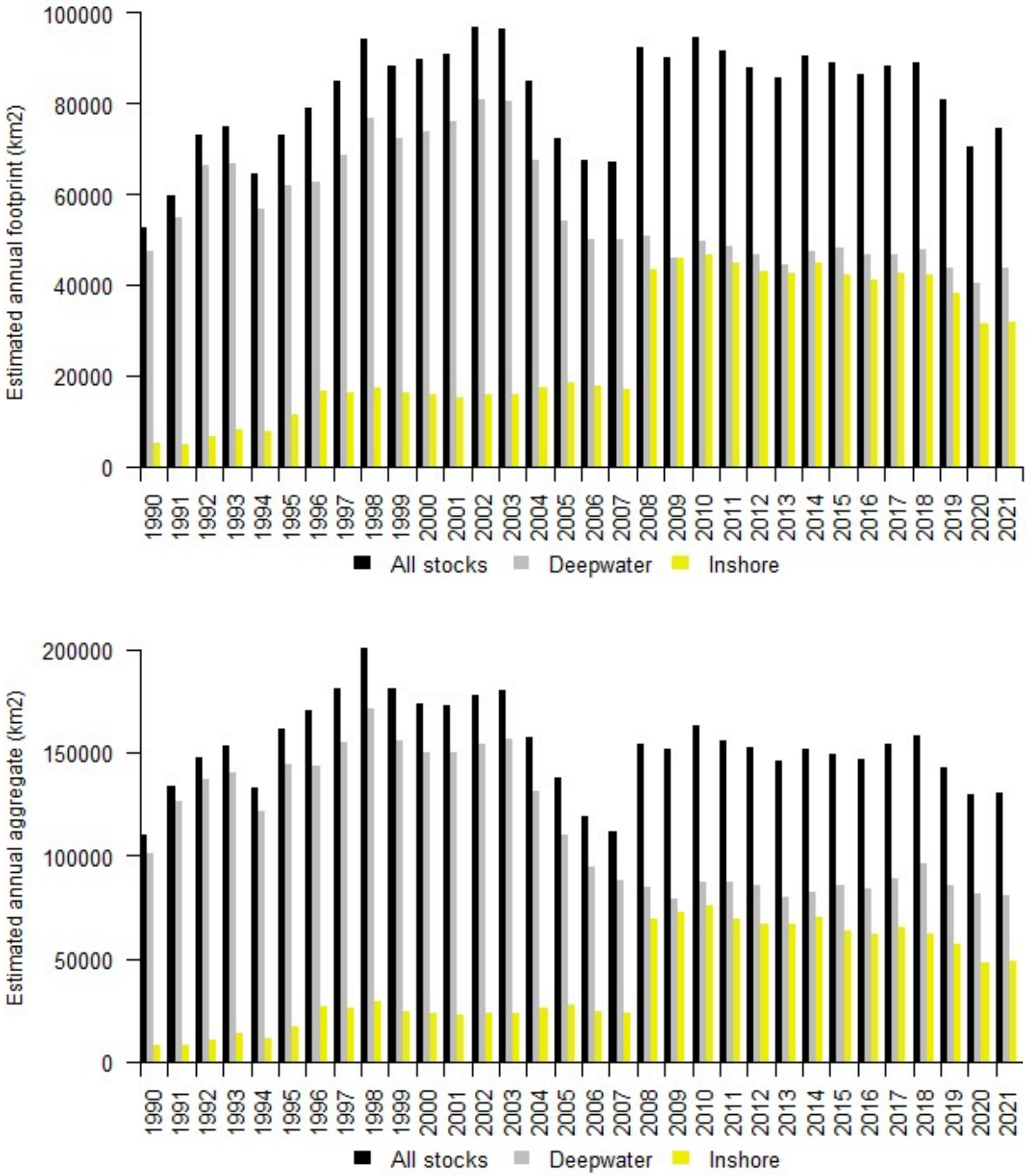

Figure 2: Annual estimated footprint (top panel) and aggregate area (bottom panel) for All Stocks, Deepwater stocks, and Inshore stocks, 1990–2021. The data represent TCEPR (1990–2018), TCER (2008–20), and ERS (2018–2021) bottom-contacting effort. Note: TCER data collection was introduced in the 2008 fishing year and ERS data collection started in the 2018 fishing year.

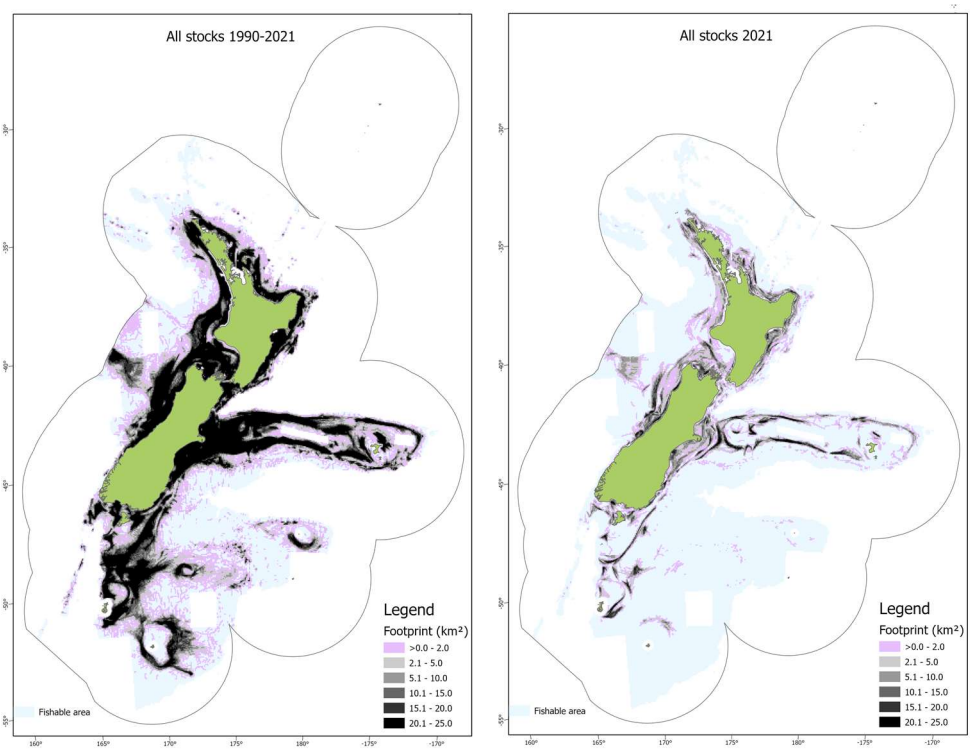

Figure 3: Distribution of the All Stocks footprint represented by 25-km^2 cells, 1990–2021 and 2021.

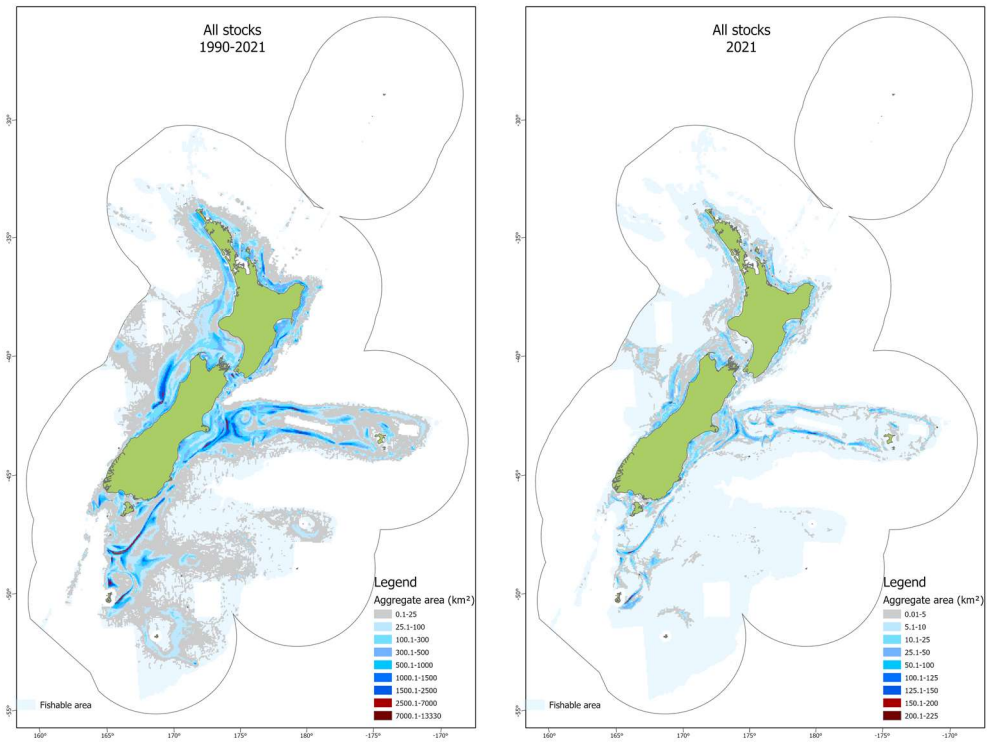

Figure 4: Distribution of the All Stocks aggregate area per 25-km^2 cell, during the combined fishing years 1990–2021 (left) and for 2021 (right).

3.2.1 Extent of new areas contacted across the time series

A measure of change across all years is the number of cells contacted in a year (for example 1998) that were not contacted in previous years (1990–1997); these cells are referred to as 'new cells'. These cells provide a way in which to isolate new areas that have been contacted, beyond the usual fishing areas. From a total of 26 912 cells contacted during the 1990–1994 fishing years, 1330 cells were contacted

for the first time in 1995, with around 1100 or more new cells contacted each year until 2000, with the highest number being 1480 in 1998 (Table C4). Since 2000 fewer than 1000 new cells have been contacted each year, with an overall declining trend with several years having contacted fewer than 100 new cells. The apparent increase in the number of new cells contacted in 2008 is a result of the introduction of the TCER data which allowed most of the inshore activity to be included. The following year, values for the number of new cells contacted are similar to those seen in 2006 and 2007. For the most recent year, 2021, 42 new cells were contacted, the lowest number in the time series (Table C4). The estimated trawl footprint and aggregate area within these new cells provides an indication of the extent of area newly contacted and the intensity of contact in those newly contacted areas. In most years given in Table C4, there is little difference between the aggregate area and the footprint, and the areas are small and likely represent the edge of the main fishing areas. For 1990–2007, the annual new cell footprint represents between 83.4 and 95.7% of the pre-2008 new cell aggregate area, and for 2009–2021 the annual new cell footprint represents between 87.6 and 100% of the total 2009–2021 aggregate area. This suggests the swept area of the tows is spread out within each cell, without much overlap between tows. However, in 2008, when the complete set of bottom-contacting inshore data could be included (resulting in a large number of new cells relative to previous years), the new cell footprint was 65.3% of the new cell aggregate area, suggesting more overlap of tows.

3.2.2 Intensity

For the combined 1990–2021 All Stocks data, the median number of tows that contacted a cell was 31 tows (mean of 299), and 50% of cells were contacted by between 4 and 251 tows, with a maximum of 20 326 tows over the total data set (Table 3). The top ten 25-km^2 cells with the highest total aggregate area ranged between 8272 and 13 331 km^2 swept. All ten cells are located at the southern edge of the Stewart-Snares shelf, and nine of those cells were in the top ten cells for the number of tows per cell (8272–13 331 cells) with the other cell occurring off the west coast of the South Island (7557 cells).

Between 1990 and 2007 the median number of tows in a cell in a year was 3–6 tows. This increased in the period between 2008 and 2021, where the median number was 8–10 tows (Table C5). During the pre-2008 fishing years (before most inshore data were included), the spread of the data was tighter than for the 2008–2021 years, but the maximum numbers of tows contacting cells during 1990–2007 (when the data were mainly deepwater) was between 2 and 3 times that in most years for the 2008–2021 data. The year with the maximum of tows contacting a cell was 1991 (2405 tows off the southern edge of the Stewart-Snares shelf) and, for 2008–2021, the maximum number was in 2018 (825 tows near the Hokitika Canyon off the west coast South Island). Substantially smaller maximum aggregate areas per cell were seen in the last 14 years compared with the earlier years; a reflection of the decrease in deepwater component of aggregate area as well as the inclusion of the inshore data (see Figure 2). The peak years for aggregate area during 2008–2021 were mainly between 2013 and 2021 (with the exception 2017) when maxima were between 276 and 445 km^2 per cell (in the Hokitika Canyon for most years and on the Stewart-Snares shelf southern and eastern edge). The maximum footprint in a cell in each year was equivalent to the cell area (25 km^2).

Table 3: Summary data for the number of tows that contact a cell, the aggregate area, and the footprint by 25-km^2 cell for the All Stocks data, for the combined fishing years 1990–2021. Annual summaries are given in Table C5.

	Minimum	1st quarter	Median	Mean	3rd quarter	Maximum
No. of tows	1	4	31	299	251	20 326
Aggregate area (km^2)	< 0.1	1.6	12.2	120.8	89.4	13 331.1
Footprint (km^2)	< 0.1	1.5	8.8	11.4	23.0	25.0

3.2.3 Number of years contacted

Of the 40 445 cells contacted by the total All Stocks footprint, 15% (n = 6021) were contacted in one year only, 8% in 2 years, and 6% in 3 years (Figure 5). Just over half the cells (51%) were contacted for up to 14 years (the number of years TCERs were used). In total, 6.9% of cells (n = 2815) were contacted each year. Beyond the 14 years, these data largely reflect the deepwater stocks reported on TCEPRs. This is reflected in the spatial distribution of number of years per cell, as shown in Figure 6.

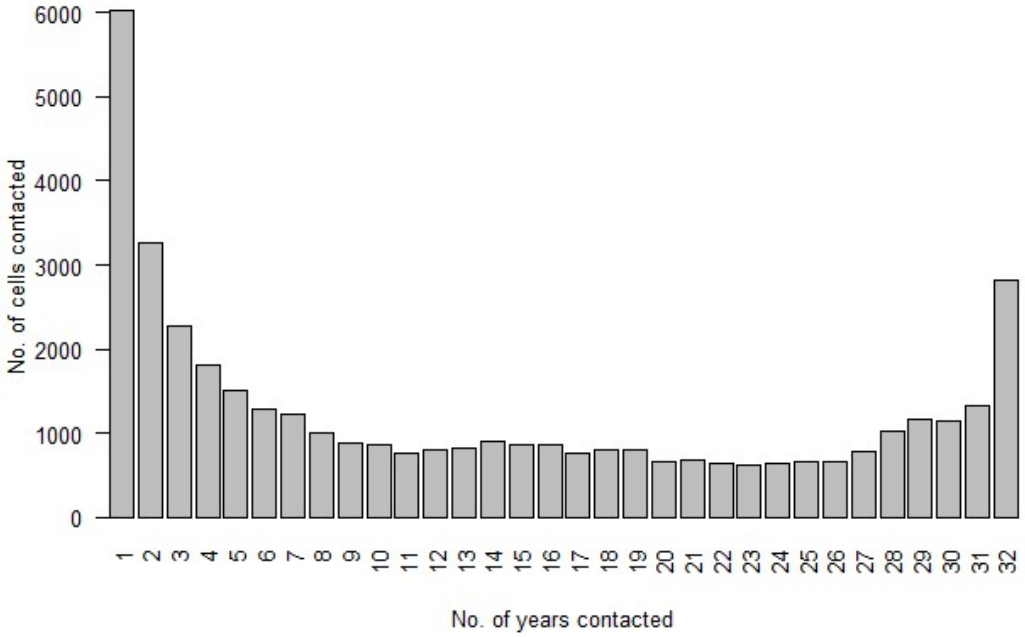

Figure 5: Frequency of the number of years cells were contacted, All Stocks for 1990–2021.

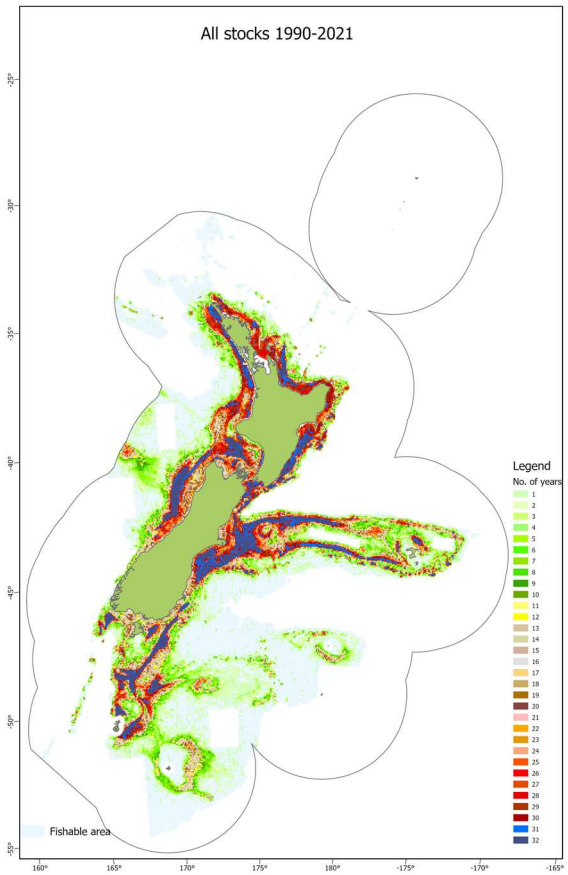

Figure 6: Distribution of the All Stocks cells by the number of years contacted, during 1990–2021.

3.3 Overlap of All Stocks footprint with 200-m depth zones

Tables C6, C7, and C8 in Appendix C give the total and annual extent of the 1990–2021 bottom-contacting measures (footprint, aggregate area, and number of cells contacted), by year. Almost 40% of the 1990–2021 footprint was in the shallowest depth zone of 0–200 m (Tables 4 & C6). Another 23% of the total footprint was in 400–600 m, 13% in 600–800 m, and 10% in 200–400 m. The percent of the 1990–2021 footprint in depths over 1000 m was less than 7%. In 2021, 50% of the footprint was in waters shallower than 200 m, 25% in 400–600 m, and 9% in 200–400 m. The percent of the 2021 footprint in depths over 1000 m was 3%. The extent of the distribution of the footprint by depth class for all years and for 2021 is shown in Figure 7.

Table 4: The total area of the seafloor in each depth zone within 'fishable' waters (all depth zones ≤ 1600 m combined), the All Stocks footprint, the percent of the total footprint in each depth zone, and the percent of each depth zone area contacted by the trawl footprint, for 1990–2021 and 2021.

Depth	Area	Footprint (km^2)		Total footprint (%)		Footprint overlap with depth zone area (%)	
zone (m)	(km^2)	1990–2021	2021	1990–2021	2021	1990–2021	2021
< 200	249 341.9	180 816.1	37 595.2	39.1	50.5	72.5	15.1
200–400	98 295.9	46 553.8	6 622.6	10.1	8.9	47.4	6.7
400–600	253 939.2	105 762.7	18 597.8	22.9	25.0	41.6	7.3
600–800	185 161.6	60 754.3	5 583.1	13.1	7.5	32.8	3.0
800–1000	166 645.0	37 332.5	3 782.7	8.1	5.1	22.4	2.3
1000–1200	144 930.5	20 567.9	1 800.2	4.4	2.4	14.2	1.2
1200–1400	168 376.8	7 692.5	422.3	1.7	0.6	4.6	0.3
1400–1600	124 988.8	3 163.6	104.0	0.7	0.1	2.5	0.1
≤ 1600	1 391 679.7	462 643.3	74 507.9	100.0	100.0	33.2	5.4

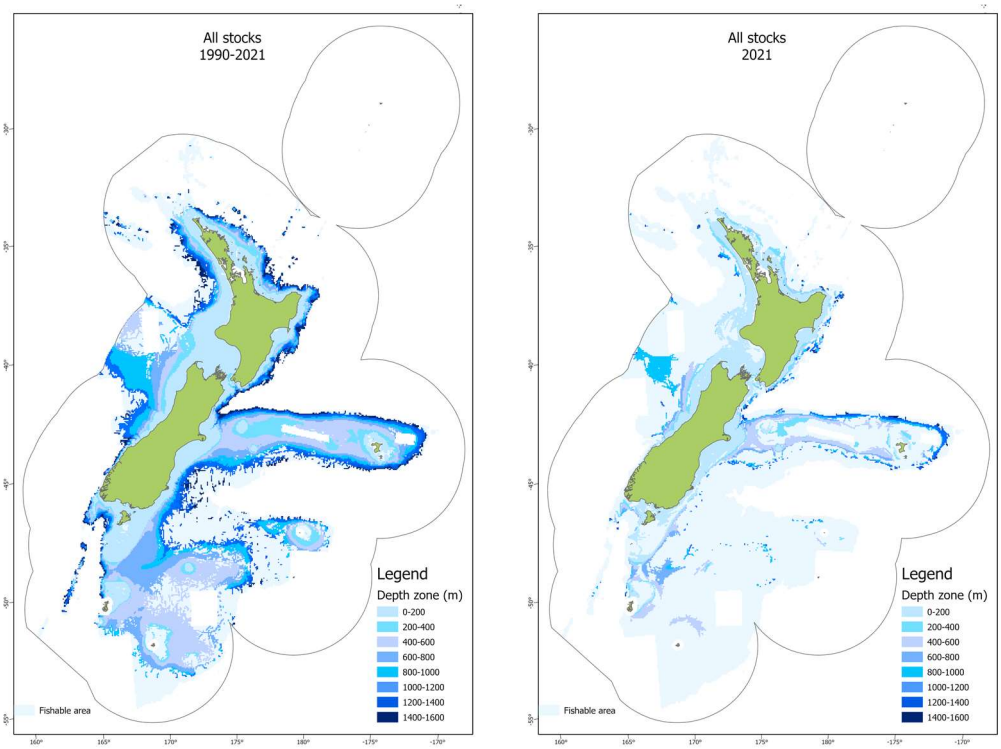

Figure 7: Extent of the All Stocks footprint overlap with 200-m depth zones, represented by 25-km^2 cells, for all years combined (left), and for 2021 (right).

The footprint overlap was greatest in the shallowest depth zone, which had the second largest seafloor area (72.5% of the < 200 m depth zone contacted for all years combined, and 15% for 2021) (see Table 4). About 47% of the relatively small seafloor area in 200–400 m (7% in 2021), 42% of the 400–600 m zone (7% in 2021), and 33% of the 600–800 m zone (3% in 2021) was contacted by the 1990–2021 footprint. Although the 1990–2021 overlap was about 22% in 800–1000 m and 14% in 1000–1200 m, the 2021 footprint contacted 2.3% and 1.2%, respectively, of the seafloor in these deeper zones.

The annual change in the percent of each depth zone contacted by the footprint is shown in Figure 8. The percent of the overlap of the 400–600 m zone increased from 1990 to a peak in 2003, then dropped to under 10% from 2005. The influence of the addition of the TCER data in 2008 is evident in the marked increase in overlap of under 200 m zone, with a peak at 20–21% each year between 2008 and 2020, before dropping to 15% in 2020 and 2021. For the years since 2008, the percent overlap of other depth zones by the annual All Stocks footprint has been relatively steady, though there has been a small uptick in the overlap extent in 2021 for the 200–400 and 600–800 m depth zones.

The total aggregate area by depth zone showed a similar pattern to the footprint in the two shallowest depth zones, with 40% of the total aggregate area in under 200 m and 12.5% in 200–400 m, but the higher estimated aggregate area in the 400–600 m zone (32% of the total) indicated more intense contact (Table C7). In contrast, relatively small proportions of the total aggregate area were in deeper waters where the tow swept areas are likely smaller because the effort often consists of short tows on underwater features. The aggregate area in waters over 800 m accounted for under 5% of the total 1990–2021 area. The spread of the 2021 aggregate area showed a similar pattern with 47% in under 200 m, 11% in 200–400 m, 29% in 400–600m, and 7% in 600–800 m. 6% of the 2021 aggregate area was in 800–1600 m.

The changes described above are reflected in the numbers of cells contacted (Table C8), particularly with the increase in cells in less than 200 m as a result of the addition of more inshore data in 2008.

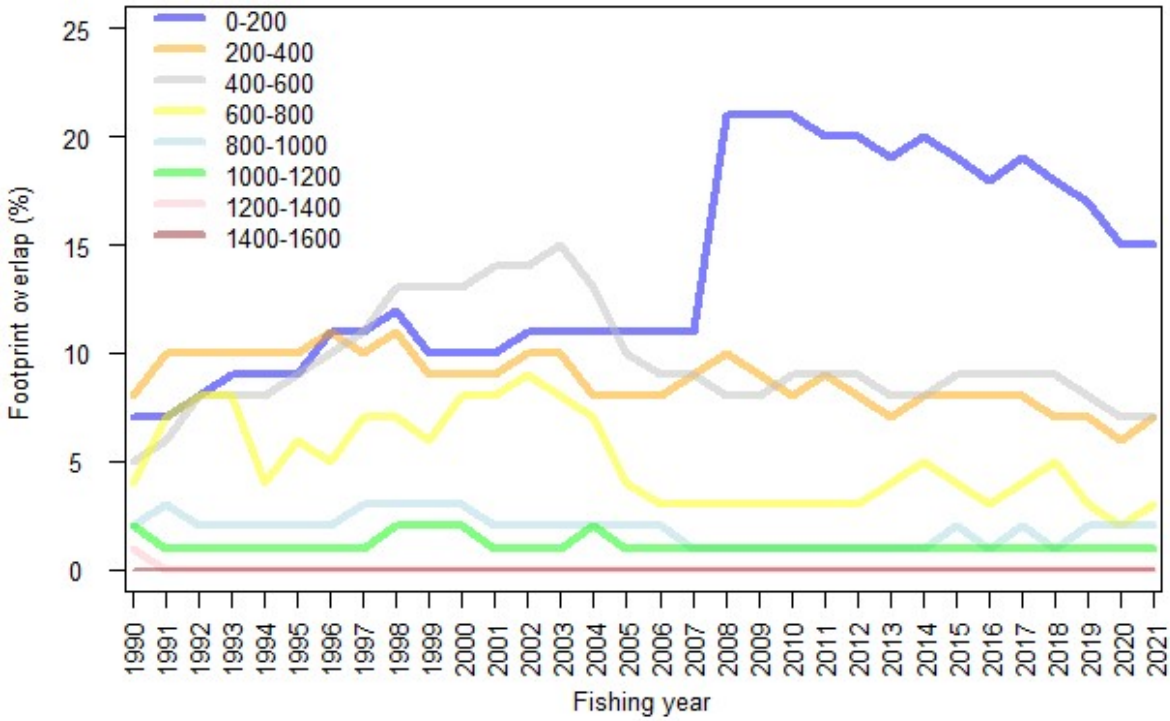

Figure 8: Percent of each 200-m depth zone contacted by the All Stocks footprint each year, for 1990–2021.

3.4 Overlap of All Stocks footprint with BOMEC classes

The extent of the distribution of the footprint by BOMEC class for all years and for 2021 is shown in Figure 9, and Tables C9–C11 in Appendix C provide the annual overlap of the footprint, aggregate area, and number of contacted cells for each class.

The 1990–2021 footprint was mainly in classes C, H, J, and L (Table 5); these four classes accounted for 64% of the 32-year data set. These classes represent four of the five groups discriminated by Leathwick et al. (2012): class C is part of the inshore and shelf group (classes A-E), class H is in the upper slope group (classes F-H), class J is in the northern mid-depths group (classes I-K), and class L is in southern mid-depths group (classes L and M); classes N and O are in the deeper waters group.

The annual footprints for classes A–D (inshore and shelf areas) increased markedly with the addition of TCER data in 2008, whereas the footprints for other groups tend to drop off or remain reasonably steady from 2008, after peaks years in 1998–2004 for classes H-J, for example, and 2001–2004 for class L (Figure 10, Table C9). Comparatively small areas of seabed contact were in classes N and O. For 2021, classes C and H-J accounted for 65% of the footprint; all classes except class A, B, C and F showed an increase in 2021.

When the 1990–2021 All Stocks footprint is considered as a percent of the seafloor area of each class (based on the full BOMEC distribution), between 52 and 88% of classes A-D (inshore and shelf groups) were contacted, 57–77% of classes G-I were contacted (continental slope), and 18–29% of the seafloor of classes F (continental shelf), J (continental slope), and L (continental slope) seafloor were contacted (see Table 5). For the 2021 data, a similar pattern was seen, though at a smaller scale. The impact of the TCER additional data is evident in the annual percent of each class area that was contacted shown in Figure 11, with higher percent overlap in the inshore and shelf group especially.

The 1990–2021 aggregate area was greatest in classes H-J, with 51% from these classes; 24% was in classes C and E, and 15% in classes A, D, and L (Table C10). For the classes more likely to be comparable across years (middle depth and deepwater trawling effort), in middle depths and deeper waters, Class J accounted for the greatest spread when measured by the number of contacted cells (Table C11), followed by classes, L, H, and N; these classes are expansive and effort in them is widespread (see Figure 9). In contrast, the numbers of cells contacted annually in class I were about half the numbers contacted in class H, yet the aggregate areas for these two classes, for all years, were similar (the aggregated area for class I is 92% for the 32-year period). Thus, although the footprint in class I is relatively smaller than that in class H, the intensity, as measured by the aggregate area, is greater because of the high frequency of contact over a relatively small area.

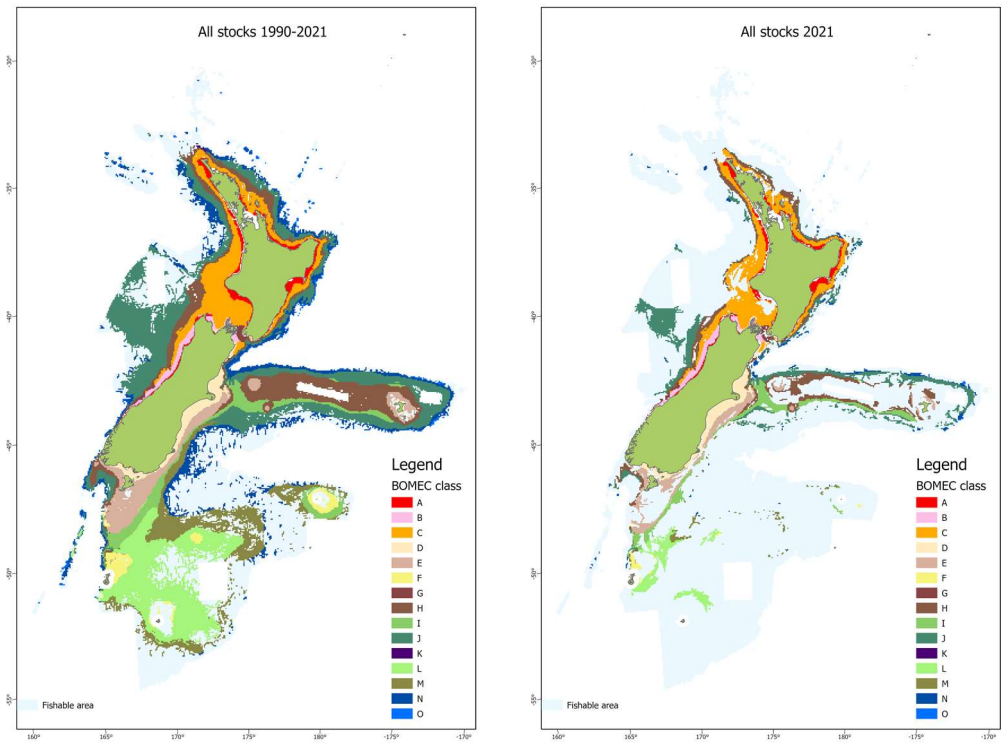

Figure 9: Extent of the All Stocks footprint overlap with BOMEC classes, represented by 25-km^2 cells for all years combined (left), and for 2021 (right).

Table 5: The total area of the seafloor in each BOMEC class within the EEZ+TS, the All Stocks footprint, the percent of the total footprint in each class and the percent of each class area contacted by the trawl footprint, for 1990–2021 and the 2021.

BOMEC	Area	Footprint (km^2)		Total footprint (%)		Footprint overlap with BOMEC class (%)	
class	(km^2)	1990–2021	2021	1990–2021	2021	1990–2021	2021
A	30 661.00	16 066.0	4 101.0	3.5	5.5	52.4	13.4
B	12 786.10	11 277.8	3 725.3	2.4	5.0	88.2	29.1
C	90 256.50	74 940.7	14 882.3	16.2	20.0	83.0	16.5
D	28 085.70	21 876.4	5 591.5	4.7	7.5	77.9	19.9
E	61 258.00	34 604.5	6 018.0	7.5	8.1	56.5	9.8
F	38 775.80	6 909.8	273.8	1.5	0.4	17.8	0.7
G	6 702.30	5 152.2	735.1	1.1	1.0	76.9	11.0
H	138 399.10	78 520.8	11 613.7	17.0	15.6	56.7	8.4
I	52 008.30	38 919.0	10 199.5	8.4	13.7	74.8	19.6
J	312 604.90	84 655.9	11 534.3	18.3	15.5	27.1	3.7
K	1 200.20	40.4	0.0	<0.1	0.0	3.4	0.0
L	198 578.40	56 666.4	4 583.9	12.2	6.2	28.5	2.3
M	233 837.40	18 943.6	583.0	4.1	0.8	8.1	0.2
N	495 154.20	13 418.1	648.3	2.9	0.9	2.7	0.1
O	1 006 911.10	611.1	17.6	0.1	0.0	0.1	0.0
Total	2 707 219.00	462 643.3	74 507.9	100.0	100.0	17.1	2.8

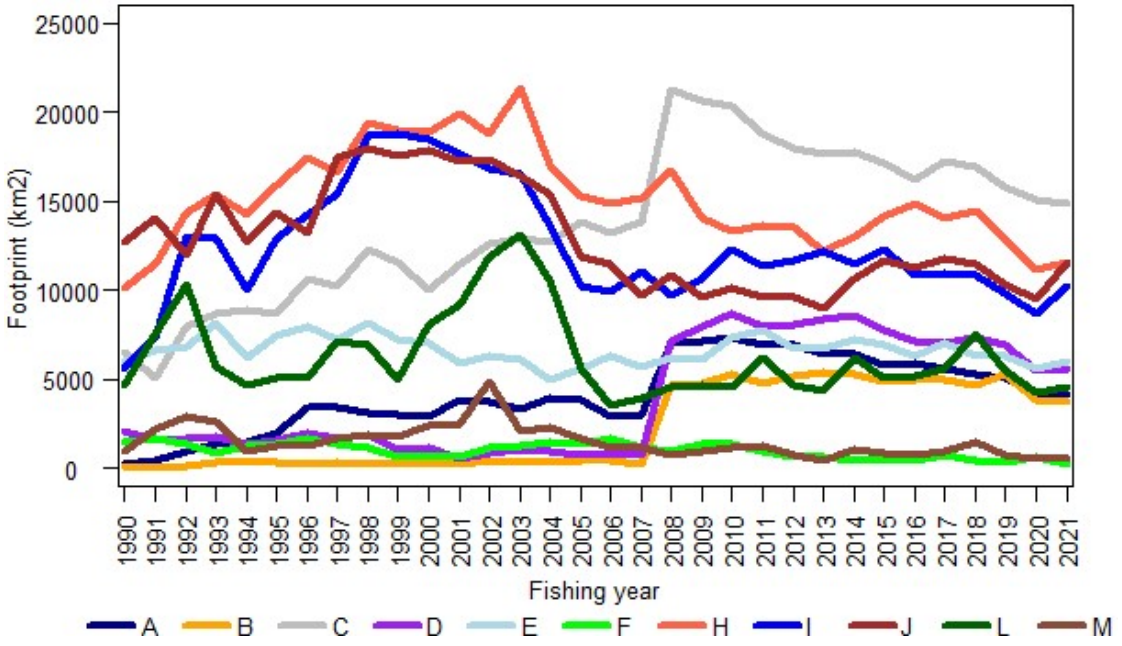

Figure 10: Estimated annual footprint for bottom-contacting trawling for All Stocks, by BOMEC class within the fishable area, for 1990–2021. The full data set is given in Table C9.

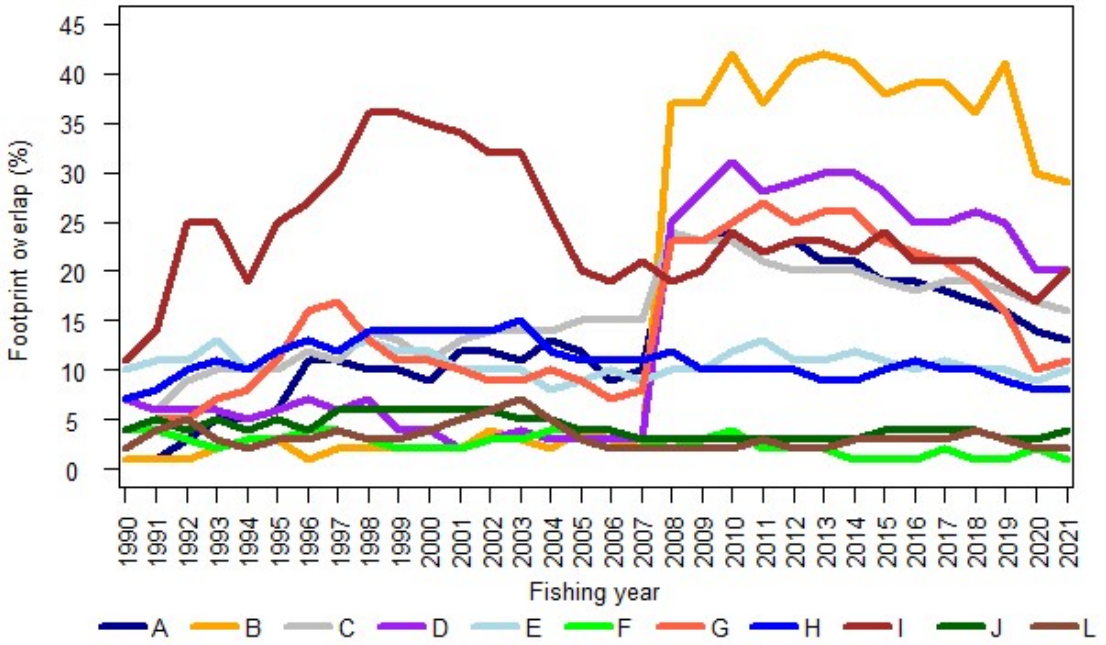

Figure 11: The percent of each BOMEC class contacted by the All Stocks footprint each year, for 1990–2021. Classes K and O are not included (see Table C9 for the footprint areas).

3.5 Overlap of All Stocks footprint with Seafloor Community Classification (SCC) classes

Of the 75 unique classes in the SCC, 64 occur within the fishable area. This makes applying the SCC to an EEZ-wide study in a meaningful way difficult. For an initial investigation into the utility of the SCC for this and future footprint projects, we assessed the top 15 SCC classes with greatest extent of seabed contact for the 1990–2021 All Stocks data set. This accounted for 80% of the footprint for this time period (Table 6). Individual SCC classes not represented here accounted for only very small proportions of the total (0.00002–1.5%). The top 15 classes are plotted for 1990–2021 and 2021 in Figure 12.

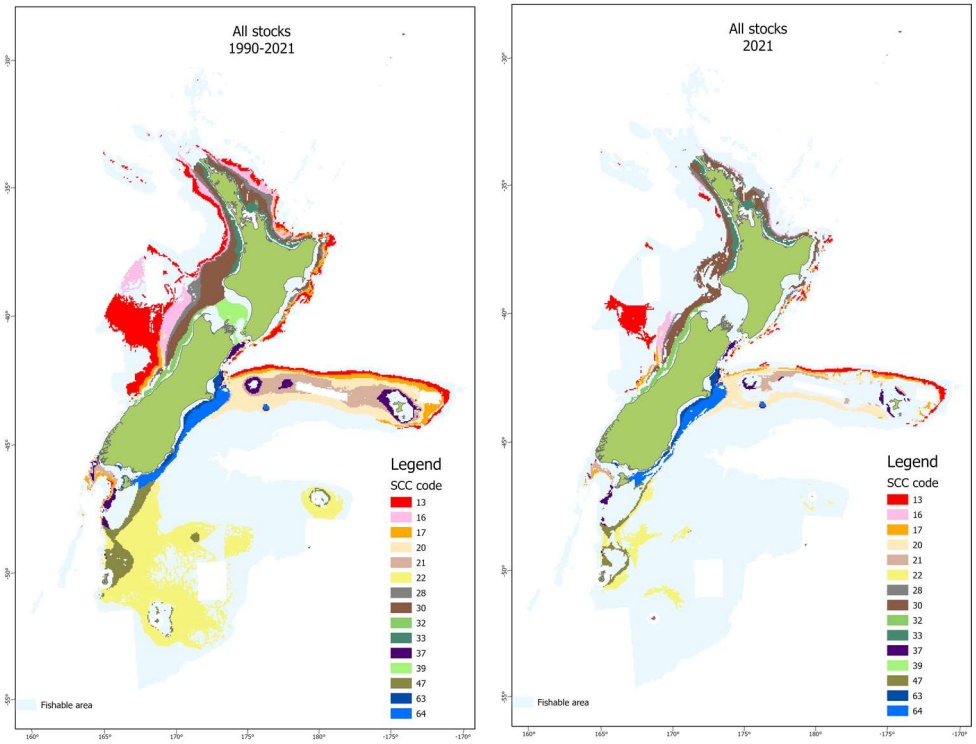

Figure 12: Extent of the All Stocks footprint overlap with SCC classes, represented by 25-km^2 cells for all years combined (left), and for 2021 (right).

Displaying only the top 15 classes results in 20% of the footprint not being represented. Inshore areas in particular suffer poor representation when using this approach. This is not because of poor knowledge of the SCC as it applies to the fishable area: more than 99% of cells have a valid SCC classification. Rather, inshore is poorly represented due to having many different classifications. Thirty-seven of the 75 classes in the system are in depths less than 50 metres (49%). When considered as part of just those classes that occur within the fishable area, 58% of classes are not represented. But each additional class beyond the top 15 classes fails to improve the overall footprint representation significantly.

The top 3 classes are classes 20, 22, and 30 and represent 11.1, 16.3, and 10.4% of the total footprint for 1990–2021. Class 20 steadily increased in footprint size between 1990 and 1998 with a plateau between 1998 and 2004 (peaking in 1999 at 25 639 km^2) (Figure 13). The footprint then declined over the next few years until 2006 to about 15 000 km^2 and has been relatively steady since then. Class 20 is characterised as a large and widespread class occurring mainly along the Chatham Rise shelf break at intermediate depths (Petersen et al. 2020). It is characterised by low bottom temperatures, high concentrations of bottom nitrate, and low to moderate values for other environmental variables (productivity, dissolved oxygen, and salinity at depth).

Class 22 rose steadily between 1994 to a peak in 2002 at 18 203 km^2 before declining similarly to class 20 to 2006 at about 5000 km^2. Class 22 is a large group occurring on Campbell and Bounty plateaus, south of the Subtropical Front at intermediate water depths waters with high concentrations of nitrate and moderate to high concentrations of dissolved oxygen at depth.

Class 30 was steady at around 7000–9000 km^2 until 2008. This appears to be the only class where there is a more noticeable increase in 2008 with the introduction of the TCER form, most likely because inshore classes are not well represented in this analysis. After the peak footprint in 2008 at 12 701 km^2, the footprint is relatively steady, but slightly higher than pre-2008. Class 30 is a large widespread group that occurs on the continental shelf north of the Subtropical Front in warm, moderate productivity coastal waters on both sides of the North Island but predominantly off the west coast. This group is characterised by moderate oxygen concentrations and low dissolved silicate and nitrate concentrations at depth.

Other classes in the top 15 are relatively steady through time and have footprints mainly under 5000 km^2 each year. For more detailed descriptions of all SCC classes, see Petersen et al. (2020).

Table 6: The total area of the seafloor in the top 15 SCC classes by footprint, within 'fishable' waters (all depth zones ≤ 1600 m combined), the All Stocks footprint, the percent of the total footprint in each class and the percent of each class area contacted by the trawl footprint, for 1990–2021 and the 2021.

SCC class	Footprint (km^2)		Total footprint (%)		Footprint overlap (%)	
	1990–2021	2021	1990–2021	2021	1990–2021	2021
13	33 928.0	4 678.3	7.3	6.3	23.2	3.2
16	13 435.4	2 317.3	2.9	3.1	23.9	4.1
17	16 644.5	1 802.2	3.6	2.4	42.6	4.6
20	51 245.9	13 171.0	11.1	17.7	73.9	19.0
21	21 586.9	3 314.4	4.7	4.4	42.4	6.5
22	75 491.8	5 910.4	16.3	7.9	29.5	2.3
28	14 463.6	2 276.7	3.1	3.1	59.9	9.4
30	48 300.3	7 502.2	10.4	10.1	82.9	12.9
32	9 156.6	2 870.4	2.0	3.9	93.9	29.4
33	12 940.4	3 754.3	2.8	5.0	82.8	24.0
37	12 599.4	1 526.3	2.7	2.0	63.6	7.7
39	10 109.5	1 676.2	2.2	2.2	86.8	14.4
47	15 838.7	2 719.0	3.4	3.6	32.6	5.6
63	6 676.0	2 370.1	1.4	3.2	89.6	31.8
64	18 865.4	3 988.7	4.1	5.4	88.7	18.8
Other	101 360.8	14 630.5	21.9	19.6	3.1	0.4
Total	462 643.3	74 507.9	100.0	100.0	11.3	1.8

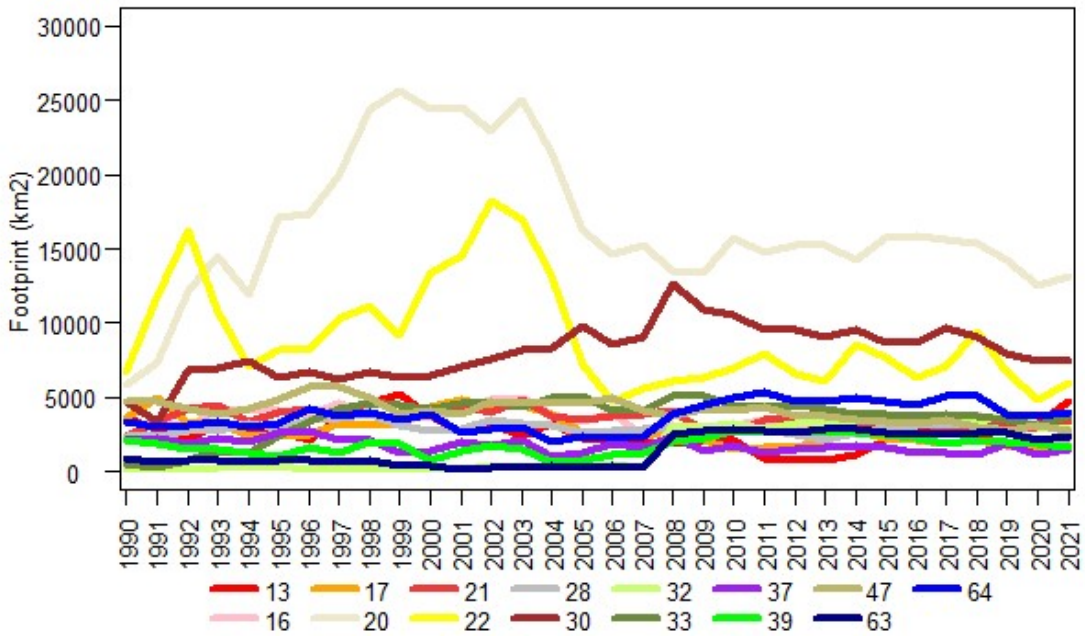

Figure 13: The footprint of the top 15 SCC classes contacted by the All Stocks footprint each year, for 1990–2021.

3.6 Overlap of All Stocks footprint with surficial sediment layers

In relation to the interpolated surficial sediments layers available for within the EEZ+TS (Bostock et al. 2019a, 2019b), the overlap of the 1990–2021 and 2021 footprints of the seafloor areas estimated for

each sediment layer are summarised in Table C12. There are overlaps between substrate types: for example, 0–20% sand could overlap with 80–100% gravel (compare plots in Figure B3).

The footprint is reasonably well spread throughout the carbonate classes (Table C12), whereas the footprint in the gravel classes is greatest in 0–20%. For mud, most of the footprint is with the 0–20%, 20–40%, and 40–60% classes and, for sand, in the 40–60% and 60–80% classes.

The seafloor areas of these classes can vary greatly within each sediment layer: for example, the class area for carbonate 0–20% is about a third the size of the 80–100% area (Table 7), whereas the seafloor area for gravel 0–20% is almost 8 times the size of the 80–100% class. The greatest overlap of the All Stocks footprint is with the carbonate layer (as percent of the seafloor area in each sediment class): in the 0–20% and 20–40% categories, at 64% and 48%, respectively, for 1990–2021 and 15% and 10% for 2021 (Table 7). For gravel, the footprint contacts more than a third of the vastly different sized areas in the 0–20% and 20–40% classes, and about a quarter of the 40–60% and 60–80% classes. The footprint overlap with the mud class ranges contacts more than one-third of the 0–20, 20–40, and 40–60% classes, and more than a quarter of the 60–80 and 80–100% classes. For sand, more than a quarter of the 0–20 and 20–40% classes are contacted, more than a third of the 40–60 and 60–80% classes, and almost half of the 80–100% class.

The extent of the 1990–2021 All Stocks footprint overlap with each substrate type is shown in Figure 14.

Table 7: Percentage overlap of the seafloor area of the substrate classes by the fishable area 1990–2021 and 2021 All Stocks footprint. For gravel, mud, and sand, the percentage classes total 100%, and for carbonate the percentage represents the proportion that is carbonate versus non-carbonate.

Substrate	Class (%)	Class area within fishable area (km^2)	1990–2021 overlap (%)	2021 overlap (%)
Carbonate	0–20	138 252.7	63.5	14.9
Carbonate	20–40	282 469.8	48.4	9.0
Carbonate	40–60	275 070.0	33.6	4.3
Carbonate	60–80	288 732.7	22.8	3.0
Carbonate	80–100	369 402.8	21.2	2.2
Gravel	0–20	1 037 250.7	35.0	5.9
Gravel	20–40	188 550.0	37.4	5.7
Gravel	40–60	77 886.4	25.8	2.6
Gravel	60–80	26 682.0	22.1	0.7
Gravel	80–100	14 188.5	11.0	2.9
Mud	0–20	387 549.1	38.8	6.1
Mud	20–40	323 852.0	34.8	5.2
Mud	40–60	299 719.3	34.8	6.3
Mud	60–80	233 123.9	27.9	4.7
Mud	80–100	109 712.9	26.3	3.9
Sand	0–20	142 639.8	28.9	4.5
Sand	20–40	348 482.0	26.5	4.3
Sand	40–60	482 383.1	34.6	5.4
Sand	60–80	303 832.8	40.3	6.3
Sand	80–100	77 166.5	49.3	10.5

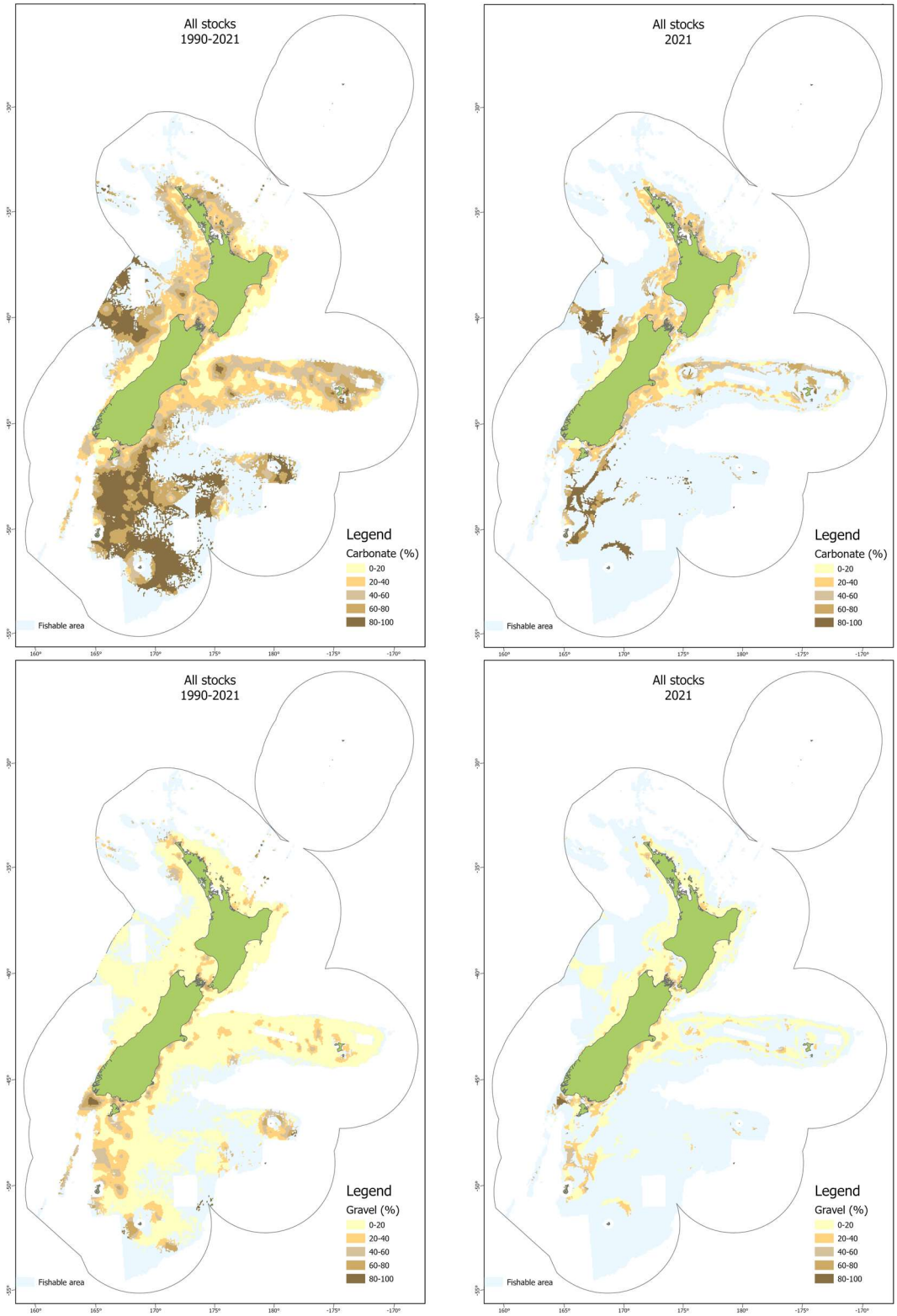

Figure 14: Distribution of the extent of the 25-km^2 cells for the All Stocks 1990–2021 (left) and the 2021 trawl footprints (right) for substrate types, by class: carbonate, gravel, mud, and sand (after Bostock et al. 2019a, 2019b). Carbonate (upper) and gravel (lower). [Continued on next page]

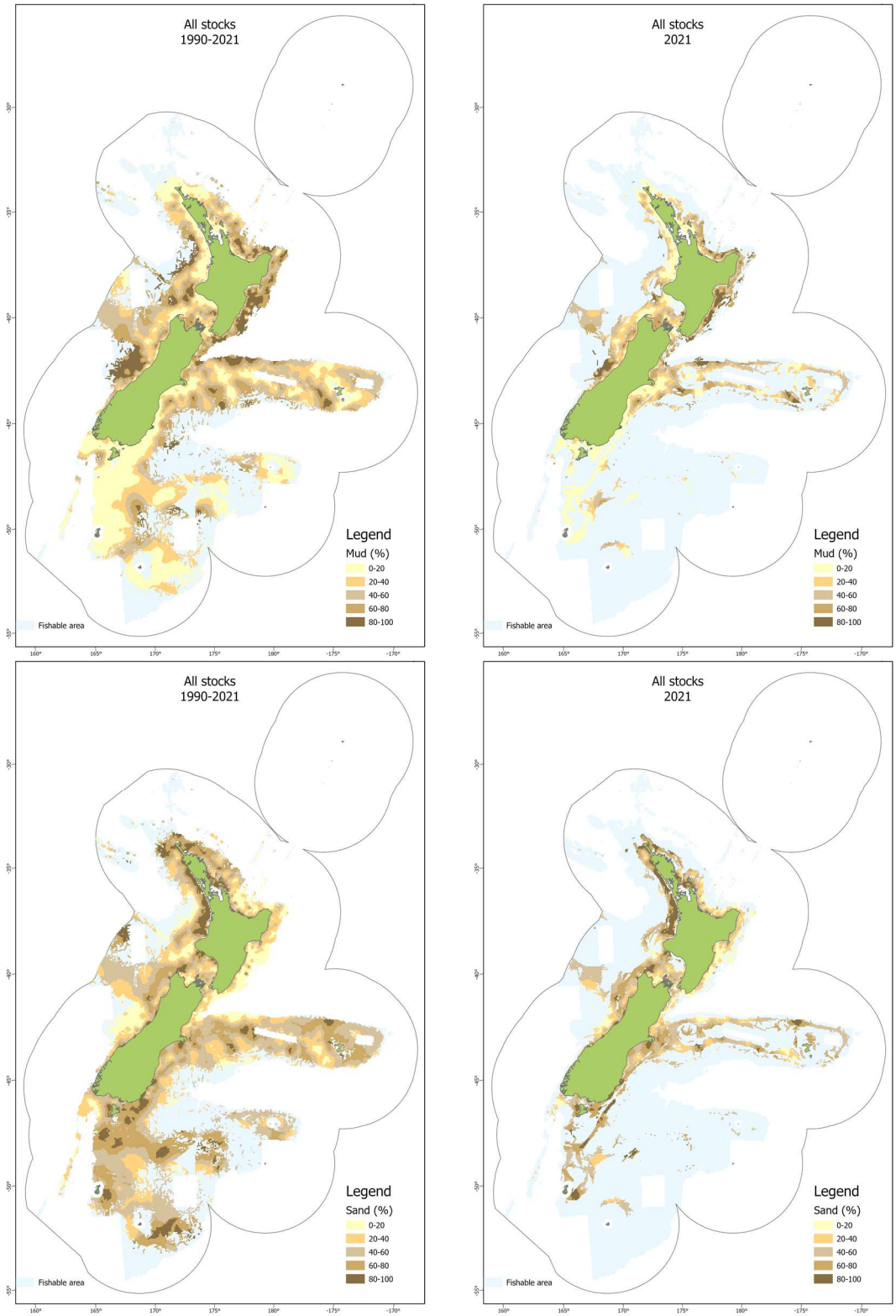

Figure 14: — *continued*. Mud (upper) and sand (lower).

4. RESULTS: DEEPWATER FISHSTOCKS TRAWL FOOTPRINT, 1990–2021

4.1 Deepwater data

During 1990–2021, a total of 570 vessels reported bottom-contacting effort that targeted deepwater Tier 1 and Tier 2 species (Table D1). These vessels represented both foreign and domestic fleets and over time there have been substantial changes in the numbers of vessels and the type and size of vessels in this data set. The numbers of vessels in most vessel groups have decreased over the years, especially the foreign-owned fleets and this is reflected in the decrease in reported tows by these vessels (Figure 15). Different trawl gear set-ups have been used by these vessel groups to target a variety of deepwater species and, until there is better information on the spread of gear that contacts the seafloor, vessels in each group are considered to have similar bottom contact in these analyses.

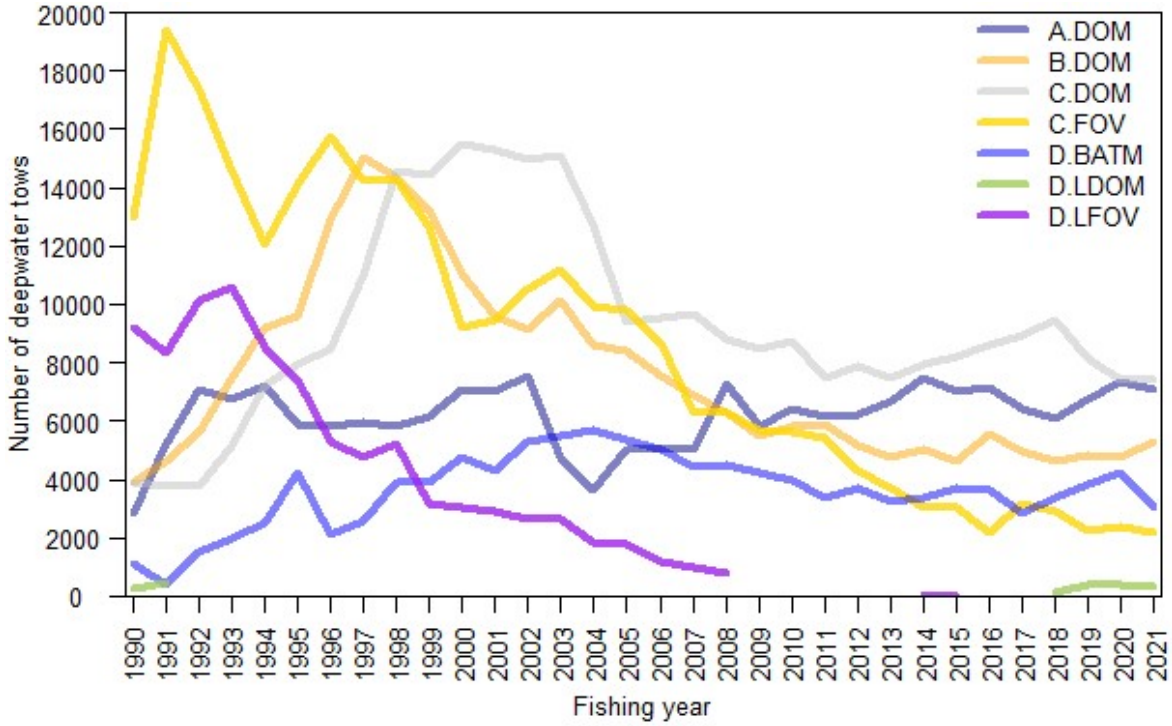

Figure 15: The number of bottom-contacting tows reported by vessels that targeted Tier 1 and Tier 2 deepwater fishstocks during 1990–2021, by year and vessel type. A.DOM is domestic vessel ≤ 28 m in length; B.DOM is domestic vessel > 28 m and ≤ 46 m; C.DOM is domestic vessel > 46 and ≤ 82 m; C.FOV is foreign-owned vessel > 46 and ≤ 82 m; D.BATM is foreign-owned vessel of 104 m in length; D.LDOM is domestic vessel > 82 m; and D.LFOV is foreign-owned vessel > 82 m long.

The underlying tow data and results of analyses based on the deepwater Tier 1 and Tier 2 fishstocks (see Table 1) are presented in Appendix D. The tow data are from TCEPRs from 1990 to 2019, TCERs from 2008 to 2020, and ERS from 2018 to 2021 (Table D1). Over 1.1 million tows in the deepwater data set targeted Tier 1 fishstocks, primarily hoki (40.3%), arrow squid (17.0%), scampi (12.9%), and orange roughy (12.8%) (Table D2). Over the time series, the number of Tier 1 bottom-contacting tows increased from just under 31 000 in 1990 to over 55 300 in 1998, then decreased in most years to about 29 000 tows in 2007. A small amount of TCER data was included in subsequent years, but the decrease in numbers of tows continued, with between about 23 000 and 24 000 tows during 2012–2020. In 2021 there were just over 22 400 tows, which is the lowest in the time series. Data reported on TCER forms were last present in the data set in 2020 (just 0.2% of Tier 2 fishing events only) and TCEPR forms were last present in the data set in 2019. In 2021, data were entirely reported on ERS forms.

The number of bottom-contacting tows by year for the Tier 1 species is shown in Figure 16 and in Table D2. Overall, hoki data accounted for most of the annual tow data, with 447 248 tows for the time

period and more than 20 000 tows in each year between 1996 and 2003. The impact of decreases in the hoki TACC (Fisheries New Zealand 2020) can be seen in the subsequent drop in annual effort beginning in 2001. The number of hoki tows then dropped below 20 000 in 2004 and 2005, and then below 10 000 in 2006, only exceeding this in 2014, 2015, and 2018. Regardless, there are more tows targeting hoki each year than any other species, with the exception of 1990 when there were slightly more tows targeting arrow squid. Arrow squid had the second highest number of tows for the time period but this was still less than half the number of tows targeting hoki and only exceeded 10 000 tows in 1991 and 1995. Over time the number of tows targeting arrow squid has declined and has been less than 5000 tows each year since 2007.

The number of tows targeting scampi has been relatively steady throughout the time period with roughly 4500–5000 tows in most years. The number of tows targeting orange roughy fluctuated during 1990–2000, peaking at more than 10 000 in 1994, before a fairly steady period of around 3500–4000 tows each year until 2009, then declining to a nadir of 1563 tows in 2012. Since 2016 the number of tows targeting orange roughy has been relatively steady at around 3000 tows per year. The number of tows targeting oreo species each year fluctuated between about 1200 and 3000 tows per year until 2016. Since then, fewer than 1000 tows each year have targeted oreo species. Tows targeting Jack mackerel numbered around 1500–3000 in most years but since 2015 annual tow numbers have mostly been under 1000 tows per year. The number of tows targeting ling over the time period has increased from a few hundred tows in most years until 2005 after which around 1000 tows targeted ling each year. There were fewer than 1000 tows targeting hake each year apart from a period of around 1200–1700 annual tows during 2004–2009, after which numbers dropped off again to a few hundred tows each year. Of all the Tier 1 species, southern blue whiting had the lowest number of targeted tows with fewer than 500 in most years, exceeding 1000 tows only in 1991 and 1992.

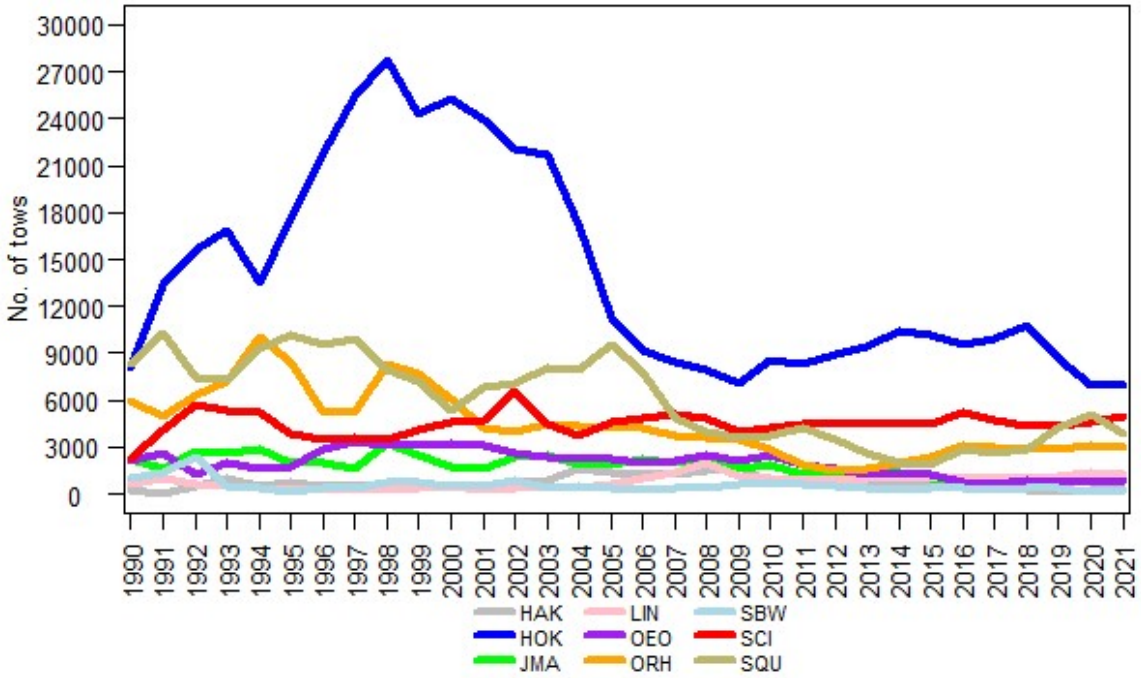

Figure 16: The number of bottom-contacting tows by year for the Tier 1 species.

Of the Tier 1 effort, the percentage of hake effort increased during the 2000s when the hoki TACC was decreased, but this has decreased in recent years with only about 2% or less of Tier 1 tows targeting hake since 2016. Jack mackerel effort has been relatively steady throughout the time period at between 4–7% of annual Tier 1 tows, with slightly more effort during the mid-2000s as well. Ling effort generally contributed under 2% until 2006 at which time effort increased with a peak of 7% in 2008 before decreasing, but has been generally above 4% since then. Oreo effort was fairly steady during 1990–2007 at around 5–7% each year before increasing slightly to between 7 and 10% during 2008–2012, after

which effort decreased to between about 3–5% each year, with 3.8% in 2021. Oreo fishstocks have been subject to a decreasing TACC throughout the time series (Fisheries New Zealand 2020). Southern blue whiting bottom-contacting tows accounted for the smallest percentage of bottom-contacting tows of all Tier 1 species with 1.6% for the time series, and most years being under 2%, with a peak of 5.5% in 1992.

The Tier 2 fishstock data for 1990–2021 represent about 9% of the total deepwater bottom-contacting tows, with a total of 107 386 tows (Table D3). The number of tows before the introduction of the TCERs was generally between about 3000 and 4000 per year, with lows of just over 2500 in 1992 and 2004, and peaks over 4000 in 1995, 1996, 2006, and 2007. The peak number for the time series was in 2008, with over 5000 tows; subsequently the effort gradually dropped to about 2500 (in 2018 and 2019). Barracouta accounted for 35% of all tows, with alfonsino, silver warehou, and black cardinalfish contributing 18.3%, 18.2%, and 14.3%, respectively; these four species accounted for 86% of all bottom-contacting Tier 2 tows. White warehou, sea perch, and rubyfish accounted for another 10%. For the remaining targets, effort was low and intermittent.

During 1990–2007, barracouta accounted for a decreasing percentage over the years, from over 50% in 1990–1991, to a nadir of 14.4% in 2006, then increased to a second peak at 42.4% in 2008 and between 33 and 39% during 2012–2019, before increasing again to a time series high of 61.5% in 2020, remaining high in 2021 at 56.1%. The percentage of alfonsino tows increased in the late 1990s, with 20–29% of tows in most years between 1997 and 2012, apart from peaks of 31% in 2006. The percentage of tows targeting alfonsino then decreased to a time series low of 8.4% in 2013 before an increase to between 15 and 20% in most years thereafter. Silver warehou accounted for 20–30% of annual Tier 2 tows during 1990–1996, under 16% in 1997–2006, 17–25% in 2007–2018, then 13% in 2019 and 7.6% in 2020 when there were small relative increases for the other main target species, before increasing slightly to 12.7% in 2021. Black cardinalfish accounted for about 20–30% of Tier 2 annual tows during 1996–2007, but since then has dropped to under 10% in most years.

4.2 Spatial extent

The annual totals of cells, aggregate swept area, and footprint for all deepwater fishstocks are given in Table 8 and by Tier 1 and Tier 2 in Table D4 and by target in Tables D5–D10. For all years, the deepwater fishstock effort contacted 37 983 25-km^2 cells, based on the total estimated aggregate area of almost 3.62 million km^2 and a total footprint of 355 701 km^2, equivalent to about 10.1% of the aggregate area. Overall, the footprint contacted almost 9% of the area of the EEZ+TS and 25% of the fishable area. The greatest annual overlap was during 1992–2004, with peak overlap in 2002 and 2003, but from 2006 the footprint overlap has been 1.1–1.2% of the EEZ+TS and 3.2–3.6% of the fishable area (1.1 and 3.1%, respectively, in 2021).

The annual aggregate area increased each year (except 1994) to a peak in 1998 of 171 109 km^2, ranged from about 150 000–156 000 km^2 during 1999–2003, followed by a sharp decline in 2004 and 2005 (around 131 000 km^2 and 110 000 km^2, respectively). In 2006 the aggregate area dropped below 100 000 km^2 and has remained below 100 000 km^2 ever since, levelling out at between almost 80 000 and 96 217 km^2 during 2007–2021 (80 996 km^2 in 2021).

The footprint generally followed the trend of the aggregate area in the 1990s, but the peak annual spread as measured by the footprint (at about 80 600 km^2) and numbers of cells (15 940–17 024 cells) was during 2002 and 2003. Subsequently, the footprint decreased to about 50 000–51 000 km^2 during 2006–2008 and has been below 50 000 km^2 ever since. The footprint of 40 235 km^2 in 2020 is the lowest in the time series; the footprint increased slightly in 2021 to 43 634 km^2. The numbers of cells steadily decreased after the peak in the early 2000s to a series minimum of 9505 in 2020, corresponding with the lowest footprint.

Table 8: The number of cells contacted by the deepwater bottom-contact trawls, the aggregate area, and the footprint, and the percent of the EEZ+TS (4.1 million km2) and the fishable area (1.39 million km^2) contacted by the deepwater footprint, for 1990–2021.

Fishing year	No. of cells	Aggregate (km^2)	Footprint (km^2)	%EEZ+TS	% fishable
1990	12 235	101 379.8	47 426.1	1.2	3.4
1991	13 153	125 970.8	54 833.1	1.3	3.9
1992	14 432	136 924.7	66 415.2	1.6	4.7
1993	13 830	139 786.8	66 852.2	1.6	4.8
1994	13 105	121 675.8	56 804.3	1.4	4.1
1995	13 416	144 372.1	61 740.7	1.5	4.4
1996	13 476	143 830.8	62 436.4	1.5	4.5
1997	13 812	154 842.7	68 468.5	1.7	4.9
1998	15 258	171 108.8	76 682.6	1.9	5.5
1999	14 866	155 926.6	72 080.2	1.8	5.1
2000	15 244	149 922.4	73 761.9	1.8	5.3
2001	15 278	150 121.9	75 852.4	1.9	5.4
2002	17 024	154 289.3	80 638.4	2.0	5.8
2003	15 940	156 160.2	80 301.4	2.0	5.7
2004	14 051	130 890.6	67 496.9	1.6	4.8
2005	13 367	110 290.8	54 011.8	1.3	3.9
2006	12 429	94 642.2	49 846.4	1.2	3.6
2007	12 121	87 788.7	50 070.0	1.2	3.6
2008	13 166	85 013.1	50 747.1	1.2	3.6
2009	12 307	78 948.5	45 932.8	1.1	3.3
2010	12 469	87 134.8	49 625.5	1.2	3.5
2011	12 004	86 861.1	48 569.5	1.2	3.5
2012	11 417	85 460.1	46 641.0	1.1	3.3
2013	10 710	79 595.4	44 616.2	1.1	3.2
2014	11 738	82 085.1	47 305.2	1.2	3.4
2015	11 506	85 257.5	47 986.2	1.2	3.4
2016	11 578	84 131.3	46 526.4	1.1	3.3
2017	11 503	88 846.2	46 750.9	1.1	3.3
2018	11 034	96 217.8	47 782.0	1.2	3.4
2019	10 273	85 911.3	43 566.8	1.1	3.1
2020	9 505	81 763.7	40 235.0	1.0	2.9
2021	10 098	80 996.5	43 633.7	1.1	3.1
Total	37 983	3 618 147.4	355 701.7	8.7	25.4

The spatial distribution of the footprint and aggregate area for all years, and for 2021, is shown in Figure 17. The 2021 deepwater footprint shows the spread of the main Tier 1 fishery activity for hoki (Chatham Rise, west coast South Island, and Stewart-Snares shelf), arrow squid (Stewart-Snares shelf and Auckland Islands Shelf), orange roughy (western Challenger Plateau, northern and southeastern Chatham Rise), and scampi (east coast North Island, Chatham Rise, southeast Auckland Islands Shelf).

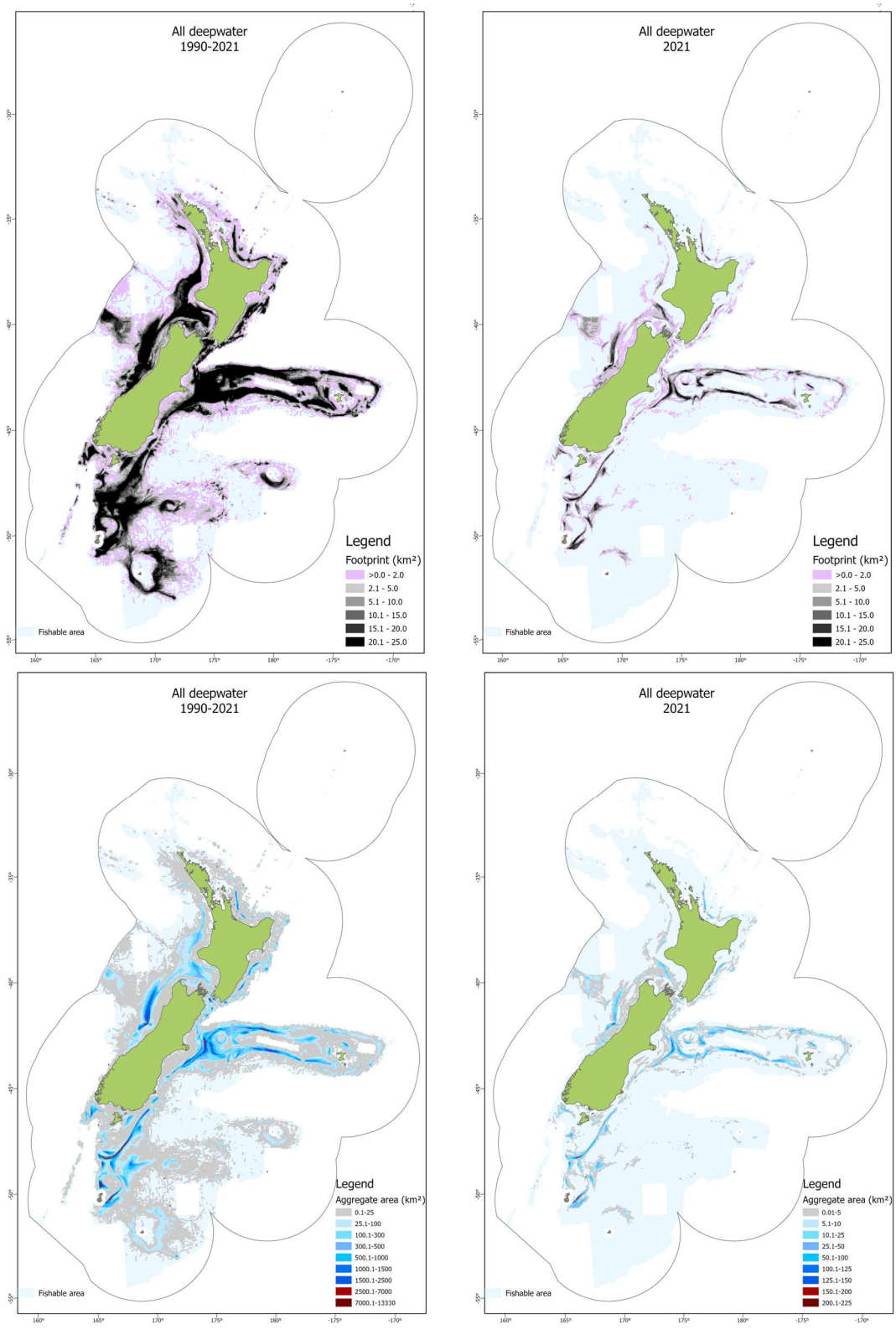

Figure 17: Distribution of the deepwater fishstocks footprint (upper maps) and aggregate area (lower), by 25-km² cells, 1990–2021 (left) and 2021 (right), with the fishable area (light blue background).

The greater extent of the Tier 1 component of the deepwater footprint and the overlap between fishery areas is evident in the spatial distribution of Tier 1 and Tier 2 footprints shown in Figures D1 and D2.

There is overlap of the footprints for each tier, and Tier 1 targets contacted 96% of the cells containing deepwater tows, whereas Tier 2 targets contacted just over 40% of the cells (Table D4). Up to 2008, Tier 1 fishstocks contacted over 90% of the annual cells, but from 2008 (when TCER forms were introduced and some smaller vessel data entered the series, coincident with some decreases in effort for some Tier 1 components) this dropped to between 82% and 87%, while the spread of the Tier 2 effort increased from mainly under 20% to over 30% during 2008–2017, dropping back to just below 30% after this (28.8% in 2021).

This 2008 effect is not as strong in the relative contributions of each tier in the aggregate area estimates; almost 94% of the 1990–2021 deepwater aggregate area was from Tier 1 target fishstocks. Almost 93% of the footprint was from Tier 1 fishstocks, with over 95% each year in the late 1990s and early 2000s, and between 87.6% (in 2008) and 93.4% (in 2019) in the last 14 years. Tier 2 targets did peak in 2008, however, at 12.4% but dropped below 10% from 2010 and were 6.1% for the 32-year period.

4.2.1 Tier 1 fishstocks: number of cells, aggregate area, and footprint

Tier 1 targets contacted 36 466 cells during 1990–2021 and the total aggregate area and footprint were estimated at 3.4 million km^2 and 328 669 km^2, respectively (Table 9). These fishstocks accounted for 93.9% of the deepwater aggregate area and 92.4% of the footprint for the time series (Table D4). Although there is overlap of effort for different targets, hoki contacted over 50% of the cells, aggregate area, and the footprint for Tier 1 targets during the 32 years (Table 9), indicating the larger number of tows and swept areas made in relatively broad areas that describe the main hoki fishery areas. In comparison, orange roughy contacted 25.1% of cells, 4.1% of aggregate area, and 13.4% of the footprint for Tier 1 targets, numbers that indicate the use of a mix of short tows on features and longer tows on the flat, with fishery areas spread throughout the EEZ. Similarly, for oreo species, 15.4% of deepwater cells were contacted, with 1.3% of the aggregate area and 5.3% of the footprint.

Arrow squid effort contacted 21.5% of cells and accounted for 20.5% of the aggregate area and 12.9% of the footprint. Scampi fisheries are in relatively small defined areas (Fisheries New Zealand 2020), and scampi tows contacted 17.2% of the deepwater cells and accounted for 6.7% of the aggregate area and 6.4% of the footprint. For middle depth fishstocks such as hake, jack mackerels, ling, and southern blue whiting, 11.0–18.6% of deepwater cells were contacted, with larger footprints relative to the aggregate area for targets with distinct fishery areas in different areas of the EEZ, such as jack mackerels which have been targeted off the west coasts of the North Island and South Island as well as Stewart-Snares shelf and western edge of the Chatham Rise.

During the most recent fishing year, 2021, hoki trawling contacted 38.4% of deepwater cells and accounted for 52.1% and 50.5% of the aggregate area and footprint, respectively. This is a reduction in the number of cells compared with the previous iteration of this project where it was 58% (for 1990–2019) and lower than the overall value of nearly 58% for the time series. The aggregate area and footprint values for 2021 however are only slightly lower than for the overall time series, suggesting that hoki target fishing was concentrated in a smaller area. Orange roughy contacted 21.8% of deepwater cells and accounted for almost 9.1% of the aggregate area and 13.4% of the footprint, an increase from 2019. Compared with the overall time series values the number of cells contacted was lower, the aggregate area was more than double, and the footprint was identical, suggesting that there was more fishing activity in a similar area. Ling, southern blue whiting, and oreo species accounted for 3.9, 1.3, and 0.9% of the footprint, respectively. Trawling for scampi, squid, and jack mackerels accounted for 11.3%, 10.1%, and 6.9% of the 2021 footprint area, respectively.

The Tier 1 outputs by target are given in Tables D5–D7. The annual deepwater footprint is dominated by hoki effort (Table D5) which drives the overall trend. After a peak in the early 2000s (at more than 50 000 km^2), the hoki footprint area dropped to a low in 2008 and 2009 (at about 18 025–18 529 km^2), then increased slightly to 2018 (to 28 960 km^2), and dropped again in 2019 and 2020 (24 279 and 18 436 km^2), and increased slightly in 2021 at 20 498 km^2. In contrast to hoki all other targets are under 10 000 km^2 a year. They showed different trends over the time series, with most showing declining trends overall, other than scampi which remained relatively steady throughout, and orange roughy which

showed an increase after 2013 to similar levels seen in the mid-1990s. Ling peaked in 2006–2009, between steady periods, at under 2000 km^2.

Hoki effort was the main contributor, throughout the series, to the annual aggregate area, with over 40 000 km^2 in most years, with the exceptions being in 1990 and 2006–2009 and 2020–2021 when it ranged from 29 875 km^2 in 2008 and 39 406 km^2 in 2021 (Table D6). The aggregate area for hoki peaked at about 107 491 km^2 in 1998, was stable during 1999 to 2003 at over 90 000 km^2, and was over 40 000 km^2 again from 2010 to 2019, with a high of 61 556 km^2 in 2018, then a drop to 46 856 km^2 in 2019 and below 40 000 km^2 in 2020 and 2021 (39 406 km^2).

Table 9: Percentages of the total number of cells contacted, aggregate area (km^2), and footprint (km^2) by each Tier 1 target for 1990–2021 (left) and for 2021 (right). Note that the footprints of some of the targets overlap.

	Percent of total Tier 1 for 1990–2021			Percent of total Tier 1 for 2021		
Target	Cells	Aggregate area	Footprint	Cells	Aggregate area	Footprint
HAK	12	2.8	6.4	5	1.1	1.8
HOK	58	55.1	50.9	38	52.1	50.5
JMA	17	6.2	14.3	14	4.7	6.9
LIN	19	2.2	8.7	8	3.5	3.9
OEO	15	1.3	5.3	5	0.5	0.7
ORH	25	4.1	13.4	22	9.1	13.4
SBW	11	1.3	7.1	3	0.8	1.3
SCI	17	6.7	6.4	8	12.7	11.3
SQU	22	20.5	12.9	11	15.6	10.1
Total	36 466	3 396 811.2	328 669.4	8 477	75 668.0	40 622.8

Arrow squid was the second largest contributor to the Tier 1 aggregate area before 2012, with about 21 715–40 809 km^2 (peak in 1995) for 1990–2006. From 2007, the aggregate area decreased from 16 819 km^2 to below 10 000 km^2 from 2012 onwards including lows of close to 6618 and 6197 km^2 in 2014 and 2015, respectively. The next five years saw increases to 16 521 km^2 in 2020 but a drop back down to 11 794 in 2021. Scampi had the next highest annual aggregate area and topped 10 000 km^2 in 2002 and was generally stable at over 7000 km^2 in most years after that, then increasing with between 8225 and 9576 km^2 (in 2021) since then. No other target species had annual aggregate areas over 10 000 km^2 except for jack mackerels in 1992–1994 and 1998. Most showed decreasing trends overall, in particular jack mackerels, except for orange roughy with an increasing trend in the last eight years.

Hoki again dominated the total number of cells contacted with 21 059 cells for the time series, contributing more than half of the Tier 1 total (36 466) (Table D7). Other species also displayed a broadly similar pattern to the overall footprint, with arrow squid and scampi having the second and third highest number of cells contacted overall respectively, and all species overall showing declining trends throughout the 32-year period.

4.2.2 Tier 2 fishstocks: number of cells, aggregate area, and footprint

Summary tables for Tier 2 footprint, aggregate area, and number of cells contacted are given by target and fishing year in Tables D8–D10. The 1990–2021 footprint totalled 76 926.7 km^2, with a range from 3138 km^2 (in 2004) to 8564 km^2 (in 2008) (Table D8). The second highest footprint was at the start of the time series with 80 889 km^2 in 1990, but in subsequent years the annual footprint decreased, most notably from almost 6825 km^2 in 2009 to 4013 km^2 in 2019, and was almost 5000 km^2 in 2020 and 4415 km^2 in 2021. Barracouta and silver warehou dominated the data; barracouta accounted for 49% and silver warehou accounted 34% of the total Tier 2 footprint, and 48% and 32%, respectively, for the total aggregate area (Table D9). The annual footprints (and aggregate areas) indicated the nature of many Tier 2 fishstocks, often being secondary targets, with either strong annual fluctuations or groups of years when more effort is expended, perhaps because of TACC changes, market demand, or fleet

activity. The highest annual footprints for barracouta were in 1990 (4736 km^2) and in 1995 (4052 km^2), with another peak in 2008 (3854 km^2). The footprint then dropped to around 2000–2500 km^2, increased to 3712 km^2 in 2020, but dropped to just under 3000 km^2 in 2021.

Silver warehou showed a similar pattern until 2008 which was its highest overall footprint (3432 km^2). After 2008 however, the silver warehou footprint gradually decreased to under 2000 km^2 and further to under 1000 km^2 in each of the last three fishing years. Sea perch accounted for 6.4%, and alfonsino for 5.4%, of the total Tier 2 footprint, with sea perch being generally under 400 km^2 since 2008 and alfonsino being under 400 km^2 for the entire time series. The remaining targets contacted under 4000 km^2 throughout the 32-year time series.

For the number of cells contacted, a similar pattern was seen as for the footprint and aggregated area. Barracouta dominated with 7238 (48%) cells from a total of 15 419 for Tier 2 species. Similarly, silver warehou was the next most important Tier 2 species with 6623 (43%) of cells contacted. Sea perch and alfonsino were again the third and fourth most important species but were of much less importance with 1870 and 1973 cells contacted, or 12 and 13%, respectively. Most other Tier 2 targets contacted fewer than 1500 cells for the 32-year time series.

4.2.3 HAK/HOK/LIN/SWA/WWA: number of cells, aggregate area, and footprint

The combined main middle depths targets of hake, hoki, ling, silver warehou, and white warehou contacted about 62% of deepwater cells, 59% of deepwater aggregate area, and 54% of the deepwater footprint (Tables D4 & D11). These species are often targeted on the same trips and in the same areas and depths, with the same gear. Quota changes for one species (e.g., hoki) may result in an increase in effort for one or more of the other species in this group. Fisheries New Zealand requires summary footprint output for this group of species for provision to the Marine Stewardship Council (MSC) certification process and requested that the combined data are analysed by Bycatch Assessment Areas (see Anderson & Edwards 2018). These data are summarised in Tables D11–D14.

The total combined footprint for these targets contacted 4.6% of the EEZ+TS (annual range 0.5–1.4%) and 13.8% of the fishable area (annual range 1.5–4%) (Table D11). The peak years were in the late 1990s to the mid-2000s when the aggregate area was close to or over 100 000 km^2, the footprint about or over 50 000 km^2, and the number or contacted cells close to or over 9000. In 2005, these measures showed large decreases (e.g., aggregate area of less than 55 000 km^2 and footprint of about 31 500 km^2). The subsequent years showed a further aggregate area decrease to under 50 000 km^2 for 2006–2009, an increase from 2010 to a recent peak in 2018 (66 899 km^2), then a drop to under 45 000 km^2 in both of the last two fishing years (44 176 km^2 in 2021). A similar trend was seen in the footprint, with the two most recent fishing years having the second and third lowest footprints in the time series (21 115 km^2 and 23 274 km^2 in 2020 and 2021, respectively), the lowest in the time series being 20 881 km^2 in 1990.

The spatial distribution of the footprint by the Bycatch Assessment Areas, for 1990–2021 and 2021, is shown in Figure 18. For 1990–2021, the extent of the contact by these combined targets is greatest in CHAT4, which accounted for 44% of the estimated HAK/HOK/LIN/SWA/WWA footprint, 53% of the aggregate area, and 33% of the contacted cells (Tables D12–D14). The next most important area was STEW5, which encompasses the Stewart-Snares shelf and this accounted for 19% of the footprint, 17% of the aggregate area, and 15% of the cells. The other main southern area (SUBA6) accounted for 12% of the total footprint, 3% of the aggregate area, and 21% of the cells (indicating the relatively small amount of effort spread over a larger number of cells). The latter area boundary does not appear to effectively separate the effort for these targets in the fisheries off the Stewart-Snares shelf, the Auckland Islands Shelf, and the wider sub-Antarctic waters.

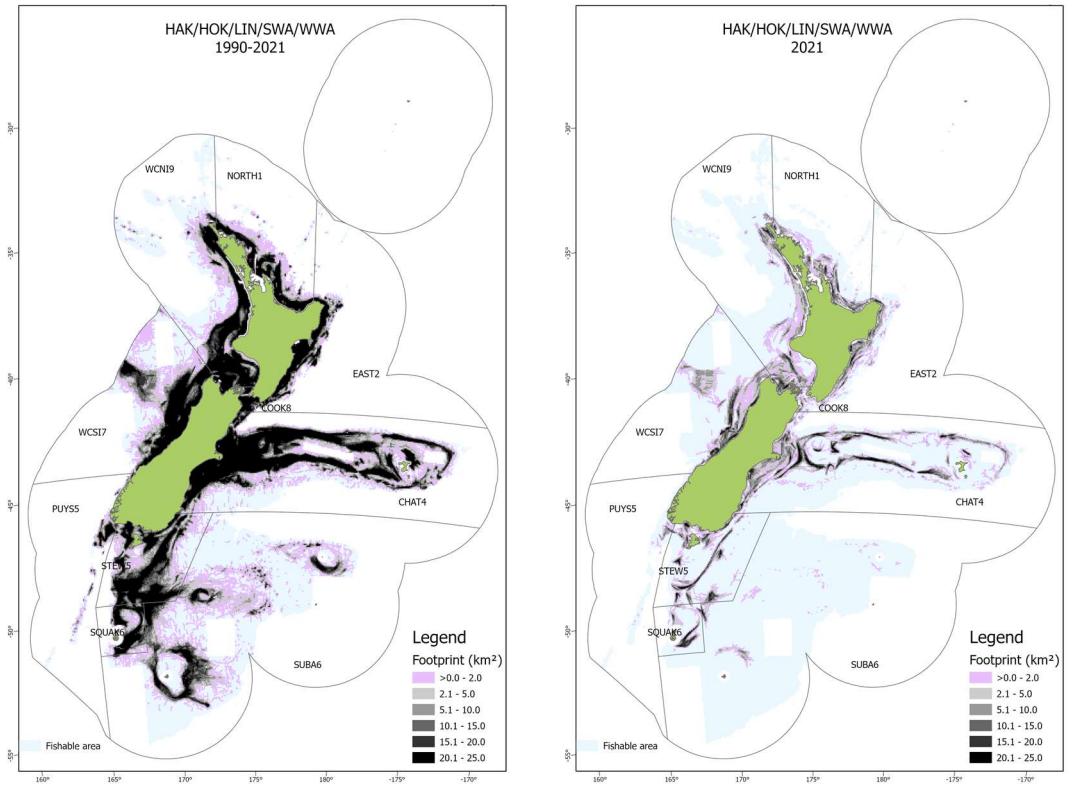

Figure 18: Distribution of the HAK/HOK/LIN/SWA/WWA footprint, by 25-km^2 cells in each Bycatch Assessment Area (see Anderson & Edwards 2018), 1990–2021 (left) and 2021 (right).

The other main area, WCSI7, accounted for 12% of the total combined footprint, 19% of the aggregate area, and 11% of the cells; the relatively larger percent of the aggregate area in WCSI7 is indicative of more effort in a relatively confined fishery area compared with other main areas (apart from CHAT4). Much of the WCSI7 data will be from the hoki spawning fishery, whereas areas such as CHAT4 and STEW5 are more likely to include a more even spread of effort for the five target species in this group. In the most recent analysis year, 2021 (which had the third lowest estimated annual footprint in the time series), slight increases were seen in the footprint for CHAT4 and STEW5 and a slight decrease in SUBA6 compared with the 2020 fishing year. All of these areas however have seen decreases since the last iteration of this project in 2019. COOK8 saw a slight increase in 2021 compared with 2020 while PUY5 and SQUAK6 both saw slight increases. All of these less fished areas, however, were down from 2019. For the main areas, 58% of the 2021 HAK/HOK/LIN/SWA/WWA footprint was in CHAT4, 17% in STEW5, 3% in SUBA6, and 15% in WCSI7; 63% of the aggregate area was in CHAT4, 14% in STEW5, 2% in SUBA6, and 14% in WCSI7; and 46% of cells contacted were in CHAT4, 19% in STEW5, 5% in SUBA6, and 15% in WCSI7. These numbers are all broadly similar to 2019, suggesting that the fishing activity was similar between years.

4.2.4 ORH/OEO for MSC areas: number of cells, aggregate area, and footprint

Fisheries New Zealand requires summary footprint output for orange roughy and oreo species for provision to the MSC certification process and requested that the combined data be analysed by orange roughy areas ORH7A (Challenger Plateau), NWCR (northwest Chatham Rise), and ESCR (southeast Chatham Rise) (Figure 19).

The annual and total numbers of cells contacted, aggregate area, and footprint are given for each area in Table D15. The western area ORH7A has been subject to closures (Fisheries New Zealand 2020), with the first after the peak footprint in 1998 and 1999 which was over 2000 km^2 in both years and about 895 cells contacted (Table D15). The aggregate areas in both of these peak years was not substantially higher than the footprint, indicating that the effort was not intensive. The footprint more than halved in 2000 and there was very little contact in years with data until 2015–2020, after which there was a steadily

increasing pattern with between 322 and 699 cells contacted and the footprint ranging between 755 and 1596 km^2. The footprint in 2021 increased substantially from 2020 at 2451 km^2 and is the largest in the time series, with the corresponding aggregate area (2750 km^2) also being the highest, and the number of cells contacted (756) being the second highest in the time series. In total, ORH7A had an aggregate area of 26 965 km^2 and a footprint of 11 187 km^2 that contacted 1568 cells. This is a noticeable increase from the 1990–2019 analysis when, for the *total* time period, the footprint was 8 975 km^2, the aggregate area was 22 467 km^2, and the number of cells contacted at that time was 1481 (Baird & Mules 2021b). This suggests in 2021 the effort in ORH7A was more widespread and intensive than in previous years.

The NWCR area contacted fewer cells overall (861 cells), a slightly smaller aggregate area (22 706 km^2) and a smaller footprint (7057 km^2) when compared with ORH7A (Table D15). The main period of contact in NWCR was during 1997–2005, albeit with a noticeable dip in 2000 (footprint range of 639 to 1609 km^2), with the peak years being 2001–2004. In 2008–2010, the annual footprints were between about 210 and 512 km^2, and in 2011–2013 there was very little trawling with footprints of just 4.9–6.1 km^2. From 2014 to 2021, the footprint was variable, at 239 km^2 in 2014, a peak at 881 km^2 in 2017, and 514 km^2 in 2021.

Overall, the ESCR area had an aggregate area of 37 565 km^2 and a footprint of 10 388 km^2 that contacted 1366 cells (Table D15). This is the largest overall of the three orange roughy areas examined in the project. Of the three areas, ESCR is the one with the most consistent effort each year during 1990–2021; however, there were still periods of smaller footprints (1992–2002), with footprints generally under 600 km^2, with higher footprints in some years (e.g., 690 km^2 in 1998). This was followed by increased footprints during 2004–2010 (1188–1808 km^2), lower footprints in 2011–2015 (160–230 km^2), before increases to 700–2025 km^2 in 2016–2021. The 2021 footprint of 2025 km^2 is the second highest footprint in the time series, behind 2849 km^2 in 1990.

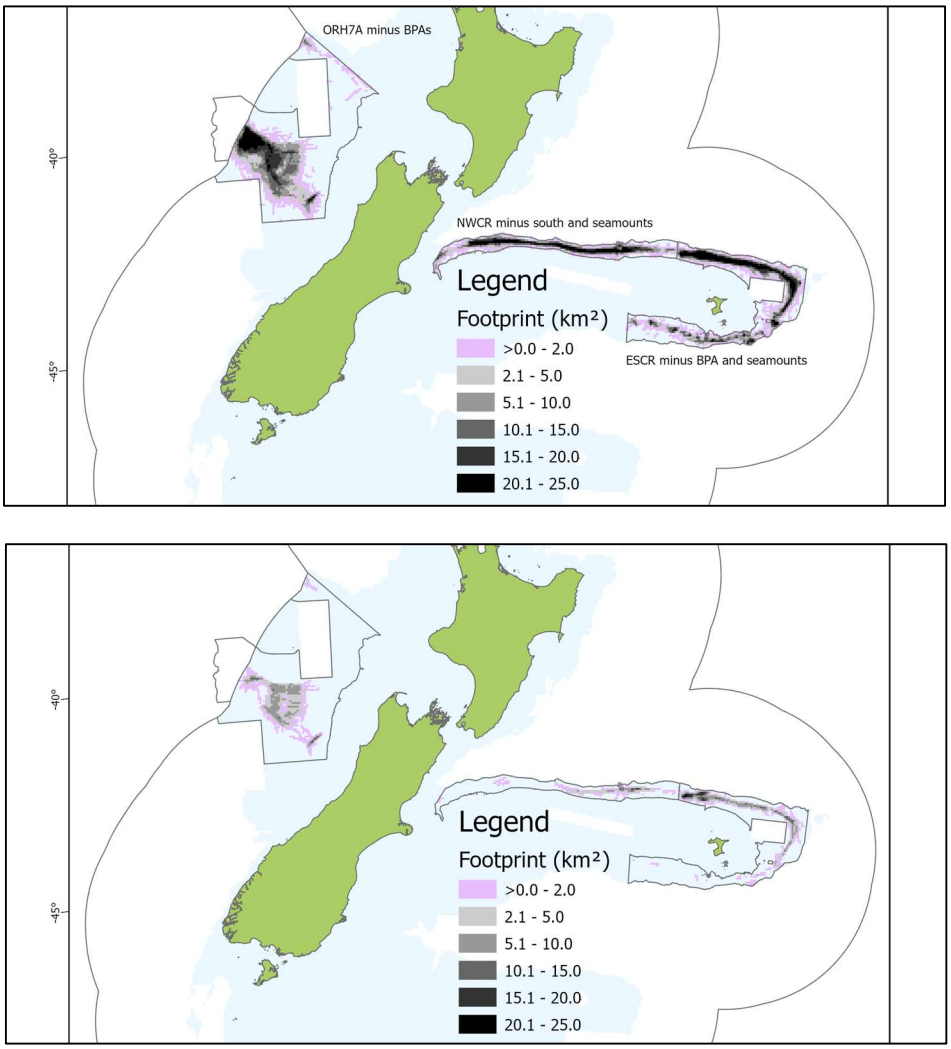

Figure 19: The extent of the footprint, based on 25-km^2 cells, for the ORH/OEO fishery for the ORH MSC ORH7A, NWCR, and ESCR areas, in 800–1600 m, for 1990–2021 (upper plot) and 2021 (lower plot).

4.3 Extent of new cells contacted across the time series

The number of cells that were fished in one year, but not in previous years, is shown in Table 10 for the combined deepwater fishstocks, where the base footprint was created for 1990–1994 during which time 24 315 unique cells were contacted. Table D16 shows the equivalent data separated by Tier 1 and Tier 2 fishstocks. It is evident from Tables 10 and D16 that in many of these years the contact in the new cells is of low intensity; there is little difference between the aggregate area and the footprint, which could indicate exploratory fishing or be an artefact of the methodology used to generate the spatial data. However, in years of higher effort and increased swept areas (as seen in 1998–2000), the numbers of new cells increased and the aggregate area relative to the footprint was greater. This larger difference is also evident in some of the Tier 1 targets, such as hoki in 1998 and 2000, orange roughy in 1998 and 1999, and scampi in 2005 (Table D17). It should also be noted that when looking at different tiers or species in isolation in Tables D16 and D17, new cells for one tier or species might not necessarily be new cells when looking at all historical effort. A cell might have been fished previously when targeting a different species. So it is also important to consider Table 10 which presents data for all deepwater fishstocks, irrespective of species or tier.

For the main middle depth targets combined (hake, hoki, ling, silver warehou, and white warehou) there were 36 new cells contacted in 2021. These were in a variety of locations in the EEZ but mostly off the west coast of the South Island and east of Stewart Island in depths less than 200 metres with ling being

the most common target species. For oreo and orange roughy fisheries, 70 new cells were contacted in 2021. These were all on the south Challenger Plateau, almost entirely targeting orange roughy, in depths between 800 and 1000 metres.

Table 10: For the deepwater fishstocks, the number of cells contacted in a year, that had not been contacted in previous years, and the aggregate area and footprint within those new cells. A base of 24 315 cells were contacted in 1990–94, and, for example, 1183 cells were contacted in 1995 (but not in 1990–94), with an aggregate area of 1087 km^2 and footprint of 938 km^2. Table D16 shows the equivalent data separated by Tier 1 and Tier 2 fishstocks.

Fishing year	No. new cells	Aggregate area (km^2)	Footprint (km^2)
No. cells contacted in 1990–94 = 24 315			
1995	1 183	1 086.9	938.3
1996	1 364	1 012.8	930.1
1997	1 118	898.1	848.9
1998	1 487	1 957.6	1 583.1
1999	1 271	1 229.5	1 111.6
2000	1 190	1 453.0	1 321.4
2001	749	710.8	616.0
2002	1 173	1 004.4	970.0
2003	648	714.3	639.3
2004	345	341.7	310.2
2005	610	615.0	558.9
2006	266	123.5	119.3
2007	271	152.5	146.8
2008	308	198.3	186.9
2009	232	97.5	95.2
2010	181	67.8	65.6
2011	171	76.8	65.1
2012	102	38.4	38.4
2013	63	31.6	31.1
2014	95	40.9	40.9
2015	194	177.7	165.4
2016	183	108.3	104.3
2017	116	73.2	69.7
2018	117	33.7	33.6
2019	84	94.8	90.9
2020	69	60.5	59.5
2021	78	89.2	85.8

4.4 Intensity

For the combined 1990–2021 deepwater fishstocks data, the median number of tows that contacted a cell was 15 tows (mean of 192.5), and 50% of cells were contacted by between 3 and 89 tows, with a maximum of 20 276 tows over the total data set (Table 11). Figure 17 illustrates the areas where fishing was most intense in 1990–2021 and 2021.

For Tier 1 targets, the median number of tows in a cell in a year was about 4 tows during 1990–2021 (Table D18). The mean numbers increased during the 1990s to 2005 (peak at about 22 tows per cell), before dropping to a steady 14–16 tows in 2017, and about 17–19 tows in 2018 and 2021. At the same time the maximum number of tows per cell decreased from over 1000 to about 500 in most years after 2006.

The annual median values for the aggregate areas in a cell were 1–2 km^2, with 2021 having the highest (2.26 km^2), whereas the means ranged between about 7 and 11 km^2, with peak years during the mid-1990s to mid-2000s. The maximum aggregate areas in a cell were mostly during 1991–1995, at 790–1617 km^2, and in 2004 and 2005 (at about 915–948 km^2). Median footprint estimates in comparison with aggregate area values indicated that many cells have low levels of contact with most years being under 2 km^2 and means mostly under 5 km^2 (Table D18).

The influence of the HAK/HOK/LIN/SWA/WWA mixed fishery group is obvious when comparing summary data of Tables D18 and D19, particularly after the mid–1990s: hoki effort has the greatest effect, noting that silver warehou and white warehou are Tier 2 targets (compare data in Tables D5 and D8). Overall, the median aggregate area per cell increased, and the highest median values for number of tows contacted, aggregate area, and footprint per cell were in 2021. When these mixed fishery group data are split by Bycatch Assessment Area, the areas with the greatest intensity as measured by the number of tows per cell were COOK8, CHAT4, and WCSI7 (Table 12) and by the aggregate area per cell were CHAT4, COOK8, STEW5, and WCSI7 (Table D20). Different sized vessels fish in these areas and this is reflected in the data: for example, smaller vessels fish in Cook Strait waters (where the available area is small relative to that in the offshore areas where the larger vessels operate). The maximum number of tows per cell for 1990–2021 was from Cook Strait with 14 506, followed closely by the west coast of the South Island with 12 437. Both of these areas are likely to have had high numbers of tows due to spawning hoki fisheries that occur in them. Most areas appeared to have more intense effort during the early-2000s.

Summary data for the ORH/OEO targets (Table D21) reflect the generally shorter tows for these targets, often in isolated areas, and the effects of quota changes in some years, in contrast to the larger HAK/HOK/LIN/SWA/WWA tows in broader fishery grounds where, despite some quota changes for hoki, the other targets can be fished.

Table 11: Summary data for the number of tows that contact a cell, the aggregate area, and the footprint by 25-km^2 cell for the deepwater fishstocks data, for the combined fishing years 1990–2021.

	Minimum	1st quarter	Median	Mean	3rd quarter	Maximum
No. of tows	1	3	15	192.5	89	20 276.0
Aggregate area (km^2)	< 0.1	1.1	6.0	95.3	38.2	13 307.2
Footprint (km^2)	< 0.1	1.1	5.2	9.4	18.2	25.0

Table 12: Number of tows per cell for six of the Bycatch Assessment Areas used to analyse the bottom-contacting trawl footprint of HAK/HOK/LIN/SWA/WWA, for 1990–2021 and 2021.

	1990–2021 no. tows per cell			2021 no. tows per cell		
	Median	Mean	Maximum	Median	Mean	Maximum
CHAT4	14	211	4 292	7	17	167
COOK8	23	373	14 506	6	16	69
PUYS5	12	186	2 502	8	17	108
STEW5	15	168	5 846	4	11	242
SUBA6	2	22	1 749	2	8	74
WCSI7	6	282	12 437	6	17	480

For comparison, the summary data for Tier 2 targets are given in Table D22; these data reflect the lower level of effort for these targets.

4.5 Number of years contacted

Of the 37 983 cells contacted by the 1990–2021 deepwater footprint, 58% had under 10 years of contact: 18% were contacted in 1 year, 10% in 2 years, 7% in 3 years, and 5% in 4 years. Another 5% were contacted each year in the 30-year data set (Figure 20). The spatial distribution of these cells, by number of years contacted is shown in Figure 21 with the primary fishery areas for Tier 1 targets clearly distinguished.

About 27% (n = 10 098) of all deepwater cells were contacted in 2021, and 5% (n = 1967 cells) were last contacted in 2020, another 19% were last contacted during 2016–2019, and about 14% have not been contacted since 2000 (see Figure 20). The spatial distribution of these cells by last year fished is shown in Figure 21.

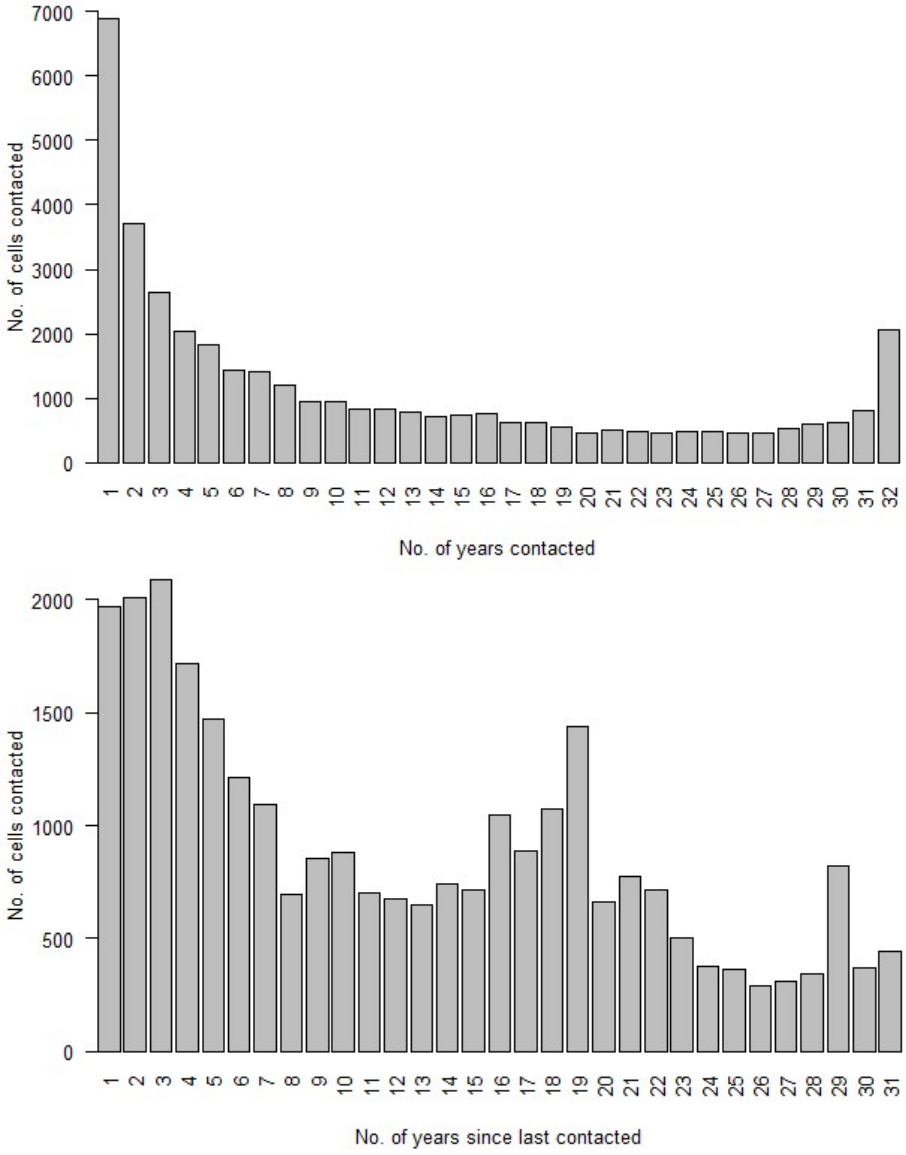

Figure 20: The number of cells contacted in annual year bins for 1990–2021 (upper) and the number of cells in each bin representing the number of years since a cell was last contacted (lower).

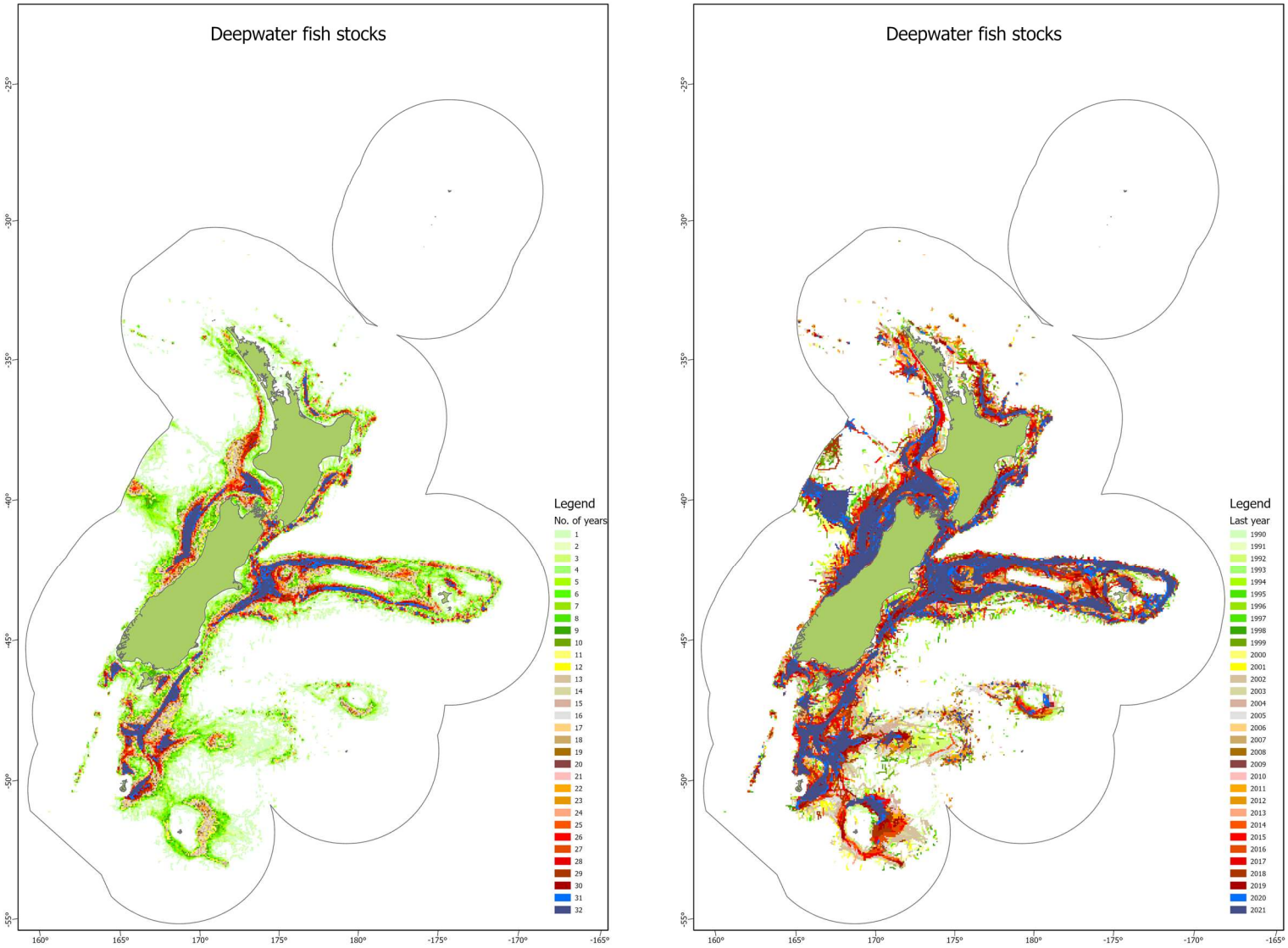

Figure 21: Distribution of the deepwater cells, by the number of years contacted (left), and by the year last fished (right).

4.6 Overlap of the deepwater footprint and 200-m depth zones

The all-year deepwater contact (Tier 1 and Tier 2 combined) was greatest in middle depths: 29% of the total 1990–2021 footprint was in 400–600 m and 17% was in 600–800 m (Table D23). Shallower depths accounted for 25% in under 200 m and 11% in 200–400 m. Beyond 800 m, 10% of the total deepwater footprint was in 800–1000 m, 6% in 1000–1200 m, and almost 3% in 1200–1600 m. For 2021, the spread of the annual footprint by depth zone was similar to that above, but a greater percent was in 400–600 m (at 42%), with 86% in 0–800 m compared with 82% of the 32-year footprint. This is down from 2019, when 92% of the footprint was in 0–800 m. The extents of these footprints, by depth zones, are shown in Figure 22.

Overall, the total deepwater footprint contacted 25.6% of the seafloor area open to trawling in depths under 1600 m, with most of this being Tier 1 fisheries (23.6%) (Table 13). In comparison, Tier 2 fisheries contacted 5.5%. Note that there is spatial overlap of Tier 1 and Tier 2 fisheries, which is why the overlap of all deepwater fisheries is less than the sum of the Tier 1 and Tier 2 overlaps. In the middle depths, 40.8% of 400–600 m and 32.1% of 600–800 m of the seafloor areas were contacted; in shallower depths, 40.5% in 200–400m and 34.9% in under 200 m were contacted; and 21.8% of 800–1000 m, 13.6% of 1000–1200 m, and under 7% of the two deepest zones were contacted. The 2021 overlap shows a similar pattern to the all-year pattern although the actual percentages are much lower. The overlap is greatest in the under 800 m zones, with a maximum overlap of 7.2% in 400–600 m.

The estimated footprints by Tier 1 and Tier 2 targets are given in Tables D24–D27. For Tier 1 fisheries, the middle depths are most important with 31% of the 1990–2021 footprint coming from 400–600 m, and another 18% coming from 600–800 m (Table D24). A further 21% is from shallower than 200 m. Less than 9% was from deeper than 1000 m.

Shallower depths are more important for Tier 2 species with the 0–200 m depth range comprising over half the footprint for 1990–2021 at 51% (Table D25). This depth range has been the most important throughout the time series, ranging from 37% in 2006 to 73% in 2020. The 200–400 m range contributed to 21% of the footprint for the time period and appears to be decreasing slightly in importance over the last ten years. The 400–600 m depth range is less important for Tier 2 species compared with Tier 1, but still contributes 20% of the footprint. However, the 600–800 m depth range contributes just 6% for Tier 2 compared with 18% for Tier 1. Less than 2.5% of the total footprint comes from deeper than 1000 m for Tier 2.

Jack mackerel, arrow squid, and hoki had the largest footprints in 0–200 m; hoki, scampi, and arrow squid in 200–400 m; mainly hoki, then southern blue whiting, hake, ling, and scampi in 400–600 m; mainly hoki, then ling, hake, and arrow squid in 600–800 m; and in waters deeper than 800 m, mainly orange roughy, as well as oreo and hoki. Note that the distribution for some targets is outside their main depth range and this is partly an artefact of using the 25-km^2 cell grid with the depth value being the midpoint. The 2021 footprint has a similar pattern although scampi is more important in 200–400 m and 400–600 m in 2021 than for the time series as a whole.

The 1990–2021 footprint overlap of each depth zone, expressed as the percentage contacted in each depth zone, is shown for Tier 1 targets separately and combined in Table 14. The total hoki footprint has the greatest coverage of 200–800 m waters, contacting about 18.6% of the 200–400 m zone, 28% of the 400–600 m zone, and 28.6% of the 600–800 m zone (Table 14). In less than 200 m, the targets with the greatest footprint overlap are jack mackerel species and arrow squid. Other targets with footprint overlap of at least 6% in the 200–400 m zone are jack mackerels, ling, scampi, and arrow squid. Hake, ling, and southern blue whiting cover 5.1–7.6% of the 400–600 m zone.

In the deeper zones over 800 m, the orange roughy footprint has an 12.2% overlap, and oreo species and hoki footprints each have 5.3 and 5.2% overlap, respectively, in 800–1000 m. In 1000–1200 m, 9.6% of the seafloor area is contacted by the orange roughy footprint, and 3.5% by the oreo footprint. Orange roughy has the largest overlap in the two deepest zones, with 3.2% in 1200–1400 m and about 1.5% in

1400–1600 m. All other Tier 1 species have overlaps of less than 1% in the two deepest depth zones. The patterns seen for the 2021 footprint for these species were similar to those described above, though the percentage overlap was substantially smaller, for only one year of footprint; for example, the hoki overlap in 2021 in 400–600 m was 5.7% and the orange roughy footprint in 800–1000 m was 1.9 % (Table 15).

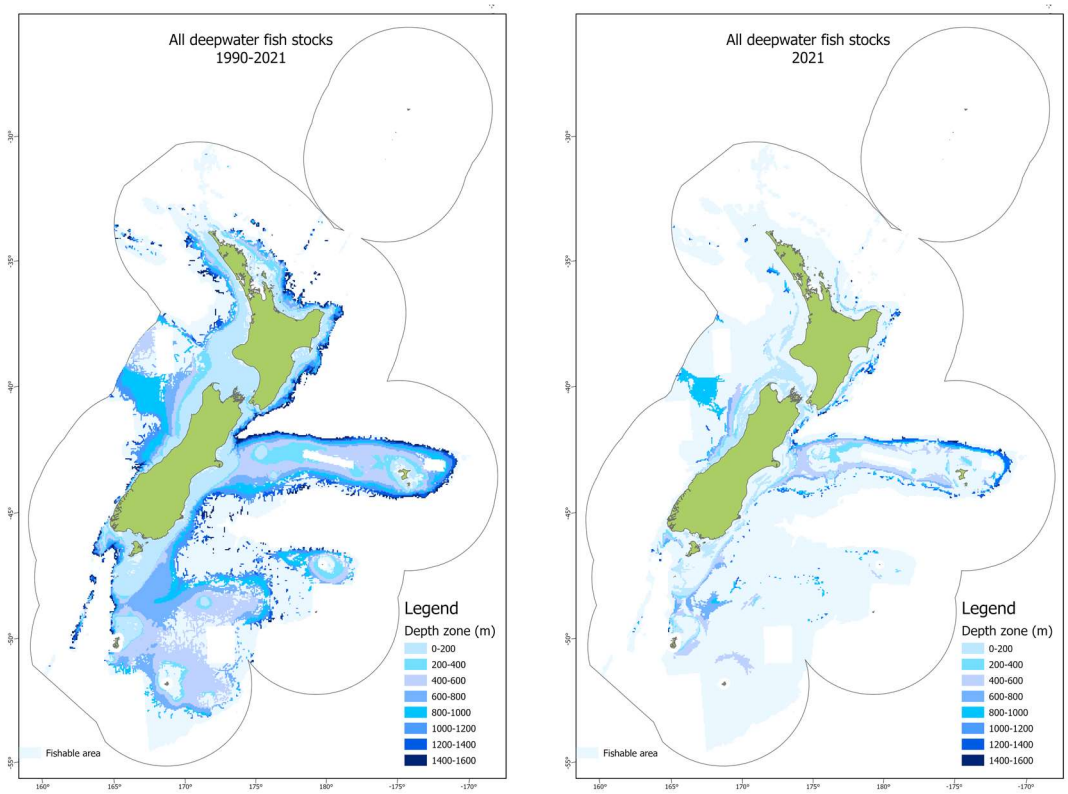

Figure 22: Extent of the deepwater footprint overlap with 200-m depth zones, represented by 25-km^2 cells for 1990–2021 (left) and 2021 (right).

Table 13: The total area of each fishable area depth zone and the percent contacted by the 1990–2021 and 2021 footprints for the Tier 1, Tier 2, and total deepwater target species.

Depth zone (m)	Area (km^2)	1990–2021 footprint overlap (%)			2021 footprint overlap (%)		
		Tier 1	Tier 2	All	Tier 1	Tier 2	All
< 200	249 341.90	27.4	15.7	34.9	2.3	1.2	3.4
200–400	98 295.90	36.7	16.1	40.5	4.8	0.7	5.3
400–600	253 939.20	40.1	5.9	40.8	7.1	0.2	7.2
600–800	185 161.60	31.3	2.0	32.1	2.9	0.1	3.0
800–1000	166 645.00	21.4	0.9	21.8	2.2	0.0	2.3
1000–1200	144 930.50	13.3	0.7	13.6	1.2	0.0	1.2
1200–1400	168 376.80	4.1	0.3	4.2	0.2	0.0	0.3
1400–1600	124 988.80	2.0	0.3	2.2	0.1	0.0	0.1
≤ 1600	1 391 679.70	23.6	5.5	25.6	2.9	0.3	3.1

Table 14: The total seafloor area in each depth zone within 'fishable' depth zones ≤ 1600 m, and the percentage of each depth zone contacted by the 1990–2021 Tier 1 footprint.

Depth zone (m)	Area (km^2)	Footprint area overlap (%)									
		HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier
< 200	249 341.90	0.1	5.3	15.8	1.2	0.0	0.1	0.0	0.7	9.9	27.4
200–400	98 295.90	1.2	18.6	6.1	7.0	0.1	0.2	3.7	9.5	8.0	36.7
400–600	253 939.20	5.1	28.0	0.4	4.8	0.1	0.2	7.6	3.6	2.1	40.1
600–800	185 161.60	3.0	28.6	0.2	3.3	0.7	0.9	0.2	0.2	1.7	31.3
800–1000	166 645.00	0.6	5.3	0.0	0.2	5.2	12.2	0.0	0.1	0.3	21.4
1000–1200	144 930.50	0.0	1.3	0.0	0.0	3.5	9.6	0.0	0.1	0.2	13.3
1200–1400	168 376.80	0.0	0.3	0.0	0.0	0.9	3.2	0.0	0.0	0.1	4.1
1400–1600	124 988.80	0.0	0.3	0.0	0.0	0.3	1.5	0.0	0.1	0.1	2.0
≤ 1600	1 391 679.70	1.5	12.0	3.4	2.1	1.3	3.2	1.7	1.5	3.0	23.6

Table 15: The total area of the seafloor in each depth zone within 'fishable' waters, all depth zones ≤ 1600 m combined, and the percentage of each depth zone covered by the 2021 trawl footprint for each Tier 1 target species and for the Tier 1 targets combined. – indicates no overlap.

Depth zone (m)	Area (km^2)	Footprint area overlap (%)									
		HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
< 200	249 341.90	0.01	0.06	1.10	0.05	–	0.00	–	0.01	1.09	2.30
200–400	98 295.90	0.04	0.73	0.06	0.32	–	0.00	0.01	2.73	1.07	4.81
400–600	253 939.20	0.13	5.66	0.00	0.37	–	0.00	0.21	0.75	0.12	7.07
600–800	185 161.60	0.18	2.65	0.00	0.12	0.00	0.06	–	0.00	0.00	2.94
800–1000	166 645.00	0.01	0.20	–	0.00	0.09	1.91	–	0.00	0.00	2.22
1000–1200	144 930.50	0.00	0.00	–	–	0.08	1.13	–	–	–	1.21
1200–1400	168 376.80	–	0.00	–	–	0.01	0.23	–	–	–	0.24
1400–1600	124 988.80	–	0.00	–	–	0.00	0.07	–	–	–	0.08
≤ 1600	1 391 679.70	0.05	1.47	0.20	0.12	0.02	0.39	0.04	0.33	0.29	2.86

4.7 Overlap of the deepwater footprint and BOMEC classes

About 85% of the 1990–2021 deepwater footprint was distributed in six BOMEC classes: J (23%), H (18%), L (16%), I (11%), C (10%), and E (7%) (Table D28). About another 8% of the footprint was distributed within classes M and N. For Tier 1 species the distribution was almost identical with about 86% of the 1990–2021 footprint within six BOMEC classes: J (24%), H (18%), L (17%), I (12%), C (9%), and E (6%) (Table D29). Another 10% of the footprint was in classes M and N. For Tier 2 species the distribution was slightly different, although five of the top six classes are in common with Tier 1 but in a different order of importance. Ninety-one percent of the Tier 2 1990–2021 footprint was made up of six classes—H was the most important with 31% of the total (Table D30). Classes C and E were more important than for Tier 1, with 18 and 17% respectively. With 12% of the total, J was the fourth most important class in contrast to Tier 1 where it is the most important. Class I was the fifth most important with 7% of the total. With 6% of the total Tier 2 footprint, class B was the sixth most important class, compared with Tier 1 where it was the 13th most important class and contributed just 0.4%. The spatial distribution of the footprint by class is shown in Figure 23 for both Tier 1 and Tier 2 species.

When the overlap is expressed as a percent of the seafloor area of each class, the deepwater footprint had the greatest overlap, in descending order, in BOMEC classes I (74.4% area contacted), G (54.6%), H (47.3%), C (41.1%), and E (40.5%) (Table 16). For some classes, the overlap was mainly from the

Tier 1 footprint (C, G-J, and L), from the Tier 2 footprint (B), or more evenly spread (E). In the BOMEC classes M–O, the overlap was very small, mainly because these classes are in deeper waters. There was minimal overlap of class K, a very small area north of the North Island (see Figure B1). In many years, this class is not contacted at all, including in 2021. The overlap of the 2021 footprint with the BOMEC classes shows a similar pattern to 1990–2021, but with much smaller percentages, and with the most important classes remaining the same (C, E, G–I, and L). The percent overlap by Tier 1 target footprints is given in Tables 17 and 18. The large overlap of hoki with classes G–J shows why these classes have a large overlap for Tier 1 as a whole, as hoki dominated the Tier 1 footprint (see Table D5). Jack mackerel was the main contributor to class C (28%); arrow squid, jack mackerel, and hoki for class E; hoki and ling in class G; hake, hoki, jack mackerel, ling, and arrow squid in class H; hoki in class I; hoki and orange roughy in class J; and hoki and southern blue whiting in class L.

Table 16: The total area of each BOMEC class within the EEZ+TS and the percentage of each class area covered by the 1990–2021 and 2021 bottom-contacting trawl footprint for the Tier 1, Tier 2, and combined deepwater fishstocks. – indicates no overlap.

	BOMEC	1990–2021 footprint overlap (%)			2021 footprint area overlap (%)		
Class	Area (km^2)	Tier 1	Tier 2	All	Tier 1	Tier 2	All
A	30 661.00	2.5	2.9	4.8	0.0	0.1	0.1
B	12 786.10	10.2	33.5	38.2	0.5	5.7	6.1
C	90 256.50	33.1	15.6	41.1	2.5	0.9	3.3
D	28 085.70	8.2	7.2	13.5	0.2	0.4	0.5
E	61 258.00	34.0	21.6	40.5	3.9	1.6	5.1
F	38 775.80	17.7	0.6	17.8	0.7	–	0.7
G	6 702.30	42.2	26.4	54.6	2.7	2.8	5.2
H	138 399.10	43.7	17.0	47.3	5.7	0.6	6.2
I	52 008.30	73.9	10.8	74.4	19.3	0.5	19.6
J	312 604.90	24.9	2.9	25.9	3.5	0.1	3.6
K	1 200.20	0.3	0.0	0.3	0.0	0.0	0.0
L	198 578.40	28.4	0.4	28.5	2.3	0.0	2.3
M	233 837.40	7.9	0.1	7.9	0.2	–	0.2
N	495 154.20	2.4	0.2	2.5	0.1	0.0	0.1
O	1 006 911.10	0.1	0.0	0.1	0.0	0.0	0.0
All	2 707 219.00	12.1	2.8	13.1	1.5	0.2	1.6

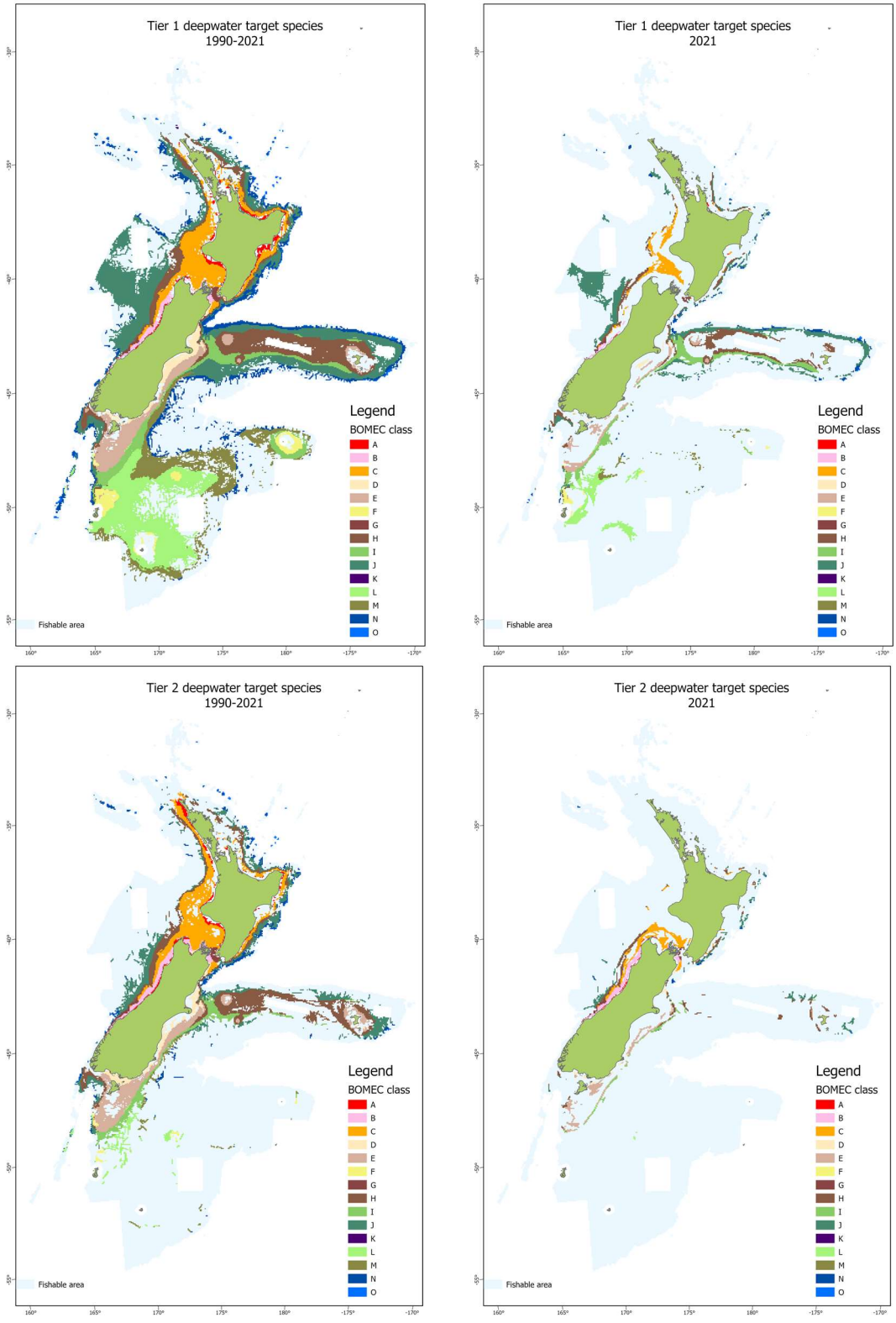

Figure 23: Extent of the deepwater footprint overlap with BOMEC classes, represented by 25-km^2 cells for 1990–2021 (left) and 2021 (right) for Tier 1 (upper plots) and Tier 2 (lower plots).

Table 17: The total area of each BOMEC class within the EEZ+TS and the percentage of each area covered by the 1990–2021 footprint for the Tier 1 deepwater target species. Note: there are some large differences in the areas of some classes. – indicates no overlap.

		Footprint area overlap (%)									
Class	Area (km^2)	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
A	30 661.00	0.00	0.50	0.39	0.03	0.01	0.13	0.01	0.22	1.23	2.46
B	12 786.10	0.38	6.16	0.65	2.93	0.01	0.09	0.13	0.05	0.36	10.21
C	90 256.50	0.09	3.12	27.87	0.37	0.01	0.10	–	0.62	1.72	33.09
D	28 085.70	0.02	3.04	1.70	0.65	0.07	0.14	–	0.01	4.34	8.25
E	61 258.00	0.39	9.00	14.39	2.30	0.13	0.03	0.01	0.16	25.38	34.01
F	38 775.80	0.04	1.08	0.31	1.17	0.01	0.00	5.09	0.76	11.24	17.66
G	6 702.30	1.14	31.65	0.27	11.37	0.06	1.44	–	1.48	0.08	42.21
H	138 399.10	5.58	28.12	7.72	7.25	0.05	0.16	0.02	8.31	5.24	43.69
I	52 008.30	3.75	66.14	0.64	8.57	0.56	0.24	4.38	0.10	9.75	73.92
J	312 604.90	3.16	12.02	0.32	0.85	2.50	10.64	0.01	0.83	0.58	24.91
K	1 200.20	–	0.23	–	–	–	0.03	–	–	–	0.26
L	198 578.40	0.45	15.89	0.03	3.85	0.03	0.00	9.32	2.73	2.16	28.42
M	233 837.40	0.08	4.53	0.00	0.09	2.88	0.37	0.26	0.01	0.17	7.88
N	495 154.20	0.00	0.31	0.01	0.01	0.42	1.78	0.00	0.03	0.06	2.37
O	1 006 911.10	–	0.00	–	0.00	0.02	0.04	–	0.00	0.00	0.05
All	2 707 219.00	0.78	6.18	1.73	1.06	0.64	1.63	0.87	0.77	1.56	12.14

Table 18: The total area of each BOMEC class within the EEZ+TS and the percentage of each area covered by the 2021 bottom-contacting trawl footprint for the Tier 1 deepwater target species. – indicates no overlap.

		Footprint area overlap (%)									
Class	Area (km^2)	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
A	30 661.0	<0.01	0.01	–	<0.01	–	–	–	–	–	0.01
B	12 786.1	0.06	0.03	–	0.40	–	–	–	–	–	0.47
C	90 256.5	0.01	0.06	2.37	0.04	–	–	–	–	–	2.46
D	28 085.7	–	0.03	0.03	0.01	–	0.01	–	–	0.08	0.16
E	61 258.0	–	0.12	0.51	0.03	–	–	–	–	3.26	3.88
F	38 775.8	–	0.01	<0.01	<0.01	–	–	0.01	–	0.68	0.71
G	6 702.3	0.19	1.12	–	1.39	–	0.01	–	–	–	2.68
H	138 399.1	0.03	2.71	0.25	0.30	–	<0.01	–	2.04	0.48	5.67
I	52 008.3	0.17	18.26	0.01	0.30	<0.01	0.01	0.03	0.01	0.74	19.27
J	312 604.9	0.19	1.61	<0.01	0.13	0.06	1.55	–	0.08	<0.01	3.53
K	1 200.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
L	198 578.4	–	0.75	–	0.20	–	–	0.26	0.77	0.39	2.30
M	233 837.4	–	0.21	–	–	0.04	<0.01	–	–	–	0.25
N	495 154.2	–	<0.01	–	–	<0.01	0.11	–	–	–	0.12
O	1 006 911.1	–	<0.01	–	–	<0.01	<0.01	–	–	–	<0.01
All	2 707 219.0	0.03	0.76	0.10	0.06	0.01	0.20	0.02	0.17	0.15	1.47

4.8 Overlap of the Tier 1 target footprints and predicted habitat

The overlap of each Tier 1 species footprint on their 'preferred habitat' distribution (probability of occurrence) for the seven fish species (or annual distribution for scampi and arrow squid) is shown in Figures 24a–24e. This distribution represents the probability of capture (%) of a fish in a standardised trawl where, for example, 91–100% is the body of water in which a trawl is most likely to capture the species.

For all the Tier 1 fish species, except hake and jack mackerels, the footprint is mainly distributed in areas where the probability of occurrence in over 90% (Table D31). For hake, the footprint is mainly spread out in 40–90% occurrence. For jack mackerels, the footprint is mainly spread out in 20–90% occurrence. The footprint overlap of the seafloor area of each probability bin is given in Table 19 for the 1990–2021 and 2021 footprints.

The footprint overlap of the annual distributions for scampi and arrow squid is given in Table D31, the percent overlap of seafloor area in Table 19, and the spatial distribution in Figure 24e. For both species, the footprint is predictably concentrated in areas of high occurrence. The footprint is lower in areas where the population extent is unknown or the species is thought not to exist for 1990–2021, with the footprint being zero in 2021 for both species.

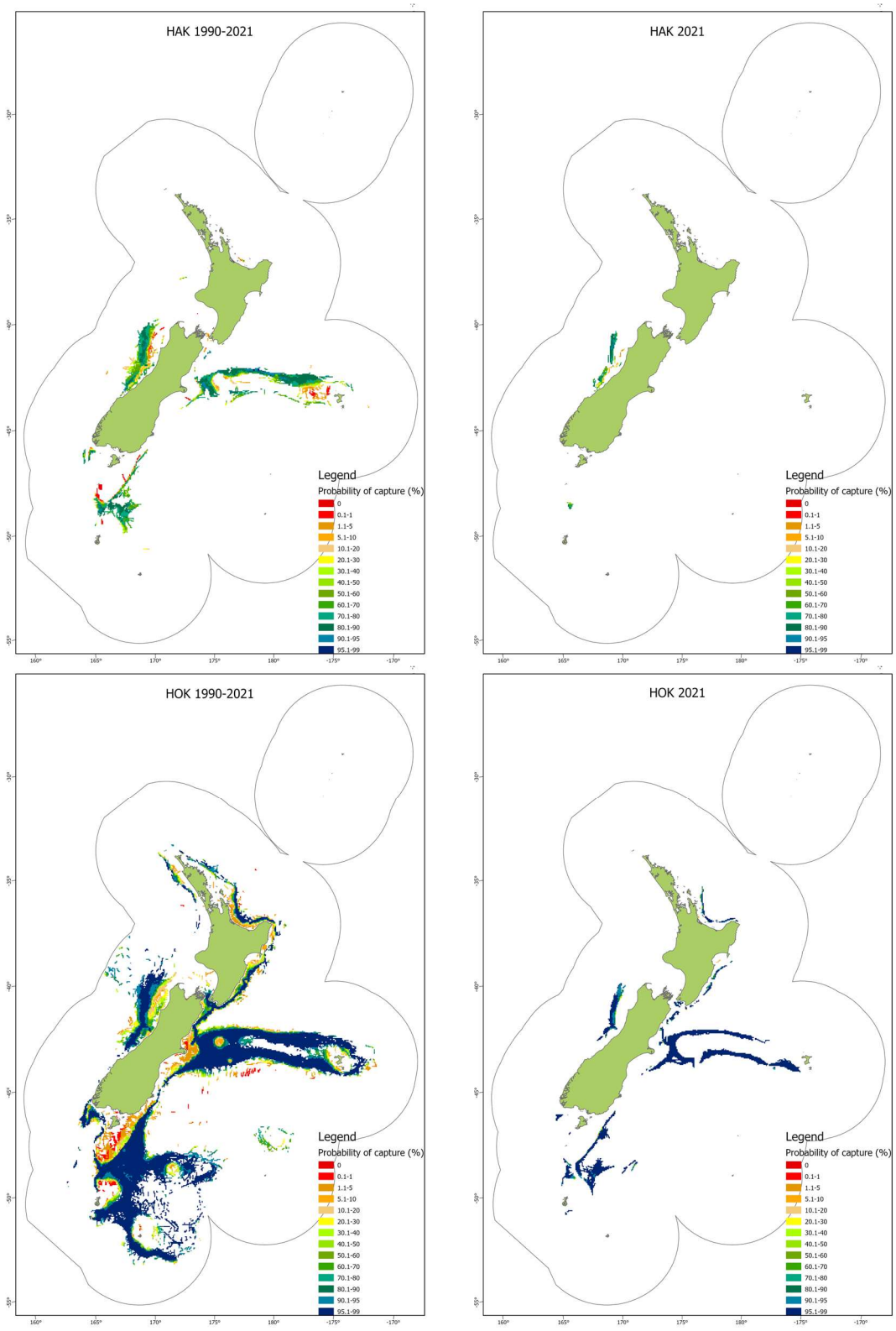

Figure 24a: Distribution of the 1990–2021 (left) and the 2021 trawl footprints (right) for hake (top) and hoki (bottom), displayed by 25-km^2 contacted cell, relative to the probability of capture for that species (after Leathwick et al. 2006).

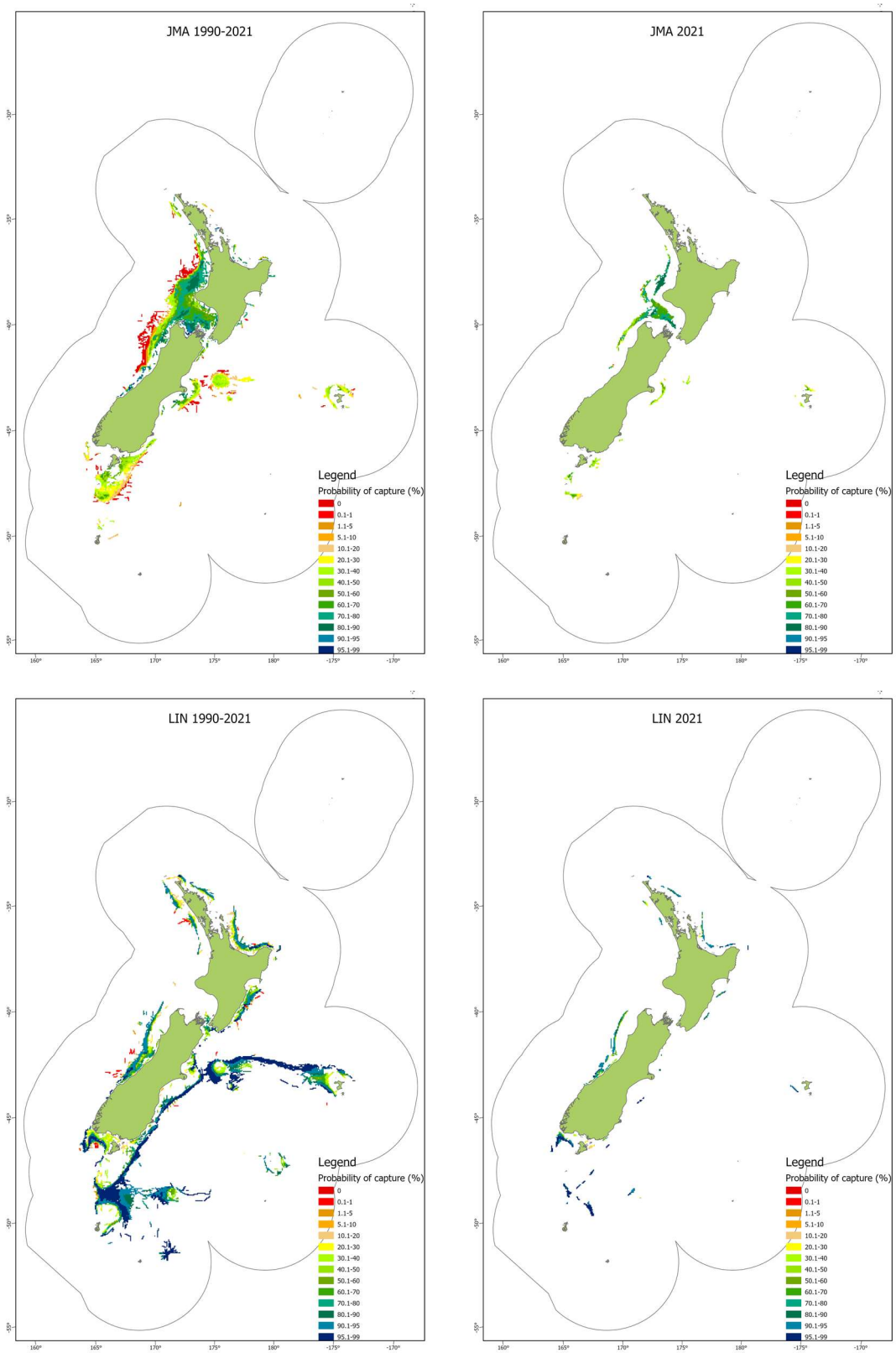

Figure 24b: Distribution of the 1990–2021 (left) and the 2021 trawl footprints (right) for jack mackerels (top) and ling (bottom), displayed by 25-km^2 contacted cell, relative to the probability of capture for that species (after Leathwick et al. 2006).

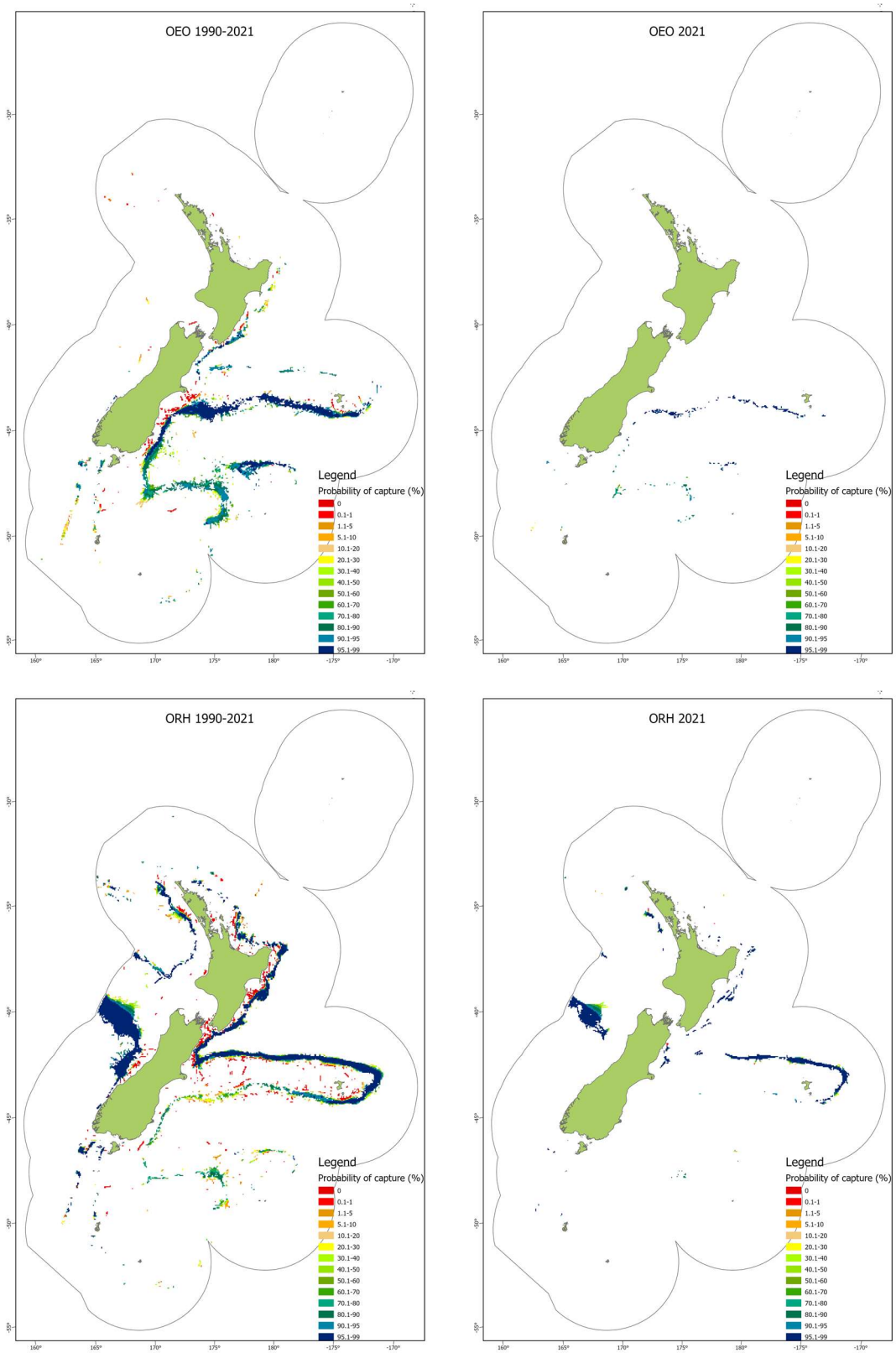

Figure 24c: Distribution of the 1990–2021 (left) and the 2021 trawl footprints (right) for oreo species (top) and orange roughy (bottom), displayed by 25-km^2 contacted cell, relative to the probability of capture for that species (after Leathwick et al. 2006).

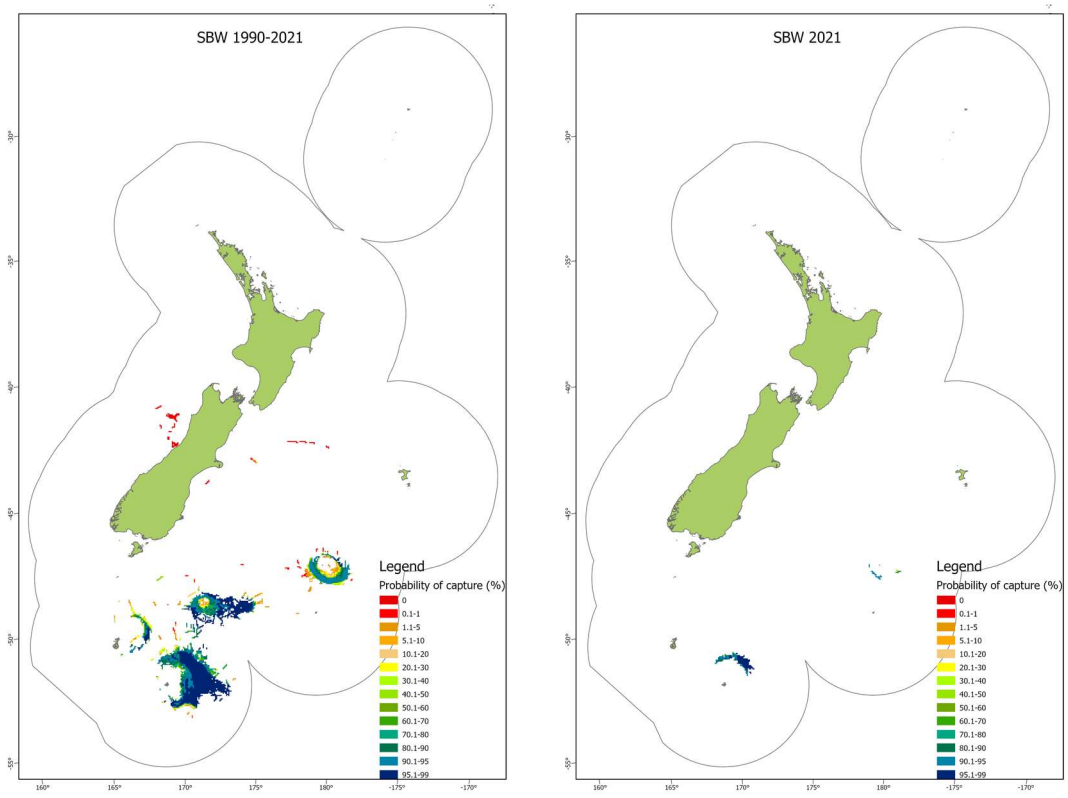

Figure 24d: Distribution of the 1990–2021 (left) and the 2021 trawl footprints (right) for southern blue whiting, displayed by 25-km^2 contacted cell, relative to the probability of capture for that species (after Leathwick et al. 2006).

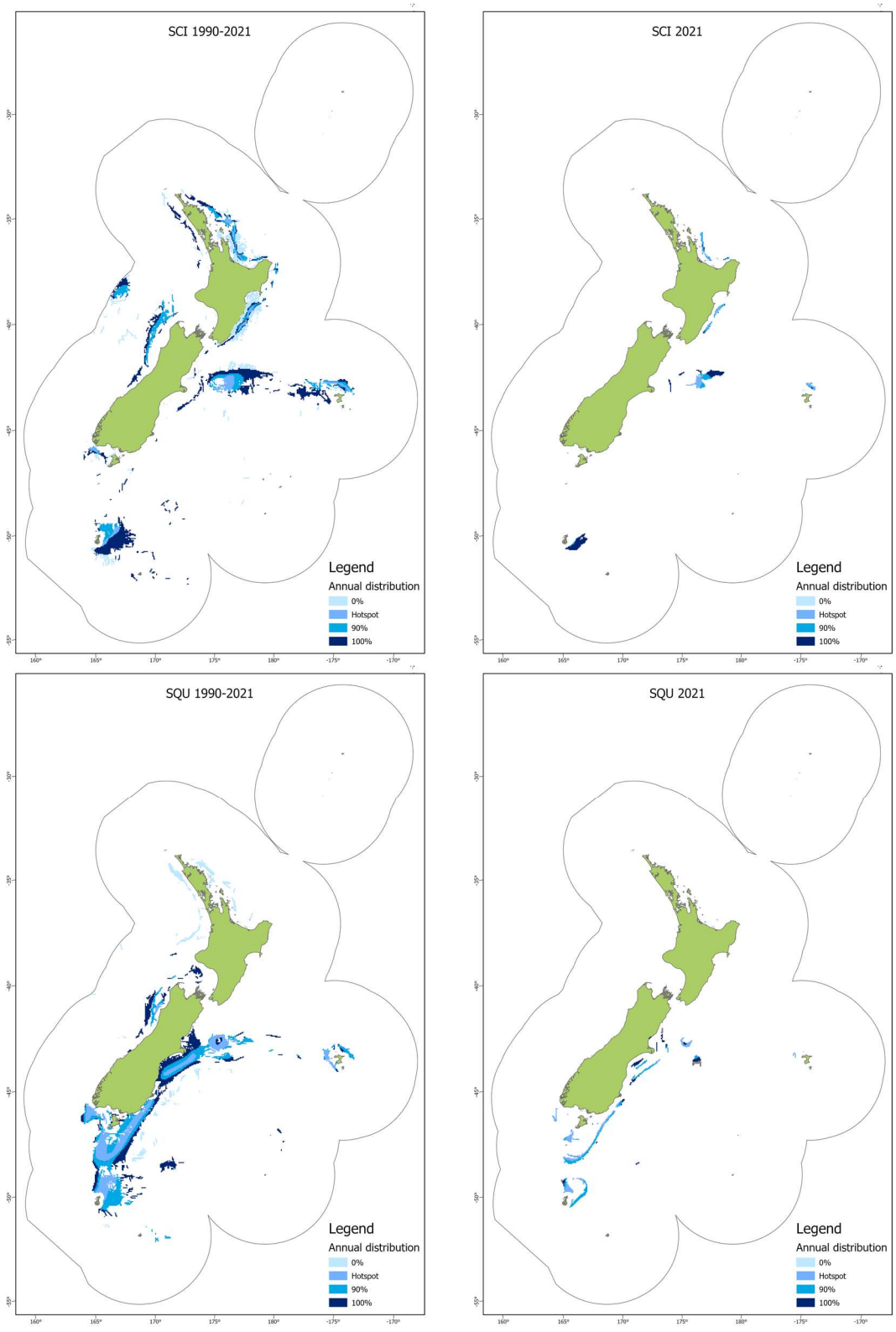

Figure 24e: Distribution of the 1990–2021 (left) and the 2021 trawl footprints (right) for scampi (top) and arrow squid (bottom), displayed by 25-km^2 contacted cell, relative to the annual distribution of the species population (see www.nabis.govt.nz).

Table 19: The total area of each 'preferred habitat' (probability of capture) and the percentage of each species 'preferred habitat' (probability of capture) area (for HAK, HOK, JMA, LIN, OEO, ORH, and SBW) or area of the annual distribution (for SCI and SQU) covered by the 1990–2021 and 2021 bottom-contact trawl footprint for the Tier 1 deepwater target species. – indicates no data. [Continued over next two pages]

Probability occurrence	HAK area	HAK footprint overlap (%)		HOK area	HOK footprint overlap (%)		JMA area	JMA footprint overlap (%)	
(%)	(km^2)	1990–2021	2021	(km^2)	1990–2021	2021	(km^2)	1990–2021	2021
0	157 798.9	157 798.90	0.15	59 927.6	0.27	<0.01	970 883.1	0.10	<0.01
0.1–1.0	143 613.4	143 613.40	0.16	191 141.7	0.55	<0.01	32 448.6	0.57	0.01
1.1–5.0	372 123.2	372 123.20	0.13	232 065.7	1.23	0.01	61 167.9	1.93	0.01
5.1–10.0	157 588.0	157 588.00	0.23	94 978.0	3.25	0.02	44 463.3	2.23	0.01
10.1–0.0	136 822.9	136 822.90	0.40	107 078.6	3.71	0.03	47 819.6	4.84	0.12
20.1–30.0	89 636.3	89 636.30	0.57	47 646.2	5.77	0.07	47 433.6	12.59	0.42
30.1–40.0	71 790.2	71 790.20	1.10	38 300.4	6.60	0.14	40 735.0	15.97	0.60
40.1–50.0	64 748.6	64 748.60	2.50	31 571.6	8.43	0.23	35 569.3	13.14	1.10
50.1–60.0	60 031.3	60 031.30	3.88	27 614.6	10.20	0.31	31 777.9	16.29	1.72
60.1–70.0	55 069.8	55 069.80	5.84	31 773.8	8.59	0.43	34 795.2	27.43	2.06
70.1–80.0	53 189.8	53 189.80	11.53	35 949.5	10.54	0.57	27 510.5	24.48	1.21
80.1–90.0	26 263.0	26 263.00	16.67	58 122.5	11.16	0.92	13 200.3	20.13	2.39
90.1–95.0	2 801.7	2 801.70	10.04	118 974.0	17.30	1.75	3 330.3	1.96	-
95.1–99.0	202.6	202.60	2.05	316 535.4	35.30	5.44	545.2	1.65	-
0.0–99.0	1 391 679.7	1.52	0.05	1 391 679.7	12.01	1.47	1 391 679.7	3.38	0.20

Table 19: — *continued*.

Probability occurrence (%)	LIN area (km^2)	LIN footprint overlap (%)		OEO area (km^2)	OEO footprint overlap (%)		ORH area (km^2)	ORH footprint overlap (%)	
		1990–2021	2021		1990–2021	2021		1990–2021	2021
0	16 384.1	0.02	-	591 875.4	0.06	<0.01	775 356.3	0.14	<0.01
0.1–1.0	421 963.7	0.03	-	96 946.8	0.06	-	83 107.9	0.20	<0.01
1.1–5.0	123 925.6	0.09	<0.01	133 348.9	0.15	<0.01	96 265.0	0.39	0.01
5.1–10.0	70 480.9	0.27	<0.01	72 594.5	0.25	<0.01	44 139.3	0.86	0.03
10.1–0.0	106 096.8	0.70	0.02	79 444.5	0.28	<0.01	46 647.0	1.33	0.05
20.1–30.0	70 823.3	2.18	0.07	55 551.7	0.42	<0.01	35 606.4	1.67	0.08
30.1–40.0	43 367.4	3.67	0.15	37 984.7	0.47	0.01	27 429.2	1.99	0.21
40.1–50.0	33 728.4	4.66	0.27	33 074.3	0.63	0.01	23 537.9	2.43	0.33
50.1–60.0	36 340.8	3.95	0.28	33 600.8	0.80	0.01	22 652.0	2.44	0.22
60.1–70.0	31 498.5	4.65	0.34	35 852.2	1.31	0.04	28 958.4	2.52	0.31
70.1–80.0	42 477.3	4.10	0.22	52 184.0	2.45	0.05	34 593.1	3.08	0.29
80.1–90.0	96 312.2	4.54	0.22	77 332.4	4.01	0.03	40 907.6	5.91	0.85
90.1–95.0	129 835.6	6.41	0.35	43 870.1	6.84	0.06	27 886.2	10.58	1.28
95.1–99.0	168 444.9	5.46	0.36	48 019.4	15.75	0.38	104 593.2	30.52	4.08
0.0–99.0	1 391 679.7	2.33	0.13	1 391 679.7	1.24	0.02	1 391 679.7	3.16	0.39

Table 19: — *continued*.

Preferred habitat (%)	SBW Area (km^2)	SBW Footprint overlap (%) 1990–2021	SBW Footprint overlap (%) 2021	Annual distribution*	SCI Area (km^2)	SCI Footprint overlap (%) 1990–2021	SCI Footprint overlap (%) 2021	SQU Area (km^2)	SQU Footprint overlap (%) 1990–2021	SQU Footprint overlap (%) 2021
0	931 718.1	0.01	-	Hotspot	14 914.5	34.47	10.18	56 994.5	28.5	2.51
0.1–1.0	122 249.7	0.08	-	90% population	77 916.5	6.77	0.95	172 093.3	8.95	1.32
1.1–5.0	140 341.1	0.27	-	100% population	463 031.2	2.04	0.51	306 136.0	2.40	0.12
5.1–10.0	23 088.7	1.52	-	Not Exist /unknown	927 060.7	0.11	-	854 868.7	0.08	-
10.1–20.0	18 499.5	2.71	<0.01							
20.1–30.0	13 156.5	3.28	<0.01							
30.1–40.0	11 096.7	3.44	0.01							
40.1–50.0	9 764.8	3.63	<0.01							
50.1–60.0	8 856.4	6.14	0.01							
60.1–70.0	8 626.1	8.74	0.03							
70.1–80.0	11 355.4	12.02	0.07							
80.1–90.0	21 664.4	17.54	0.74							
90.1–95.0	20 464.7	26.49	0.91							
95.1–99.0	50 797.8	17.67	0.37							
0.0–99.0	1 391 679.7	1.69	0.04							

***** For SCI and SQU, the areas given here represent the areas shown for the annual distribution for scampi and arrow squid provided by MPI at www.nabis.govt.nz. The 'None' category is the area outside the 100% population area within the combined EEZ and Territorial Sea as Figure B2c.

4.9 Overlap of the deepwater target footprints and sediment layers

The overlap of the 1990–2021 and 2021 footprints of the seafloor areas estimated for each sediment layer is summarised in Table D32. Note that these layers do not include the occlusions to the EEZ where the seafloor is beyond 200 n. miles from land (one southeast on Chatham Rise and one near Pukaki Rise in southern waters).

The footprint is reasonably well spread throughout the carbonate classes (Table D32), whereas the footprint in the gravel classes is greatest in 0–20%. For mud, most of the footprint is within the 0–20%, 20–40%, and 40–60% classes and, for sand, in the 20–40%, 40–60%, and 60–80% classes. Refer to Figure 14 which shows the overlap of the All Stocks with the sediment layers and the extent of the deepwater footprint shown in Figure 17.

Table 20 gives the footprint overlap for the substrate classes as percentage of the class area. The overlap of the deepwater footprint in the carbonate layer for 1990–2021 is highest in the 0–20% class (44.2% overlap), around 31% for the 20–40% class, 25% for the 40–60% class, and around 21% for both the 60–80% and 80–100% classes. The overlap with the gravel classes for 1990–2021 is highest in the 0–20% and 20–40% classes (around 27–29%), around 20% for both the 40–60 and 60–80% classes, and substantially smaller for the 80–100% class at around 11%. For mud from 1990–2021, the overlap is fairly even at around 27–28% for the 0–20, 20–40, and 40–60% classes, and around 21–22% for the 60–80 and 80–100% classes. For sand from 1990–2021, the overlap with the 0–20% class is around 24%, 20% for the 20–40% class, and between about 28–31% for the remaining classes. For 2021, the classes within each substrate type show similar coverage to the 1990–2021 overlap, but are much smaller footprints themselves.

Table 20: Percentage overlap of the seafloor area of the substrate classes by the fishable area 1990–2021 and 2021 deepwater footprint. For gravel, mud, and sand, the percentage classes total 100%, and for carbonate the percentage represents the proportion that is carbonate versus non-carbonate.

Substrate	Class (%)	Class area (km^2)	1990–2021 overlap (%)	2021 overlap (%)
Carbonate	0–20	138 252.7	44.2	7.7
Carbonate	20–40	282 469.8	30.7	3.7
Carbonate	40–60	275 070.0	24.9	2.3
Carbonate	60–80	288 732.7	20.8	2.8
Carbonate	80–100	369 402.8	21.0	2.2
Gravel	0–20	1 037 250.7	26.7	3.4
Gravel	20–40	188 550.0	29.1	3.6
Gravel	40–60	77 886.4	20.1	1.6
Gravel	60–80	26 682.0	20.0	0.5
Gravel	80–100	14 188.5	10.9	2.9
Mud	0–20	387 549.1	28.3	3.3
Mud	20–40	323 852.0	27.1	3.1
Mud	40–60	299 719.3	27.8	4.2
Mud	60–80	233 123.9	21.2	2.5
Mud	80–100	109 712.9	22.0	2.3
Sand	0–20	142 639.8	23.7	2.4
Sand	20–40	348 482.0	19.8	2.4
Sand	40–60	482 383.1	28.3	3.7
Sand	60–80	303 832.8	30.7	3.5
Sand	80–100	77 166.5	28.0	4.3

5. RESULTS: INSHORE FISHSTOCKS TRAWL FOOTPRINT, 2008–2021

5.1 Inshore data

The groomed inshore data for 2008–2021 yielded a data set of 684 177 bottom-contacting tows for the spatial analysis (Table E1). The main form type used to report inshore data was the TCER (55% of inshore bottom-contacting tows), with another 35% from TCEPRs and 10% from ERS. Overall, 99.2% of the inshore data used bottom trawl gear.

These tows targeted at least 32 species (Table E1), 30% of which targeted flatfish species, 21% targeted tarakihi, 13% targeted red gurnard, 7% targeted snapper, 5% targeted trevally, and 4% red cod. Lesser targets included John dory, barracouta, giant stargazer, and blue warehou. This data set included effort from 297 vessels, with 90.2% of tows carried out by vessels that were 28 m or less, 8.1% by vessels > 28 m and ≤ 46 m, with the remaining 1.9% of tows carried out by vessels larger than 46 m. The largest vessels targeted mainly barracouta. Over the 14 years, the number of vessels steadily dropped from 81 in 2008 to 53 in 2021. In 2021, 95% of tows were carried out by vessels 28 m or less, 3% were carried out by vessels > 28 m and ≤ 46 m, and the remainder were from vessels over 46 m.

The effort dropped from a peak in 2010 (at 59 983 bottom-contacting tows) to a low in 2021 (36 072 tows). Annual effort decreased for most of the main inshore targets, except for red gurnard (with increased numbers of tows over the 14 years) and trevally which was relatively steady throughout the series.

5.2 The spatial extent

The total number of cells, aggregate area, and footprint for the inshore targets during 2008–2021 are given in Table E2, listed in order of the greatest footprint, with the top 10 targets including tarakihi, red gurnard, flatfish species, snapper, trevally, red cod, barracouta, giant stargazer, John dory, and blue warehou. The greatest footprint and aggregate area (for tarakihi) was more than twice the footprint and aggregate swept area estimated for the species with the second largest footprint (red gurnard) and about 33% larger than the flatfish aggregate area (the third largest aggregate area). Note that the footprint is larger for red gurnard than for flatfish, but the aggregate area is larger for flatfish than it is for gurnard. The tarakihi footprint contacted 54% of the 2008–2021 footprint (compared with 52% for 2008–2019). The red gurnard footprint was smaller in comparison with 26% contacted for 2008–2021 (24% for 2008–2019). For flatfish, 18% of the footprint contacted the total 2008–2021 footprint, snapper 14%, and red cod 14%. For these three species, these are the same proportions as for 2008–2019. Overall, 15 114 cells were contacted by inshore targets (based on TCERs, TCEPRs, and ERS data) during 2008–2021, with the swept areas for all tows summing to an estimated aggregate area of 896 661 km^2 to give an overall footprint of 150 105 km^2 (Table 21). This footprint represented 3.7% of the EEZ+TS and 10.9% of the fishable area; and the 2021 footprint represented 0.8% of the EEZ+TS and 2.3% of the fishable area.

The number of cells contacted was between 9108 (in 2013) and 9557 (in 2011) each year for the first 11 years but dropped to 8576 cells in 2019, then to the lowest number of cells in any one year in 2020 with 7034 cells, before a small increase to 7066 cells for 2021 (the year with the lowest number of tows, see Table E1). The aggregate area was generally over 65 000 km^2 (peak in 2010 at 76 640 km^2) until 2015 when it decreased in most years to a low of 47 789 km^2 in 2020, coinciding with the lowest number of cells contacted and overall footprint. The 2021 footprint increased slightly from 2020, to 48 863 km^2.

A similar trend was seen in the estimated footprint; during 2008–2018 the footprint was always about 40 000 km^2, but dropped in 2019 to 38 031 km^2, then further still to 31 380 km^2 (the lowest in the time series) in 2020, before a small increase in 2021 to 32 001 km^2. The spatial distribution of the 2008–2021 and 2021 footprints and aggregate areas are shown in Figure 25.

Table 21: Annual summary for the spatial overlap of the inshore bottom-contacting effort for 2008–2021 and the overlap (%) with the EEZ+TS (4 111 569.7 km^2) and fishable area (1 391 680km^2).

Fishing year	No. cells	Aggregate (km^2)	Footprint (km^2)	% EEZ+TS	% fishable
2008	9 413	69 271.3	43 500.3	1.1	3.1
2009	9 359	72 847.0	45 767.7	1.1	3.3
2010	9 459	75 640.2	46 560.0	1.1	3.4
2011	9 557	69 103.6	44 731.7	1.1	3.2
2012	9 193	66 757.6	42 830.6	1.0	3.1
2013	9 108	66 419.9	42 696.4	1.0	3.1
2014	9 516	69 822.0	44 879.7	1.1	3.2
2015	9 383	63 671.9	42 148.3	1.0	3.1
2016	9 292	62 095.5	40 970.0	1.0	3.0
2017	9 429	65 385.8	42 668.7	1.0	3.1
2018	9 133	62 168.3	42 166.1	1.0	3.1
2019	8 576	56 824.9	38 031.2	0.9	2.8
2020	7 034	47 789.1	31 380.7	0.8	2.3
2021	7 066	48 863.4	32 000.6	0.8	2.3
2008–21	15 114	896 660.5	150 105.2	3.7	10.9

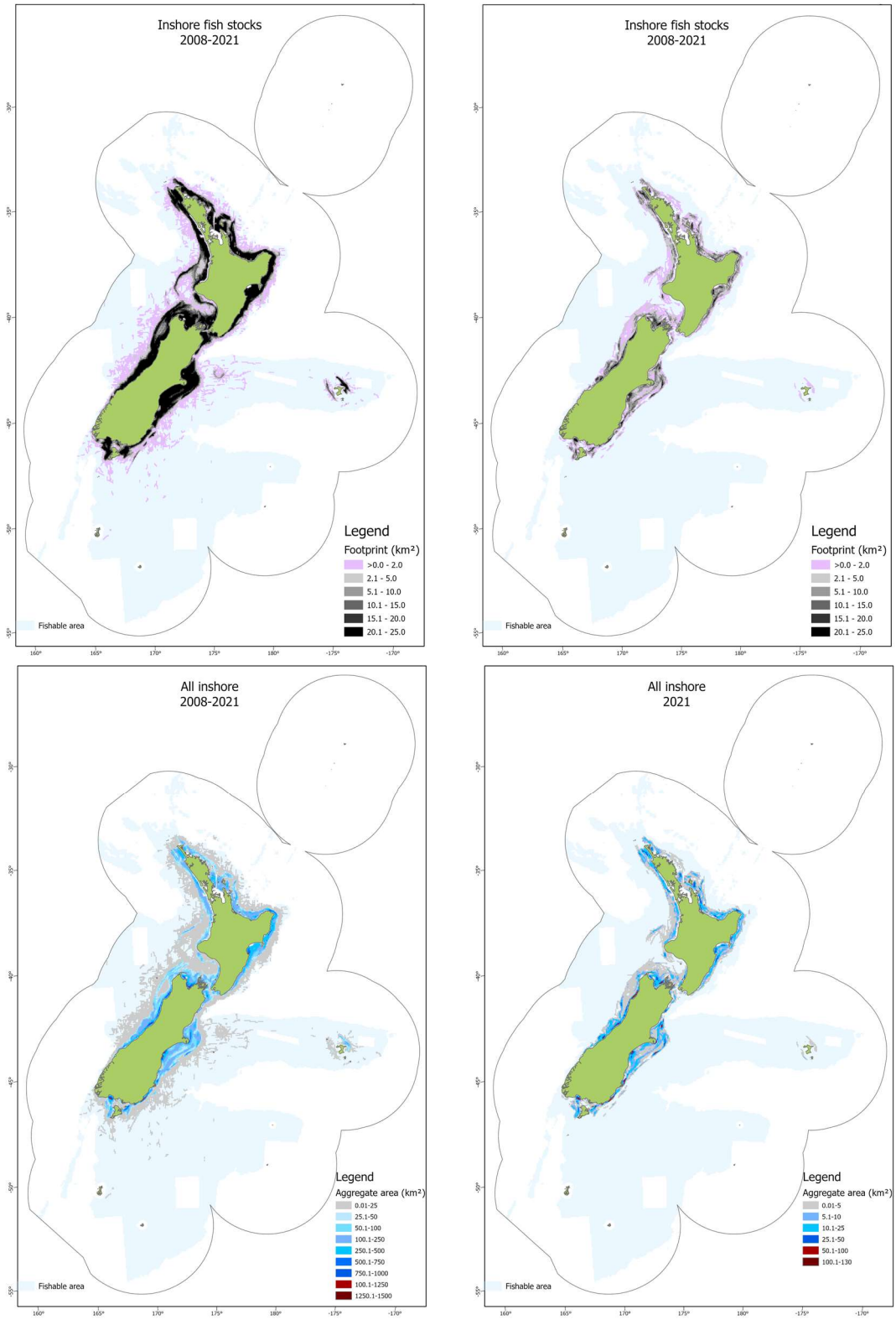

Figure 25: Distribution of the inshore fishstocks footprint (upper maps) and aggregate area (lower), by 25-km^2 cells, 2008–2021 (left) and 2021 (right), with the fishable area (light blue background).

Spatial analysis by fishstock. A fishstock analysis provides a spatial comparison of the effort for each target. When the data are combined by the main fishstocks for inshore bottom-contacting targets (see Table 2), 98% of the inshore contacted cells, 97.3% of the aggregate area, and 97% of the footprint is retained in the analysis (Table E3). The targets retained in these data include BAR, ELE, FLA, GSH, GUR, JDO, LEA, MOK, RCO, RSK, SCH, SKI, SNA, SPD, SPO, STA, TAR, TRE, and WAR; the annual totals of contacted cells, aggregate area, and footprint for the inshore fishstocks are given in Tables E4–E6 in Appendix E.

For all years, the inshore fishstock effort contacted 15 114 25-km^2 cells, with a total estimated aggregate area of 896 660 km^2 and a total fishstock footprint equivalent to about 17% of the aggregate area (150 105 km^2, see Table E2). Overall, the fishstock footprint contacted 3.7% of the area of the EEZ+TS and 10.9% of the fishable area. There was very little difference from year to year in the percent overlap although the two years have been the lowest in the time series with less than 1% of the EEZ+TS and under 3% of the fishable area.

Overall, the main contributors to the 2008–2021 aggregate area were flatfish and tarakihi (see Table E5), with FLA 3, FLA 7, and TAR 2 contributing 89 405–93 626 km^2. TAR 7, TAR 1, GUR 2, and TRE 7 contributed between 41 181 and 60 775 km^2, with BAR 1 totalling 39 345 km^2, SNA 1 totalling 38 861 km^2, and RCO 3, GUR 7, and TAR 3 between 23 553 and 31 000 km^2.

The fishstocks that contributed the most to the footprint over the 14 years (see Table E6) were: TAR 7 (23 884 km^2), TAR 1 (19 847 km^2), BAR 1 (15 787 km^2), TAR 2 (15 591 km^2), FLA 3 (13 309 km^2), TAR 3 (12 640 km^2), FLA 7 (11 645 km^2), SNA 1 (11 641 km^2), GUR 7 (11 091 km^2), TRE 7 (11 048 km^2), and RCO 3 (10 713 km^2). Other fish stocks contributed under 10 000 km^2. Note that fishstock numbers do not necessarily match the FMA boundaries: for example, TAR 1 includes FMAs 1 and 9; BAR 1 includes FMAs 1–3; FLA 3, GUR 3, and RCO 3 include FMAs 3–5; and TRE 7 includes FMAs 7–9.

Annual footprints for the main targets, by fishstock, are shown in Figure 26. Fishstocks TAR 1, 2, and 7 were generally above 3000 km^2 a year but showed different trends, although all have been declining in the last few years. TRE 7 declined from about 3000 km^2 a year to about 1200 km^2 and other tarakihi and trevally fishstocks were reasonably steady, below 2500 km^2. The FLA 7 footprint decreased from about 5000 km^2 in 2009 and 2010 to a low in 2021 (about 2000 km^2). FLA 3 showed a slight increase to 4500 km^2 in 2013, then a decrease to a low in 2021 (around 2000 km2). FLA2 and RCO 3 and 7 decreased overall. Apart from a peak of nearly 4000 km^2 in 2010, GUR 2 was steady at about 2700 km^2 a year before dropping markedly in 2020 and again 2021 to around 1700 km^2. In contrast, GUR 7 increased over the time series to a high in 2019 (at about 3000 km^2), before decreasing again in 2020 and 2021. GUR 1, 3, and 8 were all relatively steady through time (generally under 1000 km^2 in most years), although GUR 1 increased markedly in 2021 to about 1500 km^2. The SNA 1 footprint decreased to a low in 2016–17 then increased in 2018 and 2019 to about 2500 km^2 before decreasing again to levels similar to 2008–13. From a peak in 2008, the SNA 8 footprint decreased by half (from 2011) and remained at this lower level of under 500 km^2 between 2016 and 2021.

Spatial analysis by the main coastal FMAs. The annual aggregate area and footprint summaries of the inshore fishstock data by the coastal FMAs around the North Island, South Island, Chatham Islands, and Stewart Island are given in Tables E7 and E8. FMA 7, FMA 3, and FMA 2 accounted for most of the aggregate area, and FMA 7, FMA 3, and FMA 8/9 accounted for most of the footprint, for 2008–2021 (Table 22).

Table 22: The total aggregate area and footprint area, and the percent of total aggregate area and footprint area totals, for 2008–2021, by FMAs 1–3 and 5–8/9, based on the inshore fishstock data.

	FMA 1	FMA 2	FMA 3	FMA 4	FMA 5	FMA 7	FMA 8/9	Total
Aggregate area								
Area (km^2)	115 744.0	167 718.7	198 812.3	7 510.4	53 423.9	236 202.8	116 241.8	895 654.0
% Total	13	19	22	1	6	26	13	100
Footprint								
Area (km^2)	22 784.0	20 220.3	31 263.6	2 447.7	8 699.4	38 180.3	28 247.1	151 842.4
% Total	15	13	21	2	6	25	19	100

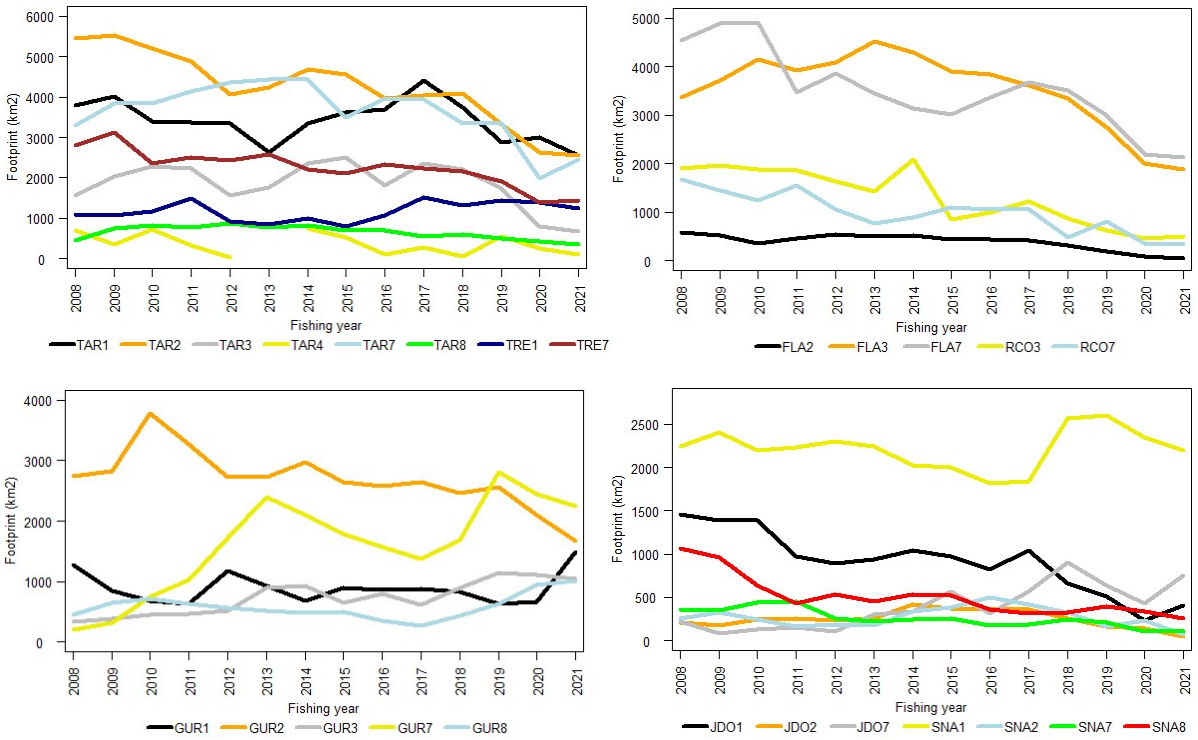

Figure 26: Annual footprints for the main inshore fishstocks, 2008–2021 (see also Tables E4–E6). Upper: tarakihi and trevally (left), flatfish and red cod (right). Lower: red gurnard (left) and John dory and snapper (right).

The main fishstocks in FMA 7 were TAR 7, FLA 7, TRE 7, GUR 7, RCO 7, WAR 7, and STA 7. For FMA 3, the main fishstocks included BAR 1, FLA 3, TAR 3, RCO 3, GUR 3, ELE 3, and WAR 3. In FMA 2, most of the footprint came from TAR 2, with the remainder mainly from GUR 2, JDO 2, and SNA 2. FMA 8/9 fishstocks included part of TAR 1, TAR 8, SNA 8, part of GUR 1, and GUR 8. FMA 1 fishstocks included part of TAR 1, part of GUR 1, SNA 1, TRE 1, and JDO 1, amongst others. The main fishstocks in the least contacted, FMA 5, were STA 5 and parts of FLA 3, GUR 3, RCO 3, and WAR 3.

Over the 14 years, the FMA annual aggregate areas generally decreased in FMAs 1, 2, and 8/9, whereas FMAs 3, 5, and 7 were reasonably steady, though all had lower annual aggregate values during 2019–2021 compared with the rest of the time series. FMA 4 was more variable over time though decreased overall. The footprint data show a similar pattern with the smallest footprints estimated in most FMAs during 2019–2021. When comparing the annual aggregate area and the footprint, the intensity of bottom

contact is greater in FMAs 2, 3, and 7 than in the other FMAs. This is not only because of the greater effort but also a result of the limited area for targeting these species in some areas: for example, the largest red gurnard aggregate area was from GUR 2, at almost double the GUR 7 aggregate area (in FMA 7), but GUR 2 had a slightly smaller footprint area which indicates a wider extent of targeting in GUR 2 than in GUR 7.

5.3 Extent of new cells contacted across the time series

The number of cells that were fished in one year, but not in previous years is shown in Table 23 for the combined inshore fishstocks, where the base footprint was the 2008 footprint. These data are limited in extent because data before the 2008 fishing year were not available to generate a spatial analysis, and as shown in Section 3.1, the substantial data from CELR data collection that occurred before the 2008 fishing year are not included here. Thus, Table 23 provides data relative to 2008 only. As with the deepwater data, it is evident that in most of the years the contact in the new cells is of low intensity, because there is little difference between the aggregate area and the footprint, and in some years they are in fact the same (e.g., 2016 and 2020). This is likely to be an artefact of the methodology used to generate the spatial data, particularly the endpoints of TCER tows. It is very likely that many of these 'new cells' have been fished in years before 2008.

Table 23: For the inshore fishstocks, the number of cells contacted in a year, that had not been contacted in previous years, and the aggregate area and footprint within those cells. A base of 9459 cells were contacted in 2008 (the fishing year that tow-level data were first collected for all inshore fisheries), and, for example, 1467 cells were contacted in 2009 (but not in 2008), with an aggregate area of 809.9 km^2 and footprint of 763.7 km^2.

Fishing year	No. new cells	Aggregate area (km^2)	Footprint (km^2)
No. cells contacted in 2008 = 9459			
2009	1 467	809.9	763.7
2010	967	649.7	572.8
2011	747	306.8	298.5
2012	472	152.8	150.4
2013	372	150.0	147.8
2014	401	174.7	170.2
2015	324	131.7	127.6
2016	284	81.9	81.9
2017	262	74.0	73.9
2018	199	63.4	63.3
2019	130	42.3	41.0
2020	69	25.0	25.0
2021	7	7.0	6.1

5.4 Intensity

For the main inshore fishstocks during 2008–2021, the median number of tows that contacted a cell ranged from around 2–4 (FLA 2, GUR 1, JDO 1 & 2, TAR 4 & TAR 8) to 15–21 (GUR 2, SNA 1, and TAR 2). The highest maximum number of tows in a cell (and aggregate area) was seen in the flatfish fishstocks FLA 2, FLA 3, and FLA 7 (Table E9). Unsurprisingly, these same fishstocks also had some of the highest mean values for aggregate area, along with GUR 2 and TAR 2. The highest median aggregate areas per cell were for TAR 2, SNA 1, TAR 7, GUR 2, and RCO 3 (unchanged since the last footprint analysis for 1990–2019). The most intensely contacted areas are shown in Figure 25, for the combined years data, and for 2021. Data for the most recent fishing year, 2021, indicate that for most fishstocks, the maximum aggregate areas represented at least the cell area of 25 km^2 (Table E10). For FLA 2, the maximum aggregate area of a cell was equivalent to its area, and for FLA 3 and 7, that the

maximum aggregate area of a cell was equivalent to the whole cell area being contacted more than three to four times, respectively (Table E10). FLA 3 and 7 both had footprint values close to the cell area and were located close inshore in FMA 3, FMA 5, and FMA 7 (see Figure 25).

5.5 Number of years contacted

Of the 15 114 cells contacted by the inshore fishstocks (for 2008–2021), 5374 cells (36%) were contacted every year and 2819 (19%) were contacted in one year, with another 9% in two years (Figure 27, upper plot). In total, 7066 (47%) of inshore fishstock cells were contacted in 2021 (lower plot in Figure 27, Table 24), and another 5.2% were last contacted in 2020, and about 12% of cells have not been contacted since 2012.

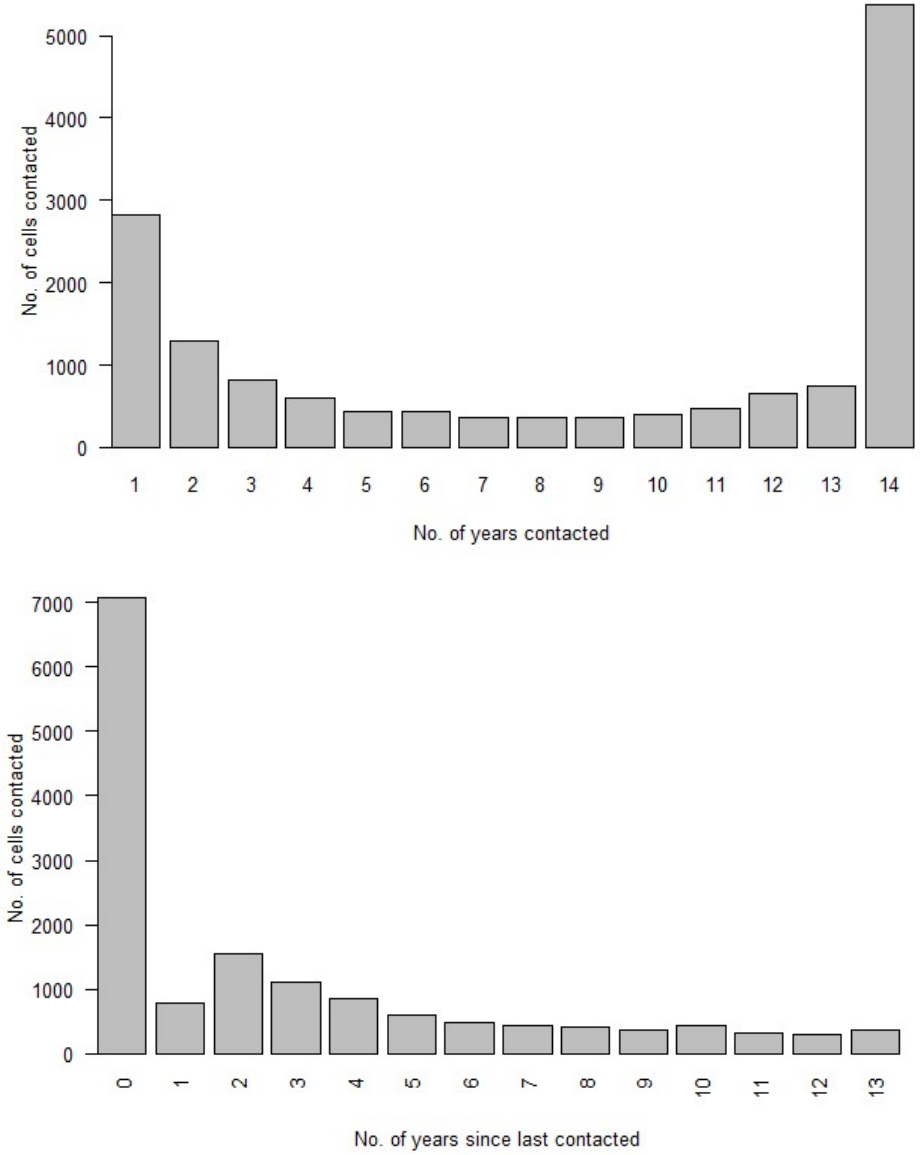

Figure 27: The number of cells contacted in annual bins by the inshore tows for 2008–2021 (upper) and the number of cells in each bin representing the number of years since a cell was last contacted (lower).

Table 24: The number of cells contacted for the most recent year that the cells were contacted (Year), for inshore fishstocks, 2008–2021.

Year	No. cells	% total
2021	7 066	46.8
2020	784	5.2
2019	1 556	10.3
2018	1 122	7.4
2017	853	5.6
2016	598	4.0
2015	486	3.2
2014	438	2.9
2013	407	2.7
2012	371	2.5
2011	442	2.9
2010	332	2.2
2009	300	2.0
2008	359	2.4
All	15 114	100.0

5.6 Overlap of inshore bottom contact on 50-m depth zones

The spatial distribution of the inshore fishstock footprint overlap with the 50-m depth zones is shown in Figure 28. Annual data for the number of contacted cells, aggregate area, and footprint, for each depth zone are given in Tables E11–E13. There were few differences in the annual patterns of the footprint in each depth zone. For 2008–2021, most of the 14-year footprint and aggregate area was in depths shallower than 150 m (Table 25) and continued to be so in 2021. The relatively large percent of the 14-year footprint in over 250 m depths compared with the percent of the aggregate area indicates that this 'deeper' swept area represents some of the difficulties in locating effort based on TCER forms, unlikely start position data, and the use of the 25-km^2 cell grid, where the cell depth represents the depth at the midpoint of each cell.

The footprint overlap of each depth zone is expressed as the percent of the depth zone seafloor area contacted by the 2008–2021 and 2021 footprints. The 100–150 m depth zone has the largest seafloor area and the 2008–2021 and 2021 footprints contacted 26.2% and 6.8% of this depth zone, respectively (Table 26).

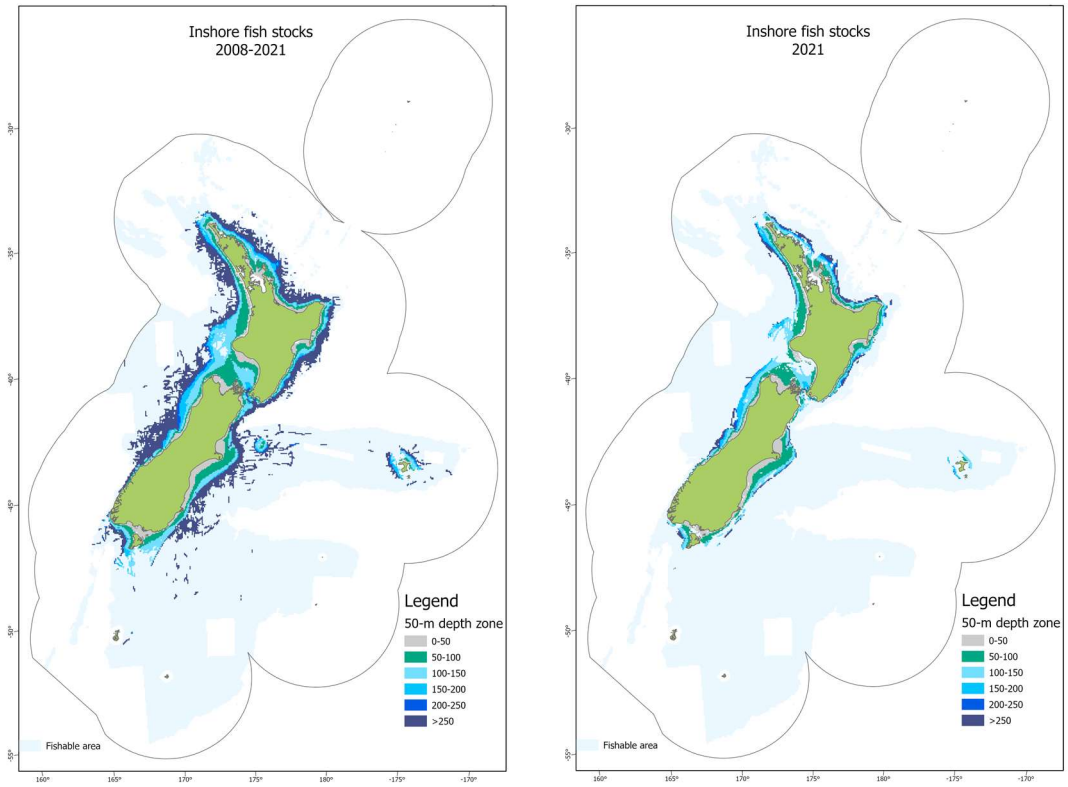

Figure 28: Distribution of the extent of the inshore fishstock footprint on 50-metre depth zones, as displayed by 25-km^2 cells, 2008–2021 (left) and 2021 (right), with the fishable area (light blue background).

Table 25: Percent of total inshore fishstock footprint (150 105 km^2) and total aggregate area (896 660 km^2), by 50-m depth zone, based on 25-km^2 cells, during 2008–2021 and 2021.

Depth zone (m)	Footprint (%)		Aggregate area (%)	
	2008–2021	2021	2008–2021	2021
0–50	22	30	38	34
50–100	31	37	33	35
100–150	23	20	17	19
150–200	10	8	6	7
200–250	3	2	1	1
Over 250	11	4	4	3

Table 26: The total seafloor area of each 50-m depth zone and the percentage of each depth zone within the fishable area that was contacted by the 2008–2021 and 2021 inshore footprints.

Depth zone (m)	Area (km^2)	Footprint area overlap (%)	
		2008–2021	2021
0–50	48 005.1	25.0	19.7
50–100	66 210.6	34.6	17.8
100–150	94 095.2	26.2	6.8
150–200	43 568.4	11.3	6.0
200–250	21 407.0	2.9	2.5

5.7 Overlap of inshore fishstock footprint with BOMEC classes

The extent of the distribution of the footprint by BOMEC class for all years and for 2021 is shown in Figure 29, and Tables E14–E16 in Appendix E provide the number of contacted cells, aggregate area, and footprint for each class and fishing year. There were few differences in the annual patterns of the footprint in each BOMEC class.

About 35% of the 2008–2021 footprint was in class C (Table 27), the largest inshore class. The next largest class (as a percentage) was class H, close to the shelf edge and near Chatham Islands, with just under 15.0%, followed by class D (about 14%) in inshore areas off the east and south coasts of the South Island, 10% in class A inshore areas around the North Island and off the west coast South Island, 10.8% in class E on the shelf in deeper waters beyond the distribution of class D and on Mernoo Bank and near the Chatham Islands, 7.4% in class B, 10.1% in class A off the west coast South Island and in waters off the north coast of the South Island, and 2.8% in class G in Cook Strait. A small proportion of contact was in areas of deep water (e.g., class J further offshore from the west coasts of the North Island and South Islands and east coast of the North Island).

The distribution of the 2021 footprint was similar to that of the 14-year data set, although there was little overlap beyond the continental shelf with a more equal amount of contact in the inner shelf areas such as classes A, B, and D (Figure 29 and Table 27). Throughout the 14 years, contact in each class generally decreased, though annual footprints in classes B, D, E, and H were reasonably steady (Table E16). The decreases have been more noticeable in the last 2–3 years, particularly for the major classes (A–J).

The footprint as a percent of the seafloor area of each class is greatest in the main inshore and shelf classes, classes A–D and G (Table 27), for both the 2008–2021 and the 2021 footprints.

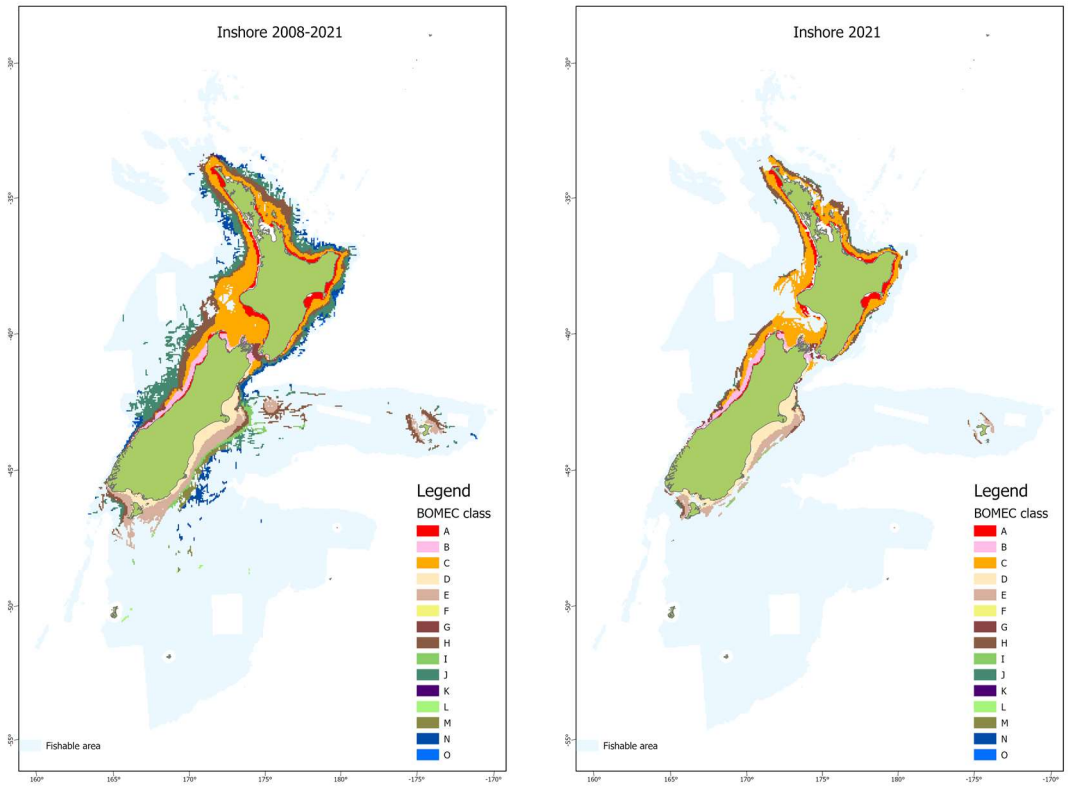

Figure 29: The extent of the inshore fishstocks footprint overlap with the BOMEC classes, represented by 25-km^2 cells for 2008–2021 (left) and 2021 (right).

Table 27: The total area of each BOMEC class within the EEZ+TS and the percentage of each class area covered by the 2008–2021 and 2021 bottom-contacting trawl footprint for the combined inshore fishstocks.

BOMEC		% footprint		% each class contacted	
Class	Area (km^2)	2008–2021	2021	2008–2021	2021
A	30 661.0	10.1	12.8	49.3	13.3
B	12 786.1	7.4	10.3	86.9	25.7
C	90 256.5	35.6	38.1	59.2	13.5
D	28 085.7	13.8	17.2	73.8	19.6
E	61 258.0	10.8	9.7	26.4	5.1
F	38 775.8	–	–	–	–
G	6 702.3	2.8	1.5	63.7	7.0
H	138 399.1	14.8	9.7	16.0	2.2
I	52 008.3	0.5	0.2	1.5	0.1
J	312 604.9	3.4	0.6	1.6	0.1
K	1 200.2	0.0	0.0	1.9	0.0
L	198 578.4	0.0	–	0.0	–
M	233 837.4	0.2	–	0.1	–
N	495 154.2	0.6	0.0	0.2	0.0
O	1 006 911.1	0.0	–	0.0	–
All	2 707 219.0	100.0	100.0	5.5	1.2

5.8 Overlap of inshore fishstocks footprint with surficial sediment layers

The overlap of the 2008–2021 and 2021 footprints of the seafloor areas estimated for each sediment layer is summarised in Table E17, and the inshore and shelf areas shown in Figure 14 when compared with Figure 25 provide an understanding of the spatial distribution of the inshore footprint relative to the sediment layers. The 14-year footprint overlap with the carbonate layer is mainly in the 0–20%, 20–40%, and 40–60% classes (Table E17), whereas the overlap with the gravel layer is mainly in 0–20%. For both the mud and sand layers, the footprint is reasonably well spread across the first four classes (0–80%), but is noticeably lower in the 80–100% class in comparison and throughout most of the sand layer. A similar pattern is seen in the 2021 footprint overlap.

When the footprint overlap is considered as the percent contact of the seafloor area of each sediment class, the highest percent is in the 0–20% and 20–40% carbonate classes and the 80–100% sand class (Table 28). About 11–12% of the 0–20% and 20–40% gravel classes is contacted by the footprint, and 10–13% of the 0–20%, 20–40%, and 40–60% mud classes is contacted, whereas for the sand layer the 60–80% and 80–100% classes have about 14% and 24% percent cover, respectively. The data for 2021 show a similar pattern to the overall footprint overlap, but the 80–100% gravel class was not contacted at all in 2021.

Table 28: Percentage overlap of the seafloor area of the substrate classes by the fishable area 2008–2021 and 2021 inshore footprint. For gravel, mud, and sand, the percentage classes total 100%, and for carbonate the percentage represents the proportion that is carbonate versus non-carbonate.

Substrate	Class (%)	Class area (km^2)	2008–2021 overlap (%)	2021 overlap (%)
Carbonate	0–20	138 252.70	31.4	7.6
Carbonate	20–40	282 469.80	24.7	5.4
Carbonate	40–60	275 070.00	10.8	2.0
Carbonate	60–80	288 732.70	2.3	0.2
Carbonate	80–100	369 402.80	0.2	0.0
Gravel	0–20	1 037 250.70	11.8	2.6
Gravel	20–40	188 550.00	11.2	2.2
Gravel	40–60	77 886.40	6.7	1.0
Gravel	60–80	26 682.00	3.0	0.2
Gravel	80–100	14 188.50	0.3	-
Mud	0–20	387 549.10	12.8	2.9
Mud	20–40	323 852.00	11.6	2.2
Mud	40–60	299 719.30	10.0	2.2
Mud	60–80	233 123.90	10.2	2.3
Mud	80–100	109 712.90	8.3	1.8
Sand	0–20	142 639.80	9.6	2.2
Sand	20–40	348 482.00	9.6	2.0
Sand	40–60	482 383.10	8.8	1.8
Sand	60–80	303 832.80	13.9	2.8
Sand	80–100	77 166.50	23.7	6.2

6. RESULTS: GEOSPATIAL POSITION REPORTING (GPR) RESULTS

6.1 All Stocks GPR data results

To make a valid comparison between the footprint and aggregate area for GPR data and ERS data, only ERS data where there were corresponding tows in the GPR data were used. This resulted in a data set consisting of 56 316 bottom-contacting fishing events involving GPR data for the All Stocks data set, with 8.9% of events needing to be dropped because there were no corresponding GPR data with which to create a trawl path (Table 29). Cases where ERS data have no corresponding GPR data typically arise when a fishing event begins and ends in between GPR 'pings' that report the vessel's position.

Table 29: The number of fishing events present in the ERS data, the number of corresponding fishing events with GPR data, and the % of ERS data not present in GPR data.

	Events reported in ERS data	ERS events with GPR data	% ERS events without GPR
All stocks	61 834	56 316	8.9
Deepwater	26 414	23 633	10.5
Inshore	35 390	32 656	7.7

The All Stocks GPR data set had an overall footprint of 70 484 km^2 (Table 30). The equivalent footprint for the ERS data (that is, ERS fishing events for which there were corresponding GPR data) was slightly smaller at 68 057 km^2. Expressed as a ratio of GPR:ERS data, this is 1.04, indicating that the GPR estimate was around 4% larger than the equivalent ERS ratio. This is not surprising given that the 'traditional' ERS data assumes a straight line between start and end positions. GPR data allows for successive points within a tow to be plotted, and these will often result in trawl tracks that are not

straight lines (e.g., curved) which must therefore be longer than straight lines between points. The 'full' ERS footprint (all ERS fishing events, regardless of whether they were contained in the GPR data or not) was slightly smaller than the GPR footprint at 70 302 km^2, which as a ratio to the GPR data was an almost perfect match at 1.0026. But it should be noted that there are more fishing events in the full ERS data set (8.9% more). This shows that the GPR data will produce higher estimates of the footprint than the traditional straight-line method.

The All Stocks GPR data set had an overall aggregate area of 165 373 km^2 (Table 30). The equivalent aggregate area for the ERS data was noticeably smaller at 124 436 km^2. Expressed as a ratio of GPR:ERS data, this is 1.33, indicating that the GPR estimate was around 33% larger than the equivalent ERS ratio. The GPR:Full ERS ratio is 1.28, showing that the GPR aggregate area is also noticeably higher than the full ERS aggregate area despite the GPR data containing fewer fishing events. This is likely because while there may be fewer events retained in the GPR data set, those that do remain are concentrated—such tows won't add to the footprint, but they will continue to add to the aggregate area. GPR tows will always be longer than the equivalent ERS tow plotted using previous methods, unless of course the GPR tow is an actual straight line. Figure 30 gives examples of the potentially vast differences in both the length and direction of tows between the two methods.

Table 30: The footprint and aggregate area (GPR swept area), the equivalent swept area for ERS data that were in the GPR data (Equivalent ERS), the ratio between GPR swept area and Equivalent ERS, the full ERS swept area (Full ERS), and the ratio between the GPR swept area and Full ERS swept areas, for the All Stocks data set for the 2020 fishing year.

	GPR swept area	Equivalent ERS	GPR:equiv ERS ratio	Full ERS	GPR:Full ERS ratio
All Stocks footprint (km^2)	70 483.8	68 057.4	1.04	70 301.8	1.0026
All Stocks aggregate area (km^2)	165 372.7	124 436.4	1.33	129 594.3	1.2800

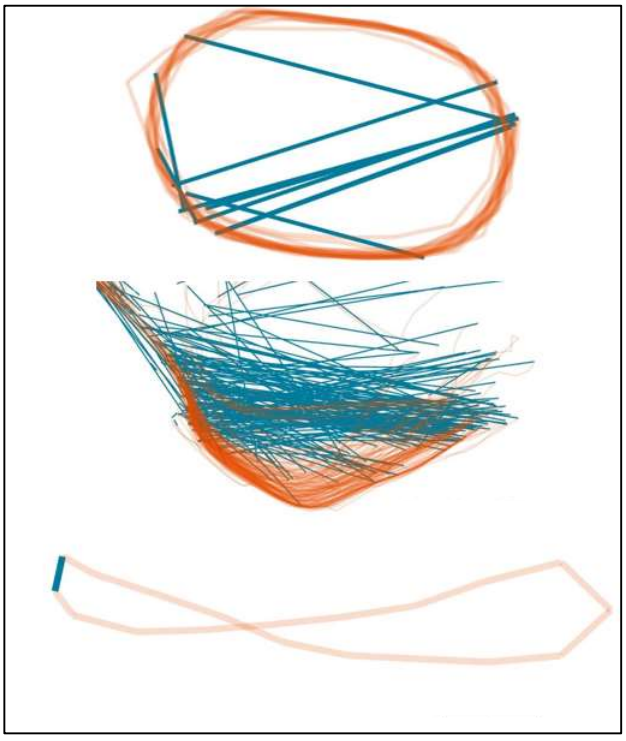

Figure 30: A selection of trawl paths created using GPR data (orange lines) and the corresponding tows created using the 'traditional ERS straight-line' method (green lines).

6.2 Deepwater GPR data results

After removing fishing events for which there were no corresponding GPR data, there were 23 633 bottom-contacting fishing events for deepwater (Table 29, Table 31). For all target species, 10.5% of ERS fishing events were dropped from the analyses due to there being no corresponding GPR data. For individual targets, the percentage of ERS tows with no corresponding GPR data ranged from 0% (for redbait and white warehou) to 66% (oreo species) (Table 31). As discussed in Section 6.1 above, the problem of ERS data with no corresponding GPR data typically arises when a fishing event begins and ends in between GPR 'pings' that report the vessel's position. For deepwater vessels, the ping rate varied between once every half hour to once every two hours, with once every hour being the most common rate. For fisheries focused on underwater topographic features (UTFs) this is a particular problem because tows are typically short in duration. Unsurprisingly, the target fisheries with relatively high proportions of missing GPR data are those commonly associated with UTFs; for example, alfonsino (31.1%), orange roughy (41.5%), and oreo species (66.3%).

Table 31: The number of deepwater ERS fishing events with no corresponding GPR events, the number of ERS fishing events with GPR events, total number of ERS events, and the percentage missing from the GPR data by target species, for the 2020 fishing year.

	ERS events with no GPR	Events with GPR	Total number of ERS events	% missing from GPR summaries
BAR	43	1 907	1 950	2.2
BYX	126	279	405	31.1
CDL	16	113	129	12.4
HAK	7	253	260	2.7
HOK	274	6 708	6 982	3.9
JMA	30	1 046	1 076	2.8
LDO	23	29	52	44.2
LIN	68	1 264	1 332	5.1
OEO	482	245	727	66.3
ORH	1 269	1 792	3 061	41.5
RBT	0	3	3	0.0
RBY	35	54	89	39.3
SBW	8	118	126	6.3
SCI	206	4 355	4 561	4.5
SKI	2	2	4	50.0
SPE	5	255	260	1.9
SQU	171	4 945	5 116	3.3
SWA	16	226	242	6.6
WWA	0	39	39	0.0
Total	2 781	23 633	26 414	10.5

The deepwater GPR data set had an overall footprint of 41 642 km^2 (Table 32). The equivalent footprint for the ERS data was slightly smaller at 39 403 km^2. Expressed as a ratio of GPR:ERS data, this is 1.06, indicating that the GPR estimate was around 6% larger than the equivalent ERS ratio. As for the All Stocks data set, this is not surprising given that the 'traditional methodology' for ERS data assumes a straight line between start and end positions. The 'full' ERS footprint was also smaller than the GPR footprint at 40 235 km^2, which as a ratio the GPR data was 1.035, or around 3.5% difference. As for the All Stocks data set, this showed that the GPR data can produce higher estimates of the footprint than the traditional straight-line method. This is unsurprising given that the deepwater data is a subset of the All Stocks data set.

The deepwater GPR data set had an overall aggregate area of 112 651 km^2 (Table 32). The equivalent aggregate area for the ERS data was noticeably smaller at 79 644 km^2. Expressed as a ratio of GPR:ERS

data, this was 1.41, indicating that the GPR estimate was around 41% larger than the equivalent ERS ratio. The GPR:Full ERS ratio was 1.38, showing that the GPR aggregate area was also noticeably higher than the full ERS aggregate area despite the GPR data containing fewer fishing events. As for the All Stocks data set, this was likely because while there may be fewer events retained in the GPR data set, those that did remain were concentrated—such tows won't add to the footprint but they will continue to add to the aggregate area.

Table 32: The footprint and aggregate area (GPR swept area), the equivalent swept area for ERS data that were in the GPR data (Equivalent ERS), the ratio between GPR swept area and Equivalent ERS, the full ERS swept area (Full ERS), and the ratio between the GPR swept area and Full ERS swept areas, for deepwater for the 2020 fishing year.

	GPR swept area	Equivalent ERS	GPR:equiv ERS ratio	Full ERS	GPR:Full ERS ratio
Deepwater footprint (km^2)	41 641.6	39 403.1	1.06	40	1.035
Deepwater aggregate area (km^2)	112 651.2	79 644.1	1.41	81	1.38

6.3 Inshore GPR data results

After removing fishing events for which there were no corresponding GPR data, there were 32 656 bottom-contacting fishing events for inshore (Table 29, Table 33). For all target species, 7.7% of ERS fishing events were dropped from the analyses due to there being no corresponding GPR data. For individual targets, the percentage of ERS tows with no corresponding GPR data ranged from 0% for several species up to 40% for rough skate, although it should be noted that only 25 fishing events targeted rough skate (Table 31).

The inshore GPR data set had an overall footprint of 30 479 km^2 (Table 34). The equivalent footprint for the ERS data was slightly smaller at 29 913 km^2. Expressed as a ratio of GPR:ERS data, this was 1.02, indicating that the GPR estimate was around 2% larger than the equivalent ERS footprint. The 'full' ERS footprint was slightly *larger* than the GPR footprint at 31 381 km^2—a ratio of 0.97, or around a 3% difference.

The inshore GPR data set had an overall aggregate area of 52 680 km^2 (Table 34). The equivalent aggregate area for the ERS data was noticeably smaller at 44 756 km^2. Expressed as a ratio of GPR:ERS data, this was 1.18, indicating that the GPR estimate was around 18% larger than the equivalent ERS aggregate area. The GPR:Full ERS ratio is 1.14, showing that the GPR aggregate area is also noticeably higher than the full ERS aggregate area despite the GPR data containing fewer fishing events.

The Inshore data set was the only one to have a GPR footprint that was smaller than the full ERS footprint. Deepwater still had a larger GPR footprint than full ERS footprint despite losing a higher percentage of fishing events (10.5%) than inshore did (7.7%). This is likely because much of the deepwater fishing events that were dropped, due to there being no equivalent GPR data, were in target fisheries where tows are typically short and focused on UTFs. For inshore, however, 11.6% of flatfish events were dropped and 8.9% of red gurnard events were dropped, and both of these fisheries contained a large number of fishing events. Red gurnard and flatfish have the second and third highest footprints, respectively, of all inshore targets (see Section 5) so the loss of relatively high proportions of tows from these two fisheries is likely driving the lower estimate of the GPR inshore footprint compared with the full ERS inshore footprint. Further investigation is needed to determine why these fisheries in particular had lower GPR reporting rates than other target fisheries but it could be related to a delayed rollout of GPR devices to some vessels which may have targeted these species in particular.

Table 33: The number of inshore ERS fishing events with no corresponding GPR events, the number of ERS fishing events with GPR events, total number of ERS events, and the percentage missing from the GPR data by target species, for the 2020 fishing year.

	ERS events with no GPR	Events with GPR	Total number of ERS events	% missing from GPR summaries
BAR	52	1 622	1 674	3.1
BCO	0	1	1	0.0
BNS	0	1	1	0.0
ELE	100	1 116	1 216	8.2
FLA	1 075	8 221	9 296	11.6
GAR	0	3	3	0.0
GSH	6	45	51	11.8
GUR	645	6 596	7 241	8.9
HPB	8	57	65	12.3
JDO	24	641	665	3.6
KAH	0	1	1	0.0
LEA	0	17	17	0.0
LIN	3	45	48	6.3
MOK	18	209	227	7.9
QSC	1	103	104	1.0
RCO	51	660	711	7.2
RSK	10	15	25	40.0
RSN	0	1	1	0.0
SCC	86	986	1 072	8.0
SCH	24	199	223	10.8
SKI	0	18	18	0.0
SNA	115	2 426	2 541	4.5
SPO	6	93	99	6.1
STA	63	1 022	1 085	5.8
TAR	356	6 016	6 372	5.6
TRE	59	2 070	2 129	2.8
WAR	32	472	504	6.3
Total	2 734	32 656	35 390	7.7

Table 34: The footprint and aggregate area (GPR swept area), the equivalent swept area for ERS data that were in the GPR data (Equivalent ERS), the ratio between GPR swept area and Equivalent ERS, the full ERS swept area (Full ERS), and the ratio between the GPR swept area and Full ERS swept areas, for inshore for the 2020 fishing year.

	GPR swept area	Equivalent ERS	GPR:equiv ERS ratio	Full ERS	GPR:Full ERS ratio
Inshore footprint (km^2)	30 479.1	29 912.6	1.02	31 380.7	0.97
Inshore aggregate area (km^2)	52 679.9	44 756.0	1.18	46 041.0	1.14

6.4 GPR data—differences in footprints, aggregate areas, and other considerations

The overall result of larger footprints and aggregate areas for GPR data when compared with equivalent ERS footprints (at least for All Stocks and deepwater) and aggregate areas was not surprising for reasons discussed above.

Aside from the different values between footprints and aggregate areas, the use of GPR data has the potential to identify different *areas* as being more or less important, and for the extent and intensity to be different when used instead of the traditional method. Table 35 gives a summary in the difference in footprint and aggregate area between the two methods when the results of the traditional method (equivalent) were subtracted from the GPR method for the All Stocks data set for each 25 km^2 cell.

Table 35: Summary of the difference between the GPR footprint and aggregate area and the 'traditional' equivalent ERS footprint and aggregate area when the latter is subtracted from the former for each 25 km^2 cell.

	Min	1st quartile	Median	Mean	3rd quartile	Max
Footprint	-23.14	-0.44	0.06	0.24	1.01	16.90
Agg. area	-274.84	-0.19	0.33	3.28	2.48	543.02

On average, the footprint was 0.24 km^2 larger per cell for the GPR data compared with the ERS data. It can be as much as 23 km^2 smaller, however, and as much as 16.9 km^2 larger per cell. The differences in the aggregate area can also be starkly different. The aggregate area can be as much as almost 275 km^2 smaller or as much as 543 km^2 larger for the GPR data.

Depending on whether GPR data or ERS data are used, there can be differences in the location of greatest effort, and its extent. According to the GPR data, the cell with the highest aggregate area (at 700.8 km^2) is located on the Auckland Island Shelf. That same cell according to the full ERS data has an aggregate area of just 157.8 km^2. According to the full ERS data the cell with the highest aggregate area (at 445.5 km^2) is off the west coast of the South Island. The same cell according to the GPR data has an aggregate area of 162.5 km^2, because a number of fishing events are missing due to there being no GPR pings for them.

Figure 31 also shows that the extent of intensely fished areas can be markedly different between the GPR and ERS data, with the GPR data showing more intensely fished (red coloured) cells off the west coast of the South Island, the western end of the Chatham Rise, south of Otago, Foveaux Strait, and around the Stewart-Snares shelf and Auckland Islands Shelf.

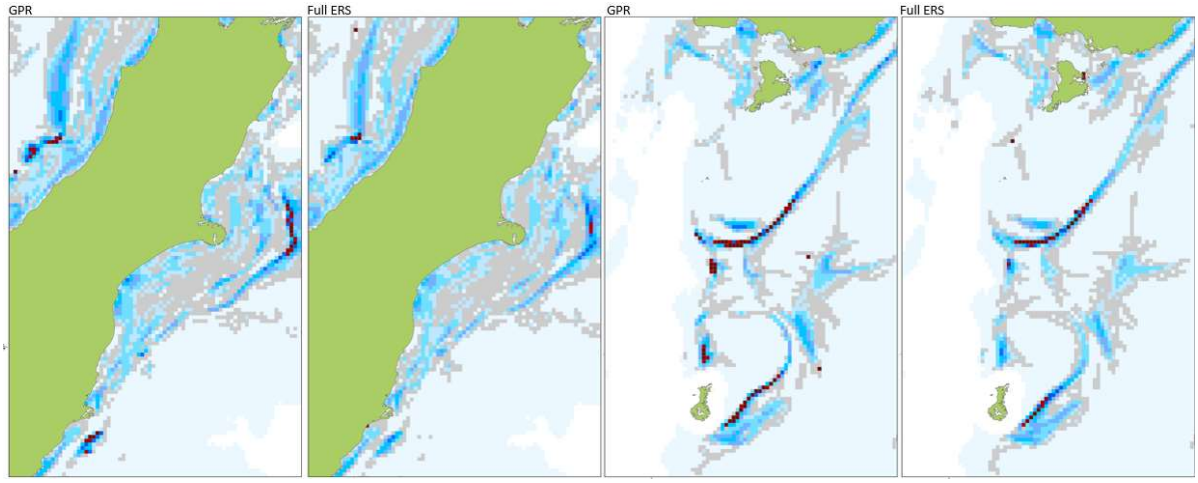

Figure 31: A comparison of the aggregate area for GPR data and full ERS data for the All Stocks data set for the 2020 fishing year.

7. DISCUSSION AND MANAGEMENT IMPLICATIONS

The nature of the data and the underlying assumptions mean that these relative measures reflect the fitness of the data and the relevance of the assumptions. The analyses presented here represent estimates of swept areas for bottom-contacting trawling within the EEZ+TS, with the main analyses restricted to the 'fishable area'; that is, a seafloor area that is open to trawling, to a maximum depth of 1600 m, that provides a comparable seafloor area across all years.

This means that in some early years of the data, particularly in the deepwater data, some legitimate effort is not included because the trawling took place before a closure was implemented (for example, closure of seamounts took place from 2001). In total, the retained data represented 98.3% of the All Stocks total aggregate area, and 93.5% of the footprint for all tows, including those totally in closed areas, on land, in depths over 1600 m, or portions of tows that crossed into closed areas or onto land (see Appendix C). For much of the non-retained portion, it is highly unlikely that the location data are correct, for either the whole tow or for either the start or end position; there is no way of knowing where this effort should be located and its exclusion from analyses is the best course of action.

For the All Stocks data, the 1990–2021 data set represents different sets of data throughout the 32 years and includes only the effort collected on a tow-by-tow basis. Baird et al. (2011) indicated that for data between the 1990 and 2005 fishing years, the footprint represented about 25% of the trawl and dredge effort for those years. During this period, the trawl footprint was based on TCEPRs only and predominantly represented deepwater offshore trawling. At the same time, the inshore vessels mainly reported daily effort (number of tows) by main target and statistical area, on CELRs, and dredge activity (which was more prevalent in this period than in later years) was reported in the same way on CELRs. Baird et al. (2011) summarised all the data at the statistical area level and showed that the areas of highest intensity were close inshore off the east coast of the North Island, mainly in FMA 2, and also in Statistical Area 038 in FMA 7 in inshore areas off the top of the South Island. The annual data summary given in Table A2 of Appendix A in this report indicates the large amount of data not able to be included in the trawl footprint analysis in the years in which CELRs were used.

The most valid years for the All Stocks data are for 2008–2021—years in which both the deepwater and inshore components are both reported on forms that reported at a tow-by-tow resolution. For the deepwater fleet trawl contact is represented mainly by TCEPR, a small amount on TCER during 2008–2020, but mainly by the ERS data from 2018. The inshore component is represented by the TCER in all years except for a small amount of effort during 2018–2020, but from 2018 most effort has been recorded by ERS. The ERS data are comparable to the TCEPR other than the increased precision of the resolution of the start and end positions of the former. The TCER data are comparable with the TCEPR data except the former reports only the start of tow data, and the estimated swept area of each TCER tow is developed using a tow distance calculated from the reported duration × speed that is then represented as a straight line to generate a potential tow endpoint (see Methods); whereas the TCEPR tow is represented by a straight-line distance (between reported start and end positions).

As previously noted by Baird & Mules (2021a, b), this method of track line creation inevitably creates a disparity in the swept areas and a straight line may be more relevant for some target tows than others. The duration × speed distance may take into account the trackline that follows contours (a more realistic track), but when applied as a straight line the spatial representation may place parts of the tow in unlikely depths. Similarly, the straight-line representation of TCEPR and ERS data does not account for any trawling that includes U-turns or other trawl paths that deviate from a straight line. The methods developed using GPR data in this study are a first step towards addressing this issue, although they won't be able to address historical data from before vessels used GPR devices. As such, and with the difficulty in defining the location of the net behind the vessel, the potential to better represent the distribution of trawl contact is limited.

The development of the footprint would also be enhanced by a better representation of the likely width of the trawl gear on the seafloor. Doorspread data by tow are not collected; only wingspread data are

reported. The use of electronic gear providing doorspread by tow is not universal, though most deepwater fleet vessels are likely to have this capability. When observers have been on commercial trawlers, the doorspread data they report generally is the same for every tow. An approach was made to the deepwater and inshore industry prior to work commencing on this project in an attempt to improve the doorspread values that had been applied. This would have been especially valuable for the inshore data where the vessel size and potentially gears used vary between areas and target fisheries. However, it was agreed by the Aquatic Environment Working Group (which included industry representatives), that the current values for the different vessel length categories would be adequate and were again used in this study.

Swept area analysis summary

The All Stocks analysis for 2008–2021 contacted between about 70 300 and 94 500 km^2 each year, decreasing over the 14 years, with the lowest value estimated for 2020. These data reflect the decreasing amount of bottom-contacting trawl effort during these years; the numbers of tows in the TCEPR, TCER, and ERS data steadily dropped from 91 920 in 2010 to 64 764 in 2021. The annual aggregate areas for All Stocks decreased overall from a peak of 162 887 km^2 in 2010 to the nadir of 129 594 km^2 in 2021. The number of cells contacted was more variable during this time period although, predictably, the years with the lowest footprint and aggregate areas (2020 and 2021) also have the lowest numbers of cells contacted. The All Stocks footprint contacted between 1.7 and 2% of the EEZ+TS seafloor annually for 2008–2021 and between 5.1 and 6.8% of the fishable area each year.

In the 32-year time series for deepwater data, there was a steady increase in the footprint from under 48 000 km^2 in 1990 to a sustained period of contact during 1998 to 2003 (range 72 080 to 80 638 km^2), followed by a steady decrease to 40 235 km^2 in 2020 (the lowest of the 32-year time series), with a slight increase to 43 567 km^2 in 2021. Declines have been seen for most deepwater targets and the swept area data reflect the drop in effort. The annual aggregate areas have decreased from around 150 000–171 000 km^2 during 1997–2003 to under 100 000 km^2 from 2006 on, with a nadir in 2009 (78 949 km^2), between about 80 000 and 90 000 km^2 during 2010–2017, before another peak at 96 218 km^2 in 2018, before dropping again thereafter. The 2021 estimate is the third lowest aggregate area in the time series. In total, the deepwater analysis estimated a 32-year total of 3 618 147 km^2 aggregate area and 355 702 km^2 footprint, representing 8.7% of the EEZ+TS and 25.4% of the fishable area. Between 1990 and 2007, the annual footprint contacted between 1.2% and 2.0% of the EEZ+TS and 3.4% and 5.8% of the fishable area (peaks in 2002 and 2003); whereas, between 2008 and 2021, the annual footprint contacted 1.0–1.2% and 2.9–3.6% of the fishable area (lowest value in 2020).

The 2008–2021 inshore footprint also decreased, from a peak of about 53 273 km^2 in 2010 to a nadir of 35 400 km^2 in 2020. This contact was equivalent to 0.8–1.3% of the EEZ+TS seafloor area and 2.5–3.7% of the fishable area, with the lowest values from 2020 and 2021 (2.5% in *both* years). The aggregate areas during these years ranged between the low in 2020 (47 789 km^2) and the peak in 2010 (75 640 km^2). As noted above, the decrease in swept areas seen for each group of fishstock reflects the drop in bottom-contacting effort.

Method development for use of GPR data

This project developed methods to utilise GPR data to generate trawl footprints. Although there is a problem with the loss of some data, due mainly to infrequent ping rates meaning some tows cannot be used, the basic concept behind the method itself has been proved. More consistent and frequent ping rates from GPR devices would allow a greater proportion of tows to be retained for analyses potentially all if ping rates were frequent enough. This would be especially beneficial to target fisheries where tows are short and often begin and end in between GPR pings. Future studies could look at what the optimal ping rate might be to get the highest retention of data. This would need to be balanced against the cost of increased reporting rates and management goals. Where reporting rates from GPR cannot be increased, a 'hybrid' footprint could potentially be created where those tows reported by ERS that do not have corresponding GPR data and would otherwise be discarded, could instead be included but the area swept could be derived using the traditional straight-line assumption currently used. Another added

benefit of incorporating GPR data into the analyses is improved grooming for ERS data by having an independent and automated source of location information that can correct ERS errors where these may have been manually entered incorrectly and also correct other issues such as incorrect reporting of hemispheres.

Regardless, the GPR method will still encounter some of the same problems that affect the traditional data such as the fact that the tow start, finish, and intervening ping positions (from all data collection methods) represent the position of the vessel, not the trawl gear, when the gear has reached or left the fishing depth. This is a particular problem for fisheries based on underwater topographic features. The generic doorspread values applied to the different vessel length categories are the same for GPR data as for the ERS data and are another hindrance to more accurate swept areas being estimated. As for the traditional straight-line method of creating trawl tracks, the GPR method could be improved through more accurate reporting of doorspread values.

Effort data and use of environmental layers

The data used in this study bring together many different vessel and gear types and sizes, and comparison between years does not adequately reflect these differences, although there is likely to be better comparability from 2008 onwards. The footprint overlap with various layers such as depth, BOMEC, and SCC can be problematic because each of these layers is joined to the 25-km^2 cell grid and the cell midpoint is used to define the depth, or BOMEC class, etc. of that cell. For a cell that covers a range of depths, for example, the midpoint may not well represent the data within the cell. However, the data behind these summaries are stored in a Ministry for Primary Industries Geographic Information System geodatabase at the level of each tow, with the potential to analyse data at regional or smaller scales by target or groups of targets, as well as at the 25-km^2 cell grid level for the broad analysis of the EEZ+TS given here.

This study also investigated the potential use of the SCC system as an alternative to the BOMEC system to classify the different types of seafloor and communities the All Stocks trawl footprint overlaps with. However, with 75 distinct classes, the SCC is too complex to be of much practical use, at least at the scale of the EEZ + TS. Other, more condensed bioregionalisations with fewer classes could be of more use here. It is also possible that the SCC could be useful in other footprint work that might be applied to smaller geographic regions where there are a smaller number of classes present in a given area.

Similarly, the data representing the dredge effort for scallop and oyster fisheries and Foveaux Strait swept area are held by the Ministry for Primary Industries Spatial Intelligence Team (see Appendix F). The phased implementation of ERS data during the 2019 fishing year in the Foveaux Strait oyster dredge fishery and the development of a swept area based on the number of standardised tows in each 1 nautical mile grid cell provides a finer scale measure of contacted area (compared with the larger fishery-specific areas). This fishery reported exclusively on these form types from 2020 and the method can now be applied each year from now on.

ERS data for scallop fisheries was phased in during the 2020 fishing year and was used exclusively in 2021. However, there is no equivalent of the 1 n. mile cell grid in these fisheries that would enable the same fine-scale data to be mapped as in the Foveaux Strait oyster fishery, although there is potential to develop one if necessary.

8. ACKNOWLEDGEMENTS

This project was funded by Fisheries New Zealand under project BEN2020-01. Special thanks to Suze Baird (Fisheries New Zealand) for her assistance with training and advice with analyses in this project. Thanks to Karen Tunley (Fisheries New Zealand), the MPI Spatial Intelligence team, Keith Michael (NIWA), and members of the Aquatic Environment Working Group for constructive discussion throughout this project. Thanks to Darren Parsons of NIWA and Karen Lisa Tunley from Fisheries New Zealand for thorough reviews of this document.

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APPENDIX A: TRAWL FISHERY DATA

The data extract for this work (RepLog 13793; fishing years 1990–2020, and RepLog 13978; 2020 fishing year) included all trawling effort reported on Catch Effort Landing Returns (CELRs), Trawl Catch Effort Returns (TCERs), Trawl Catch Effort Processing Returns (TCEPRs), and via the Electronic Reporting System (ERS). This effort was reported for the fishing years 1990–2021. Note that the data from 1990–2007 are from TCEPRs and include the effort from offshore fisheries but also a smaller amount of effort from inshore fisheries (in particular in northern waters from the mid-1990s). Data for 2008 to 2017 are from TCEPRs and TCERs, and data for 2018 and 2019 are from TCERs, TCEPRs, and ERS.

In total, 2 117 792 tows were reported on TCERs, TCEPRs, and via ERS, available as tow-by-tow data (Table A1), as opposed to the daily data (with more than one tow reported per record) provided by the CELRs (see Table A2).

The TCER/TCEPR/ERS data were groomed following the methods described by Baird & Mules (2019). These methods concentrate on the main variables required to generate the spatial output. Changes as described by Baird & Mules (2019) were made to less than 1% of the data and were related to reported target species, depths fished and bottom depths, and incorrect position data such as placement east or west of 180°.

The TCER/TCEPR/ERS data set retained for the spatial analysis included 2 117 792 bottom-contacting tows (tows that used bottom trawl gear and midwater trawl gear within a metre of the seafloor, based on reported depth values). Of these tows, 58% were for deepwater Tier 1 and Tier 2 fishstocks (see Table 1) with Tier 1 targets accounting for 91% of deepwater targets. Inshore targets accounted for 42% of the TCER/TCEPR/ERS for 1990–2021. A total of 1881 tows could not be assigned to a stock (mainly when no target species has been identified); these data represent 0.09% of the total tows.

Of the retained tows (essentially the All Stocks data set for the spatial analysis), 87% used bottom trawl gear (78% of deepwater tows in the data set used bottom trawl gear and 99% of the inshore tows) throughout the 32-year data set and the 14-year inshore data set (2008–2021) used this gear type.

The CELR data with ‘trawl’ as the reported fishing method comprised 445 747 daily fishing records in the data extract. These data are from small domestic vessels fishing inshore. These records are not summarised in this report, but Baird & Mules (2021a) carried out a broad summary to indicate the amount of effectively missing data from the 1990–2007 period because the data are inadequate for spatial analysis, other than at the General Statistical Area level. As CELR data are no longer in use and have not been in use since the study carried out by Baird & Mules (2021a) they have not been updated here but their summary is included: minimal grooming checks were applied to the number of tows reported for each record: records that were null or had over 6 tows a day were assigned a median ‘number of tows’ of 3 (3% of records). Of the CELR data, 2.4% reported midwater gear as the fishing method, with the remainder using bottom trawl or bottom pair trawl. At least 67 targets were reported in the CELR data, and 42% of the tows were for flatfish species, 12% red cod, 10% tarakihi, 8% red gurnard, 7% snapper, and 6% barracouta. These annual numbers of tows can be compared with the numbers of tows in the data set used to estimate the footprints (see Table A2).

Table A1: Number of bottom-contacting tows in the 1990–2021 TCER/TCEPR/ERS data set retained for the spatial analysis, by form type. 'na' means not assigned to a stock.

		Deepwater			
	Inshore	Tier 1	Tier 2	na	Grand Total
ERS	84 242	84 155	9 337	115	177 849
TCE	499 147	16 530	14 365	1 132	531 174
TCP	314 006	1 010 445	83 684	634	1 408 769
All	897 395	1 111 130	107 386	1 881	2 117 792

Table A2: Number of records and number of tows reported as trawl tows on CELRs, and the number of tows in the raw data set prior to grooming, number of tows retained for the analysis, and the percentage of the trawl retained for the analysis for TCER/TCEPR/ERS data, for 1990–2021.

	CELR data*		TCER/TCEPR/ERS data		
Fishing year	No. of records	No. of tows	Raw no. of tows	Retained no. of tows	% of tows retained
1990	27 106	80 031	45 406	37 700	83
1991	29 923	93 390	54 539	45 522	83
1992	30 123	98 389	59 205	50 592	85
1993	32 140	96 538	63 876	53 315	83
1994	29 610	87 153	65 708	53 264	81
1995	28 640	88 076	74 060	59 019	80
1996	25 296	78 522	83 427	68 408	82
1997	26 437	87 479	86 986	72 635	84
1998	24 557	88 391	90 249	78 769	87
1999	25 322	79 415	84 890	71 324	84
2000	22 854	64 840	76 697	66 512	87
2001	21 094	60 938	73 974	64 590	87
2002	19 657	55 833	72 484	65 762	91
2003	20 759	59 472	70 990	64 720	91
2004	20 346	57 425	64 258	58 892	92
2005	21 182	59 618	60 842	55 748	92
2006	19 910	56 014	54 412	50 645	93
2007	19 098	53 620	50 028	46 148	92
2008	477	1 282	87 831	84 635	96
2009	622	1 766	85 428	82 275	96
2010	167	437	91 920	88 741	97
2011	58	157	85 556	81 573	95
2012	63	195	84 204	80 019	95
2013	63	173	83 574	79 221	95
2014	74	268	84 830	79 764	94
2015	38	103	78 570	73 383	93
2016	87	306	77 639	72 940	94
2017	39	154	77 754	73 241	94
2018	0	–	75 121	69 640	93
2019	5	21	71 430	65 576	92
2020	0	–	66 347	61 834	93
2021	0	–	64764	61 385	95
All	445 747	1 350 006	2 346 999	2 117 792	90

APPENDIX B: SPATIAL OVERLAYS

Table B1: Seafloor area (km^2) of the full extent of the available data for the main overlap layers, within the EEZ+TS: depth zones, BOMEC, probability of occurrence for Tier 1 fish species and population extent for scampi and arrow squid, and surficial layers. The data are represented on a 25-km^2 cell grid.

Data layer	Seafloor area (km^2)		Data layer	Seafloor area (km^2)
200-m depth zones			**BOMEC class** (total for each = 2 627 072.6 km^2)	
0–200 m	249 342		A	30 661.00
200–400 m	98 296		B	12 786.10
400–600 m	253 939		C	90 256.50
600–800 m	185 162		D	28 085.70
800–1000 m	166 645		E	61 258.00
1000–1200 m	144 930		F	38 775.80
1200–1400 m	168 377		G	6 702.30
1400–1600 m	124 989		H	138 399.10
0–1600 m	1 391 680		I	52 008.30
50-m depth zones			J	312 604.90
0–50 m	58 789		K	1 200.20
50–100 m	70 001		L	198 578.40
100–150 m	96 126		M	233 837.40
150–200 m	44 628		N	495 154.20
200–250 m	21 965		O	1 006 911.10

Surficial layers – seafloor area (km^2)				
(%)	Carbonate	Gravel	Mud	Sand
0–20	926 764.1	2 535 379.0	762 571.7	1 169 746.0
20–40	818 608.4	504 713.7	732 798.3	1 099 216.0
40–60	782 044.8	318 555.8	739 087.0	944 924.3
60–80	600 899.8	170 432.6	695 296.7	370 066.2
80–100	519 662.3	108 750.5	768 737.1	116 733.9

Probability of occurrence seafloor area (km^2) (total for each = 1 872 931 km^2)							
%	HAK	HOK	JMA	LIN	OEO	ORH	SBW
0	202 097	204 964	1 418 074	26 441	706 800	994 473	1 197 845
0.1–1.0	244 964	330 294	33 410	718 182	171 801	141 916	240 707
1.1–5.0	577 217	291 969	67 480	205 226	260 248	156 027	201 706
5.1–10.0	204 473	111 676	49 148	81 338	124 020	67 560	28 602
10.1–0.0	170 408	134 901	54 084	114 741	114 076	73 394	22 369
20.1–30.0	103 565	59 165	49 732	77 477	70741	49 725	15 581
30.1–40.0	79 792	42 155	42 506	47 409	48 614	36 247	12 632
40.1–50.0	72 627	34 019	37 320	36 658	44 832	30 953	11 644
50.1–60.0	67 559	32 943	33 291	40 624	45 664	31 241	10 187
60.1–70.0	63 800	35 693	36 193	35 529	48 856	39 780	9 455
70.1–80.0	56 649	39 001	28 729	48 160	62 442	49 936	12 704
80.1–90.0	26 713	64 032	14 934	106 259	81 103	57 127	26 675
90.1–95.0	2 827	138 827	5 123	141 069	45 309	34 929	23 575
95.1–99.0	240	353 292	2 907	193 818	48 425	109 623	59 249
0.0–99.0	1 872 931	1 872 931	1 872 931	1 872 931	1 872 931	1 872 931	1 872 931

Estimated extent of population – seafloor area (km^2)					
Scampi	Hotspot	15 122	Arrow squid	Hotspot	58 591
	90%	78 404		90%	251 879
	100%	496 344		100%	605 231
	Unknown/ not exist	3 654 869		Unknown/ not exist	3 545 982

Table B2: Seafloor area (km^2) of the full extent of the available data for the Seafloor community classification (SCC) classes. NB: classes 1, 2, 7, 25, 26, 45, 58, 61, 73–75 either did not have any contact recorded or do not occur within the fishable area.

Seafloor Community Classification Class					
SCC code	Seafloor area (km^2)	SCC code	Seafloor area (km^2)	SCC code	Seafloor area (km^2)
1	85 311	26	355	51	4 535
2	1 151 542	27	448	52	4 658
3	290 406	28	24 151	53	2 029
4	500 248	29	5 441	54	1 943
5	453 241	30	58 233	55	4 290
6	22 736	31	4 786	56	849
7	1 665	32	9 747	57	511
8	328 687	33	15 622	58	90
9	111 112	34	9 148	59	1 810
10	2 247	35	4 005	60	217
11	2 802	36	11 328	61	735
12	186 855	37	19 803	62	111
13	146 081	38	12 120	63	7 449
14	14 759	39	11 648	64	21 257
15	1 539	40	3 104	65	3 077
16	56 301	41	3 353	66	951
17	39 055	42	3 007	67	4 266
18	4 072	43	782	68	2 541
19	682	44	1 037	69	971
20	69 355	45	265	70	760
21	50 860	46	4 976	71	545
22	255 861	47	48 652	72	61
23	4 853	48	498	73	753
24	175	49	613	74	364
25	1 353	50	3 759	75	1 199

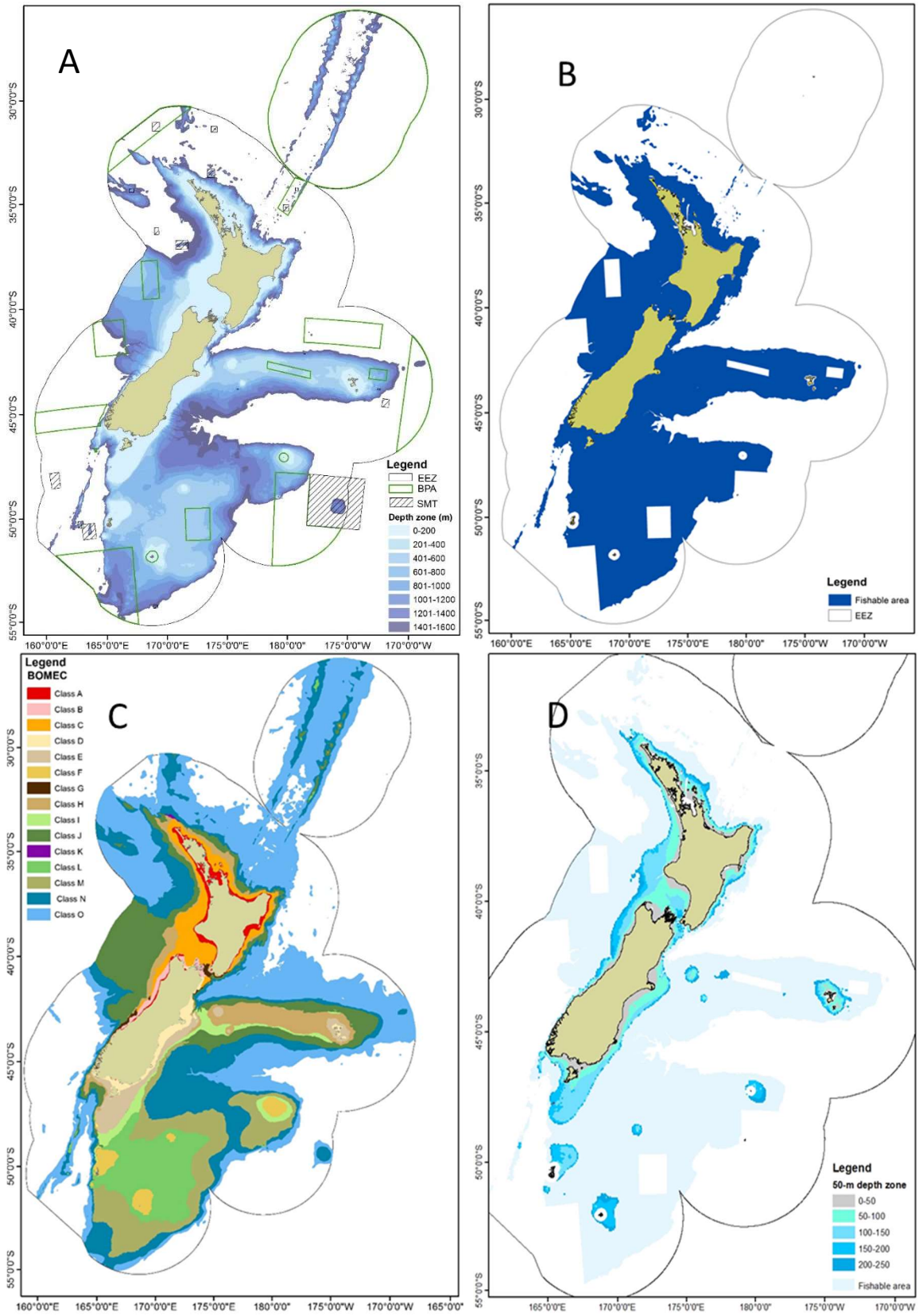

Figure B1: A. The extent of waters within the EEZ and Territorial Sea down to 1600 m depths, delineated by 200-m depth zones, showing the Benthic Protection Areas and closed seamounts. B. The 'fishable' area with areas closed to bottom trawling (including BPAs, closed seamounts, cable lanes, marine farms, and marine reserves) removed. C. The Benthic-optimised Marine Environment Classification (BOMEC) distribution (right), down to 3000 m (see Leathwick et al. 2012). D. Inshore 50-m depth zones. Note: the two EEZ occlusions are considered as part of the EEZ+TS; the outer boundary of the EEZ is shown.

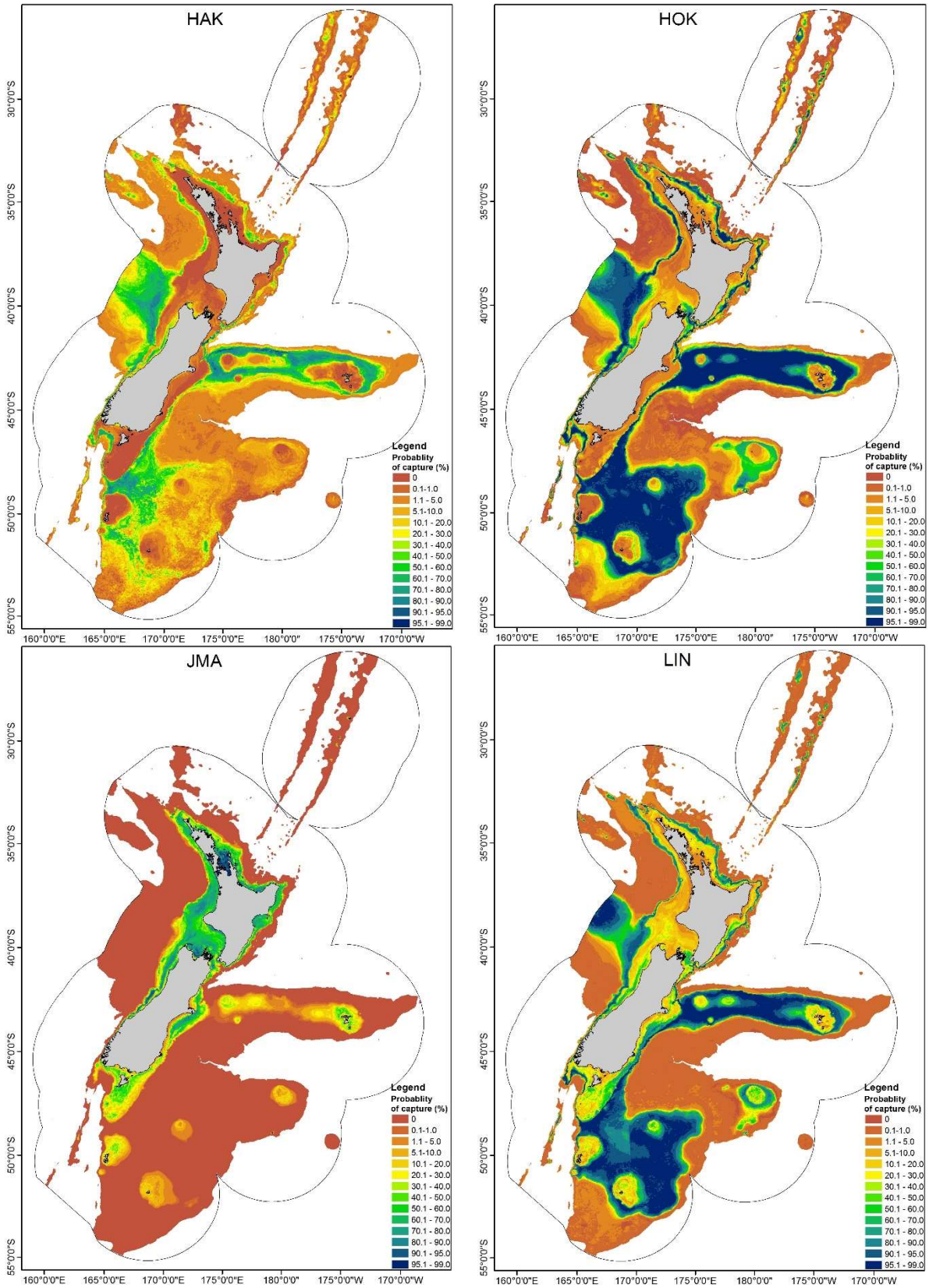

Figure B2a: The extent of the predicted distribution of the preferred habitat for hake (upper left), hoki (upper right), jack mackerels (lower left), and ling (lower right) (after Leathwick et al. 2006), where the preferred habitat represents the probability of capture of that species in a standardised trawl in waters down to 1950 m depth.

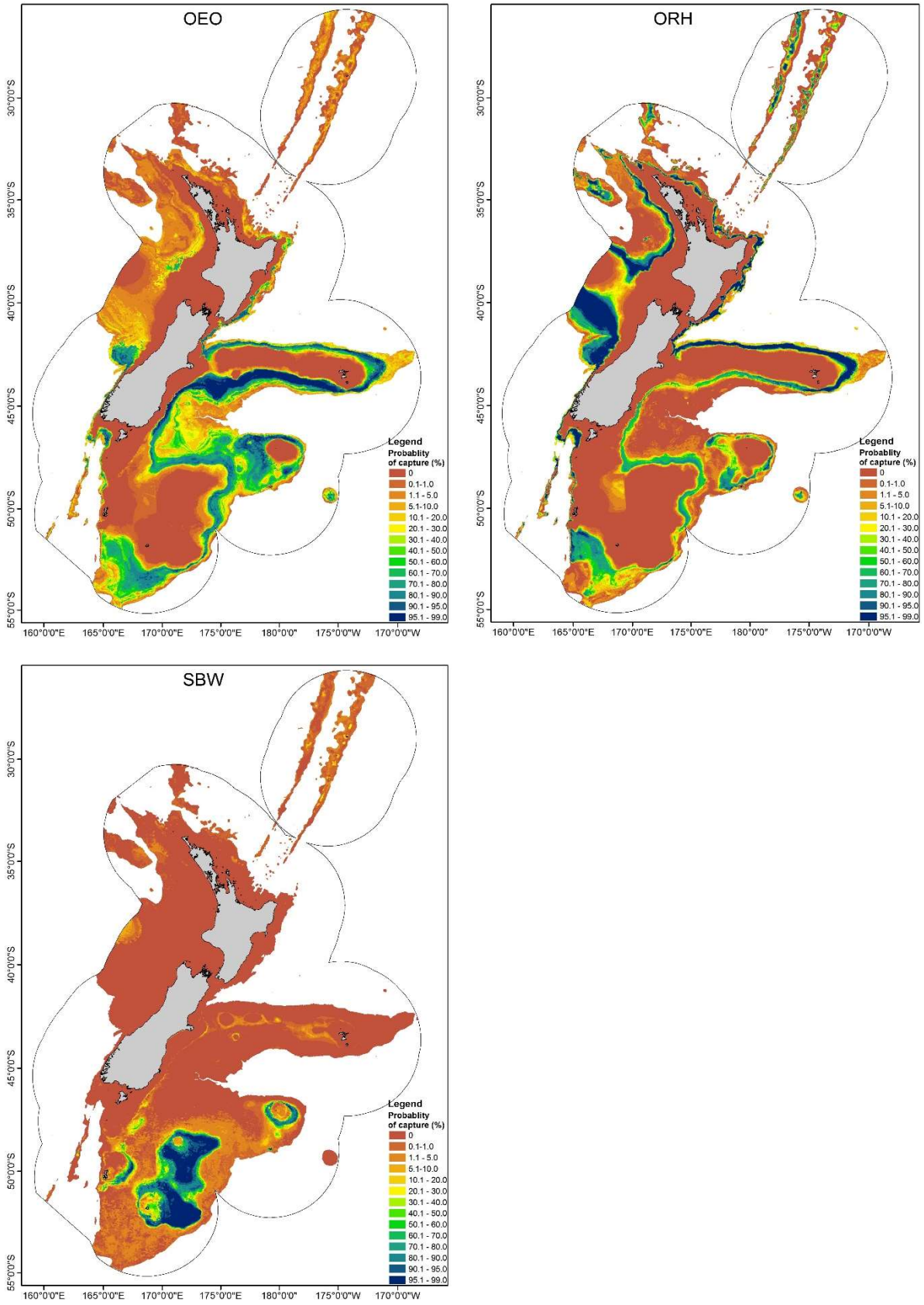

Figure B2b: The extent of the predicted distribution of the preferred habitat for oreo species (upper left), orange roughy (upper right), and southern blue whiting (lower left (after Leathwick et al. 2006), where the preferred habitat represents the probability of capture of that species in a standardised trawl in waters down to 1950 m depth.

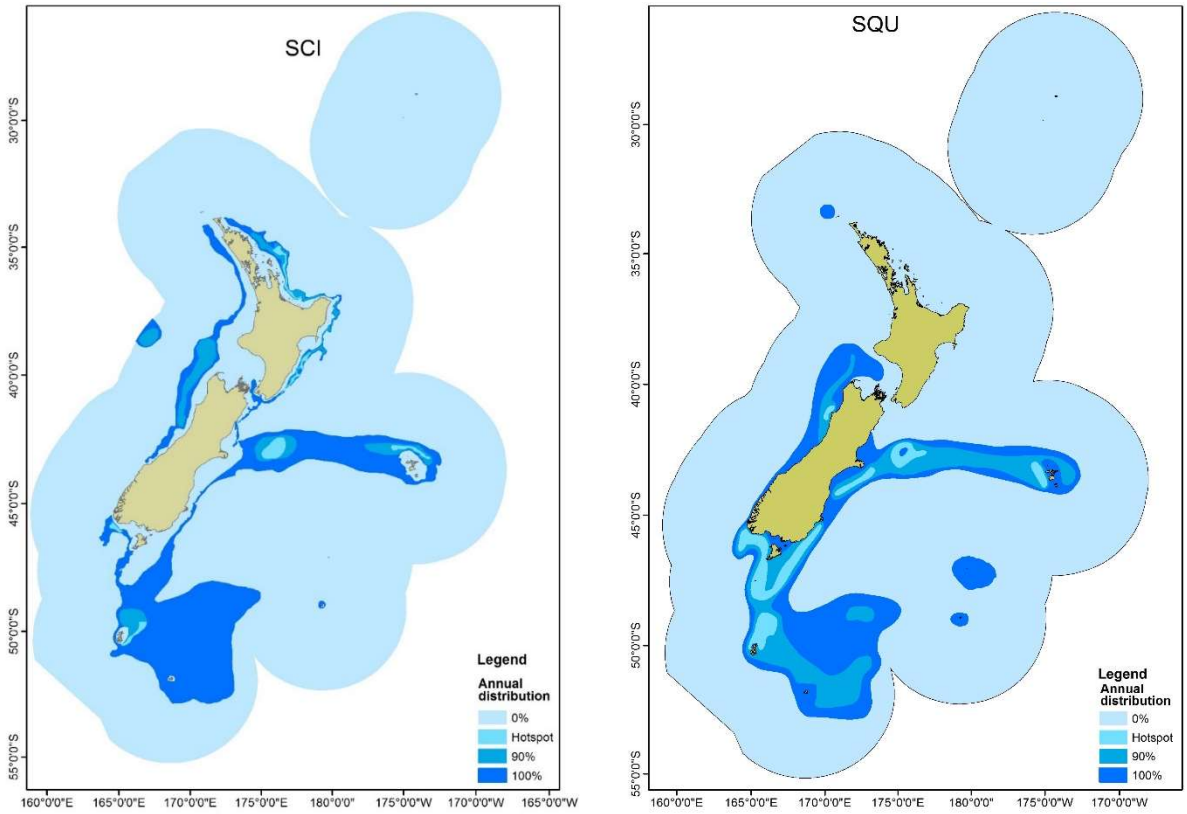

Figure B2c: The extent of the annual distribution of scampi (left) and arrow squid (right) (from www.nabis.govt.nz).

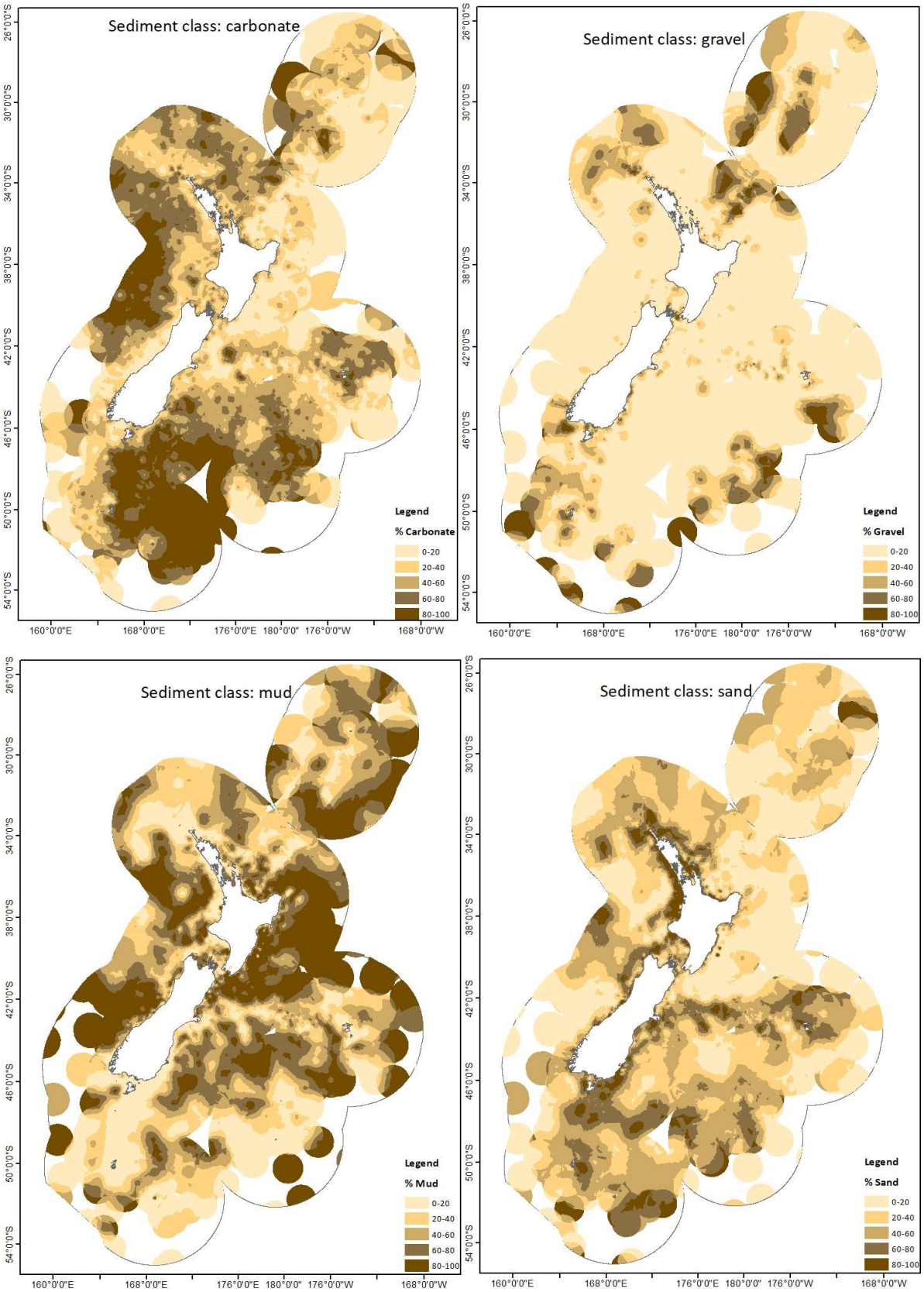

Figure B3: The interpolated distribution (%) of carbonate, gravel, mud, and sand based on the nzSEABED database (after Bostock et al. 2019a, 2019b).

APPENDIX C: ALL STOCKS SUMMARY

Table C1: The number of contacted 25-km^2 cells, the aggregate area, and the footprint area for All Stocks in the fishable area, and the percent of the EEZ+TS seafloor and the fishable area seafloor that was contacted the footprint, by year and for 1990–2021.

Fishing year	No. of cells	Aggregate area (km^2)	Footprint (km^2)	EEZ+TS (%)	Fishable (%)
1990	13 590	109 835.8	52 477.4	1.3	3.8
1991	14 765	133 650.3	59 503.9	1.5	4.3
1992	16 537	147 189.0	72 884.8	1.8	5.3
1993	16 122	153 308.5	74 992.3	1.8	5.4
1994	15 583	132 808.7	64 551.4	1.6	4.7
1995	16 350	161 227.9	73 031.9	1.8	5.3
1996	16 553	170 355.2	79 071.0	1.9	5.7
1997	16 918	181 183.1	84 818.1	2.1	6.1
1998	18 465	200 572.3	94 063.6	2.3	6.8
1999	17 858	180 684.9	88 213.7	2.2	6.4
2000	18 102	173 404.4	89 642.5	2.2	6.5
2001	18 147	173 162.5	90 907.4	2.2	6.6
2002	19 879	177 569.0	96 616.5	2.4	7.0
2003	18 983	179 958.0	96 267.4	2.3	7.0
2004	17 628	157 069.9	84 809.5	2.1	6.1
2005	17 078	137 591.5	72 400.4	1.8	5.2
2006	16 085	119 334.1	67 480.7	1.6	4.9
2007	15 756	111 328.7	67 105.6	1.6	4.9
2008	18 539	154 337.4	92 240.0	2.2	6.7
2009	18 124	151 878.0	90 034.0	2.2	6.5
2010	18 072	162 886.6	94 568.0	2.3	6.8
2011	17 617	156 055.8	91 582.9	2.2	6.6
2012	17 171	152 329.0	87 924.7	2.1	6.4
2013	16 311	146 112.7	85 665.8	2.1	6.2
2014	17 349	151 979.8	90 434.4	2.2	6.5
2015	17 427	149 050.6	88 996.3	2.2	6.4
2016	17 598	146 401.9	86 331.8	2.1	6.2
2017	17 558	154 330.0	88 146.1	2.1	6.4
2018	17 195	158 504.7	88 809.7	2.2	6.4
2019	15 942	142 797.9	80 701.3	2.0	5.8
2020	14 170	129 594.3	70 301.8	1.7	5.1
2021	14 757	130 080.6	74 507.9	1.8	5.4
All	40 445	4 886 573.1	462 643.3	11.3	33.5

Table C2: Number of tows not included in the fishable area analysis because they were inside closed areas, on the land, or beyond 1600 m, by form type for 1990–2021. Note some tows may be in more than category.

Fishing	On land			In closed areas			Beyond 1600 m			Total		
year	ERS	TCE	TCP	ERS	TCE	TCP	ERS	TCE	TCP	ERS	TCE	TCP
1990	0	0	60	0	0	71	0	0	90	0	0	221
1991	0	0	41	0	0	63	0	0	121	0	0	225
1992	0	0	66	0	0	107	0	0	123	0	0	296
1993	0	0	145	0	0	382	0	0	157	0	0	684
1994	0	0	83	0	0	339	0	0	184	0	0	606
1995	0	0	80	0	0	525	0	0	362	0	0	967
1996	0	0	49	0	0	694	0	0	265	0	0	1 008
1997	0	0	64	0	0	623	0	0	250	0	0	937
1998	0	0	74	0	0	685	0	0	375	0	0	1 134
1999	0	0	32	0	0	780	0	0	583	0	0	1 395
2000	0	0	20	0	0	588	0	0	357	0	0	965
2001	0	0	13	0	0	520	0	0	247	0	0	780
2002	0	0	6	0	0	512	0	0	161	0	0	679
2003	0	0	7	0	0	473	0	0	189	0	0	669
2004	0	0	3	0	0	379	0	0	110	0	0	492
2005	0	0	3	0	0	398	0	0	68	0	0	469
2006	0	0	0	0	0	262	0	0	128	0	0	390
2007	0	0	8	0	0	197	0	0	76	0	0	281
2008	0	200	1	0	215	83	0	91	96	0	506	180
2009	0	96	1	0	153	61	0	83	65	0	332	127
2010	0	99	3	0	210	105	0	81	52	0	390	160
2011	0	113	3	0	179	78	0	64	43	0	356	124
2012	0	102	2	0	372	59	0	68	43	0	542	104
2013	0	66	9	0	351	62	0	68	27	0	485	98
2014	0	71	3	0	385	45	0	73	56	0	529	104
2015	0	56	0	0	311	33	0	46	43	0	413	76
2016	0	70	0	0	280	59	0	44	40	0	394	99
2017	0	95	6	0	190	38	0	47	44	0	332	88
2018	0	42	1	18	167	5	6	35	1	24	244	7
2019	10	83	2	41	155	2	16	49	1	67	287	5
2020	17	1	0	267	0	0	19	0	0	303	1	0
2021	61	0	0	31	0	0	17	0	0	109	0	0
All	88	1 094	785	357	2 968	8 228	58	749	4 357	503	4 811	13 370

Table C3: Swept areas for TCER, TCEPR, and ERS data were inside the EEZ outer boundary and the percentage retained for the 'fishable' area summaries for All Stocks, by fishing year, where 'Out' gives the swept area not included in the final spatial analysis (outside the fishable area), 'Fishable total' gives the estimated swept area within the fishable area, and '% kept' gives the percent retained in the 'fishable' area analyses.

Fishing	Aggregate area (km^2)			Footprint (km^2)		
year	Out	Fishable total	% kept	Out	Fishable total	% kept
1990	691.8	110 527.6	99.4	648.6	53 126.0	98.8
1991	565.5	134 215.8	99.6	531.8	60 035.7	99.1
1992	901.5	148 090.5	99.4	847.8	73 732.5	98.9
1993	2 011.9	155 320.4	98.7	1 515.7	76 508.0	98.0
1994	1 215.5	134 024.2	99.1	1 088.7	65 640.1	98.3
1995	1 529.5	162 757.4	99.1	1 360.5	74 392.4	98.2
1996	2 379.1	172 734.3	98.6	1 821.5	80 892.5	97.7
1997	1 937.1	183 120.3	98.9	1 650.5	86 468.5	98.1
1998	2 169.0	202 741.4	98.9	1 722.2	95 785.8	98.2
1999	2 204.2	182 889.1	98.8	1 643.6	89 857.3	98.2
2000	1 629.4	175 033.8	99.1	1 324.0	90 966.5	98.5
2001	1 575.2	174 737.7	99.1	1 303.6	92 211.0	98.6
2002	1 748.8	179 317.7	99.0	1 369.5	97 986.0	98.6
2003	1 684.4	181 642.4	99.1	1 244.7	97 512.1	98.7
2004	1 532.1	158 602.0	99.0	1 174.6	85 984.1	98.6
2005	1 701.7	139 293.2	98.8	1 206.4	73 606.8	98.4
2006	1 334.9	120 669.0	98.9	1 025.0	68 505.7	98.5
2007	1 089.2	112 417.9	99.0	885.8	67 991.4	98.7
2008	5 535.5	159 872.9	96.5	4 307.5	96 547.6	95.5
2009	5 070.0	156 948.0	96.8	3 917.4	93 951.4	95.8
2010	5 828.8	168 715.3	96.5	4 398.5	98 966.5	95.6
2011	5 146.0	161 201.8	96.8	3 983.5	95 566.4	95.8
2012	5 204.4	157 533.4	96.7	3 981.7	91 906.4	95.7
2013	5 062.1	151 174.9	96.7	3 846.6	89 512.3	95.7
2014	5 063.6	157 043.4	96.8	3 812.0	94 246.4	96.0
2015	4 164.4	153 214.9	97.3	3 232.4	92 228.7	96.5
2016	4 213.5	150 615.4	97.2	3 171.6	89 503.4	96.5
2017	4 224.8	158 554.8	97.3	3 243.8	91 390.0	96.5
2018	3 813.8	162 318.4	97.7	2 900.9	91 710.6	96.8
2019	2 995.4	145 793.3	97.9	2 420.5	83 121.7	97.1
2020	1 046.7	130 641.0	99.2	711.8	71 013.6	99.0
2021	618.7	130 699.3	99.5	512.5	75 020.4	99.3
All	85 888.4	4 972 461.4	98.3	31 985.7	494 629.0	93.5

Table C4: For All Stocks data, the number of cells contacted in 1990–94 and the number of 'new' cells contacted in subsequent years and the aggregate area and footprint estimated for those new cells, where data for 1995 represent cells contacted in 1995 but not in 1990–94, and data for 1996 represent cells contacted in 1996 but not in 1990–95, etc.

Number of cells contacted in 1990–94 = 26 912

Fishing year	No. new cells	Aggregate area (km^2)	Footprint (km^2)
1995	1 330	1 295.9	1 081.4
1996	1 354	943.5	858.8
1997	1 062	886.5	833.4
1998	1 480	1 891.0	1 522.9
1999	1 238	1 101.0	1 019.8
2000	1 099	1 402.4	1 266.8
2001	771	752.5	651.1
2002	986	891.5	860.2
2003	567	656.1	582.6
2004	320	327.2	295.8
2005	612	616.4	556.6
2006	225	103.6	99.1
2007	246	137.9	132.0
2008	599	1 388.2	906.8
2009	235	85.0	83.0
2010	171	60.2	58.1
2011	223	146.3	128.2
2012	98	30.6	30.5
2013	75	31.5	31.2
2014	87	40.4	40.3
2015	192	175.9	163.0
2016	157	76.9	75.8
2017	130	65.5	65.0
2018	107	28.4	28.4
2019	60	79.1	76.4
2020	67	58.2	57.2
2021	42	55.4	53.1

Table C5: Annual summary data for the number of tows that contact each cell, the footprint, and the aggregate area for All Stocks data, 1990–2021, giving the 25th percentile (1st Qu), median, mean, 75th percentile (3rd Qu), and the maximum. The minimum number of tows that contacted each cell was 1 and the minimum values for the footprint and aggregate areas was < 0.0001.

Fishing	No. of tows					Footprint (km^2)					Aggregate area (km^2)				
year	1st Qu	Median	Mean	3rd Qu	Max	1st Qu	Median	Mean	3rd Qu	Max	1st Qu	Median	Mean	3rd	Max
1990	1	3	16.3	13.0	1 095	0.5	1.3	3.9	4.9	25	0.5	1.4	8.1	5.6	719.5
1991	1	4	18.7	13.0	2 405	0.6	1.5	4.0	4.8	25	0.6	1.5	9.1	5.6	1 629.9
1992	1	4	18.9	15.0	1 297	0.7	1.7	4.4	5.7	25	0.7	1.8	8.9	6.7	833.7
1993	2	5	19.6	17.0	1 838	0.7	2.0	4.7	6.3	25	0.7	2.0	9.5	7.6	1 393.3
1994	1	4	19.0	15.0	1 276	0.6	1.6	4.1	5.3	25	0.6	1.7	8.5	6.2	813.2
1995	2	5	20.9	18.0	1 125	0.6	1.8	4.5	6.0	25	0.7	1.9	9.9	7.1	872.3
1996	1	5	23.1	22.0	1 307	0.6	1.9	4.8	6.8	25	0.6	2.0	10.3	8.4	617.9
1997	2	6	23.7	23.0	1 416	0.7	2.0	5.0	7.2	25	0.7	2.1	10.7	9.1	544.4
1998	2	5	23.5	23.0	884	0.7	2.0	5.1	7.2	25	0.7	2.1	10.9	9.0	449.6
1999	1	5	22.4	22.0	1 222	0.6	1.9	4.9	6.9	25	0.6	2.0	10.1	8.6	751.0
2000	2	5	21.2	22.0	827	0.7	1.9	5.0	7.2	25	0.7	2.0	9.6	9.1	407.2
2001	2	5	21.0	23.0	842	0.7	2.0	5.0	7.2	25	0.7	2.1	9.5	8.9	584.8
2002	2	5	19.9	20.0	1 037	0.7	2.0	4.9	6.9	25	0.7	2.1	8.9	8.5	699.9
2003	2	6	20.5	21.0	1 001	0.8	2.3	5.1	7.4	25	0.8	2.4	9.5	9.2	679.7
2004	2	6	19.6	19.0	1 453	0.7	2.1	4.8	6.9	25	0.8	2.3	8.9	8.5	927.8
2005	1	5	18.8	17.0	1 478	0.6	1.8	4.2	5.7	25	0.7	1.9	8.1	6.7	949.4
2006	2	5	17.8	18.0	957	0.6	1.8	4.2	5.8	25	0.6	1.9	7.4	7.0	600.4
2007	2	5	17.1	19.0	571	0.6	1.9	4.3	6.2	25	0.6	2.0	7.1	7.5	284.0
2008	2	8	25.2	28.0	597	0.8	2.6	5.0	7.6	25	0.8	2.8	8.3	9.6	242.5
2009	2	8	24.7	28.0	569	0.7	2.5	5.0	7.6	25	0.7	2.7	8.4	9.6	284.6
2010	2	9	26.4	29.0	624	0.7	2.7	5.2	8.1	25	0.7	2.9	9.0	10.3	214.7
2011	2	9	25.7	30.0	658	0.7	2.6	5.2	8.1	25	0.7	2.9	8.9	10.5	286.9
2012	2	9	25.6	29.0	537	0.7	2.7	5.1	7.9	25	0.7	2.9	8.9	10.0	249.7
2013	2	9	26.5	31.0	681	0.8	2.9	5.3	8.1	25	0.8	3.1	9.0	10.4	276.8
2014	2	9	25.5	30.0	579	0.8	2.8	5.2	8.0	25	0.8	3.1	8.8	10.3	284.5
2015	2	9	24.1	28.0	542	0.8	2.7	5.1	7.7	25	0.8	2.9	8.6	9.8	321.4
2016	2	8	23.7	27.0	577	0.7	2.4	4.9	7.4	25	0.7	2.6	8.3	9.3	336.5
2017	2	8	24.3	28.0	628	0.7	2.6	5.0	7.5	25	0.8	2.9	8.8	9.5	209.3
2018	2	9	24.3	28.5	825	0.8	2.7	5.2	7.8	25	0.8	3.0	9.2	10.3	404.7
2019	2	9	24.4	28.0	607	0.8	2.7	5.1	7.7	25	0.8	3.0	9.0	10.2	295.8
2020	3	9	25.1	29.0	723	0.8	2.8	5.0	7.4	25	0.8	3.2	9.1	9.9	445.5
2021	3	10	24.2	29.0	595	0.8	3.0	5.0	7.6	25	0.8	3.4	8.8	10.1	225.3

Table C6: Estimated footprint (km^2) for All Stocks bottom-contacting trawls, by the 200-m depth zones, for 1990–2021.

	Depth zones (m)								
Fishing year	0–200	200–400	400–600	600–800	800–1000	1000–1200	1200–1400	1400–1600	0–1600
1990	18 142.3	7 852.9	11 460.5	7 420.1	3 306.3	2 413.0	1 608.4	273.9	52 477.4
1991	16 354.5	9 500.0	14 670.0	12 104.1	4 324.8	1 724.6	656.2	169.7	59 503.9
1992	20 304.9	10 156.5	21 335.5	15 181.3	3 829.1	1 318.8	529.0	229.7	72 884.8
1993	22 919.6	9 450.9	21 396.4	14 628.5	4 141.4	1 515.3	649.1	291.1	74 992.3
1994	21 684.1	9 401.7	19 592.6	7 649.3	3 229.6	1 865.1	767.4	361.5	64 551.4
1995	23 554.8	9 368.6	23 762.5	10 546.5	3 164.0	1 783.7	576.0	276.0	73 031.9
1996	28 501.2	10 567.4	25 064.6	9 714.2	3 186.1	1 433.1	410.0	194.3	79 071.0
1997	26 942.4	10 247.8	28 039.3	12 590.4	4 451.7	1 884.5	426.5	235.5	84 818.1
1998	29 002.6	10 678.2	33 348.3	12 559.1	5 111.2	2 370.8	687.4	306.0	94 063.6
1999	25 519.7	8 898.7	33 308.8	10 884.8	5 495.7	2 962.9	837.1	306.0	88 213.7
2000	24 468.8	8 720.1	34 154.3	14 152.7	4 814.5	2 473.6	591.9	266.6	89 642.5
2001	25 027.3	9 035.7	35 632.2	14 870.4	3 639.1	1 982.6	538.8	181.3	90 907.4
2002	27 140.9	9 733.6	36 253.4	16 695.4	4 103.2	1 989.7	552.5	147.9	96 616.5
2003	27 448.9	9 549.7	38 474.2	15 454.6	2 813.2	1 871.2	515.3	140.2	96 267.4
2004	26 181.7	7 568.1	32 301.1	12 078.4	3 498.4	2 464.3	577.4	140.1	84 809.5
2005	28 195.2	7 772.5	24 218.7	6 692.0	2 743.1	2 075.7	544.5	158.7	72 400.4
2006	27 496.8	8 068.1	21 768.8	5 419.5	2 591.0	1 549.1	461.3	126.0	67 480.7
2007	27 198.2	8 539.6	21 598.3	5 170.5	2 382.9	1 615.9	479.5	120.7	67 105.6
2008	51 154.7	9 736.6	20 961.4	6 234.8	2 008.5	1 509.0	498.2	136.8	92 240.0
2009	51 365.6	8 491.5	20 322.1	5 368.3	2 049.7	1 860.1	453.2	123.3	90 034.0
2010	53 436.6	8 246.1	22 541.8	5 966.7	1 969.8	1 814.5	465.5	127.0	94 568.0
2011	50 621.4	8 519.7	23 151.7	6 426.7	1 703.0	782.7	255.7	122.1	91 582.9
2012	48 790.3	8 012.9	22 583.8	6 141.2	1 342.8	734.4	243.2	76.2	87 924.7
2013	48 511.8	7 031.3	21 383.2	6 498.5	1 212.1	735.6	222.1	71.0	85 665.8
2014	49 544.1	7 461.5	21 003.9	9 583.3	1 639.0	830.4	271.6	100.6	90 434.4
2015	46 336.1	7 582.3	23 074.6	8 218.2	2 551.4	909.0	234.7	90.0	88 996.3
2016	44 590.2	8 047.2	23 032.9	6 434.8	2 252.5	1 388.8	494.4	91.0	86 331.8
2017	46 333.0	7 578.6	22 402.0	6 966.3	2 912.9	1 356.7	478.7	118.0	88 146.1
2018	44 747.7	7 270.4	24 036.5	8 640.4	2 240.9	1 241.4	509.2	123.1	88 809.7
2019	42 737.5	6 958.3	21 288.3	5 743.5	2 502.6	1 052.2	352.8	66.1	80 701.3
2020	37 680.7	6 244.9	17 739.4	4 077.1	2 699.8	1 453.9	337.4	68.5	70 301.8
2021	37 595.2	6 622.6	18 597.8	5 583.1	3 782.7	1 800.2	422.3	104.0	74 507.9
All	180 816.1	46 553.8	105 762.7	60 754.3	37 332.5	20 567.9	7 692.5	3 163.6	462 643.3

Table C7: Estimated aggregate area (km^2) for All Stocks bottom-contacting trawls, by the 200-m depth zones, for 1990–2021.

	Depth zones (m)								
Fishing year	0–200	200–400	400–600	600–800	800–1000	1000–1200	1200–1400	1400–1600	0–1600
1990	40 842.9	21 730.1	22 763.9	12 927.8	5 425.8	3 220.9	2 572.4	352.0	109 835.8
1991	45 195.2	23 954.3	30 218.5	23 929.6	6 927.3	2 278.8	950.2	196.4	133 650.3
1992	46 591.3	24 846.7	40 079.6	26 532.2	6 009.0	2 019.6	786.0	324.7	147 189.0
1993	53 489.4	21 414.0	42 860.7	25 742.0	5 940.5	2 465.4	991.7	404.9	153 308.5
1994	45 777.5	27 620.0	38 349.0	11 025.7	4 950.9	3 277.6	1 315.9	492.1	132 808.7
1995	56 957.9	25 689.0	53 425.7	16 051.8	4 896.5	2 983.2	848.7	375.1	161 227.9
1996	62 131.4	28 221.9	57 388.0	15 336.6	4 548.7	1 967.4	526.1	235.1	170 355.2
1997	53 999.9	28 664.5	65 703.5	22 920.2	6 456.8	2 608.9	532.5	296.7	181 183.1
1998	59 750.1	25 431.0	80 122.2	23 427.4	7 103.1	3 333.1	947.6	457.9	200 572.3
1999	56 376.1	19 946.6	72 268.4	18 908.3	7 457.7	4 021.2	1 266.6	439.9	180 684.9
2000	44 888.3	20 827.0	70 773.6	26 035.6	6 591.3	3 169.2	793.9	325.3	173 404.4
2001	48 169.1	21 034.3	68 531.2	27 126.6	4 935.2	2 482.3	660.7	223.1	173 162.5
2002	48 600.3	24 135.7	66 388.6	29 213.7	5 920.7	2 466.3	674.5	169.1	177 569.0
2003	50 226.9	24 619.7	74 332.6	23 882.6	3 665.4	2 373.2	698.9	158.8	179 958.0
2004	50 285.1	19 007.5	60 064.4	18 785.6	4 694.6	3 293.7	780.6	158.3	157 069.9
2005	58 441.9	17 839.3	43 863.6	10 216.4	3 542.7	2 760.2	725.7	201.7	137 591.5
2006	48 318.3	15 887.2	39 656.7	9 408.3	3 468.5	1 868.9	580.1	146.1	119 334.1
2007	42 962.3	15 938.9	38 217.6	8 362.9	3 109.9	1 994.5	603.2	139.5	111 328.7
2008	86 071.4	17 299.5	35 950.6	9 812.3	2 620.2	1 828.1	605.7	149.7	154 337.4
2009	85 957.9	14 141.4	37 277.2	9 040.8	2 593.8	2 179.8	550.7	136.4	151 878.0
2010	90 411.1	14 882.2	43 158.7	9 110.2	2 467.8	2 169.3	544.1	143.2	162 886.6
2011	83 356.7	15 402.5	44 230.1	9 487.8	2 219.4	935.2	282.5	141.4	156 055.8
2012	80 993.5	14 191.4	44 650.3	9 520.4	1 720.0	893.3	277.6	82.6	152 329.0
2013	78 727.0	12 702.1	41 277.5	10 713.6	1 455.9	922.1	238.7	75.8	146 112.7
2014	79 475.4	13 521.6	39 693.4	15 784.7	2 121.0	964.9	309.7	109.2	151 979.8
2015	72 747.3	13 362.7	44 905.3	13 266.0	3 309.8	1 085.2	274.1	100.2	149 050.6
2016	70 676.8	15 436.0	44 935.9	10 058.8	2 850.4	1 729.8	613.3	100.9	146 401.9
2017	74 421.9	14 120.3	48 131.2	11 786.0	3 497.5	1 678.3	562.7	132.1	154 330.0
2018	69 773.6	14 697.9	52 555.8	16 065.7	2 968.3	1 582.3	711.4	149.5	158 504.7
2019	70 785.6	13 893.6	43 717.6	9 346.8	3 188.0	1 304.2	481.0	81.2	142 797.9
2020	65 576.8	13 871.1	37 504.5	6 720.9	3 436.9	1 895.4	495.3	93.4	129 594.3
2021	61 405.8	14 319.3	37 188.2	9 306.1	4 718.7	2 344.8	655.3	142.5	130 080.6
All	1 983 384.9	608 649.0	1 560 183.8	499 853.5	134 812.3	70 097.0	22 857.6	6 734.8	4 886 573.0

Table C8: The number of cells contacted by All Stocks bottom-contacting trawls, by the 200-m depth zones, for 1990–2021.

	Depth zones (m)								
Fishing year	0–200	200–400	400–600	600–800	800–1000	1000–1200	1200–1400	1400–1600	0–1600
1990	4 927	1 424	2 539	2 024	1 081	842	474	279	13 590
1991	4 803	1 613	3 009	2 607	1 358	827	340	208	14 765
1992	5 466	1 763	4 221	2 681	1 172	706	306	222	16 537
1993	5 732	1 821	3 369	2 628	1 276	727	336	233	16 122
1994	6 096	1 673	3 012	2 152	1 089	843	393	325	15 583
1995	6 385	1 772	3 217	2 326	1 202	792	374	282	16 350
1996	6 495	1 733	3 383	2 188	1 221	846	397	290	16 553
1997	6 130	1 596	3 610	2 395	1 520	903	431	333	16 918
1998	6 229	1 887	4 063	2 575	1 839	1 035	494	343	18 465
1999	5 542	1 759	4 092	2 293	2 044	1 282	514	332	17 858
2000	5 532	1 786	4 312	2 583	1 839	1 262	463	325	18 102
2001	5 792	1 873	4 565	2 839	1 275	1 044	462	297	18 147
2002	6 315	1 967	5 371	3 133	1 342	1 006	457	288	19 879
2003	6 361	1 901	4 833	3 039	1 220	959	430	240	18 983
2004	6 045	1 487	4 509	2 693	1 246	964	423	261	17 628
2005	6 083	1 558	4 093	2 062	1 424	1 137	454	267	17 078
2006	6 216	1 793	3 581	1 690	1 290	887	385	243	16 085
2007	6 254	1 858	3 409	1 543	1 214	863	386	229	15 756
2008	8 390	1 948	3 466	1 764	1 217	957	513	284	18 539
2009	8 417	1 895	3 382	1 500	1 233	961	478	258	18 124
2010	8 448	1 878	3 279	1 582	1 167	1 015	455	248	18 072
2011	8 331	1 877	3 376	1 600	1 056	728	373	276	17 617
2012	8 238	1 850	3 346	1 567	994	693	306	177	17 171
2013	8 154	1 652	2 993	1 634	773	623	298	184	16 311
2014	8 263	1 700	3 203	1 870	946	796	342	229	17 349
2015	8 108	1 695	3 298	1 801	1 256	773	303	193	17 427
2016	8 077	1 681	3 269	1 711	1 284	911	441	224	17 598
2017	8 187	1 660	3 163	1 714	1 330	874	403	227	17 558
2018	7 876	1 602	3 446	1 849	1 086	811	352	173	17 195
2019	7 714	1 505	2 952	1 390	1 157	728	334	162	15 942
2020	6 944	1 323	2 478	1 152	1 261	645	262	105	14 170
2021	7 191	1 330	2 632	1 217	1 382	671	233	101	14 757
All	10 272	3 485	8 832	5 825	4 633	3 338	2 204	1 856	40 445

Table C9: Estimated footprint (km^2) for All Stocks bottom-contacting trawls, by BOMEC class A–O, for 1990–2021. Note: 41.5 km^2 for class K and 44.7 km^2 not assigned to a class (totalled across all years for both categories) are not included in this table.

Fishing year	A	B	C	D	E	F	G	H	I	J	L	M	N	O	Total
1990	237.9	84.7	6 522.5	2 058.9	5 974.0	1 484.7	269.8	10 119.6	5 624.6	12 721.8	4 702.1	906.9	1 749.8	19.8	52 477.4
1991	397.2	71.4	5 036.4	1 555.0	6 635.5	1 710.5	323.5	11 453.0	7 394.5	14 077.4	7 528.4	2 140.2	1 161.2	19.7	59 503.9
1992	956.4	96.2	7 991.7	1 646.0	6 875.8	1 324.6	308.0	14 308.2	12 975.3	11 993.0	10 300.8	2 890.1	1 170.6	47.3	72 884.8
1993	1 383.9	305.6	8 728.6	1 789.9	8 170.0	838.1	485.9	15 381.5	12 862.2	15 340.1	5 668.2	2 563.4	1 430.2	43.2	74 992.3
1994	1 458.7	342.4	8 912.0	1 322.5	6 259.0	1 308.9	554.7	14 220.5	10 051.0	12 657.1	4 678.4	972.2	1 756.6	56.7	64 551.4
1995	1 979.7	336.6	8 709.9	1 575.0	7 407.6	1 334.2	716.2	15 942.9	12 956.5	14 327.5	5 051.3	1 282.1	1 351.4	60.7	73 031.9
1996	3 416.7	176.9	10 674.3	1 945.3	7 912.9	1 627.7	1 069.1	17 444.4	14 248.0	13 234.4	5 124.9	1 268.7	872.1	53.0	79 071.0
1997	3 414.4	285.7	10 269.5	1 661.1	7 190.3	1 386.4	1 135.6	16 641.8	15 413.5	17 471.3	7 150.8	1 715.2	994.3	85.8	84 818.1
1998	3 145.4	214.3	12 316.6	1 834.0	8 187.0	1 116.4	865.5	19 415.9	18 667.7	17 964.9	6 939.0	1 880.0	1 433.7	76.4	94 063.6
1999	3 045.3	204.4	11 574.6	1 050.4	7 201.5	642.8	712.3	19 031.7	18 783.6	17 537.5	5 018.9	1 754.4	1 578.4	75.5	88 213.7
2000	2 858.9	260.9	9 979.5	1 108.4	7 051.1	591.5	739.7	18 873.9	18 451.9	17 882.3	8 064.7	2 429.3	1 277.7	66.5	89 642.5
2001	3 823.1	271.9	11 476.8	493.5	5 860.4	626.4	636.8	19 934.2	17 702.6	17 221.7	9 158.1	2 528.4	1 114.4	59.0	90 907.4
2002	3 703.2	466.1	12 604.2	869.1	6 319.6	1 106.1	575.4	18 785.1	16 838.0	17 397.3	11 913.9	4 818.5	1 147.9	71.7	96 616.5
2003	3 355.4	343.7	12 926.6	1 028.9	6 125.3	1 307.6	579.4	21 389.2	16 526.0	16 377.9	13 137.2	2 041.4	1 059.2	67.4	96 267.4
2004	3 916.9	295.5	12 663.6	908.7	4 952.7	1 465.5	659.8	17 033.9	13 594.9	15 397.0	10 516.5	2 257.0	1 085.0	61.0	84 809.5
2005	3 820.3	468.8	13 838.1	782.3	5 552.1	1 402.3	632.6	15 318.5	10 253.5	11 865.2	5 624.0	1 708.6	1 074.1	59.9	72 400.4
2006	2 899.6	416.6	13 189.6	801.4	6 358.3	1 620.9	459.2	14 865.6	9 925.7	11 459.2	3 560.5	1 105.6	778.2	39.0	67 480.7
2007	3 048.1	273.9	13 842.8	763.2	5 693.0	1 111.4	502.8	15 212.8	11 085.6	9 696.2	3 970.0	1 140.1	724.0	41.8	67 105.6
2008	6 993.5	4 688.9	21 293.0	7 122.5	6 229.3	968.9	1 532.5	16 708.2	9 740.9	10 803.5	4 535.4	790.5	776.5	46.6	92 240.0
2009	7 159.3	4 729.0	20 621.1	7 923.6	6 112.7	1 336.0	1 548.0	14 011.7	10 609.2	9 663.2	4 640.0	908.6	739.2	26.1	90 034.0
2010	7 392.5	5 322.9	20 322.8	8 692.1	7 322.6	1 398.4	1 669.4	13 355.0	12 319.9	10 178.9	4 597.8	1 107.2	848.4	30.9	94 568.0
2011	6 880.2	4 794.4	18 771.3	7 984.3	7 718.3	923.8	1 804.7	13 589.3	11 392.8	9 618.0	6 212.9	1 308.5	550.2	27.0	91 582.9
2012	6 922.2	5 213.1	18 012.2	8 024.5	6 733.8	667.4	1 648.2	13 527.2	11 724.4	9 591.8	4 626.7	695.3	513.7	17.6	87 924.7
2013	6 404.4	5 364.1	17 698.2	8 403.9	6 676.9	684.4	1 719.3	12 172.3	12 197.6	9 012.5	4 344.7	471.8	491.0	15.2	85 665.8
2014	6 430.2	5 286.6	17 759.9	8 545.4	7 215.5	438.0	1 766.4	13 012.8	11 502.7	10 621.2	6 184.7	1 046.5	583.5	31.1	90 434.4
2015	5 766.5	4 845.9	17 111.5	7 727.0	6 974.8	411.6	1 553.0	14 115.2	12 344.2	11 724.8	5 098.1	800.2	495.7	17.0	88 996.3
2016	5 939.9	4 973.6	16 261.8	7 158.7	6 291.9	465.5	1 463.7	14 836.3	10 816.1	11 299.1	5 156.2	788.5	843.1	26.0	86 331.8
2017	5 619.5	4 995.4	17 227.6	7 042.1	7 037.1	783.6	1 375.8	14 030.5	10 905.8	11 806.4	5 563.3	902.9	817.0	27.0	88 146.1
2018	5 285.0	4 618.2	16 938.5	7 346.7	6 330.1	383.8	1 276.8	14 511.0	10 838.6	11 517.4	7 526.7	1 458.0	748.1	21.3	88 809.7
2019	5 047.8	5 230.1	15 845.1	6 950.8	6 312.0	315.7	1 100.2	12 956.9	9 852.7	10 308.8	5 502.3	713.9	543.3	17.8	80 701.3
2020	4 251.1	3 818.4	15 075.7	5 519.2	5 572.0	669.0	697.8	11 153.5	8 698.2	9 458.8	4 250.0	551.6	571.6	13.9	70 301.8
2021	4 101.0	3 725.3	14 882.3	5 591.5	6 018.0	273.8	735.1	11 613.7	10 199.5	11 534.3	4 583.9	583.0	648.3	17.6	74 507.9
All	16 066.0	11 277.8	74 940.7	21 876.4	34 604.5	6 909.8	5 152.2	78 520.8	38 919.0	84 655.9	56 666.4	18 943.6	13 418.1	611.1	462 643.3

Table C10: Estimated aggregate area (km^2) for All Stocks bottom-contacting trawls, by BOMEC class A-O, for 1990–2021. Note: 44.4 km^2 (class K) and 117.5 km^2 (not assigned to a class) are not included in this table. Annual totals are given in Table C1. Year is fishing year.

Year	A	B	C	D	E	F	G	H	I	J	L	M	N	O
1990	261.8	89.0	8 228.8	2 816.8	14 710.7	8 892.2	432.7	20 867.2	11 509.2	25 174.9	13 254.6	1 029.1	2 546.2	22.5
1991	430.4	74.9	6 285.8	1 923.3	29 347.0	4 252.2	877.4	23 864.5	16 567.4	30 070.1	15 137.8	3 194.9	1 600.1	24.6
1992	1 228.7	105.4	10 953.1	2 266.5	25 449.5	3 530.7	687.8	30 339.5	26 002.1	22 019.6	17 725.6	5 088.5	1 708.9	82.2
1993	2 172.4	392.1	12 453.0	2 199.4	32 449.3	1 416.2	1 279.3	30 396.8	27 829.6	28 667.2	8 163.4	3 648.9	2 176.4	63.0
1994	1 854.3	378.9	11 551.7	1 683.6	19 265.3	9 762.1	1 213.1	29 522.8	18 632.8	25 165.7	9 617.4	1 217.5	2 856.0	86.6
1995	2 502.8	364.0	10 848.7	2 055.0	28 572.6	8 453.9	1 878.9	34 086.0	28 188.9	29 967.4	10 428.7	1 753.5	2 012.0	115.5
1996	5 553.6	245.5	13 616.2	2 684.1	25 851.9	9 107.3	4 331.1	35 062.8	33 015.7	25 793.6	12 041.1	1 742.1	1 190.3	117.3
1997	5 746.4	373.5	13 554.6	2 294.4	22 476.9	4 343.6	4 153.2	35 729.2	36 259.5	36 055.5	15 924.5	2 654.0	1 392.8	222.5
1998	5 216.2	245.1	17 653.6	2 792.0	28 361.0	3 018.4	2 589.6	40 824.6	45 869.4	37 432.2	11 436.1	2 821.0	2 126.0	180.7
1999	4 996.6	231.1	16 310.2	1 352.4	28 839.6	1 156.5	2 092.9	39 433.6	42 990.8	31 072.5	7 038.3	2 779.1	2 261.2	127.9
2000	4 513.6	292.1	14 250.8	1 346.2	18 885.8	945.2	2 244.6	37 172.8	41 180.5	33 016.1	14 246.6	3 425.2	1 767.2	111.4
2001	6 336.3	328.6	16 470.0	562.1	20 561.9	912.9	1 644.1	39 578.4	35 631.7	32 711.7	13 336.7	3 552.2	1 442.3	93.6
2002	5 834.2	548.9	17 354.7	1 022.4	19 135.5	2 701.0	1 411.2	37 523.2	32 937.2	30 833.5	18 425.3	8 246.6	1 497.6	97.1
2003	5 095.0	403.3	18 262.1	1 203.6	19 926.6	3 076.2	1 593.9	42 799.6	32 573.6	30 724.7	20 342.1	2 417.9	1 449.4	88.1
2004	6 365.8	350.6	17 396.2	1 071.9	18 404.0	4 563.2	1 899.2	32 975.9	24 993.8	26 544.3	18 176.2	2 783.0	1 467.1	77.3
2005	6 398.7	584.0	19 549.3	946.9	23 616.4	4 591.0	1 858.7	27 525.6	20 313.3	18 917.3	9 767.9	1 967.2	1 456.5	98.6
2006	4 193.7	472.4	17 701.9	983.4	19 099.8	3 394.3	1 068.8	24 652.9	19 420.9	19 072.0	6 816.6	1 386.8	1 014.0	55.4
2007	4 371.6	306.0	18 246.1	890.9	13 914.1	1 888.3	1 154.4	24 297.7	22 147.0	14 422.9	7 310.7	1 430.5	891.1	57.3
2008	12 408.6	9 543.7	30 569.5	12 597.3	13 727.1	2 149.4	2 813.9	25 995.6	18 528.9	16 897.0	6 974.8	1 094.0	966.1	60.4
2009	12 583.9	8 789.0	30 748.0	14 097.6	11 675.1	2 906.6	2 813.9	21 388.3	22 073.1	15 154.0	7 512.0	1 185.0	908.3	36.5
2010	13 524.5	10 410.7	29 714.9	16 031.8	14 702.9	2 202.3	2 856.0	21 705.4	26 170.5	15 971.8	7 043.6	1 498.7	1 006.1	35.4
2011	11 994.5	8 234.8	26 228.3	14 254.5	15 344.8	1 637.0	3 119.5	22 124.7	22 883.6	16 658.7	11 088.8	1 787.1	659.1	31.7
2012	12 064.2	9 719.2	24 774.1	14 555.3	13 488.2	976.8	2 860.8	22 978.1	24 147.6	16 616.4	8 614.4	894.7	606.9	24.4
2013	10 748.1	9 553.2	24 379.0	15 790.0	11 900.3	965.3	3 034.5	20 666.6	26 002.4	14 438.4	7 394.0	651.2	558.4	19.8
2014	11 047.1	9 690.5	24 249.5	15 980.7	12 303.3	524.6	3 329.4	21 928.7	23 063.6	17 749.7	9 774.4	1 604.6	682.3	40.2
2015	9 499.8	8 910.8	24 000.3	13 199.0	11 618.9	639.4	2 657.3	24 152.5	26 117.7	19 153.8	7 400.5	1 085.4	584.7	18.7
2016	9 753.4	8 909.0	21 741.8	13 309.8	10 337.7	997.0	2 641.2	26 655.0	22 171.4	18 527.3	9 259.5	1 015.5	1 036.1	34.2
2017	9 054.7	9 613.6	23 255.1	13 240.3	12 117.8	1 514.2	2 454.1	24 148.3	23 410.8	23 476.0	9 797.4	1 195.8	1 005.5	32.7
2018	8 249.1	7 871.0	23 200.6	12 453.4	11 625.8	523.2	2 203.5	26 520.0	22 734.4	24 032.2	15 382.5	2 607.2	1 056.7	34.2
2019	7 920.4	9 048.5	21 842.9	11 899.8	14 359.7	443.9	1 852.4	23 857.1	22 780.0	16 848.3	10 177.8	965.4	767.1	30.2
2020	6 637.0	6 744.0	21 828.7	9 627.6	14 746.2	1 428.2	1 248.4	19 825.0	20 887.5	15 330.3	9 736.7	684.4	847.1	22.5
2021	6 348.9	6 377.3	21 162.6	10 345.5	11 534.8	423.3	1 377.0	22 064.2	21 937.9	17 424.9	9 300.5	788.6	971.9	22.7
All	214 906.0	129 200.7	608 382.2	217 477.5	588 350.4	93 336.4	67 672.9	910 662.5	838 972.7	745 939.9	358 646.6	68 195.7	42 511.3	2 165.1

Table C11: The number of cells contacted by All Stocks bottom-contacting trawls, by BOMEC class A–O, for 1990–2021. Out gives cells not assigned to a class.

Fishing year	Out	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Total
1990	2	239	97	1 940	627	1 337	300	98	2 017	1 079	2 966	–	1 466	609	765	48	13 588
1991	3	316	83	1 865	583	1 304	389	98	2 162	1 287	3 216	–	1 927	835	654	43	14 762
1992	2	424	114	2 156	623	1 422	355	109	2 530	1 608	2 907	1	2 740	869	631	46	16 535
1993	9	429	197	2 172	699	1 524	288	139	2 800	1 587	3 316	2	1 590	679	627	64	16 113
1994	4	636	240	2 447	641	1 309	296	167	2 610	1 505	3 052	2	1 352	459	804	59	15 579
1995	5	700	258	2 495	610	1 474	309	177	2 913	1 507	3 332	1	1 293	463	736	77	16 345
1996	8	747	123	2 550	686	1 459	328	165	2 792	1 542	3 130	5	1 593	584	768	73	16 545
1997	6	750	145	2 477	526	1 322	272	184	2 755	1 517	3 735	5	1 641	649	846	88	16 912
1998	11	710	173	2 536	566	1 414	256	175	3 200	1 592	4 190	9	1 775	839	925	94	18 454
1999	9	679	185	2 202	451	1 261	251	158	3 063	1 637	4 434	3	1 708	700	1 010	107	17 849
2000	6	555	224	2 224	427	1 303	246	133	3 098	1 599	4 122	9	2 157	954	944	101	18 096
2001	2	681	147	2 629	340	1 203	231	154	3 252	1 562	3 489	–	2 450	1 045	875	87	18 145
2002	–	705	288	2 839	395	1 209	290	155	3 301	1 593	3 359	2	3 275	1 465	895	108	19 879
2003	1	698	255	2 923	447	1 194	243	142	3 466	1 525	3 396	7	2 798	991	811	86	18 982
2004	4	725	207	2 798	435	1 082	244	134	2 940	1 456	3 353	5	2 369	989	805	82	17 624
2005	3	703	240	2 821	382	1 107	213	137	3 071	1 364	3 078	–	1 759	1 203	916	81	17 075
2006	–	631	290	2 839	325	1 258	272	142	3 250	1 377	3 007	2	1 138	734	747	73	16 085
2007	3	686	269	2 904	342	1 214	239	157	3 231	1 336	2 826	–	1 080	702	692	75	15 753
2008	36	1 024	537	3 330	1 115	1 407	239	247	3 385	1 354	3 270	7	1 072	591	845	80	18 503
2009	34	1 036	533	3 359	1 106	1 395	288	243	3 081	1 343	3 058	1	1 140	649	793	65	18 090
2010	46	1 030	536	3 321	1 109	1 449	312	251	2 957	1 331	3 083	1	1 165	575	834	72	18 026
2011	39	1 017	538	3 305	1 123	1 319	279	259	3 007	1 257	2 672	3	1 340	655	730	74	17 578
2012	39	1 031	527	3 280	1 125	1 325	234	255	2 922	1 345	2 776	1	1 209	451	603	48	17 132
2013	43	997	539	3 288	1 119	1 268	215	257	2 686	1 338	2 609	1	1 035	290	584	42	16 268
2014	41	1 007	534	3 308	1 137	1 268	223	256	2 833	1 348	2 971	11	1 329	350	663	70	17 308
2015	40	972	533	3 173	1 135	1 380	142	255	2 941	1 271	3 419	9	1 240	291	578	48	17 387
2016	42	978	531	3 176	1 095	1 330	164	241	2 936	1 294	3 344	10	1 223	381	796	57	17 556
2017	38	985	531	3 269	1 087	1 327	192	244	2 822	1 273	3 313	10	1 310	360	748	49	17 520
2018	39	956	532	3 214	1 092	1 142	168	250	2 805	1 309	3 093	10	1 453	450	643	39	17 156
2019	26	925	533	3 111	1 068	1 215	141	235	2 625	1 137	2 918	1	1 091	298	571	47	15 916
2020	12	782	497	2 876	958	1 070	160	173	2 236	1 054	2 845	–	830	206	434	37	14 158
2021	5	803	494	2 965	986	1 152	119	191	2 314	1 147	3 007	1	898	239	404	32	14 752
All	83	1 117	542	3 599	1 207	2 321	827	263	5 083	2 010	9 172	25	5 653	3 860	4 243	440	40 362

Table C12: The estimated footprint (km^2) for All Stocks during 1990–2021and 2021 by the surficial layers representing the percent of carbonate, gravel, mud, and sand. 'unk' is where there was no overlap.

	1990–2021 footprint (km^2)					2021 footprint (km^2)				
Sediment (%)	Carbonate	Gravel	Mud	Sand	Sediment (%)	Carbonate	Gravel	Mud	Sand	
0–20	87 832.7	363 062.6	150 319.8	41 267.0	20 594.4	61 133.3	23 566.7	6 409.7	20 594.4	
20–40	136 761.8	70 547.0	112 756.7	92 363.1	25 339.0	10 739.5	16 881.6	15 044.5	25 339.0	
40–60	92 476.7	20 075.3	104 348.6	167 339.6	11 870.9	2 020.7	18 810.1	25 968.3	11 870.9	
60–80	65 722.5	5 896.2	64 925.8	122 337.8	8 557.7	197.9	10 930.3	18 998.8	8 557.7	
80–100	78 563.8	1 568.5	28 834.3	38 060.2	8 145.4	416.1	4 318.7	8 086.1	8 145.4	
unk	1 285.9	1 493.7	1 458.1	1 275.7	0.5	0.5	0.5	0.5	0.5	
Total	462 643.4	462 643.3	462 643.3	462 643.4	74 507.9	74 508.0	74 507.9	74 507.9	74 507.9	

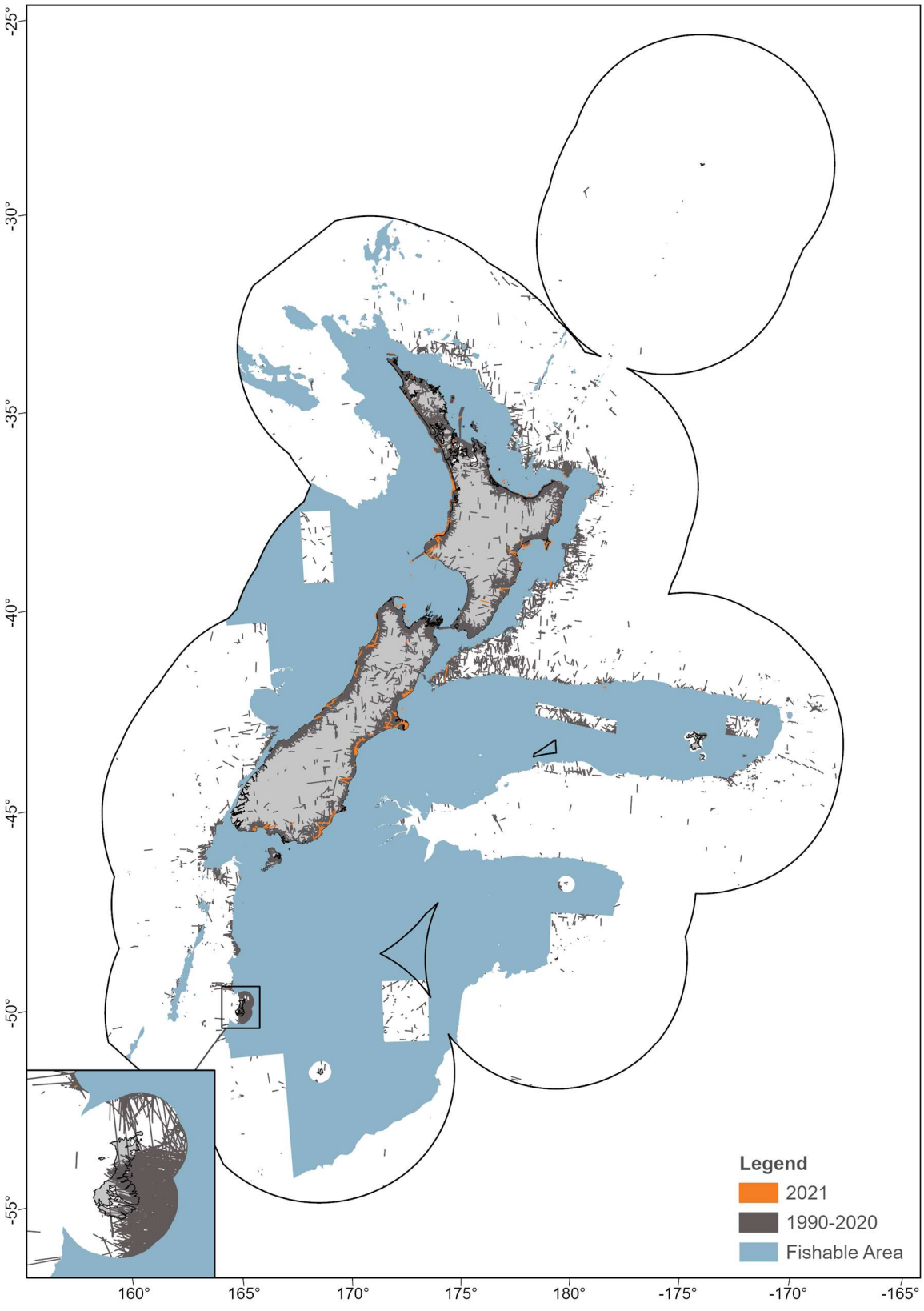

Figure C1: Tows and portions of tows either completely or partially removed from the footprint analyses, for 1990–2021 fishing years combined, and for 2021. The coastline is defined by a blue line. The inset shows where portions of tows that are outside the fishable area are removed from the footprint analyses; these tows cross the marine mammal sanctuary extent (12 n. miles beyond land, established in 1978) and the Auckland Islands.

APPENDIX D: DEEPWATER STOCKS SUMMARY

Table D1: Percent of deepwater tows by data collection method, the number of tows, and number of vessels (based on unique vessel key), by deepwater stock and fishing year for 1990–2021. ERS is Electronic Reporting System, TCE is Trawl Catch Effort Return, and TCP is Trawl Catch Effort Processing Return.

	Tier 1					Tier 2					Tier 1 & Tier 2
Fishing year	ERS (%)	TCE (%)	TCP (%)	No. tows	No. vessels	ERS (%)	TCE (%)	TCP (%)	No. tows	No. vessels	No. vessels
1990	–	–	100.0	30 803	127	–	–	100.0	3 358	50	127
1991	–	–	100.0	39 412	147	–	–	100.0	2 884	54	148
1992	–	–	100.0	42 806	150	–	–	100.0	2 644	59	150
1993	–	–	100.0	43 276	136	–	–	100.0	3 261	61	137
1994	–	–	100.0	43 962	142	–	–	100.0	2 812	69	147
1995	–	–	100.0	44 961	154	–	–	100.0	4 180	77	157
1996	–	–	100.0	46 231	147	–	–	100.0	4 136	84	154
1997	–	–	100.0	50 255	157	–	–	100.0	3 313	73	165
1998	–	–	100.0	55 396	147	–	–	100.0	2 824	71	149
1999	–	–	100.0	50 752	131	–	–	100.0	2 761	71	136
2000	–	–	100.0	47 591	100	–	–	100.0	3 067	58	109
2001	–	–	100.0	45 720	99	–	–	100.0	2 901	58	102
2002	–	–	100.0	46 703	97	–	–	100.0	3 415	57	103
2003	–	–	100.0	45 327	94	–	–	100.0	3 957	55	101
2004	–	–	100.0	39 807	92	–	–	100.0	2 586	50	95
2005	–	–	100.0	36 411	81	–	–	100.0	3 464	57	87
2006	–	–	100.0	32 922	77	–	–	100.0	4 005	54	80
2007	–	–	100.0	29 187	70	–	–	100.0	4 147	50	72
2008	–	4.8	95.2	28 727	94	–	32.6	67.4	5 173	81	112
2009	–	4.1	95.9	25 439	89	–	29.6	70.4	4 266	80	106
2010	–	5.3	94.7	26 453	95	–	31.9	68.1	4 110	88	114
2011	–	4.9	95.1	24 449	93	–	31.8	68.2	3 837	90	116
2012	–	5.5	94.5	23 683	92	–	33.4	66.6	3 530	79	104
2013	–	6.5	93.5	22 856	87	–	49.0	51.0	3 048	78	101
2014	–	7.5	92.5	23 460	87	–	41.4	58.6	3 446	82	104
2015	–	7.1	92.9	23 430	89	–	36.9	63.1	3 260	78	103
2016	–	7.1	92.9	24 155	96	–	36.6	63.4	2 958	73	105
2017	–	6.1	93.9	23 553	90	–	29.3	70.7	2 850	73	97
2018	75.8	5.6	18.6	24 140	87	52.5	39.7	7.7	2 471	62	95
2019	85.6	3.5	11.0	23 613	85	73.2	26.7	0.1	2 521	60	89
2020	100.0	0.0	0.0	23 241	82	99.8	0.2	0.0	3 173	54	89
2021	100.0	0.0	0.0	22 409	78	100.0	0.0	0.0	3 028	53	81
Total	7.6	1.5	90.9	1 111 130	549	8.7	13.4	77.9	107 386	363	570

Table D2: Total number of bottom-contacting Tier 1 tows and percentage by target species, for each fishing year during 1990–2021. Target species codes are defined in Table 1.

Fishing year	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Total Tier 1 tows
1990	243	8 130	2 227	700	2 096	5 915	961	2 229	8 302	30 803
1991	68	13 368	1 591	1 009	2 566	4 950	1 381	4 167	10 312	39 412
1992	552	15 667	2 712	657	1 278	6 326	2 362	5 760	7 492	42 806
1993	979	16 798	2 661	553	1 991	7 181	486	5 318	7 309	43 276
1994	572	13 480	2 823	428	1 617	10 064	447	5 168	9 363	43 962
1995	758	17 549	2 060	241	1 713	8 418	187	3 869	10 166	44 961
1996	531	21 854	2 018	388	2 931	5 164	352	3 482	9 511	46 231
1997	478	25 362	1 615	333	3 397	5 274	341	3 576	9 879	50 255
1998	460	27 808	3 286	331	3 063	8 286	813	3 450	7 899	55 396
1999	705	24 232	2 526	362	3 180	7 674	782	4 051	7 240	50 752
2000	421	25 293	1 699	467	3 203	6 043	553	4 603	5 309	47 591
2001	563	23 924	1 593	308	3 076	4 175	460	4 774	6 847	45 720
2002	811	22 090	2 376	414	2 621	3 980	833	6 540	7 038	46 703
2003	908	21 729	2 502	382	2 399	4 450	361	4 542	8 054	45 327
2004	1 620	17 209	1 876	369	2 221	4 412	471	3 693	7 936	39 807
2005	1 411	11 318	1 894	665	2 295	4 265	399	4 642	9 522	36 411
2006	1 255	9 219	2 251	999	1 986	4 254	315	4 864	7 779	32 922
2007	1 223	8 461	2 005	1 346	2 100	3 757	342	5 131	4 822	29 187
2008	1 533	7 893	1 974	2 021	2 439	3 651	429	4 801	3 986	28 727
2009	1 700	7 116	1 588	1 172	2 158	3 511	613	3 964	3 617	25 439
2010	812	8 553	1 908	996	2 532	2 897	739	4 245	3 771	26 453
2011	798	8 365	1 259	953	1 891	1 859	694	4 443	4 187	24 449
2012	644	8 992	1 524	836	1 653	1 563	495	4 503	3 473	23 683
2013	680	9 393	1 383	1 001	1 264	1 586	389	4 535	2 625	22 856
2014	779	10 367	1 333	964	1 245	1 992	311	4 421	2 048	23 460
2015	932	10 177	955	984	1 259	2 315	454	4 421	1 933	23 430
2016	479	9 503	897	974	785	3 102	348	5 205	2 862	24 155
2017	535	9 977	786	1 010	681	2 963	307	4 704	2 590	23 553
2018	247	10 818	923	994	841	2 817	341	4 346	2 813	24 140
2019	161	8 681	862	1 186	797	2 884	394	4 375	4 273	23 613
2020	260	6 982	1 076	1 332	727	3 061	126	4 561	5 116	23 241
2021	263	6 940	1 027	1 288	844	3 045	248	4 933	3 821	22 409
All	23 381	447 248	57 210	25 663	62 849	141 834	17 734	143 316	191 895	1 111 130

Table D3: Total number of bottom-contacting Tier 2 tows and percentage by target species, for each fishing year during 1990–2021. Target species codes are defined in Table 1.

	BAR	BYX	CDL	EMA	FRO	GSH	LDO	PRK	PTO	RBT	RBY	RIB	SKI	SPD	SPE	SWA	WWA	All
1990	51.7	6.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	4.5	0.9	0.4	27.8	5.4	3 358
1991	51.8	8.5	13.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	2.0	1.0	0.5	20.9	1.5	2 884
1992	45.5	13.0	6.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.5	0.0	3.9	0.3	1.2	27.4	0.6	2 644
1993	45.7	11.3	5.7	0.0	0.2	0.0	0.3	0.1	0.0	0.0	2.2	0.0	4.7	0.0	1.2	28.6	0.1	3 261
1994	37.3	17.5	10.6	0.2	0.0	0.0	0.1	0.0	0.0	0.0	1.8	0.0	0.7	0.0	1.6	30.2	0.0	2 812
1995	42.4	15.8	11.7	0.0	0.7	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.3	0.0	1.0	25.9	0.1	4 180
1996	39.8	16.1	20.6	0.0	0.0	0.0	0.0	0.0	0.8	0.0	1.7	0.0	0.5	0.0	0.4	20.1	0.0	4 136
1997	37.5	21.6	25.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.8	0.2	0.3	13.0	0.0	3 313
1998	38.3	20.7	24.1	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.4	0.0	1.6	12.9	0.2	2 824
1999	27.8	26.8	28.7	1.7	4.1	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.1	7.0	2.2	2 761
2000	26.1	25.8	31.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.5	0.0	0.0	11.2	2.4	3 067
2001	32.7	25.1	22.3	0.0	2.5	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.1	9.8	3.2	2 901
2002	30.1	16.5	22.1	0.0	2.2	0.0	0.8	0.0	0.0	0.0	2.5	0.0	0.0	1.1	2.4	15.6	6.9	3 415
2003	24.3	23.1	28.2	0.2	0.1	0.0	0.1	0.0	0.0	0.0	1.2	0.0	0.5	0.0	7.6	6.1	8.5	3 957
2004	23.6	28.8	22.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.1	0.1	5.3	4.8	11.9	2 586
2005	22.4	28.3	22.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	3.4	0.2	0.0	0.2	0.3	11.7	10.2	3 464
2006	14.4	32.2	24.5	0.9	0.3	0.0	0.0	0.0	0.0	0.3	3.8	0.3	0.0	1.0	0.8	15.4	6.2	4 005
2007	23.0	20.0	24.8	0.3	0.1	0.0	0.0	0.0	0.0	0.1	2.7	0.0	0.0	0.3	4.2	19.3	5.2	4 147
2008	42.4	12.5	10.4	0.3	0.0	0.0	0.5	0.0	0.0	0.1	1.9	0.0	0.2	3.2	2.4	21.8	4.3	5 173
2009	30.8	18.2	9.4	0.6	0.0	0.0	0.2	0.0	0.0	0.4	1.5	0.0	0.2	5.6	0.7	24.8	7.6	4 266
2010	24.8	22.6	12.7	0.0	0.0	0.0	0.9	0.0	0.0	0.2	4.8	0.0	0.4	6.3	3.8	18.4	5.0	4 110
2011	24.0	22.8	10.1	0.1	0.0	0.0	1.5	0.0	0.0	0.1	4.5	0.0	1.9	3.9	5.8	22.3	3.0	3 837
2012	32.8	22.1	10.5	0.7	0.0	0.1	1.3	0.0	0.0	0.6	3.2	0.0	2.3	3.2	1.3	17.4	4.3	3 530
2013	36.6	8.4	7.3	0.2	0.0	0.4	3.5	0.0	0.0	1.3	3.8	0.0	2.4	1.7	6.3	23.0	5.1	3 048
2014	34.3	15.2	9.0	0.0	0.1	0.1	1.3	0.0	0.0	1.0	3.3	0.0	1.1	2.1	4.2	21.3	7.1	3 446
2015	35.7	15.8	5.8	0.0	0.1	0.0	2.2	0.0	0.0	0.5	3.2	0.0	1.4	2.6	10.0	19.5	3.1	3 260
2016	34.9	14.1	4.9	0.0	0.4	0.1	2.2	0.0	0.0	0.2	8.5	0.0	1.4	0.0	10.1	19.9	3.5	2 958
2017	39.0	16.0	4.1	0.0	0.4	0.0	1.5	0.0	0.0	0.5	4.9	0.0	0.7	0.0	7.7	21.3	3.9	2 850
2018	37.2	12.5	3.3	0.0	0.5	0.0	2.2	0.0	0.0	0.1	4.0	0.1	0.5	0.0	11.9	24.0	3.5	2 471
2019	38.4	20.9	6.9	0.6	0.9	0.0	1.4	0.0	0.0	0.2	3.5	0.0	0.2	0.0	11.2	13.4	2.6	2 521
2020	61.5	12.8	4.1	0.0	0.0	0.0	1.6	0.0	0.0	0.1	2.8	0.0	0.1	0.0	8.2	7.6	1.2	3 173
2021	56.1	13.6	5.2	0.1	0.1	0.0	2.0	0.0	0.0	0.0	1.7	0.0	0.3	0.0	6.6	12.7	1.5	3 028
All	35.3	18.3	14.3	0.2	0.4	0.0	0.7	0.0	0.0	0.2	2.7	0.0	1.0	1.2	3.5	18.2	3.9	107 386

Table D4: The annual number of cells contacted and the estimated aggregate and footprint areas for Deepwater Tier 1 and Tier 2 fishstocks combined, within the fishable area, for 1990–2021.

	Contacted cells			Aggregate area			Footprint		
Fishing year	No.	Tier 1 (%)	Tier 2 (%)	Area (km2)	Tier 1 (%)	Tier 2 (%)	Area (km2)	Tier 1 (%)	Tier 2 (%)
1990	12 235	93.3	25.0	101 379.8	88.8	11.2	47 426.1	88.3	17.1
1991	13 153	94.9	19.3	125 970.8	93.8	6.2	54 833.1	93.5	10.4
1992	14 432	95.4	17.6	136 924.7	94.0	6.0	66 415.2	94.4	8.9
1993	13 830	93.7	21.1	139 786.8	92.7	7.3	66 852.2	93.4	10.4
1994	13 105	93.8	20.3	121 675.8	93.3	6.7	56 804.3	94.5	9.6
1995	13 416	92.5	25.9	144 372.1	92.0	8.0	61 740.7	92.8	12.2
1996	13 476	91.5	23.0	143 830.8	93.7	6.3	62 436.4	93.9	10.1
1997	13 812	95.4	16.7	154 842.7	96.4	3.6	68 468.5	96.3	6.2
1998	15 258	95.8	15.2	171 108.8	97.0	3.0	76 682.6	97.2	5.1
1999	14 866	95.6	14.8	155 926.6	97.1	2.9	72 080.2	97.6	4.8
2000	15 244	95.2	13.7	149 922.4	96.9	3.1	73 761.9	97.1	4.7
2001	15 278	94.1	15.7	150 121.9	96.9	3.1	75 852.4	96.5	4.8
2002	17 024	92.1	18.7	154 289.3	96.2	3.8	80 638.4	95.7	6.0
2003	15 940	92.9	18.5	156 160.2	95.7	4.3	80 301.4	95.1	6.4
2004	14 051	94.2	14.4	130 890.6	97.1	2.9	67 496.9	96.3	4.6
2005	13 367	94.1	18.0	110 290.8	94.7	5.3	54 011.8	94.3	8.4
2006	12 429	93.7	20.9	94 642.2	93.5	6.5	49 846.4	93.8	9.7
2007	12 121	91.4	26.7	87 788.7	91.1	8.9	50 070.0	91.2	12.5
2008	13 166	83.3	36.3	85 013.1	87.6	12.4	50 747.1	85.7	16.9
2009	12 307	84.3	31.9	78 948.5	89.3	10.7	45 932.8	87.4	14.9
2010	12 469	85.1	32.9	87 134.8	92.1	7.9	49 625.5	90.1	12.2
2011	12 004	82.6	35.0	86 861.1	91.8	8.2	48 569.5	89.3	12.8
2012	11 417	83.1	33.0	85 460.1	92.6	7.4	46 641.0	90.2	11.8
2013	10 710	83.1	32.6	79 595.4	91.6	8.4	44 616.2	89.2	12.9
2014	11 738	81.8	34.3	82 085.1	91.7	8.3	47 305.2	90.0	12.4
2015	11 506	84.1	30.9	85 257.5	92.0	8.0	47 986.2	90.9	11.4
2016	11 578	84.8	30.7	84 131.3	93.3	6.7	46 526.4	91.1	10.4
2017	11 503	84.3	30.2	88 846.2	93.1	6.9	46 750.9	91.3	10.5
2018	11 034	87.3	27.9	96 217.8	94.1	5.9	47 782.0	92.1	9.6
2019	10 273	84.8	27.9	85 911.3	93.6	6.4	43 566.8	92.7	9.2
2020	9 505	84.9	29.2	81 763.7	92.1	7.9	40 235.0	89.8	12.3
2021	10 098	83.9	28.8	80 996.5	93.4	6.6	43 633.7	91.2	10.1
All	37 983	96.0	40.6	3 618 147.4	93.9	6.1	355 701.6	92.4	21.6

Table D5: Estimated footprint (km^2) for Deepwater Tier 1 bottom-contacting trawls, by target, for 1990–2021. Codes are defined in Table 1.

Fishing year	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
1990	628.5	16 769.1	7 310.8	2 033.7	2 079.4	5 560.6	1 670.0	1 181.3	6 544.0	41 885.6
1991	250.5	26 747.4	5 857.8	2 619.2	1 594.1	3 786.8	2 505.6	2 221.0	7 941.6	51 267.6
1992	1 604.8	33 103.3	8 746.3	2 080.0	783.0	3 277.3	5 212.2	3 866.4	7 091.0	62 718.8
1993	2 392.0	35 216.0	8 466.8	1 797.0	1 077.6	3 677.4	1 067.3	3 882.2	7 390.1	62 455.0
1994	1 681.1	26 469.8	8 631.6	1 432.5	1 290.0	4 504.5	743.7	3 924.8	7 667.9	53 662.6
1995	1 362.7	34 678.7	6 089.4	837.2	985.3	3 860.5	405.2	3 199.0	9 527.3	57 314.9
1996	1 286.1	36 522.7	6 457.4	1 306.3	1 623.5	2 698.4	678.7	2 791.1	8 480.8	58 619.2
1997	1 428.5	42 749.8	4 801.0	1 074.8	1 923.1	3 885.7	844.3	3 022.0	9 415.2	65 961.6
1998	1 454.1	48 153.2	7 486.4	1 151.5	1 468.5	5 605.6	1 740.3	3 004.1	7 888.8	74 504.5
1999	1 645.2	44 769.0	5 682.8	1 099.9	2 193.1	6 284.5	1 512.4	3 338.3	7 097.5	70 334.4
2000	1 566.8	48 907.4	4 087.5	1 519.5	2 060.0	4 451.6	1 210.5	3 805.7	7 521.1	71 622.8
2001	1 787.2	50 558.8	3 797.9	1 177.6	1 421.0	3 109.9	1 167.5	3 734.3	9 230.6	73 209.6
2002	2 473.0	50 726.7	5 905.9	1 294.1	1 419.7	3 122.3	2 404.6	4 594.3	7 802.8	77 172.8
2003	2 929.4	51 754.4	5 980.5	1 086.4	960.8	2 802.7	659.6	4 336.4	8 490.3	76 350.4
2004	3 912.1	41 010.8	4 320.7	1 028.9	1 164.8	3 736.5	838.2	4 055.6	7 424.0	64 997.6
2005	3 803.6	25 748.1	4 644.5	1 753.6	1 601.3	2 957.9	758.1	3 797.1	8 112.9	50 914.0
2006	2 902.4	21 383.2	5 494.7	2 479.5	1 226.0	2 648.5	653.1	4 171.5	7 780.7	46 741.7
2007	3 226.5	20 088.5	5 648.0	3 249.4	1 195.6	2 549.7	719.5	4 373.9	6 386.0	45 642.3
2008	4 353.7	18 025.5	5 631.5	4 858.8	922.1	2 039.4	852.1	4 352.2	4 177.1	43 511.5
2009	3 926.5	18 529.4	4 505.9	2 490.2	989.4	2 548.9	1 113.1	3 681.5	4 256.2	40 148.6
2010	1 844.2	23 159.9	5 431.4	1 823.7	1 066.5	2 476.8	1 484.9	3 863.2	4 769.2	44 721.5
2011	2 294.3	24 283.0	4 008.7	1 525.7	810.1	1 026.9	1 438.6	4 261.1	5 411.9	43 392.4
2012	1 991.4	24 553.9	4 582.7	1 534.3	707.0	811.6	1 041.4	4 182.9	4 261.0	42 075.8
2013	1 581.3	24 124.4	4 288.5	1 096.9	537.6	891.8	845.9	4 098.7	3 427.2	39 816.5
2014	2 002.8	26 704.1	4 011.9	1 587.4	458.6	1 297.7	656.6	4 073.6	2 980.1	42 573.4
2015	2 440.9	27 667.2	2 947.3	1 171.2	570.0	2 168.9	943.8	4 013.1	2 956.5	43 621.6
2016	1 451.8	25 222.9	2 818.3	1 667.0	396.0	2 838.1	851.8	4 824.6	3 369.8	42 394.0
2017	1 236.9	26 195.3	2 584.7	1 360.8	303.6	3 561.4	585.7	4 632.9	3 516.9	42 687.3
2018	595.5	28 960.5	2 682.8	1 410.7	376.5	2 886.1	726.6	4 545.4	3 019.1	44 010.9
2019	373.3	24 279.3	2 815.5	1 643.3	288.9	2 983.2	752.9	4 521.9	3 907.5	40 376.7
2020	753.1	18 436.1	2 907.2	1 983.2	347.1	3 851.2	233.0	4 482.0	4 182.6	36 117.0
2021	733.5	20 497.9	2 818.9	1 600.6	285.0	5 427.4	547.0	4 610.0	4 102.5	39 813.1

Table D6: Estimated aggregate area (km^2) for Deepwater Tier 1 bottom-contacting trawls, by target, for 1990–2021. Codes are defined in Table 1.

Fishing year	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
1990	942.2	30 557.5	9 293.8	2 704.1	2 563.8	8 609.4	2 266.3	2 161.4	30 948.5	90 047.1
1991	279.5	52 420.5	7 338.5	3 887.4	2 014.7	5 341.5	3 174.5	4 983.5	38 712.0	118 152.2
1992	2 577.6	58 802.0	11 918.8	2 619.6	1 079.5	4 896.7	6 311.2	7 595.6	32 897.5	128 698.5
1993	5 107.7	63 414.6	12 208.9	2 161.2	1 431.0	5 737.2	1 176.1	6 712.6	31 624.5	129 573.8
1994	2 450.9	47 445.3	11 523.7	1 765.9	1 732.4	7 517.0	827.5	7 257.9	32 945.8	113 466.4
1995	2 572.3	67 311.1	7 890.1	963.4	1 218.9	6 376.5	417.9	5 209.4	40 809.9	132 769.5
1996	1 733.7	75 772.2	8 577.8	1 511.3	2 107.4	3 551.7	734.0	4 554.2	36 216.0	134 758.3
1997	2 002.1	91 935.5	5 901.6	1 202.9	2 763.3	5 022.2	944.7	4 965.9	34 588.1	149 326.2
1998	1 694.3	107 491.2	11 692.7	1 268.6	1 795.8	7 538.5	2 023.5	4 813.1	27 650.1	165 967.8
1999	2 059.3	92 137.8	8 475.2	1 212.8	2 856.4	8 348.9	1 737.0	5 509.4	29 084.4	151 421.0
2000	1 870.9	97 518.0	5 789.3	1 680.9	2 672.9	5 604.6	1 366.8	7 030.8	21 715.3	145 249.4
2001	2 251.1	94 797.7	5 097.0	1 307.8	1 720.9	3 899.0	1 282.1	7 291.5	27 849.0	145 496.1
2002	4 101.1	90 397.9	7 765.8	1 488.9	1 686.6	3 786.7	2 636.2	10 231.5	26 270.2	148 364.9
2003	4 086.3	93 124.5	8 130.3	1 267.9	1 134.4	3 570.3	780.5	7 886.7	29 541.5	149 522.4
2004	7 755.4	69 804.4	6 011.7	1 172.9	1 389.9	4 885.0	1 056.2	7 108.0	27 954.0	127 137.4
2005	6 007.5	43 604.1	6 343.8	2 232.3	1 784.5	4 023.9	860.1	6 814.6	32 783.3	104 454.2
2006	5 067.9	36 349.8	7 019.4	3 450.8	1 490.3	3 411.0	716.6	7 151.3	23 853.4	88 510.6
2007	4 395.4	34 354.7	7 072.2	4 291.9	1 412.7	3 224.1	815.7	7 573.7	16 819.0	79 959.4
2008	6 945.4	29 875.2	6 606.3	6 365.4	1 227.8	2 459.1	979.2	7 965.4	12 071.4	74 495.1
2009	6 424.8	32 717.1	5 263.8	3 315.8	1 208.0	3 016.2	1 213.5	6 416.9	10 948.1	70 524.2
2010	3 078.9	42 375.8	6 989.9	2 241.7	1 351.2	2 934.6	1 648.6	7 406.4	12 204.7	80 231.8
2011	3 520.0	43 362.8	4 845.6	1 975.4	978.1	1 230.1	1 700.8	8 070.1	14 068.3	79 751.1
2012	3 127.7	45 418.2	5 734.3	1 964.2	871.9	984.4	1 134.1	7 680.2	12 258.3	79 173.3
2013	2 138.7	44 780.2	5 139.7	1 978.7	643.5	1 098.5	1 012.6	7 520.5	8 559.9	72 872.2
2014	2 692.9	48 746.0	4 804.3	2 390.9	538.3	1 509.5	747.3	7 265.7	6 617.7	75 312.6
2015	3 622.6	51 096.9	3 536.7	1 946.1	690.9	2 743.7	1 081.7	7 516.8	6 197.0	78 432.4
2016	1 833.8	48 137.8	3 250.3	2 278.0	458.2	3 613.5	942.1	9 506.2	8 473.0	78 493.0
2017	1 788.8	53 563.1	2 970.8	1 920.3	333.6	4 259.2	643.8	8 419.8	8 804.9	82 704.4
2018	690.1	61 556.2	3 285.6	2 058.1	469.7	3 625.0	801.8	8 246.1	9 835.6	90 568.3
2019	415.1	46 856.3	3 292.3	2 552.5	353.1	3 731.4	852.9	8 224.8	14 123.6	80 402.0
2020	887.5	36 930.1	3 633.8	3 261.7	428.6	4 962.0	247.6	8 435.0	16 521.4	75 307.5
2021	830.1	39 406.2	3 522.8	2 675.0	354.2	6 899.7	609.9	9 576.4	11 793.8	75 668.0
All	94 951.7	1 872 060.2	210 926.7	73 114.2	42 762.5	138 411.3	42 742.9	227 101.3	694 740.3	3 396 811.2

Table D7: The number of 25-km^2 cells contacted by Deepwater Tier 1 bottom-contacting trawls, by target, for 1990–2021. Codes are defined in Table 1.

Fishing year	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
1990	451	4 453	2 284	1 070	1 040	2 080	589	774	1 814	11 410
1991	185	5 848	1 830	1 243	1 055	1 807	815	979	2 143	12 483
1992	726	6 154	2 118	1 239	511	1 551	2 135	1 525	1 724	13 764
1993	828	6 629	2 032	933	629	1 699	689	1 826	1 767	12 963
1994	498	5 791	2 150	736	727	2 141	532	1 322	2 196	12 299
1995	509	6 904	2 051	613	639	1 785	454	1 274	2 571	12 407
1996	493	6 777	2 070	758	940	1 586	541	1 098	2 138	12 335
1997	537	7 556	1 807	720	1 182	1 815	505	1 028	2 307	13 176
1998	736	8 002	2 233	845	1 104	2 475	657	1 282	2 114	14 623
1999	858	6 965	1 667	705	1 295	2 725	851	1 544	1 923	14 218
2000	700	8 003	1 549	1 006	1 204	2 389	569	1 194	2 367	14 514
2001	790	8 785	1 290	796	1 096	1 605	617	1 010	2 356	14 371
2002	857	8 682	1 845	753	1 089	1 638	1 214	1 371	2 059	15 680
2003	937	8 556	2 007	741	859	1 490	405	1 205	2 222	14 806
2004	894	7 693	1 393	576	950	1 679	422	955	1 722	13 240
2005	973	5 672	1 454	889	1 414	1 650	492	1 303	1 785	12 583
2006	726	4 328	1 773	1 243	1 124	1 406	409	1 261	2 111	11 650
2007	1 079	3 923	1 719	1 497	1 179	1 248	417	1 147	1 676	11 084
2008	1 009	4 131	1 676	2 068	892	1 265	364	1 069	1 181	10 972
2009	1 093	3 811	1 551	1 331	890	1 421	657	965	1 039	10 371
2010	502	3 973	1 497	1 422	853	1 419	726	1 024	1 278	10 614
2011	592	4 336	1 400	1 104	752	821	598	1 055	1 267	9 914
2012	465	4 308	1 352	872	671	753	637	942	1 137	9 486
2013	499	4 318	1 421	735	489	698	337	1 015	856	8 905
2014	570	4 625	1 488	872	469	1 112	318	1 080	751	9 602
2015	608	4 746	1 139	707	476	1 333	385	1 051	836	9 674
2016	474	4 300	1 151	868	473	1 691	465	1 117	1 072	9 819
2017	379	4 401	1 061	775	419	1 708	368	1 087	1 058	9 702
2018	282	4 588	1 101	866	436	1 508	355	1 211	759	9 633
2019	269	3 886	1 118	781	411	1 545	334	999	906	8 712
2020	282	3 091	1 016	847	395	1 809	174	726	1 027	8 068
2021	382	3 259	1 158	670	420	1 850	246	681	970	8 477
All	4 426	21 059	6 196	6 784	5 616	9 155	4 014	6 265	7 853	36 466

Table D8: Estimated footprint (km^2) for Deepwater Tier 2 bottom-contacting trawls, by target, for 1990–2021. Codes are defined in Table 2. Not included in the table: 6.0 km^2 for PRK, 73.7 km^2 for PTO.

Fishing year	BAR	BYX	CDL	EMA	FRO	GSH	LDO	RBT	RBY	RIB	SKI	SPD	SPE	SWA	WWA	Tier 2
1990	4 735.9	81.3	43.6	–	5.0	2.2	–	–	12.3	–	503.1	110.8	30.9	2 636.4	492.8	8 088.8
1991	3 213.8	53.5	130.9	36.0	11.0	–	–	–	5.7	–	213.8	97.0	34.8	2 006.2	155.6	5 679.6
1992	3 274.1	156.9	92.0	0.7	7.2	–	–	0.4	29.8	–	434.5	27.0	26.1	2 033.5	47.9	5 928.2
1993	3 512.5	271.1	96.4	4.1	39.8	–	28.9	–	36.0	–	403.7	–	24.7	2 794.3	8.1	6 978.2
1994	2 466.7	313.6	186.0	29.7	0.4	–	5.1	–	24.0	–	66.1	–	30.4	2 466.5	–	5 432.9
1995	4 052.4	295.3	138.5	–	98.7	–	–	–	56.2	–	37.4	–	25.1	3 154.9	9.1	7 502.5
1996	3 425.7	249.2	269.2	–	–	–	–	–	26.4	–	86.1	5.8	14.5	2 404.0	–	6 317.9
1997	2 508.6	252.3	173.0	49.3	–	–	–	–	24.2	–	101.2	17.7	30.5	1 123.1	3.0	4 238.3
1998	2 403.5	237.3	248.4	–	73.3	–	–	–	50.4	–	38.3	–	79.3	852.5	12.6	3 945.4
1999	1 869.5	247.7	392.1	125.0	257.5	–	–	–	60.6	–	–	–	5.1	543.1	78.1	3 467.1
2000	1 698.7	247.2	427.1	–	32.4	–	–	–	76.0	–	52.9	–	–	900.8	106.8	3 442.2
2001	1 846.2	212.3	221.3	–	236.2	–	–	–	119.4	–	–	–	6.8	910.7	168.2	3 613.6
2002	2 245.5	159.7	186.2	–	231.1	1.8	49.2	–	61.4	–	–	93.2	297.2	1 384.4	304.1	4 828.4
2003	2 193.0	221.7	255.8	11.7	9.9	–	7.2	–	28.3	–	123.7	–	1 259.0	780.0	345.7	5 172.3
2004	1 478.0	201.6	133.9	–	10.5	–	–	–	53.3	–	15.8	16.3	652.4	314.9	301.6	3 138.4
2005	2 097.6	281.5	176.5	27.3	5.9	–	–	0.9	57.5	38.4	–	38.0	41.0	1 478.3	413.5	4 518.2
2006	1 411.6	357.7	199.0	84.0	38.5	–	–	40.0	73.9	60.3	2.2	125.1	166.0	1 972.3	386.2	4 824.1
2007	2 220.8	290.4	252.9	26.5	8.7	1.5	–	3.2	91.1	–	–	42.7	638.8	2 520.0	292.6	6 238.3
2008	3 854.1	263.4	158.6	46.7	–	–	72.5	21.5	76.5	–	21.2	130.5	420.6	3 431.8	245.0	8 564.8
2009	2 603.1	212.2	110.9	52.5	–	–	13.0	43.0	41.0	–	37.5	224.1	45.3	3 199.5	323.7	6 825.0
2010	1 986.9	349.5	169.5	1.5	–	–	83.8	28.2	152.6	–	32.5	244.5	242.5	2 485.4	330.9	6 053.4
2011	1 760.2	343.7	132.0	5.5	–	–	126.5	6.9	141.0	–	126.3	162.4	505.8	2 816.6	147.1	6 225.2
2012	2 199.6	390.6	87.6	46.5	–	16.0	104.0	33.5	122.2	–	150.1	105.6	122.5	1 967.1	211.9	5 517.2
2013	2 197.0	142.1	57.2	11.1	–	43.7	260.4	106.4	126.7	–	156.6	48.6	245.5	2 178.0	252.0	5 749.4
2014	2 497.8	267.0	86.7	–	2.1	20.4	121.5	86.4	95.8	–	83.8	79.0	203.0	1 992.7	354.1	5 849.1
2015	2 676.3	290.7	83.3	–	11.3	4.7	181.5	25.0	71.1	0.4	89.6	99.1	269.8	1 494.6	192.6	5 461.2
2016	2 185.4	208.8	53.0	–	38.7	11.8	155.1	5.4	133.3	–	82.9	–	257.8	1 561.0	190.3	4 838.9
2017	2 412.4	226.0	56.9	–	24.2	–	90.9	30.9	71.4	–	44.5	0.7	215.2	1 608.0	184.5	4 925.7
2018	2 013.0	152.1	34.2	–	22.5	–	156.0	12.8	106.0	5.6	19.3	–	214.5	1 734.8	137.2	4 580.1
2019	2 072.3	314.5	69.2	24.1	67.6	–	85.4	9.0	71.6	–	15.3	–	245.7	961.4	111.1	4 013.1
2020	3 712.2	373.1	48.0	–	–	–	116.7	8.6	45.6	–	11.0	–	91.7	485.1	66.1	4 941.7
2021	2 934.4	310.0	62.9	10.8	8.5	–	135.4	–	35.3	–	14.4	–	103.5	767.3	52.5	4 415.0
All	37 662.9	4 188.0	2 235.6	566.2	1 042.1	90.6	1 218.6	446.3	1 567.1	103.9	2 524.9	1 417.8	4 991.4	26 316.1	3 729.7	76 926.7

Table D9: Estimated aggregate area (km^2) for Deepwater Tier 2 bottom-contacting trawls, by target, for 1990–2021. Codes are defined in Table 2. Not included in the table: 6.6 km^2 for PRK, 74.6 km^2 for PTO.

Fishing year	BAR	BYX	CDL	EMA	FRO	GSH	LDO	RBT	RBY	RIB	SKI	SPD	SPE	SWA	WWA	Tier2
1990	6 223.3	123.7	62.6	–	5.0	2.2	–	–	12.5	–	606.6	111.8	31.1	3 585.9	568.1	11 332.7
1991	4 384.1	104.7	257.5	36.2	11.0	–	–	–	5.8	–	239.3	100.7	35.0	2 481.6	162.6	7 818.6
1992	4 379.8	272.2	117.3	0.7	7.2	–	–	0.4	31.4	–	480.5	27.0	27.7	2 832.3	49.7	8 226.2
1993	5 096.0	377.4	113.3	4.1	39.9	–	30.8	–	37.4	–	439.9	–	26.5	4 033.2	8.1	10 213.0
1994	3 609.1	401.3	258.2	29.7	0.4	–	5.1	–	24.9	–	67.1	–	31.5	3 782.0	–	8 209.4
1995	6 392.1	381.6	206.6	–	104.8	–	–	–	66.9	–	39.7	–	26.6	4 375.2	9.1	11 602.6
1996	4 946.0	322.9	395.3	–	–	–	–	–	27.8	–	88.5	5.8	14.6	3 196.9	–	9 072.4
1997	3 241.6	345.9	319.4	49.9	–	–	–	–	25.0	–	107.0	18.5	30.8	1 375.3	3.0	5 516.4
1998	3 192.4	314.4	340.8	–	76.9	–	–	–	52.0	–	39.8	–	83.2	1 028.8	12.8	5 141.0
1999	2 385.4	322.8	560.4	130.3	305.8	–	–	–	63.4	–	–	–	5.1	639.4	92.9	4 505.6
2000	2 398.9	330.4	576.8	–	34.7	–	–	–	79.6	–	55.0	–	–	1 068.3	129.3	4 673.0
2001	2 430.9	276.8	285.3	–	272.3	–	–	–	137.0	–	–	–	6.8	1 008.5	208.2	4 625.8
2002	2 584.7	197.5	261.1	–	254.0	1.8	52.3	–	67.1	–	–	96.8	325.0	1 699.8	384.3	5 924.3
2003	3 010.0	302.5	381.2	11.8	9.9	–	7.2	–	29.6	–	131.1	–	1 469.0	860.0	425.7	6 637.8
2004	1 744.6	267.8	177.7	–	10.5	–	–	–	56.4	–	16.5	16.3	760.4	336.1	367.0	3 753.2
2005	2 567.9	436.7	254.2	27.3	5.9	–	–	0.9	63.7	38.8	–	38.0	41.2	1 838.3	523.6	5 836.6
2006	1 716.2	543.3	302.3	86.5	41.4	–	–	41.9	80.1	60.7	2.2	127.5	169.4	2 488.5	471.6	6 131.5
2007	2 639.5	412.8	386.5	26.8	8.8	1.5	–	3.2	99.8	–	–	43.9	689.5	3 171.1	345.8	7 829.3
2008	4 584.7	340.7	206.6	47.1	–	–	77.3	21.8	84.1	–	21.3	136.9	438.1	4 260.3	299.2	10 518.0
2009	2 968.9	310.9	137.6	54.1	–	–	13.0	44.2	43.1	–	37.6	240.0	45.7	4 116.5	412.5	8 424.2
2010	2 172.3	458.6	210.4	1.5	–	–	89.5	28.5	165.3	–	35.4	277.5	250.9	2 840.3	372.7	6 903.0
2011	1 943.8	450.2	157.7	5.6	–	–	140.8	6.9	156.8	–	139.8	176.9	558.0	3 211.5	162.2	7 110.0
2012	2 438.4	518.1	106.0	49.1	–	16.0	111.7	33.8	134.1	–	159.9	114.9	124.4	2 219.0	261.5	6 286.8
2013	2 471.1	164.9	65.9	11.1	–	46.1	289.0	108.8	140.4	–	164.2	52.7	280.6	2 625.3	303.0	6 723.1
2014	2 750.0	330.7	100.2	–	2.2	20.9	130.1	90.4	109.3	–	85.6	84.0	229.6	2 402.7	436.7	6 772.5
2015	3 280.7	361.2	93.4	–	11.3	4.7	201.7	25.5	86.3	0.4	94.2	103.6	381.5	1 960.0	220.6	6 825.2
2016	2 597.5	245.5	61.6	–	40.5	12.1	164.3	5.4	176.1	–	86.3	–	301.1	1 742.9	205.0	5 638.2
2017	3 178.7	272.5	70.8	–	24.8	–	93.2	31.5	75.5	–	45.6	0.7	291.7	1 850.7	205.8	6 141.7
2018	2 624.3	210.2	45.4	–	22.7	–	164.7	12.8	113.8	5.6	20.4	–	287.7	1 990.3	151.9	5 649.6
2019	3 060.2	428.9	88.8	24.5	74.1	–	87.6	9.1	76.6	–	15.7	–	321.7	1 193.9	128.1	5 509.4
2020	4 827.1	465.4	60.7	–	–	–	128.4	8.6	66.5	–	11.0	–	143.6	676.7	68.2	6 456.2
2021	3 427.3	415.3	87.0	10.8	8.5	–	144.4	–	48.0	–	14.5	–	128.7	982.7	61.2	5 328.5
All	105 267.4	10 707.9	6 748.7	607.1	1 372.6	105.3	1 931.0	473.7	2 436.4	105.4	3 244.9	1 773.6	7 556.7	71 873.9	7 050.2	221 336.2

Table D10: The number of 25-km^2 cells contacted by Deepwater Tier 2 bottom-contacting trawls, by target, for 1990–2021. Codes are defined in Table 2.

Fishing year	BAR	BYX	CDL	EMA	FRO	GSH	LDO	PRK	PTO	RBT	RBY	RIB	SKI	SPD	SPE	SWA	WWA	Tier2
1990	1 757	59	33	–	9	5	–	–	–	–	16	–	319	132	62	1 237	323	3 055
1991	1 345	38	96	49	16	–	–	–	–	–	12	–	164	104	62	1 088	186	2 541
1992	1 372	99	82	2	13	–	–	–	–	2	40	–	189	42	47	1 109	57	2 538
1993	1 427	174	109	6	48	–	33	6	–	–	63	–	327	–	35	1 256	12	2 920
1994	1 171	257	156	50	2	–	15	–	–	–	37	–	86	–	60	1 251	–	2 659
1995	1 773	294	127	–	55	–	–	–	–	–	55	–	52	–	46	1 549	13	3 473
1996	1 659	255	218	–	–	–	–	–	124	–	44	–	96	11	47	1 145	–	3 093
1997	1 175	217	139	55	–	–	–	–	–	–	59	–	74	21	36	758	7	2 300
1998	1 219	234	189	–	65	–	–	–	–	–	82	–	42	–	96	680	18	2 326
1999	1 061	265	293	98	138	–	–	–	–	–	82	–	–	–	10	501	67	2 200
2000	1 052	244	294	–	34	–	–	–	–	–	115	–	37	–	–	613	69	2 084
2001	1 236	212	218	–	111	–	–	–	–	–	141	–	–	–	15	720	97	2 403
2002	1 656	175	168	–	143	4	40	–	–	–	133	–	–	105	195	860	189	3 187
2003	1 361	202	225	22	20	–	24	–	–	–	59	–	116	–	498	553	241	2 951
2004	961	203	174	–	14	–	–	–	–	–	77	–	13	30	245	346	178	2 022
2005	1 081	228	194	51	12	–	–	–	–	3	89	43	–	71	66	698	224	2 408
2006	792	296	151	94	31	–	–	–	–	41	141	85	6	152	199	942	206	2 598
2007	1 265	247	181	49	12	6	–	–	–	6	138	–	–	68	437	1 193	221	3 238
2008	2 324	247	151	72	–	–	55	–	–	34	116	–	49	169	407	1 676	215	4 784
2009	1 780	188	123	58	–	–	30	–	–	46	78	–	68	207	119	1 447	306	3 931
2010	1 549	306	182	4	–	–	95	–	–	52	222	–	41	206	393	1 355	221	4 105
2011	1 654	300	133	7	–	–	134	–	–	10	165	–	127	160	407	1 532	152	4 200
2012	1 699	307	106	65	–	18	106	–	–	60	135	–	148	116	187	1 208	136	3 765
2013	1 597	148	77	21	–	32	187	–	–	129	134	–	164	73	235	1 162	202	3 496
2014	1 892	254	105	–	4	17	130	–	–	75	115	–	120	107	246	1 190	259	4 027
2015	1 661	257	109	–	16	10	150	–	–	43	69	3	106	127	224	999	189	3 560
2016	1 609	215	89	–	40	9	167	–	–	15	148	–	108	–	281	1 110	187	3 554
2017	1 684	252	81	–	28	–	110	–	–	38	132	–	56	4	219	1 097	172	3 469
2018	1 268	199	53	–	34	–	173	–	–	26	174	16	40	–	209	1 133	140	3 077
2019	1 334	357	84	35	60	–	100	–	–	19	111	–	29	–	188	733	137	2 866
2020	1 802	374	71	–	–	–	93	–	–	17	64	–	27	–	89	350	93	2 772
2021	1 713	318	67	15	21	–	135	–	–	–	49	–	28	–	121	564	58	2 904
All	7 238	1 973	1 028	470	374	57	496	6	124	375	913	120	1 124	832	1 870	6 623	1 557	15 419

Table D11: The number of contacted 25-km^2 cells, estimated aggregate area, and footprint for combined targets HAK/HOK/LIN/SWA/WWA bottom-contacting trawls, for 1990–2021. Codes are defined in Tables 1 and 2.

Fishing year	No. cells	Aggregate area (km^2)	Footprint (km^2)	EEZ+TS (%)	Fishable (%)
1990	5 268	38 357.8	20 881.6	0.5	1.5
1991	6 547	59 231.7	30 200.8	0.7	2.2
1992	7 006	66 903.4	36 821.9	0.9	2.7
1993	7 368	74 725.4	40 213.7	1.0	2.9
1994	6 533	55 444.1	30 501.8	0.7	2.2
1995	7 578	75 245.5	38 443.3	0.9	2.8
1996	7 412	82 220.2	40 130.6	1.0	2.9
1997	8 086	96 553.5	45 236.9	1.1	3.3
1998	8 474	111 514.9	50 619.3	1.2	3.7
1999	7 371	96 246.3	47 027.0	1.1	3.4
2000	8 610	102 313.7	51 460.6	1.3	3.7
2001	9 173	99 682.9	53 164.8	1.3	3.8
2002	9 495	98 157.4	54 624.5	1.3	4.0
2003	9 386	100 055.0	55 605.6	1.4	4.0
2004	8 281	79 570.4	45 329.4	1.1	3.3
2005	6 555	54 278.1	31 563.4	0.8	2.3
2006	5 718	48 188.8	27 529.4	0.7	2.0
2007	5 652	46 917.0	27 849.6	0.7	2.0
2008	6 670	48 305.5	29 477.0	0.7	2.1
2009	5 801	47 628.9	27 139.9	0.7	2.0
2010	5 552	51 336.8	28 652.0	0.7	2.1
2011	5 857	52 553.3	29 764.4	0.7	2.2
2012	5 592	53 227.5	29 090.2	0.7	2.1
2013	5 635	52 148.9	28 357.6	0.7	2.1
2014	5 996	57 039.5	31 580.6	0.8	2.3
2015	5 970	59 195.1	32 058.4	0.8	2.3
2016	5 650	54 615.0	29 428.9	0.7	2.1
2017	5 729	59 951.6	29 966.9	0.7	2.2
2018	5 818	66 898.9	32 211.8	0.8	2.3
2019	4 808	51 295.7	26 709.1	0.7	1.9
2020	3 906	41 958.9	21 115.3	0.5	1.5
2021	4 179	44 176.2	23 274.3	0.6	1.7
All	23 400	2 125 937.6	190 392.8	4.6	13.8

Table D12: Estimated footprint (km^2) for HAK/HOK/LIN/SWA/WWA bottom-contacting trawls, by Bycatch Assessment Area for 1990–2021.

Fishing year	CHAT4	COOK8	EAST2	NORTH1	PUYS5	SQUAK6	STEW5	SUBA6	WCNI9	WCSI7	All
1990	7 462.9	133.9	11.2	–	1 302.2	147.9	6 012.1	805.3	9.7	4 996.5	20 881.6
1991	11 593.1	255.3	40.7	–	1 180.5	166.0	8 849.2	1 832.0	9.8	6 274.2	30 200.8
1992	15 384.4	288.8	37.5	2.1	1 287.2	185.9	11 956.5	2 093.7	4.5	5 581.5	36 821.9
1993	18 375.6	482.8	127.7	46.7	1 014.7	284.4	11 588.1	605.1	13.7	7 675.0	40 213.7
1994	13 139.6	562.0	437.5	31.6	873.9	397.3	6 835.1	561.0	7.2	7 656.5	30 501.8
1995	20 632.0	568.2	220.7	85.3	787.6	347.6	8 134.6	402.6	14.3	7 250.5	38 443.3
1996	20 932.9	1 276.0	845.1	440.6	1 021.9	507.0	8 269.6	505.2	12.0	6 320.2	40 130.6
1997	23 239.6	1 507.6	1 614.6	863.2	1 088.3	706.4	9 047.0	416.3	80.7	6 673.3	45 236.9
1998	29 235.0	1 085.3	1 612.7	740.5	1 141.7	1 550.4	9 011.0	587.9	42.1	5 612.7	50 619.3
1999	29 519.2	807.2	577.8	488.5	923.3	712.7	7 442.6	550.3	21.4	5 984.0	47 027.0
2000	28 613.8	900.7	462.2	330.6	1 204.1	1 407.9	9 431.3	3 260.4	132.6	5 716.9	51 460.6
2001	28 611.3	667.9	632.9	194.1	1 417.7	1 670.3	9 054.6	4 228.0	138.3	6 549.6	53 164.8
2002	26 143.4	522.7	297.0	332.7	942.5	1 565.0	10 579.3	5 645.3	91.6	8 505.0	54 624.5
2003	28 651.3	610.8	417.6	309.2	788.2	1 615.2	8 009.0	7 318.0	49.5	7 836.8	55 605.6
2004	25 040.2	652.9	402.5	375.3	523.8	1 086.3	6 032.9	4 637.4	72.7	6 505.5	45 329.4
2005	17 429.7	611.2	292.7	230.2	795.4	650.5	3 925.3	2 185.7	19.1	5 423.6	31 563.4
2006	15 144.6	446.7	156.1	447.0	797.5	110.7	3 786.3	387.9	103.9	6 148.7	27 529.4
2007	16 397.4	405.5	290.9	266.1	644.6	128.6	4 356.5	818.7	67.3	4 474.1	27 849.6
2008	16 313.2	407.1	273.9	273.0	777.7	394.9	3 841.0	1 141.9	214.8	5 839.4	29 477.0
2009	15 089.7	380.1	409.3	270.0	425.1	366.8	4 479.6	946.5	223.9	4 549.0	27 139.9
2010	16 622.5	425.7	359.3	532.1	409.5	213.4	5 059.7	667.4	62.8	4 299.5	28 652.0
2011	16 245.1	328.5	543.2	424.0	576.7	368.7	5 035.2	1 195.2	74.7	4 973.0	29 764.4
2012	16 564.0	306.2	341.9	441.3	659.4	224.3	5 005.7	632.8	96.9	4 817.8	29 090.2
2013	16 075.5	386.7	373.0	522.0	464.2	233.9	4 902.5	823.9	116.5	4 459.5	28 357.6
2014	15 034.4	456.4	711.2	436.9	600.9	565.3	6 799.6	1 631.7	79.0	5 265.1	31 580.6
2015	16 194.6	405.5	425.3	481.9	456.0	564.7	6 602.4	919.9	78.4	5 929.6	32 058.4
2016	17 026.0	349.7	473.1	430.9	718.6	352.4	4 213.1	618.0	29.4	5 217.6	29 428.9
2017	15 843.2	357.9	605.8	470.9	466.4	410.0	5 292.8	840.2	78.9	5 600.8	29 966.9
2018	16 131.7	283.1	700.6	505.7	353.2	593.5	6 046.9	1 713.1	100.6	5 783.5	32 211.8
2019	14 907.0	220.9	524.1	705.3	524.0	367.0	4 071.8	1 028.0	31.4	4 329.7	26 709.1
2020	12 305.8	138.9	176.6	566.6	408.2	179.1	3 026.1	814.2	75.6	3 424.2	21 115.3
2021	13 497.2	136.4	179.3	561.7	457.9	301.1	3 916.5	676.6	32.9	3 514.7	23 274.3
All	83 203.1	3 431.4	5 483.5	3 928.2	3 917.4	7 262.3	36 605.0	22 918.0	1 448.3	22 195.6	190 392.8

Table D13: Estimated aggregate area (km^2) for HAK/HOK/LIN/SWA/WWA bottom-contacting trawls, by Bycatch Assessment Area (see Figure 18), for 1990–2021.

Fishing year	CHAT4	COOK8	EAST2	NORTH1	PUYS5	SQUAK6	STEW5	SUBA6	WCNI9	WCSI7	All
1990	10 903.9	276.6	11.5	–	2 502.6	159.9	10 344.3	865.2	9.7	13 284.1	38 357.8
1991	22 724.2	864.3	50.3	–	3 211.9	170.5	15 553.3	2 365.9	10.1	14 281.0	59 231.7
1992	27 125.5	762.3	40.5	2.1	3 768.5	205.5	21 345.2	2 550.1	4.5	11 099.2	66 903.4
1993	33 392.6	1 427.1	137.8	50.9	2 049.4	321.8	21 080.6	697.8	13.7	15 553.8	74 725.4
1994	19 926.7	1 306.7	496.6	33.1	1 369.5	484.3	11 351.0	651.6	7.2	19 817.3	55 444.1
1995	39 466.4	1 879.6	282.9	87.0	1 295.1	445.1	12 025.1	442.5	14.3	19 307.5	75 245.5
1996	43 446.6	5 099.1	1 276.4	561.9	1 983.1	586.7	13 758.8	551.2	12.1	14 944.3	82 220.2
1997	51 368.2	5 419.2	2 416.7	1 285.0	2 019.7	853.0	15 726.8	445.3	81.2	16 938.3	96 553.5
1998	66 302.2	3 201.2	2 571.6	928.9	2 217.9	2 096.7	17 014.9	814.5	42.5	16 324.5	111 514.9
1999	60 312.0	2 549.1	1 110.2	727.6	1 696.8	842.8	13 310.0	1 109.6	21.5	14 566.7	96 246.3
2000	56 061.2	2 808.7	895.2	392.3	2 512.1	1 925.8	18 984.4	4 321.6	139.3	14 273.2	102 313.7
2001	52 208.4	1 880.7	957.1	207.6	2 620.2	2 107.0	17 217.1	5 677.9	146.3	16 660.6	99 682.9
2002	46 519.7	1 456.2	411.8	443.1	1 455.0	2 138.0	20 090.0	7 562.8	103.4	17 977.4	98 157.4
2003	53 164.2	1 750.2	645.0	402.3	1 104.1	1 988.8	11 912.7	9 535.0	53.9	19 498.8	100 055.0
2004	44 225.1	2 029.4	598.8	520.2	634.8	1 282.2	8 932.6	5 781.5	74.2	15 491.7	79 570.4
2005	30 101.8	2 044.4	478.4	282.2	1 149.1	740.3	6 217.5	2 773.6	19.3	10 471.3	54 278.1
2006	25 893.5	1 166.0	246.8	546.5	1 379.6	114.6	6 189.0	415.0	112.5	12 125.4	48 188.8
2007	28 134.4	1 103.2	405.6	333.5	875.9	142.4	7 659.2	970.4	72.0	7 220.4	46 917.0
2008	26 409.5	1 181.8	313.0	303.8	1 045.2	535.8	6 049.8	1 704.9	248.7	10 513.0	48 305.5
2009	27 320.7	1 062.2	529.0	288.4	549.1	493.6	7 690.0	1 467.5	266.3	7 962.2	47 628.9
2010	30 775.2	952.1	422.1	593.6	490.2	266.6	8 828.8	899.2	66.7	8 042.4	51 336.8
2011	29 021.2	728.6	744.5	468.1	809.7	683.3	8 184.2	2 129.1	77.5	9 707.0	52 553.3
2012	31 101.2	776.7	388.2	519.0	886.4	252.2	8 658.0	772.4	112.5	9 760.8	53 227.5
2013	30 268.6	1 124.1	450.3	615.1	614.8	270.0	9 097.9	1 029.0	135.4	8 543.8	52 148.9
2014	27 622.4	1 331.1	932.9	512.3	952.3	849.7	12 109.7	2 058.0	86.8	10 584.2	57 039.5
2015	30 609.9	1 106.6	527.3	605.5	563.9	804.8	12 096.3	1 142.7	88.5	11 649.6	59 195.1
2016	33 031.3	1 168.6	584.4	525.9	999.2	446.4	6 218.5	904.6	32.5	10 703.5	54 615.0
2017	32 088.6	1 044.0	759.0	594.4	594.6	462.4	8 347.3	976.6	81.0	15 003.7	59 951.6
2018	33 012.3	918.2	855.7	659.4	482.2	901.4	11 045.1	2 510.0	112.3	16 402.2	66 898.9
2019	30 045.5	562.4	637.4	1 340.2	782.3	493.4	6 906.6	1 589.0	33.0	8 905.9	51 295.7
2020	25 295.9	349.6	199.8	999.2	616.2	204.7	5 157.0	1 329.3	80.0	7 727.1	41 958.9
2021	27 818.1	367.5	200.9	915.9	672.9	466.9	6 398.4	1 002.7	36.0	6 297.1	44 176.2
All	1 125 696.9	49 697.2	20 577.9	15 744.7	43 904.5	23 736.4	365 500.2	67 046.7	2 395.0	411 638.1	2 125 937.6

Table D14: The number of 25-km^2 cells contacted by HAK/HOK/LIN/SWA/WWA trawls, by Bycatch Assessment Area (see Figure 18), for 1990–2021.

Fishing year	CHAT4	COOK8	EAST2	NORTH1	PUYS5	SQUAK6	STEW5	SUBA6	WCNI9	WCSI7	All
1990	1 945	66	13	–	212	113	1 538	744	17	664	5 268
1991	2 444	93	33	–	155	162	1 666	1 114	18	921	6 547
1992	2 889	119	56	4	179	104	1 959	837	9	912	7 006
1993	3 261	164	151	41	169	155	2 090	260	14	1 127	7 368
1994	2 746	188	329	45	166	215	1 645	259	12	982	6 533
1995	3 547	173	253	115	180	103	1 873	221	25	1 133	7 578
1996	3 194	263	398	307	180	241	1 733	336	34	782	7 412
1997	3 504	295	582	324	187	250	1 648	285	188	897	8 086
1998	3 928	242	523	303	186	437	1 595	492	94	761	8 474
1999	3 718	189	255	224	139	267	1 519	285	41	791	7 371
2000	3 595	183	229	199	182	467	1 699	1 226	111	781	8 610
2001	3 840	170	375	174	192	539	1 608	1 439	114	817	9 173
2002	3 454	160	209	158	162	523	1 731	2 106	135	961	9 495
2003	3 607	166	234	178	162	517	1 524	1 945	52	1 114	9 386
2004	3 564	164	170	179	138	409	1 291	1 458	97	909	8 281
2005	2 905	132	155	148	157	321	1 037	954	44	782	6 555
2006	2 909	134	76	222	143	113	981	210	127	840	5 718
2007	2 877	147	147	135	150	69	1 045	291	80	750	5 652
2008	3 384	127	184	216	166	210	1 000	325	179	929	6 670
2009	2 853	136	212	236	140	132	943	280	144	771	5 801
2010	2 686	163	228	346	140	62	929	205	75	765	5 552
2011	2 700	125	272	294	207	99	973	361	98	773	5 857
2012	2 608	114	280	310	167	124	937	194	120	776	5 592
2013	2 491	136	262	329	161	93	931	381	130	763	5 635
2014	2 342	158	365	293	149	176	1 139	565	95	776	5 996
2015	2 583	143	305	275	152	179	1 127	304	65	899	5 970
2016	2 632	121	273	262	168	149	1 093	166	49	787	5 650
2017	2 342	131	342	256	146	175	1 111	386	70	832	5 729
2018	2 431	94	365	281	129	165	1 080	493	74	762	5 818
2019	2 153	80	302	327	133	118	841	276	53	575	4 808
2020	1 740	61	160	161	107	94	745	203	87	585	3 906
2021	1 913	61	151	194	107	103	807	206	32	647	4 179
All	7 758	367	1 091	1 024	449	956	3 615	4 918	849	2 585	23 400

Table D15: The number of contacted 25-km^2 cells, estimated aggregate area (km^2), and footprint (km^2) for combined targets ORH/OEO bottom-contacting trawls, for 1990–2021. Areas are shown in Figure 19.

Fishing	ORH7A			NWCR			ESCR		
year	No. cells	Aggregate	Footprint	No. cells	Aggregate	Footprint	No. cells	Aggregate	Footprint
1990	143	819.6	486.0	437	1 502.4	1 102.7	796	4 723.0	2 849.3
1991	137	842.5	579.2	296	865.4	703.3	627	2 046.7	1 407.8
1992	156	850.3	603.1	91	103.7	96.1	317	913.3	610.9
1993	197	1 333.1	932.5	142	180.3	143.1	238	372.1	255.5
1994	167	984.3	681.8	197	307.5	241.2	294	744.5	453.8
1995	166	755.2	557.6	177	450.6	361.5	332	712.2	478.0
1996	212	995.9	778.8	175	329.8	280.1	296	566.9	422.8
1997	349	1 820.9	1 462.1	296	1 110.3	854.2	302	518.7	440.4
1998	591	2 614.6	2 164.1	326	1 046.0	880.1	442	881.4	689.9
1999	895	2 727.1	2 400.4	350	1 469.2	1 148.2	389	765.6	593.5
2000	718	1 242.6	1 166.9	239	753.0	638.8	275	450.2	347.9
2001	5	2.7	1.5	352	1 571.6	1 252.3	286	501.8	401.8
2002	–	–	–	426	1 631.9	1 359.0	428	1 152.8	897.7
2003	–	–	–	392	1 589.1	1 255.4	320	1 064.2	737.1
2004	2	0.8	0.3	434	2 033.4	1 609.1	453	1 791.2	1 249.6
2005	63	29.3	28.2	343	871.6	748.6	456	1 863.5	1 187.7
2006	47	20.6	20.4	318	663.2	587.6	489	1 610.7	1 255.6
2007	–	–	–	67	56.7	48.9	618	2 253.4	1 808.1
2008	–	–	–	179	252.0	209.8	554	1 493.9	1 221.0
2009	49	22.5	22.3	211	257.1	230.5	598	1 811.8	1 518.6
2010	54	25.5	25.2	296	562.1	511.7	446	1 494.4	1 230.5
2011	56	106.2	92.6	14	6.5	6.1	196	259.2	231.3
2012	60	81.5	74.3	14	4.9	4.9	168	234.2	206.3
2013	72	104.5	92.4	16	5.7	5.7	117	179.0	159.1
2014	145	273.2	232.1	230	265.0	238.9	233	269.3	235.6
2015	479	1 590.0	1 188.6	266	388.4	345.9	150	226.3	190.4
2016	394	942.7	754.5	334	743.4	642.2	415	773.6	636.4
2017	558	1 689.2	1 491.3	372	1 101.7	881.4	378	872.2	700.5
2018	322	981.6	866.4	367	906.8	709.5	373	1 046.4	793.9
2019	499	1 546.4	1 364.4	278	564.6	483.1	359	1 034.8	716.4
2020	699	1 812.6	1 596.0	232	482.8	421.0	455	2 003.1	1 379.0
2021	756	2 749.7	2 451.1	229	630.1	514.2	490	2 934.4	2 025.4
All	1 568	26 965.1	11 186.5	861	22 706.5	7 056.5	1 366	37 564.7	10 388.6

Table D16: For deepwater Tier 1 and Tier 2 fishstocks, the number of 25-km^2 cells contacted during 1990–1994 and the number of 'new' cells contacted for the first time in subsequent years and the aggregate area (km^2) and footprint (km^2) estimated for those new cells, where data for 1995 represent cells contacted in 1995 but not in 1990–1994, and data for 1996 represent cells contacted in 1996 but not in 1990–1995, etc.

Fishing year	Tier 1 targets			Tier 2 targets		
	New	Aggregate	Footprint	New cells	Aggregate	Footprint
1990–1994	No. cells = 23 428			No. cells = 6329		
1995	1 106	933.3	810.9	905	713.6	665.2
1996	1 075	741.3	682.8	867	664.8	619.5
1997	1 095	911.5	860.5	362	169.9	168.0
1998	1 529	2 032.6	1 653.1	368	268.5	250.3
1999	1 273	1 244.1	1 130.0	386	351.7	273.0
2000	1 165	1 473.0	1 339.3	282	139.9	134.9
2001	763	721.1	626.3	355	188.4	181.6
2002	1 074	955.9	924.7	686	523.0	501.4
2003	664	734.0	655.7	459	706.8	621.9
2004	366	354.7	323.2	177	89.4	87.8
2005	633	663.0	589.7	343	590.1	527.7
2006	272	124.9	120.9	279	157.3	154.7
2007	256	140.0	134.5	293	171.9	169.1
2008	216	136.6	131.1	665	591.2	508.7
2009	173	68.2	66.8	383	214.0	208.0
2010	155	63.8	61.5	349	162.3	157.7
2011	154	71.2	59.7	359	193.1	188.4
2012	101	41.0	41.0	245	125.4	123.6
2013	64	28.2	28.2	229	151.1	146.7
2014	84	38.6	38.6	275	180.8	175.2
2015	173	167.9	155.6	140	54.0	53.8
2016	181	111.6	106.7	141	51.8	51.4
2017	108	69.1	65.7	154	91.6	90.7
2018	117	32.6	32.6	110	58.1	56.9
2019	80	91.9	88.0	118	54.8	54.5
2020	81	63.7	62.7	74	45.8	43.9
2021	80	90.3	86.9	86	31.8	30.7

Table D17: For deepwater Tier 1 targets, the number of 25-km^2 cells contacted during 1990–1994 and the number of 'new' cells contacted for the first time in subsequent years and the aggregate area (km^2) and footprint (km^2) estimated for those new cells, where data for 1995 represent cells contacted in 1995 but not in 1990–1994, and data for 1996 represent cells contacted in 1996 but not in 1990–1995, etc.

	HAK			HOK			JMA		
Fishing year	New cells	Aggregate	Footprint	New cells	Aggregate	Footprint	New cells	Aggregate	Footprint
1990–1994	No. cells = 1 728			No. cells = 11 691			No. cells = 3 906		
1995	207	147.5	144.6	1 069	925.3	858.6	314	237.9	233.4
1996	165	134.7	128.9	1 045	1 160.0	891.8	315	370.1	343.1
1997	83	79.2	75.6	879	653.5	625.0	175	106.6	105.9
1998	235	148.6	146.8	1 124	1 338.1	1 072.5	349	365.6	330.2
1999	268	239.5	228.6	574	422.8	413.7	190	115.5	113.7
2000	130	168.9	151.9	1 137	1 690.4	1 543.7	127	88.7	86.9
2001	149	105.3	103.2	850	810.0	787.4	28	10.4	10.4
2002	239	360.7	321.0	863	757.2	742.5	119	93.3	89.3
2003	206	149.9	148.7	667	754.6	687.7	142	119.7	116.7
2004	139	190.2	169.4	259	273.7	255.8	79	55.5	53.9
2005	114	130.8	122.2	106	72.1	71.0	54	26.9	26.8
2006	106	82.6	82.0	49	21.7	21.7	46	22.0	22.0
2007	95	61.4	60.5	53	33.9	33.6	49	25.8	25.8
2008	75	61.7	61.3	44	20.9	20.9	46	22.9	22.9
2009	165	150.6	140.3	47	31.7	31.7	22	9.6	9.6
2010	12	7.3	7.2	72	28.8	28.5	34	11.2	11.2
2011	61	40.1	39.2	86	50.4	50.3	65	25.2	25.2
2012	49	20.3	20.3	90	39.9	39.9	5	2.6	2.6
2013	49	35.2	32.1	47	26.8	26.8	26	8.4	8.4
2014	21	7.2	7.2	66	31.8	31.8	18	10.6	10.5
2015	28	12.7	12.7	55	27.8	27.8	25	7.1	7.1
2016	22	9.4	9.4	52	27.5	27.5	8	4.0	4.0
2017	13	5.4	5.4	22	13.3	13.3	22	7.9	7.9
2018	13	2.6	2.6	35	12.3	12.3	7	1.6	1.6
2019	4	2.3	2.3	54	23.5	22.2	10	4.8	4.8
2020	22	7.3	7.3	14	6.1	6.1	9	3.6	3.6
2021	28	6.5	6.5	9	2.9	2.9	6	3.7	3.7

Table D17: continued.

	LIN			OEO			ORH		
Fishing year	New cells	Aggregate	Footprint	New cells	Aggregate	Footprint	New cells	Aggregate	Footprint
1990–1994	No. cells = 2 809			No. cells = 2 083			No. cells = 4362		
1995	125	65.0	64.0	132	87.7	75.2	320	238.5	175.1
1996	67	40.2	39.0	277	189.1	171.5	324	209.7	177.0
1997	219	151.9	149.9	328	184.8	170.1	425	461.3	427.9
1998	217	258.8	247.6	309	182.1	170.6	559	810.8	699.9
1999	78	42.6	42.3	301	264.1	235.4	589	621.2	577.2
2000	347	490.4	440.6	294	192.8	177.6	302	259.9	238.4
2001	258	265.3	256.5	187	93.0	83.2	204	292.5	182.3
2002	225	201.5	195.4	185	109.4	105.3	179	103.3	97.0
2003	177	130.5	128.1	102	69.2	61.6	143	79.2	72.1
2004	98	111.5	105.4	120	48.2	47.2	176	97.1	94.0
2005	105	105.8	96.8	494	477.2	458.6	235	128.2	123.8
2006	193	205.7	193.2	205	147.7	134.5	74	25.1	24.7
2007	220	130.8	130.1	206	113.3	109.1	92	45.2	42.0
2008	460	458.3	421.5	66	22.0	21.4	36	10.5	10.5
2009	181	86.6	84.5	65	28.3	27.9	68	33.1	31.6
2010	242	124.3	122.0	66	41.1	37.7	45	17.3	17.3
2011	137	51.1	50.1	36	31.5	20.2	29	7.9	7.9
2012	75	23.9	23.9	38	13.9	13.9	25	8.7	8.7
2013	69	29.4	29.4	11	2.5	2.5	17	6.2	6.2
2014	61	40.5	37.0	15	7.1	7.1	35	18.2	17.1
2015	53	26.1	25.8	23	20.9	17.9	163	176.2	164.3
2016	85	47.4	42.7	18	7.7	7.7	153	83.5	82.3
2017	44	14.0	14.0	15	3.9	3.9	83	52.5	52.0
2018	78	52.1	50.7	16	6.4	5.8	47	18.7	18.7
2019	40	20.0	20.0	7	2.8	2.8	54	85.9	82.7
2020	69	38.8	38.8	15	4.6	4.6	78	61.1	60.1
2021	52	28.2	28.2	2	1.2	1.2	69	90.6	86.7

Table D17: continued.

	SBW			SCI			SQU		
Fishing year	New cells	Aggregate	Footprint	New cells	Aggregate	Footprint	New cells	Aggregate	Footprint
1990–1994	No. cells = 2 787			No. cells = 3 498			No. cells = 4 088		
1995	135	126.9	123.1	250	65.5	64.8	496	388.4	379.6
1996	106	85.7	84.4	99	15.8	15.8	293	173.8	172.4
1997	54	44.1	43.7	106	20.1	20.0	293	168.7	164.6
1998	71	138.1	119.0	229	51.3	50.9	215	137.7	136.9
1999	183	145.6	143.4	356	81.9	81.6	217	436.9	316.7
2000	29	16.2	16.1	127	26.9	26.8	421	486.9	394.1
2001	50	27.8	27.7	51	10.9	10.8	416	332.9	317.0
2002	293	400.2	382.9	157	31.9	31.8	174	85.6	85.5
2003	38	21.8	21.8	116	26.2	26.2	342	280.8	267.4
2004	51	93.4	85.0	28	5.2	5.2	116	72.0	71.5
2005	34	47.9	42.4	289	584.0	403.8	90	72.7	70.9
2006	3	1.0	1.0	170	45.6	45.0	145	73.4	73.3
2007	11	6.0	6.0	63	12.2	12.2	89	54.4	52.7
2008	22	12.1	12.1	48	8.7	8.7	43	16.8	16.8
2009	33	16.1	16.0	33	7.4	7.4	24	10.7	10.7
2010	32	23.9	23.7	50	11.0	10.9	50	27.6	27.6
2011	15	28.7	24.1	33	5.2	5.2	18	9.3	9.3
2012	14	11.4	10.8	26	6.0	6.0	21	10.1	10.1
2013	3	2.2	2.2	78	18.1	18.1	23	10.0	10.0
2014	4	2.4	2.4	87	16.6	16.6	20	29.0	28.3
2015	10	8.5	8.3	49	12.2	12.2	21	5.2	5.2
2016	2	0.8	0.8	43	12.0	11.8	56	28.8	28.2
2017	6	3.8	3.8	69	35.5	29.9	46	15.9	15.9
2018	1	0.5	0.5	115	27.0	26.9	11	1.9	1.9
2019	8	12.5	11.9	72	15.1	15.1	30	12.8	12.8
2020	0	0.0	0.0	7	1.1	1.1	80	49.2	47.7
2021	19	36.9	34.0	16	6.3	6.3	15	7.2	7.2

Table D18: Summary data for the number of tows, the aggregate area, and the footprint for Tier 1 bottom-contacting effort per 25-km^2 cell, for each year, from 1990–2021. In any year, the minimum number of tows per cell was 1, and the aggregate area or footprint was < 0.00001 km^2. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year.

Fishing	No. tows per cell					Aggregate area per cell (km^2)					Footprint per cell (km^2)				
year	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
1990	1	3	15.63	11	1 095	0.48	1.12	7.89	5.08	717.63	0.48	1.10	3.67	4.5	25.00
1991	1	3	19.29	12	2 384	0.56	1.48	9.47	5.78	1 616.89	0.56	1.43	4.11	5	25.00
1992	1	4	19.46	15	1 277	0.65	1.79	9.35	7.31	822.37	0.64	1.71	4.56	6.13	25.00
1993	1	5	19.87	18	1 828	0.66	2.03	10.00	8.32	1 387.11	0.65	1.93	4.82	6.79	25.00
1994	1	4	19.66	15	1 276	0.62	1.69	9.23	6.89	813.21	0.61	1.62	4.36	5.81	25.00
1995	1	4	21.33	16	1 016	0.62	1.80	10.7	7.56	789.99	0.61	1.73	4.62	6.33	25.00
1996	1	4	21.99	17	1 307	0.63	1.72	10.92	7.85	617.86	0.62	1.66	4.75	6.45	25.00
1997	1	4	22.52	19	1 415	0.65	1.87	11.33	8.81	544.18	0.64	1.79	5.01	7.03	25.00
1998	1	4	22.17	19	879	0.66	1.83	11.35	8.81	443.56	0.65	1.76	5.10	7.05	25.00
1999	1	4	21.25	18	1 213	0.60	1.79	10.65	8.23	745.21	0.60	1.73	4.95	6.66	25.00
2000	1	4	20.06	18	827	0.62	1.77	10.01	8.61	407.23	0.61	1.70	4.93	6.88	25.00
2001	1	4	20.01	19	841	0.72	1.91	10.12	8.98	583.99	0.71	1.83	5.09	7.20	25.00
2002	1	4	19.17	17	1 031	0.66	1.87	9.46	8.52	697.01	0.65	1.79	4.92	6.87	25.00
2003	1	5	19.72	18	998	0.74	2.12	10.1	9.39	678.14	0.73	2.01	5.16	7.49	25.00
2004	1	5	18.63	17	1 433	0.75	2.12	9.60	8.56	914.65	0.74	2.01	4.91	7.01	25.00
2005	1	4	17.48	13	1 476	0.59	1.55	8.30	6.03	947.83	0.58	1.51	4.05	5.14	25.00
2006	1	4	16.67	13	932	0.52	1.50	7.60	5.99	584.93	0.52	1.43	4.01	5.13	25.00
2007	1	4	16.09	15	571	0.58	1.65	7.21	6.8	278.51	0.57	1.58	4.12	5.68	25.00
2008	1	4	15.49	13	578	0.59	1.74	6.79	6.07	239.59	0.58	1.66	3.97	5.23	24.99
2009	1	4	13.85	12	460	0.53	1.54	6.80	5.6	283.04	0.53	1.49	3.87	4.88	24.99
2010	1	4	14.62	13	504	0.50	1.63	7.56	6.58	214.66	0.50	1.54	4.21	5.52	24.98
2011	1	4	15.62	14	485	0.52	1.63	8.04	6.95	286.90	0.51	1.56	4.38	5.81	24.96
2012	1	4	15.69	14	425	0.51	1.57	8.35	7.45	248.99	0.51	1.51	4.44	6.12	25.00
2013	1	4	15.80	15	459	0.54	1.90	8.18	7.53	276.80	0.53	1.79	4.47	6.17	25.00
2014	1	4	14.91	14	455	0.55	1.84	7.84	7.61	283.14	0.54	1.75	4.43	6.21	24.99
2015	1	4	15.15	14	504	0.57	1.81	8.11	7.65	320.34	0.56	1.71	4.51	6.33	25.00
2016	1	4	15.46	13	572	0.50	1.56	7.99	7.12	335.50	0.50	1.50	4.32	5.86	25.00
2017	1	4	15.69	13	408	0.53	1.72	8.52	6.69	208.09	0.52	1.62	4.40	5.64	25.00
2018	1	4	16.52	14	816	0.53	1.78	9.4	7.76	400.01	0.52	1.66	4.57	6.22	25.00
2019	1	4	17.75	15	565	0.57	2.01	9.23	8.3	285.50	0.56	1.84	4.63	6.48	24.99
2020	2	5	18.93	16	722	0.63	2.11	9.33	8.02	445.51	0.61	1.9	4.48	6.2	25.00
2021	2	5	17.72	16	481	0.66	2.26	8.93	8.6	223.90	0.63	2.07	4.7	6.74	25.00

Table D19: Summary data for the number of tows, the aggregate area, and the footprint for HAK/HOK/LIN/SWA/WWA bottom-contacting effort per 25-km^2 cell, for each year, from 1990–2021. In any year, the minimum number of tows per cell was 1, and the aggregate area or footprint was < 0.00001 km^2. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year.

Fishing	No. of tows					Aggregate area (km^2)					Footprint (km^2)				
year	1st Qu	Median	Mean	3rd Qu	Max	1st Qu	Median	Mean	3rd Qu	Max	1st Qu	Median	Mean	3rd Qu	Max
1990	1	2	13.1	11	333	0.5	1.1	7.3	5.4	203.5	0.5	1.1	4.0	4.8	25.00
1991	1	3	16.4	14	384	0.6	1.4	9.0	7.0	220.4	0.6	1.4	4.6	5.9	25.00
1992	1	4	17.5	19	359	0.8	2.0	9.5	9.8	221.7	0.8	2.0	5.3	7.9	25.00
1993	1	5	18.0	19	640	0.8	2.5	10.1	10.3	468.8	0.8	2.4	5.5	8.1	25.00
1994	1	4	15.2	15	372	0.7	1.8	8.5	7.6	210.9	0.7	1.7	4.7	6.5	25.00
1995	1	4	17.2	18	764	0.7	1.9	9.9	9.7	301.1	0.7	1.8	5.1	7.7	25.00
1996	1	4	20.0	19	1307	0.8	2.1	11.1	10.2	476.3	0.8	2.0	5.4	7.9	25.00
1997	1	4	20.8	21	1415	0.7	2.1	11.9	11.4	544.2	0.7	2.0	5.6	8.5	25.00
1998	1	4	22.4	24	879	0.8	2.2	13.2	12.6	337.1	0.8	2.1	6.0	9.4	25.00
1999	1	5	22.2	28	732	0.8	2.6	13.1	15.4	307.1	0.8	2.4	6.4	11.0	25.00
2000	1	5	20.3	23	827	0.8	2.3	11.9	13.1	310.6	0.8	2.2	6.0	9.8	25.00
2001	1	4	18.1	22	714	0.8	2.3	10.9	12.4	482.7	0.8	2.2	5.8	9.4	25.00
2002	1	4	17.4	21	631	0.8	2.3	10.3	12.3	348.3	0.8	2.2	5.8	9.4	25.00
2003	1	5	17.7	21	664	0.8	2.8	10.7	12.5	372.6	0.8	2.6	5.9	9.5	25.00
2004	1	5	16.2	17	1135	0.9	2.8	9.6	10.4	617.6	0.9	2.7	5.5	8.3	24.97
2005	1	4	14.4	15	710	0.8	2.1	8.3	8.5	380.2	0.8	2.0	4.8	6.9	25.00
2006	1	4	14.5	16	537	0.8	1.9	8.4	9.0	305.0	0.8	1.8	4.8	7.3	24.96
2007	1	5	14.1	17	433	0.8	2.3	8.3	9.4	272.9	0.8	2.2	4.9	7.4	24.97
2008	1	4	12.9	14	417	0.7	2.0	7.2	7.6	219.7	0.7	1.9	4.4	6.3	24.94
2009	1	4	12.5	14	342	0.7	2.0	8.2	8.1	203.6	0.7	1.9	4.7	6.6	24.99
2010	1	4	12.9	15	334	0.6	2.2	9.2	9.7	214.7	0.6	2.1	5.2	7.8	24.96
2011	1	4	12.7	15	282	0.7	2.1	9.0	9.7	130.1	0.7	2.0	5.1	7.8	24.93
2012	1	4	13.1	15	307	0.7	2.1	9.5	10.4	183.4	0.7	2.1	5.2	8.1	25.00
2013	1	4	13.3	15	459	0.6	2.2	9.3	9.4	276.8	0.6	2.1	5.0	7.4	25.00
2014	1	4	13.8	16	455	0.8	2.5	9.5	10.1	283.1	0.7	2.3	5.3	7.9	24.99
2015	1	4	14.1	16	504	0.8	2.3	9.9	10.7	320.3	0.8	2.2	5.4	8.3	25.00
2016	1	4	13.4	15	572	0.7	2.2	9.7	10.1	335.2	0.7	2.1	5.2	7.8	25.00
2017	1	4	14.1	15	408	0.7	2.2	10.5	9.8	208.1	0.7	2.1	5.2	7.7	25.00
2018	1	4	14.9	16	815	0.8	2.6	11.5	11.2	400.0	0.8	2.4	5.5	8.3	25.00
2019	1	5	14.5	17	565	0.7	2.7	10.7	11.9	270.5	0.7	2.5	5.6	8.8	24.99
2020	2	5	15.5	17	721	0.8	3	10.7	11.4	445.2	0.8	2.6	5.4	8.2	25.00
2021	2	5	14.5	18	480	0.8	3	10.6	12.5	223.9	0.8	2.7	5.6	8.8	25.00

Table D20: Summary data for the aggregate area (km^2) for HAK/HOK/LIN/SWA/WWA bottom-contacting effort per 25-km^2 cell, for Bycatch Assessment Areas CHAT4, COOK8, PUYS5, STEW5, SUBA6, and WCSI7, from 1990–2021. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year. The minimum values given for each area are the largest over the time series.

Fishing	CHAT4 (min. < 3.0e-10 km^2)					COOK8 (min. < 4.0e-7 km^2)					PUYS5 (min. <8.0e-7 km^2)				
year	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
1990	0.6	1.3	5.6	6.3	69	0.3	0.6	4.2	1.0	66.6	0.7	3.1	11.8	16.4	107.4
1991	0.8	1.9	9.3	7.7	212.8	0.4	0.8	9.3	2.1	185.9	0.8	4.9	20.7	23.6	220.4
1992	0.8	2.3	9.4	10.1	119.6	0.3	0.8	6.4	1.8	128.4	0.8	3.8	21.1	18.9	221.7
1993	0.8	2.5	10.2	11.2	148.2	0.5	1.0	8.7	3.5	161.7	1.0	2.9	12.1	13.4	116.0
1994	0.8	2.3	7.3	8.8	66.8	0.5	1.0	7.0	3.1	153.8	1.1	4.7	8.3	10.5	56.6
1995	0.8	2.5	11.1	13.1	184.8	0.4	1.2	10.9	3.6	301.1	0.6	1.9	7.2	7.7	44.6
1996	0.9	3.3	13.6	14.6	374.8	0.7	2.1	19.4	9.2	476.3	0.8	3.1	11.0	13.5	96.6
1997	0.8	2.9	14.7	16.5	261.2	0.8	2.3	18.4	9.9	544.2	0.7	2.7	10.8	14.9	86.1
1998	0.8	3.3	16.9	21.3	318	0.5	2.0	13.2	8.4	337.1	0.7	2.9	11.9	17.7	75.5
1999	1.0	4.6	16.2	24.4	143.2	0.7	1.6	13.5	7.5	307.1	0.8	5.5	12.2	17.3	74.0
2000	1.0	5.8	15.6	22.1	156.7	0.8	2.1	15.3	8.8	310.6	0.8	4.6	13.8	17.7	98.4
2001	1.0	4.3	13.6	21.6	109.3	0.6	1.4	11.1	6.5	192.8	0.9	4.5	13.6	20.2	76.2
2002	1.0	5.5	13.5	20.6	160.0	0.3	1.1	9.1	4.3	151.0	0.8	4.2	9.0	14.3	55.7
2003	1.0	6.0	14.7	21.4	133.6	0.5	1.2	10.5	5.7	205.3	0.8	3.3	6.8	10.4	36.6
2004	1.0	5.1	12.4	15.3	155.4	0.5	1.0	12.4	5.8	260.9	1.0	3.6	4.6	6.8	22.3
2005	1.0	3.6	10.4	12.2	106.2	0.6	1.6	15.5	8.9	233.5	1.0	3.3	7.3	11.2	40.8
2006	0.8	2.1	8.9	10.4	112.4	0.5	1.1	8.7	4.0	127.9	0.8	3.3	9.6	14.6	75.9
2007	0.9	3.1	9.8	11.9	118.6	0.5	0.9	7.5	2.4	141.1	0.9	3.7	5.8	8.3	36.1
2008	0.8	2.5	7.8	8.9	151.9	0.5	1.0	9.3	3.8	156.8	0.7	2.9	6.3	10.4	39.0
2009	0.8	2.2	9.6	10.5	203.6	0.3	0.9	7.8	2.7	115.8	0.6	1.7	3.9	5.1	22.6
2010	0.8	3.3	11.5	13.8	143.6	0.3	0.8	5.8	2.5	111.6	0.4	2.0	3.5	5.6	17.2
2011	0.8	3.0	10.7	13.2	124.5	0.3	0.8	5.8	2.5	86.1	0.4	1.1	3.9	4.8	37.4
2012	1.0	3.9	11.9	14.6	169.1	0.4	0.8	6.8	2.4	99.6	0.5	2.2	5.3	8.1	28.7
2013	0.9	3.8	12.2	14.5	158.9	0.4	0.8	8.3	3.5	118.7	0.4	1.4	3.8	5.2	21.7
2014	1.0	4.2	11.8	14.0	118.4	0.3	0.8	8.4	3.4	138.1	0.4	1.7	6.4	6.8	57.0
2015	1.0	3.2	11.9	14.5	139.7	0.3	0.8	7.7	3.4	104.5	0.5	1.4	3.7	5.0	23.5
2016	0.9	3.5	12.5	14.8	123.5	0.2	0.8	9.7	4.4	127.3	0.5	2.2	5.9	9.3	38.3
2017	1.0	4.0	13.7	16.1	181.1	0.3	0.8	8.0	3.0	117.1	0.5	1.9	4.1	5.3	23.1
2018	1.0	4.0	13.6	16.2	157.7	0.4	0.9	9.8	4.1	105.0	0.6	1.2	3.7	3.6	37.5
2019	1.0	4.6	14.0	17.5	178.1	0.3	1.3	7.0	5.6	77.6	0.7	2.4	5.9	7.2	49.6
2020	1.3	5.3	14.5	17.1	191.0	0.3	0.9	5.7	5.2	38.7	0.7	2.0	5.8	6.8	38.1
2021	1.1	5.1	14.5	18.3	163.2	0.4	1.4	6.0	6.5	38.7	0.6	3.3	6.3	8.5	34.5

Table D20 continued.

Fishing	STEW5 (min. < 3.0e-7 km^2)					SUBA6 (min. < 1.0e-6 km^2)					WCSI7 (min. < 6.0e-8 km^2)				
year	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
1990	0.6	1.2	6.7	5.0	105.9	0.3	0.6	1.2	1.0	16.8	0.8	3.3	20	20.6	203.5
1991	0.8	2.2	9.3	10.4	118.8	0.4	0.8	2.1	1.2	50.5	0.7	1.8	15.5	19.0	135.8
1992	0.9	2.9	10.9	13.1	206.1	0.6	0.9	3.0	3.2	31.1	0.8	2.0	12.2	13.9	169.5
1993	0.9	3.2	10.1	9.7	468.8	0.7	1.3	2.7	3.1	17.9	0.8	3.2	13.8	18.4	248.5
1994	0.7	1.5	6.9	5.9	93.6	0.5	1.0	2.5	2.8	23.3	0.8	3.8	20.2	21.1	210.9
1995	0.8	2.0	6.4	7.4	67.6	0.5	1.0	2.0	2.1	12.1	0.7	2.0	17.0	14.8	207.5
1996	0.8	2.0	7.9	7.3	102.9	0.5	1.0	1.6	1.9	15.2	1.0	4.8	19.1	24.1	159.4
1997	0.8	2.5	9.5	10.9	111.8	0.4	1.0	1.6	1.8	13.1	0.8	3.0	18.9	19.3	171.4
1998	1.0	2.9	10.7	10.2	149.6	0.4	0.8	1.7	1.1	100.4	0.8	2.5	21.5	22.0	219.5
1999	0.8	2.2	8.8	7.4	127.0	0.4	1.0	3.9	2.0	239.1	0.9	3.3	18.4	23.7	247.1
2000	0.8	2.2	11.2	9.8	205.1	0.6	1.0	3.5	3.4	158.9	0.8	2.9	18.3	19.2	242.1
2001	0.9	2.6	10.7	10.4	200.9	0.7	1.2	3.9	3.9	149.8	0.8	3.9	20.4	25.8	482.7
2002	0.9	2.6	11.6	13.7	127.9	0.6	1.1	3.6	3.3	163.2	0.9	7.2	18.7	28.3	348.3
2003	1.0	2.9	7.8	10.5	77.5	0.8	1.8	4.9	6.1	54.4	0.8	2.4	17.5	18.7	372.6
2004	1.0	2.6	6.9	8.4	130.2	0.8	1.7	4.0	4.6	57.4	0.9	3.0	17.0	20.8	617.6
2005	0.8	1.8	6.0	6.3	164.7	0.5	1.0	2.9	2.3	60.0	0.8	4.1	13.4	18.0	380.2
2006	0.7	1.6	6.3	5.9	179.1	0.6	1.3	2.0	2.6	9.9	0.8	4.7	14.4	19.4	305.0
2007	0.8	1.8	7.3	6.4	272.9	0.7	1.8	3.3	4.5	22.3	0.9	3.5	9.6	13.2	97.8
2008	0.8	1.9	6.0	6.6	182.5	0.7	1.6	5.2	4.2	63.0	0.8	3.1	11.3	14.1	219.7
2009	0.7	2.2	8.2	9.4	196.3	0.5	1.5	5.2	5.0	73.6	0.8	3.0	10.3	12.6	102.1
2010	0.7	2.4	9.5	12.3	214.7	0.6	1.9	4.4	4.1	41.3	0.7	2.3	10.5	11.2	203.3
2011	0.9	2.5	8.4	10.4	109.9	0.7	1.2	5.9	3.8	130.1	0.7	2.5	12.6	15.0	95.2
2012	0.8	2.5	9.2	12.3	183.4	0.7	1.8	4.0	5.4	30.7	0.6	2.1	12.6	14.1	140.8
2013	0.7	2.6	9.8	10.6	276.8	0.6	1.7	2.7	2.8	59.4	0.7	2.6	11.2	13.0	252.0
2014	0.9	3.5	10.6	13.0	277.1	0.8	1.9	3.6	4.2	49.0	0.9	3.9	13.6	16.1	283.1
2015	0.9	3.0	10.7	13.3	238.2	0.9	2.0	3.8	4.5	37.9	0.9	3.2	13.0	14.0	320.3
2016	0.6	1.7	5.7	6.2	128.1	0.7	1.7	5.4	4.5	53.4	0.7	3.0	13.6	17.6	335.2
2017	0.8	2.2	7.5	8.9	162.2	0.6	1.0	2.5	2.4	22.8	0.8	2.9	18.0	15.4	208.1
2018	1	2.9	10.2	12.3	169.9	0.6	1.9	5.1	4.3	83.9	0.9	3.1	21.5	22.8	400.0
2019	0.8	2.7	8.2	9.8	171.2	0.7	1.6	5.8	4.7	61.7	1.0	5.0	15.5	21.4	270.5
2020	0.8	2.3	6.9	8.1	157.8	0.7	1.7	6.5	5.3	70.7	0.7	2.4	13.2	12.5	445.2
2021	0.8	2.5	7.9	10.0	130.6	0.5	1.1	4.9	3.6	61.3	0.5	2.6	9.7	13.5	223.9

Table D21: Summary data for the number of tows, the aggregate area, and the footprint for bottom-contacting effort for ORH/OEO targets combined per 25-km^2 cell, for each year, from 1990–2021. In any year, the minimum number of tows per cell was 1, and the aggregate area or footprint was < 0.00001 km^2. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year.

Fishing	No. tows per cell					Aggregate area per cell (km^2)					Footprint per cell (km^2)				
year	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
1990	1	2	9.5	9	255	0.4	1.0	4.1	3.8	170.3	0.4	1.0	2.7	3.3	24.1
1991	1	2	7.5	6	336	0.3	0.8	2.8	2.4	68.4	0.3	0.8	2.0	2.2	22.6
1992	1	2	9.7	8	357	0.3	0.8	3.2	2.4	106.1	0.3	0.8	2.1	2.2	22.1
1993	1	2	10.5	9	398	0.3	0.8	3.4	2.4	143.5	0.3	0.8	2.2	2.1	22.3
1994	1	2	10.8	8	427	0.3	0.8	3.5	2.4	151.5	0.3	0.8	2.2	2.2	22.8
1995	1	3	10.6	9	366	0.3	0.8	3.4	2.7	184.6	0.3	0.8	2.1	2.4	24.4
1996	1	2	8.1	8	245	0.3	0.8	2.5	2.2	64.1	0.3	0.7	1.9	2.0	21.3
1997	1	2	8.2	9	368	0.3	0.8	2.9	2.8	97.3	0.3	0.8	2.1	2.6	22.7
1998	1	3	8.8	9	355	0.3	0.8	2.9	3.1	77.6	0.3	0.8	2.2	2.9	21.3
1999	1	3	8.3	9	245	0.4	1.0	3.0	3.1	134.4	0.4	0.9	2.2	2.8	23.2
2000	1	3	7.3	7	163	0.3	0.9	2.4	2.4	52.2	0.3	0.8	1.9	2.3	19.9
2001	1	2	6.8	8	140	0.3	0.8	2.2	2.2	44.7	0.3	0.8	1.8	2.0	16.2
2002	1	3	6.2	7	187	0.3	0.8	2.1	2.4	33.9	0.3	0.8	1.8	2.2	16.8
2003	1	2	6.7	7	259	0.3	0.8	2.1	1.9	52.1	0.3	0.8	1.7	1.8	17.6
2004	1	3	6.9	8	172	0.3	0.8	2.5	2.5	83.8	0.3	0.8	2.0	2.2	23.8
2005	1	2	5.8	6	185	0.3	0.8	2.0	2.0	109.1	0.3	0.8	1.6	1.8	23.8
2006	1	2	6.2	6	176	0.2	0.8	2.0	2.0	74.4	0.2	0.7	1.6	1.9	23.1
2007	1	2	6.1	6	163	0.3	0.7	2.0	1.9	46.2	0.3	0.7	1.6	1.7	18.9
2008	1	2	6.2	6	167	0.2	0.7	1.8	2.0	84.0	0.2	0.7	1.4	1.8	18.9
2009	1	2	5.9	7	121	0.3	0.8	1.9	2.2	32.8	0.3	0.8	1.6	2.0	14.7
2010	1	3	5.9	7	115	0.3	0.8	2.0	2.1	33.5	0.3	0.7	1.6	1.9	16.7
2011	1	2	5.1	6	69	0.2	0.6	1.5	1.5	23.5	0.2	0.6	1.2	1.3	11.1
2012	1	2	4.7	5	123	0.2	0.5	1.3	1.2	58.7	0.2	0.5	1.1	1.2	16.9
2013	1	2	5.1	6	159	0.2	0.6	1.5	1.5	89.1	0.2	0.6	1.2	1.4	17.0
2014	1	2	4.6	5	72	0.2	0.6	1.3	1.4	22.7	0.2	0.6	1.1	1.3	12.9
2015	1	2	5.6	5	210	0.3	0.8	1.9	1.9	69.1	0.3	0.8	1.5	1.7	22.2
2016	1	2	5.2	5	146	0.3	0.7	1.9	1.6	78.7	0.3	0.7	1.5	1.5	23.3
2017	1	2	5.6	6	117	0.3	0.8	2.2	2.6	29.4	0.3	0.8	1.8	2.4	16.4
2018	1	2	5.7	6	126	0.3	0.8	2.1	2.3	31.6	0.3	0.8	1.7	2.0	17.2
2019	1	3	5.7	6	144	0.3	0.8	2.1	2.5	53.6	0.3	0.8	1.7	2.2	18.6
2020	1	3	6.1	7	177	0.4	1.1	2.5	2.8	98.9	0.4	1.0	1.9	2.5	23.9
2021	1	3	7.1	9	153	0.4	1.3	3.2	4.1	92.1	0.4	1.2	2.5	3.7	23.6

Table D22: Summary data for the number of tows, the aggregate area, and the footprint for bottom-contacting effort for Tier 2 targets combined per 25-km^2 cell, for each year, from 1990–2021. In any year, the minimum number of tows per cell was 1, and the aggregate area or footprint was < 0.00001 km^2. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year.

Fishing	No. tows per cell					Aggregate area per cell (km^2)					Footprint per cell (km^2)				
year	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
1990	1	2	7.2	8	96	0.49	1.04	3.71	3.32	63.3	0.48	1.03	2.65	3.06	22.28
1991	1	2	6.5	6	246	0.45	0.92	3.08	2.71	154.56	0.44	0.91	2.24	2.50	21.67
1992	1	2	6.4	6	223	0.44	0.94	3.24	2.83	91.13	0.43	0.92	2.34	2.63	23.56
1993	1	2	7.0	7	154	0.47	1	3.50	3.03	100.8	0.47	0.98	2.39	2.7	23.77
1994	1	2	6.7	5	145	0.40	0.84	3.09	2.24	87.33	0.40	0.83	2.04	2.10	23.54
1995	1	2	7.2	5	250	0.37	0.8	3.34	2.36	90.66	0.37	0.79	2.16	2.22	23.83
1996	1	2	6.8	5	225	0.33	0.77	2.93	2.06	96.84	0.33	0.76	2.04	1.94	24.05
1997	1	2	5.9	5	361	0.32	0.77	2.40	2.08	76.71	0.32	0.76	1.84	1.88	21.57
1998	1	2	5.2	4	161	0.31	0.75	2.21	1.75	63.02	0.30	0.75	1.70	1.69	22.63
1999	1	1	5.1	4	126	0.29	0.66	2.05	1.45	48.24	0.29	0.66	1.58	1.38	20.11
2000	1	2	5.8	5	149	0.30	0.75	2.24	2.00	100.49	0.29	0.75	1.65	1.84	20.04
2001	1	2	5.0	5	106	0.29	0.75	1.93	1.68	75.75	0.29	0.74	1.50	1.59	22.77
2002	1	2	4.8	5	130	0.33	0.75	1.86	1.67	57.22	0.32	0.74	1.52	1.60	20.13
2003	1	2	5.4	5	186	0.34	0.76	2.25	2.06	86.73	0.33	0.75	1.75	1.94	24.04
2004	1	2	4.7	4	105	0.33	0.75	1.86	1.62	39.68	0.33	0.75	1.55	1.56	18.47
2005	1	2	5.6	5	189	0.32	0.81	2.42	2.18	85.03	0.32	0.81	1.88	2.03	18.38
2006	1	2	5.6	5	188	0.35	0.8	2.36	2.25	67.86	0.35	0.80	1.86	2.10	20.49
2007	1	2	5.6	5	163	0.40	0.89	2.42	2.42	58.19	0.39	0.88	1.93	2.26	22.19
2008	1	2	5.7	6	135	0.36	0.81	2.20	2.13	48.63	0.36	0.80	1.79	2.04	21.30
2009	1	2	5.5	5	122	0.35	0.77	2.14	1.93	47.07	0.34	0.76	1.74	1.82	20.40
2010	1	2	4.6	5	134	0.34	0.76	1.68	1.93	26.12	0.34	0.76	1.47	1.82	14.35
2011	1	2	4.5	5	106	0.35	0.75	1.69	1.69	25.70	0.34	0.75	1.48	1.62	14.51
2012	1	2	4.4	5	134	0.33	0.78	1.67	1.95	33.38	0.33	0.77	1.47	1.84	16.02
2013	1	2	5.0	5	98	0.34	0.77	1.92	2.01	34.98	0.34	0.76	1.64	1.91	19.21
2014	1	2	4.5	5	117	0.34	0.76	1.68	1.82	33.61	0.33	0.75	1.45	1.73	17.52
2015	1	2	4.9	5	137	0.31	0.71	1.92	1.60	62.04	0.31	0.71	1.53	1.54	23.31
2016	1	2	4.1	4	105	0.33	0.71	1.59	1.66	39.91	0.33	0.69	1.36	1.58	20.45
2017	1	2	4.3	4	116	0.32	0.7	1.77	1.55	62.10	0.32	0.69	1.42	1.50	23.08
2018	1	2	4.5	5	134	0.33	0.75	1.84	1.84	50.22	0.33	0.75	1.49	1.74	20.92
2019	1	2	4.8	4	116	0.31	0.68	1.92	1.49	76.40	0.31	0.66	1.40	1.42	23.36
2020	1	3	6.3	7	103	0.36	0.82	2.33	2.21	54.18	0.36	0.80	1.78	2.02	22.1
2021	1	2	5.4	6	95	0.35	0.80	1.83	2.01	33.32	0.34	0.77	1.52	1.85	15.84

Table D23: The deepwater (Tier 1 and Tier 2 combined) footprint by depth zone within the fishable area, for 1990–2021.

Fishing year	0–200 m	200–400 m	400–600 m	600–800 m	800–1000 m	1000–1200 m	1200–1400 m	1400–1600 m	0–1600 m
1990	13 572.8	7 504.3	11 402.5	7 386.5	3 295.4	2 397.7	1 598.3	268.6	47 426.1
1991	12 272.2	9 098.8	14 554.8	12 064.6	4 312.5	1 715.7	652.0	162.3	54 832.9
1992	14 615.6	9 652.2	21 159.1	15 145.3	3 807.3	1 301.5	511.4	222.8	66 415.2
1993	15 752.1	8 736.7	21 260.4	14 584.4	4 113.5	1 488.8	630.0	286.3	66 852.2
1994	15 078.6	8 445.4	19 504.5	7 611.5	3 207.9	1 851.0	753.1	352.4	56 804.4
1995	14 064.4	8 085.5	23 410.5	10 463.2	3 132.4	1 765.0	555.2	264.4	61 740.6
1996	14 500.3	8 558.7	24 667.8	9 605.1	3 133.1	1 403.8	386.4	181.4	62 436.6
1997	12 844.5	8 616.5	27 657.0	12 467.4	4 403.2	1 866.0	405.9	208.0	68 468.5
1998	13 909.5	8 912.2	32 978.9	12 496.4	5 082.6	2 351.7	666.2	285.1	76 682.6
1999	10 963.1	7 719.6	33 063.1	10 815.5	5 466.3	2 938.9	814.5	299.2	72 080.2
2000	10 060.6	7 639.2	33 892.1	14 102.7	4 788.6	2 447.6	577.2	253.9	73 761.9
2001	11 585.1	7 903.6	35 310.1	14 795.3	3 609.2	1 961.8	519.4	167.9	75 852.4
2002	12 641.9	8 578.5	36 022.2	16 660.5	4 079.6	1 975.5	536.9	143.2	80 638.3
2003	12 864.2	8 526.8	38 244.9	15 377.3	2 790.9	1 860.3	503.1	134.0	80 301.5
2004	10 139.9	6 591.1	32 133.1	12 029.2	3 476.2	2 446.5	556.1	124.8	67 496.9
2005	11 087.1	6 737.1	24 072.4	6 643.2	2 725.4	2 065.1	531.2	150.3	54 011.8
2006	11 487.9	6 768.2	21 545.5	5 369.0	2 568.7	1 537.2	450.2	119.8	49 846.5
2007	11 653.1	7 344.8	21 393.6	5 131.5	2 365.1	1 601.1	470.6	110.2	50 070.0
2008	12 603.1	7 805.8	20 443.6	6 043.5	1 882.6	1 420.9	442.1	105.4	50 747.0
2009	10 390.8	6 325.3	19 798.6	5 199.6	1 940.0	1 772.0	409.2	97.3	45 932.8
2010	11 402.2	6 267.3	22 076.7	5 777.5	1 868.6	1 716.9	412.9	103.4	49 625.5
2011	10 526.9	6 504.0	22 720.2	6 239.9	1 591.3	685.5	208.2	93.4	48 569.4
2012	9 993.9	6 381.9	22 181.7	5 977.0	1 209.8	644.4	198.5	53.8	46 641.0
2013	9 807.6	5 546.2	20 946.2	6 327.1	1 101.5	656.8	187.6	43.4	44 616.4
2014	9 150.9	5 617.0	20 568.4	9 390.5	1 520.0	755.0	226.4	77.0	47 305.2
2015	8 103.9	5 656.3	22 644.2	8 040.5	2 428.4	827.6	211.6	73.7	47 986.2
2016	7 727.8	5 965.5	22 587.8	6 274.7	2 137.9	1 314.2	439.4	79.0	46 526.3
2017	7 998.7	5 441.7	21 901.4	6 810.1	2 793.2	1 272.7	444.3	88.9	46 751.0
2018	6 823.6	5 084.7	23 536.2	8 454.3	2 123.5	1 166.2	481.4	112.0	47 781.9
2019	7 601.2	5 509.3	20 978.2	5 645.2	2 438.6	1 009.9	335.6	48.9	43 566.9
2020	9 044.4	5 015.0	17 555.9	4 065.6	2 696.4	1 452.9	337.1	67.8	40 235.1
2021	8 398.5	5 219.3	18 348.7	5 572.0	3 776.8	1 795.8	421.1	101.4	43 633.6
All	87 086.0	39 803.4	103 539.6	59 381.5	36 374.4	19 719.6	7 037.2	2 760.0	355 701.6

Table D24: The deepwater Tier 1 footprint by depth zone within the fishable area, for 1990–2021.

Fishing year	0–200 m	200–400 m	400–600 m	600–800 m	800–1000 m	1000–1200 m	1200–1400 m	1400–1600 m	0–1600 m
1990	10 514.5	6 097.0	10 603.6	7 178.2	3 262.4	2 375.7	1 590.9	263.4	41 885.7
1991	10 427.5	8 115.5	14 072.0	11 916.4	4 249.3	1 685.5	643.1	158.2	51 267.5
1992	12 463.6	8 732.7	20 775.5	15 035.3	3 742.0	1 269.1	488.6	212.0	62 718.8
1993	13 470.4	7 419.1	20 723.9	14 469.4	4 043.0	1 451.4	612.7	265.2	62 455.1
1994	13 531.6	7 492.2	19 150.1	7 486.3	3 137.4	1 797.8	733.0	334.2	53 662.6
1995	11 419.4	7 070.1	22 959.7	10 294.3	3 058.3	1 715.2	541.1	256.7	57 314.8
1996	12 415.5	7 428.0	24 402.5	9 476.9	3 026.6	1 342.0	366.8	160.9	58 619.2
1997	11 375.2	8 006.9	27 471.0	12 393.8	4 312.8	1 814.2	389.9	197.8	65 961.6
1998	12 896.3	8 215.1	32 791.1	12 390.2	5 002.0	2 291.2	647.7	271.0	74 504.6
1999	10 127.6	7 337.1	32 907.1	10 676.8	5 338.3	2 876.7	788.4	282.2	70 334.2
2000	9 001.4	7 176.5	33 706.5	13 968.1	4 636.7	2 366.0	542.4	225.3	71 622.9
2001	10 183.9	7 214.5	35 026.0	14 699.1	3 518.6	1 916.8	494.5	156.2	73 209.6
2002	10 733.0	7 682.4	35 645.1	16 526.9	3 998.1	1 931.4	519.7	136.2	77 172.8
2003	10 941.5	7 418.4	37 694.1	15 226.7	2 679.3	1 780.3	488.8	121.5	76 350.6
2004	8 957.8	6 212.9	31 497.0	11 905.2	3 380.8	2 394.7	537.5	111.7	64 997.6
2005	9 526.8	6 036.3	23 643.3	6 466.9	2 606.3	1 996.6	513.0	124.9	50 914.1
2006	10 308.7	6 067.9	20 802.9	5 135.1	2 421.2	1 473.8	433.8	98.2	46 741.6
2007	9 723.7	6 118.1	20 626.0	4 874.6	2 223.6	1 529.0	446.2	101.1	45 642.3
2008	8 949.9	5 894.8	19 218.9	5 838.3	1 751.9	1 341.4	424.7	91.5	43 511.4
2009	7 631.4	4 668.6	18 732.3	5 056.8	1 852.0	1 727.7	391.9	87.8	40 148.5
2010	9 058.6	5 247.7	20 872.2	5 635.6	1 762.7	1 659.0	395.8	89.9	44 721.5
2011	8 098.6	5 331.6	21 514.2	6 047.7	1 500.1	618.6	196.5	85.2	43 392.5
2012	7 670.9	5 263.6	21 410.2	5 819.1	1 102.0	594.9	166.8	48.2	42 075.7
2013	7 100.1	4 582.6	20 126.3	6 119.7	1 045.8	619.2	180.1	42.6	39 816.4
2014	6 360.6	4 917.2	19 652.2	9 229.8	1 426.4	706.6	209.4	71.3	42 573.5
2015	5 314.7	4 953.6	22 061.5	7 881.2	2 354.7	789.4	200.6	65.8	43 621.5
2016	5 409.9	5 234.3	21 781.6	6 118.4	2 071.5	1 282.3	426.4	69.7	42 394.1
2017	5 570.5	4 719.8	21 225.2	6 682.0	2 730.7	1 238.6	434.6	85.7	42 687.1
2018	4 824.1	4 292.2	22 751.9	8 349.8	2 073.6	1 136.5	475.4	107.4	44 010.9
2019	5 676.3	4 934.1	20 514.8	5 534.4	2 379.6	970.6	320.7	46.2	40 376.7
2020	5 935.5	4 685.6	17 138.8	3 935.4	2 614.6	1 418.1	325.2	63.7	36 116.9
2021	5 732.3	4 723.7	17 957.6	5 451.3	3 701.8	1 753.1	398.0	95.3	39 813.1
All	68 401.6	36 084.2	101 721.8	58 031.3	35 697.1	19 311.2	6 867.2	2 554.9	328 669.4

Table D25: The deepwater Tier 2 footprint by depth zone within the fishable area, for 1990–2021.

Fishing year	0–200 m	200–400 m	400–600 m	600–800 m	800–1000 m	1000–1200 m	1200–1400 m	1400–1600 m	0–1600 m
1990	3 795.2	2 436.5	1 481.1	294.4	43.9	23.9	8.6	5.3	8 088.9
1991	2 598.2	1 761.2	933.7	221.0	100.7	48.1	12.4	4.4	5 679.7
1992	2 968.6	1 606.3	983.5	196.5	89.1	42.9	29.6	11.7	5 928.2
1993	3 212.9	2 154.8	1 233.4	171.0	102.2	56.7	24.9	22.4	6 978.3
1994	2 276.5	1 848.5	907.1	149.8	113.5	91.2	26.4	19.8	5 432.8
1995	3 933.9	1 984.8	1 130.8	239.3	105.0	82.1	18.2	8.3	7 502.4
1996	3 147.3	2 009.9	707.0	163.5	141.4	104.3	21.5	22.9	6 317.8
1997	2 230.9	1 154.2	518.1	101.5	126.6	77.4	18.1	11.5	4 238.3
1998	2 082.9	1 038.0	416.2	137.3	123.3	98.8	30.9	17.9	3 945.3
1999	1 773.7	671.7	420.5	195.8	202.0	124.3	54.2	25.0	3 467.2
2000	1 640.9	713.9	467.5	179.3	224.1	124.3	56.1	36.2	3 442.3
2001	1 704.2	994.7	593.9	118.4	107.9	54.6	27.6	12.1	3 613.4
2002	2 336.4	1 376.3	781.8	162.6	95.1	50.5	17.8	7.9	4 828.4
2003	2 358.0	1 509.2	886.9	168.8	128.8	90.3	16.6	13.7	5 172.3
2004	1 396.9	547.0	863.8	137.8	104.5	54.1	19.9	14.5	3 138.5
2005	2 154.5	1 104.5	782.9	215.5	132.0	77.7	20.0	31.1	4 518.2
2006	1 799.8	1 068.1	1 397.0	294.6	157.1	68.8	17.0	21.7	4 824.1
2007	2 628.8	1 691.3	1 354.5	297.8	152.2	79.1	25.4	9.2	6 238.3
2008	4 084.3	2 268.9	1 689.3	250.3	149.4	90.2	18.2	14.1	8 564.7
2009	3 106.0	1 905.1	1 478.5	161.9	95.6	50.6	17.5	9.8	6 825.0
2010	2 608.3	1 243.1	1 841.9	157.5	110.1	60.7	17.9	13.9	6 053.4
2011	2 730.3	1 403.1	1 680.4	215.2	102.1	73.7	11.9	8.5	6 225.2
2012	2 655.1	1 326.6	1 150.4	176.2	117.9	52.4	32.6	5.9	5 517.1
2013	3 017.4	1 136.5	1 234.8	252.3	60.3	39.5	7.6	0.8	5 749.2
2014	3 221.5	896.6	1 348.3	206.8	100.0	52.1	18.1	5.7	5 849.1
2015	3 385.7	869.4	847.1	217.4	81.2	40.9	11.4	8.1	5 461.2
2016	2 576.9	862.0	1 085.9	187.9	70.5	32.6	13.7	9.4	4 838.9
2017	2 761.4	936.9	959.8	152.6	65.0	36.5	10.3	3.3	4 925.8
2018	2 280.2	938.9	1 131.8	127.4	55.9	34.7	6.6	4.6	4 580.1
2019	2 354.0	742.5	661.3	133.0	63.4	40.8	15.3	2.7	4 013.0
2020	3 623.9	499.8	535.8	143.3	86.5	36.0	12.3	4.1	4 941.7
2021	2 964.3	650.3	512.9	133.7	79.3	44.4	23.8	6.3	4 415.0
All	39 082.2	15 810.9	15 006.8	3 686.8	1 513.9	1 066.9	432.6	326.6	76 926.7

Table D26: The estimated 1990–2021 footprint (km^2) for Tier 1 targets, by 200-m depth zones.

Depth zone (m)	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
0–200	360.6	13 159.2	39 464.4	2 915.6	110.8	292.2	86.2	1 684.5	24 748.4	68 401.6
200–400	1 136.2	18 326.5	5 965.0	6 875.7	68.8	197.2	3 583.7	9 325.5	7 869.8	36 084.2
400–600	12 894.3	71 210.9	985.6	12 159.1	204.0	503.7	19 361.1	9 104.9	5 396.4	101 721.8
600–800	5 617.2	53 013.0	342.1	6 177.2	1 353.3	1 683.4	349.7	366.5	3 199.7	58 031.3
800–1000	1 052.8	8 819.9	54.8	341.0	8 735.5	20 285.0	56.2	162.9	453.6	35 697.1
1000–1200	58.6	1 893.6	56.6	64.9	5 115.1	13 920.1	17.0	125.6	286.7	19 311.2
1200–1400	7.4	479.2	42.6	26.6	1 441.4	5 297.4	11.2	62.0	194.3	6 867.2
1400–1600	4.8	334.3	12.5	17.7	319.2	1 861.2	1.9	57.9	90.9	2 554.9
0–1600	21 131.7	167 236.5	46 923.5	28 577.6	17 348.2	44 040.2	23 466.7	20 889.7	42 239.8	328 669.4

Table D27: The estimated 2021 footprint (km^2) for Tier 1 targets, by 200-m depth zones. – indicates no contact.

Depth zone (m)	HAK	HOK	JMA	LIN	OEO	ORH	SBW	SCI	SQU	Tier 1
0–200	16.0	144.3	2 748.4	121.3	–	4.0	–	15.2	2 727.1	5 732.3
200–400	38.0	713.0	62.5	319.1	–	0.4	5.1	2 685.7	1 051.1	4 723.7
400–600	328.8	14 382.4	7.5	929.6	–	4.8	541.9	1 904.0	315.3	17 957.6
600–800	335.2	4 913.7	0.4	223.3	4.7	114.0	–	2.5	7.7	5 451.3
800–1000	15.5	339.8	–	7.3	150.6	3 190.7	–	2.6	1.4	3 701.8
1000–1200	0.1	2.5	–	–	118.4	1 632.3	–	–	–	1 753.1
1200–1400	–	2.0	–	–	8.6	388.6	–	–	–	398.0
1400–1600	–	0.2	–	–	2.7	92.5	–	–	–	95.3
0–1600	733.6	20 497.9	2 818.8	1 600.6	285.0	5 427.3	547.0	4 610.0	4 102.6	39 813.1

Table D28: The deepwater (Tier 1 and Tier 2 combined) footprint by BOMEC class within the fishable area, for 1990–2021. The 'All' includes 10 km^2 not assigned to a class and 3.1 km^2 in class K. Year is fishing year.

Year	A	B	C	D	E	F	G	H	I	J	L	M	N	O	All
1990	49.7	73.0	5 857.2	332.8	4 268.7	1 483.9	203.9	9 560.5	5 571.5	12 677.5	4 701.9	884.4	1 741.0	19.8	47 426.1
1991	18.4	66.9	4 323.7	333.1	5 124.9	1 710.5	254.7	10 884.5	7 276.8	14 017.8	7 523.8	2 132.9	1 145.5	19.7	54 833.1
1992	50.0	77.5	6 917.4	229.1	4 927.9	1 324.2	264.0	13 538.8	12 842.3	11 905.5	10 278.6	2 864.7	1 148.2	46.4	66 415.2
1993	55.7	219.7	7 052.9	250.1	6 112.0	838.1	397.9	14 293.2	12 749.7	15 226.0	5 667.7	2 530.7	1 414.9	43.2	66 852.2
1994	62.0	220.3	6 401.5	261.5	5 310.5	1 307.3	465.1	12 784.9	10 007.1	12 559.3	4 678.3	959.9	1 730.1	56.4	56 804.3
1995	40.6	253.0	4 029.2	287.2	6 503.2	1 331.5	587.8	14 093.0	12 900.4	14 018.5	5 044.9	1 275.0	1 316.7	59.7	61 740.7
1996	101.0	107.8	4 349.9	348.2	6 349.5	1 624.6	981.1	14 279.7	14 167.1	12 865.2	5 121.2	1 258.9	830.5	51.4	62 436.4
1997	141.4	144.5	3 233.7	393.6	5 914.4	1 385.6	1 001.7	13 938.3	15 345.4	17 085.6	7 148.5	1 708.5	941.5	85.3	68 468.5
1998	77.9	118.9	4 113.1	437.2	6 877.9	1 115.5	750.7	16 627.3	18 605.4	17 678.2	6 939.0	1 873.2	1 388.5	75.7	76 682.6
1999	118.8	80.7	2 950.2	300.6	6 107.8	642.8	612.8	16 843.9	18 732.1	17 302.7	5 018.9	1 751.5	1 540.1	75.4	72 080.2
2000	71.4	109.1	1 986.1	278.2	5 672.3	591.5	686.6	16 500.3	18 401.7	17 670.4	8 064.0	2 420.1	1 242.0	65.1	73 761.9
2001	336.9	104.9	3 946.3	176.6	5 059.0	625.5	551.3	17 610.4	17 677.3	16 947.9	9 158.1	2 518.7	1 080.9	58.6	75 852.4
2002	230.0	168.3	5 042.8	231.0	4 970.6	1 092.0	473.7	16 512.4	16 809.2	17 185.4	11 909.9	4 817.0	1 126.2	69.6	80 638.4
2003	206.5	93.2	5 015.9	217.3	4 926.4	1 307.4	512.1	19 129.5	16 501.6	16 157.0	13 110.4	2 015.5	1 041.7	66.9	80 301.4
2004	57.9	54.4	3 711.8	129.1	3 953.2	1 465.4	572.4	14 928.3	13 540.7	15 209.5	10 515.9	2 251.5	1 045.5	61.0	67 496.9
2005	14.5	45.4	4 588.7	70.2	4 202.3	1 370.9	496.5	12 854.4	10 214.6	11 718.2	5 623.7	1 704.7	1 048.1	59.5	54 011.8
2006	7.6	31.0	4 371.4	71.7	4 851.8	1 620.5	354.2	11 931.8	9 904.3	11 244.9	3 558.6	1 105.0	754.8	38.8	49 846.4
2007	17.4	27.1	4 880.1	82.7	4 522.4	1 106.5	338.1	12 666.1	11 073.3	9 507.6	3 969.3	1 139.9	699.0	40.5	50 070.0
2008	128.5	777.9	6 168.1	229.2	3 445.2	968.8	657.9	12 425.2	9 671.0	10 261.3	4 532.8	762.5	673.7	44.6	50 747.1
2009	107.5	511.5	4 678.0	236.7	2 905.5	1 333.7	577.1	9 738.7	10 501.6	9 163.4	4 635.5	862.7	656.3	24.3	45 932.8
2010	65.5	488.3	5 615.7	328.6	3 357.7	1 398.4	618.8	9 398.4	12 210.7	9 708.2	4 595.2	1 071.6	738.7	29.5	49 625.5
2011	89.5	372.9	4 196.3	295.0	3 960.8	923.8	624.5	9 664.2	11 330.5	9 150.1	6 211.4	1 266.1	458.4	25.7	48 569.5
2012	62.1	536.8	4 485.6	257.3	3 404.5	667.0	547.4	10 158.7	11 657.3	9 133.7	4 626.2	662.1	425.2	16.6	46 641.0
2013	59.1	588.1	4 214.7	268.7	3 180.1	684.4	654.7	9 084.6	12 120.7	8 552.3	4 344.5	446.6	403.3	14.1	44 616.2
2014	82.8	586.4	4 112.9	252.6	2 850.2	438.0	669.5	9 015.4	11 439.4	10 122.6	6 184.7	1 028.6	491.8	30.4	47 305.2
2015	34.3	341.1	3 495.0	199.1	2 953.6	411.6	517.6	10 171.4	12 270.2	11 265.2	5 098.1	775.8	438.4	14.6	47 986.2
2016	15.9	373.6	2 882.0	139.0	2 919.8	465.5	484.7	10 980.4	10 738.2	10 843.1	5 153.9	725.5	779.5	25.3	46 526.4
2017	14.8	267.4	2 859.4	159.5	3 108.8	783.6	495.9	9 725.0	10 837.0	11 295.1	5 563.3	878.2	737.5	25.1	46 750.9
2018	24.4	354.6	2 517.8	84.2	2 462.6	383.8	418.3	10 077.4	10 768.7	11 021.1	7 526.7	1 436.1	685.0	21.1	47 782.0
2019	23.0	359.2	2 695.8	77.6	3 285.1	315.7	368.3	9 878.6	9 819.2	10 026.6	5 502.3	700.5	497.8	17.0	43 566.8
2020	18.2	841.8	3 599.4	75.4	2 906.4	669.0	362.1	8 345.7	8 669.9	9 361.4	4 250.0	551.6	569.7	13.9	40 235.0
2021	24.5	779.2	2 969.0	146.4	3 130.1	273.8	350.0	8 579.9	10 170.4	11 386.8	4 583.6	583.0	639.3	17.6	43 633.7
All	1 465.2	4 882.3	37 133.9	3 804.6	24 788.3	6 898.9	3 658.9	65 421.8	38 695.3	80 927.3	56 624.7	18 566.2	12 231.5	589.6	355 701.6

Table D29: The deepwater Tier 1 footprint by BOMEC class within the fishable area, for 1990–2021. The 'All' includes 8.8 km^2 not assigned to a class and 2.9 km^2 in class K. Year is fishing year.

Year	A	B	C	D	E	F	G	H	I	J	L	M	N	O	All
1990	33.3	29.7	5 306.7	126.0	2 609.6	1 441.2	119.7	7 372.1	5 216.2	12 397.3	4 613.9	872.7	1 727.6	19.4	41 885.6
1991	11.5	26.9	3 995.0	142.7	4 176.1	1 705.7	212.2	9 415.5	7 092.5	13 791.4	7 438.8	2 124.6	1 116.1	18.6	51 267.6
1992	23.9	38.1	6 325.9	167.7	3 839.2	1 285.5	248.6	12 324.4	12 574.2	11 645.1	10 232.9	2 857.3	1 109.9	45.4	62 718.8
1993	25.9	101.3	6 505.9	131.4	4 987.2	811.7	313.8	12 517.2	12 579.1	14 904.4	5 640.1	2 525.8	1 368.9	41.9	62 455.0
1994	27.6	115.7	6 020.5	217.9	4 561.9	1 299.4	396.5	11 606.3	9 840.0	12 250.3	4 647.4	955.6	1 668.9	54.3	53 662.6
1995	20.7	109.8	3 092.7	190.0	5 414.4	1 328.7	456.0	12 788.1	12 635.7	13 708.7	4 984.3	1 267.0	1 271.6	47.1	57 314.9
1996	26.5	51.9	3 785.4	264.6	5 332.5	1 604.9	976.5	12 852.6	14 056.1	12 563.6	5 067.8	1 217.2	773.7	45.7	58 619.2
1997	28.6	77.7	2 648.7	331.3	5 407.0	1 379.1	996.7	13 168.5	15 298.6	16 791.7	7 137.7	1 704.7	909.7	81.2	65 961.6
1998	49.2	74.0	3 890.8	373.0	6 392.4	1 106.9	737.5	15 759.1	18 541.6	17 381.7	6 923.2	1 864.8	1 335.0	71.3	74 504.5
1999	63.8	47.7	2 722.5	270.7	5 834.2	635.6	580.6	16 254.4	18 676.9	16 956.8	5 004.4	1 744.0	1 475.0	65.7	70 334.4
2000	40.4	48.1	1 640.1	209.6	5 305.1	580.6	657.3	15 870.9	18 329.0	17 266.6	8 050.7	2 408.5	1 157.9	54.8	71 622.8
2001	307.1	32.3	3 434.1	115.9	4 731.6	619.3	520.2	16 519.1	17 591.1	16 607.0	9 144.5	2 512.1	1 027.8	47.4	73 209.6
2002	177.8	42.7	4 291.3	168.8	4 369.0	1 089.2	440.1	15 204.9	16 710.1	16 854.9	11 869.8	4 811.7	1 081.7	60.5	77 172.8
2003	105.8	59.4	4 391.9	138.2	4 034.2	1 302.3	497.7	17 512.3	16 428.9	15 767.3	13 070.9	2 015.3	971.7	54.5	76 350.4
2004	2.7	35.1	3 414.7	53.1	3 306.2	1 461.6	557.9	14 022.2	13 520.4	14 895.2	10 452.9	2 251.5	975.0	49.1	64 997.6
2005	2.6	30.2	3 866.1	56.5	3 611.1	1 370.6	492.3	11 857.9	10 124.3	11 248.9	5 559.1	1 697.7	951.9	44.8	50 914.0
2006	3.0	26.8	4 129.4	61.2	4 081.7	1 618.8	349.3	10 885.6	9 640.7	10 619.5	3 501.3	1 104.6	693.8	26.0	46 741.7
2007	6.8	14.4	4 473.7	46.9	3 311.8	1 096.4	321.5	10 957.8	10 765.8	8 895.7	3 928.7	1 136.0	654.3	32.5	45 642.3
2008	5.4	89.6	4 744.7	91.8	2 620.9	966.7	508.0	9 769.8	9 187.5	9 634.4	4 480.4	758.5	616.0	37.8	43 511.5
2009	4.4	61.7	3 802.8	51.2	1 988.3	1 320.8	443.3	7 777.5	9 950.7	8 704.3	4 548.5	855.8	619.8	19.5	40 148.6
2010	11.5	96.1	4 967.3	70.7	2 572.2	1 395.3	472.2	7 940.9	11 801.3	9 097.7	4 517.3	1 069.2	689.6	20.1	44 721.5
2011	11.5	85.2	3 687.8	69.2	2 849.1	923.5	429.7	8 026.3	10 885.4	8 559.0	6 173.7	1 260.9	411.8	19.5	43 392.4
2012	7.6	61.1	3 815.6	65.1	2 660.2	659.3	351.8	8 849.4	11 425.8	8 592.1	4 541.0	656.8	379.1	10.5	42 075.8
2013	4.5	62.7	3 618.0	92.8	2 074.2	683.8	362.3	7 974.2	11 724.0	8 093.4	4 282.2	445.7	389.0	9.7	39 816.5
2014	5.3	49.7	3 163.7	56.9	2 110.0	431.5	461.8	7 972.7	11 058.5	9 635.8	6 119.1	1 024.0	459.8	24.7	42 573.4
2015	4.9	74.0	2 382.5	43.5	1 971.4	408.8	383.6	9 271.1	12 030.6	10 836.5	5 047.6	764.6	390.5	11.8	43 621.6
2016	2.7	40.2	2 367.3	67.4	1 807.2	463.9	331.2	9 851.8	10 426.1	10 431.8	5 130.3	716.5	738.2	19.5	42 394.0
2017	1.5	99.0	2 419.4	43.8	1 762.2	782.0	410.2	8 531.6	10 551.6	10 942.4	5 538.8	869.2	712.2	23.3	42 687.3
2018	4.0	67.7	2 225.9	40.5	1 459.1	383.8	294.3	8 753.6	10 410.7	10 756.9	7 505.9	1 431.5	657.8	19.2	44 010.9
2019	15.1	27.7	2 407.7	23.8	2 398.4	315.7	264.9	8 901.5	9 688.1	9 656.7	5 495.8	697.4	468.9	15.1	40 376.7
2020	0.4	78.6	2 521.4	25.5	2 052.9	669.0	204.0	7 747.1	8 575.7	8 894.3	4 245.2	551.6	538.8	11.9	36 117.0
2021	3.8	60.6	2 224.0	45.3	2 376.1	273.8	179.6	7 846.3	10 023.2	11 019.5	4 569.2	583.0	592.2	16.3	39 813.1
All	753.3	1 305.1	29 862.4	2 316.5	20 836.1	6 846.4	2 829.2	60 464.7	38 444.9	77 882.4	56 430.5	18 431.2	11 712.7	542.6	328 669.4

Table D30: The deepwater Tier 2 footprint by BOMEC class within the fishable area, for 1990–2021. The 'All' includes 1.2 km^2 not assigned to a class and 0.2 km^2 in class K. Year is fishing year.

Year	A	B	C	D	E	F	G	H	I	J	L	M	N	O	All
1990	16.4	43.6	601.9	220.0	2 305.9	49.4	85.0	3 316.0	828.8	442.0	151.7	13.5	14.2	0.4	8 088.8
1991	6.9	40.0	353.9	192.5	1 703.7	5.3	42.8	2 254.4	485.3	385.1	151.6	9.0	48.0	1.0	5 679.6
1992	26.8	39.6	718.3	66.9	1 751.3	44.5	15.5	1 892.5	719.6	508.7	85.2	8.2	49.9	1.3	5 928.2
1993	29.8	120.2	560.6	121.1	2 032.3	33.8	85.6	2 668.1	640.7	529.9	96.0	5.4	53.1	1.5	6 978.2
1994	34.4	105.1	391.0	44.0	1 450.2	10.8	72.0	1 986.6	584.7	556.3	112.8	4.4	78.4	2.2	5 432.9
1995	20.0	145.7	1 045.0	100.1	2 122.1	6.3	137.9	2 397.1	760.6	554.9	131.1	8.3	59.5	13.9	7 502.5
1996	77.7	57.2	627.3	90.1	1 961.9	23.4	11.4	2 279.2	465.0	447.5	147.0	42.6	74.8	12.7	6 317.9
1997	115.1	70.4	682.1	77.6	1 154.8	11.9	11.4	1 305.0	257.1	434.6	54.1	3.8	46.3	14.1	4 238.3
1998	30.4	45.2	317.1	96.1	1 444.2	12.5	15.2	1 213.0	162.9	465.3	35.6	8.6	84.9	14.4	3 945.4
1999	61.6	33.1	307.6	46.0	1 065.1	9.2	35.0	955.0	199.4	598.7	33.1	7.9	101.5	13.8	3 467.1
2000	31.4	61.3	412.9	68.7	887.9	14.7	40.5	878.7	231.7	636.9	33.8	12.2	117.3	14.2	3 442.2
2001	29.8	73.3	521.8	60.7	607.0	7.2	36.5	1 482.7	238.6	447.8	29.3	7.7	59.7	11.5	3 613.6
2002	54.2	125.8	770.1	63.2	990.1	3.0	46.7	1 796.0	359.3	464.7	89.8	5.3	48.7	11.5	4 828.4
2003	151.3	34.7	736.0	80.6	1 122.3	13.4	24.2	2 151.7	246.7	465.1	51.9	0.1	80.0	14.4	5 172.3
2004	55.1	19.4	320.9	76.1	839.6	4.6	24.2	1 181.0	93.1	364.7	73.2	-	73.1	13.2	3 138.4
2005	11.9	15.2	840.0	13.9	1 115.7	1.2	4.5	1 337.1	308.0	632.3	106.6	7.2	107.7	17.0	4 518.2
2006	4.6	4.2	297.3	10.6	1 390.7	2.7	5.0	1 429.3	689.4	803.8	109.1	0.4	63.6	13.4	4 824.1
2007	10.6	12.7	523.4	37.3	1 831.5	13.9	17.0	2 156.8	755.5	720.1	99.7	4.2	47.5	8.0	6 238.3
2008	123.2	697.5	1 506.7	137.9	1 153.0	3.0	169.5	3 054.6	763.2	783.7	99.1	4.0	62.4	7.0	8 564.8
2009	103.1	454.4	924.3	185.6	1 207.1	22.6	156.7	2 168.7	868.7	544.7	139.3	6.9	37.8	5.0	6 825.0
2010	54.0	399.9	699.5	258.1	1 039.8	4.6	162.4	1 697.4	820.7	733.1	121.0	2.3	50.9	9.5	6 053.4
2011	78.1	294.6	518.8	227.8	1 397.8	0.2	215.0	1 925.8	746.7	677.1	82.0	5.6	49.2	6.2	6 225.2
2012	54.6	483.8	719.2	193.2	1 035.5	8.9	210.1	1 569.5	458.5	598.9	123.4	5.3	49.7	6.3	5 517.2
2013	54.7	535.7	620.5	180.3	1 358.7	1.3	315.9	1 276.5	715.4	551.9	117.8	0.9	15.1	4.4	5 749.4
2014	77.4	542.7	1 146.3	196.6	993.2	7.2	224.1	1 198.8	736.4	582.2	99.6	4.6	34.1	5.8	5 849.1
2015	29.5	270.8	1 396.3	155.8	1 294.3	2.9	143.6	995.7	474.4	548.2	84.6	11.2	50.9	2.9	5 461.2
2016	13.2	336.4	594.4	71.9	1 294.3	1.7	164.8	1 281.8	484.3	505.1	33.0	9.1	42.7	6.1	4 838.9
2017	13.3	172.5	470.1	115.9	1 682.3	1.8	95.9	1 355.1	524.6	421.2	33.8	9.0	28.2	1.9	4 925.7
2018	20.3	293.6	332.1	43.8	1 244.2	-	132.3	1 469.0	646.3	330.7	28.7	4.6	32.5	2.0	4 580.1
2019	7.9	333.7	302.9	53.8	1 317.3	-	106.4	1 081.6	323.4	421.9	27.8	3.1	31.3	2.1	4 013.1
2020	17.8	782.5	1 331.9	50.0	1 075.3	-	177.2	736.0	219.5	509.6	6.8	-	32.8	2.1	4 941.7
2021	20.8	733.0	772.7	103.7	1 003.8	-	189.3	838.5	270.9	403.3	28.7	-	49.0	1.3	4 415.0
All	901.1	4 286.7	14 072.0	2 012.6	13 240.8	237.4	1 767.8	23 507.9	5 619.8	8 990.0	874.0	199.6	1 125.4	89.8	76 926.7

Table D31: Estimated footprint (km^2) for the Tier 1 target fish species relative to the probability of occurrence of each target and for the scampi and arrow squid targets relative to the estimated extent of the species (based on www.nabis.govt.nz).

Probability occurrence (%)	HAK		HOK		JMA		LIN		OEO		ORH	
	1990-2021	2021	1990-2021	2021	1990-2021	2021	1990-2021	2021	1990-2021	2021	1990-2021	2021
0	243.4	–	160.1	0.5	997.4	3.7	2.9	–	356.1	0.1	1 048.6	7.7
0.1–1.0	230.7	0.3	1 043.8	2.0	184.3	3.0	122.6	–	59.9	–	167.4	2.3
1.1–5.0	472.1	12.1	2 863.4	13.0	1 178.3	6.9	113.8	0.1	194.7	0.4	376.9	6.5
5.1–10.0	365.9	18.2	3 089.0	20.8	991.1	6.1	192.1	1.9	184.7	0.2	381.6	13.0
10.1–0.0	549.4	17.4	3 977.8	29.5	2 314.8	56.2	743.8	15.9	225.5	1.6	620.6	21.0
20.1–30.0	512.0	7.5	2 746.9	34.4	5 970.9	197.4	1 540.5	49.1	234.9	0.7	594.1	27.2
30.1–40.0	791.4	7.9	2 526.1	55.3	6 505.3	244.6	1 590.0	65.5	179.7	3.6	545.2	57.5
40.1–50.0	1 621.5	27.2	2 661.6	73.0	4 673.0	389.6	1 573.1	90.3	209.2	3.3	571.4	77.2
50.1–60.0	2 330.5	92.7	2 815.6	86.9	5 177.7	546.9	1 435.9	100.4	270.1	4.4	552.4	50.3
60.1–70.0	3 217.2	139.1	2 727.9	136.7	9 545.5	716.6	1 464.1	106.7	469.6	15.0	728.7	90.1
70.1–80.0	6 133.2	246.6	3 789.4	205.2	6 733.7	332.8	1 742.6	95.0	1 277.3	24.8	1 064.6	99.8
80.1–90.0	4 378.8	157.1	6 488.2	536.7	2 657.8	315.1	4 373.3	213.4	3 100.2	24.9	2 417.7	349.6
90.1–95.0	281.4	7.3	20 588.3	2 080.5	65.4	–	8 323.6	455.5	3 002.4	25.2	2 951.2	355.9
95.1–99.0	4.2	–	111 729.2	17 223.2	9.0	–	9 194.0	612.1	7 561.5	180.7	31 925.3	4 268.4
0.0–99.0	21 131.7	733.5	167 207.3	20 497.8	47 004.3	2 818.9	32 412.4	1 805.9	17 325.9	285.0	43 945.6	5 426.7

Table D31 continued

Probability		SBW
(%)	1990–2021	2021
0	114.8	–
0.1–1.0	97.8	–
1.1–5.0	372.4	–
5.1–10.0	351.4	–
10.1–0.0	502.1	0.1
20.1–30.0	431.7	0.6
30.1–40.0	381.9	0.8
40.1–50.0	354.6	0.1
50.1–60.0	544.1	0.7
60.1–70.0	754.1	2.6
70.1–80.0	1 365.4	8.4
80.1–90.0	3 799.9	160.3
90.1–95.0	5 421.8	186.7
95.1–99.0	8 974.5	186.6
0.0–99.0	23 466.7	547.0

Population		SCI		SQU
extent	1990–2021	2021	1990–2021	2021
Hotspot	5 141.2	1 518.5	16 245.9	1 431.2
90% population	5 278.3	743.9	15 408.9	2 264.4
100% population	9 465.5	2 347.6	7 349.8	367.7
Not Exist /unknown	998.3	–	686.1	–
All	20 883.4	4 610.0	39 690.7	4 063.3

Table D32: The estimated footprint (km^2) for deepwater fishstocks during 1990–2021 and 2021 by the surficial layers representing the percent of carbonate, gravel mud, and sand. 'unk' is where there was no overlap.

	1990–2021 footprint (km^2)			
Sediment (%)	Carbonate	Gravel	Mud	Sand
0–20	61 086.6	276 788.2	109 779.6	33 768.1
20–40	86 759.8	54 886.6	87 763.2	68 855.9
40–60	68 523.1	15 678.2	83 289.7	136 889.7
60–80	60 193.3	5 324.5	49 312.9	93 345.2
80–100	77 876.8	1 554.2	24 121.9	21 590.9
unk	1 262.1	1 469.9	1 434.3	1 251.9
Total	355 701.7	355 701.6	355 701.6	355 701.7

	2021 footprint (km^2)			
Sediment (%)	Carbonate	Gravel	Mud	Sand
0–20	10 714.1	34 999.1	12 610.7	3 432.9
20–40	10 442.1	6 791.1	10 173.6	8 455.9
40–60	6 388.8	1 282.8	12 505.1	17 754.9
60–80	7 977.2	144.3	5 838.2	10 669.3
80–100	8 111.2	416.1	2 505.8	3 320.3
unk	0.4	0.4	0.4	0.4
Total	43 633.8	43 633.8	43 633.8	43 633.7

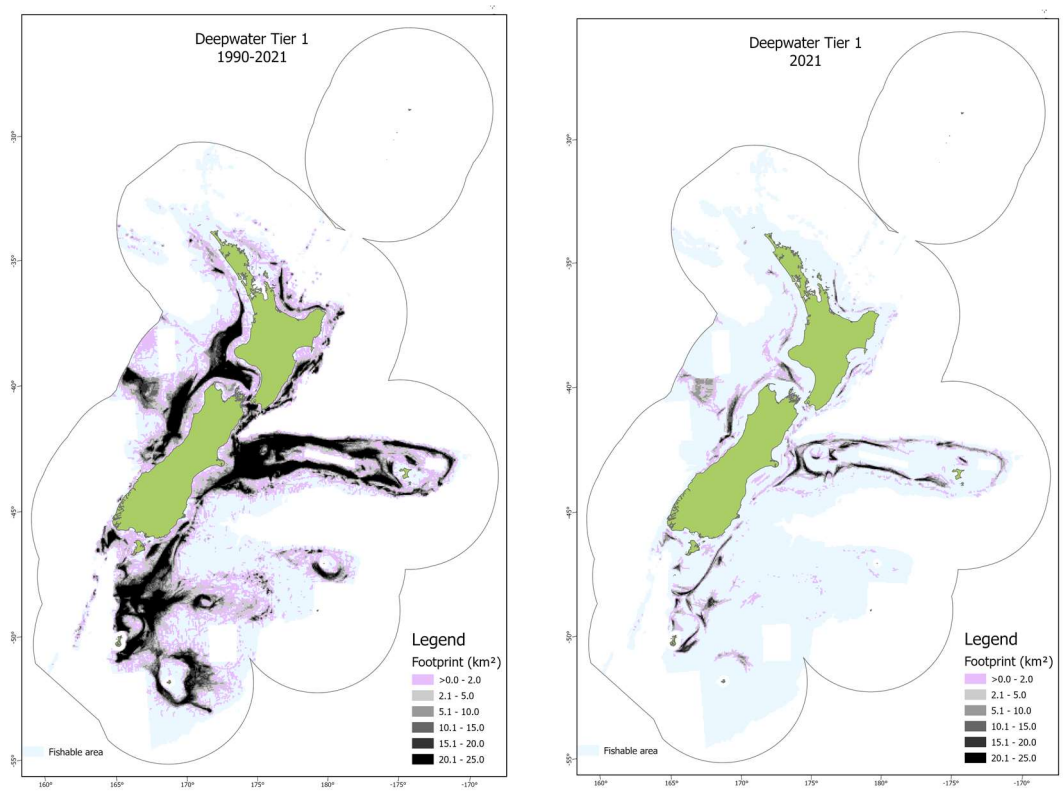

Figure D1: Distribution of the deepwater Tier 1 footprint, by 25-km^2 cells, 1990–2021 and 2021.

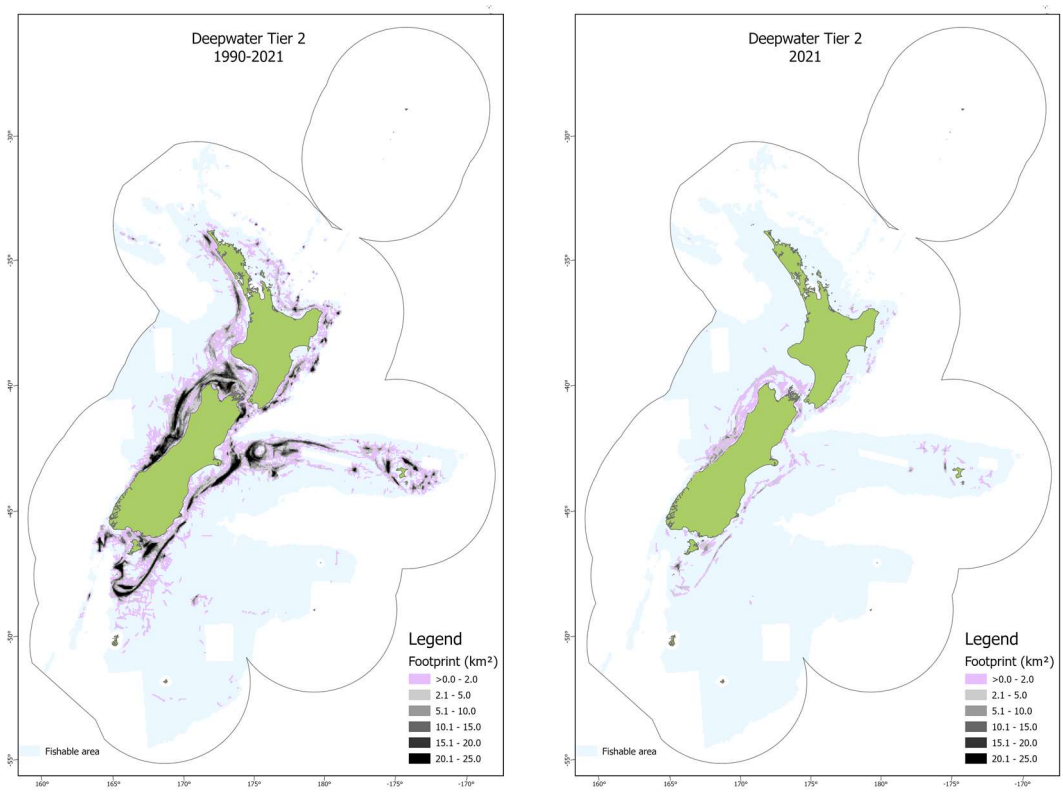

Figure D2: Distribution of the deepwater Tier 2 footprint, by 25-km^2 cells, 1990–2021 and 2021.

APPENDIX E: INSHORE FISHSTOCKS SUMMARY

Table E1: The number of bottom-contacting tows by inshore target retained for the inshore spatial analysis, for 2008–2021. 'Others' include BCO, BNS, FRO, HPB, QSC, PAD, POR, RSN, TRU. [See Table 2 and Table E2 for definition of codes.]

Target	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
BAR	923	1 170	1 234	1 199	1 210	1 507	1 314	1 383	1 150	1 543	2 177	1 265	1 674	2 103	19 852
ELE	642	697	864	675	792	658	605	789	649	659	648	888	1 216	1 306	11 088
FLA	17 585	17 101	19 591	15 238	17 074	16 926	15 887	13 359	14 943	14 660	12 353	9 998	9 296	8 779	202 790
GSH	173	564	705	804	491	524	424	248	102	92	70	110	51	68	4 426
GUR	4 857	4 896	6 839	6 389	6 748	7 579	7 327	6 259	6 043	5 377	6 002	7 089	7 478	7 473	90 356
JDO	2 092	1 930	2 054	1 639	1 407	1 732	2 028	1 964	1 604	2 140	1 486	1 004	665	937	22 682
JMA	1 974	1 588	1 911	1 261	1 525	1 384	1 334	956	898	786	923	864	1 076	1 027	17 507
KAH	4	0	3	10	4	3	22	8	13	8	0	5	1	0	81
LEA	67	87	224	155	324	193	134	80	36	58	30	13	17	1	1 419
LIN	2 219	1 390	1 192	1 099	946	1 146	1 128	1 125	1 140	1 225	1 162	1 246	1 380	1 376	17 774
MOK	73	80	62	143	85	106	94	97	77	116	137	272	227	128	1 697
RCO	3 038	2 902	2 981	2 904	2 634	2 365	2 568	1 614	1 819	2 062	1 187	1 409	711	596	28 790
RSK	3	8	72	65	29	125	228	237	78	250	226	127	25	7	1 480
SCH	76	102	69	106	101	106	88	75	90	133	220	234	223	371	1 994
SKI	107	124	167	215	83	133	186	82	159	165	147	71	18	17	1 674
SNA	4 019	4 316	3 950	4 011	4 220	3 948	3 679	3 498	2 975	2 813	3 185	3 133	2 542	2 387	48 676
SPD	123	177	127	74	63	9	11	26	0	14	0	1	0	0	625
SPO	6	2	8	24	20	11	8	27	41	38	43	39	44	67	378
SSK	0	0	0	0	0	5	0	1	0	0	0	0	0	0	6
STA	1 069	1 119	1 519	1 439	1 303	1 200	1 345	1 229	1 282	975	1 184	916	783	1 074	16 437
TAR	11 044	11 924	12 362	12 269	11 272	10 928	12 213	11 030	9 664	10 644	9 189	8 064	6 112	5 894	142 609
TRE	2 816	3 102	2 896	3 471	2 588	2 735	2 581	2 305	2 506	2 707	2 219	2 200	2 148	1 839	36 113
WAR	1 064	1 041	1 041	1 243	1 358	1 241	1 129	1 410	1 332	1 116	986	635	504	497	14 597
Other	151	109	112	71	34	30	23	52	82	98	95	77	67	125	1 126
Total	54 125	54 429	59 983	54 504	54 311	54 594	54 356	47 854	46 683	47 679	43 669	39 660	36 258	36 072	684 177
No. vessels	81	80	88	90	79	78	82	78	73	73	62	60	54	53	297

Table E2: The number of 25-km^2 cells contacted by inshore targets, aggregate area, and footprint for 2008–2021 (ordered from largest to smallest footprint). Note that the 'All' number of cells is less than the sum of cells from individual targets because many target fisheries overlap. 'All' is the number of unique cells contacted by all inshore targets combined.

Target	Common name	No. of cells	Aggregate (km^2)	Footprint (km^2)
TAR	Tarakihi	11 369	259 468.8	80 352.1
GUR	Red gurnard	7 078	116 845.0	38 549.3
FLA	Flatfish species	5 030	195 219.2	26 777.9
SNA	Snapper	3 867	55 629.3	20 903.2
TRE	Trevally	3 884	62 114.5	19 234.5
RCO	Red cod	4 119	40 290.0	19 223.1
BAR	Barracouta	3 050	39 344.9	15 768.6
STA	Giant stargazer	3 229	32 319.3	13 812.9
JDO	John dory	3 813	24 936.2	13 016.1
WAR	Blue warehou	3 465	24 952.7	12 094.8
ELE	Elephantfish	1 966	14 404.0	6 987.1
SCH	School shark	2 678	4 147.1	3 468.8
SPO	Rig	1 733	3 138.7	2 498.8
GSH	Dark ghost shark	1 252	4 776.0	2 201.1
SKI	Gemfish	904	3 900.7	1 973.3
LEA	Leatherjacket	954	2 050.7	1 649.3
RSK	Rough skate	798	1 938.1	1 597.6
MOK	Moki	862	2 280.8	1 536.6
SPD	Spiny dogfish	833	874.3	818.4
KAH	Kahawai	235	128.7	125.1
SSK	Smooth skate	19	7.3	7.0
All		15 114	896 660.5	150 105.2

Table E3: Comparison of annual totals (number of cells contacted, aggregate area, and footprint) for combined TCER, TCEPR, and ERS data for inshore Targets (those listed without an asterisk in Table E2) and inshore Fishstocks and the percent of the Target totals retained in the Fishstock totals, 2008–2021. The annual overlap of the Fishstock footprint on the EEZ+TS and fishable area is given in the lower part of the table.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
No. cells contacted															
Target	9 413	9 359	9 459	9 557	9 193	9 108	9 516	9 383	9 292	9 429	9 133	8 576	7 034	7 066	15 114
Fishstock	9 256	9 093	9 218	9 286	8 873	8 859	9 304	9 166	9 049	9 239	8 930	8 409	6 891	6 941	14 812
%	98.3	97.2	97.5	97.2	96.5	97.3	97.8	97.7	97.4	98.0	97.8	98.1	98.0	98.2	98.0
Aggregate (km^2)															
Target	69 271.3	72 847.0	75 640.2	69 103.6	66 757.6	66 419.9	69 822.0	63 671.9	62 095.5	65 385.8	62 168.3	56 824.9	47 789.1	48 863.4	896 660.5
Fishstock	67 939.5	71 217.0	73 574.6	67 271.9	64 914.5	64 668.5	68 003.0	61 952.3	60 112.5	63 615.4	60 279.3	54 992.4	46 530.5	47 387.4	872 458.9
%	98.1	97.8	97.3	97.3	97.2	97.4	97.4	97.3	96.8	97.3	97.0	96.8	97.4	97.0	97.3
Footprint (km^2)															
Target	49 376.4	52 066.1	53 272.9	51 067.3	48 716.3	48 801.2	51 326.5	48 057.4	46 504.0	48 585.4	47 780.3	43 590.2	35 400.3	36 290.1	150 105.2
Fishstock	48 236.3	50 572.8	51 484.9	49 396.3	47 058.1	47 243.3	49 682.9	46 495.9	44 736.3	46 970.1	46 109.2	42 078.3	34 365.3	35 031.6	145 237.5
%	97.7	97.1	96.6	96.7	96.6	96.8	96.8	96.8	96.2	96.7	96.5	96.5	97.1	96.5	97
Overlap of fishstock footprint with EEZ+TS															
% overlap	1.2	1.2	1.3	1.2	1.1	1.2	1.2	1.1	1.1	1.1	1.1	1.0	0.8	0.9	3.5
Overlap of fishstock footprint with fishable area															
% overlap	3.5	3.7	3.7	3.6	3.4	3.4	3.6	3.4	3.2	3.4	3.3	3.0	2.5	2.5	10.5

Table E4: The number of cells contacted by inshore fishstocks during 2008–2021. [Continued on next page]

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
BAR1	1 082	1 221	1 084	1 140	1 227	1 146	1 217	1 407	1 259	1 249	1 531	1 253	1 121	1 192	3 050
ELE3	475	621	637	556	604	483	447	525	488	434	532	610	664	673	1 236
ELE5	78	60	62	88	48	117	106	135	115	132	142	109	87	47	310
ELE7	44	22	32	109	29	50	41	105	92	145	161	69	9	50	438
FLA1	19	10	22	10	6	8	–	–	–	–	–	6	–	–	53
FLA2	274	254	170	181	224	232	202	181	202	116	125	99	66	25	570
FLA3	1 119	1 091	1 163	1 150	1 132	1 147	1 097	1 129	1 107	1 090	1 032	836	603	606	2 359
FLA7	1 144	1 172	1 222	923	1 060	987	865	805	856	840	945	911	540	515	2 069
GSH2	10	8	20	33	23	21	11	12	5	5	13	19	–	–	97
GSH3	109	119	125	143	36	92	219	153	43	30	100	37	13	14	455
GSH7	112	222	275	315	201	280	261	117	58	70	69	111	55	56	715
GSH8	18	–	11	10	16	5	–	–	–	–	8	11	–	–	65
GUR1	761	728	663	555	638	622	533	631	494	546	467	366	408	533	1 623
GUR2	745	719	762	784	713	690	778	693	707	788	740	709	502	495	1 256
GUR3	373	467	479	499	494	720	721	566	709	586	702	762	601	599	1 420
GUR7	331	425	745	868	921	1 046	976	860	894	872	892	1 115	993	962	1 972
GUR8	305	380	402	399	392	411	392	359	344	282	361	396	379	448	902
JDO1	607	558	663	542	510	635	747	730	601	675	479	423	303	318	1 625
JDO2	213	280	289	284	268	324	408	379	354	398	302	243	225	133	1 002
JDO3	–	–	–	–	–	–	–	–	–	–	6	–	–	–	6
JDO7	294	150	208	172	223	383	380	590	432	499	768	635	474	636	1 315
KAH1	17	–	9	10	10	9	20	7	9	4	–	13	–	–	62
KAH2	–	–	–	49	–	–	34	9	25	7	–	–	6	–	97
KAH3	–	–	3	–	–	–	–	9	–	7	–	–	–	–	19
KAH8	6	–	–	–	–	–	9	12	13	25	–	–	–	–	57
LEA1	14	25	14	11	37	39	38	31	20	25	32	18	–	–	158
LEA2	132	183	266	241	268	277	176	133	89	90	21	6	–	10	542
LEA3	8	14	19	86	30	5	32	49	56	36	50	33	29	–	254

Table E4: continued.

Fishstock	2 008	2 009	2 010	2 011	2 012	2 013	2 014	2 015	2 016	2 017	2 018	2 019	2 020	2 021	All
MOK1	123	174	119	196	134	133	121	173	151	190	294	350	282	209	793
MOK3	–	2	12	8	–	11	–	–	5	–	13	8	–	–	59
RCO2	55	27	22	135	131	80	12	23	87	103	7	37	5	9	374
RCO3	1 076	985	1 032	1 034	1 133	1 000	1 247	967	766	971	921	538	455	631	2 027
RCO7	937	874	855	807	762	572	589	630	675	639	555	586	442	399	1 796
RSK3	15	41	84	120	111	201	338	404	208	274	365	310	39	26	750
RSK7	–	–	9	–	–	–	–	–	6	–	–	–	19	–	34
SCH1	67	126	110	200	155	197	218	119	71	60	175	128	73	189	702
SCH2	2	–	–	5	13	–	–	15	5	7	–	13	37	4	87
SCH3	66	67	84	81	11	89	50	65	61	57	164	106	72	68	608
SCH5	5	11	–	–	–	–	–	–	–	–	10	–	–	–	26
SCH7	131	142	94	130	122	124	23	54	134	88	271	134	253	279	956
SCH8	67	114	48	62	121	95	94	83	69	142	141	163	129	152	381
SKI1	184	85	109	64	98	105	159	61	76	107	65	48	36	11	380
SKI2	61	115	148	234	86	136	176	152	147	149	212	143	43	52	548
SNA1	826	840	831	893	883	809	817	845	801	854	899	839	728	691	1 491
SNA2	233	277	189	192	201	178	250	208	321	295	330	138	151	82	627
SNA3	–	–	–	17	–	–	4	–	–	–	–	–	–	–	21
SNA7	271	235	290	303	196	237	258	219	212	197	217	178	85	96	584
SNA8	550	531	449	416	491	402	342	451	383	387	376	387	218	255	1 199
SPD1	–	–	–	3	–	–	–	–	–	33	–	–	–	–	36
SPD3	344	373	345	208	123	44	50	72	–	–	–	–	–	–	771
SPD7	–	–	11	–	–	–	–	–	–	7	–	8	–	–	26
SPO2	–	–	–	6	–	–	–	–	–	–	–	–	–	–	6
SPO7	8	8	21	88	107	75	14	46	88	38	45	39	31	86	445
SPO8	23	8	18	9	7	–	29	37	87	59	104	63	45	60	229
SSK3	–	–	–	–	–	14	–	5	–	–	–	–	–	–	19
STA2	–	–	–	–	11	–	–	–	–	–	–	–	–	–	11

Table E4: continued.

Fishstock	2 008	2 009	2 010	2 011	2 012	2 013	2 014	2 015	2 016	2 017	2 018	2 019	2 020	2 021	All
STA3	136	280	398	386	272	315	274	304	431	420	470	408	260	359	1 177
STA4	40	–	73	25	–	–	7	–	–	–	–	–	–	–	126
STA5	363	344	392	383	381	400	388	393	376	341	357	281	238	233	749
TAR1	1 645	1 579	1 599	1 530	1 478	1 363	1 646	1 655	1 633	1 725	1 514	1 282	1 170	1 001	3 029
TAR2	1 202	1 104	1 105	1 121	1 120	1 103	1 152	1 121	1 100	1 057	1 134	949	682	688	1 748
TAR3	950	1 008	1 023	1 089	908	917	1 078	1 172	1 091	1 118	1 018	868	582	538	1 894
TAR4	164	82	210	115	33	–	158	147	56	100	95	212	147	86	445
TAR5	40	46	83	158	140	128	105	158	106	109	79	94	64	122	403
TAR7	1 520	1 688	1 687	1 932	1 877	1 867	1 893	1 730	1 743	1 771	1 710	1 503	1 150	1 318	3 266
TRE1	755	682	665	664	564	561	594	545	591	697	619	615	631	534	1 304
TRE2	129	241	160	68	28	148	184	134	221	132	42	48	88	63	622
TRE3	–	–	–	–	–	–	–	–	–	2	–	5	5	25	36
TRE7	883	1 029	938	982	924	861	874	747	818	873	822	689	498	652	1 991
WAR1	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2
WAR2	212	205	192	85	119	90	103	109	162	177	167	128	152	68	473
WAR3	461	432	367	379	424	381	345	433	386	427	340	415	330	279	1 345
WAR7	635	627	605	660	561	652	614	645	695	553	632	340	345	247	1 513
WAR8	21	–	12	38	77	35	93	47	120	48	44	40	10	12	243
Total	9 093	8 955	9 093	9 164	8 794	8 733	9 207	9 086	8 973	9 104	8 856	8 346	6 808	6 791	14 643

Table E5: The estimated aggregate area (km^2) for inshore fishstocks, by fishing years 2008–2021. [Continued on next page]

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
BAR1	1 746.7	2 235.5	2 534.0	2 456.2	2 293.2	2 698.2	2 638.4	2 731.0	2 286.4	3 158.6	4 366.6	2 569.8	3 325.1	4 305.1	39 344.9
ELE3	842.5	907.2	1 060.2	788.4	985.5	739.3	682.0	905.1	774.6	756.6	742.3	1 080.2	1 432.7	1 571.1	13 267.8
ELE5	36.9	41.9	37.3	41.9	22.0	64.6	60.4	101.0	59.8	66.8	73.6	65.6	48.7	23.8	744.3
ELE7	15.1	5.5	17.0	52.4	12.3	15.4	16.8	44.0	47.5	61.0	58.1	28.3	4.2	13.1	390.6
FLA1	6.7	3.9	4.4	7.9	1.2	1.6	–	–	–	–	–	1.4	–	–	27.0
FLA2	1 083.9	922.0	597.3	900.0	1 015.7	921.3	1 086.2	864.4	837.6	781.7	644.5	333.7	157.2	76.5	10 222.1
FLA3	6 521.3	6 697.5	7 844.6	6 888.6	7 884.6	8 891.7	8 510.3	6 649.7	7 437.3	7 169.4	5 909.7	4 891.7	4 130.3	4 199.1	93 625.8
FLA7	9 473.9	9 680.0	10 116.9	6 069.6	7 069.8	5 939.4	5 671.3	5 563.7	6 426.2	7 473.1	6 036.6	4 718.8	3 539.7	3 565.4	91 344.3
GSH2	4.2	5.9	7.4	13.8	9.4	8.7	7.3	8.1	2.5	1.0	4.1	5.0	–	–	77.4
GSH3	58.9	43.9	40.5	73.2	12.4	101.8	97.5	66.6	14.4	7.9	37.4	11.0	3.7	5.1	574.2
GSH7	114.4	513.0	662.8	821.3	496.1	510.9	367.6	196.8	75.7	83.8	38.7	116.5	42.6	56.1	4 096.2
GSH8	8.1	–	3.4	4.2	4.8	1.6	–	–	–	–	2.2	4.0	–	–	28.2
GUR1	1 447.6	919.1	773.4	712.5	1 387.3	1 077.6	803.9	998.6	976.7	1 045.5	1 027.4	797.1	839.2	1 948.0	14 753.9
GUR2	3 976.5	4 063.7	6 050.5	5 037.4	3 997.3	3 868.9	4 229.6	3 837.7	3 630.1	3 509.6	3 321.8	3 457.5	2 852.8	2 155.4	53 988.8
GUR3	367.4	404.4	468.6	498.6	564.0	967.6	1 052.1	707.6	870.0	675.4	973.7	1 326.9	1 359.7	1 301.2	11 537.2
GUR7	203.3	330.6	811.3	1 119.5	1 995.5	2 853.5	2 512.4	2 097.4	1 787.5	1 541.9	1 926.8	3 501.3	3 224.3	2 957.8	26 863.1
GUR8	489.2	736.7	887.2	724.4	643.4	601.1	550.7	556.9	369.5	285.5	502.4	737.3	1 282.7	1 335.2	9 702.1
JDO1	1 863.7	1 740.3	1 715.5	1 194.9	1 034.5	1 078.9	1 207.3	1 112.5	938.2	1 194.6	782.4	576.3	245.8	452.4	15 137.5
JDO2	237.5	182.3	268.3	275.5	254.1	272.8	457.0	406.9	381.2	393.9	280.9	168.1	145.3	48.8	3 772.6
JDO3	–	–	–	–	–	–	–	–	–	–	2.1	–	–	–	2.1
JDO7	231.7	90.6	138.0	174.8	110.6	323.8	384.5	631.3	332.5	623.9	994.4	698.5	457.8	831.7	6 024.0
KAH1	4.9	–	2.7	2.7	6.4	3.1	8.6	1.4	3.6	0.8	–	7.0	–	–	41.2
KAH2	–	–	–	21.6	–	–	23.5	3.9	6.9	1.6	–	–	1.7	–	59.1
KAH3	–	–	0.7	–	–	–	–	2.3	–	2.5	–	–	–	–	5.5
KAH8	1.7	–	–	–	–	–	2.5	3.9	4.2	10.6	–	–	–	–	22.9
LEA1	3.4	6.9	3.2	2.9	22.5	11.3	10.4	8.2	5.6	15.1	7.6	4.3	–	–	101.2
LEA2	132.7	150.3	385.1	159.2	400.7	243.6	141.7	74.4	30.0	47.3	7.8	1.5	–	2.4	1 776.7
LEA3	2.9	3.5	7.5	29.3	24.9	0.9	11.6	16.3	19.1	11.5	23.8	9.9	11.5	–	172.7
MOK1	102.8	99.8	71.6	187.7	98.6	105.8	97.4	109.5	89.4	145.7	194.6	402.5	357.9	195.6	2 259.0

Table E5: continued.

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
MOK3	–	0.3	2.5	3.7	–	5.0	–	–	1.1	–	2.9	1.6	–	–	17.1
RCO2	22.0	5.7	7.9	51.0	147.1	40.1	3.0	10.8	34.1	43.1	1.6	11.7	0.9	2.9	381.9
RCO3	2 533.4	2 823.6	2 529.2	2 485.5	2 025.4	2 016.6	2 551.3	956.1	1 219.1	1 504.6	991.5	787.4	563.1	565.7	23 552.5
RCO7	2 098.8	1 704.9	1 445.4	1 908.4	1 249.6	924.4	1 035.5	1 358.3	1 243.1	1 226.8	513.9	905.5	383.2	357.8	16 355.6
RSK3	3.0	12.3	78.1	77.1	41.0	144.0	303.0	342.5	129.4	309.8	280.1	176.3	14.3	12.7	1 923.6
RSK7	–	–	1.9	–	–	–	–	–	1.3	–	–	–	6.2	–	9.4
SCH1	19.8	49.8	59.7	166.8	160.3	145.0	178.5	86.2	50.2	31.8	142.8	88.9	36.6	178.1	1 394.4
SCH2	0.2	–	–	1.1	3.6	–	–	5.0	1.0	1.7	–	4.2	14.3	1.6	32.6
SCH3	19.5	18.7	26.9	21.9	4.1	33.8	17.2	15.3	18.3	23.3	65.0	43.8	22.9	19.6	350.2
SCH5	1.1	5.4	–	–	–	–	–	–	–	–	2.5	–	–	–	9.0
SCH7	59.8	70.5	35.8	47.0	38.5	47.3	5.5	16.5	48.4	36.7	126.4	72.7	173.9	282.4	1 061.6
SCH8	62.7	102.2	28.2	19.6	50.8	49.1	52.1	46.3	51.4	126.9	140.8	219.3	137.6	208.7	1 295.7
SKI1	282.8	170.1	255.4	237.5	169.9	204.8	220.4	27.6	194.7	211.4	121.6	35.1	27.7	5.3	2 164.4
SKI2	30.4	152.4	128.3	229.9	54.0	118.4	185.2	126.2	188.4	173.0	209.8	98.1	17.1	25.3	1 736.3
SNA1	2 741.1	3 077.0	2 728.3	2 739.4	2 910.3	2 880.2	2 546.3	2 417.1	2 117.6	2 097.0	3 229.6	3 304.9	3 111.9	2 960.1	38 860.5
SNA2	288.1	391.1	265.8	174.6	201.7	178.6	404.3	450.6	640.3	508.3	404.2	273.4	289.4	74.6	4 545.1
SNA3	–	–	–	3.8	–	–	1.4	–	–	–	–	–	–	–	5.2
SNA7	500.6	458.8	535.2	550.5	321.3	246.8	281.7	298.6	187.2	213.2	273.7	235.9	122.5	113.0	4 339.0
SNA8	1 248.0	1 091.7	712.1	460.4	577.9	482.1	583.7	557.4	381.2	334.8	348.2	429.8	388.2	283.9	7 879.5
SPD1	–	–	–	1.0	–	–	–	–	–	16.8	–	–	–	–	17.8
SPD3	165.0	220.2	240.7	98.9	75.7	11.1	13.2	25.4	–	–	–	–	–	–	850.2
SPD7	–	–	2.4	–	–	–	–	–	–	1.5	–	2.5	–	–	6.4
SPO2	–	–	–	1.4	–	–	–	–	–	–	–	–	–	–	1.4
SPO7	2.5	3.4	5.9	41.8	60.0	22.1	2.4	15.3	23.0	8.0	10.9	10.6	10.3	43.0	259.2
SPO8	5.7	1.9	6.1	2.3	1.5	–	7.8	22.3	31.5	36.1	62.6	43.3	30.3	47.1	298.4
SSK3	–	–	–	–	–	6.2	–	1.0	–	–	–	–	–	–	7.3
STA2	–	–	–	–	3.1	–	–	–	–	–	–	–	–	–	3.1
STA3	54.1	160.7	269.4	415.5	176.9	241.6	176.6	300.1	370.0	321.1	330.4	440.8	144.3	352.3	3 753.9
STA4	34.5	–	74.5	85.0	–	–	7.5	–	–	–	–	–	–	–	201.5

Table E5: continued.

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
STA5	1 124.2	1 074.9	1 559.5	1 432.3	1 564.7	1 381.0	1 565.7	1 385.4	1 447.3	836.9	1 468.3	824.7	857.1	969.0	17 490.9
TAR1	4 590.9	5 157.3	4 213.1	4 191.1	4 080.4	3 220.0	4 045.8	4 426.6	4 529.3	5 343.0	4 645.3	3 584.6	3 751.0	3 213.2	58 991.6
TAR2	8 600.7	9 109.6	8 354.9	7 585.0	6 525.1	6 407.5	7 335.8	6 779.9	5 547.9	5 730.7	5 554.4	4 574.3	3 727.4	3 572.2	89 405.3
TAR3	1 752.8	2 375.6	2 711.1	2 700.7	1 750.2	2 057.2	2 908.4	3 033.0	2 079.9	2 891.6	2 714.5	2 180.6	995.7	848.8	31 000.3
TAR4	1 288.9	471.0	1 003.1	551.8	18.0	–	1 210.4	718.0	104.2	436.3	60.1	877.3	355.5	123.3	7 217.8
TAR5	21.3	16.4	101.1	179.9	134.8	161.3	87.1	96.0	140.3	95.0	67.3	48.3	65.0	112.7	1 326.5
TAR7	3 831.9	4 614.4	4 755.6	4 950.1	5 349.4	5 375.5	5 267.5	4 034.2	4 650.6	4 621.8	3 884.9	4 187.1	2 381.2	2 871.3	60 775.4
TRE1	1 272.5	1 244.0	1 400.0	1 870.1	1 062.3	1 008.0	1 226.0	973.4	1 337.9	1 824.7	1 544.8	1 814.5	1 923.3	1 688.3	20 189.9
TRE2	62.9	106.0	77.9	21.3	7.0	65.8	60.9	65.4	111.4	50.9	12.4	30.1	33.2	25.1	730.5
TRE3	–	–	–	–	–	–	–	–	–	0.3	–	1.2	1.2	10.8	13.5
TRE7	3 633.4	4 071.9	3 063.0	3 150.5	3 121.2	3 362.0	2 750.1	2 947.3	3 143.0	2 950.9	2 741.0	2 423.5	2 031.0	1 791.7	41 180.6
WAR1	–	–	0.4	–	–	–	–	–	–	–	–	–	–	–	0.4
WAR2	312.1	232.0	202.9	143.5	149.6	145.3	158.7	108.9	176.5	222.3	179.2	112.1	80.9	35.5	2 259.5
WAR3	562.3	505.0	773.4	849.3	1 279.0	772.7	768.2	840.3	790.8	717.9	500.8	710.6	544.3	525.4	10 139.9
WAR7	950.2	1 115.7	836.1	1 122.5	911.7	1 075.7	950.8	1 325.3	1 112.6	812.9	997.0	355.0	323.1	329.9	12 218.6
WAR8	8.7	–	2.4	13.1	39.1	9.1	50.2	17.5	74.6	33.6	36.8	26.6	13.6	9.1	334.4
Total	67 163.6	70 399.2	73 003.7	66 843.8	64 611.8	64 141.7	67 593.2	61 529.2	59 584.0	62 859.9	59 624.7	54 450.2	46 041.0	46 704.1	864 550.0

Table E6: The estimated footprint (km^2) for inshore fishstocks, by fishing years 2008–2021. [Continued on next page]

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
BAR1	1 524.7	1 812.6	1 914.6	1 961.3	1 857.5	2 150.9	2 126.0	2 233.2	1 959.0	2 426.3	3 352.3	2 258.0	2 648.1	3 217.1	15 768.6
ELE3	721.0	777.1	905.5	676.0	831.7	636.0	570.0	756.7	648.7	631.1	649.6	926.8	1 159.2	1 228.2	6 005.4
ELE5	35.7	39.2	35.0	40.3	21.3	62.8	58.6	96.9	58.9	64.9	70.9	64.1	47.9	23.4	612.9
ELE7	15.0	5.5	16.3	49.9	12.3	15.3	14.7	43.4	46.3	59.8	57.6	27.8	4.1	13.1	367.5
FLA1	6.6	3.8	4.4	6.9	1.2	1.6	–	–	–	–	–	1.4	–	–	25.0
FLA2	583.7	510.8	349.4	452.6	532.9	495.6	528.6	442.2	446.2	420.0	315.4	185.2	89.7	50.8	1 799.0
FLA3	3 371.3	3 724.9	4 153.0	3 929.3	4 091.1	4 518.6	4 297.3	3 895.2	3 849.4	3 611.1	3 351.1	2 739.6	2 004.5	1 885.1	13 309.3
FLA7	4 548.8	4 889.8	4 920.5	3 462.1	3 867.3	3 451.6	3 129.4	3 019.3	3 360.3	3 676.5	3 501.7	3 001.3	2 186.8	2 131.2	11 644.5
GSH2	3.9	5.6	7.3	13.6	9.1	8.4	7.1	7.8	2.4	1.0	4.1	5.0	–	–	63.6
GSH3	58.1	43.6	39.4	71.8	12.2	82.6	95.9	65.3	13.5	7.9	35.0	10.9	3.7	5.0	508.6
GSH7	103.9	380.0	500.0	601.6	378.4	426.9	313.3	172.2	71.2	78.9	36.4	106.9	36.1	49.4	1 602.5
GSH8	7.8	–	2.9	3.2	4.8	1.6	–	–	–	–	2.2	4.0	–	–	26.4
GUR1	1 281.4	841.5	687.4	627.7	1 177.7	923.2	686.9	894.6	853.8	870.7	824.2	623.8	667.0	1 488.1	6 781.9
GUR2	2 746.7	2 832.1	3 774.8	3 263.4	2 731.9	2 734.3	2 975.2	2 636.3	2 574.1	2 636.3	2 459.8	2 561.2	2 103.1	1 676.8	9 658.4
GUR3	332.1	383.8	440.8	458.7	520.4	896.3	926.0	650.2	800.7	615.7	888.4	1 142.1	1 105.3	1 041.5	6 599.5
GUR7	197.0	313.8	748.0	1 023.2	1 724.5	2 404.2	2 101.1	1 789.2	1 572.3	1 367.3	1 690.2	2 802.9	2 449.6	2 252.3	11 091.3
GUR8	444.6	648.5	720.9	625.6	559.0	516.9	483.5	495.0	341.8	266.1	439.7	630.1	940.8	1 017.3	4 418.2
JDO1	1 452.1	1 385.5	1 384.3	967.6	893.3	940.5	1 042.5	968.0	821.5	1 038.8	663.6	512.9	229.8	403.4	6 227.7
JDO2	207.3	174.4	244.6	254.5	233.8	255.6	413.4	371.5	356.3	364.0	260.4	158.5	140.1	48.6	2 590.2
JDO3	–	–	–	–	–	–	–	–	–	–	2.1	–	–	–	2.1
JDO7	218.8	85.3	126.7	155.5	106.6	297.1	340.0	573.0	313.0	569.3	908.4	643.4	429.8	748.4	4 196.0
KAH1	4.8	–	2.7	2.7	6.3	3.1	8.5	1.4	3.6	0.8	–	6.9	–	–	39.7
KAH2	–	–	–	21.6	–	–	22.1	3.9	6.9	1.6	–	–	1.7	–	57.0
KAH3	–	–	0.7	–	–	–	–	2.3	–	2.5	–	–	–	–	5.5
KAH8	1.7	–	–	–	–	–	2.5	3.9	4.2	10.5	–	–	–	–	22.8
LEA1	3.4	6.9	3.2	2.9	21.6	11.3	10.3	8.1	5.4	14.7	7.3	4.3	–	–	97.0
LEA2	117.0	141.4	341.4	155.2	355.8	235.2	135.6	73.0	30.0	46.7	7.8	1.5	–	2.4	1 386.4
LEA3	2.9	3.5	7.3	29.3	23.2	0.9	11.4	16.3	19.1	11.5	23.3	9.9	11.3	–	165.8

Table E6: continued.

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
MOK1	91.9	88.0	67.0	164.8	89.5	94.2	88.4	100.4	84.3	129.4	182.0	363.2	312.7	179.0	1 514.9
MOK3	–	0.3	2.5	3.7	–	5.0	–	–	1.1	–	2.9	1.6	–	–	17.1
RCO2	21.0	5.7	6.2	50.6	124.4	35.4	3.0	10.7	32.1	40.8	1.6	11.7	0.9	2.9	331.8
RCO3	1 899.1	1 956.5	1 874.6	1 852.4	1 643.3	1 426.1	2 077.7	857.8	1 001.4	1 217.8	873.8	619.3	452.4	509.5	10 713.2
RCO7	1 685.2	1 450.4	1 247.3	1 560.6	1 053.0	768.6	888.8	1 106.9	1 061.6	1 061.3	480.1	801.8	351.7	333.2	8 178.1
RSK3	3.0	12.3	60.4	70.0	39.1	137.7	281.1	323.9	122.0	279.9	259.6	168.2	14.1	11.7	1 583.5
RSK7	–	–	1.9	–	–	–	–	–	1.3	–	–	–	5.9	–	9.1
SCH1	19.8	49.7	59.5	162.0	153.3	139.9	172.0	85.3	49.0	31.7	130.9	86.7	36.3	170.9	1 151.9
SCH2	0.2	–	–	1.1	3.5	–	–	5.0	1.0	1.7	–	4.2	14.2	1.6	32.5
SCH3	19.1	18.7	26.7	21.7	4.1	33.5	16.9	15.3	18.3	22.1	63.8	42.6	22.8	19.5	341.1
SCH5	1.1	5.4	–	–	–	–	–	–	–	–	2.5	–	–	–	9.0
SCH7	59.5	69.5	34.9	47.0	38.4	46.9	5.5	16.5	48.0	36.3	121.5	70.5	160.2	247.7	923.3
SCH8	59.5	94.6	27.9	19.6	50.3	47.3	51.3	45.3	50.1	119.9	134.1	201.7	131.2	189.6	1 007.5
SKI1	226.3	125.4	191.4	169.5	149.7	156.0	182.9	27.6	142.4	159.7	106.8	34.8	27.2	5.3	832.9
SKI2	30.0	130.1	116.2	200.3	52.3	112.6	165.8	119.8	167.6	157.9	191.0	91.0	16.6	24.2	1 140.4
SNA1	2 238.5	2 404.3	2 197.3	2 229.9	2 295.8	2 238.4	2 025.5	2 001.8	1 819.2	1 836.3	2 567.4	2 600.4	2 346.0	2 195.8	11 641.1
SNA2	260.3	331.1	240.5	165.5	192.5	170.4	338.7	379.3	497.2	420.2	322.4	160.1	235.1	71.0	2 360.4
SNA3	–	–	–	3.8	–	–	1.4	–	–	–	–	–	–	–	5.2
SNA7	364.9	347.3	442.9	455.0	260.6	221.5	249.3	259.5	170.1	189.7	240.3	209.5	103.5	104.8	2 044.7
SNA8	1 066.6	965.5	638.9	430.1	536.0	447.8	534.2	526.3	363.3	316.7	328.5	396.7	334.5	256.7	4 851.9
SPD1	–	–	–	1.0	–	–	–	–	–	15.6	–	–	–	–	16.6
SPD3	162.1	214.2	230.1	97.5	73.6	10.9	13.1	25.3	–	–	–	–	–	–	795.5
SPD7	–	–	2.4	–	–	–	–	–	–	1.5	–	2.5	–	–	6.3
SPO2	–	–	–	1.4	–	–	–	–	–	–	–	–	–	–	1.4
SPO7	2.5	3.4	5.8	40.9	58.9	22.1	2.4	15.3	23.0	8.0	10.9	10.6	10.1	37.4	248.2
SPO8	5.7	1.9	6.1	2.3	1.5	–	7.8	22.0	30.6	33.3	61.3	38.2	27.0	39.9	252.5
SSK3	–	–	–	–	–	6.0	–	1.0	–	–	–	–	–	–	7.0
STA2	–	–	–	–	3.1	–	–	–	–	–	–	–	–	–	3.1

Table E6: continued.

Fishstock	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All
STA3	53.6	153.1	253.5	366.8	156.8	220.5	165.7	256.8	324.8	300.9	314.2	387.3	138.4	289.4	2 625.4
STA4	34.1	-	68.3	66.1	-	-	7.5	-	-	-	-	-	-	-	172.2
STA5	868.1	851.1	1 138.8	1 105.8	1 179.4	1 093.2	1 188.7	1 091.9	1 114.0	683.5	1 086.9	671.4	645.1	701.8	4 692.6
TAR1	3 788.0	4 005.3	3 400.3	3 359.7	3 335.0	2 616.5	3 354.0	3 610.6	3 696.7	4 403.6	3 751.4	2 887.2	3 010.5	2 545.0	19 847.1
TAR2	5 442.1	5 518.4	5 192.0	4 882.5	4 072.4	4 236.7	4 675.7	4 547.8	3 963.7	4 041.1	4 089.8	3 325.5	2 635.2	2 546.0	15 591.0
TAR3	1 569.5	2 047.0	2 280.3	2 229.4	1 553.8	1 751.9	2 361.4	2 506.8	1 804.6	2 349.0	2 208.6	1 736.5	799.6	677.5	12 639.8
TAR4	708.6	356.3	733.8	323.5	18.0	-	758.0	513.8	91.9	287.6	59.5	553.6	259.4	95.0	2 306.5
TAR5	20.9	16.2	84.1	157.2	122.8	136.6	78.6	93.1	121.3	91.3	60.7	47.6	62.7	106.0	929.5
TAR7	3 297.0	3 845.0	3 843.9	4 144.0	4 353.3	4 435.2	4 447.0	3 485.7	3 967.4	3 928.4	3 347.2	3 350.9	1 984.2	2 465.0	23 884.3
TRE1	1 096.7	1 073.2	1 169.5	1 481.0	924.6	842.5	997.2	799.0	1 075.9	1 503.3	1 311.7	1 446.1	1 403.4	1 249.5	7 486.4
TRE2	61.6	103.6	77.0	21.2	7.0	63.1	60.7	64.1	109.2	49.6	12.4	28.5	32.8	24.8	687.3
TRE3	-	-	-	-	-	-	-	-	-	0.3	-	1.2	1.2	10.6	13.3
TRE7	2 801.3	3 119.4	2 362.9	2 499.1	2 420.2	2 573.3	2 197.1	2 115.7	2 341.6	2 229.3	2 150.8	1 912.0	1 393.6	1 446.7	11 047.5
WAR1	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	0.4
WAR2	280.5	213.9	190.2	122.7	133.8	121.4	121.9	96.1	155.8	193.3	163.6	105.2	75.4	34.5	1 323.2
WAR3	496.1	431.8	597.8	655.7	906.5	632.7	604.2	663.3	629.5	602.7	414.8	587.5	471.5	449.3	4 142.3
WAR7	823.1	882.8	762.4	959.3	761.1	879.4	830.7	1 088.0	941.6	716.8	884.6	327.4	298.0	303.8	6 348.4
WAR8	8.7	-	2.4	12.1	38.3	9.0	47.6	17.1	72.2	30.9	34.3	24.7	6.6	5.7	280.4
Total	43 500.3	45 767.7	46 560.0	44 731.7	42 830.6	42 696.4	44 879.7	42 148.3	40 970.0	42 668.7	42 166.1	38 031.2	31 380.7	32 000.6	150 105.2

Table E7: The aggregate area (km^2) estimated for inshore fishstocks in FMAs 1–5, and 7–8/9, for fishing years 2008–2021.

Fishing year	FMA1	FMA2	FMA3	FMA4	FMA5	FMA7	FMA89	Total
2008	9 459.2	14 552.4	12 207.3	1 342.5	3 571.7	18 264.8	9 854.8	69 252.7
2009	9 933.5	15 159.8	14 280.0	501.7	3 337.4	19 354.1	10 264.5	72 831.0
2010	9 959.9	15 901.6	16 741.6	1 079.4	3 745.7	20 474.6	7 735.4	75 638.2
2011	9 467.3	14 455.6	15 632.1	648.1	3 547.2	17 906.0	7 439.5	69 095.8
2012	8 163.8	12 245.3	14 460.5	20.8	4 545.1	18 528.3	8 789.4	66 753.2
2013	7 124.7	11 901.7	15 967.4	1.7	4 628.4	18 281.2	8 514.6	66 419.7
2014	7 768.7	13 676.2	17 037.8	1 237.7	4 625.9	17 298.7	8 171.9	69 816.9
2015	7 337.0	12 448.4	14 229.2	718.0	4 097.4	16 370.8	8 471.1	63 671.9
2016	7 931.6	11 489.2	13 465.7	105.6	4 338.6	16 951.4	7 811.3	62 093.4
2017	8 802.7	11 600.0	14 714.0	436.3	4 055.5	17 746.4	8 030.9	65 385.8
2018	8 487.8	11 026.2	15 125.5	62.6	3 773.5	15 641.5	7 980.9	62 098.0
2019	7 403.4	9 394.6	12 238.1	877.3	3 170.7	15 768.2	7 692.0	56 544.3
2020	7 139.0	7 613.5	10 602.3	355.5	3 063.1	11 295.9	7 450.5	47 519.8
2021	6 765.4	6 254.2	12 110.6	123.3	2 923.9	12 320.9	8 035.0	48 533.3
All	115 744.0	167 718.7	198 812.1	7 510.5	53 424.1	236 202.8	116 241.8	895 654.0

Table E8: The footprint (km^2) estimated for inshore fishstocks in FMAs 1–5, and 7–8/9, for fishing years 2008–2021.

Fishing year	FMA1	FMA2	FMA3	FMA4	FMA5	FMA7	FMA89	Total
2008	6 787.3	8 435.1	8 020.8	760.1	2 010.8	10 499.0	7 037.4	43 550.5
2009	6 913.4	8 509.3	9 128.9	379.5	1 993.7	11 379.7	7 520.4	45 824.9
2010	7 032.2	8 610.5	10 270.3	785.8	2 278.8	11 775.6	5 872.5	46 625.7
2011	6 742.0	8 362.8	9 866.3	373.0	2 318.6	11 349.7	5 797.3	44 809.7
2012	6 032.3	7 091.5	9 109.4	20.8	2 612.7	11 476.0	6 582.3	42 925.0
2013	5 180.3	7 188.1	9 611.3	1.7	2 661.6	11 783.7	6 364.9	42 791.6
2014	5 768.5	8 012.6	10 248.3	774.4	2 671.4	11 162.7	6 355.3	44 993.2
2015	5 582.9	7 518.6	9 239.4	513.8	2 698.9	10 377.3	6 310.0	42 240.9
2016	5 974.4	7 248.9	8 348.6	93.1	2 538.9	10 808.5	6 026.0	41 038.4
2017	6 712.8	7 481.3	9 127.5	287.6	2 255.7	10 852.3	6 030.1	42 747.3
2018	6 328.3	7 318.9	9 675.3	62.1	2 314.3	10 484.1	6 018.7	42 201.7
2019	5 407.0	6 155.3	8 046.4	553.6	1 939.7	10 308.7	5 643.7	38 054.4
2020	5 013.8	5 004.2	6 791.3	259.4	1 782.6	7 295.0	5 209.4	31 355.7
2021	4 706.5	4 303.4	7 184.2	95.0	1 759.5	8 009.4	5 926.2	31 984.2
All	22 784.0	20 220.3	31 263.6	2 447.7	8 699.4	38 180.3	28 247.1	150 105.2

Table E9: Summary data for the number of tows, the aggregate area, and the footprint for the main bottom-contacting inshore fishstocks per 25-km^2 cell, for 2008–2021. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year.

Main	No. of tows per cell (minimum=1)					Aggregate area (minimum < 0.003)					Footprint (minimum < 0.003)				
fishstock	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
FLA2	1	3	92.0	13.8	5 532	0.3	0.6	17.9	2.7	1 052.4	0.3	0.6	3.2	2.5	25.0
FLA3	1	6	196.2	63.0	5 660	0.4	1.1	39.7	11.8	1 441.3	0.4	1.0	5.6	8.1	25.0
FLA7	2	6	195.1	57.0	4 850	0.4	1.5	44.1	10.8	932.6	0.4	1.4	5.6	7.2	25.0
GUR1	1	4	35.9	28.0	1 469	0.4	1.0	9.1	6.0	302.0	0.4	1.0	4.2	4.8	24.8
GUR2	2	15	183.4	149.8	2 349	0.5	2.8	43.0	31.9	565.6	0.5	2.5	7.7	14.7	25.0
GUR3	2	7	35.5	39.0	379	0.4	1.5	8.1	8.8	95.1	0.4	1.4	4.6	6.9	24.4
GUR7	1	6	54.4	58.0	634	0.4	1.4	13.6	12.6	172.5	0.4	1.3	5.6	9.2	25.0
GUR8	2	6	41.7	35.0	626	0.4	1.5	10.8	8.4	220.0	0.4	1.4	4.9	6.8	24.9
JDO1	1	4	43.9	22.0	977	0.3	0.9	9.3	4.8	234.8	0.3	0.9	3.8	4.0	25.0
JDO2	1	4	16.0	16.0	315	0.3	0.8	3.8	3.5	93.3	0.3	0.8	2.6	3.2	23.4
JDO7	2	6	18.5	18.0	372	0.4	1.4	4.6	4.3	105.9	0.4	1.3	3.2	3.9	24.1
RCO3	2	12	47.8	46.0	1 933	0.5	2.7	11.6	10.5	541.2	0.5	2.5	5.3	8.2	25.0
RCO7	2	6	34.2	31.0	500	0.4	1.3	9.1	7.3	168.6	0.4	1.2	4.6	6.1	24.9
SNA1	2	17	109.3	140.0	1 391	0.5	3.5	26.1	33.9	380.5	0.5	3.1	7.8	15.3	25.0
SNA2	1	5	22.6	23.0	309	0.4	1.0	7.2	5.6	162.8	0.4	1.0	3.8	4.9	24.9
SNA7	1	6	36.6	23.0	941	0.3	1.1	7.4	5.0	233.4	0.3	1.1	3.5	4.3	25.0
SNA8	1	5	18.9	18.0	262	0.4	1.4	6.6	5.7	89.3	0.4	1.3	4.0	4.9	22.9
TAR1	2	11	68.1	62.0	1 067	0.5	2.6	19.5	16.8	302.7	0.5	2.4	6.6	11.0	25.0
TAR2	4	21	196.6	206.0	3 231	0.7	4.3	51.1	50.5	899.2	0.7	3.8	8.9	18.9	25.0
TAR3	2	12	67.8	73.0	960	0.5	2.6	16.4	17.3	311.3	0.5	2.4	6.7	11.9	25.0
TAR4	1	2	37.3	34.0	478	0.4	0.8	16.2	12.2	256.0	0.4	0.8	5.2	8.0	25.0
TAR7	2	13	65.9	77.0	1 511	0.5	3.3	18.6	21.0	447.9	0.5	3.0	7.3	13.6	25.0
TAR8	2	4	28.8	18.0	549	0.4	1.1	8.1	4.7	164.5	0.4	1.1	3.9	4.3	24.8
TRE1	2	10	62.1	56.0	1 112	0.4	2.0	15.5	12.6	356.1	0.4	1.9	5.7	9.0	25.0
TRE7	2	6	58.3	39.0	979	0.4	1.5	20.7	10.6	453.1	0.4	1.4	5.5	7.5	25.0

Table E10: Summary data for the number of tows, the aggregate area, and the footprint for the main bottom-contacting inshore fishstocks per 25-km^2 cell, for 2021. Data show the value at the first quartile and third quartile, and the median, mean, and maximum per cell per year.

Main	No. of tows per cell (minimum=1)					Aggregate area (minimum < 0.003)					Footprint (minimum < 0.003)				
fishstock	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.	1st Qu.	Median	Mean	3rd Qu.	Max.
FLA2	2	6	28.7	26.0	227	0.3	1.1	3.1	3.7	25.3	0.3	1.0	2.0	3.1	10.7
FLA3	2	7	36.2	27.5	577	0.4	1.1	6.9	5.0	117.5	0.4	1.0	3.1	3.8	23.3
FLA7	2	12	29.0	40.0	248	0.4	1.9	6.9	8.6	83.8	0.4	1.8	4.1	6.6	23.3
GUR1	2	5	11.4	13.0	95	0.5	1.5	3.7	4.1	38.9	0.5	1.4	2.8	3.6	19.3
GUR2	3	11	19.9	25.0	175	0.5	2.1	4.4	5.9	44.4	0.5	2.0	3.4	5.2	20.0
GUR3	1	4	10.2	12.5	133	0.3	0.8	2.2	2.4	39.4	0.3	0.8	1.7	2.3	17.0
GUR7	1	4	12.3	15.0	237	0.4	1.0	3.1	3.7	62.8	0.4	1.0	2.3	3.2	22.2
GUR8	1	3	12.1	15.2	90	0.3	0.7	3.0	3.3	38.9	0.3	0.7	2.3	3.0	18.5
JDO1	1	2	6.1	7.0	48	0.2	0.6	1.4	1.4	10.2	0.2	0.6	1.3	1.4	8.3
JDO2	1	1	1.5	2.0	6	0.2	0.4	0.4	0.4	1.2	0.2	0.4	0.4	0.4	1.2
JDO7	1	2	5.2	6.0	58	0.3	0.5	1.3	1.4	14.9	0.3	0.5	1.2	1.3	11.3
RCO3	1	2	3.4	4.0	37	0.2	0.4	0.9	1.0	16.1	0.2	0.4	0.8	1.0	10.7
RCO7	1	2	3.4	4.0	21	0.2	0.4	0.9	1.2	7.9	0.2	0.4	0.8	1.2	6.5
SNA1	3	9	14.9	20.0	126	0.6	2.0	4.3	5.2	40.2	0.6	1.8	3.2	4.4	19.4
SNA2	1	2	3.3	4.0	13	0.3	0.5	0.9	1.4	5.3	0.3	0.5	0.9	1.4	4.5
SNA7	1.8	4	6.4	9.0	32	0.3	0.6	1.2	1.6	5.4	0.3	0.6	1.1	1.5	4.5
SNA8	1	1	3.4	4.0	30	0.2	0.6	1.1	1.2	9.4	0.2	0.6	1.0	1.2	7.5
TAR1	1	5	9.8	14.0	72	0.4	1.4	3.2	4.5	31.4	0.4	1.3	2.5	3.9	15.4
TAR2	3	13	21.2	31.0	177	0.5	2.6	5.2	7.8	58.8	0.5	2.2	3.7	6.0	20.4
TAR3	1	3	6.7	7.0	69	0.3	0.5	1.6	1.5	24.0	0.3	0.5	1.3	1.4	10.8
TAR4	2	3	4.5	6.0	22	0.5	0.8	1.4	1.9	9.3	0.5	0.8	1.1	1.6	4.7
TAR7	2	4	7.4	10.0	62	0.4	1.1	2.2	2.7	19.9	0.4	1.0	1.9	2.4	14.1
TAR8	1	2	5.3	5.0	48	0.2	0.4	1.5	1.1	17.0	0.2	0.4	1.2	1.0	10.9
TRE1	2	4	12.1	15.0	142	0.3	1.0	3.2	3.4	40.6	0.3	0.9	2.3	2.9	16.8
TRE7	1	4	7.8	9.0	63	0.4	0.9	2.7	2.7	26.6	0.4	0.9	2.2	2.5	16.2

Table E11: The number of 25-km^2 cells contacted by inshore fishstocks, by 50-m depth zone, for fishing years 2008–2021.

Fishing year	0–50	50–100	100–150	150–200	200–250	Over 250	All
2008	2 086	2 268	1 821	800	238	2 200	9 413
2009	2 100	2 308	1 928	809	232	1 982	9 359
2010	2 103	2 313	1 941	827	246	2 029	9 459
2011	2 115	2 298	1 895	826	254	2 169	9 557
2012	2 132	2 302	1 905	786	238	1 830	9 193
2013	2 085	2 302	1 954	785	215	1 767	9 108
2014	2 115	2 349	2 006	842	241	1 963	9 516
2015	2 077	2 291	2 085	807	241	1 882	9 383
2016	2 063	2 278	2 029	802	229	1 891	9 292
2017	2 061	2 280	2 032	825	243	1 988	9 429
2018	2 040	2 242	1 948	798	218	1 887	9 133
2019	1 976	2 240	1 866	815	241	1 438	8 576
2020	1 665	2 055	1 701	718	188	707	7 034
2021	1 691	2 137	1 681	678	174	705	7 066
All	2 328	2 543	2 710	1 011	363	6 159	15 114

Table E12: The aggregate area (km^2) estimated for inshore fishstocks, by 50-m depth zone, for fishing years 2008–2021.

Fishing year	0-50	50-100	100-150	150-200	200-250	Over 250	All
2008	27 137.7	21 511.5	11 583.5	4 855.6	1 095.1	3 087.9	69 271.3
2009	28 293.4	23 726.0	11 572.6	4 675.7	1 262.2	3 317.1	72 847.0
2010	31 807.2	23 551.5	11 447.8	4 531.3	989.3	3 313.0	75 640.2
2011	26 585.8	21 844.3	12 311.0	4 079.0	1 054.5	3 229.0	69 103.6
2012	27 285.1	21 468.4	10 614.3	3 843.3	692.7	2 853.7	66 757.6
2013	26 345.2	23 325.4	10 088.8	3 375.9	586.2	2 698.4	66 419.9
2014	26 871.3	22 128.8	12 635.4	4 285.2	886.3	3 014.9	69 822.0
2015	22 045.8	22 403.2	11 644.2	3 807.7	856.5	2 914.7	63 671.9
2016	23 200.8	20 699.7	10 273.0	3 779.0	908.1	3 235.0	62 095.5
2017	23 787.3	21 087.4	12 106.2	4 108.8	934.5	3 361.6	65 385.8
2018	20 811.2	20 821.8	12 313.1	3 961.3	985.8	3 275.1	62 168.3
2019	19 509.0	20 617.1	10 772.1	3 281.0	705.0	1 940.8	56 824.9
2020	16 748.9	16 863.8	9 026.6	3 072.2	599.3	1 478.3	47 789.1
2021	16 835.9	17 185.3	9 083.6	3 486.1	686.8	1 585.8	48 863.4
All	337 264.6	297 234.1	155 472.1	55 142.2	12 242.2	39 305.2	896 660.5

Table E13: The footprint (km^2) estimated for inshore fishstocks, by 50-m depth zone, for fishing years 2008–2021.

Fishing year	0-50	50-100	100-150	150-200	200-250	Over 250	All
2008	14 055.3	14 184.4	8 178.5	3 723.6	860.8	2 574.2	43 576.7
2009	14 861.7	15 568.3	8 297.3	3 560.0	938.2	2 621.2	45 846.8
2010	15 921.1	15 528.9	8 280.2	3 462.8	788.7	2 649.3	46 631.0
2011	14 546.7	14 962.3	8 674.4	3 207.7	821.1	2 602.9	44 815.1
2012	14 578.3	14 650.7	7 822.2	3 025.6	581.9	2 272.5	42 931.2
2013	14 327.3	15 483.0	7 530.3	2 714.8	514.7	2 227.0	42 797.1
2014	14 325.4	14 827.4	9 275.3	3 387.6	726.2	2 462.7	45 004.5
2015	12 696.8	14 656.0	8 624.0	3 138.9	715.8	2 415.8	42 247.3
2016	12 699.3	13 974.4	7 953.3	3 056.2	742.4	2 619.6	41 045.2
2017	12 542.8	14 329.3	9 027.7	3 290.1	773.6	2 785.8	42 749.2
2018	12 094.8	14 516.7	8 917.5	3 180.8	801.3	2 715.9	42 226.9
2019	11 558.8	13 974.7	7 727.6	2 587.9	572.2	1 659.1	38 080.3
2020	9 603.6	11 238.1	6 540.9	2 381.3	475.7	1 187.4	31 427.0
2021	9 457.3	11 776.8	6 375.7	2 626.5	540.3	1 267.3	32 044.0
All	33 315.1	46 066.6	34 904.8	15 080.8	3 841.5	16 896.4	150 105.2

Table E14: The number of cells contacted by the inshore fishstocks during 2008–2021 by BOMEC class. The 'Out' group are cells for which there is no BOMEC information.

Fishing year	Out	A	B	C	D	E	G	H	I	J	K	L	M	N	O	All
2008	35	1 020	535	2 696	1 078	931	240	1 438	126	944	7	11	90	246	16	9 413
2009	34	1 036	533	2 880	1 068	909	235	1 387	109	814	1	17	97	226	13	9 359
2010	44	1 029	536	2 850	1 071	958	244	1 461	115	801	1	–	75	262	12	9 459
2011	39	1 015	538	2 871	1 096	876	252	1 491	127	863	3	–	85	286	15	9 557
2012	38	1 031	527	2 869	1 104	888	250	1 303	78	785	1	2	71	240	6	9 193
2013	43	997	539	2 920	1 083	888	252	1 301	104	692	1	1	58	217	12	9 108
2014	41	1 005	534	3 001	1 109	907	252	1 452	102	799	11	–	49	248	6	9 516
2015	36	970	533	2 912	1 116	995	251	1 437	124	765	9	2	70	152	11	9 383
2016	40	976	531	2 946	1 084	907	234	1 364	112	810	10	4	88	177	9	9 292
2017	38	985	531	2 948	1 074	928	233	1 467	99	826	10	–	54	224	12	9 429
2018	38	954	532	2 908	1 089	821	243	1 425	112	777	10	–	57	163	4	9 133
2019	25	924	532	2 774	1 067	907	228	1 327	71	524	1	–	43	148	5	8 576
2020	9	782	495	2 531	949	807	150	1 090	50	166	–	–	–	4	1	7 034
2021	4	801	492	2 658	976	702	162	1 048	44	167	1	–	–	11	–	7 066
All	68	1 111	542	3 490	1 179	1 392	262	2 353	331	2 793	19	33	275	1 197	69	15 114

Table E15: The estimated aggregate area (km^2) for the inshore fishstocks during 2008–2021 by BOMEC class. The 'Out' group are cells for which there is no BOMEC information.

Fishing year	Out	A	B	C	D	E	G	H	I	J	K	L	M	N	O	All
2008	6.6	12 263.4	8 648.6	23 099.7	12 343.8	4 333.9	1 507.8	6 161.4	119.1	643.1	4.1	2.9	28.2	106.8	2.0	69 271.3
2009	6.5	12 459.9	8 200.7	25 149.9	13 795.7	4 574.9	1 702.4	6 008.6	199.2	614.9	0.1	6.7	40.8	84.9	1.8	72 847.0
2010	11.4	13 454.6	9 864.6	22 419.8	15 616.6	5 932.6	1 771.2	5 667.5	196.4	564.4	0.4	–	30.5	108.8	1.4	75 640.2
2011	8.0	11 894.2	7 816.9	21 145.7	13 883.2	5 879.9	2 117.2	5 531.0	107.0	589.4	0.4	–	34.2	95.2	1.3	69 103.6
2012	7.1	11 992.8	9 114.0	19 157.6	14 203.0	5 053.1	1 915.9	4 561.4	89.5	545.0	0.1	1.5	26.8	88.8	1.0	66 757.6
2013	11.1	10 683.0	8 886.6	19 252.8	15 431.6	5 337.1	1 806.6	4 206.7	111.4	585.7	0.1	0.1	16.2	89.8	1.1	66 419.9
2014	8.5	10 947.4	9 024.5	19 089.6	15 671.8	6 869.7	1 930.2	5 449.6	86.8	631.2	2.8	–	13.1	96.0	0.7	69 822.0
2015	7.8	9 464.2	8 539.5	19 365.2	12 907.8	5 832.6	1 630.1	5 169.6	89.0	580.0	3.9	0.8	21.6	57.4	2.4	63 671.9
2016	8.0	9 735.5	8 484.2	18 253.4	13 113.0	4 893.4	1 524.3	5 259.6	120.7	582.0	4.7	3.2	52.0	60.8	0.8	62 095.5
2017	8.8	9 038.1	9 318.1	19 865.2	13 048.3	6 027.3	1 396.8	5 777.1	116.3	679.6	4.4	–	21.9	82.1	1.9	65 385.8
2018	7.2	8 223.3	7 478.6	19 820.1	12 340.3	6 085.0	1 306.9	6 067.5	87.8	662.1	3.4	–	20.3	65.6	0.2	62 168.3
2019	4.2	7 895.8	8 638.1	18 477.4	11 808.5	4 304.7	1 157.1	4 090.7	45.9	341.6	0.4	–	13.4	46.4	0.7	56 824.9
2020	0.5	6 617.8	5 678.8	16 953.1	9 533.2	4 213.5	631.1	3 926.7	50.2	182.4	–	–	–	1.9	0.1	47 789.1
2021	0.3	6 323.3	5 411.7	17 250.0	10 173.1	4 546.0	773.3	4 051.1	79.0	246.3	0.0	–	–	9.4	–	48 863.4
All	96.0	140 993.2	115 104.9	279 299.2	183 869.8	73 883.8	21 171.0	71 928.4	1 498.3	7 447.6	25.0	15.2	318.9	994.0	15.3	896 660.5

Table E16: The estimated footprint (km^2) for the inshore fishstocks during 2008–2021 by BOMEC class. The 'Out' group are cells for which there is no BOMEC information.

Fishing year	Out	A	B	C	D	E	G	H	I	J	K	L	M	N	O	All
2008	5.6	6 897.2	4 236.6	15 728.7	6 938.8	3 104.6	1 039.6	4 775.4	103.9	605.8	4.1	2.9	28.1	103.4	1.9	43 576.7
2009	5.7	7 084.6	4 458.9	16 529.5	7 730.3	3 419.4	1 165.9	4 620.9	140.5	558.4	0.1	6.7	40.5	83.5	1.8	45 846.8
2010	8.8	7 353.5	5 046.3	15 127.6	8 413.0	4 240.5	1 261.2	4 368.4	138.8	534.7	0.4	–	29.6	106.8	1.4	46 631.0
2011	6.5	6 821.9	4 591.4	14 904.3	7 745.7	4 277.3	1 415.6	4 277.4	94.2	552.2	0.4	–	33.9	93.0	1.3	44 815.1
2012	5.9	6 884.8	4 980.4	13 917.8	7 820.0	3 674.0	1 288.9	3 658.6	74.0	512.8	0.1	1.5	24.8	86.6	1.0	42 931.2
2013	9.2	6 372.4	5 088.8	13 916.7	8 200.1	3 801.3	1 270.8	3 401.4	87.4	543.9	0.1	0.1	16.1	87.6	1.1	42 797.1
2014	7.1	6 376.8	4 996.4	14 045.4	8 370.7	4 756.6	1 289.9	4 389.9	74.2	589.4	2.7	–	12.9	91.7	0.7	45 004.5
2015	6.7	5 746.5	4 684.2	13 871.6	7 544.0	4 302.6	1 167.4	4 215.7	85.1	540.0	3.8	0.8	21.2	55.3	2.4	42 247.3
2016	6.6	5 927.4	4 782.8	13 631.2	7 050.6	3 613.8	1 099.0	4 183.1	92.1	542.7	4.7	3.2	47.2	60.2	0.8	41 045.2
2017	7.7	5 610.6	4 869.1	14 596.4	6 935.9	4 226.4	991.5	4 689.4	86.4	629.7	4.4	–	20.5	79.3	1.9	42 749.2
2018	6.1	5 270.4	4 413.7	14 618.2	7 295.5	4 118.4	944.3	4 791.7	82.6	599.0	3.2	–	20.0	63.5	0.2	42 226.9
2019	3.6	5 033.7	5 068.7	13 316.4	6 905.0	3 194.8	816.9	3 316.8	43.7	320.8	0.4	–	13.4	45.3	0.7	38 080.3
2020	0.5	4 244.6	3 305.7	11 746.7	5 467.6	3 027.0	392.4	3 051.9	41.9	146.7	–	–	–	1.9	0.1	31 427.0
2021	0.3	4 090.4	3 283.2	12 207.3	5 494.5	3 110.4	476.6	3 112.6	56.4	203.4	0.0	–	–	9.0	–	32 044.0
All	31.7	15 110.1	11 114.6	53 454.8	20 723.2	16 153.1	4 270.8	22 163.5	768.7	5 079.2	23.1	15.0	292.0	890.6	14.9	150 105.2

Table E17: The estimated inshore footprint (km^2) for inshore fishstocks during 2008–2021 and 2021 by the surficial layers representing the percent of carbonate, gravel, mud, and sand. 'unk' is where there was no overlap.

	2008–2021 footprint (km^2)			
Sediment (%)	Carbonate	Gravel	Mud	Sand
0–20	43 358.7	122 815.8	49 792.5	13 685.4
20–40	69 671.9	21 196.1	37 428.0	33 463.0
40–60	29 771.6	5 227.0	30 021.6	42 474.5
60–80	6 668.9	810.2	23 706.9	42 191.3
80–100	620.0	41.9	9 141.9	18 276.8
unk	14.2	14.2	14.2	14.2
Total	64 088.0	64 088.0	64 088.0	64 087.8

	2021 footprint (km^2)			
Sediment (%)	Carbonate	Gravel	Mud	Sand
0–20	10 545.4	27 113.8	11 179.2	3 140.1
20–40	15 305.1	4 119.9	7 060.3	6 866.6
40–60	5 558.5	751.6	6 566.4	8 557.7
60–80	593.2	58.6	5 299.3	8 662.5
80–100	41.7	0.0	1 938.7	4 816.9
unk	0.1	0.1	0.1	0.1
Total	32 044.0	32 044.0	32 044.0	32 043.9

APPENDIX F: SHELLFISH DREDGE FISHERIES

Most commercial dredging for shellfish in New Zealand targets scallops (*Pecten novaezelandiae*) and oysters (*Ostrea chilensis*).

Scallop dredge fisheries

Five main scallop dredge fisheries have operated in the New Zealand coastal waters during the 1990–2021 fishing years: the three northern fisheries in the Auckland and Kermadec Areas (Northland, West Coast, Coromandel) and two southern fisheries (Nelson-Marlborough (Challenger) and Chatham Islands) (Figure F1). Scallops inhabit substrates of shell, gravel, and silt in waters to about 60 m (85 m at Chatham Islands) and are most common at depths of 10–45 m (Cryer 2001). Dredges are designed to dig into the seafloor. The substrate generally dictates the type of dredge used. Fishers in the northern fisheries generally use the self-tipping "box" dredge which is more effective on the harder substrate encountered in the northern fisheries (Cryer 2001), whereas fishers in the southern fisheries use ring bag dredges. Commercial Fishing Regulations define the dredge design and operation of these fisheries, and management closures have occurred in some areas.

Tables of groomed numbers of tows (after Baird et al. 2011) are given in Tables F1–F5.

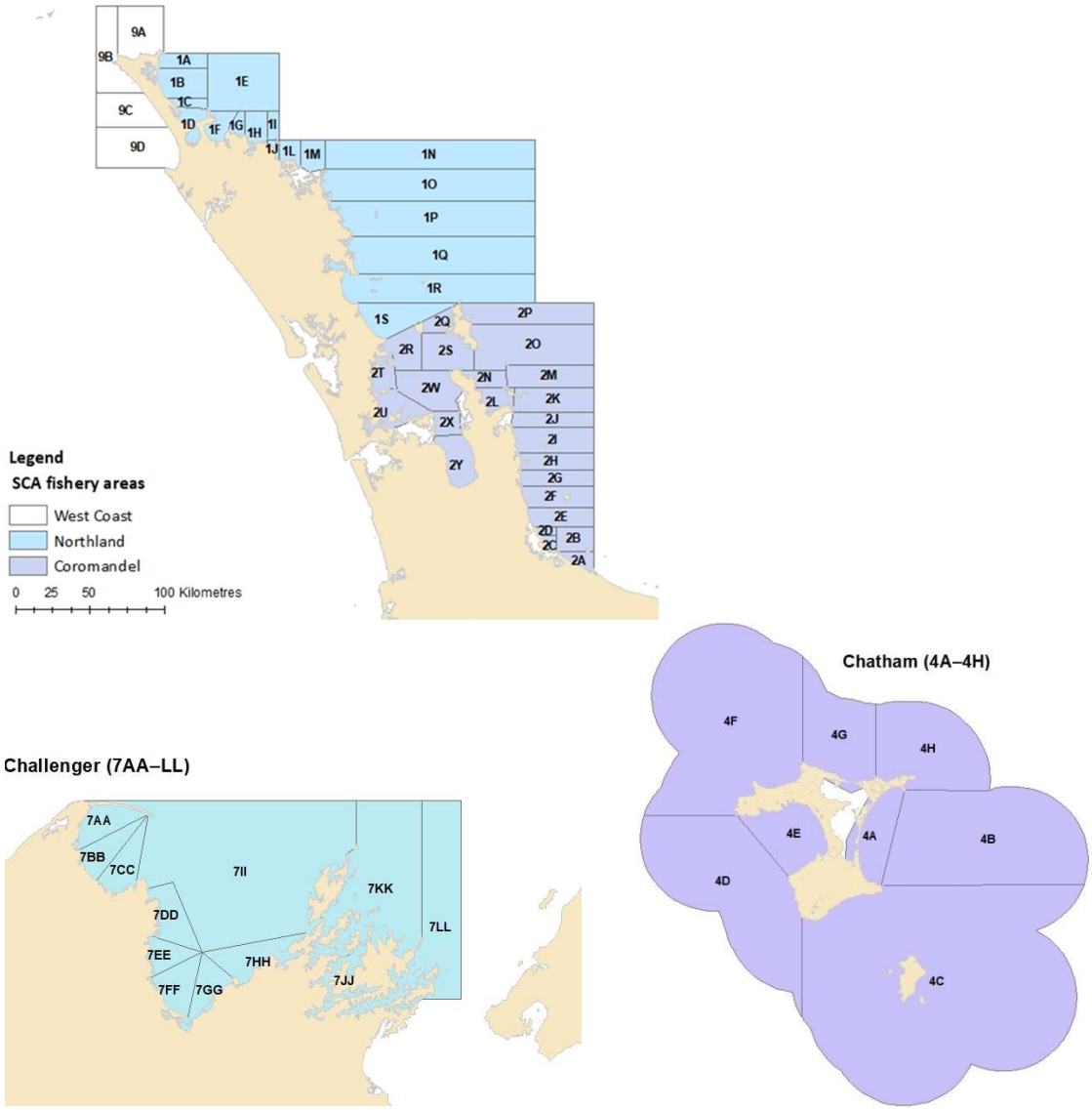

Figure F1: The five scallop fishery areas with effort during 1990–2021: the three northern areas (top) and the two southern areas (bottom).

Historically, most effort has been in the Challenger, Coromandel, and Northland fishery areas (Tables F1 & F2). However, these fisheries have been subject to multiple closures (see Fisheries New Zealand 2019c, Hartill & Williams 2014 for Northland, and Williams et al. 2014 for Challenger). There has been no effort in the Challenger fishery since the fishery was closed in 2017 in an attempt to re-build the stock (see https://www.mpi.govt.nz/fishing-aquaculture/sustainable-fisheries/the-southern-scallop-fishery-sca-7). Scallop dredging ceased in the CHAT fishery after 2005 and after 2010 in the WCNI fishery.

During 1990–2021, the annual number of daily records has dropped from a peak of over 7500 in the mid-1990s to under 1000 since 2011, with less than 400 in both 2020 and 2021 (Table F1). The number of dredge tows has decreased from over 100 000 tows a year during most years between 1991 and 1996, about 49 000–82 000 tows during 1997–2003, about 23 000–53 500 tows during 2004–2010 (Table F2). Effort then dropped to under 20 000 tows until 2017, when the lowest number of tows per year were reported (6252), followed by a small increase to about 9000 tows in 2018 and 2019 (from the two fisheries still operating—Coromandel and Northland). The number of tows then dropped again to less than 5500 in 2020, and again to about 5200 in 2021. Both the Coromandel and Northland scallop fisheries have been subject to area closures in recent times.

Table F1: Number of scallop records by area and year, 1990–2021. Data are from CELR forms which record daily effort in a fishery statistical area. See Figure F1 for areas. UNK is unknown location.

	Scallop fishery areas						
Fishing year	CHAL	CHAT	CORO	NOR	WCNI	UNK	Total
1990	901	113	760	1 593	0	1 328	4 695
1991	1 655	126	1 636	2 173	0	749	6 339
1992	1 580	80	1 761	2 883	0	1 198	7 502
1993	2 170	79	578	2 019	0	627	5 473
1994	4 182	1	761	2 700	2	128	7 774
1995	1 395	103	842	2 984	164	155	5 643
1996	3 245	134	822	1 350	1 041	677	7 269
1997	1 394	240	837	1 029	655	532	4 687
1998	1 222	150	693	759	630	598	4 052
1999	2 633	54	360	417	146	918	4 528
2000	1 916	36	158	273	168	531	3 082
2001	2 640	3	372	441	31	14	3 501
2002	3 240	12	365	407	286	10	4 320
2003	2 738	19	429	350	81	32	3 649
2004	1 675	0	597	447	112	28	2 859
2005	1 008	7	639	365	1	8	2 028
2006	1 401	0	640	417	0	27	2 485
2007	501	0	683	409	0	8	1 601
2008	345	0	544	349	42	9	1 289
2009	1 009	0	458	518	42	2	2 029
2010	461	0	398	233	1	5	1 098
2011	203	0	538	47	0	11	799
2012	385	0	525	45	0	8	963
2013	228	0	687	4	0	12	931
2014	260	0	614	11	0	17	902
2015	51	0	320	196	0	13	580
2016	109	0	350	174	0	6	639
2017	0	0	310	122	0	0	432
2018	0	0	392	197	0	3	592
2019	0	0	250	190	0	0	440
2020	0	0	208	140	0	0	348
2021	0	0	201	149	0	1	351
Total	38 547	1 157	18 728	23 391	3 402	7 655	92 880
% by area	41.5	1.2	20.2	25.2	3.7	8.2	100.0

Table F2: Number of scallop tows by area and year, 1990–2021.

	Scallop fishery areas					
Fishing year	CHAL	CHAT	CORO	NOR	WCNI	Total
1990	11 996	1 093	18 100	35 319	0	66 508
1991	15 542	1 092	38 115	45 307	0	100 056
1992	22 334	695	44 626	62 218	0	129 873
1993	31 211	721	14 639	43 917	0	90 488
1994	68 080	16	17 716	51 937	23	137 772
1995	22 994	1 238	21 245	56 166	2 945	104 588
1996	59 141	1 422	19 833	25 679	12 921	118 996
1997	25 320	2 429	21 998	19 829	11 781	81 357
1998	23 085	1 197	18 098	15 630	12 298	70 308
1999	47 392	273	9 237	8 398	2 954	68 254
2000	35 394	179	4 470	5 757	3 276	49 076
2001	47 700	6	8 200	8 430	590	64 926
2002	60 723	43	9 552	7 666	3 998	81 982
2003	56 709	266	8 708	6 333	1 496	73 512
2004	32 019	0	11 200	8 271	2 076	53 566
2005	20 852	51	13 299	5 792	22	40 016
2006	30 843	0	14 486	6 240	0	51 569
2007	9 305	0	16 670	9 199	0	35 174
2008	6 292	0	14 941	7 290	824	29 347
2009	20 486	0	11 435	8 595	801	41 317
2010	9 374	0	9 667	4 300	2	23 343
2011	4 107	0	10 700	902	0	15 709
2012	7 507	0	7 449	847	0	15 803
2013	5 130	0	11 527	58	0	16 715
2014	4 837	0	14 280	178	0	19 295
2015	908	0	6 322	4 690	0	11 920
2016	1 657	0	6 140	3 187	0	10 984
2017	0	0	3 937	2 315	0	6 252
2018	0	0	5 988	3 028	0	9 016
2019	0	0	5 195	3 758	0	8 953
2020	0	0	2 818	2 668	0	5 486
2021	0	0	2 251	2 938	0	5 189
Total	680 938	10 721	422 842	466 842	56 007	1 637 350
% by area	41.6	0.7	25.8	28.5	3.4	100.0

The number of scallop tows for each scallop fishery and statistical area are given in Table F3. For the years when the WCNI fishery was operating, 98% of the effort was in area 9A, off the northern-most coast of North Island (Table F3). At the Chatham Islands, 85% of the effort was in areas 4G and 4H, to the north and northeast of Chatham Island.

Dredging for scallops in the Northland fishery was mainly in area 1D (50% of tows during 1990–2021), though there was no effort reported during 2013–2018. Effort in area 1D in 2021 (at about 1100 tows) was less than 10% of annual effort in the 1990s (see Table F3 and Figure F1). Effort in 1D then dropped dramatically to just over 250 tows in 2020 and again to just over 120 tows in 2021. The second most important fishery area was area 1R further south (34% of the 32-year effort). This area was fished mainly during the 1990s, at a much-reduced amount in 2005–2007 and again from 2015. In 2020 and 2021 the majority of effort was from 1R with about 80% of all tows.

In the Coromandel fishery, areas 2L (62% of all dredge tows), 2R (12%), and 2W (9%) accounted for most of the tows and effort was reported in all years for 2R, and every year but one year in 2L. There has been almost no effort in any other statistical areas in the last few years.

Before the Challenger fishery was closed, the main areas were 7BB (24% tows) and 7CC (17%) in Golden Bay; 7EE (6%), 7FF (11%), and 7GG (5%) in Tasman Bay; and 7KK (16%) in Marlborough Sounds. Area 7KK was fished in most years after the early 1990s; effort in areas other than those listed above was very low after the 1990s, except for 7AA which was fished sporadically after 2007.

Table F3: Number of scallop tows by scallop fishery statistical areas (see Figure F1), by fishing year. Areas are shown in Figure F1.

West Coast North Island (WCNI)

Fishing year	9A	9B	9C	9D	Total
1994	23	0	0	0	23
1995	2 945	0	0	0	2 945
1996	11 897	0	0	1 024	12 921
1997	11 779	2	0	0	11 781
1998	12 223	0	75	0	12 298
1999	2 954	0	0	0	2 954
2000	3 276	0	0	0	3 276
2001	590	0	0	0	590
2002	3 961	19	18	0	3 998
2003	1 484	0	0	12	1 496
2004	2 076	0	0	0	2 076
2005	22	0	0	0	22
2008	824	0	0	0	824
2009	801	0	0	0	801
2010	2	0	0	0	2
Total	54 857	21	93	1 036	56 007

Chatham Islands (CHAT)

Fishing year	4A	4B	4C	4E	4F	4G	4H	Total
1990	501	337	0	0	0	22	233	1 093
1991	183	20	12	0	6	379	492	1 092
1992	0	0	0	0	0	385	310	695
1993	13	0	0	0	0	708	0	721
1994	0	0	0	16	0	0	0	16
1995	64	12	0	0	0	671	491	1 238
1996	15	0	0	0	3	934	470	1 422
1997	54	0	183	0	0	2 190	2	2 429
1998	130	68	125	0	0	808	66	1 197
1999	12	0	0	0	0	142	119	273
2000	0	0	0	0	0	179	0	179
2001	0	0	0	0	0	6	0	6
2002	0	0	0	0	0	43	0	43
2003	0	0	0	0	0	220	46	266
2005	0	0	0	0	0	0	51	51
Total	972	437	320	16	9	6 687	2 280	10 721

Table F3: *continued.* Northland. Areas are shown in Figure F1.

Fishing year	1A	1B	1C	1D	1E	1F	1G	1H	1I	1J	1K	1L	1O	1P	1Q	1R	1S	Total
1990	1 623	206	1 735	15 084	0	344	0	504	0	349	0	0	0	0	156	14 312	1 006	35 319
1991	1 204	1 011	76	8 212	56	426	0	581	0	431	0	0	0	0	0	30 611	2 699	45 307
1992	1 418	25	0	15 904	0	1 025	0	1 087	0	1 231	0	27	0	0	0	38 029	3 472	62 218
1993	0	84	0	24 323	95	2 970	30	7 327	0	1 025	0	540	0	0	0	7 431	92	43 917
1994	352	53	0	34 676	0	2 435	20	6 754	0	1 731	69	297	10	30	0	5 510	0	51 937
1995	282	4 446	593	26 921	0	658	12	3 589	438	1 530	0	62	0	0	0	17 629	18	56 178
1996	226	2 379	407	13 724	0	873	0	2 187	383	974	0	0	0	0	0	4 256	270	25 679
1997	413	1 283	96	14 074	0	228	0	352	0	360	0	0	0	0	0	2 942	81	19 829
1998	155	0	0	14 080	0	0	0	295	0	153	0	0	0	0	0	947	0	15 630
1999	46	10	0	8 342	0	0	0	0	0	0	0	0	0	0	0	0	0	8 398
2000	98	0	0	5 546	0	0	0	0	0	0	0	0	0	0	0	113	0	5 757
2001	0	0	0	7 657	0	186	0	0	0	0	0	0	0	0	0	563	24	8 430
2002	8	0	0	6 469	0	0	0	0	0	0	0	0	0	428	0	706	55	7 666
2003	44	0	0	4 887	700	0	0	0	0	0	0	0	0	111	0	493	98	6 333
2004	0	0	0	7 954	84	0	0	3	0	0	0	0	0	42	0	185	3	8 271
2005	0	0	0	590	0	0	0	0	0	0	0	0	0	0	3	5 199	0	5 792
2006	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	6 217	19	6 240
2007	21	0	0	1 888	0	0	0	0	146	0	31	0	0	0	256	6 856	1	9 199
2008	0	0	0	7 060	0	0	0	0	15	0	0	0	0	0	63	152	0	7 290
2009	21	0	0	8 566	0	0	0	0	8	0	0	0	0	0	0	0	0	8 595
2010	0	0	0	4 275	0	0	0	0	0	0	0	0	0	0	0	25	0	4 300
2011	0	0	0	853	0	0	0	0	0	0	0	0	0	0	0	6	43	902
2012	0	0	0	817	0	0	0	0	0	0	0	0	0	0	0	30	0	847
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	0	58
2014	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	162	0	178
2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4 690	0	4 690
2016	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	3 169	0	3 187
2017	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	1 231	1 056	2 315
2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 920	1 108	3 028
2019	0	0	0	1 122	0	0	0	0	0	0	0	0	0	0	0	2 636	0	3 758
2020	0	0	0	266	0	0	0	0	0	0	0	0	0	0	0	2 121	281	2 668
2021	0	0	0	127	0	0	0	0	0	0	0	0	0	0	0	2 450	361	2 938
All	5 911	9 515	2 907	233 421	935	9 161	90	22 679	990	7 784	100	926	10	611	478	160 649	10 687	466 854

Table F3: *continued.* Coromandel. Annual totals are provided in Table F2. Areas 2J, 2M, 2P, 2Q, 2T, 2U, and 2Y had less than 75 tows during 1990–2019 and are not shown here (total of 232 tows). Areas are shown in Figure F1.

Year	2A	2B	2C	2D	2E	2F	2G	2H	2I	2K	2L	2N	2R	2S	2W	2X
1990	0	0	0	0	0	0	0	0	0	0	12 771	0	1 399	57	786	3 087
1991	30	0	21	0	0	0	0	0	0	0	27 481	30	3 224	54	2 554	4 721
1992	103	0	0	0	668	35	0	70	0	232	23 361	228	4 190	0	3 172	12 567
1993	793	144	0	0	1 574	204	0	999	24	44	8 266	18	2 290	90	190	1
1994	2 363	0	111	580	1 911	417	0	1 098	227	68	10 171	369	152	125	124	0
1995	3 628	0	0	0	1 035	90	0	522	35	417	10 434	0	4 142	151	743	0
1996	406	0	56	0	0	0	80	593	138	0	12 314	0	3 653	815	1 778	0
1997	31	0	481	0	0	0	0	76	151	0	16 770	0	3 563	48	696	142
1998	0	0	290	0	0	0	0	132	0	0	16 545	0	933	0	160	0
1999	242	0	90	0	0	0	0	0	0	0	7 376	0	910	35	95	477
2000	2 185	0	219	0	0	0	105	0	0	0	1 657	0	304	0	0	0
2001	2 359	0	0	0	0	0	0	0	0	0	3 806	0	1 995	0	0	40
2002	3 216	0	387	0	161	51	0	0	0	0	4 566	0	1 124	27	0	20
2003	44	0	0	0	2 128	512	0	0	0	0	3 858	0	337	2	1 330	497
2004	591	0	0	671	3 215	380	53	0	0	0	5 671	0	619	0	0	0
2005	517	0	0	1 161	2 507	40	601	163	0	0	7 122	0	566	0	468	101
2006	0	0	0	0	0	0	0	0	0	17	12 309	0	1 423	0	726	0
2007	0	0	28	0	0	0	0	0	0	0	15 507	0	673	0	451	0
2008	38	0	224	0	6	0	0	7	0	1 020	11 451	0	879	36	1 234	46
2009	0	0	673	0	0	24	0	0	0	0	8 829	0	1 767	25	117	0
2010	0	0	0	0	0	0	0	0	0	313	7 853	0	1 088	0	413	0
2011	32	0	0	0	0	0	0	0	0	131	6 609	0	2 757	58	1 097	16
2012	0	0	0	0	0	0	0	0	0	0	0	0	14	14	7 400	0
2013	0	8	0	0	0	0	0	0	0	25	3 623	0	1 441	118	6 312	0
2014	0	0	152	0	0	0	0	0	0	0	5 651	0	874	111	7 492	0
2015	0	0	0	0	0	0	0	0	0	0	3 124	0	1 867	0	244	1 087
2016	0	0	0	0	0	0	0	0	0	0	4 704	0	1 157	0	279	0
2017	0	0	0	0	0	0	0	0	0	0	1 361	0	2 576	0	0	0
2018	0	0	0	0	0	0	0	0	0	0	3 927	0	1 174	0	887	0
2019	0	0	0	0	0	0	0	0	0	0	3 770	0	1 425	0	0	0
2020	0	0	0	0	0	0	0	0	0	0	1 152	0	1 637	14	11	0
2021	0	0	0	0	1	4	0	0	2	0	1 338	0	169	732	5	0
Total	16 578	152	2 732	2 412	13 206	1 757	839	3 660	577	2 267	263 377	645	50 322	2 512	38 764	22 802

Table F3: *continued.* Challenger fishery. Note: areas were reported as, for example, 7A and 7AA up to about 2000, with 7AA notation starting from about 1993. The data are combined for each letter in the table below.

Year	7AA	7BB	7CC	7DD	7EE	7FF	7GG	7HH	7II	7JJ	7KK	7LL	7MM	All
1990	7 221	2 177	0	201	0	0	1 237	350	225	345	0	0	240	11 996
1991	3 123	8 196	3 502	107	0	51	354	209	0	0	0	0	0	15 542
1992	54	13 400	4 057	0	0	0	325	12	870	3 602	14	0	0	22 334
1993	3 068	4 859	0	152	13	16 904	1 981	958	209	2 537	530	0	0	31 211
1994	11 649	27	12 161	20	15 011	17 425	0	93	0	3 161	7 961	572	0	68 080
1995	204	1 718	15 566	0	2 099	84	1 058	604	15	728	802	116	0	22 994
1996	8 796	5 272	10 916	1 677	3 166	7 839	5 368	434	0	6 758	8 335	580	0	59 141
1997	1 589	1 282	12 643	2 047	0	2 240	40	0	0	1 850	3 045	584	0	25 320
1998	4 361	8 939	3 310	58	1 695	0	0	18	10	860	3 470	364	0	23 085
1999	4 115	8 913	3 573	280	2 260	1 151	7 201	3 297	5 493	1 395	9 297	398	19	47 392
2000	0	3 395	19 389	3 055	6 028	1 098	274	96	38	40	354	1 627	0	35 394
2001	4 299	23 637	10 961	1 080	4 127	17	111	593	722	44	1 737	372	0	47 700
2002	5 478	41 342	4 554	916	79	1 023	3 187	0	719	0	3 372	53	0	60 723
2003	11 801	19 321	6 272	69	145	2 511	7 088	47	864	108	7 646	837	0	56 709
2004	3 977	42	9	151	4	15 735	2 820	23	310	88	7 969	890	1	32 019
2005	704	3 038	5	70	3 679	5 366	1 307	0	6	420	6 257	0	0	20 852
2006	2 847	4 777	20	1	109	1 315	277	0	0	616	18 964	1 917	0	30 843
2007	1 672	1 212	5 526	0	0	0	0	0	12	186	621	76	0	9 305
2008	0	0	5 243	0	0	6	0	0	0	0	0	1 043	0	6 292
2009	88	11 042	186	0	0	20	37	0	4	0	9 042	30	37	20 486
2010	297	1 505	421	32	0	0	0	0	0	0	6 076	1 043	0	9 374
2011	0	1 018	26	0	0	0	0	0	70	0	2 417	576	0	4 107
2012	0	96	50	0	0	0	0	0	0	0	4 508	2 853	0	7 507
2013	97	0	0	0	0	0	0	0	0	0	4 084	949	0	5 130
2014	0	0	0	0	0	0	0	0	0	0	3 917	920	0	4 837
2015	0	0	0	0	0	0	0	217	30	0	455	206	0	908
2016	0	0	0	0	14	0	0	32	0	0	1 095	516	0	1 657
All	75 440	165 208	118 390	9 916	38 429	72 785	32 665	6 983	9 597	22 738	111 968	16 522	297	680 938

Oyster dredge fisheries

The main dredge oyster fisheries are in Foveaux Strait (Figure F2) and in the Challenger area (see Figure F1). Regulations define the dredge design and use, and the fisheries have been subject to restrictions on minimum size and catch and closures (primarily due to the *Bonamia* parasite infections (Fisheries New Zealand 2019)). Heavy double ring bag dredges are used in the Foveaux Strait oyster fishery (OYU 5), whereas, historically, the Challenger (Nelson-Marlborough) fishery dredges were of lighter construction than those used in Foveaux Strait. The number of records and numbers of tows in each main fishery are given in Table F4. The Challenger fishery peaked at about 31 500 tows in 1995 during a period of sustained effort in 1993–1999 (> 20 000), dropped to under 15 000 tows during 2001–2007, with little reported effort in subsequent years. The Foveaux Strait fishery is currently the only one being fished. The highest level of effort in the Foveaux Strait fishery, for 1990–2021, was in 1990 and 1991. This was followed by a steady period of lower annual effort during 1996–2013 (16 500–19 400 tows), before a gradual increase to over 30 000 tows a year during 2017–2019, and a subsequent drop in 2020 to around 18 700 tows, and again in 2021 to about 15 600 tows.

Table F4: The number of records and number of tows reported for the Challenger (CHAL) oyster fishery and the Foveaux Strait (FOV, OYU 5) oyster fishery.

	No. of records				No. of tows			
Fishing year	CHAL	FOV	Other	total	CHAL	FOV	Other	Total
1990	723	1 020	9	1 752	8 548	39 013	101	47 662
1991	1 096	1 585	12	2 693	13 530	64 496	131	78 157
1992	1 163	344	101	1 608	15 565	12 541	1 841	29 947
1993	1 664	110	53	1 827	24 362	3 498	652	28 512
1994	1 986	157	9	2 152	29 969	4 464	318	34 751
1995	2 195	147	44	2 386	31 457	4 227	662	36 346
1996	1 775	633	243	2 651	27 977	19 299	3 614	50 890
1997	1 587	650	123	2 360	24 735	16 504	2 086	43 325
1998	1 641	652	55	2 348	27 655	16 730	1 008	45 393
1999	1 445	605	29	2 079	25 727	15 927	545	42 199
2000	927	703	19	1 649	14 828	17 951	310	33 089
2001	618	582	1	1 201	10 565	17 596	56	28 217
2002	8	982	1	991	164	32 462	2	32 628
2003	937	622	0	1 559	14 674	19 164	0	33 838
2004	493	664	0	1 157	8 448	17 565	0	26 013
2005	697	841	0	1 538	10 980	25 446	0	36 426
2006	743	737	0	1 480	11 041	19 789	0	30 830
2007	584	644	0	1 228	9 775	16 225	0	26 000
2008	124	549	0	673	2 329	16 028	0	18 357
2009	38	616	0	654	658	17 610	0	18 268
2010	77	614	0	691	1 235	16 669	0	17 904
2011	112	720	1	833	1 965	16 771	13	18 749
2012	53	847	1	901	935	19 391	18	20 344
2013	14	835	7	856	276	18 996	46	19 318
2014	5	852	5	862	81	24 369	29	24 479
2015	9	711	1	721	99	23 109	11	23 219
2016	10	726	0	736	135	23 865	0	24 000
2017	1	863	0	864	16	32 448	0	32 464
2018	1	1 011	0	1 012	2	39 013	0	39 015
2019	1	1 117	4	1 122	40	31 590	55	31 685
2020	1	874	19	894	30	18 719	367	19 116
2021	1	678	49	728	15	15 641	986	16 642
All	20 729	22 691	786	44 206	317 816	677 116	12 851	1 007 783

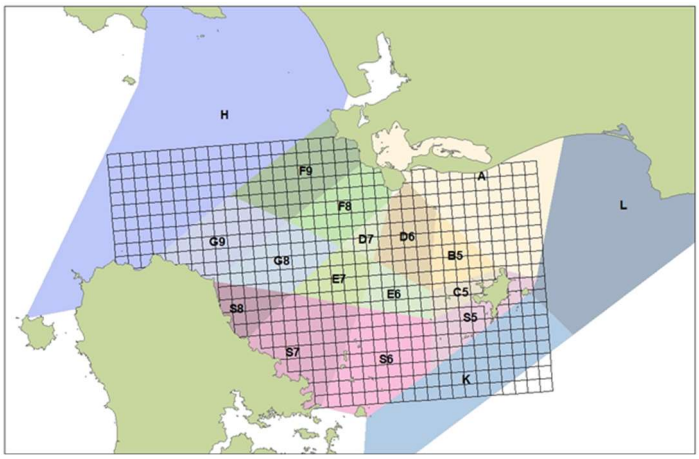

Figure F2: Foveaux Strait (OYU 5) fishery areas (coloured and labelled) with the 1 nm grid used by fishers to report fine-scale data.

Foveaux Strait oyster fishery (OYU 5), based on ERS data 2019–2021

During the 2019 oyster fishery, the ERS reporting was instigated gradually through the fleet of 12 vessels throughout the season. For ten vessels the fishing effort was reported on CELRs and ERS and for the remaining two vessels, data collection was via CELRs. In total, there were 681 CELR records and 440 ERS records for the 2019 season (Table F5). From 2020 all effort was reported on ERS forms in the OYU 5 fishery with 876 records in 2020 and 801 records in 2021 (Table F6).

Table F5: Number of oyster effort records in the 2019 OYU 5 season, by form type and OYU5 fishery area code. There are 18 fishery-specific areas (shown in Figure F2):there was no reported effort in areas K and L.

Form	A	B5	C5	D6	D7	E6	E7	F8	F9	G8	G9	H	S5	S6	S7	S8	Unk
CEL	20	56	22	16	4	20	185	17	0	203	9	0	1	5	121	0	2
ERS	28	101	36	10	1	15	33	12	17	113	60	5	3	1	2	1	1
Total	48	157	58	26	5	35	218	29	17	316	69	5	4	6	123	1	3

Table F6: Number of oyster effort records in OYU 5 for the 2019–2021 fishing years, recorded on the ERS form type by OYU5 fishery area code. There are 18 fishery-specific areas (shown in Figure F2) but for 2019–2021 there was no reported effort in areas K and L.

Year	A	B5	C5	D6	D7	E6	E7	F8	F9	G8	G9	H	S5	S6	S7	S8	Unk
2019	28	101	36	10	1	15	33	12	17	113	60	5	3	1	2	2	1
2020	30	108	2	16	12	45	362	35	30	170	37	4	1	1	2	19	2
2021	5	33	2	2	1	21	215	28	52	262	45	3	0	3	123	6	0
Total	63	242	40	28	14	81	610	75	99	545	142	12	4	5	246	27	3

These forms collect effort data in different ways: the CELR form collects daily data in the fishery-specific areas given in Table F5 and each record (*FishingEventKey*) represents daily effort in that area and the *EffortCount* in the data represent the number of dredge tows completed that day and area times the number of dredges used (two in this fishery). As such, a record with *EffortCount* = 30 as the reported effort represents 15 tows, each of two dredges.

The ERS data are collected on a 1-n. mile grid that overlays the fishery-specific areas (see Figure F2). For each *FishingEventKey* each start position reported by the fishers via ERS indicates the start of the first tow in a cell in a day and the end position gives the end position of the last tow in that cell for that day. Thus, data are collected at the level of a cell, and a fisher must create a new fishing event record

when the next tow starts in a neighbouring cell. This effectively gives a 1-n. mile cell-based number of tows and allows for a finer resolution for analysis than is provided by the larger fishery-specific statistical areas. The industry provided a shapefile of the 1-n. mile grid to be used for analysis of these data—a grid that has been used by the fishers for industry reporting for the past 15 years. ERS data were assigned to the 1-n. mile grid (in GIS) based on each record's start position.

To develop an ERS 'swept area' measure per record, the following data are required: number of tows, number of dredges used (always 2), width of combined dredges (usually 6.6.m, see below), and fishing duration and tow speed (to develop a distance fished in that cell for a day). However, the duration data is for a day's effort and is recorded as the time from the start of the first tow in a grid cell to the end of the last tow in that grid cell. Thus, duration would over-estimate the time that the gear is actually fishing.

Instead, a standardised swept area for each tow was developed:

*Standardised distance of 385 m * standard two-dredge width => 2541 m^2 swept area per tow*

where the standardised distance was calculated from a 5-minute duration for one tow at a tow speed of 2.5 knots. The swept area per tow was multiplied by the number of tows per record (per grid cell). It appeared that for some ERS data the number of tows was incorrect. A tow usually takes 15–20 minutes for the deployment, bottom-contact (fishing), and hauling and steaming back to start position (K. Michael, NIWA, pers. comm.). This means about 4 tows an hour is sensible. The numbers of tows per hour in the ERS data were looked at relative to the catch and duration and it was apparent that some records had 'number of tows' data that had been reported as if completing a CELR (that is, the CELR 'number of tows' actually reports 2 tows for each fishing event because it records the number of dredges fished per record for OYU 5, and thus CELR data would report twice the ERS 'number of tows' data per record). The spread of the estimated swept area for the OYU 5 2019–2021 seasons is shown in Figures F3–F5.

A total of 20.98 km^2 of seafloor was estimated as contacted in the 2019 ERS data (Figure F3). This comprised 101 unique grid cells being contacted by 8256 tows. The mean number of tows per contacted cell was 81.7 and ranged from 1 to 513. The area covered per contacted cell ranged from 0.003 km^2 to 1.3 km^2, with a mean of 0.2 km^2 per contacted cell. It is important to note that this is not a complete picture of dredge activity in OYU 5 for 2019, because ERS was not in use for the entire time period nor was it in used by all vessels. ERS forms only captured 26% of individual *tows* in 2019 which allows them to be mapped to the 1 n. mile grid cells. In 2019, 74% of individual tows were reported on CELR forms, but the reporting resolution does not allow these to be mapped to the grid cells.

A total of 42.5 km^2 of seafloor was estimated as contacted in the 2020 ERS data (Figure F4). This comprised 114 unique grid cells being contacted by 16 707 tows. The mean number of tows per contacted cell was 146.6 and ranged from 1 to 1083. The area covered per contacted cell ranged from 0.003 km^2 to 2.8 km^2, with a mean of 0.37 km^2 per contacted cell. It is pertinent to note here that ERS coverage for the 2019 year was incomplete, whereas in 2020 the coverage was 100%, resulting in a significantly larger footprint estimation in 2020.

A total of 35.3 km^2 of seafloor was estimated as contacted in the 2021 ERS data (Figure F5). This comprised 77 unique grid cells contacted by 13 877 tows. The mean number of tows per contacted cell was 180.2 and ranged from 1 to 964. The area covered per contacted cell ranged from 0.003 km^2 to 2.4 km^2, with a mean of 0.46 km^2 per contacted cell. This represents an overall decrease compared with 2020 both in the area swept and the number of cells contacted. Where fishing did occur, however, it was more intense, with a higher mean number of tows and area swept.

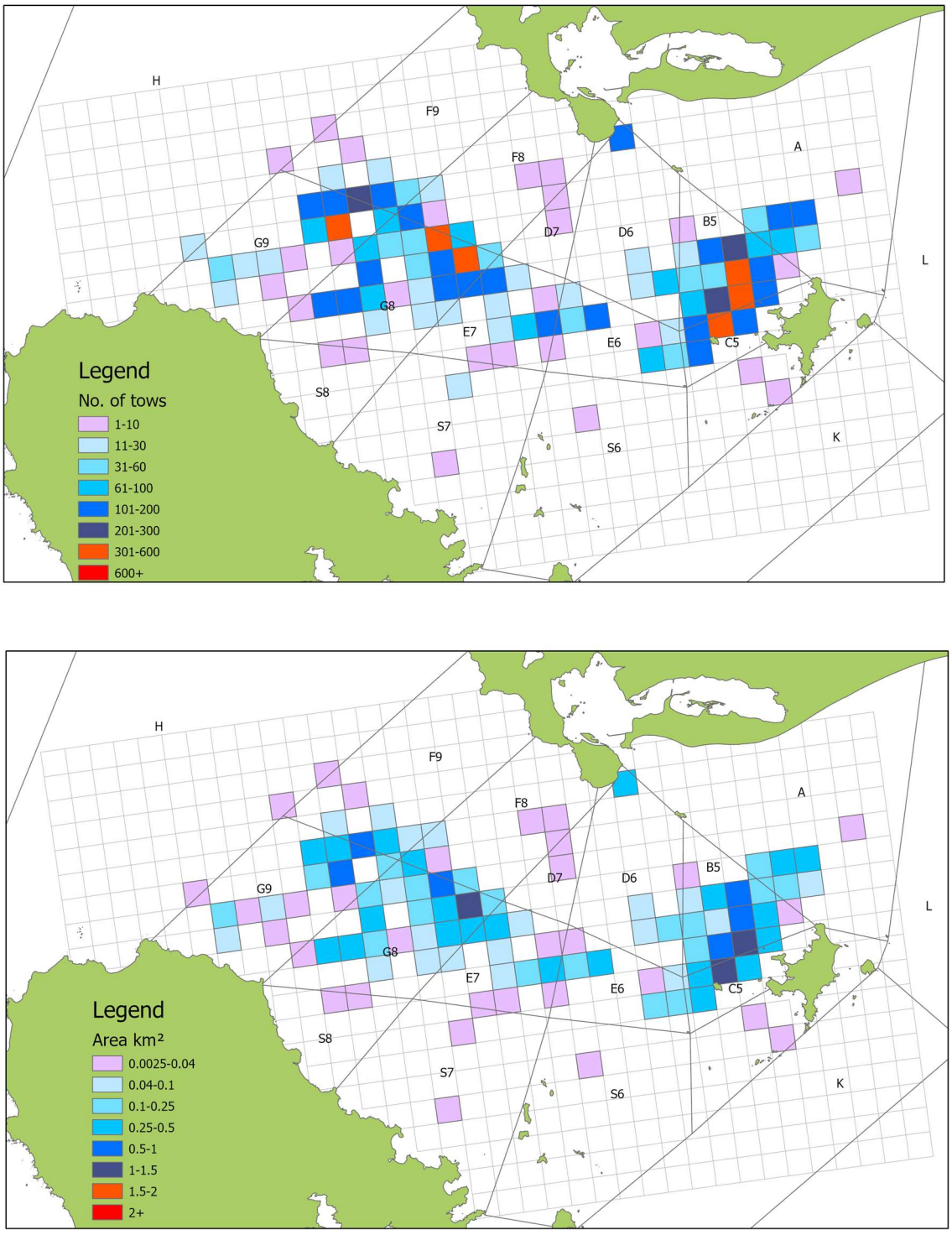

Figure F3: Number of tows (each with two dredges) per contacted 1-n. mile grid cells for 2019 (upper plot), where tow starts are shown as small yellow dots, and the estimated swept area for the 2019 data per grid cell (lower). These data represent 39% of the 436 daily records (CELR and ERS) from 10 vessels that fished in the 2019 season.

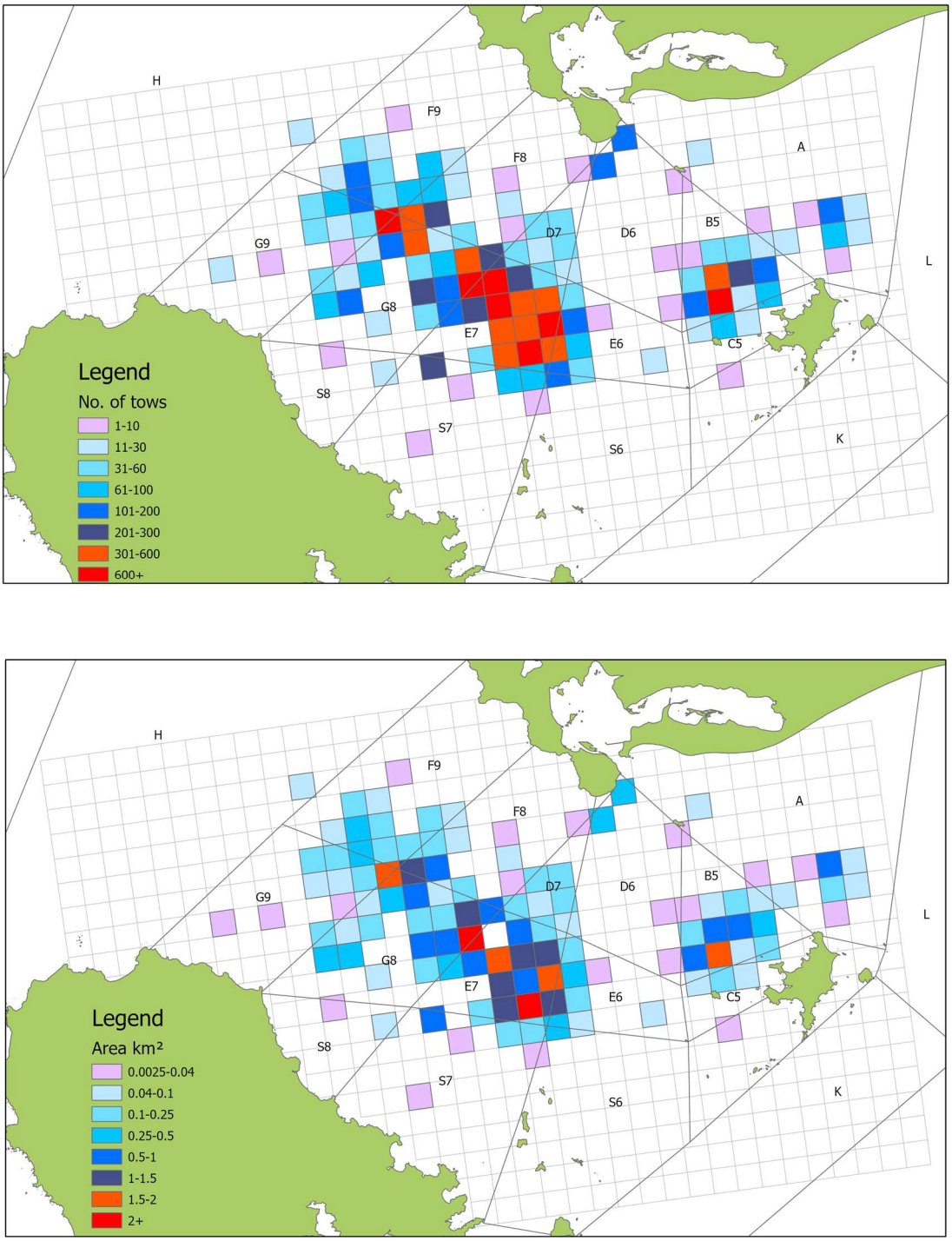

Figure F4: Number of tows (each with two dredges) per contacted 1-n. mile grid cells for 2020 (upper plot), where tow starts are shown as small yellow dots, and the estimated swept area for the 2020 data per grid cell (lower plot). These data represent all OYU 5 fishing activity in 2020.

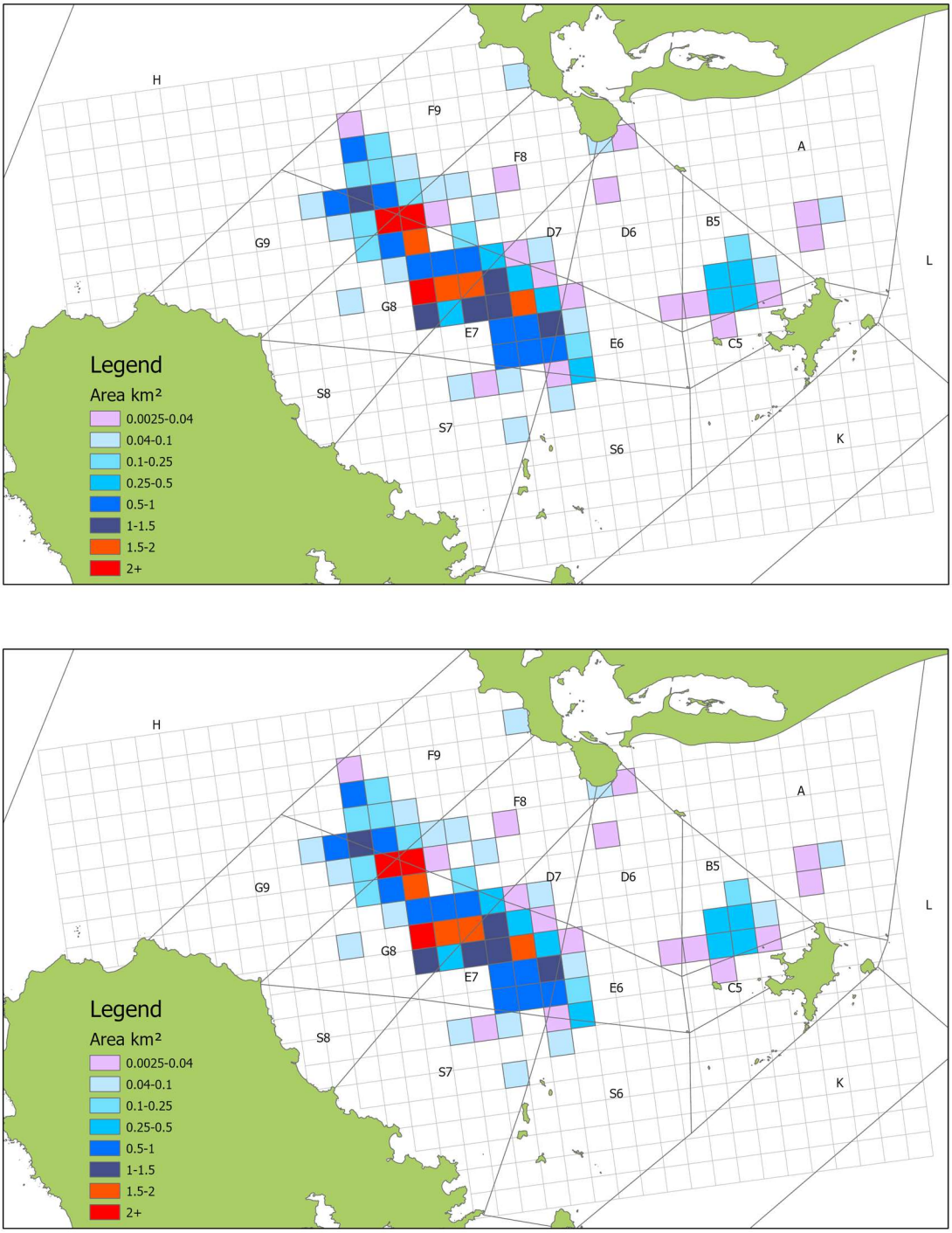

Figure F5: Number of tows (each with two dredges) per contacted 1-n. mile grid cells for 2021 (upper plot), where tow starts are shown as small yellow dots, and the estimated swept area for the 2021 data per grid cell (lower plot). These data represent all OYU 5 fishing activity in 2021.