

New Zealand Aquatic
Environment and Biodiversity
Report No. 73
2011
ISSN 1176-9440

Nature and extent of commercial fishing effort on or
near the seafloor within the New Zealand 200 n. mile
Exclusive Economic Zone, 1989–90 to 2004–05

S. J. Baird
B. A. Wood
N. W. Bagley

**Nature and extent of commercial fishing effort on or near the
seafloor within the New Zealand 200 n. mile
Exclusive Economic Zone, 1989–90 to 2004–05**

S. J. Baird
B. A. Wood
N. W. Bagley

NIWA
Private Bag 14901
Wellington 6241

**Published by Ministry of Fisheries
Wellington
2011**

ISSN 1176-9440

©
**Ministry of Fisheries
2011**

Baird, S.J.; Wood, B.A.; Bagley, N.W. (2011).
Nature and extent of commercial fishing effort on or near the seafloor within the New Zealand 200 n.
mile Exclusive Economic Zone, 1989–90 to 2004–05.
New Zealand Aquatic Environment and Biodiversity Report No. 73.

This series continues the
Marine Biodiversity Biosecurity Report series
which ceased with No. 7 in February 2005.

EXECUTIVE SUMMARY

Baird, S.J.; Wood, B.A.; Bagley, N.W. (2011). Nature and extent of commercial fishing effort on or near the seafloor within the New Zealand 200 n. mile Exclusive Economic Zone, 1989–90 to 2004–05.

New Zealand Aquatic Environment and Biodiversity Report No. 73

Trawl effort data from the 1989–90 to 2004–05 fishing years were used to map the spatial and temporal extent of commercial fishing effort conducted on or near the seafloor inside the New Zealand 200 n. mile Exclusive Economic Zone (EEZ) boundary. The tow data included in this analysis were from Trawl Catch Effort Processing Return forms where tows used bottom trawl gear or midwater trawl gear within 1 metre of the seafloor. These data represented 33–54% of the annual trawls with seafloor contact. The remaining trawl data were reported on Catch Effort Landing Return forms and summarised by statistical area, as were data reported for dredge effort.

The measures of fishing intensity calculated from these data were the number of tows and an estimate of swept area derived from an assigned doorspread value and either the distance between start and finish positions or the tow duration. A further measure to simply indicate the annual extent of trawling coverage (or “footprint”) was derived from the total annual swept areas.

The 16-year dataset included about 1 million trawls on or near the seafloor within fishable depths (down to 1600 m). The annual number of trawls peaked in 1997–98 at 78 610 tows (equivalent to an estimated swept area of about 180 450 km²). In more recent years, the effort dropped to fewer than 55 000 tows (about 130 800 km²). Most effort was in waters shallower than 800 m, with more tows reported for waters under 400 m, particularly north of 40° S where inshore species were the primary targets. About 80% of trawls in 400–800 m targeted hoki (*Macruronus novaezelandiae*) and, in most fishing years, more than 50% of the total annual swept area was in these middle depths.

Each tow was converted to a polygon to represent the estimated swept area and tows were overlaid with a 5 x 5 km cell grid to provide annual statistics by depth zone. Over the 16 fishing years, this effort crossed 55% of all cells in depths shallower than 1600 m. Over 75% of cells with trawl contact were in waters shallower than 800 m. About 20% of cells were contacted by trawl gear in one year and 10% in all 16 years. In each year, 68–77% of the annual fished cells had a trawl footprint of up to 20% of the cell area, and about half of these covered up to 4% (1 km²) of the cell area. In comparison, between 3 and 5% of annual fished cells had a footprint of at least 80%, and under 0.5% of annual fished cells were completely covered by the trawl footprint.

The aggregate swept area was about twice the footprint area in each year and seven times the footprint area over the 16-year dataset. In each year, 80% of cells had aggregate swept areas that covered less than 16% of a cell area. Cells with the highest trawled areas were in shallow and middle depths. Of the approximately 4.1 million km² of seafloor within the New Zealand EEZ boundary (and including the Territorial Sea), about 8% has been trawled by vessels completing Trawl Catch Effort Processing Returns during 1989–90 to 2004–05.

This trawl analysis produced indicative measures of effort relative to the seafloor, rather than absolute, primarily because of the resolution (or lack) of variables that describe the spread, location, and path of tows. Although the cell size was more relevant for some targeted effort than others, overall it provided a satisfactory grid for an EEZ-wide analysis. However, this cell-based analysis is restricted to only about 25% of all bottom-contact fishing in the EEZ for the study years. It may represent effort deeper than 200 m, but it severely underestimates the effort in shallower waters, in particular areas where both trawl and dredge gears are used. Thus, effort totalling at least 50 000 bottom tows per year, mainly in inshore areas, and about 2 million dredge tows can only be summarised by fishery statistical area by year.

1. INTRODUCTION

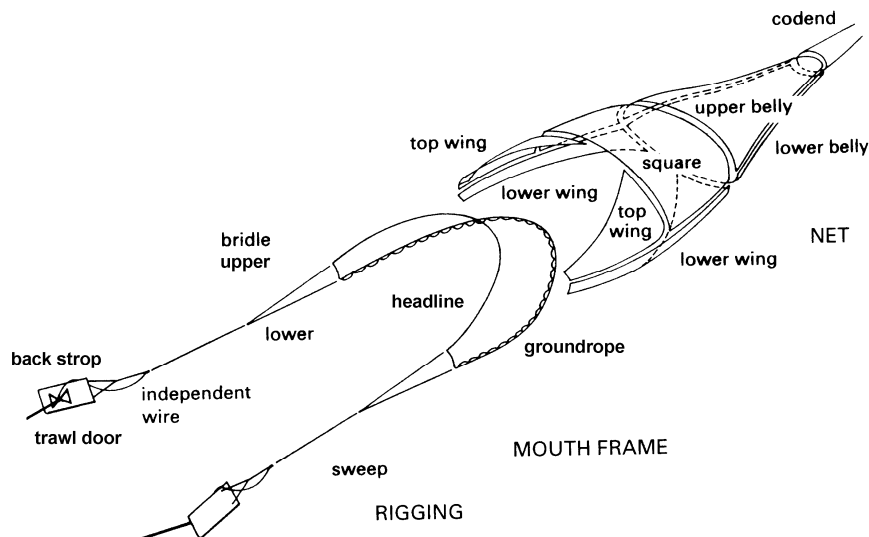
Fishing effort data provide a means to determine the nature and extent of mobile bottom fishing methods and thus identify areas or habitats that are subject to different levels of modification through fishing pressure. Effort may be represented by the number of fishing operations, the area swept by the gear, hours fished, or days fished, and these measures may be described at local, national, regional, or global scales, depending on the resolution of the data (for example, Rijnsdorp et al. 1998, Greenstreet et al. 1999, Jennings et al. 1999, Ragnarsson & Steingrímsson 2003).

Within the New Zealand 200 n. mile EEZ and the Territorial Sea, an area of about 4.1 million km², trawls and dredges are the main mobile bottom fishing methods used to target fish, shellfish, and squid species. Although vessels have long fished New Zealand waters, effort data collection was not formalised for many species until the introduction of Trawl Catch Effort Processing Returns (TCEPRs) and Catch Effort Landing Returns (CELRs) in 1989–90. The lack of position data, other than assignment to broad statistical areas used by the Ministry of Fisheries, in the latter data source confines finer scale spatial analysis to the TCEPR data. In previous work, these data have been analysed on a 0.05° latitude-longitude grid using either the number of tows or an estimate of the swept area (based on reported wingspread) as measures of effort (Baird et al. 2002, Baird et al. 2006). These measures show the general patterns of intensity and frequency of fishing on or near the seafloor, but they may be based on broad assumptions relative to the gear used, the configuration of each tow, the precision and resolution of the data, and the choice of analysis cell size.

Integral to a spatial analysis of the nature and extent of fishing effort data is both the provision of accurate and precise location data and understanding of the gear used, including its dimensions and configuration under tow. The various gear types used for trawling determine the amount of contact the gear has with the seafloor. Bottom trawl gear is fished hard on the bottom and contacts the seafloor from the doors back to the codend. Where midwater trawl gear is used to target species close to the seafloor, the points of bottom contact are from the wing-end weights back possibly to the codend. Variations in the extent of contact will result from differences in the way the gear is configured.

Bottom trawl nets are designed and rigged to maintain contact with the seafloor, and the extent of this varies depending on the species targeted and the underlying topography. The first points of contact of bottom trawl gear are the doors which are positioned to spread the wings of the net. Bottom trawl groundropes are constructed from chain or wires wrapped in rope or on a rough seafloor heavy gear such as rubber or steel bobbins, rockhopper gear, rubber discs, or rubber curtains are used (Figure 1). When a twin-rig is used, a heavy clump maintains the nets relative to each other and has continual contact with the seafloor. Tow speed and direction are influenced by many factors, including the bottom topography, environmental factors such as wind speed and direction and current direction and strength, vessel characteristics such as engine size and gear size, and target species. Factors that affect trawl spread and full bottom contact include: length of towing wire, bottom depth, warp: depth ratio, bottom type, tow speed, currents, trawl design, rigging, vessels, and drag forces from, for example, increasing codend diameter and decreasing sediment diameter (see Weinberg & Kotwicki 2007). A general description of the gear used in New Zealand was provided by Baird et al. (2002).

The commercial effort data for trawls on or near the seafloor are limited in their use in spatial analysis and restrict the results to indicative, not absolute, measures of effort relative to the seafloor. The resolution of the start and finish positions are at best, to 1 minute of arc, which is equivalent to about 1.852 km, and these positions represent the location of the fishing vessel when the net reaches fishing depth, rather than the location of the net. For example, depending on the depth fished, an orange roughly net could be 1200–1500 m behind the vessel. Several important values for the trawl gear and rigging are either not collected or represent a best guess. For example, the only measure of net spread (wingspread) is determined by the fisher from the net plans as the distance in metres between the wings of the net. Thus, there is no measure of the doorspread, which would provide a more realistic measure of trawl spread. Data that describe possible variations in gear configuration do not exist.



After: Sainsbury (1996)

Figure 1: Diagram of a typical bottom otter trawl net similar to those used in New Zealand waters.

Unlike trawl gear, dredge gear used to target dredge oysters (*Ostrea chilensis*) or scallops (*Pecten novaezelandiae*) is designed to dig into the seafloor. Within New Zealand waters, various dredges are used, depending on the target species and the substrate (see Baird et al. 2002, Beentjes & Baird 2004). Like the trawl effort collected on CELRs, these dredge data are assigned to statistical areas, generally ones that are pertinent to the various dredge fisheries. These fisheries target discrete beds (for example, see Cryer & Parkinson 2006, Michael 2008), but the actual location of these beds cannot be identified within the statistical areas.

This report is divided into several sections, based on the different spatial analyses allowed by the data, the main emphasis being on the TCEPR trawl data. The first section describes the general methodology for dealing with the two data form sources. The second concentrates on the use of data with tow-by-tow position records collected on TCEPRs. It describes the methodology used to explore and analyse 16 years of TCEPR trawl fishing effort on or near the seafloor by fishing year, depth zones, and target species groups and presents the resulting trends and patterns using indicative measures of swept area derived from generic doorspread values. This work builds on previous analyses (Baird et al. 2002, 2005) which showed patterns of the intensity and frequency of bottom trawling defined by the main target species, particularly in waters shallower than 800 m where favoured grounds were fished intensively most years, with other areas fished relatively lightly. Through the use of relational databases and Geographic Information Systems to generate polygons of individual trawl tows this current study provides an improved representation of the seafloor area fished by each trawl, for estimation of both the annual aggregate swept area and the coverage swept area which defines the footprint of the trawl effort. The results described by the TCEPR data represent 33–54% of the reported trawls on or near the seafloor each fishing year. This section forms the bulk of the work undertaken for this project.

The third and fourth sections summarise the treatment for the CELR data and the CELR bottom trawl effort (as measured by the number of tows) and the oyster and scallop dredge tows, mainly in inshore areas, for which the fishing location data are reported by the Ministry of Fisheries statistical areas (both generic and species-specific). Lastly, the report discusses the data quality and its effect on the results, with consideration of future data collection possibilities and further analyses. Appendices describe data pertinent to the body of the report and an accompanying DVD provides maps of TCEPR and CELR trawl effort.

Under the overall BEN2006/01 objective that aims to *determine the distribution, frequency, and return times of New Zealand bottom trawl and dredge fisheries*, this report addresses specific objectives 1–4:

1. *To update maps and develop GIS layers of fishing effort from project ENV2000/05 to show the spatial and temporal distribution of mobile bottom fishing throughout the EEZ between 1989/90 and 2004/05.*
2. *To produce summary statistics of major fisheries and the aggregate of all bottom impacting fisheries in terms of the extent and frequency of fishing by year, by depth zone, by fishable area, and, to the extent possible, by habitat type.*
3. *To identify and document any major trends or changes in fishing effort or fishing behaviour.*
4. *To identify, discuss the implications of, and make recommendations on data quality and other problems with current reporting systems that complicate characterisation and quantification of bottom fishing effort.*

2. DESCRIPTION OF DATA AND DATABASE DEVELOPMENT

The methods below describe the database development, data exploration and grooming, and preparation for spatial analysis. For the purposes of this study, the EEZ is deemed to include the maritime area around New Zealand that is within the outer EEZ boundary, including the enclaves and the 12 n. mile Territorial Sea. Much of this is deepwater that has not been exploited by fishing activity. Fishing takes place predominantly on the continental shelf waters in depths defined by the target species, and as in previous work (Chatham Rise and Southern Plateau studies, Baird et al. 2006) we have restricted the fishable depths used to less than 1600 m.

Fishing is known to be patchy in distribution and the extent of the effort for some of the main target species has been affected by increases and decreases in the Total Allowable Commercial Catch defined by Ministry of Fisheries, by area closures, and by various regulations, including those that relate to the incidental capture of nonfish species. Figure A1 in Appendix A shows the extent of the NZ EEZ, including the division into 10 Fishery Management Areas (FMA), and the spatial restrictions to trawling relevant for the period 1989–90 to 2004–05.

This report does not attempt to incorporate all the fisheries management changes (see Ministry of Fisheries 2009a) into the analysis, though major changes are identified where appropriate.

2.1 Data sources

The objectives of this project relate to trawl effort that has contact with the seafloor. All effort data with contact with the seafloor were provided by the Ministry of Fisheries as extracts from the *warehou* database for two form types: Trawl Catch and Effort Processing Returns (TCEPR) and Catch Effort Landing Returns (CELR). These data included effort that used bottom trawls, midwater trawls within 1 metre of the seafloor, dredges, and Danish seine nets.

Masters of trawl vessels are required to fill out TCEPRs if the vessel is over 28 m in overall length or if the vessel has been required by the Director-General of Fisheries to furnish a TCEPR (as required by the Fisheries (Reporting) Regulations 1990). These returns usually relate to trawl operations undertaken in depths greater than 200 m. However, an increasing number of masters of smaller vessels (that use trawl gear and generally fish shallow, inshore waters) report effort on TCEPRs. Other smaller trawlers report effort data on CELRs, as do vessels that use methods such as Danish seines, purse seines, and dredges.

The data collected on TCEPRs provide information about each fishing operation, with individual records of latitude and longitude position, time, and gear parameters for each tow. Data collected on CELRs during 1989–90 to 2004–05 summarise daily effort for a given statistical area (see Figure A2), fishing method, and target species. Although there was provision on these CELR forms for latitude and longitude records to be entered, this was not the common practice and would provide only a start position. These factors limit the spatial and temporal use of CELR data, and thus the CELR data are summarised separately.

Data required for this work included variables that described each fishing event, such as position, depth, date and time, gear type, form type, target species, duration, tow speed, and the associated vessel specifications. Position data were either unreliable or unavailable for the years before 1989–90, and thus the time series of data was restricted to the fishing years 1989–90 to 2004–05.

2.2 Initial database development

All TCEPR and CELR effort data were inserted into an object relational database with Open GIS Consortium compliant spatial data types and query capability PostGIS/PostgreSQL) (Wood & Baird in press). Initially, one table contained all these data (over 2 million records). Other primary database tables contained bathymetry data and New Zealand coastline data. This system was used to explore the data, with an associated graphical GIS package with provision to query and display data (QuantumGIS).

The initial data exploration on all trawl effort data included broad queries to isolate duplicates or missing data (Appendix B). Previous work indicated that vessels of the same (or similar) nationality target certain species, fish in certain depths and geographic locations, and use similar gear in a similar manner; and that vessels of similar sizes use similar gear for a target species. Thus, in the error checking and data exploration we based our approach on the premise that fishing effort would be characterised by the fishing gear used and that gear use could be collated by:

- use of a bottom trawl net or a midwater net near the bottom (within 1 m of the seafloor),
- vessel nationality,
- vessel size, and
- target species or groups of target species: such as those fished in middle depths.

Particular attention in the effort checking and 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, vessel characteristics (including nationality and speed), effort width (wingspread), and depth. Before the variable data were fully explored, several new fields were added to the database: revised vessel nationality entries to better describe the nation of origin of the vessel and vessel size category. The length ranges of the four vessel size categories were based on regulations and prior knowledge of the general distribution of vessels by size in New Zealand fisheries: under 28 m, 28–46 m, 46–80 m, and over 80 m.

2.3 Comparison of form use by trawl fishers

During the study period, vessels that reported effort that used Danish seines, purse seines, or dredges all completed CELRs (Table 1). All trawlers over 46 m used TCEPRs, and of the five vessels between 28 and 46 m long that used both forms, the CELR-reported effort represented under 0.5% of the total reported effort for four vessels and 9% for one vessel which reported its first year of effort (1996) on CELRs. Small vessels that reported trawl effort on both TCEPRs and CELRs either:

- used CELRs then changed to TCEPRs (46% of vessels)
- used CELRs, then TCEPRs for a few years, then reverted to CELRs (27%)
- used CELRs for most years, but for one or two years used both forms (14%)
- alternated between form types, beginning with CELRs (3%)
- used TCEPRs, then CELRs (6%)
- used TCEPRs for most years, but for one or two years used both forms (2%)
- used CELRs, then several years of both forms (1%),
- used TCEPRs, then CELRs, then TCEPRs (1%).

Most changes from CELR to TCEPR use occurred during the mid 1990s and relate to fishing that targeted mainly John dory, red cod, red gurnard, snapper, tarakihi, or trevally. Changes in the use of forms could be reflected in trends in the TCEPR data and this factor will be discussed later in the report.

Table 1: Number of vessels that used CELRs only (CEL), TCEPRs only (TCP), or both, by vessel length categories and fishing method, 1989–90 to 2004–05.

Vessel categories	Trawl*			Danish seine			Purse seine	Dredge	All methods
	CEL	TCP	Both	CEL	TCP	Both	CEL	CEL	All forms
A < 28 m	499	68	90	78	3	0	48	425	968
B 28–46 m	0	43	5	4	0	0	7	1	54
C 46–80 m	0	96	0	0	0	0	9	0	104
D > 80 m	0	151	0	0	0	0	0	0	151

* Vessels that used bottom trawls, bottom pair trawls, and midwater trawls within 1 m of the seafloor.

3. NATURE AND EXTENT OF TCEPR BOTTOM FISHING EFFORT

3.1 TCEPR data

Data for each of main variables were explored using the vessel/nation categories to isolate records with invalid codes or values and any obvious transcription or recording errors and to determine the distribution of variables used to characterise the effort (Table B1, Appendix B). Where possible these errors were amended. No data were deleted, other than duplicated records, and new fields were created to accommodate changed and new (derived) values. The grooming process was iterative, with ‘corrections’ made to one field at a time. Data within a defined range of values for each variable were retained as reported and those outside the range were assigned a median value determined from the data. For most variables, changes were made to less than 5% of the data. The process of this grooming for each of the main variable is summarised in Appendix C.

Underlying the data grooming, the following assumptions were made with respect to the database.

- All dates were accepted as reported.
- All gear type data were used as reported, except for a very small number of midwater tows wrongly coded as “MPT”: thus “BT” represented use of bottom trawl gear, “BPT” for a bottom pair trawl, and “MW” for midwater trawl net. Where “BPT” was the fishing method, the records of only one of the vessel pair were included.
- All vessel keys were accepted as real.
- Targets were generally accepted as reported, except those that were considered to be typographical errors or those that showed obvious inconsistencies; for example, “SNA” tows in southern waters where “SWA” was the target in tows of the same trip.

The recorded target species code may represent either the species being targeted on a tow, the species which constituted the largest proportion of the catch on a tow, or a generic code for a group of species. There were about 23 (sensible) target species or broad species groups (for example, oreo species for which the effort is often reported under the generic code of OEO rather than individual species codes) (see Appendix C). The assumption that most fishers target a group of species, often with the same gear, in similar depths, and in similar areas provided the basis to assign the data into eight groups of similar target species (Table 2).

Table 2: Target species assignment to broad groups based mainly on fishing depth (see Appendix C). Scientific names of the main target species listed below are given in Table C2 of Appendix C.

Group	Target species
Group 1	arrow squid, barracouta, blue mackerel, blue warehou, frostfish, gemfish, ghost shark, jack mackerels, red cod, ruby fish, sea perch, silver warehou, spiny dogfish, and stargazer.
Group 2	hake, hoki, ling, and white warehou
Group 3	southern blue whiting
Group 4	cardinalfish, oreo species, and orange roughy
Group 5	bluenose and alfonsino
Group 6	John dory, red gurnard, snapper, tarakihi, and trevally
Group 7	scampi
Group 8	flatfish species

3.1.1 Description of TCEPR effort variables by species group

The distributions of the groomed values for vessel size, towing speed, fishing depth, wingspread, derived distance, and derived duration for each species group are shown by fishing year in Appendix D. Vessels of all sizes targeted Group 1 species, with median towing speeds of about 4 kn. (Figure D1). Median depths fished were between 150 and 200 m, and median wingspreads ranged from 30 to 45 m for bottom trawl nets, and 75–116 m for midwater nets. Median derived distances were generally about 20–25 km each fishing year, and median tow times were between 2.5 and 5 h.

Group 2 species were targeted by vessels in all size ranges, generally at 4.0–4.5 kn. (Figure D2). The overall median depth fished with bottom trawls was 530 m, though the medians were slightly deeper in the early years. Midwater nets were used in slightly shallower waters, with the overall median depth at 450 m. The range of wingspread medians was 30–45 m for bottom trawl and 60–98 m for midwater trawls. Bottom tows were generally longer than midwater tows, both in distance (overall median of 24 km compared with 15 km) and time (median of 4.5 h compared with 2.5 h). Tow duration for bottom trawl nets appeared to increase towards the end of the time series, whereas midwater trawls were shorter than in earlier years.

Vessels over 46 m targeted southern blue whiting (Group 3 species), generally at about 4 kn. (Figure D3). The distributions of the bottom trawl values are very variable from one year to the next, perhaps because of the small amount of data or the misrepresentation of the effort as bottom trawl rather than midwater trawl. Median depths fished were generally between 400 and 450 m, and median wingspreads were 25–50 m for bottom trawls (based on few data) and 80–116 m for midwater nets. Median midwater trawl lengths varied between about 10 and 16 km (overall median of 13 km) in length and about 1.5–3 h in time.

Orange roughy and oreo species are unlikely to be targeted with midwater nets or by very small vessels, though the data suggest that vessels of all sizes target Group 4 species. Vessels towed at 3 kn. in median depths of about 925 m (Figure D4). The median wingspread decreased from about 20 m in the early years of the time series to about 16 m in the most recent years. Median derived distances and duration values are a fraction of those for Group 2 species and represent the short hill tows for these species (particularly in the most recent years).

Group 5 species were targeted by vessels of all sizes, though most were 28–46 m long (Figure D5). Median towing speeds were generally about 3.0–3.5 kn. Median depths fished were mostly about 400 m and median wingspreads varied between 15 and 30 m for bottom trawls and were 30–70 m for midwater trawls. Distances towed during bottom trawls (medians at about 2 km) were generally about half those by midwater nets, with medians of about 2 km compared with about 4 km, though there were no obvious differences in the fishing duration values.

Smaller vessels were dominant in the fisheries for Group 6 target species, using bottom trawls generally at speeds of about 3 kn. in shallow waters (median depths about 50–75 m) (Figure D6). Median wingspreads

were consistent between years, at 20 m for all years but one, and between 25 and 40 m for bottom pair trawl vessels. Median derived distances fluctuated about 15 km over the time series, though there appeared to be more variation in the bottom pair trawl data. There were few annual differences in tow duration (medians at about 2.5 h).

Scampi effort was generally made by vessels between 28 and 46 m, at speeds of under 3 kn. (Figure D7). Median depths fished were generally just under 400 m and median wingspreads were about 50 m. Tows appeared to increase in length and duration over the time series, with medians increasing from under 20 km and under 5 h in 1989–90 to almost 30 km and about 7 h after 1999–2000.

Small vessels targeted Group 8 species (combined flatfish species), and the few data result in some annual differences in the spread of variables (Figure D8). Most flatfish data were reported on CELRs (see Section 4). Median depths were under 50 m; tows were generally shorter than 30 km and 5 h in length. Little grooming was undertaken on the few data in this group.

3.1.2 Spatial allocation of TCEPR tows

Initially, the emphasis was to prepare the TCEPR data. Several fields were added to the database table to provide measures of effort other than the total numbers of tows in a given stratum. One measure of fishing effort, swept area, requires both distance towed and gear width values. Wingspread is reported by fishers on TCEPRs as the distance measured by spread sensors or the distance written on net plans. This, however, underestimates the true width of the gear and would be better represented by the doorspread of each tow. This information was not available on a tow-by-tow basis in commercial data for the years covered by the study, and a generic doorspread value was assigned to each tow, based on vessel size, target species, and known gear parameters. Thus, to progress the swept area calculations, new fields for TCEPR records were added to the database.

1. A new field of generic doorspread values was created to provide a better estimate of the gear width for bottom trawls (see Table C9 in Appendix C). For midwater trawls this field was populated with groomed wingspread values.
2. A distance for each trawl track was calculated from the start and fishing positions.
3. A second distance value was calculated for each tow; this was based on the reported speed and the start and finish times.
4. A swept area value based on the distance travelled measure.
5. A swept area value based on the speed-time measure.

To populate these fields, each tow was converted into a trackline (distance between the reported start and finish locations) and then buffered by the assigned doorspread to produce polygons to represent the trawl path. All tows were assumed to be in a straight line. Tows with a single valid position (or with identical start and finish positions) were assigned a point location, with a suitably sized polygon built around the point. For some tows this may generate apparent higher effort in some localised areas (and an apparent lower effort in surrounding areas), but it may be appropriate for very short tows that may have identical start and finish positions (such as those on underwater hill features). For such tows (about 30 000 tows), an estimated swept area based on the event's recorded speed and calculated time (difference between recorded start and finish times) and the assigned doorspread was derived and a circle the size of the estimated swept area and centred on the known point location was generated.

Under 0.4% of all TCEPR tows were excluded from the analysis because they appeared to be either outside the EEZ or on land. Most of these tows targeted inshore species and their exclusion will result in a very small negative bias on the total swept area.

3.1.3 Assignment of TCEPR tow data to cells

To aid in the categorisation and analysis of the data, a grid of about 25 km² cells was created in another database table. A 5x5 km cell size was chosen as a reasonably fine unit for an area the size of the EEZ. This grid was generated in the Albers Conic Equal Area Projection for the New Zealand EEZ and reprojected to latitude and longitude degrees to overlay with TCEPR effort data as a basis for spatial analysis. The resolution of tow position data was, at best, about 1.852 km. Each cell was assigned a depth derived from the NIWA regional bathymetry dataset that represented the depth at the cell midpoint.

The cell grid table was joined to the TCEPR data to create a new database table to enable the spatial overlay of the grid with the estimated doorspread-based polygons of swept area (Figure 2). Thus, the effort could be analysed by grid cell to identify and quantify the amount of effort per cell over time and to generate an indicative “footprint” of trawl effort on the seafloor. For area-based calculations, the data were reprojected to the Albers Conic Equal Area Projection to minimise distortions caused by converging lines of longitude with increasing latitude using degrees as the coordinate units. For each cell, the sum of the area of all the portions of the estimated doorspread polygons that lie within that cell can be calculated. Thus, a cell in any given fishing year may have an aggregate swept area of 0 (unfished) or 25 km² (swept area is similar to the cell size), or perhaps 100 km², suggesting that for that year, the swept area was four times the cell area.

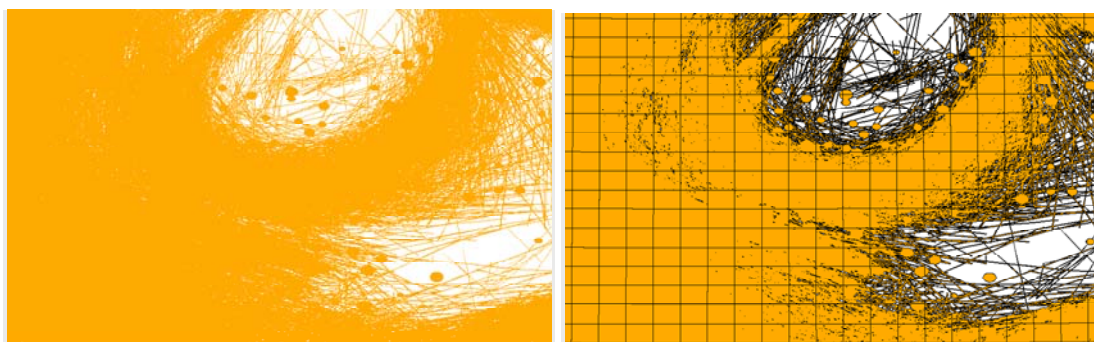


Figure 2: Spatial representation of trawl effort converted to polygons and overlaid with 25 km² cell grid, in a heavily fished area surrounding shallow unfished areas.

3.1.4 Measures used to summarise TCEPR data

As measures of the fishing intensity, this study used the reported number of tows for TCEPR data and the estimated swept area for each tow for the TCEPR data (in square kilometres), hereafter referred to as the *swept area*.

1. *Position swept area* is the area (km²) derived from the tow distance as measured between start and finish positions and the assigned doorspread. This measure was used to summarise the effort and the total for each fishing year is referred to as the **aggregate swept area**.
2. *Speed-time swept area* is the area (km²) derived from the tow duration as measured between start and finish times, the tow speed, and the assigned doorspread.
3. *Coverage area (footprint)* is the area (km²) that represents the seafloor area estimated to have been contacted by trawl gear.

The cell grid extent included waters from the New Zealand and offshore islands coastlines to the outer boundary of the EEZ. The term *available cells* defines those cells with midpoint depths of under 1600 m that lay within the EEZ boundary. *Fished cells* are those *available cells* that have been crossed by trawl gear (as determined by the *position swept area*).

3.1.5 TCEPR data representation and underlying assumptions

The effort data used here represent subsets of the total commercial trawl effort data reported during these years. First, data are for tows that used bottom trawl gear or midwater gear within 1 m of the seafloor, and second, the data are restricted to one data source (the TCEPR form).

Some underlying assumptions need to be stated.

1. The time series has an artificial start and end. The study treats the first year of data, 1989–90, as the start of fishing in each area, and thus any discussion of trends is relative to 1989–90.
2. It is assumed that the paths (trackline) of all tows follow a straight line between the reported start and end positions. In reality, tows may follow contours and may include turns, but the data do not allow any determination of actual tow path.
3. It is assumed that the gear is in contact with the seafloor throughout the tow.
4. The resolution of the position data is to the nearest minute (about 1.852 km – assuming no allowance for latitudinal changes).
5. 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. However, for about eight of the larger vessels that may have used twin-trawl gear since the late 1990s, especially when targeting hoki, the area swept may be under-estimated because it was not clear from the data whether a tow used a single trawl or a twin-trawl rig. A twin trawl is likely to have a doorspread twice that of a single trawl (for example, 400–450 m compared with 200 m) according to industry sources and gear manufacturers.
6. The irregular nature of the seafloor is ignored and it is assumed that, within each cell, the seafloor is homogeneous.
7. 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”. No areas of seafloor in depths under 1600 m were excluded as unable to be fished.

3.2 The nature and extent of TCEPR trawling on or near the seafloor

3.2.1 Results summary

Of the more than 2 million tows on or near the seafloor that were reported on TCEPRs and CELRs in 1989–90 to 2004–05, over 110 000 tows were made each year, with over 145 000 tows reported in 1996–97 and 1997–98. About 47% of the 16-year total effort was reported on TCEPRs. Before 1995–96, TCEPR records represented less than 50% of the annual effort TCEPR effort (Figure 3). Subsequently, the TCEPR effort increased very slightly relative to the CELR reported effort to represent 54–55% of all tows in 1997–98 and 2001–02, before dropping to about 50% in 2004–05.

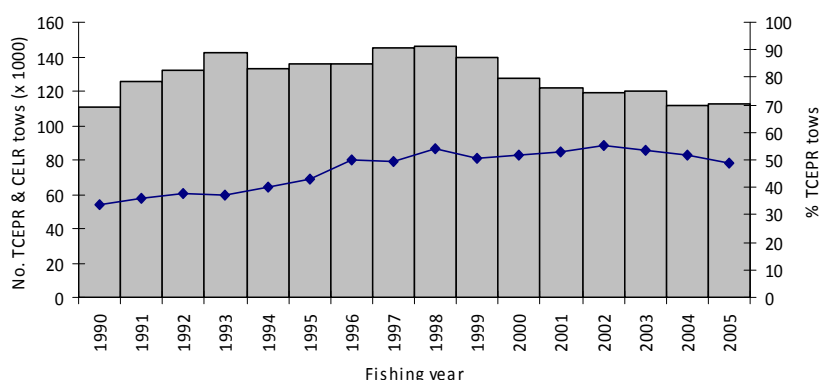


Figure 3: Total number of TCEPR and CELR tows on or near the seafloor (bars) for each fishing year, 1989–90 (1990) to 2004–05 (2005) and percentage of the annual tows reported on TCEPRs.

The final dataset of TCEPR trawl records for 1989–90 to 2004–05 contained 960 420 records, mostly bottom trawl records, with this gear type used on over 80% of the annual TCEPR trawls after 1995–96 (Figure 4). This represents 95% of the TCEPR data provided by MFish and excludes tows with position coordinates that place the effort on land, but includes all bottom tows, and midwater tows close to the seafloor, within the 200 n. mile EEZ outer boundary and with at least a valid start or finish position. Overall, 30 539 records had null EEZ values, and 22 440 of these were outside the EEZ and 97% of these were tows that targeted deepwater species primarily orange roughy (95%), but also oreo species, cardinalfish, alfonsino, and bluenose. The remainder of the tows targeted species usually targeted in shallow water; assuming the target species is correct, the position data for these tows are likely to be incorrect.

Another 16 400 tows were not used in the analysis. Half of these had no valid start or finish position and the other half had no obvious reason for not being included in the dataset, but when the TCEPR data were joined to the cell tables, these tows were not accepted into the spatial database despite appearing to meet the criteria. However, they represent less than 1% of the TCEPR data and include effort for all target groups over all years. [More work is required to isolate the problems in these data.]

Over the 16 years, about 450 different vessels reported at least one tow on TCEPRs (Table 3). Effort reported on TCEPRs increased over the time series, but fewer vessels completed this effort in recent years, with fewer than 100 vessels reporting effort in 2004–05. Effort peaked in the late 1990s, with over 78 600 tows reported in 1997–98. Since then, the number of tows has gradually decreased, and in 2004–05 the number of tows was similar to that in 1992–93 and 1993–94.

A corresponding trend is seen in the annual totals of the estimated swept area values. The aggregate swept area is the estimate of the total swept area based on the *position swept area* of each tow. This totalled at least 91 318 km² per year, with a peak at over 180 000 km² in 1997–98. Over subsequent years, the aggregate area fluctuated between about 151 000 and 174 500 km² before dropping sharply to about 130 800 km² in 2004–05.

In comparison, the coverage is equivalent to a trawl footprint and thus is an estimate of the seafloor area directly contacted by trawl gear. The coverage extended from under 50 000 km² in 1989–90 to over 90 000 km² in 2001–02 and 2002–03 and contracted to under 67 000 km² in 2004–05. In most years, the aggregate swept area was twice the footprint area, and for all years, the total was seven times the footprint.

Over the time series, 40% of the 167 173 cells in the EEZ had a midpoint depth value of under 1600 m; this gave a total of 66 853 *available cells*. Trawl effort on or near the seafloor crossed 36 792 cells (known as *fished cells*) during 1989–90 to 2004–05, which represents 55% *available cells* and 22% of all EEZ cells. The percent of *available cells* that were *fished cells* increased from about 19% in 1989–90 to over 28% in 2001–02 and then decreased to 24% in 2004–05. The percent of the total EEZ cells that were *fished cells* in a fishing year increased from about 7.5% in 1989–90 to a peak of 11.5% in 2001–02 and has since decreased to 9.6% in 2004–05.

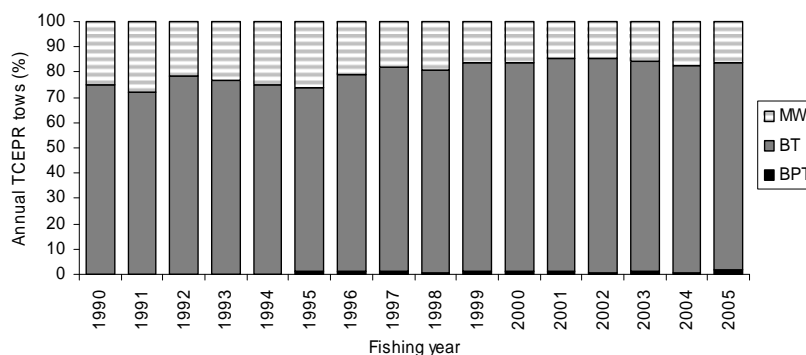


Figure 4: Percentage of TCEPR tows on or near the seafloor by gear type for each fishing year, 1989–90 (1990) to 2004–05 (2005), where MW is midwater trawl gear used within 1 m of the seafloor, BT is bottom trawl, and BPT is bottom pair trawl.

Table 3: Summary data for the TCEPR trawl effort on or near the seafloor* in less than 1600 m deep waters contained within the outer New Zealand EEZ boundary, for fishing years 1989–90 (1990) to 2004–05 (2005). The aggregate area (km²) is the sum of the estimated *Position swept area* of each tow derived from the tow distance as measured between start and finish positions and the assigned doorspread. The coverage area is equivalent to the trawl ‘footprint’, that is, the seafloor area contacted by trawl gear.

Fishing year	No. vessels	No. tows	Aggregate area (km ²)	Coverage (km ²)	No. <i>fished cells</i> *	<i>Available cells</i> that were fished (%)	Aggregate area/ <i>fished cell</i> area (%)	Coverage/ <i>fished cell</i> area (%)	Coverage/ <i>available cell</i> area (%)
1990	127	37 550	91 317.8	46 299.6	12 673	19.0	28.8	14.6	2.8
1991	149	45 479	116 453.9	52 901.2	14 045	21.0	33.2	15.1	3.2
1992	155	50 341	134 946.4	67 260.3	15 777	23.6	34.2	17.1	4.0
1993	141	53 403	137 325.8	68 416.0	15 241	22.8	36.0	18.0	4.1
1994	154	53 217	111 272.3	55 834.7	14 647	21.9	30.4	15.2	3.3
1995	160	58 514	137 519.9	64 786.5	15 423	23.1	35.7	16.8	3.9
1996	182	67 602	149 810.8	71 943.2	15 784	23.6	38.0	18.2	4.3
1997	179	71 775	159 381.4	75 773.7	15 967	23.9	39.9	19.0	4.5
1998	172	78 610	180 439.1	85 649.4	17 522	26.2	41.2	19.6	5.1
1999	151	70 972	163 573.8	79 146.7	16 796	25.1	39.0	18.8	4.7
2000	119	65 893	159 679.0	81 418.7	17 189	25.7	37.2	18.9	4.9
2001	120	64 374	165 028.6	84 835.6	17 318	25.9	38.1	19.6	5.1
2002	113	65 398	172 624.8	89 910.5	19 187	28.7	36.0	18.7	5.4
2003	113	64 188	174 487.3	90 939.6	18 452	27.6	37.8	19.7	5.4
2004	106	58 189	150 866.9	78 735.5	17 003	25.4	35.5	18.5	4.7
2005	94	54 915	130 811.7	66 448.7	16 060	24.0	32.6	16.6	4.0
Total	449	960 420	2 335 539.4	328 360.0	36 792	55.0	253.9	35.7	19.6

* Bottom trawls and midwater trawls fished within 1 m of the seafloor.

† *Fished cells* are those that were contacted by at least one tow in a fishing year. The total number of cells in the 0–1600 m depth range (i.e., *available cells*) is 66 853.

The overall coverage area for the 16-year dataset was estimated at about 328 360 km², equivalent to about 36% of the total area of *fished cells* and 20% of the *available cells* area. This annual coverage area contacted between about 15 and 20% of the area of the *fished cells*, compared with about 30–40% for the annual aggregate area. The annual coverage extended over no more than 5.5% of the *available cells* area.

3.2.2 Distribution of trawl effort

Of the nearly 1 million TCEPR tows, more than 100 000 were reported in each of FMAs 1–7, with another 70 700 in FMAs 8 & 9 combined, and only 51 in FMA 10 (Table E1 and Figure A1 for FMA areas). [It is likely that a proportion of those reported from FMA 10 are incorrectly allocated due to typographical mistakes in the position data.] Over the time series, about 33% of the effort was made in FMAs 3 & 4 (including the Chatham Rise), about 12.5% in each of FMA 5 (mainly Stewart–Snare shelf) & FMA 6 (Southern Plateau), 12% in FMA 7, 11% in each of FMA 1 and FMA 2, 5% in FMA 9, and about 3% in FMA 8.

The patterns of effort in each FMA have varied over the years, but the broad annual pattern of the increase in TCEPR reported effort (see Table 3) to the peak in 1997–98, followed by a subsequent decrease, was largely a result of increased effort in FMA 3 and FMA 1. Effort reported from northern waters increased sharply (to a 1997–98 peak of nearly 12 000 tows in FMA 1) and steadily (to a peak of 9000 tows in 1996–97 in FMA 2) in the mid 1990s, then gradually decreased over the subsequent years to about 8500 tows in FMA 1 and 5000 tows in FMA 2 towards the end of the time series. Effort reported from FMA 9 also increased during the mid 1990s, though at a slower rate, to peak at over 4500 tows in the last few years. Effort in FMA 8 has fluctuated between about 1000 and 2400 tows over the years.

In most years, effort in FMA 3 was greater than elsewhere. The number of TCEPR tows reported from FMA 3 increased from about 8000 tows in 1989–90 to a peak of about 16 400 tows in 1995–96 and 1997–98 before dropping off to fewer than 6000 tows in 2004–05. During those peak years, effort in FMA 3 represented over 21% of all tows near or on the seafloor in the EEZ, compared with about 11% in 2005. On the eastern Chatham Rise, effort peaked in FMA 4 during 1997–98 and 1998–99 (at over 10 800 tows), before levelling off at about 9000 tows towards the end of the time series, almost twice that in 1989–90.

In the southern FMA 5, where the TCEPR effort was concentrated off the Stewart–Snare shelf edge, the effort peaked sharply in the early years of the time series at almost 11 000 tows in 1992–93, then fluctuated around 7000 tows apart from a second peak in 1997–98 and 1998–99 at around 9000 tows. Apart from FMA 9, this was the only area to show an increase in effort in 2004–05 relative to the most recent 5 years. Generally about 7000–8000 tows were made in each year in FMA 6, with a peak of over 10 000 tows in 2001–02, apart from 1992–93 and 1998–99 when fewer than 6000 tows a year were reported. The number of tows reported in 2004–05 in FMA 6 was very similar to that in 1989–90 (about 7000).

Effort in FMA 7 occurred in waters off the west coast of the South Island out to the EEZ boundary on the Challenger Plateau and in part of Cook Strait. Effort here peaked at about 8500 tows in each of 1993–94 and 1994–95 and since then has gradually decreased to under 5000 tows in 2004–05.

Thus, over the time series, some of the FMAs that were responsible for a higher proportion of the fishing effort in a year in the early 1990s now contribute substantially less: for example, about 20% of effort was in FMA 3 until recent years when it dropped to 11% in 2004–05. For years at the end of the time series, FMA 1 contributed almost 16% compared with about 3% in the early 1990s, FMA 5 between 10 and 14% compared with up to 22% in 1990–91, and FMA 7 about 10% compared with 12–18% in earlier years.

3.2.2 Distribution of swept area

Over 2.3 million km² were estimated (as the aggregate swept area) to have been trawled during 1989–90 to 2004–05 (see Table 3). The fluctuations in the relative proportions of total annual effort were more marked when represented by aggregate areas. Annual swept area totals for the northern FMAs rarely exceeded 10 000 km² except for FMA 1, where since 1995–96 between 10 700 and 12 500 km² were swept a year (Table E2). This area contributed between 6.5 and almost 9% of the annual aggregate totals. The swept area in FMA 2 increased from about 2500 km² to over 8000 km² in 1993–94 and remained about this level other than peaks in 1996–97 and 2001–02 at over 10 000 km². The swept area dropped after the second peak to about 6400 km². In northern waters off the west coast of the North Island, the swept area in FMA 8 has fluctuated quite markedly between 2200 and over 7500 km² over the time series. Since 1999–2000, annual aggregate areas were estimated at between 4000 and 5700 km². The annual aggregate area in FMA 9 steadily increased throughout the time series from under 500 km² in 1989–90 to about 9000 km² in the last few years of the time series.

The aggregate swept area in FMA 3 contributed 20–32.5% to the annual totals until 2003–04 and 2004–05, when less than 18% of the swept area was from FMA 3. The aggregate area peaked at over 49 500 km² in 1997–98, before steadily dropping off to under 20 000 km² in 2004–05 — less than that estimated for 1989–90. The total annual swept area in FMA 4 fluctuated between about 10 000 km² and 33 600 km² (in 1998–99), with between 26 000 and 32 000 km² in the 2000s before it dropped to almost 25 000 km² in 2004–05.

Annual aggregate area for FMA 5 also fluctuated since the highs of about 30 000 km² in the early 1990s and dropped gradually after a second peak of about 29 000 km² in 1997–98 and 1998–99. This area was the only one to show any real increase in the aggregate area in 2004–05 (from 17 500 km² to over 23 000 km²). After an early peak in 1991–92 (at over 25 000 km²), the aggregate area in FMA 6 fluctuated between 14 600 and 20 000 km² before dropping to a low in 1998–99 of about 12 500 km². The following year the aggregate area almost doubled to over 22 000 km², peaked in 2001–02 at over 31 000 km², then decreased over the next three years to 16 500 km² in 2004–05. The swept area annual totals for FMA 7 ranged between over 14 000 and 20 800 km² (peak in 1994–95) before dropping to about 16 000 km² in 1999–2000. The swept area increased again to over 22 000 km² in both 2001–02 and 2002–03, before decreasing to about 15 500 km² in 2004–05.

Overall, the FMAs that contribute most to the aggregate swept area are the Chatham Rise areas of FMA 3 (23%) and FMA 4 (16%), Stewart-Snares shelf (FMA 5: 17%, FMA 6: 14%), and FMA 7 (12.5%). The aggregate area in FMA 1 was similar from the mid-late 1990s through to 2004–05 at about 12 000 km²; in FMA 2 the area trawled showed a slight increase over the time series, though it dropped in the last years to about 6000 km². In FMA 3 the aggregate area more than doubled in the first half of the time series and subsequently decreased to less than the 1989–90 level in 2004–05. Large fluctuations characterised the annual aggregate area in FMA 4, until the late 1990s and 2000s when it remained relatively steady at around 30 000 km² then dropped sharply to under 25 000 km² in 2004–05.

In FMA 5 the swept area was highest in the early 1990s and then fluctuated in subsequent years with under 25 000 km² estimated since 1999–2000. FMA 6 showed increases in the early 1990s, a low in 1998–99 and a peak in 2001–02, then a steep decline in the last years. There was little variation in the FMA 7 annual aggregate areas, and the slight increase seen in the early 2000s was shortlived and the area in the last two years was similar to that trawled at the start of the time series. The aggregate area in FMA 8 varied between about 2200 and 7500 km² and was relatively steady in the 2000s at about 4000–5000 km², whereas FMA 9 showed a steady increase over the years from under 1000 km² to about 9000 km² in 2004–05. Thus, as the relative contributions of FMAs 3, 6, and 7 decreased in the last few years of the dataset, that of FMAs 4 and 5 increased.

3.2.3 Distribution by target species groups

Of the total effort during the 16 fishing years, TCEPR tows targeted at the species in Groups 1 and 2 comprised 60% of the tows on or near the seafloor (Table E3): Group 1 (26%), Group 2 (34%), Group 6 (15%), Group 4 (15%), Group 7 (7%), and Groups 3, 5, and 8 (combined 2.5%). Group 8 is virtually unrepresented in the TCEPR data because almost all flatfish effort was reported on CELRs (see Section 4.1). Over all years, 1299 flatfish tows were reported on TCEPRs.

The number of tows reported on TCEPRs for Group 1 species peaked at over 19 500 in 1995–96, then decreased to under 14 500 in 2004–05, fewer than reported in 1989–90 (Table E3). Group 1 species accounted for 17–26% of the annual tows since 1995–96. Group 1 fisheries are dominated by squid targeted effort, which accounted for about 50% of the annual Group 1 effort in most years, except for the most recent years; squid targeting increased to over 9000 tows in 2004–05, about 66% of the Group 1 effort (13 000 tows) (Table E4). Jack mackerel and barracouta accounted for another 30% of the annual Group 1 effort until the most recent two years.

Group 2 (hake, hoki, ling, and white warehou) accounted for at least 34% of annual tows after 1994–95 until after 2002–03 (Table E3). Effort in this group was dominated by hoki fishing (Table E5) and peaked in 1997–98 at over 28 600 tows before decreasing to about 23 500 tows in 2001–02 and 2002–03 and dropping steeply in the last two years to about 13 800 tows in 2004–05.

Targeting for the Group 4 deepwater species of orange roughy, oreo species, and cardinalfish peaked in the mid 1990s and again in the late 1990s at over 11 500 tows a year before dropping to about 7000 tows in recent years. Orange roughy accounted for most of the annual effort in this group, with more than 75% of the annual Group 4 tows up to the mid 1990s (Table E5). Cardinalfish and oreo species contributed increasing amounts and in the 2000s, 54–61% of annual tows targeted orange roughy, 32–39% targeted oreos, and 7.5–13% targeted cardinalfish.

Effort reported on TCEPRs for Group 6 increased dramatically during the mid-late 1990s when many of the vessels that previously completed CELRs changed to reporting their effort on TCEPRs and more vessels began fishing. In 1995–96 over 11 700 tows for red gurnard, John dory, snapper, tarakihi, and trevally were reported, over twice that in the previous year and more than 30 times that reported in 1989–90 (Table E6). Over the years, about 42% of this effort was targeted at snapper, 20% at tarakihi, and 18% at trevally. Snapper effort peaked in the mid-late 1990s at over 7000 tows and has since dropped off, whereas effort for the other species, except John dory, has increased in recent years. In the 2000s, about 30% of Group 6 tows targeted snapper, 30% tarakihi, 22% trevally, 13% red gurnard, and less than 10% John dory.

Scampi effort (Group 7) has generally been fewer than 6000 tows a year, with peak years in 1991–92 to 1993–94 (between 5800 and 5200 tows) and in 2001–02 at over 6500 tows. During those peak years, scampi tows contributed to about 10% of the annual effort (see Table E3). Effort for Group 3 (southern blue whiting), Group 5 (alfonsino and bluenose), and Group 8 (flatfish) was usually under 1000 tows a year.

Groups 1, 2, 4, & 6 together accounted for at least 85% of the annual swept area (Table E7, Figure 5). In most fishing years, particularly since the mid 1990s, more than half the annual swept area was by gear targeting hake, hoki, ling, and white warehou until 2004–05 when less than 45% of the swept area was from this species group. This was due to the drop in hoki effort and increases in swept area totals for Groups 1, 6, and 7. The area swept by Group 4 tows has substantially decreased over the time series, but has been relatively steady in the last 5 years, at about 4000 km². The Group 6 swept area has increased markedly, with the early increases likely to be related to fishers changing their reporting habits and using TCEPRs rather than CELRs. The relative contributions to the tow and aggregate area totals by Group 2 species compared with that by other groups recognises the effect of the use of larger gear and longer tow lengths during trawling for Group 2 targets (see Figure E1).

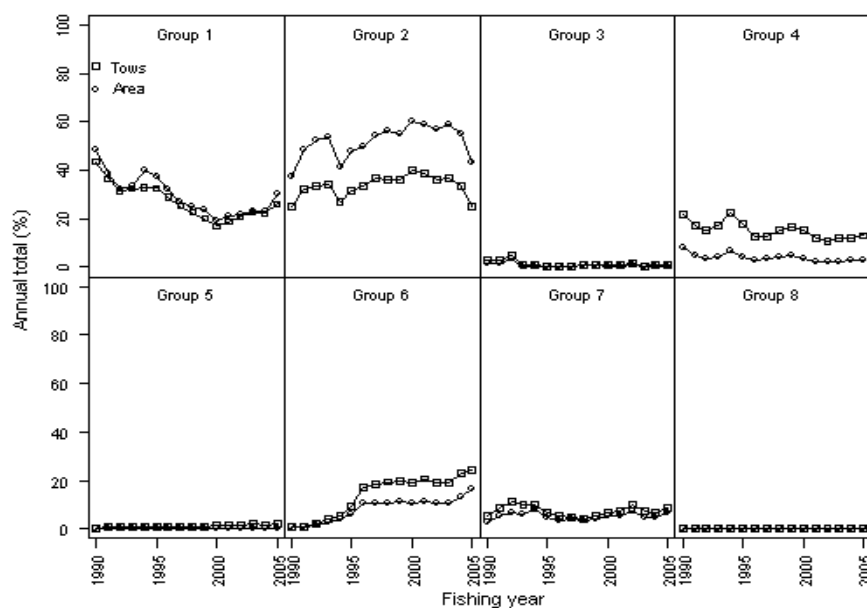


Figure 5: Relative proportions of the annual number of tows and aggregate swept area by species groups and fishing year, 1989–90 (1990) to 2004–05 (2005).

3.2.4 Distribution by depth zone

Most trawling on or near the seafloor has been in depths shallower than 800 m (Figure 6). Fishing effort increased in the shallow (under 400 m) waters of the New Zealand EEZ over the time series, with a peak in the late 1990s at almost 40 000 tows, followed by a steady period of about 32 000–33 000 tows per fishing year. Fishing in 400–800 m peaked in the early 1990s (at about 19 000 tows) and again in 1997–98 (at about 28 700 tows). Since then, effort remained at about 25 000 tows, but dropped after 2002–03 to about 16 000 tows in these depths in 2004–05, similar to that in 1990–91. In 800–1200 m, the annual tow totals ranged between 6000 and almost 10 000 tows, with peak years in 1993–94 and 1997–98 to 1999–2000. Towards the end of the time series, about 6000 tows were made a year in this depth zone.

Thus, in most fishing years, more than 50% of the tows were in waters shallower than 400 m, 28–42% in 400–800 m, and 9–18% in 800–1200 m. Several years are exceptions to the range in under 400 m: in 1995–96 when 58% of annual tows were in under 400 m and in 2004–05 (60%). This resulted from an increase in shallow water reporting in 1995–96, but from a decrease in number of tows reported from 400 to 800 m in 2004–05. Effort in 400–800 m relative to the other depth zones was highest in 1999–2000 (at 41.6%) and lowest in 2004–05 (at 29.2%). Towards the end of the time series, effort in 800–1200 m represented about 10% of the annual tows, and deep tows (in over 1200 m) accounted for less than 0.5% of annual tows. A very small proportion of fishing occurred in depths over 1200 m.

When this effort is represented by the estimated aggregate swept area, in most years the effort in 400–800 m was greater than that in under 400 m, particularly after the mid 1990s when the increased effort in 400–800 m resulted in annual aggregate areas of 80 000–102 000 km² from 1996–97 to 2003–04. In 2004–05, the aggregate area was less than 60 000 km². The annual aggregate area totals in shallow depths fluctuated over the time series between about 60 000 and 75 000 km². Since the late 1990s more than 50% of the annual aggregate area was in middle depths until 2004–05.

In waters less than 400 m, 50% of the effort was for Group 1 species, 29% Group 6 species, 10% for Group 2, and 8% for Group 7. In the early 1990s, Group 1 species accounted for over 60% of the TCEPR tows in the shallow depths, but after the late 1990s, these groups accounted for about 40% each of annual shallow tows (as more TCEPR reporting of Group 6 species occurred), with the remainder mainly from Group 2 and Group 7 (Figure E2). The total estimated aggregate area in these depths was dominated by Group 1 species (60%), with the remainder mainly Group 6 (20%), Group 2

(9%), and Group 7 (7%). Similar annual trends were seen in relative proportions of Group 1 and Group 6 effort, though the Group 1 aggregate effort decreased from over 80% in 1989–90 to about 55% in the 2000s when Group 6 species accounted for about 30%.

In 400–800 m, most tows targeted Group 2 (78%), Group 7 (8.5%), and Group 4 (7%); however, Group 2 species accounted for over 90% of the annual aggregate area (see Figure E2). In 800–1200 m, 95% of the total tows targeted Group 4 species and 5% targeted Group 2; a higher percentage of the total aggregate area was represented by Group 2 effort (77%) compared with 22% for Group 4 species. In years of increased numbers of Group 2 tows (particularly 2000–01 to 2003–04), the Group 2 aggregate area in these depths accounted for over 30% of the annual total and peaked at almost 50% in 2000–01. Group 4 accounted for 97% of effort in waters deeper than 1200 m, and apart from 1995–96 and 1996–97, at least 80% of the annual aggregate swept area.

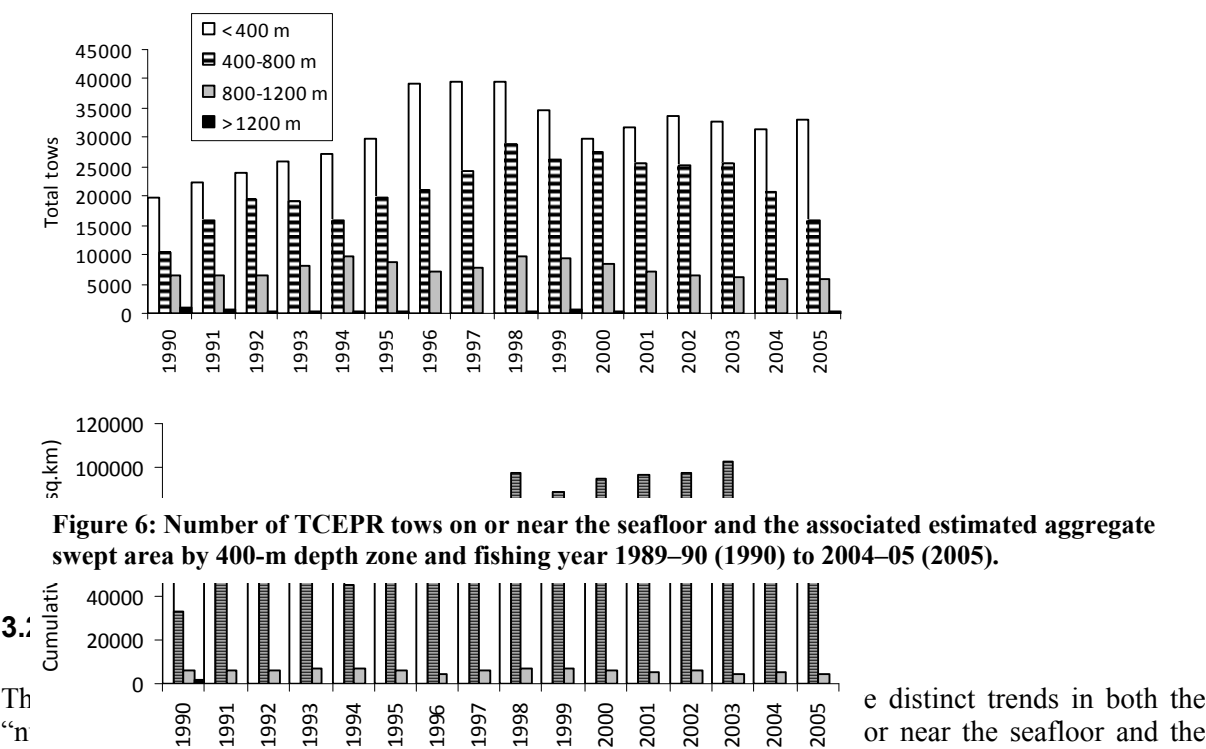


Figure 6: Number of TCEPR tows on or near the seafloor and the associated estimated aggregate swept area by 400-m depth zone and fishing year 1989–90 (1990) to 2004–05 (2005).

There are distinct trends in both the number of tows on or near the seafloor and the spatial distribution of this effort. Within the bounds of this work, the relationship between the two measures is determined largely by the gear used, the species being targeted, the size of the vessel, the area fished, and the assumption that the data treatment is adequate.

The distribution of the fishing effort is determined by target species, depth, season, and vessel. Where the fishers choose to set their trawl gear may depend on the scale of their fishing enterprise, and this may include the size and type of vessel (from a small “ice” boat to a large factory freezer vessel) and the size and type of trawl gear, their land address (local port), their favoured target species, and their knowledge and experience. Such factors are not generally available in the type of data description undertaken here. Thus, the main variables used to describe the trawl fishing distribution on or near the seafloor, on this EEZ-wide scale, are the fishing depth, target species, and location with respect to Fishery Management Areas and known regions of the continental shelf, such as the Chatham Rise.

The distribution by FMA allows for discussion of bodies of water and associated seafloor in relation to the main fishing areas for many target species; after all the FMAs are generic management areas that generally encompass areas of intense and frequent fishing activity for the main target species. Figure E3 shows the distribution of the fishing effort in each year by FMA and 400-m depth zone for all species groups combined and for each species group.

FMA 1 fisheries are primarily shallow species fisheries. The narrow shelf area restricts the available area of fishable depths, with much within the 12 n. mile Territorial Sea. Species can be readily targeted by small vessels operating on short trips from local ports; in fact, vessels over 46 m are not permitted to fish in FMA 1 or FMA 2 waters (hence the distribution of effort by vessel category shown in Figure 7). Thus, this area accounts for a large number of the annual shallow water tows in the EEZ (Figure E3), and with FMA 2 is largely responsible for the apparent increase in the mid 1990s in shallow water effort when many small vessel skippers were encouraged (and changed) to report effort on TCEPRs. Initially, scampi was the main target reported by small vessels in FMA 1 until the mid 1990s, after which snapper was the primary Group 6 target, with over 5000 tows reported in 1997–98. Snapper effort reported by these vessels subsequently dropped to about 2500 tows after 2000–01. Other targets reported by these vessels were John dory, tarakihi, trevally, and gurnard; less than 25% John dory tows were reported in 2004–05 (about 400 tows) than in 1999–2000, whereas annual effort levels changed little in the 2000s for the other main targets (1200–1500 tows for tarakihi, 1300–1700 for trevally, and about 650 tows per year for gurnard). Scampi effort over that period was similar to the early 1990s (generally about 800 tows per year).

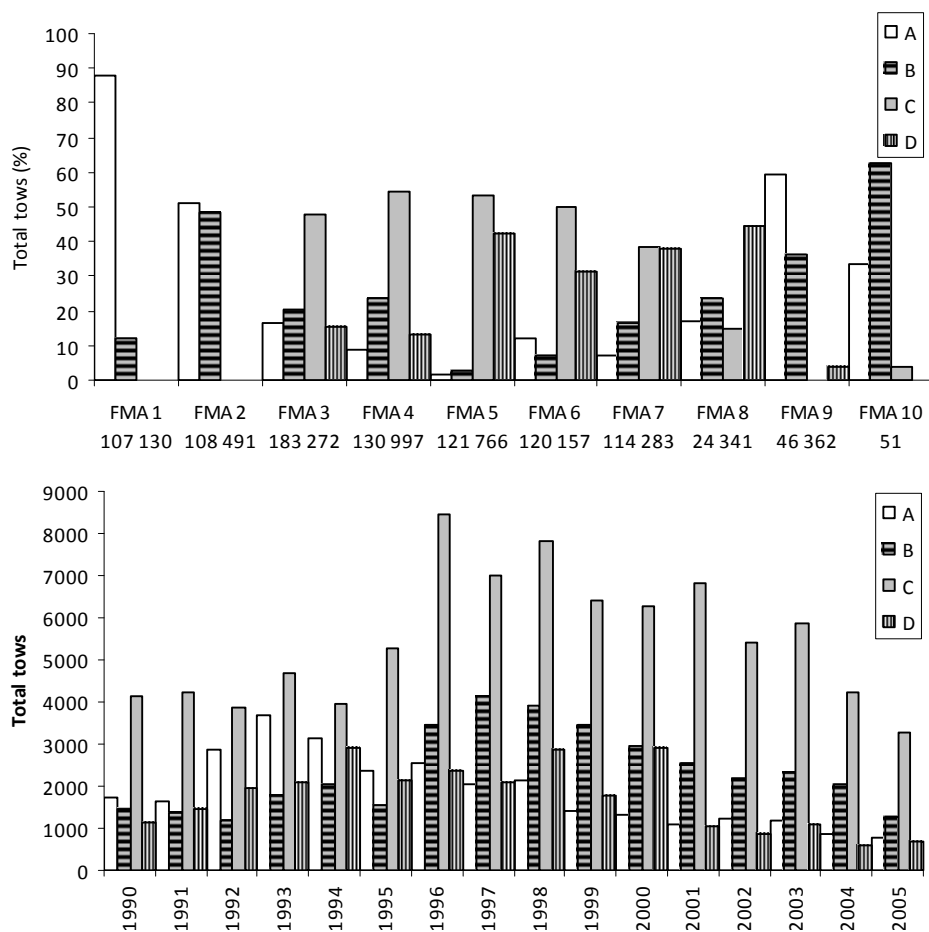


Figure 7: Percentage of TCEPR-reported tows on or near the seafloor, by vessel size category for each FMA, all years combined (1989–90 to 2004–05), with total tow numbers per FMA given below the FMA label (upper) and total tows by vessel category for each fishing year (where 1990 is 1989–90). Vessel categories are: A: <28 m: B: 28–46 m: C: 46–80 m: D: > 80 m.

The low level of fishing by 28–46 m vessels in FMA 1 reported few tows for deeper water species such as orange roughy and cardinalfish, as well as snapper, tarakihi, and gemfish. The smaller gear used by the primary fleet in FMA 1 is reflected in the lower values estimated for the aggregate swept area relative to those in shallow waters on more southern waters where other species such as those in Group 1 are targeted and the area of available fishing depths is greater (see Figures E2 & E3).

Effort in FMA 2 was similar to that in FMA 1 in the mid-late 1990s, about 10 000 tows per year, but the effort was not sustained subsequently. Similar numbers of tows were reported by Category A and B vessels in FMA 2 and thus the effect of changing reporting forms is not as great. This FMA is characterised by a narrow shelf that drops off deeply in some places and thus there was comparatively more effort in over 400 m than in FMA 1. Category A vessels targeted a variety of species, particularly scampi, tarakihi, orange roughy, gemfish, gurnard, and hoki. The numbers of tows for all targets of A vessels decreased in the later years of the time series, all apart from tarakihi which showed steadily increasing effort since a low in 1999–2000 to about 1000 tows in 2004–05.

The spike in effort in the shallow waters in 2001–02 was mainly due to Category A scampi effort, whereas the peak around 1996–97 was from increased hoki effort by Category B vessels. The shape of the tow numbers in the 800–1200 m reflects the annual orange roughy and cardinalfish effort. The numbers of tows reported for hoki and orange roughy as two main targets of B vessels dropped markedly after 1997–98, though hoki remained the most targeted single species (1000 tows a year since 2001–02). The smaller gear used by the FMA 2 vessels and the use of short hill tows for deepwater targets are reflected in the smaller values estimated for the aggregate swept area.

On the western coast of the North Island, in FMA 9, most effort was by the smaller vessels (Figure 7) operating in shallow waters, with about 5% of the total tows set by category D vessels for Group 1 targets (jack mackerels). Fishing restrictions here limit the activity of larger vessels (see Figure A1). The primary target for Category A vessels was snapper, and the increase in tow numbers in the late 1990s resulted primarily from the increasing use of TCEPRs to report effort. Trevally was an increasingly important target for these vessels in FMA 9 as the level of snapper targeting decreased. Tarakihi and gurnard were low level targets, and in the middle of the time series, gemfish and barracouta featured, though generally at under 200 tows a year.

Snapper-targeted fishing by Category B vessels in FMA 9 fluctuated throughout the 16-year series, between 100 and almost 1000 tows a year. Towards the end of the time series, snapper effort increased to 600 tows in 2004–05, the same amount of trevally tows reported by B vessels. This trevally effort has slowly increased over the years. Other category B targets include orange roughy and tarakihi, both peaking in 2004–05 with over 200 tows — a tenth of the effort reported by D vessels in 2004–05, targeting jack mackerels. These vessels also targeted Group 1 species in FMA 8.

FMA 3 at the western extent of the Chatham Rise includes waters that extend south off the South Island east coast and thus covers the full range of fishable depths and includes all vessel sizes. Over the time series the reported fishing effort in shallow depths increased until the late 1990s then decreased and by 2004–05 the reported effort was less than in 1989–90. Most effort was by small vessels targeting barracouta (in the early years), red cod up until 1997–98, and scampi in the early 1990s. Reported effort for these species dropped to less than half in the subsequent years. However, the small vessels operating in these inshore waters of FMA 3 have continued to use CELRs, and the reported TCEPR effort will underestimate the effort for the inshore species, especially flatfish, which accounted for a large proportion of the tows in the FMA 3 statistical areas (see Section 4). The main targets of the Category B vessels in FMA 3 were oreo species and hoki; effort for both peaked in the late 1990s at over 1500 tows a year before dropping down to fewer than 500 tows in 2004–05. Other species targeted by these vessels included orange roughy, barracouta, red cod, and squid.

The biggest effect on the spread of effort in FMA 3 is that from the category C vessels that primarily targeted hoki, reaching a peak of about 5500 tows in 1997–98 in 400–800 m (Figure E3). The larger gear and longer tows made for hoki are reflected in the increased aggregate swept area in middle

depths. Squid tows were the second most important target species for these vessels, mostly fished in shallow waters. From a peak of about 2500 tows in 1995–96, the squid effort by these vessels dropped to about 1500 tows in 2000–01 then further to about 800 in 2004–05. Other targets by these vessels included oreo species, barracouta, silver warehou, and lesser targets throughout the fishable depth range. Category D vessels also mainly targeted hoki in middle depths. This effort showed sharp fluctuations of up to about 800 tows from year to year, especially in the late 1990s. After peaking in 1999–2000 at 2300 tows, the number of tows reported by these vessels dropped to about 500 a year in 2003–04 and 2004–05. Effort for squid and jack mackerel was highest in the early 1990s, but generally fewer than 300 tows a year after 1995–96. Barracouta effort was fewer than 200 tows a year after the mid 1990s. Thus the pattern in FMA 3 is one of a gradual rise in vessel numbers and tows over the time series to a peak in the late 1990s and then fewer vessels in all categories setting fewer trawls in all depths and for all species in subsequent years.

The spread of effort across the Chatham Rise resulted in the increase in effort in FMA 4 in all depth zones, though mainly in 400–800 m. Small vessels mainly targeted scampi, with some tows for a range of shallow to deepwater species in waters surrounding the Chatham Islands. The scampi effort peaked at over 1500 tows a year in 1991–92 and 2004–05, and numbered about 500 tows a year in most other years. Category B vessels also worked these waters, primarily targeting deepwater species orange roughy, alfonso, and oreo. Orange roughy effort built up from under 500 tows in 1989–90 to a peak of almost 2000 tows in 1997–98, dropped to about 800 tows in 1999–2000, and increased again to over 1500 tows a year since 2002–03.

Category C and D vessels operated in the open waters of FMA 4, mostly in 400–1200 m. C vessels targeted hoki and orange roughy, with annual fluctuations of about 1000 tows a year in the early to mid 1990s (peak over 2000 tows). In the following years, hoki tows peaked at 4800 tows in 1998–99, then fluctuated about 3500 for five years and dropped to 2300 tows in 2004–05 — a level similar to the peak effort in the mid 1990s. After a 1994–95 peak at about 2000 orange roughy tows, effort for this species dropped to about 1000 tows a year. Hoki effort by D vessels fluctuated annually between 400 and 1000 tows before peaking in 1994–95 and 1997–98 at over 1700 tows. In the following years, hoki effort by these vessels decreased to about 200 tows a year in 2003–04 and 2004–05. Low levels of hake and barracouta targeting (under 200 tows a year) occurred during 1991–92 to 2003–04 and for orange roughy and oreos in the first two and last two years of the 16-year series.

FMA 5 is characterised by the Stewart-Snares shelf and the fishing effort is targeted at Group 1 species in under 400 m and Group 2 in 400–800 m. Small vessels operating in the inshore waters of FMA 5 are more likely to complete CELRs. About 2000 tows were reported by A vessels for the 16 years, most of which were for stargazer, scampi, ling, orange roughy, and flounders, and 67% was reported before 1993–94. About 3000 tows were reported from B vessels, mainly for orange roughy and oreos between 1991–92 and 2003–04. Squid was the main target reported for 2004–05.

The larger vessels in FMA 5 operate off the shelf edge and off Puysegur Point, with C vessels reporting 1000–2500 hoki tows a year (peaks in 1991–92 and 1999–2000), except in 1989–90, 2003–04, and 2004–05 (about 600 tows a year). As this hoki effort decreased, the squid effort by C vessels increased to over 3000 tows in 2004–05, up from about 2000 tows a year during 2001–02 to 2003–04. Before this squid effort fluctuated between 500 and 2500 tows a year (peak in 1998–99). This squid effort is strongly affected by the management issues surrounding the bycatch of Hooker's (New Zealand) sea lions (*Phocarctos hookeri*) in FMA 6 and the movement of vessels and their squid targeting effort between the two areas can be quite fluid. These vessels targeted other middle depths species at a low level (fewer than 400 tows a year per species) and orange roughy and oreo, especially before the mid 1990s. Squid is the main target of the D vessels and after the peak years in the early 1990s (over 5000 tows in 1992–93), squid effort by these vessels remained at about 1000–2500 tows a year from 1995–96 to 2004–05. Other targets of D vessels (at a rate of fewer than 1000 tows) a year were hoki (mainly pre 1995–96) and jack mackerel (most between 1996–97 and 2000–01).

All vessel sizes also fish in FMA 6, a vast area that encompasses the Southern Plateau and where fishing takes place around the main shelf areas: Auckland Islands Shelf, Campbell Rise, Pukaki Rise, and the Bounty Platform. Category A vessels almost exclusively targeted scampi off the southeastern edge of the Auckland Islands Shelf. This effort built up gradually, with peaks of about 1300 tows in 1994–95 and 1995–96 and also in 1999–2000 to 2001–02. Effort subsequently dropped to 530 tows in 2003–04 and rose slightly to 750 tows in 2004–05. B vessels also targeted scampi, but at a lower rate and less consistently. Peaks of over 500 tows a year were achieved in 1993–94 and 2004–05. These vessels also targeted oreo species from 1993–94, peaking at 500 tows in 1998–99 and 1999–2000, but this effort dropped to just over 200 tows in 2004–05. Orange roughy was targeted in the late 1990s at over 200 tows a year, but this effort was below 100 tows a year after 1998–99.

The larger vessel classes targeted squid and hoki. Category C vessels targeted mainly hoki (up to 2500 tows in 1991–92) in the early 1990s, then reported similar numbers of hoki and squid tows between 1993–94 and 1996–97 before concentrating on hoki and gradually increasing the annual effort to over 4500 tows in 2001–02. This represented the development of ‘new’ (in the 16-year dataset) fishing grounds to the southeast off the Campbell Rise. After 2001–02 hoki effort plummeted to under 1000 tows in FMA 6 in 2004–05 — a similar level fished in the mid 1990s. Deepwater fishing by these vessels initially targeted orange roughy from the late 1990s at fewer than 500 tows a year, but since 1996–97 there has been a steady increase in the effort targeting oreos (1000 tows in 2004–05) and the squid effort increased after 2000–01 to at least 1200 tows a year for 2003–04 and 2004–05.

Category D vessels mainly targeted squid in FMA 6 and were subject to fluctuations in squid availability and fishery closures due to sea lion management measures. Annual tow totals by these vessels dropped from over 4000 tows in 1989–90 to 500 in 1992–93, and again from a high of 3500 in 1993–94 to about 250 in 1998–99. Since then there has been a gradual increase in annual tows, to over 1250 a year in 2003–04 and 2004–05.

Relatively few tows were reported by category A vessels in FMA 7. Many of these vessels complete CELRs rather than TCEPRs, though there was an increase in reported tows in the mid 1990s that may represent the effort of some vessels that changed forms. These vessels operate close inshore along the west coast of the South Island and in Cook Strait. The primary targets are hoki, orange roughy, and barracouta, with single species effort usually under 250 tows a year. Hoki was the major target for B vessels in FMA 7, with a peak in 1996–97 at 1800 tows, and about 600 tows a year from 2000–01 to 2003–04 before dropping to under 500 tows in 2004–05. These vessels also targeted orange roughy, with 400–600 tows a year until 1999–2000 when effort dropped away to about 50 tows by 2004–05. A low level of effort targeted barracouta, with a peak in 2001–02 at 250 tows, but this declined to zero in 2004–05.

Category C effort for hoki increased steadily over the times series from 700 tows in 1989–90 to over 3000 tows in 2002–03, before dropping by over 800 tows a year to just over 1400 tows in 2004–05. These vessels also targeted other species such as jack mackerel, hake, barracouta, and orange roughy, with annual tows per species rarely exceeding 300 tows, except for hake effort which increased in the 2000s to almost 550 tows in 2004–05. Over 3500 hoki tows were reported by D vessels in 1993–94, but this effort dropped in subsequent years to about 1500–1900 tows a year between 1996–97 and 2003–04 and further to about 1000 tows in 2004–05. Jack mackerel tows were reported by D vessels at the rate of about 500 tows a year, and hake and barracouta effort amounted at less than 100 tows in most years.

Thus, trends overall show fluctuations in the effort in the major depth zones, with an apparent increase in shallow water effort towards the end of the time series, relative to decrease in the middle depths effort primarily due to changes in the fishery management including lowering the TACC (Ministry of Fisheries 2009a) and reasonably static effort in deeper waters.

3.2.6 Distribution by cell

Each cell covers 25 km² in an equal area projection, and the cell depths reported here are the depths at the midpoint of each cell. Cells in areas of relatively uniform depth may exhibit little variation in depth, but those that straddle slope or shelf edges or contain underwater hill features such as seamounts may vary greatly in the distribution of actual depths relative to the midpoint depth.

The spatial distribution of the aggregate swept area estimated from the TCEPR effort on or near the seafloor at the beginning of the time series and the aggregate extent for all the fishing years combined are shown in Figures 8 and 9. Distribution maps for each fishing year are shown in Figures F1–F16 in Appendix F. An accompanying DVD shows the spatial representation by species groups and individual species for each of the 16 fishing years, and a brief summary of these distributions is provided in Appendix F. Generally, the broad spread of effort represents the bottom trawl effort apart from where effort is shown east of the Campbell Rise, and in some years at the Pukaki Rise and Bounty Platform. Midwater trawl effort near the seafloor is otherwise in areas where bottom trawls were also used. The ‘spotty’ distribution in 1989–90 and 1990–91 on the Southern Plateau and in 2002–03 on the Challenger Plateau off the South Island west coast is a result of several trawl surveys on commercial vessels.

The distributions shown in Figures F1–F16 show the trends described by FMA. Spatial restrictions for some or all vessels are evident (see Figure A1), as is the influence of depth, with many waters of the EEZ either too deep for fishing or over rough or steeply sloping seafloor areas. The trends of major fisheries show the expansion and contraction of effort, both spatially and in intensity. For example, the changes in the distribution of hoki effort to the southeast of the Stewart-Snares shelf (FMA 6) throughout the time series; the jack mackerel fishery off the west coast of the North Island (FMAs 7–9); the increased and sustained reporting of Group 6 species by small vessels in inshore waters from the mid 1990s in FMAs 1, 2, and 9; the development of a new fishery for hoki (not sustained) off the western and southern edge of Campbell Rise; and the distribution of orange roughy fishing on the Challenger Plateau off the west coast South Island (within the EEZ) until 2000–01. These distributions reflect management changes (as occurred in the latter orange roughy example when the TACC was lowered to 1 t (Ministry of Fisheries 2009a)), changes in fleet distribution and in form use, and legislative restrictions.

In most years, the same cells are repeatedly trawled, to some extent. The distribution of the cells with the highest aggregate swept areas in each year varied little from year to year (indicated by dark blue in Figures F1–F16), but the swept areas estimated for these cells increased during the 1990s from at least 7.5 km² per cell to at least 13.4 km² in 2000–01, then decreased subsequently to at least 9.5 km² per cell. Thus, cells in this group include those where the aggregate area was greater than the cell area. Most *fished cells* in each year had aggregate swept areas of under 4 km² and many of these are on the edges of major fisheries and include cells at the end of a tow or off the edge on the trawl path or are in depths where deepwater species are targeted by short tows and thus the swept areas are substantially smaller.

The cells with the greatest numbers of tows in a year were off the southern and eastern edges of the Stewart-Snares shelf (where Group 1 and 2 targets are fished by large vessels), off the Auckland Islands Shelf (off the northern edge in waters fished by large squid vessels and to the southeast where large squid vessels and small scampi vessels fished), off Puysegur Point (large vessels targeting Group 2 species), in some years off the east coast of the South Island in waters where Group 1 and 2 species were targeted, by all vessel sizes, and in 2000–01 in hoki fishery off the South Island west coast.

Over the entire dataset, the aggregate swept areas of the 20% of *fished cells* that define the main fishery areas were equivalent to more than twice the area of a cell (see Figure 9) and 20% had aggregate swept areas equal to no more than 3% of a cell area.

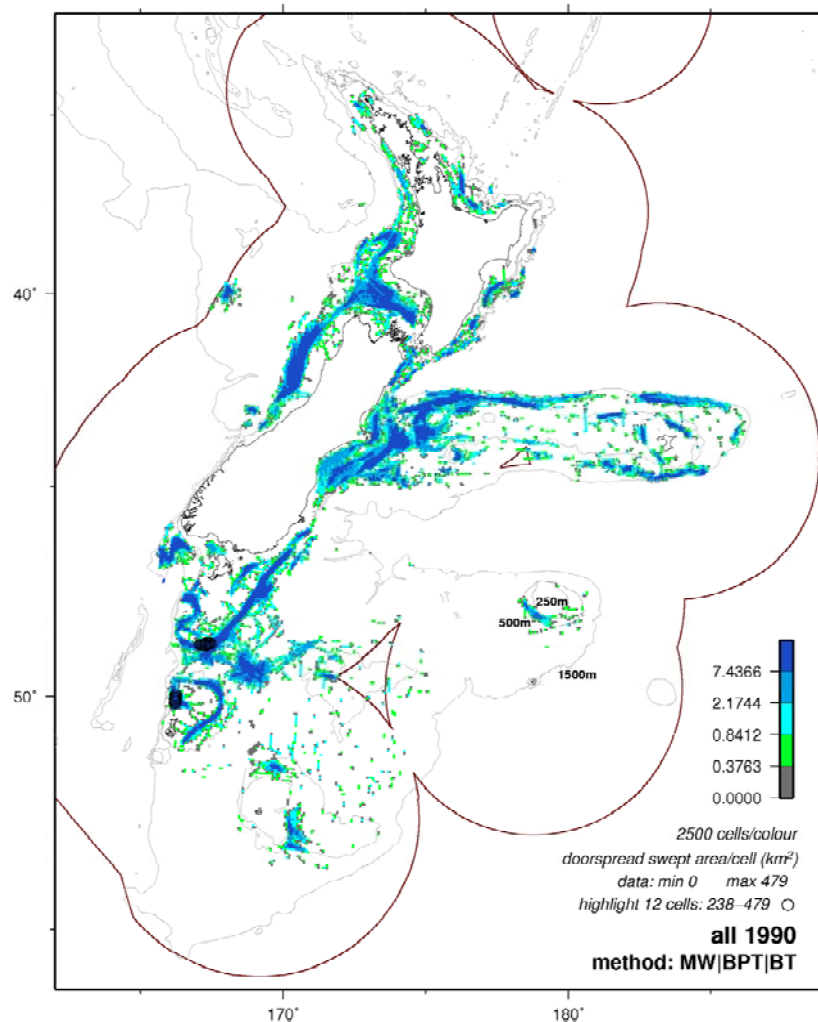


Figure 8: Distribution of aggregate swept area totals per cell, for trawl effort on or near the seafloor, based on TCEPR records, 1989-90.

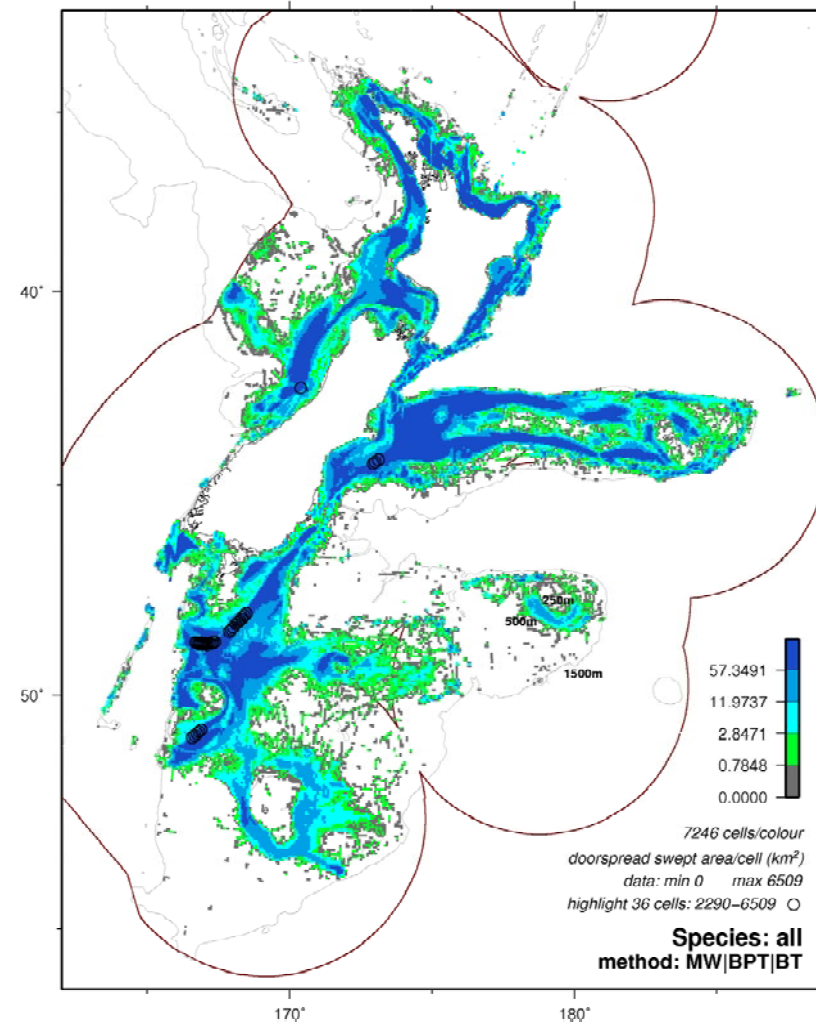


Figure 9: Distribution of aggregate swept area totals per cell, for trawl effort on or near the seafloor, based on TCEPR records, for all years combined (1989-90 to 2004-05).

3.2.6.1 Number of cells

Each cell was allocated a depth value equal to the depth at the midpoint of the cell. For the 16-year dataset, there were 36 792 *fished cells* and these represent a subset of the 66 853 *available cells* (that is, with midpoint depths of under 1600 m). The distribution of all the *fished cells* is shown in Figure 9. Of the *available cells*, 25% were allocated to the 0–400 m range, 30% to 400–800 m, 22% to 800–1200 m, and 23% to 1200–1600 m. However, the distribution of cells is not evenly spread within these broad depth ranges, particularly in the shallower waters (Figure 10). For example, most cells in under 400 m were shallower than 200 m. Over the 16-year dataset, over 80% of the *available cells* in waters shallower than 500 m were contacted by trawl gear, but with increasing depths, this percentage for each 100-m depth zone decreased to about 10% for the deepest waters.

For all years, 35% of the *fished cells* were in depths under 200 m, and another 38% were between 400 and 800 m (Table G1). The depth distributions of the annual totals of *fished cells* are shown in Figure 11. In the early 1990s, the numbers of *fished cells* in the shallowest depths increased, especially in under 100 m which peaked at over 3000 cells in 1995–96. Numbers dropped slightly around 1999–2000, but by 2004–05 about 6000 cells in under 200 m were reported as having been contacted by trawl gear. In 200–400 m, the number of *fished cells* varied slightly over the time series, at just over 1000 cells in each of 200–300 m and 300–400 m.

Fished cells with depths between 400 and 600 m peaked at over 1500 cells each in the early 1990s and then increased steadily to a peak in 2001–02 of over 2500 cells in 500–600 m and over 2000 cells in 400–500 m. Numbers in these depths decreased by about 500 cells in subsequent years. These trends were mirrored in 600–700 m and 700–800 m, but to a lesser extent, and the second peak for these depths was in 2002–03: 1750–1800 cells in each depth zone. The number of *fished cells* in deeper waters rarely exceeded 1000 a year for each 100-m depth zone: peak cell numbers for 900–1000 m were in 1996–97 to 1999–2000. For the other 100-m zones in deeper waters, fewer than 500 *fished cells* a year was the norm. Relatively few cells were touched by trawl gear where cell midpoint depths were over 1200 m.

The trends in the numbers of shallow water *fished cells* reflect the increased reporting for shallow water species and the sustained fishing in these depths. Similarly for the middle depths, the expansion of fishing grounds for hoki, especially in the early 2000s, is reflected in the increase then subsequent decrease as vessels explored then contracted their effort in new areas.

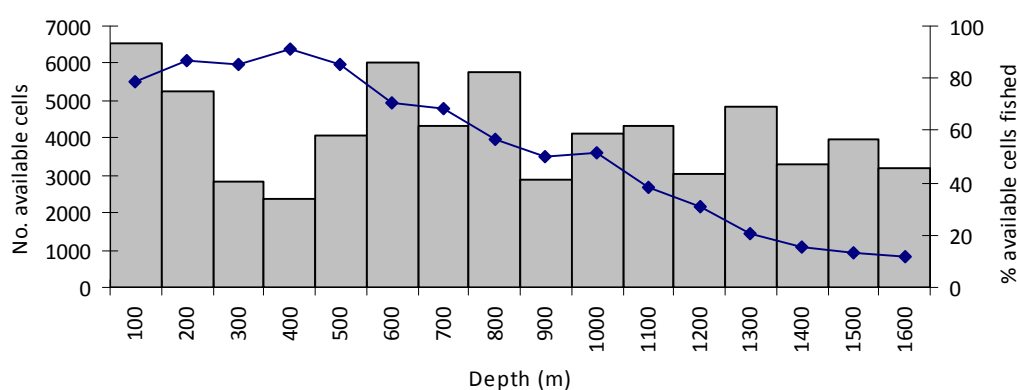


Figure 10: Number of *available cells* (bars) and percentage of *available cells* that were fished, for each 100-m depth zone, 1989–90 to 2004–05.

A comparison of the numbers of cells crossed by trawls in 100-m depth zones (as determined by the cell midpoints) for each target species group shows the depth separation, and suggests that, generally, the cell midpoint depth represents the fishing depth of the target tows (Figure G1). As expected the groups with higher numbers of tows that used larger gear and/or were towed longer (mainly Group 1, dominated by squid effort, and Group 2 dominated by hoki trawls) contacted the highest numbers of cells. Other groups with large numbers of tows that were generally short in length (Group 4) contacted fewer cells. Group 6, targeted by smaller vessels and smaller gear, had high numbers of tows each year, and the maximum number of cells contacted by Group 6 trawls was not too dissimilar from that for Group 2.

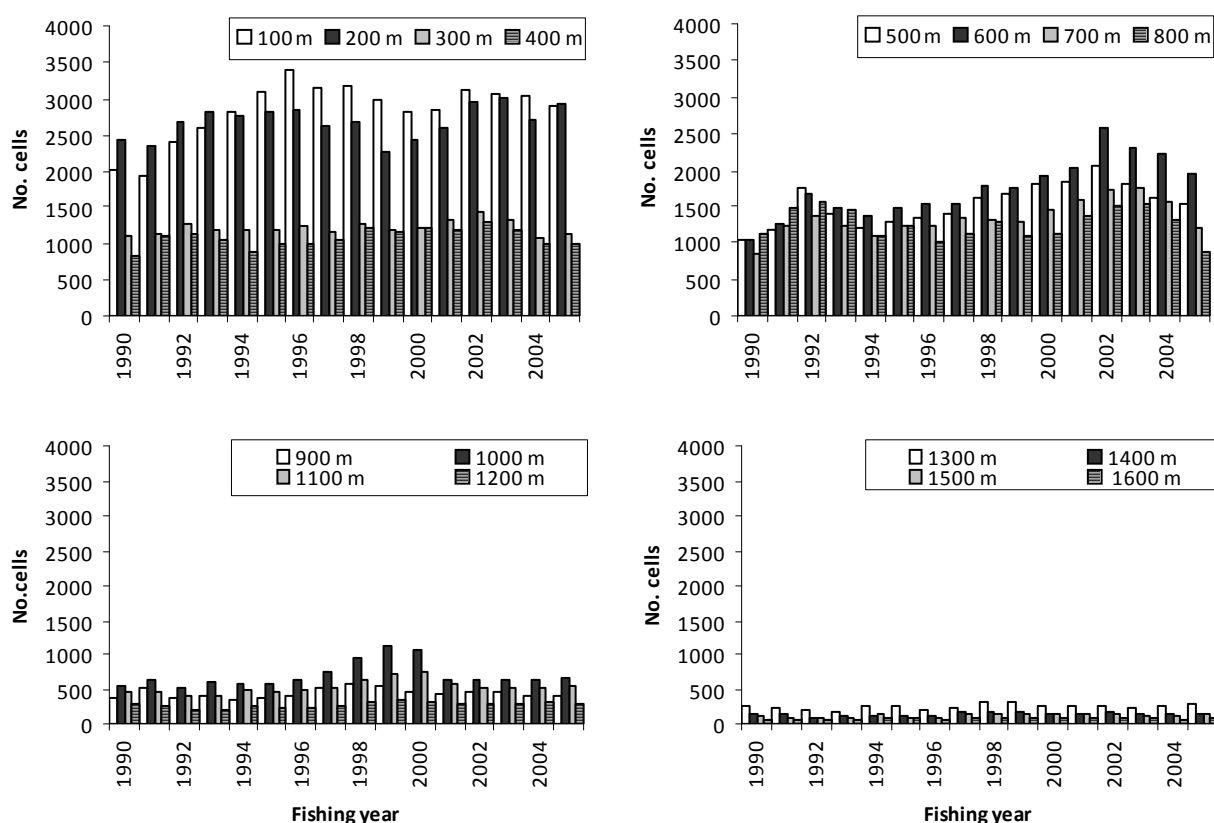


Figure 11: Number of fished cells, for each 100-m depth zone, 1989–90 (1990) to 2004–05 (2005).

3.2.5.2 Number of tows per fished cell

Of the *fished cells*, 45% were contacted by up to 10 tows per cell during 1989–90 to 2004–05: 23.5% were contacted by one or two tows; 11.7% by 3–5 tows; and 9.3% by 6–10 tows. Another 31% had between 11 and 100 tows, and the remaining 25% were crossed by more than 100 tows (maximum of 14 311 tows per cell) (Table G2). Some differences were seen in the intensity by depth zones, with cells in shallower depths having higher proportions of cells in the categories with higher numbers of tows per cell. Generally, as the depth increased a higher proportion of cells was lightly fished.

The highest numbers of tows per cell were in cells with midpoint depths of 100–400 m, though this occurred in some years more than others (Figure G2). Twelve of the 16 years had at least one cell with more than 1200 tows per cell; the notable exceptions were 1989–90, 1993–94, 1997–98 and 2001–02 (the last two years had peak cell numbers). Median numbers of tows per *fished cell* peaked in the shallower depths in the early 1990s, the shallow and middle depths through the mid 1990s, and primarily the middle depths in the late 1990s and subsequent years (Figure G2). Median tows per cell in middle depths were at over 15 tows during the peak effort years of 1996–97 through to 1999–2000. In the following years, the annual median values were smaller, generally fewer than 10 tows per

fished cell. The median in 100 m in 2004–05 was 10 tows per cell, reflecting the more intensive effort in the shallowest depths since the late 1990s.

3.2.6.3 Aggregate swept area per *fished cell*

Of the 36 792 *fished cells*, 48% had aggregate swept areas that represented up to 20% of a cell area (25 km²) when all the data were combined for 1989–90 to 2004–05 (Table G2). Another 19% had aggregate areas equivalent to 20–80%, 3% had *aggregate areas* of 80–100% of the cell area, 8.6% were twice the cell area, and 7.2% were 3–4 times the cell area. For about 6% the *aggregate area* was 5–8 times the cell area, 5% were 9–20 times, and 3% (52 *fished cells*) were more than 20 times (maximum of 260 times in two cells, in 200 m and 300 m depths). Cells with light trawl contact (up to 4% of the cell area) accounted for a higher proportion of the *fished cells* in each 100-m depth zone as depth increased, varying from less than 20% in the shallower depth cells to 60% in 1600 m. Cells with 4.1–20% of their area trawled showed less variation with depth, and the more intensively fished cells were mainly in depths shallower than 900 m.

The trends in the spread of aggregate areas of each cell in a year and 100-m depth are similar to the trends in the number of tows per cell, except the range of values is greater in the middle depths indicating the use of larger gear and longer tows in these depths (Figure G3). The median aggregate area values also show similar trends to the distribution of the median number of tows per cell, but the peaks in the middle depths area medians are higher relative to those in the shallower depths.

There are some interesting trends in the aggregate areas of the effort for each target group when summed over 100-m depths and fishing years (see Figure G1). The plot for Group 1 species reflects the variety of species included in that group; with larger gear used for fishing in cells with 201–300 m midpoint depths.

3.2.6.4 The coverage swept area (“footprint”)

Over the 16 years, trawling on or near the seafloor contacted a seafloor area of 328 360 km², about 36% of the area of the total number of *fished cells* and 20% of the *available cells* area (see Table 3). Between 19 and 29% of *available cells* were fished each year. The footprint (coverage) each year increased over the time series to a peak of almost 91 000 km² in 2002–03 — nearly twice the coverage area in 1989–90. Between 15 and 20% of the area of the annual *fished cells* was covered by the annual footprint: this equated to 3–5.5% of the *available cells* area.

Over 30% of the coverage swept area was in waters less than 200 m (Figure 12) and another 40% in 400–800 m. The spread of the footprint each year reflected the fishing trends (Figure 13 and Table G3), with the increase over the years in the footprint in shallow waters and in 400–500 m and 500–600 m. During 1999–2000 to 2003–04, about 26% of the annual footprint was from waters shallower than 200 m and 37% from 400–600 m, but in 2004–05, the proportions were similar, at 34% and 32% respectively. Over all years, the trawl footprint covered 36.5% of the seafloor in depths shallower than 400 m, 27.4% in 400–800 m, 8.1% in 800–1200 m, and 1.6% in 1200–1600 m.

Of the total *fished cells*, 24% had a cell footprint of up to 1 km², 12% of 1–2 km², and 12.5 % had a footprint equal to the cell area (Figure 14). There were few differences between years in the distribution of the annual cell footprints: in most fishing years, the footprint covered up to 1 km² (4% of the cell area) in 33–44% of the annual *fished cells*. Another 25% had footprints of 1–3 km² (up to 4–12% of the area of each cell) in a year. At the other end of the scale, the annual trawl footprint in a cell covered 80–100% of the cell area in 3–4% of *fished cells* each year (Table 4).

About 20% of *fished cells* was contacted by trawl gear in just one year of the 16-year period (Figure 15). Another 11% had some fishing in 2 years, and 10% in 16 years (all years). The remaining 59% of *fished cells* were trawled to some extent in 3–15 years.

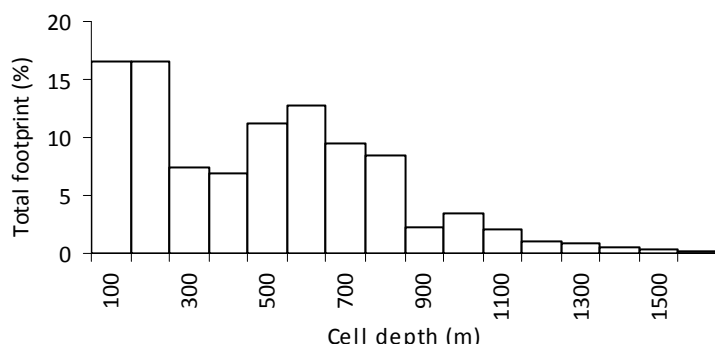


Figure 12: Percentage of the total footprint or coverage area (328 360 km²) in each 100-m depth zone, based on the depth at each cell midpoint, for all years combined (1989–90 to 2004–05).

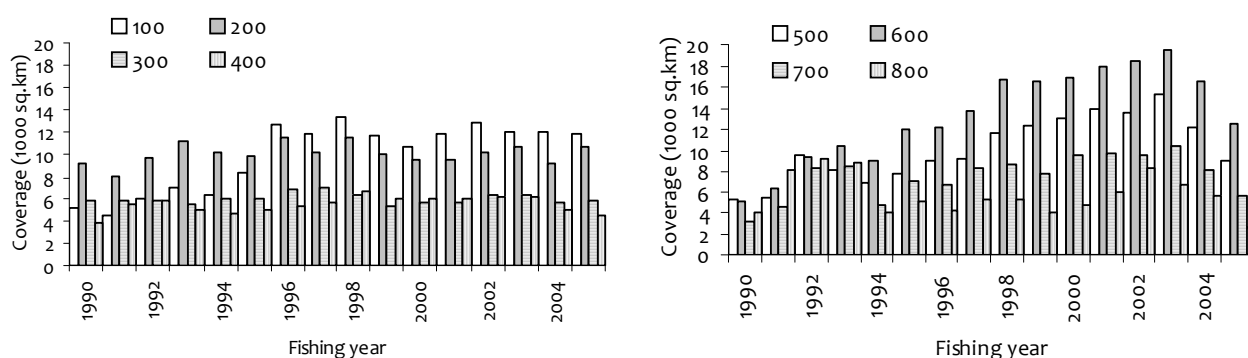


Figure 13: Footprint or coverage area (1000 km²) in each 100-m depth zone for waters shallower than 800 m (based on the depth at each cell midpoint), for fishing years 1989–90 (1990) to 2004–05 (2005). See Table G3 for areas in deeper waters.

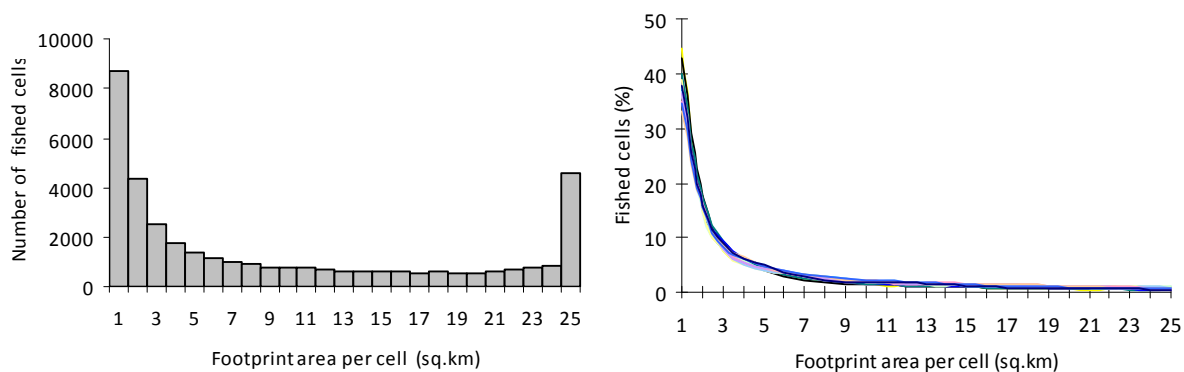


Figure 14: Number of *fished cells* by 1-km² bins of annual footprint (left) and proportion of *fished cells* with footprint values of between 0.1 and 25 km² (cell area totally covered) for each fishing year (right).

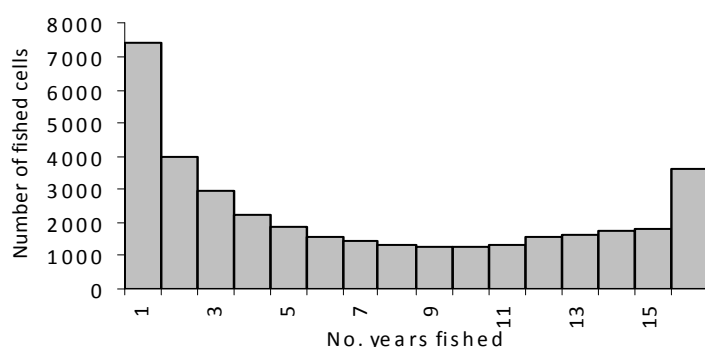


Figure 15: Number of *fished cells* by the number of years each cell was contacted by trawl gear, 1989–90 to 2004–05.

Table 4: The percentage of annual *fished cells* for a given amount of cell area covered by the annual footprint, by fishing year 1989–90 (1990) to 2004–05 (2005).

Fishing year	Amount of cell area covered by the annual footprint							No. <i>fished cells</i>
	≤ 4.0%	4.1– 8.0%	8.1– 20.0%	20.1– 40.0%	40.1– 60.0%	60.1– 80.0%	80.1– 100%	
1990	45.6	14.1	17.3	11.5	5.6	3.2	2.7	12 673
1991	44.3	16.1	17.3	9.8	5.2	3.7	3.5	14 045
1992	39.8	15.2	18.8	11.6	5.9	5.0	3.7	15 777
1993	36.8	14.9	19.7	13.2	6.6	5.1	3.7	15 241
1994	40.7	16.3	19.5	11.3	5.8	3.7	2.6	14 647
1995	39.3	14.5	19.5	12.7	6.3	4.4	3.3	15 423
1996	38.4	14.2	17.5	14.0	7.2	4.6	4.1	15 785
1997	37.3	13.6	18.7	13.2	7.8	5.0	4.3	15 997
1998	37.6	14.2	17.4	12.8	7.3	5.5	5.2	17 529
1999	39.8	13.8	16.5	12.3	7.1	6.0	4.5	16 796
2000	38.0	14.9	16.6	13.1	7.6	5.6	4.3	17 189
2001	36.2	14.8	17.5	13.0	8.1	6.3	4.2	17 318
2002	37.7	14.5	17.3	13.4	7.6	6.0	3.6	19 187
2003	34.6	14.3	19.2	13.8	7.9	6.1	4.0	18 452
2004	35.9	14.5	18.7	14.5	8.2	4.9	3.3	17 003
2005	38.7	15.0	19.9	12.1	7.3	4.1	2.8	16 060

4. NATURE AND EXTENT OF BOTTOM TRAWL FISHING EFFORT BY STATISTICAL AREA, 1989–90 TO 2004–05

‘Bottom trawl’ was the main fishing method recorded on CELR forms. Generally vessels under 28 m complete these forms (see Section 2.3); however, fishers can use CELR or TCEPR forms to report trawl effort. The location of CELR effort is almost all reported by statistical area rather than latitude and longitude and thus the tow positions cannot be described more finely. Although this limits the spatial use of the data, it is likely that most data are relatively close to shore (because of the vessel size and the depths fished for the reported target species). For most effort the given statistical area was sensible, and where statistical areas were specific to a fishery (for example, trawl effort reported by rock lobster areas) the general statistical area was assigned. Few records had data that suggest the given statistical area was an error, or at least unlikely (for example, because of distance from shore); these were not amended. The change in use of CELR to TCEPR will have an effect on the numbers reported here; particularly for effort targeted at Group 6 species: red gurnard, John dory, snapper, tarakihi, and trevally. Summary data for CELR bottom trawl effort are provided in Appendix H.

4.1 Temporal distribution of CELR trawl effort by target species

Bottom trawl effort reported on CELR forms numbered about 73 000 tows per year in 1989–90 to 57 500 tows in 2004–05, with a peak of 89 000 tows in 1992–93 (Table 5). At least 36 target species were reported by fishers (Tables H1 & H2). Of the almost 1.1 million tows reported on CELR forms, 43% targeted flatfish (range from under 35% of tows in the early 1990s, at least 50% in 1995–96 to 1997–98, to about 43% in recent years). Another 13% targeted red cod, and the remainder mainly targeted tarakihi (10%), red gurnard (7.5%), snapper (6%), barracouta (6%), and stargazer, trevally, John dory, orange roughy, gemfish, and blue warehou.

Effort for flatfish peaked in the mid to late 1990s (peak of over 38 600 tows in 1996–97) and in the last five years was generally over 25 500 tows per fishing year. Red cod effort almost doubled in the first few years of the time series and was also highest in the mid to late 1990s (at about 11 000–12 000 tows) before dropping to fewer than 9000 tows in 1998–99. Fishing for this species since 2002–03 has been at levels similar to those in 1989–90 and 1990–91 (about 6500 tows). Trends for red cod and flatfish were not affected by any change in the use of effort reporting forms.

Effort for most other species increased in the first few years in the early 1990s. Subsequently, some species showed declines in CELR-reported effort — most spectacularly in snapper effort where, from a high of over 12 000 tows in 1991–92, the reported effort dropped sharply to about 2000 tows in 1996–97 and remained below 1000 tows for the following years until recent years when there was a small increase in effort and nearly 2500 tows in 2004–05 targeted snapper. This was directly related to the change of reporting: in 1994–95 the relative numbers of snapper tows reported on CELRs and TCEPRs were 6016 and 2190, respectively; in 1995–96, the equivalent numbers were 2090 and 6178. The TCEPR effort levelled off in subsequent years and in 2004–05 about 800 more tows were reported by Category A vessels on TCEPRs than CELRs.

A less dramatic decrease was apparent in the CELR reported effort for tarakihi, for which effort dropped from over 10 000 tows in the early 1990s to fewer 6000 tows in 1995–96, after which generally 5000–6000 tows were made a fishing year and there appeared to be a small increase in the most recent fishing year to over 6000 tows. A change to TCEPR reporting probably accounted for about 50% of the CELR decrease from 1993–94 to 1995–96.

Table 5: Annual (fishing year) total numbers of bottom tows and percentage of the main target species reported on CELRs, 1989–90 (1990) to 2004–05 (2005). [See Tables H1 & H2 for species codes and all species effort.]

			Annual tows (%)												
Fishing year	No. vessels	No. tows	FLA	RCO	TAR	GUR	BAR	SNA	STA	TRE	JDO	ORH	SKI	WAR	Other
1990	371	72 879	36.3	9	10.5	5.1	4.3	14.3	3.5	2.5	1.6	2.3	2.5	0.6	7.5
1991	353	80 506	31.9	8.4	13.2	7.1	6.4	14.4	2.7	2.7	1.9	2.3	2.4	0.6	6.1
1992	342	81 902	31.9	11.7	12.9	8.1	5.6	14.9	2.1	1.7	1.8	1.9	2.9	0.8	3.6
1993	354	89 079	40.4	13.3	9.9	7.1	5.5	9.8	1.6	2.4	2	1.4	3	0.7	3
1994	341	79 480	38.8	13.7	11.3	6.4	4	10.2	3.3	2.6	2.4	1.3	1.3	0.5	4.1
1995	331	77 282	43.2	15.5	9.7	4.8	4.1	7.8	3.2	1.6	2	1.4	1.1	0.6	5
1996	309	68 010	50.2	15.3	7.7	4.6	6.4	3.1	3.2	1.1	1.5	0.8	0.9	0.7	4.5
1997	306	73 709	52.5	15.2	7.3	4.7	8.2	1	2.5	1.7	1.1	0.8	0.9	0.5	3.7
1998	280	67 301	53.6	17.3	7.5	5.6	4.4	1.2	1.1	2.2	1	0.9	0.4	0.7	4
1999	253	68 918	49.3	12	9.5	8.2	6.8	1.1	2.4	2.6	1.4	1.7	0.3	1	3.7
2000	239	61 413	41.9	11.1	9.7	10.9	9.1	1.1	3.3	2.4	1.6	1.9	0.1	1.1	5.5
2001	237	57 582	42	14.8	8.5	11	10	0.6	3.8	1.4	1.2	0.7	0.2	1.2	4.5
2002	221	53 252	43.2	14.6	8.7	12.3	7.6	1.5	3	1.2	1.2	0.8	0.1	1.2	4.7
2003	212	55 921	46	12.5	9.2	10.4	7.2	1.6	2.4	1.1	1.8	0.5	0.2	1.9	5.2
2004	217	53 685	47.9	11.4	9.8	7.9	6.6	2.2	3.6	0.8	3.2	0.7	0.1	1.9	4
2005	206	57 476	45	11.1	11	9	5.1	4.2	3.4	0.6	3.1	1.1	0.1	1.8	4.4
All	589	1 098 395	42.9	12.9	9.9	7.5	6.2	6.2	2.8	1.9	1.8	1.3	1.2	0.9	4.6

The drop in red gurnard CELR effort after a peak of over 6500 tows in 1991–92 to under 4000 tows in 1994–95 to 1997–98 was followed by a second peak during 1999–2000 to 2001–02 when over 6000 tows were reported. A comparison of the CELR and TCEPR data for small vessels suggests that the change of form use had a minimal effect on the decrease in CELR-reported effort in the mid 1990s; TCEPR gurnard effort was greatest in the 2000s, at between 1200 and 1750 tows per year. About 5200 CELR gurnard tows were reported in 2004–05.

Throughout the time series, barracouta effort reported on CELRs has fluctuated between about 3000 tows (in 1989–90 and 2004–05) and 6000 tows (peak in 1996–97), to about 3000 tows in 2004–05. Effort for this target has shown a steady decrease in the last five years of the time series. Stargazer fishing effort reported on CELRs has fluctuated at about 1600–2600 tows per fishing year, except in 1997–98 when it dropped to under 800 tows. CELR effort for some minor target species has generally dropped steadily over the years to about 600 tows for orange roughy, fewer than 100 tows for gemfish, and about 300 tows for trevally in recent years. The reporting of trevally target tows was affected by the change in form use, though after a large drop in CELR tows in 1994–95, the numbers of tows on both forms increased until after 1999–2000 when an increasing number of small vessels reported this effort on TCEPRs relative to a steep drop in the CELR numbers.

In contrast, effort for other minor targets (in terms of CELR reporting) has shown increases in recent years: for example, blue warehou, with over 1000 tows a fishing year since 2002–03 compared with about 390 to over 700 tows in previous years; and John dory, with about 1700 tows in the last two fishing years, up from less than 1000 tows in most years after 1995–96. The reporting of John dory effort appeared to have been affected by the change in form use between 1995–96 and 2001–02, though it appears that the change was not sustained because in 2002–03 to 2004–05 the trend was reversed.

4.2 Spatial distribution of CELR trawl effort by statistical area

Over all years, eight statistical areas accounted for 60% of the total fishing effort reported on CELRs (Figure 16): Statistical Areas 020, 022, 024, and 026 off the east coast South Island, 038 in Tasman Bay, 017 in Nelson-Marlborough, 034 off west coast South Island, and 013 off the east coast North Island. The annual distribution by statistical area is given in Table H3 and Figures in H1–H4 of Appendix H. It is obvious from these plots that a few tows have incorrect statistical area records, given the distance from land of some southern areas showing minimal effort.

The east coast South Island areas mentioned above accounted for over 30% of all CELR effort. Statistical Area 022 consistently had the highest number of tows in any fishing year. In Statistical Area 022, the annual number of bottom trawl tows fluctuated between 7000 and 8000 tows before peaking in 1996–97 and 1997–98 at over 9000 tows and then dropping off sharply to a low of 5600 in 2001–02. In subsequent years, 6000–7000 tows were made here in each fishing year. The general trend over all years for the adjacent Statistical Area 024 has been of a decrease from over 7000 tows in 1989–90 to about 4500 tows in 2004–05, with a peak in 1993–94 at about 8000 tows. Effort in Statistical Area 020 has been reasonably constant at between about 5000 and 6000 tows before a peak of nearly 7000 tows in 2000–01, and in later years between 4500 and 5500 tows. Similarly, effort in the Statistical Area 026 off the southern east coast of the South Island has increased from over 3000 tows in 1989–90 to a peak in 1996–97 of about 5500 and then dropped and levelled out at about 4500 tows in 2003–04 and 2004–05. Fishers in these areas generally maintained the use of CELRs to report effort.

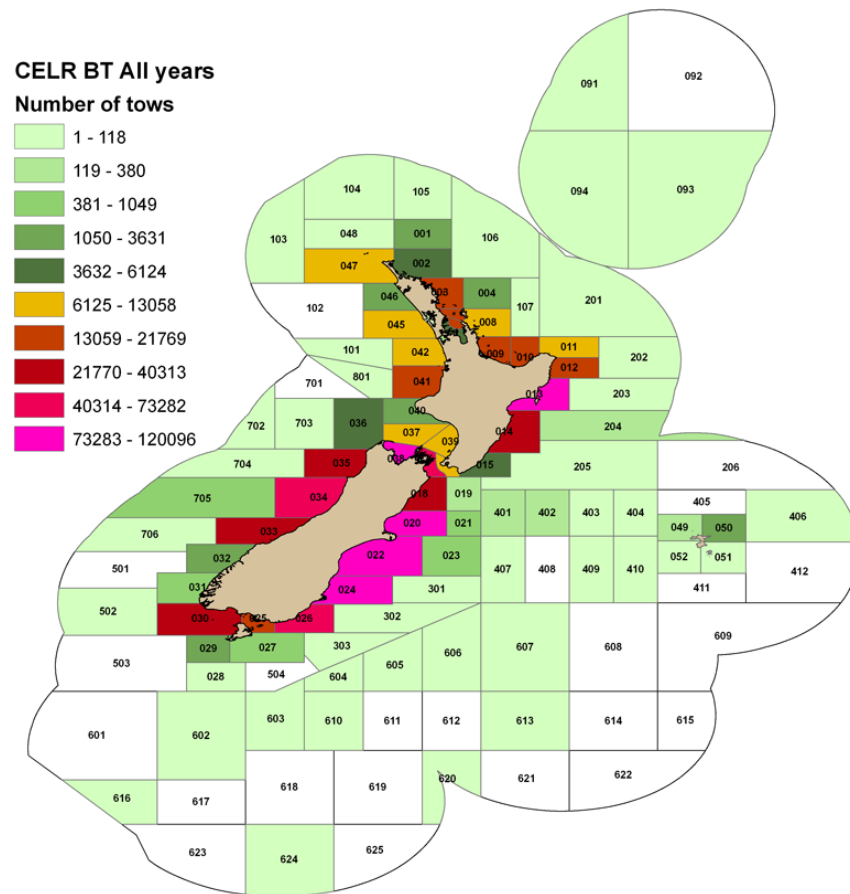


Figure 16: Distribution of bottom trawl effort reported on CELRs, for all fishing years 1989–90 to 2004–05.

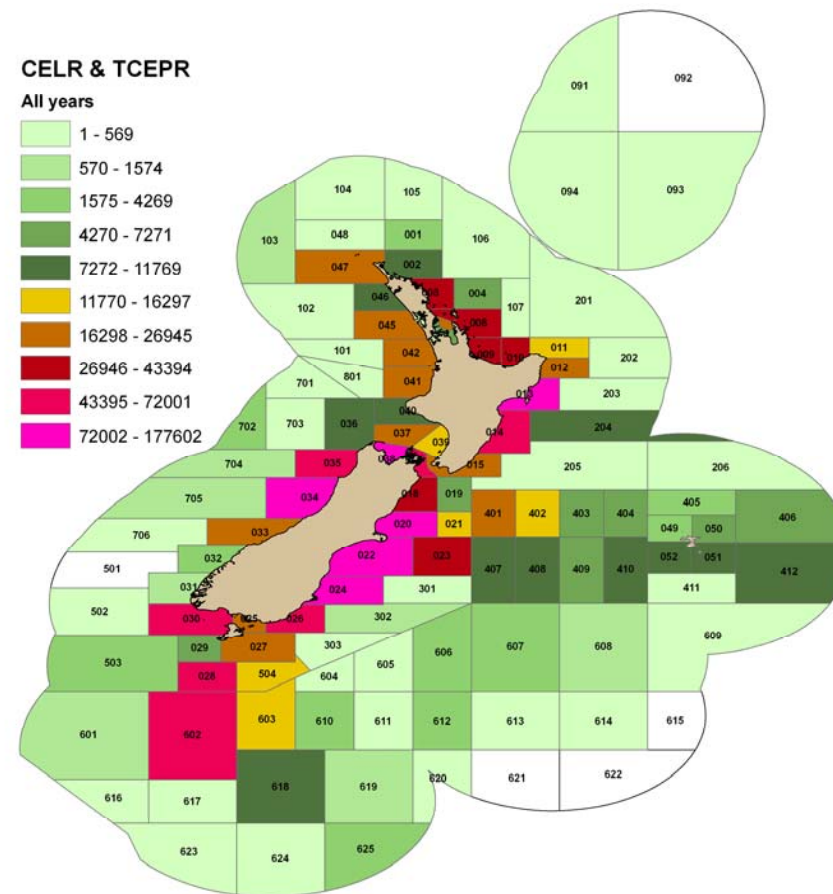


Figure 17: Distribution of bottom trawl effort reported on CELRs and TCEPRs, for all fishing years 1989–90 to 2004–05. [Note the scale is different from that in Figure 16.]

Effort in Statistical Area 034 off the South Island west coast increased sharply in the early 1990s with peaks of about 6400, one in 1992–93 and another in 1996–97. Subsequent smaller year-to-year peaks characterised a gradual decrease in this area to about 4000 tows a year in recent years. CELR-reported annual effort in Statistical Area 030 varied between about 2000 and 2800 tows until 1997–98 when it dropped to a low of 1700 tows, then increased to between 2250 and 3400 in the following years.

Year-to-year fluctuations were also characteristic in Statistical Area 038 (between about 6000 and 8000 tows). After 1997–98, effort dropped to fewer than 4000 tows in 2000–01, and in subsequent years effort increased to about 6300 tows. The effort in the adjacent Statistical Area 017 peaked at over 5200 tows in 1994–95 before steadily decreasing to a low of fewer than 2000 tows in 2004–05.

Effort in the North Island statistical area with the greatest effort (013) shows a slight decreasing trend over the fluctuations (between 4500 and 6600 tows per fishing year), with 4700 and 5700 tows in recent years. Many North Island statistical areas showed decreases in CELR-reported effort over the time series, generally after the mid 1990s: especially those off the east coast north from the Bay of Plenty (Statistical Areas 001 to 010). Generally this trend (as a result of changes in reporting form use) continued through the time series, but there are a few exceptions: Statistical Area 003 in which effort increased sharply from about 400 tows in 2002–03 to about 1250 tows in 2003–04 and 2300 in 2004–05. A small increase was also seen in Statistical Area 005, when in 2004–05 almost 1000 tows were reported, still small compared with the peak of nearly 4000 tows in 1991–92. Effort in nearby Statistical Area 006 in 2004–05 (about 300 tows) represented a tenth of that in 1989–90.

4.2.1 Main target species distribution by statistical area

The spatial distribution of CELR bottom trawl effort for the main target species is given by fishing year in Tables H4–H38 (listed in common name alphabetical order). Flatfish effort was mainly in Statistical Areas 013, 017, 020, 022, 024–026, 034, 035, and 038 (Table H10). Target fishing for red cod was concentrated in many of the same areas, especially Statistical Areas 020 and 022. CELR-reported effort for tarakihi was mostly off the east coasts of the North Island and South Island, particularly in Statistical Areas 012, 013, 020, and 022, with other effort concentrated in 033, 034, 047, and 050. Effort reported on these forms for tarakihi and snapper in the statistical areas off the northern east and west coasts of the North Island decreased after the mid-late 1990s (primarily because of the change in form use, see above), though in the last few years of the time series there appears to be an increase in CELR-reported effort for these targets in Statistical Area 003. Red gurnard and trevally tows were mainly reported from waters north of 40° S: most red gurnard tows were in Statistical Area 013 where the CELR-reported effort appears to be increasing, whereas most trevally effort was off the west coast of the North Island, with decreases seen in recent years. Recent increases in CELR effort for John dory were evident also, in Statistical Areas 003, 005, 006, and 008.

Barracouta effort was reported mainly from waters including, and south of, Cook Strait, particularly Statistical Areas 034 and 038, but also in 017, 018, 020, 022, and 033. Effort for stargazer was concentrated in more southern waters, particularly in Statistical Area 030 as well as 025, 029, and 034. CELR-reported effort for deepwater targets was mainly for orange roughy, especially in Statistical Area 013 until 1999–2000, and 033 and 034. Gemfish effort reported on CELRs decreased gradually over the years; some of this decrease may have been due to change in form use, especially in FMA 2, but effort reported on both form types has trended down from about 1000 tows on TCEPR and 600 tows on CELR to about 180 and 80 tows respectively in 2004–05.

4.3 CELR and TCEPR trawl effort on or near the seafloor by statistical area

A broad picture of fishing intensity results from the combination of CELR and TCEPR data for effort on or near the seafloor by statistical area (Figure 17 and Figures H5–H9). This representation of the data must be viewed with the understanding that (as shown by the spatial representation of the

TCEPR aggregate areas) the depth limits of many target species restrict the coverage of effort, as do some regulations, and that from year to year fishing is concentrated in certain patches. Further, these statistical area figures indicate the number of tows started in each area, with no knowledge of the actual location or extent. The most obvious differences between Figures 16 and 17 are the increases in the statistical areas where the large commercial trawl fisheries operate: the offshore areas such as 028 and 602 (southern edge of the Stewart-Snares shelf and the Auckland Islands Shelf) and 023 and 401–411 across the Chatham Rise, as well as 034 off the South Island west coast. Coastal areas show increases with the addition of TCEPR data around the North Island in particular, but less so off the South Island east coast, where fishers have maintained the use of CELRs, particularly for the main targets in those areas, red cod and flatfish.

5. NATURE AND EXTENT OF DREDGE EFFORT BY STATISTICAL AREA, 1989–90 TO 2004–05

Fishers used the dredge code ‘D’ for a variety of fishing methods, including diving during 1989–90 to 2004–05. Although 97% of the fishing effort coded as D targeted scallops and oysters with dredges, about 35 other target species were reported under this code. Of the remainder, 2% were for sea urchins and surf clams, and 1% targeted species such as paua, mussels, paddle crabs, flatfish, rock lobster, flatfish, and several roundfish species. Only data using method code “D” and target species SCA, OYS, or OYU are included in this summary.

Data pertinent to the number of dredge tows per day are thought to be reported with poor precision. Any obvious outliers were amended simply by applying acceptable ranges determined by researchers, for example, the maximum number of dredges in a day for a fishery area. A median value for the number of reported dredge tows per day was applied to data above the maximum limit or where the field for reporting the number of daily tows was blank. It must be noted that these decisions were made without corresponding checks with other (linked) variables, such as the hours fished for the number of daily tows. In general, data that were considered unreliable (including those above the set maximum limit) constituted about 5% of data in any fishery area. Data ranges for the fishing effort variables (Tables I1 & I2) and effort summaries are given in Appendix I.

Some trends shown by these data are directly related to management issues which are not discussed in great detail here and the reader is referred to relevant sections in the 2009 Plenary Report (Ministry of Fisheries 2009a). These data are presented by fishing year (1 October to 30 September) to be consistent with the other fishing effort data presented in this report. Oyster fisheries usually run from March to August and scallop fisheries generally run from July to February (and thus straddle October–September fishing years).

5.1 Scallop dredge data

There are four main scallop fisheries in New Zealand waters: SCA 1 (Northland and the west coast North Island), SCA-CS (Coromandel), SCA 7 (Challenger in Nelson-Marlborough), and SCA 4 (Chatham Islands) (Figure I1 in Appendix I). Commercial scallop fishers use two main dredge types: the self-tipping box dredges preferred by fishers in northern scallop fisheries and the ring bag dredge used by southern scallop fishers (Cryer & Parkinson 2006, Mincher 2008). This effort is in defined beds in shallow waters and effort in the northern fisheries has been restricted by catch limits, dredge size, fishing hours, and non-fishing days (in the Coromandel) and operates in defined seasons of 15 July to 14 February (Northland) and to 21 December (Coromandel) (Cryer & Parkinson 2006). The history of the Nelson-Marlborough scallop fishery is complex and was outlined by Mincher (2008).

Dredge effort targeting scallops was recorded from all around the New Zealand coastline, including around the Chatham Islands. Effort data were reported by general statistical areas or by scallop fishery statistical areas. Appendix I gives the annual effort tables by fishery subarea (Tables I3–I8) and by

month (Tables I9–I13). Over 280 vessels completed at least one daily return with ‘SCA’ as the target species (Table 6). Over half the vessels fished in the Nelson-Marlborough area, where in most years at least 60 vessels were involved. More vessels fished in the Northland fishery than the Coromandel fishery, but in both areas the numbers of vessels have decreased each year: since 1995–96 Northland vessel numbers have decreased from 43 to 12 in 2004–05, and in the Coromandel fishery numbers have dropped from over 19 in the first half of the time series to 7 in 2004–05. Fishing in the West Coast fishery was not well reported until 1993–94, but during 1995–96 to 1997–98 almost 30 vessels fished here each year. Subsequently vessel numbers fluctuated from year to year, on a downward trend, with one vessel reporting effort there in 2004–05.

From the 77 842 records from the 16-year dataset, the groomed daily numbers of tows amounted to a total of 1.47 million dredge tows. Most effort was reported from Nelson-Marlborough (41% scallop tows over the 16-year dataset), with 28% from Northland, 18% from Coromandel, 4% from West Coast, 1% from Chatham Islands, and 8% from other statistical areas (Table 7). Numbers of tows for the individual fisheries and their subareas are given in Tables I3–I7. Table I8 gives data for effort reported by general statistical area rather than by scallop fishery area. In some circumstances, the statistical area data can be amalgamated into scallop fishery areas (but not to subarea): for example, Statistical Area 038 is equivalent to the Nelson-Marlborough fishery. For others, the area is not so clear: for example Statistical Area 001 is likely to mean the Northland fishery, but Statistical Area 002 could equally be the Northland or Coromandel fishery. However, it is not clear and these data are summarised separately.

Northland scallop fishery (East Northland)

In the early to mid 1990s, fishing effort in this area was concentrated in the north and south of the area, with most effort before 1997–98 in 1D and 1R (Table I3). The peak year for 1D was 1993–94 (at over 34 600 tows) and for 1R in 1994–95 (peak of over 17 600 tows). Both have decreased substantially in the following years, and the annual totals for the area (range about 6000–8000 tows) were mostly in 1D except in 2004–05 when there was obviously a shift in concentration, with the primary area being 1R.

Northland scallop fishery (West Northland)

There are 3360 records from CELR data for this fishery. The West Coast scallop fishery area is equivalent to Statistical Area 047 and thus the total in Table 7 should include another 435 tows (see Table I8). These records span the all years except for 1989–90 and 1992–93 when fishers had no means of reporting fishing because of the lack of suitable statistical areas (M. Cryer, MFish, pers comm.). Most fishing took place during July–February. At least 97% of the tows were reported from 9A, off the northern tip of the North Island. Fishing here peaked in 1995–96 to 1997–98 at over 12 000 tows a year (Table I4), then fluctuated between about 1500 and 4000 tows in most of the following years, except 2000–01 (590 tows) and 2004–05 when only 22 tows were reported.

Coromandel fishery

Over 60% of the fishing effort was made in one area (2L) (Table I5). This subarea was fished each year, with peaks in the early 1990s (over 20 000 tows) and again in 1996–97 and 1997–98 (about 16 000 tows). In more recent years, there has been an expansion of effort in 2L from about 4000 tows in the early 2000s to over 7000 in 2004–05. The other area fished each year was 2R, though at a lesser rate to 2L and with sharp fluctuations between some years. Some other areas appeared to have patterns of fishing for about four years, then having at least 6 years of fallow. Overall, the Coromandel fishery has increased the number of tows in the last two years from under 10 000 in the early 2000s to 11 000–13 000 in 2003–04 and 2004–05.

Table 6: Total number of vessels that reported scallop dredge tows in each main scallop fishery area, 1989–90 (1990) to 2004–05 (2005).

Fishing year	Northland	West Coast	Coromandel	Nelson-Marlborough	Chatham Is.	Total
1990	38	0	23	53	9	129
1991	39	0	25	56	7	133
1992	42	0	26	61	5	136
1993	36	0	23	67	5	133
1994	36	2	22	80	1	139
1995	41	12	19	73	5	141
1996	43	29	19	79	8	144
1997	34	29	20	69	8	134
1998	25	28	15	67	9	128
1999	17	15	11	64	3	101
2000	12	8	10	54	2	86
2001	11	5	10	68	1	91
2002	15	11	11	66	1	89
2003	16	7	10	74	1	96
2004	14	7	8	61	0	80
2005	12	1	7	43	1	76
All	79	41	44	158	18	283

Table 7: Total number of scallop dredge tows reported for the main scallop fishery areas, 1989–90 (1990) to 2004–05 (2005).

Fishing year	Northland	West Coast	Coromandel	Nelson-Marlborough	Chatham Is.	Others	Total
1990	35 405	—	17 660	16 286	1 093	22 534	92 978
1991	45 307	—	37 303	19 596	1 092	11 076	114 374
1992	62 269	—	43 298	30 307	695	14 836	151 405
1993	43 917	—	13 803	32 602	721	12 180	103 223
1994	51 937	23	17 016	68 148	16	2 197	139 337
1995	56 178	2 945	20 461	23 049	1 238	2 612	106 483
1996	25 817	13 597	18 997	59 396	1 462	10 222	129 491
1997	19 989	12 456	21 189	25 470	2 569	11 002	92 675
1998	16 602	13 171	17 438	23 588	1 251	11 860	83 910
1999	8 453	3 158	8 990	48 054	283	14 586	83 524
2000	5 790	3 364	4 286	36 022	179	8 826	58 467
2001	8 430	590	8 152	47 753	6	234	65 165
2002	7 666	3 998	9 372	60 761	43	335	82 175
2003	6 333	1 496	8 648	56 885	266	915	74 543
2004	8 271	2 076	11 176	32 033	0	472	54 028
2005	5 792	22	13 271	20 868	51	30	40 034
All	408 156	56 896	271 060	600 818	10 965	123 917	1 471 812

Nelson-Marlborough (Challenger) fishery

Before 1998–99, fishing in this area was mainly from August to December, but from 1998–99 on the season was mainly September to February. This fishery is subject to changes from one season to another; for example, in 2000–01 the fishery season was extended to March for that year only. It is managed with rotational closures as required (Mincher 2008). The level of fishing here has varied markedly from year to year (Tables 7 and I6). The fishing effort increased from about 16 000 tows in 1989–90 to peaks of 68 000 in 1993–94 and 59 300 in 1995–96. Effort halved in the following year, but another period of more sustained effort occurred during 1998–99 and 2002–03, with a peak at over 60 000 tows in 2001–02. Effort dropped to about 21 000 tows in 2004–05.

Note that the subareas reported in Table I6 are as reported by fishers and include some areas fished in the early 1990s that are no longer in existence. At the time of writing we were unable to trace the location of the areas 7N–7R used in the early 1990s. We were unable to verify that the areas 7A and 7AA, for example, had the same boundaries throughout the dataset. However, fishing effort moved each year between areas, as beds were left to recover. In the last few years of the dataset, one area in each of the two main bays (Tasman Bay, Golden Bay) was fished, and most effort in 2004–05 was in the Marlborough Sounds in 7KK and in Tasman Bay in 7FF. A comparison of Tables I6 and I8 suggests that in the late 1990s annual totals for the area as a whole would be higher than presented in Table I6 because of the effort reported at the generic statistical area resolution.

Chatham Islands fishery

Effort in this fishery is small relative to other scallop fisheries, with most effort from 4G and 4H (Table I7). These two subareas had fishing in at least 10 of the 16 years, whereas other subareas were fished in the early 1990s, then not again until the late 1990s. There has been very little effort since 1999–2000. Fishing effort around the Chatham Islands was generally during August–December, though in 1994–95 some fishing occurred in January and February (Table I13).

5.2 Oyster dredge data

Dredging for oysters is primarily carried out in two major fisheries: Foveaux Strait and Nelson-Marlborough (Challenger) (see Figure I1). The fisheries operate under different rules and use different gear (Ministry of Fisheries 2009a). Two heavy dredges with double-bit bars and up to 3.35 m wide are used per tow in the Foveaux Strait fishery, whereas elsewhere fishers use ring bag dredges (as used for scallops), either one dredge of up to 2.5 m width or two 1.4 m dredges per tow (Ministry of Fisheries 2009b).

The records for statistical area in the oyster data included codes for the general statistical areas, Fisheries Management Area (FMAs), rock lobster statistical areas, Nelson-Marlborough scallop and dredge oyster statistical areas, and Foveaux Strait dredge oyster statistical areas. Most of the data for the main fisheries could be allocated to appropriate statistical areas. However, when a general statistical area was used, for example, 025 for the Foveaux Strait dredge oyster fishery, it was not possible to include these data because they could not be allocated to an individual Foveaux Strait dredge oyster statistical area. Similarly, Statistical Areas 017 and 038 represent the Nelson-Marlborough fishery area. These data are summarised in Table I14 with oyster reported effort from outside the two major fisheries; for the Nelson-Marlborough fishery, about 16% of the total oyster effort was reported by generic statistical area, and 65% of this ‘other’ effort was in Statistical Area 038. Tables I15–I18 give the dredge oyster effort by area, year, and month.

The fishing effort data were treated separately for the two main fisheries (see Appendix I). About 25% of vessels that reported dredge oyster effort on at least one daily CELR operated in Foveaux Strait (Table 8); however, about 52% of the effort was in the Foveaux Strait fishery and 37% in Nelson-Marlborough (this proportion increases to 44% when the Statistical Area 038 effort is added).

Foveaux Strait dredge oyster fishery

Fishing in Foveaux Strait during 1989–90 to 2004–05 has been subjected to several management regimes (Ministry of Fisheries 2009a), including fishery closures and area rotations. At the start of the time series, 23–24 vessels fished there, and during these years the reported numbers of tows varied greatly between years (Table 8). The fishery was closed from 1992–93 to 1994–95 because of the *Bonamia* outbreak (Ministry of Fisheries 2009a), and the few vessels that reported effort then were fishing under special permit (see Tables I15 and I16). After the re-opening of all the oyster beds, vessel numbers increased again to 24 in 1995–96. Vessel numbers had decreased to 11 or 12 a year by the mid 2000s.

Effort was variable from year to year until after the mid 1990s. Effort in the March-August seasonal fishery almost doubled between 1989–90 and 1990–91. At the same time there was a shift in the main areas of effort between these seasons (Table I15). Fishing effort dropped by about 80% with the closure of the central areas in 1992, and there was a small shift of effort to the more outer areas. After the re-opening of the fishery in 1996, effort was less than 50% of that in 1990, with some areas remaining unfished, and the length of the season was reduced (later start for 1996, 1997, and 1998, Table I17). The effort shown over January-February is assumed to be that relevant to the special permit work. Subsequently, the full season was fished and effort was generally at about 16 000–18 000 tows a year, except in 2001–02 and 2004–05 when 32 460 and 25 450 tows were reported.

Nelson-Marlborough (Challenger) dredge oyster fishery

The number of vessels in this fishery doubled between 1989–90 and 1994–95 (peak of 47 vessels) (Table 8), after which numbers varied slightly but were generally between 20 and 34 vessels, other than in 2001–02 when only three vessels reported effort.

At the peak of the fishery (within this 16-year dataset), at least 22 000 tows were reported during the mid 1990s (Table I16), with most in areas 7DD, 7EE, 7FF, 7GG, 7HH, and 7II. At this time the season was from March to August (Table I17). After 1996–97, most months were fished each year; the most notable exception being 2001–02 when fishing was reported only for November and December (2001). After that year, 20–27 vessels fished each year, reporting between 8400 and 14 700 tows a year with effort concentrated in May–September in 2002–03, in March–May in 2003–04, and in March–August in 2004–05. Most fishing was in 7EE and 7HH.

Table 8: Numbers of vessels and tows reported for dredge oyster fisheries, 1989–90 to 2004–05.

Fishing year	Foveaux Strait		Nelson-Marlborough		Others No. tows	Total	
	No. vessels	No. tows	No. vessels	No. tows		No. vessels	No. tows
1990	23	39 013	20	6 364	2 285	49	47 662
1991	23	64 496	31	12 459	1 205	56	78 160
1992	24	12 556	35	14 295	3 114	63	29 965
1993	5	3 498	33	17 286	7 724	47	28 508
1994	6	4 464	41	28 930	1 237	48	34 631
1995	4	4 227	47	25 813	6 162	52	36 202
1996	24	19 299	41	22 443	10 445	76	52 187
1997	19	16 504	33	16 047	11 805	63	44 356
1998	16	16 800	34	17 368	12 121	58	46 289
1999	16	15 888	22	15 814	10 750	55	42 452
2000	15	17 921	32	14 600	496	46	33 017
2001	12	17 494	29	10 254	329	41	28 077
2002	13	32 462	3	139	27	17	32 628
2003	12	19 164	27	14 674	0	39	33 838
2004	12	17 565	25	8 413	19	37	25 997
2005	11	25 446	20	10 980	0	31	36 426
All	34	326 797	99	235 879	67 719	137	630 395

6.0 DISCUSSION AND CONCLUSIONS

An understanding of the spatial and temporal extent of fishing effort with seafloor contact is fundamental to estimating the effects of fishing on marine habitats. Where fishers set their gear depends on factors including the target species, depth, vessel size, the gear they use, and local knowledge — for example, underlying characteristics of the seafloor such as areas of foul ground (rocky reef).

The nature of the data collected from the various mobile bottom fishing methods in New Zealand waters has a large bearing on the use of the data to describe spatial trends over time, particularly with a large dataset that spans a number of years, over a vast ocean area. The 16-year dataset reported here has over 2 million trawl tows on or near the seafloor and over 2 million scallop or oyster dredge tows. Different reporting regimes and areas are in place for the fisheries included here, and these influence the usefulness of the data in characterising the extent of fishing on or near the seafloor on an EEZ-wide scale.

The spatial precision of the available fishing effort data determines the way in which the spatial extent can be measured. Over a 16-year period, about 25% of the data for fishing effort for mobile bottom fishing methods had adequate data to allow a measure of the seafloor area contacted by fishing gear. This was primarily bottom trawl gear, but also included some midwater trawl gear (within 1 m of the seafloor) used in depths down to 1600 m. These data indicated increasing effort in terms of the numbers of tows and the swept area over the time series, with peak years in the late 1990s and a smaller peak in the early 2000s and then a subsequent decline in the last few years. The spatial distribution was limited by the depths fished for particular target species, areas of foul ground, restricted or closed areas, limitations of gear size, and distance from shore. Larger vessels, with larger gear, mainly fished waters 200–800 m deep, whereas smaller vessels operated closer inshore, particularly shallower than 200 m. The offshore bathymetry affected the available area for fishing, with some parts of the coastline dropping steeply to deep water and thus restricting the area in some depths; in other parts of the EEZ, there is an expansive shelf.

Interannual changes in the effort distribution by area and depth were the result of changes in targets and fleets in middle depths and deeper waters and there were some substantial changes in effort following changes to TACCs. For example, the gradual decline of effort in the hoki fishery after 2000–01 was directly related to the gradual decreases of the TACC. The large size of the hoki fishery meant that these changes drove the main trends in overall effort, especially across middle depth fisheries. The development of the hoki fishery caused a change in the spatial distribution of overall effort following increasing effort in FMA 4 across the Chatham Rise and the development of the fishery off the southeast edge of the Southern Plateau. Closures of some seamounts and limits in catch for some Group 4 (particularly orange roughy) fisheries also occurred during these years, but the overall effect was much less (because of the smaller fishing effort and the predominance of short, hill tows). In shallow waters, changes in the data reporting system had the greatest influence on our estimates of overall effort around the North Island, but this effect was less clear in southern shallow waters.

Most fishing took place in waters shallower than 800 m, but the distribution within these depths varied by area and by year. An overall area of 328 360 km² was contacted by trawl gear (the trawl “footprint”) and the aggregate swept area was about seven times that. Each year the aggregate area was roughly double the footprint area. The assignment of trawl polygons to a 25 km² cell grid allowed a measure of frequency and intensity of disturbance. In years of less effort, more than 30% of the cell area was trawled for the most heavily fished 20% of *fished cells*. In the peak years this increased to 50% of the cell area. For the less heavily fished 80% of *fished cells*, up to 4–5% of the cell area was trawled for 40% of *fished cells*, between about 5–12% for another 20% of cells, and 13–30% for the other 20% (see Figures F1–F16).

Deeper waters had more lightly trawled cells than shallow and middle depths. Over all the data, the cell area was trawled at least once for 40% of *fished cells* shallower than 200 m compared with 25–35% of cells in 200–800 m and less than 15% of cells deeper than 800 m. The maximum swept area of over 6500 km² in a cell (that is, on average each square kilometre was swept more than 260 times over 16 years) was from cells in 200 and 300 m depth. In general the most heavily *fished cells* were in 300–800 m depth (Table G2), where over the 16 years some cells had aggregate swept areas of 20 times the cell area. These cells were fished each year (10% of all cells). One third of the *fished cells* had trawl effort for one or two years, and about half were fished for 3 and 15 years.

6.1 Implications of the use of the TCEPR data — collection, treatment, and analysis

In any characterisation of the distribution and trends of fishing effort, the precision of the primary data variable records will, to a large extent, determine the certainty in the result. The data variables that are collected and the collection protocols are the basis for understanding the nature and extent of this fishing effort. Differences in scale will occur with different data collection methods and the reasoning behind the data collection (and the form design) will influence the availability of data and the precision, and the way data are collected and subsequently handled will affect data reliability, and ultimately the estimates and their patterns and trends.

The definition of what constitutes a “tow” by a trawler will affect the precision of the area fished. Definitions provided below from the explanatory notes from TCEPRs and CELRs for the variables used to characterise the fishing effort have been verified by the Ministry of Fisheries as being in use throughout the data time series 1989–90 to 2004–05. There does not appear to be a timeline of changes to the form, but a summary of some tow definitions was provided by MFish (M. Vignaux, MFish), where, a ‘shot’ represents the equivalent of a ‘tow’ in this report and the ‘fisher’ is either the permit holder or someone authorised to fish by the permit holder.

From 1990 to 1 October 1991, the start and end times of a shot were simply “*the start [end] of each shot*”, with the time recorded using a 24-hour clock. From October 1991, the instructions were “*the time of the start of the shot in applicable time using a twenty-four (24) hour clock. Start of the shot means the time at which the trawl net begins to be towed through the water at a depth at which fish are or are intended to be taken*” and “*End of shot means the time at which the trawl net begins its ascent from the depths at which fish were or were intended to be taken*”. In about 1993, this was redefined to “*a shot is a particular part of a fishing operation. The start and end time is not the same as when fishing (including trawling) begins and ends.*” “*The start of a shot is when the trawl net first reached the depth and position at which you intended to catch fish, or when fish were first caught, whichever occurred first*”. At this time a survey of fishers revealed that fishers were unclear and that some early data may report tow lengths about an hour longer than would be with the correct definition (Vignaux 1993).

From 1 October 2001, the start of a shot was defined as “*when the trawl net first reached the depth and position at which [the fisher] intended to catch fish, or when fish were caught, whatever occurred first*” and the end as “*when the trawl net left the depth and position at which [the fisher] intended to catch the fish, or when fish were last caught, whichever occurred last*”. Thus, it appears there have been some changes during the years to the data collection of the most fundamental aspect in characterising effort — the unit of effort, a tow.

Limitations of the data used to determine the magnitude of effort

The scale of this work necessitated that the grooming processes were broad, and generally most records were within acceptable ranges, with no more than 5% of data for the main variables requiring some amendment or imputation. The main problem for most of these variables was missing data.

The measures of effort used to describe the TCEPR trawling were the numbers of tows, the estimated area affected by those tows (the “footprint”), and the aggregate area swept by those tows. One of the very real advantages of the TCEPR form is that it collected data for each tow rather than the daily effort collected on the CELR. Thus, for each effort unit there was a suite of tow descriptors available to determine a measure of the seafloor trawled: time, location, depth, gear type and size, and speed.

All three measures of effort used require knowledge of ‘where’. The position of the vessel at the start of a tow, assuming that the net is at the bottom when it reaches its fishing depth, is what is reported on the TCEPR as the tow start position. Depending on various factors such as gear and depth, the actual position of the net will be at some distance from the recorded position. Similarly, the vessel position at the tow end is reported. In some situations the distance of the gear behind the vessel may be similar in extent to the finest resolution of the commercial effort data (1.853 km). This belies the precision at

which some fishers can place their gear with the widespread use of electronic equipment, especially on larger vessels. Thus, the two location coordinates provide the start and end points at a relatively coarse resolution. This allows collation of the numbers of tows, but is limiting in the estimation of footprint and swept area because there are no useful data that describe the direction or path of the tow: whether the net was towed in a straight line or included a turn.

Another limiting factor in the estimation of the footprint and swept area was the paucity of data that describe the width of the gear. During the 16-year study period, the width of the gear (for this purpose that is in contact with the seafloor) parameter that was reported by fishers was the wingspread, a measure that grossly underestimates the width of bottom trawl contact on the seafloor. The assignment of generic doorspread values for each tow depending on the target species and vessel size was a pragmatic solution used to represent the tow spread given the large amount of data. The lack of information on the tow direction and path, and thus the assumption of straight-line tows, could contribute a greater amount of uncertainty in the estimation of swept area than the generic doorspread; this would be further affected by the area where fishing took place (for example, a trawl following a contour). A bigger concern with the use of doorspread is the lack of information for a number of larger vessels that have used twin-trawl rigs from about 1998. These vessels fished mainly in middle depths and thus there is uncertainty around the estimated swept areas, particularly for the Group 2 species —the group which contributed most to the annual aggregate swept area. Therefore, the aggregate swept area will be underestimated for the middle depths, especially during 2000–04 when most of these vessels used this gear. It was not possible to ascertain from the commercial data which tows used the twin-trawl gear; however, the doorspread of a hoki twin-trawl could be between 400 and 450 m, at least twice the generic doorspread applied (200 m) for that vessel size.

A comparison of the two methods used to estimate the swept area of a tow showed some interesting differences that could be due to a number of factors. *Position swept area* was used to estimate the aggregate swept area and was calculated from the assigned (generic) doorspread and the distance derived from the start and finish points. *Speed-time swept area* was estimated from the duration of the tow (derived from the difference between the start and finish times), the tow speed, and the assigned doorspread. Figure 18 plots the two values for each bottom tow for Group 2 tows by Category C and D vessels and for Group 6 bottom tows. The distribution of the position-based area is more weighted towards smaller values and may represent tows that were missing either start or finish coordinates and thus had a polygon built around a point. For other values, where the speed-based area is greater than the position-based area, the longer distances derived from speed and time may represent a tow that has not followed a straight line, but, perhaps, a contour. Alternatively, it may represent errors in the start and finish times. Points falling roughly on a straight line in each plot that might be expected to show a 1:1 relationship between the two methods of estimating swept area consistently suggest that the speed-time method leads to higher estimates of swept area than the position method. This could be caused by reporting times and locations at different times within a tow, by the imprecision in the reported latitude and longitude values that define the start and finish positions, or by non-linear tows. It is not clear which is the better method overall, but it does seem likely that the position method underestimates the true area swept to some extent, particularly where short tows are made.

Further misrepresentations of the swept area will occur for data with either a start or finish position missing. For these tows a polygon using the doorspread width was built around the single point (assumed valid after comparison with other tow effort by the vessel). The resulting swept area for that tow may be smaller than if both positions were reported and the location of the swept area will be constricted and misrepresent the effort in the underlying cells.

The TCEPR forms do not provide for the collection of information on the gear types other than that the gear was bottom trawl gear or midwater trawl gear. Thus, other than the species group and vessel size distinctions, any variations in the gear are not distinguished, and of course there is no way of knowing how the gear was used or attempting to ascertain how much was in contact with the seafloor. We used a pragmatic approach employing some generic value applied to different fleets, with the assumption that the seafloor contact was from the doors back to the codend.

Another pragmatic decision, in part, was to use a cell size of 5 x 5 km. We considered this the best fit for the volume of data and the precision of the reported trawl positions. It allowed us to determine areas that were intensively fished (crossed by many tows) year after year, and those that were contacted by few tows very occasionally, or only once. However, within the cells, we make assumptions that mask the finer-scale patchiness or complexity. Cells are small enough to allow distinction between high activity in adjacent cells and allow us to handle this very large dataset. We assume that fishing within a cell is homogeneously distributed, although it is known that some deepwater cells include underwater features such as hills or seamounts and others may contain features that impede the passage of a trawl. Bottom trawl fishing in those cells may be restricted to areas around untrawlable ground or to the slopes of hill features. The selected cell size is best for the effort for Groups 1, 2, and 6 where tow distances are generally about 20–25 km. The choice may be less useful in fisheries that target hills, use predominantly short tows, and cover a small area. Using the cell midpoint for the cell depth as a way of summarising the data may misrepresent some of the deeper water effort on underwater features which rise from the slope. Thus, on an EEZ-wide scale this study provides indicative measures of the seafloor area contacted by trawl gear and the aggregate area swept by trawl gear over 16 years. This approach is not designed to assess the fishing effort on small seabed features or in small areas of particular habitat.

Opportunities to improve data collection

Fishers use certain strategies to fish different areas; for example, fishers may follow contours or tow in a straight line. A better understanding of the tow path and estimation of the swept area of a trawl could be gained through the use of VMS data (ensuring vessel confidentiality). Finer scale data reported by Ministry of Fisheries observers could be linked with the associated commercial data to assess the validity of assumptions about tow location and tow path.

Observer data could also be used to characterise the trawl gear and measure the extent of the gear width. The observers, who operate on a range of trawl vessels throughout the EEZ, have collected additional data on gear parameters since October 2007 when the Trawl Gear Details Form was introduced. These include data to describe the trawl doors, sweeps and bridles, the net design (wingless or not), ground gear, groundrope, and number of codends. It would be practical to choose a smaller area for analysis to test the use of these data.

6.2 Implications of the use of the CELR data — collection, treatment, and analysis

Only 25% of effort reported from fishing operations with seafloor contact in the EEZ during 1989–90 to 2004–05 was reported on TCEPR forms. The remaining 75% of data were reported on CELRs. About 25% of these were bottom trawl tows and 50% were dredge tows for scallops or oysters. There is much less certainty with these data because of the broad scale at which they were collected. The reporting location of a statistical area allocates fishing activity to large areas with little reference to depth or fishing ground. For a small proportion of the records it is unclear whether the area code given is a FMA or a statistical area. Despite a large number of skippers changing their reporting from these forms to TCEPRs in the mid 1990s, about 50% of all bottom trawl effort in the EEZ was still reported on these forms in the 2000s. All dredge fishing is still reported on CELRs.

Data collected on the CELR gave a summary of the day's fishing for a vessel for a given fishing method, target species, and statistical area. There was a field on the form for more precise position data for the start of the day's fishing, but this was rarely used, and its use is questionable. Another concern with these data was the number of tows that were reported for each record and the duration of fishing, and checks were run to ensure that these fields were within acceptable limits. Similar problems exist for the dredge data collected on CELRs. These fisheries operate on discrete beds at a scale that is not easily identified by the CELR data. Use of industry data would better characterise these fisheries and allow some measure of the area dredged.

The Ministry of Fisheries have revised the use of CELRs since the years of this study and the trawl CELR has been replaced by the Trawl Catch Effort Return for use by small vessels. This form collects data by shot, including the start and end time, start depth and start latitude and longitude, and the average trawl speed. Thus, it will allow better description of the spatial distribution and magnitude of bottom trawl effort than is provided by the simple number of tows.

6.3 Conclusions

This study provides a characterisation of bottom fishing effort from 1989–90 to 2004–05, with particular emphasis on the data reported on TCEPRs. This focus necessarily means that the results reflect primarily the fisheries in waters deeper than 200 m and some types of inshore fisheries. Information for most inshore fisheries, including the dredge fisheries, has been collected at extremely coarse resolution and there is no historical framework on which to place this period of fishing activity. There is little published information on the extent of fishing throughout the EEZ (see Baird et al. 2006, Gibbs 2008) or the collation of effort data from pre 1989, despite the presence of foreign fleets since the 1960s. Thus this work stands in isolation of any previous effort on the seafloor. A similar mapping project of the historical fishing effort, on whatever scale is possible, would provide further context for this broad scale analysis.

The database built for this work is a valuable platform for further analyses as is demonstrated in the work completed for Objective 5 of BEN200601 (Baird et al. 2009) which described the fishing effort in relation to 15 benthic-optimised marine environment classes. It provides an indicative measure of fishing effort based on the spatial representation of each tow. As the Ministry of Fisheries develops its management objectives and strategies to deal with the impacts of fishing on the benthic environment, this database could be used to inform the ministry about fishing in particular areas or in relation to particular habitats (environment classes), depending on the needs. Analysis of patchiness or randomness of the fishing effort within cells would permit better estimates of the area affected by trawling and would also allow prediction of the effects of closure under various management regimes (Dinmore et al. 2003). New data can be readily added and groomed according to algorithms already in place; these can be updated to suit new knowledge or improved understanding. Partitioning the EEZ into smaller study areas would allow a smaller cell size for analysis, should the underlying data support it (Piet & Quirijns 2009).

However, this cell-based analysis is restricted to 25% of all bottom contact fishing in the EEZ for the study years, and while it may represent effort deeper than 200 m, it severely underestimates the effort in shallower waters, in particular areas where both trawl and dredge gears are used. Thus, effort totalling at least 50 000 bottom tows per year, mainly in inshore areas, and about 2 million dredge tows can only be summarised by fishery area by year.

7.0 ACKNOWLEDGEMENTS

We thank Martin Cryer (Ministry of Fisheries) for discussions on the direction of this work and pertinent comments on this report, Craig Loveridge and Marianne Vignaux (Ministry of Fisheries) for providing advice on the CELR and TCEPR forms, and Andy McKenzie (NIWA) for statistical advice. We also thank Keith Michael, Derrick Parkinson, and Alistair Dunn (NIWA). This work was completed for Objective 1–4 under BEN200601 for the Ministry of Fisheries.

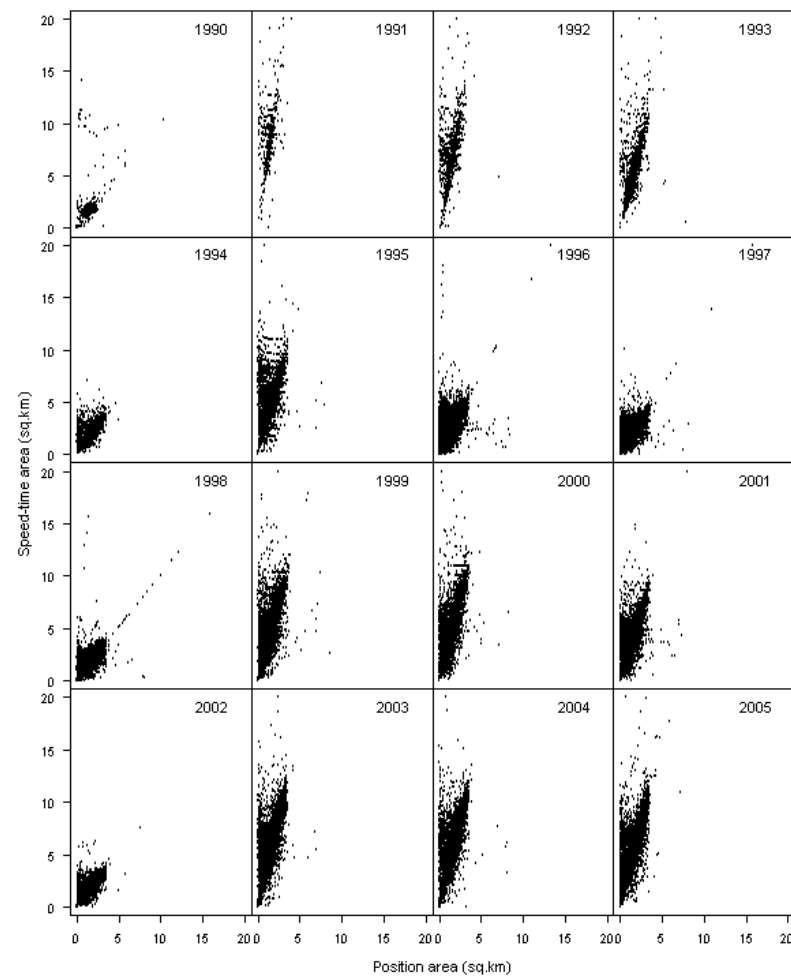
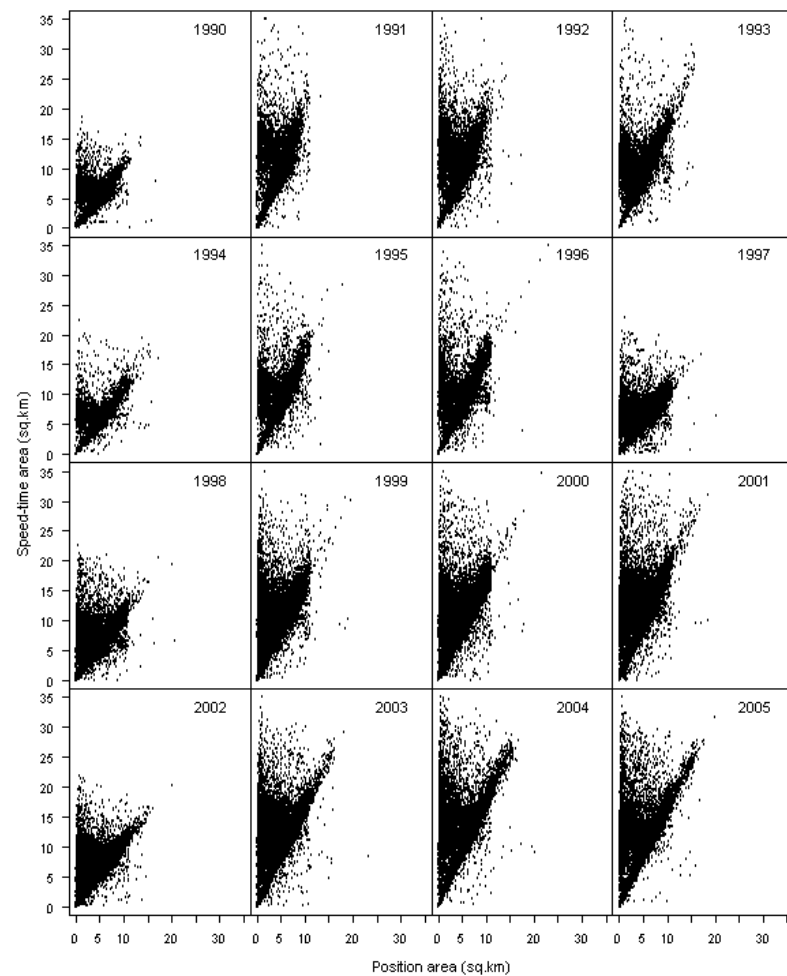


Figure 18: Estimated *position swept area* (km^2) plotted against *speed-time swept area* (km^2) for Group 2 tows by large vessels (Categories C and D) using bottom trawl gear (left) and for Group 6 vessels, 1989–90 (1990) to 2004–05 (2005).

8.0 REFERENCES

- Baird, S.J.; Wood, B.A.; Bagley, N.W. (2009). The extent of trawling on or near the seafloor in relation to benthic-optimised marine environment classes within the New Zealand EEZ. Final research report to Ministry of Fisheries prepared as part completion of Objective 5 of BEN200601. (Unpublished report held by MFish, Wellington.)
- Baird, S.J.; Bagley, N.W.; Wood, B.A.; Dunn, A.; Beentjes, M. (2002). The spatial extent and nature of mobile bottom fishing methods within the New Zealand EEZ, 1989–90 to 1998–99. Final research report prepared for the Ministry of Fisheries as completion of ENV2000/05. 36 p. plus appendices. Unpublished report held by MFish, Wellington.)
- Baird, S. J.; Wood, B.A.; Clark, M.R.; Bagley, N.W.; McKenzie, A. (2006). Description of the spatial extent and nature of disturbances by bottom trawls in Chatham Rise and Southern Plateau fisheries. Final research report prepared for the Ministry of Fisheries under ENV2003/03. 139 p. . (Unpublished report held by MFish, Wellington.)
- Beentjes, M.P.; Baird, S.J. (2004). Review of dredge fishing technologies and practice for application in New Zealand. *New Zealand Fisheries Assessment Report 2004/37*. 40 p.
- Cryer, M.; Parkinson, D.M. (2006). Biomass surveys and stock assessments for the Coromandel and Northland scallop fisheries, 2005. *New Zealand Fisheries Assessment Report 2006/34*. 53 p.
- Dinmore, T.A.; Duplisea, D.E.; Rackham, B.D.; Maxwell, D.L.; Jennings, S. (2003). Impact of large-scale closure on patterns of fishing disturbance and the consequences for benthic communities. *ICES Journal of Marine Science* 60: 371–380.
- Gibbs, M.T. (2008). The historical development of fisheries in New Zealand with respect to sustainable development principles. *The Electronic Journal of Sustainable Development* 1(2): 24–33. www.ejsd.org.
- Greenstreet, S.P.R.; Spence, F.B.; Shanks, A.M.; McMillan, J.A. (1999). Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. II. Trends in fishing effort in the North Sea by UK registered vessels landing in Scotland. *Fisheries Research* 40 (2): 107–124.
- Jennings, S.; Alvsvåg, J.; Cotter, A.J.R.; Ehrich, S.; Greenstreet, S.P.R.; Jarre-Teichmann, A.; Mergardt, N.; Rijnsdorp, A.D.; Smedstad, O. (1999). Fishing effects in northeast Atlantic shelf seas: patterns in fishing effort, diversity and community structure. III International trawling effort in the North Sea: an analysis of spatial and temporal trends. *Fisheries Research* 40 (2): 125–134.
- Michael, K. (2008). The Foveaux Strait ecosystem and effects of oyster dredging. *NIWA Information Series No. 68*. Available online at: <http://webcat.niwa.co.nz/documents/NIWAis68.pdf>
- Ministry of Fisheries (2009a). Report from the Fishery Assessment Plenary, May 2008: stock assessments and yield estimates. Ministry of Fisheries.
- Ministry of Fisheries (2009b). Foveaux Strait dredge oyster information brief, Appendix 2. Draft January 2009. Report available at www.fish.govt.nz. 24 p.
- Mincher, R. (2008). New Zealand's Challenger Scallop Enhancement Company: from reseedling to self-governance. Pp. 307–321, In "Case studies on fisheries self-governance". *FAO Fisheries and Aquaculture Technical Paper 504*. 460 p.
- Piet, G.J.; Quirijns, F.J. (2009). The importance of scale for fishing impact estimations. *Canadian Journal of Fisheries Aquatic Science* 66: 829–835.
- Ragnarsson, S.A.; Steingrímsson, S.A. (2003). Spatial distribution of otter trawl effort in Icelandic waters: comparison of measures of effort and implications for benthic community effects of trawling activities. *ICES Journal of Marine Science* 60: 1200–1215.
- Rijnsdorp, A.D.; Buys, A.M.; Storbeck, F.; Visser, E.G. (1998). Micro-scale distribution of beam trawl effort in the southern North Sea between 1993 and 1996 in relation to the trawling frequency of the sea bed and the impact on benthic organisms. *ICES Journal of Marine Science* 55: 403–419.
- Sainsbury, J. C. (1996). Commercial Fishing Methods. Third edition. Fishing News Books. 368 p.
- Vignaux, M. (1993). Catch per unit effort (CPUE) analysis of the hoki fishery, 1987–92. *New Zealand Fisheries Assessment Research Document 93/14*. 23 p.
- Weinberg, K.L.; Kotwicki, S. (2007). Factors influencing net width and sea floor contact of a survey bottom trawl. *Fisheries Research* 93 (3): 265–279.
- Wood, B.; Baird, S.J. (2010). Mapping bottom-trawl fishing activity in the New Zealand EEZ. In: Nishida, T.; Caton, A.E. (Eds), *GIS/Spatial Analyses in Fishery and Aquatic Sciences Vol. 4*, pp. 443–450. International Fishery GIS Society, Saitama, Japan. 579 p.

APPENDIX A:

FISHERIES MANAGEMENT AREAS WITHIN NEW ZEALAND 200 N. MILE EXCLUSIVE ECONOMIC ZONE

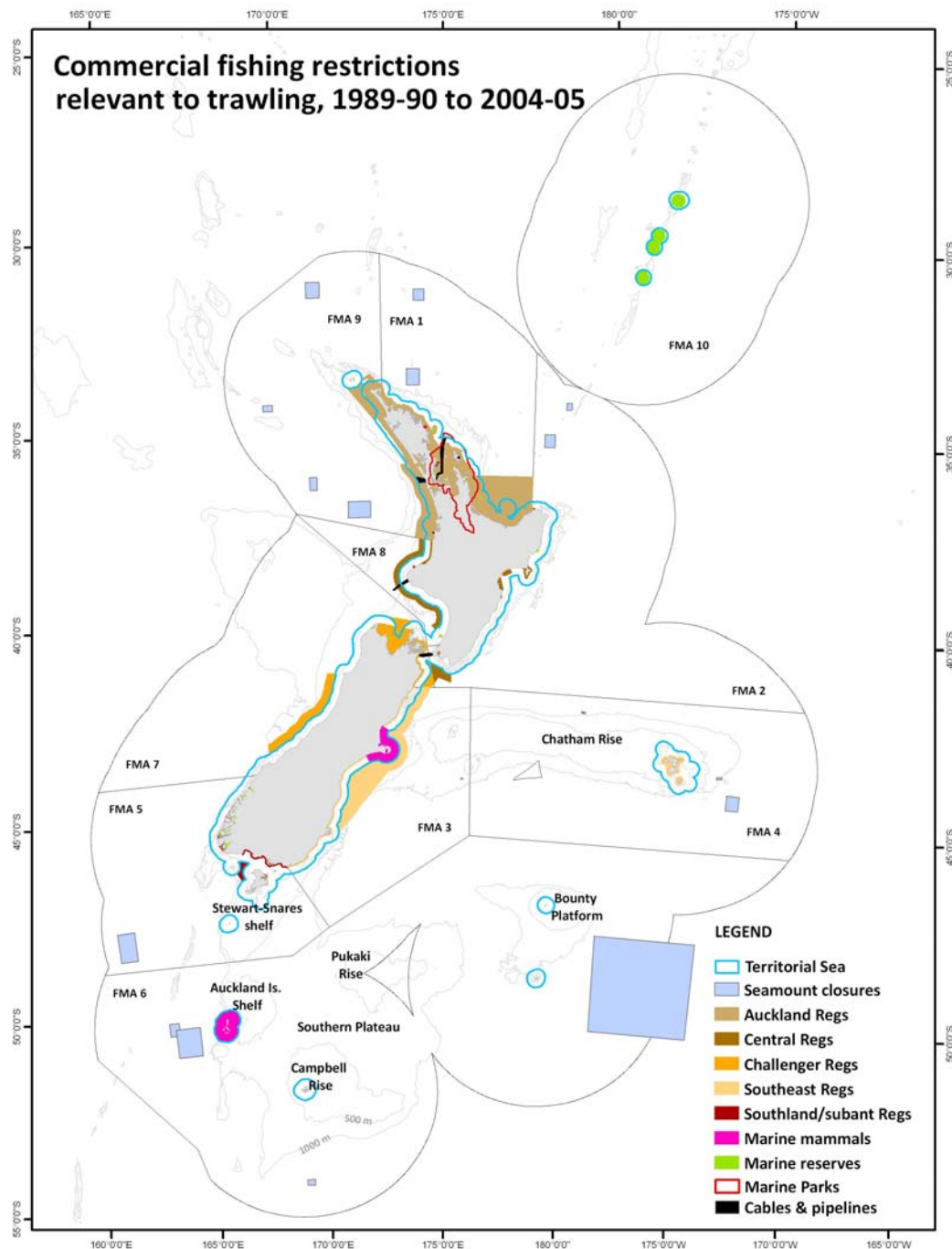


Figure A1: Major spatial restrictions to trawling present at some stage during 1989–90 to 2004–05 and the Ministry of Fisheries Fishery Management Areas (FMA) within the outer boundary of the New Zealand EEZ (Ministry of Fisheries NABIS data, with reference to Department of Conservation (2004)).

Note: The 12 n.mile Territorial Sea is limited to vessels under 28 m. **Auckland Regs** show the Fisheries (Auckland Kermadecs Commercial Fishing) Regulations 1986 pertaining to trawling, including an gear restricted (codend mesh size) area from the FMA 8/FMA 9 boundary to the FMA 1/FMA 2 boundary, area in the Bay of Plenty that excludes pair-trawling, harbours and bays prohibited to trawling, several stretches of waters outside the 12 n.mile sea that exclude vessels over 46 m, and various seasonal, time of day, vessel size, and gear type restrictions. **Central Regs** are the Fisheries (Central Area Commercial Fishing) Regulations 1986 that include areas where trawling and fishing are prohibited and waters in Cook Strait and off Taranaki Bight where trawlers over 46 m are excluded. **Challenger Regs** are the Fisheries (Challenger Area Commercial Fishing) Regulations 1986 that include seasonal, vessel size, and gear size (headline height) restrictions in Golden Bay and Tasman Bay, gear restrictions in inshore waters of South Island northeast coast, and areas off the South Island west coast, outer Golden-Tasman bays, and Cook Strait where vessels over 46 m are excluded. **Southeast Regs** are the Fisheries (South East Area Commercial Fishing) Regulations 1986 that include seasonal and trawl restrictions in inshore waters and bays and a stretch of water beyond the 12 n. mile Territorial Sea that exclude trawling by vessels over 46 m. **Southland/subant Regs** are the Fisheries (Southland and Sub-Antarctic Areas Commercial Fishing) Regulations 1991 that include prohibition of trawling in harbours, fiords, and bays, gear restriction (headline height) inshore Southland coast, and exclusion of vessels over 46 m (Solander Trench).

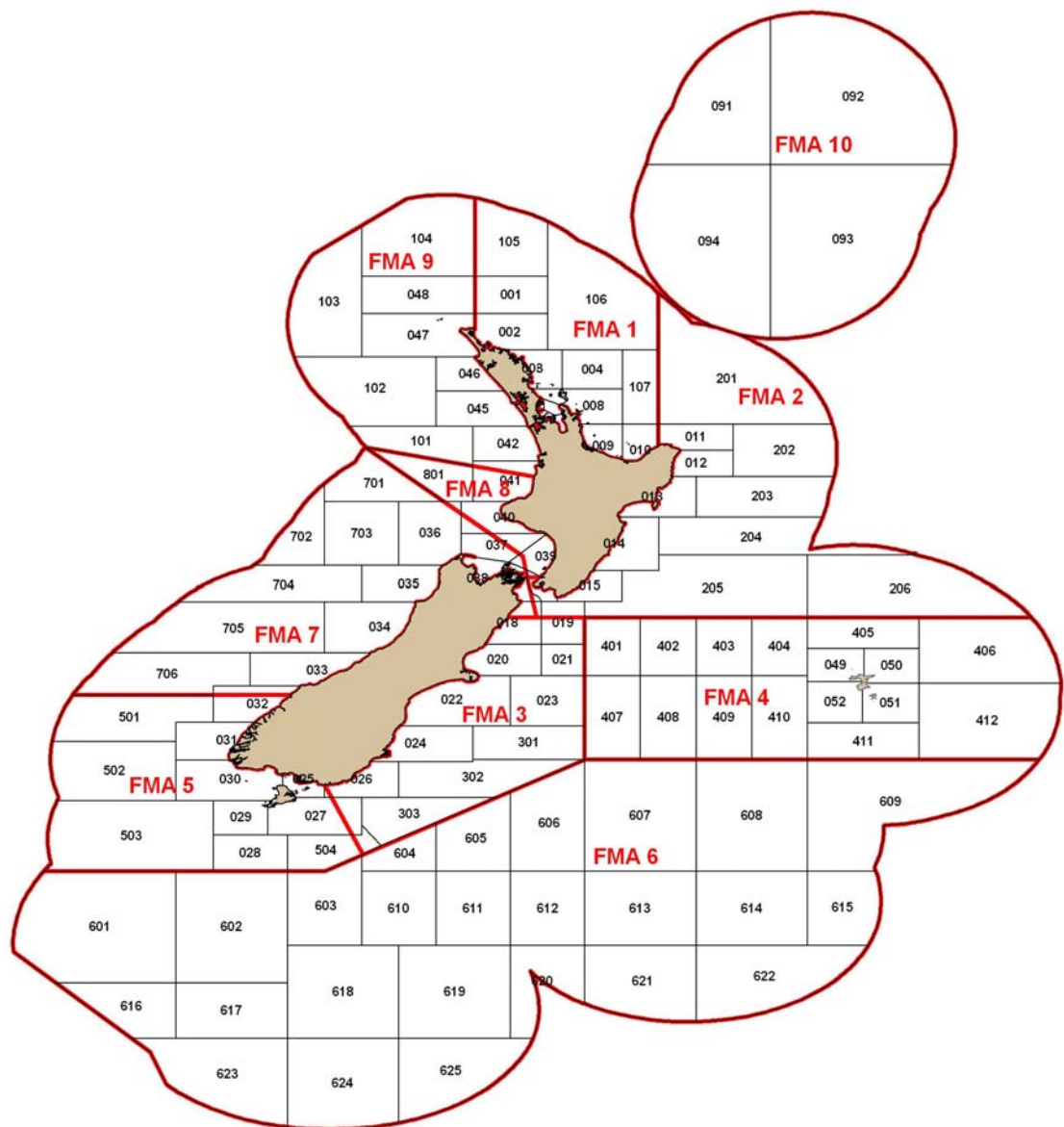


Figure A2: Ministry of Fisheries Statistical Areas and Fishery Management Areas (FMA) within the outer boundary of the New Zealand EEZ.

APPENDIX B: DATA CHECKS APPLIED TO TCEPR AND CELR DATA

Table B1: Primary grooming checks on TCEPR and CELR data.

TCEPR fields	Checked for:	Main problem
Position	Credible position	Outside 200 n. mile NZ EEZ On land
Distance	Within acceptable range	Missing latitude or longitude Missing start or finish or both
Target species	Logical for gear type and area	Typographic error or transcription error Generic or nonsense record Ill-matched target species and gear code
Gear code	Logical for target species	Incorrect code for target
Wingspread	Logical for target species and vessel size	Incorrect values Missing records
Bottom depth	< 1600 m	> 1600 m Zero values
Date	Logical record	Missing data
Vessel fields	Completeness of information	Variation in variables: size, power
Vessel nationality	Sensible	Flag nationality Missing records
CELR fields	Checked for:	Main problem
Position	Logical Statistical Area	Typographic error or transcription error Incorrect area for given gear and target species
Target species	Logical for gear type and area	Missing record Typographic error or transcription error Generic or nonsense record Ill-matched target species and gear code
Gear code	Logical for target species	Incorrect code for target
Date	Logical record	Missing data
Effort number	Credible number for target	Typographic error or transcription error Nonsense record Missing data

APPENDIX C: TCEPR DATA TREATMENT SUMMARIES

1.1 Vessels

Records where there was no vessel key were assigned the vessel key that corresponded to the event keys similar to that with no vessel key record. A total of 19 records (tows) were not able to be assigned a vessel key. Over all the years, 456 vessels completed TCEPRs; however, the final trawl dataset included 449 vessels (Table C1).

Many vessel records were not complete for each year. Where vessel length and power values were missing, the mean length and power reported over the whole dataset for each vessel was assigned to the vessel key. All vessels were categorised by vessel length:

- Vessels ≤ 28 m were grouped into vessel A category ($n = 161$)
- Vessels > 28 m and ≤ 46 were grouped into vessel B category ($n = 48$)
- Vessels > 46 m and ≤ 80 m were grouped into vessel C category ($n = 96$)
- Vessels ≤ 28 m were grouped into vessel A category ($n = 151$).

The spread of vessel length and power values are shown by vessel category in Figure C1, and vessel numbers by gear type are shown in Figure C2. The increase in the number of small vessels completing TCEPRs is evident in the plot showing vessels using bottom trawl gear, with peak numbers over the mid-late 1990s. However, by 2004–05 the number of category A vessels using bottom trawl gear was half that in the peak years. Few of these vessels reported midwater trawl effort near the seafloor. Numbers of Category B and Category C vessels using bottom trawl gear also increased in the mid 1990s, but to a lesser degree. About 30 vessels were in each of these categories in the 2000s. Category D vessels were more likely to use midwater gear and numbers of these vessels have steadily dropped throughout the time series. Many of these large vessels fished for a few years only.

The vessel nationality reported was that of the nation flag, rather than the port of origin. Records where the vessel nationality was null were populated to match the vessel nationality in other years; thus nationality for a vessel was assumed to be constant throughout the dataset, unless data existed to show that the nationality had changed.

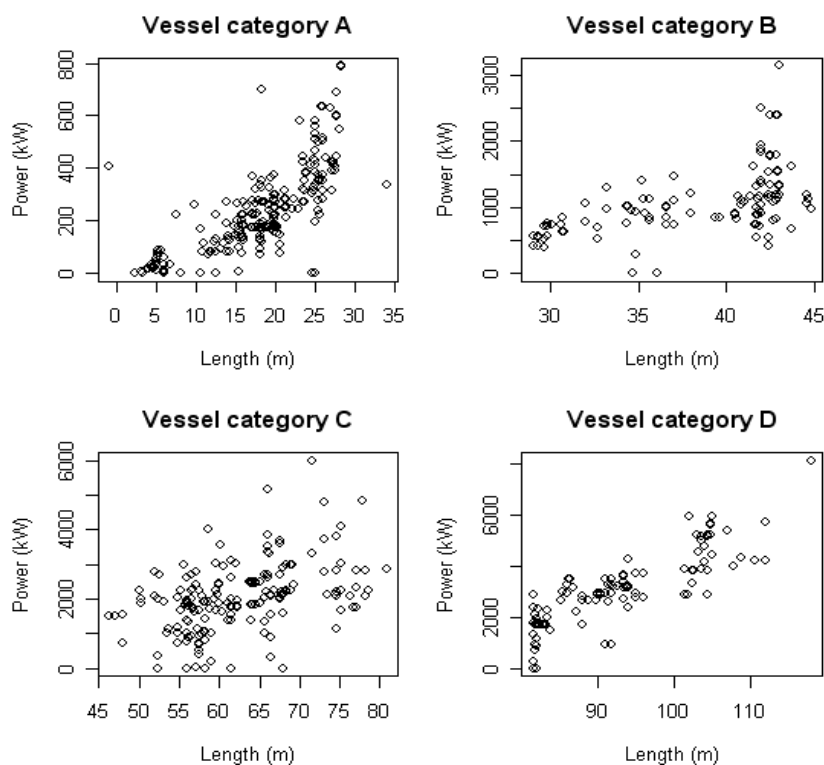


Figure C1: Reported length and power values for TCEPR vessels, 1989–90 to 2004–05.

APPENDIX C — continued

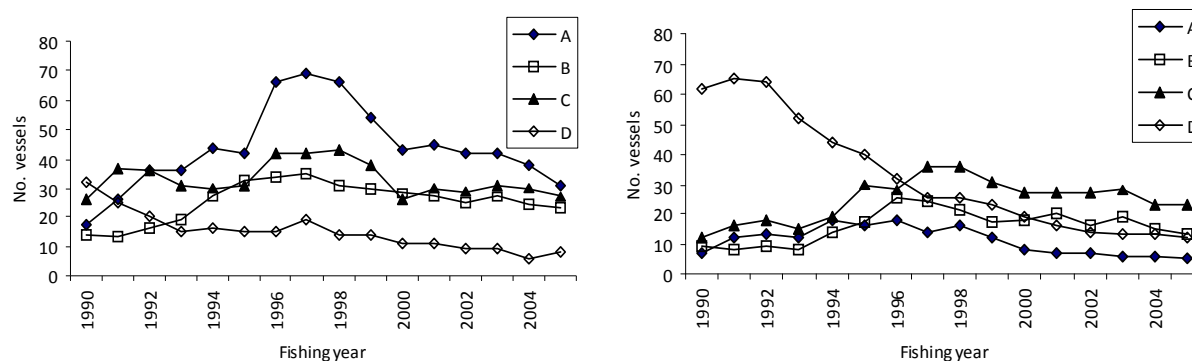


Figure C2: Numbers of vessels using bottom trawl nets (left) and midwater trawl nets within 1 metre of the seafloor (right), by vessel category, for 1989–90 (1990) to 2004–05 (2005).

Where the nationality given did not represent the home port, a new nationality was assigned, based on previous knowledge acquired under MFish projects ENV2000/05 and ENV2003/03. For example, Belize was the reported nationality for one Chinese vessel, four Russian/Ukrainian vessels, and five Korean vessels; Malta was the reported nationality for three Polish vessels; and Panama for two Korean vessels. Vessels from the Russian Federation and Ukraine were combined into a group for the Commonwealth of Independent States (CIS). No foreign vessels used bottom pair trawl nets or Danish seine nets.

1.2 Gear type

With a small number of exceptions, all gear codes were accepted as reported by fishers. A small number of tows in the TCEPR data were coded as ‘MPT’, but these were revised to ‘MW’ after comparison with other records for the charter vessel. Table C1 gives the number of vessels and effort in each category that completed records for the gear types reported on TCEPRs. Note that Danish seine data should be reported on CELRs and are not discussed in this section.

Data for bottom pair trawl vessels were problematic. Each vessel in a pair reported effort; so, to avoid counting effort twice, the records of one vessel for each pair were excluded. Matching the vessels was not always straightforward. The main problems were: paired vessels had different number of tows recorded as ‘BPT’ for what appeared as a trip, and wingspread records were not the same. About half the speed records and 7% of the target species records were different. An arbitrary decision was made to retain the effort of the vessel in each pair with the highest vessel key number. From a total of 14 386 bottom pair trawl records in TCEPR, the resulting total in the final data set was 6996.

1.3 Target species

At least 83 target species codes were reported on TCEPRs where gear codes were BPT, BT, or MW. Some species were combined; for example, oreo species were treated as one group and jack mackerels as another. About 23 target species or species groups were reported for about 99% of the bottom and midwater trawl effort for the 1989–90 to 2004–05 fishing years. These species (and several others) were included in the target species groupings used to summarise the data (see Table C2).

APPENDIX C — continued

Table C1: Numbers of vessels and fishing operations by method reported on TCEPRs, 1989–90 (1990) to 2004–05 (2005).

Year*	Danish seine		Bottom pair trawl		Bottom trawl		Midwater trawl		All trawl	
	Vessels	Nets	Vessels	Tows	Vessels	Tows	Vessels	Tows	Vessels	Tows
1990	0	0	2	55	89	28 145	90	9 350	127	37 550
1991	0	0	1	54	101	32 818	101	12 607	149	45 479
1992	0	0	0	0	108	39 585	103	10 756	155	50 341
1993	0	0	1	13	101	41 096	87	12 294	142	53 403
1994	0	0	4	117	119	39 865	95	13 235	154	53 217
1995	0	0	5	623	121	42 718	101	15 173	160	58 514
1996	2	38	7	751	159	52 709	103	14 142	182	67 602
1997	3	39	2	734	166	58 028	99	13 013	179	71 775
1998	0	0	3	413	155	63 312	98	14 885	172	78 610
1999	0	0	3	652	135	58 738	83	11 582	151	70 972
2000	0	0	3	656	108	54 579	70	10 658	119	65 893
2001	0	0	4	653	113	54 295	70	9 426	120	64 374
2002	0	0	2	422	105	55 298	64	9 678	113	65 398
2003	0	0	4	623	109	53 488	66	10 077	113	64 188
2004	0	0	3	430	98	47 553	57	10 206	106	58 189
2005	0	0	5	804	89	45 198	53	8 913	94	54 915
All	5	77	49	7000	1 889	767 425	1 343	185 995	449	960 420

APPENDIX C — continued

Table C2: Target species, listed alphabetically by common name for each of the eight main target species groups (see Table 2 in section 3.1 in main body of report).

Common name	Scientific name	Code
Group 1		
Arrow squid	<i>Nototodarus sloanii</i> , <i>N. gouldi</i>	SQU
Barracouta	<i>Thyrstites atun</i>	BAR
Blue mackerel	<i>Scomber australasicus</i>	EMA
Blue warehou	<i>Seriola brama</i>	WAR
Frostfish	<i>Lepidopus caudatus</i>	FRO
Gemfish	<i>Rexea solandri</i>	SKI
Ghost shark	<i>Hydrolagus novaezealandiae</i> , <i>H. bemisi</i>	GSH
Jack mackerels	<i>Trachurus declivis</i> , <i>T. murphyi</i> , <i>T. novaezealandiae</i>	JMA
Red cod	<i>Pseudophycis bachus</i>	RCO
Ruby fish	<i>Plagioneion rubiginosum</i>	RBY
Sea perch	<i>Helicolenus</i> spp.	SPE
Silver warehou	<i>Seriola punctata</i>	SWA
Spiny dogfish	<i>Squalus acanthias</i>	SPD
Stargazer	<i>Kathetostoma giganteum</i>	STA
Group 2		
Hake	<i>Merluccius australis</i>	HAK
Hoki	<i>Macruronus novaezealandiae</i>	HOK
Ling	<i>Genypterus blacodes</i>	LIN
White warehou	<i>Seriola caerulea</i>	WWA
Group 3		
Southern blue whiting	<i>Micromesistius australis</i>	SBW
Group 4		
Black cardinalfish	<i>Epigonus telescopus</i>	CDL
Oreos	<i>Alloctytus niger</i> , <i>Neocyttus rhomboidalis</i> , <i>Pseudocyttus maculatus</i>	OEO
Orange roughy	<i>Hoplostethus atlanticus</i>	ORH
Group 5		
Alfonsino	<i>Beryx splendens</i> , <i>B. decadactylus</i>	BYX
Bluenose	<i>Hyperoglyphe antarctica</i>	BNS
Group 6		
John dory	<i>Zeus faber</i>	JDO
Red gurnard	<i>Chelidonichthys kumu</i>	GUR
Snapper	<i>Pagrus auratus</i>	SNA
Tarakihi	<i>Nemadactylus macropterus</i>	TAR
Trevally	<i>Pseudocaranx dentex</i>	TRE
Group 7		
Scampi	<i>Metanephrops challengeri</i>	SCI
Group 8		
Flatfish		FLA

Other than these primary target species, the remaining ‘codes’ included a few true codes (such as for elephant fish, leatherjacket, and school shark), but the remainder were typographical errors, generic codes, or infrequently-used codes (such as OSD, MIX, PRA) that had few tows associated with them (Table C3).

To determine the validity of some of the reported target species, the distribution of the position, gear type, and depth data were investigated. Typographic or transcription errors resulted in corrections to about 2% of the TCEPR target species data; for example, SWA used for SNA in northern waters and shallow depths and SNA for SWA for effort off the Stewart-Snares shelf.

APPENDIX C — continued

Table C3: Records for TCEPR target species codes not included in the Groups 1–8.

Common name	Scientific name	Code	No. tows
Black flounder	<i>Rhombosolea retiaria</i>	BFL	1
Blue cod	<i>Parapercis colias</i>	BCO	54
Blue whaler shark	<i>Prionace glauca</i>	BWS	10
Capro dory	<i>Capromimus abbreviatus</i>	CDO	2
Elephant fish	<i>Callorhinus millii</i>	ELE	156
Fish		FIS	3
Green flounder	<i>Rhombosolea tapirina</i>	GFL	4
Hapuku	<i>Polyprion oxygeneios</i>	HAP	4
Hapuku/bass	<i>Polyprion oxygeneios</i> , <i>P. americanus</i>	HPB	9
Javelin	<i>Lepidorhynchus denticuatus</i>	JAV	3
Kahawai	<i>Arripis trutta</i>	KAH	7
Kingfish	<i>Seriola lalandi</i>	KIN	2
Lanternfish	Myctophidae	MTP	1
Leatherjacket	<i>Parika scaber</i>	LEA	151
Lemon sole	<i>Pelotretis flavilatus</i>	LSO	3
Lookdown dory	<i>Cyttus traversi</i>	LDO	41
Mirror dory	<i>Zenopsis nebulosus</i>	MDO	21
Mix		MIX	18
Moki	<i>Latridopsis ciliaris</i>	MOK	17
New Zealand sole	<i>Peltorhamphus novaezeelandiae</i>	ESO	13
Nil		NIL	6
Null record		unk	381
Oilfish	<i>Ruvettus pretiosus</i>	OFH	8
Orange perch	<i>Lepidoperca aurantia</i>	OPE	5
Other sharks and dogs		OSD	2
Patagonian toothfish	<i>Dissostichus eleginoides</i>	PTO	34
Prawn		PRA	35
Prawn killer	<i>Ibacus alticrenatus</i>	PRK	3
Rattail	Macrouridae	RAT	4
Ray's bream	<i>Brama brama</i>	RBM	5
Red snapper	<i>Centroberyx affinis</i>	RSN	10
Redbait	<i>Emmelichthys nitidus</i>	RBT	2
Ribaldo	<i>Mora moro</i>	RIB	8
Rig	<i>Mustelus lenticulatus</i>	SPO	18
Rough skate	<i>Dipturus nasutus</i>	RSK	38
Rubbish		RUB	1
Sand flounder	<i>Rhombosolea plebeia</i>	SFL	24
Scarlett wrasse	<i>Pseudolabrus miles</i>	SPF	1
School shark	<i>Galeorhinus galeus</i>	SCH	109
Silver dory	<i>Cyttus novaezeelandiae</i>	SDO	21
Skate		SKA	32
Smooth skate	<i>Dipturus innominatus</i>	SSK	98
Southern boarfish	<i>Pseudopentaceros richardsoni</i>	SBO	7
Sowfish	<i>Paristiopterus labiosus</i>	BOA	4
Spider crabs		SPI	151
Spotted gurnard	<i>Pterygotrigla picta</i>	JGU	1
Tam o shanter urchin	<i>Araeosoma splendens</i>	ASP	6
Trumpeter	<i>Latris lineata</i>	TRU	31
Yellow-eyed mullet	<i>Aldrichetta forsteri</i>	YEM	1

APPENDIX C — continued

1.4 Species groups

As a pragmatic way of dealing with the large number of species, groups of species (see Table C2) were defined primarily by the depths at which they were fished, with the assumption that fishers targeted certain species with similar gear and in similar areas, based on knowledge from previous work and discussions with fishing industry representatives. The spread of depths fished for the species of each group is given in Table C4, based on the bottom depth TCEPR records. Note that these depth data have not been groomed extensively and the outliers are likely to be typographic errors.

Table C4: Numbers of TCEPR tows by 100-m depth zones for target species included in the Groups 1–8. Note that the depths given are the reported bottom depths. Species codes are given in Table C2.

Depth (m)	Group 1 species													
	BAR	EMA	FRO	GSH	JMA	RBY	RCO	SKI	SPD	SPE	SQU	STA	SWA	WAR
100	12032	1	8	7	8783	3	8183	183	250	46	1812	633	48	1564
200	18295	61	114	91	23358	122	5261	1364	369	197	84495	552	819	917
300	5644	28	197	15	2779	514	2715	5193	181	144	36637	203	2069	27
400	683	0	26	5	297	247	925	5537	71	119	7931	50	3047	12
500	67	0	0	1	93	44	432	643	17	277	622	22	1929	1
600	23	1	1	0	46	8	76	71	3	7	149	2	581	1
700	6	0	0	0	15	1	3	10	0	0	95	0	125	3
800	6	1	0	0	10	1	1	1	0	0	44	0	131	0
900	3	0	0	0	3	2	0	0	0	0	10	0	6	0
1000	4	0	0	0	0	0	2	1	0	0	2	0	2	0
1100	5	0	0	0	0	0	4	1	0	0	2	1	0	0
1200	4	0	0	0	1	0	1	1	0	0	0	0	0	0
1300	2	0	0	0	1	0	1	0	0	0	1	0	0	0
1400	0	0	0	0	1	0	1	0	0	1	2	0	1	0
1500	1	0	0	0	1	0	2	0	0	0	2	0	0	0
1600	0	0	0	0	0	0	0	0	0	0	2	0	0	0
All	36775	92	346	119	35388	942	17607	13005	891	791	131806	1463	8758	2525

Depth (m)	Group 2				Group 3	Group 4			Group 5	
	HAK	HOK	LIN	WWA		OEO	ORH	CDL	BNS	BYX
100	6	462	24	1	1	25	101	8	1	15
200	16	8397	190	6	9	21	68	0	11	25
300	18	15201	211	39	469	5	14	4	509	1047
400	140	27002	964	298	1763	4	22	19	903	3709
500	4517	80417	2337	625	6859	22	43	218	243	2356
600	2886	99121	2128	532	1989	49	216	1123	176	1398
700	1986	42926	1736	118	56	549	2750	1848	40	547
800	1247	26231	324	73	10	2196	13006	2590	11	177
900	218	4249	4	20	3	8843	21799	1307	3	60
1000	5	827	0	0	2	15040	28403	754	1	39
1100	0	169	1	0	0	8956	17267	191	1	25
1200	0	26	0	0	0	2080	7869	90	0	3
1300	0	9	0	0	0	447	2958	30	0	4
1400	0	4	0	0	0	109	988	7	0	2
1500	0	1	0	0	0	11	163	1	0	0
1600	0	2	0	0	0	0	23	0	1	0
All	11039	305044	7919	1712	11161	38357	95690	8190	1900	9407

APPENDIX C — continued

Table C4 — continued

Depth (m)	Group 6					Group 7	Group 8
	GUR	JDO	SNA	TAR	TRE	SCI	FLA
100	11963	11226	52421	8548	23412	151	1290
200	611	1736	5844	18086	1818	33	9
300	25	19	32	3867	30	677	0
400	2	6	19	195	2	39024	0
500	1	1	9	30	0	25146	0
600	0	2	5	3	3	2618	0
700	0	1	2	1	1	26	0
800	2	0	1	2	2	13	0
900	1	1	3	1	0	7	0
1000	0	0	5	5	1	18	0
1100	0	0	2	1	0	0	0
1200	0	0	0	0	1	3	0
1300	0	0	1	0	1	0	0
1400	0	0	0	0	0	1	0
1500	0	0	1	1	0	0	0
1600	0	0	0	2	0	1	0
All	12605	12992	58345	30742	25271	67718	1299

Group 1 species are fished mainly in waters down to about 400–500 m; Group 2 and Group 3 species are middle depths targets; Group 4 are fished in deepwater (800–1200 m), often on hills; Group 5 mainly in 300–600 m; Group 6 and Group 8 are shallow water targets, generally shallower than 200 m; and Group 7 (scampi) is targeted in about 400–600 m. In the larger groups many species are targeted in similar areas, and some targeting of species within the same group may be spatially separated (particularly in Group 1), but the gear used within an area is likely to be similar. For example, smaller vessels target barracouta in northern waters, whereas larger vessels target the species in more southern waters.

1.5 Position data

The resolution of the position data for the TCEPR work was to the nearest nautical mile. These data were plotted by target species to determine the general validity of the recorded position values. For most target species, there were records that either indicated:

- impossibly long (distance) tows
- tows with identical start and finish positions; these are effectively points
- tows with a start or finish position only; also effectively points
- tows with errors about 180°, implying an incorrectly recorded ‘E’ or ‘W’
- tows with no position data
- tows on land, either partially or completely; those with one position on land effectively become points
- tows outside the outer boundary of the New Zealand 200 n.mile EEZ.

APPENDIX C — *continued*

The following approach was used to deal with the above problem tows.

- Long tows. These were identified in the grooming of the ‘estimated distance’ variable obtained for each tow from the given start and end latitude and longitude and assigned a median length (see section 1.6 below). This length was truncated at whichever end was consistent with the vessel data to the median distance for that category of vessel and target fishery.
- A similar approach was taken for those tows that had only a start or finish position.
- Tows with the same start and finish data were assigned the median distance according to target species and vessel category, as described in the distance section. Position data were generated accordingly for one end of the tow.
- Tows with the 180° error were assigned the correct offset longitude.
- Tows on land were defined as those that crossed land (that is, had start and finish positions at sea, but on opposite sides of the land mass), started on land, finished on land, or were completely on land. These tows represented 0.25% of all TCEPR data, and most were those that crossed the land ($n = 1209$). The tows that crossed land were corrected manually by referring to the appropriate effort. Those that started or finished on land became tows that had one position data point, and tows completely on the land were left unchanged (and will not be included in the final analyses).
- The few tows outside the EEZ were flagged as such so they can be filtered out for the final analyses.

1.6 Distance measures

Tow lengths were determined from the start and finish positions. These were plotted by vessel category and target species to determine a range and a median value. The spread of values in each vessel category are characterised by differences in the distance ranges for each target species. Typically, the percent of records that were assigned a median value represented < 5% of the target species grouping within a fishing year (Table C5). Median distances for the main target species are given in Table C6.

The higher percentages seen in the Group 4 data represent changes made to the zero, or close to, distances reported for orange roughy and oreo tows made on hills (especially after 1993–94) and to those tows longer than 30 km. Short tows on hills may record the same start and finish position. To better incorporate the swept area of such tows that targeted species caught on hills, such as OEO, ORH, CDL, BYX, and BNS, we assigned a median distance value. This was derived by taking a median value of all point tows (by target and vessel category) where the distance derived from speed and time was less than 1.5 km.

1.7 Duration

Fishing duration was estimated from the start (when the net reached the desired fishing depth) and finish (when the net left the fishing depth) times reported on TCEPRs. Where an unrealistic time was derived, the median time was assigned. Median times are given in Table C7, and the proportions of tows that were amended are given in Table C8, for each year for each target species group.

APPENDIX C — continued

Table C5: Percentage of effort where changes were made to TCEPR distance data (as measured between start and fishing positions), by fishing year and target species group.

Fishing year	Group1	Group2	Group3	Group4	Group5	Group6	Group7	Group8	Other	All
1990	3.6	2.5	2.6	10.4	0.0	6.7	6.8	—	5.0	4.9
1991	2.5	2.4	2.7	6.4	0.0	5.4	2.9	0.0	8.5	3.2
1992	4.0	3.1	3.1	7.2	0.6	4.5	3.3	8.3	0.0	4.1
1993	4.3	4.2	3.6	8.4	2.6	7.0	3.9	1.1	1.7	5.0
1994	4.4	4.2	3.7	11.8	6.6	7.1	3.3	1.8	3.8	6.1
1995	5.4	4.5	2.2	19.5	5.9	6.6	3.6	3.0	7.5	7.7
1996	3.7	3.3	1.4	19.2	5.6	6.6	2.7	4.3	10.9	6.0
1997	3.6	3.3	2.7	16.0	3.4	5.0	2.4	4.5	3.5	5.3
1998	3.4	3.8	1.8	10.9	3.3	4.4	2.7	7.4	2.5	4.9
1999	3.4	3.1	2.6	16.8	13.0	4.0	3.2	4.0	6.9	5.6
2000	3.8	3.8	0.7	15.4	4.0	3.9	1.4	2.6	0.0	5.3
2001	2.8	3.3	0.9	9.7	1.3	2.8	1.2	0.0	0.0	3.7
2002	2.7	4.0	1.8	7.3	1.5	2.5	1.1	0.0	0.0	3.5
2003	2.6	5.1	1.4	6.6	1.6	2.6	1.9	0.0	0.0	3.9
2004	2.6	6.0	1.9	8.2	3.8	3.1	1.1	0.0	1.2	4.4
2005	3.5	5.8	0.3	4.8	1.7	2.4	1.5	0.0	0.0	3.7
All	3.6	3.9	2.3	11.7	3.6	4.0	2.5	3.4	3.8	4.9

1.8 Wingspread and doorspread

The distribution of reported wingspread values was plotted for bottom trawls and midwater trawls separately, by vessel category and target species, to determine an acceptable range of wingspread values. Where a wingspread value was outside this distribution (including null values), the median for that target species and vessel category was applied. Lower limits were applied: for example, a lower limit for vessel A using bottom trawl gear was 5 m, 10 m for vessel B, 15 m for vessel C, and 20 m for vessel D. The distribution of the wingspread data amended for upper limit and nulls (but not yet for the lower limit) is shown in Appendix D for each species group.

Over all the TCEPR bottom trawl data, median wingspread values were assigned to 7% of data: 13% of Vessel A data, 6.5% of vessel B data, 4% of vessel C data, and 3% of Vessel D data. Representatives of the fishing industry, including net makers, agreed that the ranges of median wingspread values were acceptable. We acknowledge that the use of twin-rigs is not recognised in these data. We reviewed some observer data in an attempt to get a better understanding of reported wingspreads, particularly with relevance to the use of twin-rig trawls, but we found large variations in the reports of wingspread values by observers. Current work confirmed our suspicions that fishers have their own methods of determining wingspread and these methods are not consistent within fleets (R. Hurst, NIWA, pers. comm.). For the midwater trawl data, 2% of tows were assigned a median wingspread: 20% of vessel A data, 3% of vessel B data, 2% of vessel C data, and 2% of vessel D data.

APPENDIX C — continued

Table C6: Summary data for distance derived values (km), including medians used to correct records, by main target species* for bottom and midwater trawl gear.

Species	Bottom trawl						Species	Midwater trawl					
	Minimum	1st quartile	Median	Mean	3rd quartile	Maximum		Minimum	1st quartile	Median	Mean	3rd quartile	Maximum
BAR	0.18	13.02	18.74	19.52	25.01	55.99	BAR	0.14	13.58	22.28	22.47	30.29	55.97
BNS	0.92	1.34	1.86	2.07	2.29	9.61	BNS	0.44	2.28	3.82	4.38	5.72	14.00
BYX	0.27	1.84	2.28	2.95	3.70	9.92	BYX	0.10	2.32	3.71	3.78	4.67	10.01
CDL	0.15	1.84	2.96	3.43	4.70	9.94	CDL	0.59	2.34	3.79	3.90	5.55	8.17
GUR	0.73	10.43	17.69	17.46	23.34	39.99	GUR	–	–	–	–	–	–
HAK	0.62	10.82	33.93	32.35	49.15	80.01	HAK	0.14	6.20	15.78	18.46	26.75	79.90
HOK	0.14	13.04	24.16	23.41	32.69	56.01	HOK	0.04	7.09	15.41	17.53	25.98	56.00
JDO	0.45	7.54	11.20	11.76	15.46	29.98	JDO	–	–	–	–	–	–
JMA	0.28	16.73	27.19	26.86	36.21	64.79	JMA	0.23	12.36	20.37	21.26	28.71	59.98
LIN	0.65	16.53	26.43	27.72	37.40	79.63	LIN	2.22	9.41	12.14	11.98	13.79	19.17
OEO	0.12	1.32	2.47	4.60	5.39	30.01	OEO	0.97	2.31	2.31	3.22	4.37	6.16
ORH	0.20	1.51	3.30	5.79	7.38	30.01	ORH	0.62	2.33	4.05	7.04	9.71	33.25
RCO	0.21	11.43	16.67	17.20	22.22	40.01	RCO	1.37	14.18	20.52	19.95	25.11	38.83
SCI	0.14	18.55	25.57	24.35	31.58	55.98	SCI	–	–	–	–	–	–
SKI	1.00	10.09	19.47	19.69	26.98	56.01	SKI	0.15	2.34	3.42	4.58	4.69	72.27
SNA	0.38	8.16	12.62	12.99	17.24	39.67	SNA	–	–	–	–	–	–
SQU	0.12	12.89	22.34	22.94	31.99	56.00	SQU	0.12	15.91	23.55	24.07	31.82	56.01
SWA	0.18	14.55	25.29	27.21	37.94	79.93	SWA	1.84	13.29	19.33	22.81	31.75	65.04
TAR	0.29	14.87	19.87	20.09	25.59	40.00	TAR	–	–	–	–	–	–
TRE	0.66	12.32	17.62	17.36	22.10	52.01	TRE	–	–	–	–	–	–
WAR	0.25	11.55	19.74	19.90	27.17	57.05	WAR	0.59	8.82	17.86	19.53	27.69	54.68
WWA	1.16	4.12	7.42	10.79	14.93	39.62	WWA	5.32	11.66	21.41	18.24	23.41	29.06

* Codes are defined in Table C2.

APPENDIX C — continued

Table C7: Summary data for duration derived values (h), including medians used to correct records, by main target species* for bottom and midwater trawl gear.

Species	Bottom trawl						Species	Midwater trawl					
	Minimum	1st quartile	Median	Mean	3rd quartile	Maximum		Minimum	1st quartile	Median	Mean	3rd quartile	Maximum
BAR	0.06	2.75	3.50	3.65	4.33	12.00	BAR	0.08	2.25	3.25	3.56	4.33	12.00
BNS	0.01	0.15	0.18	0.34	0.26	7.33	BNS	0.05	0.25	0.46	0.73	0.83	9.63
BYX	0.01	0.15	0.23	0.49	0.58	10.21	BYX	0.01	0.33	0.56	0.79	1.00	10.81
CDL	0.01	0.25	0.50	0.62	0.83	10.76	CDL	0.05	0.31	0.61	0.66	0.91	2.08
GUR	0.03	2.50	3.50	3.43	4.16	11.41	GUR	—	—	—	—	—	—
HAK	0.05	4.58	6.25	6.24	7.83	12.00	HAK	0.05	3.08	4.41	4.68	5.83	12.00
HOK	0.01	3.00	4.00	3.91	4.91	12.00	HOK	0.01	1.41	2.83	3.03	4.16	12.00
JDO	0.08	2.00	2.58	2.63	3.25	11.75	JDO	—	—	—	—	—	—
JMA	0.01	3.25	4.25	4.40	5.33	12.00	JMA	0.08	1.83	2.66	2.88	3.66	12.00
LIN	0.08	3.75	5.00	5.20	6.33	12.00	LIN	1.00	1.50	1.71	1.74	2.08	2.66
OEO	0.01	0.23	0.41	0.85	1.00	11.83	OEO	0.16	0.21	0.25	1.01	1.00	3.41
ORH	0.01	0.23	0.50	1.05	1.33	12.00	ORH	0.06	0.33	0.67	1.43	2.04	9.90
RCO	0.01	2.25	3.00	3.30	4.00	12.00	RCO	0.33	2.00	2.75	2.61	3.08	5.58
SCI	0.01	4.91	6.00	5.86	7.00	12.00	SCI	—	—	—	—	—	—
SKI	0.01	2.18	4.00	3.89	5.08	12.00	SKI	0.01	0.33	0.46	0.79	0.6600	1.16
SNA	0.01	1.75	2.50	2.42	3.00	12.00	SNA	—	—	—	—	—	—
SQU	0.01	2.91	4.00	4.15	5.16	12.00	SQU	0.05	2.41	3.33	3.40	4.33	12.00
SWA	0.16	3.00	4.25	4.55	5.91	12.00	SWA	0.33	1.83	2.58	3.33	4.58	11.41
TAR	0.01	3.00	4.00	4.02	5.00	12.00	TAR	—	—	—	—	—	—
TRE	0.08	2.25	3.00	2.97	3.50	12.00	TRE	—	—	—	—	—	—
WAR	0.06	3.00	4.00	4.38	5.33	11.91	WAR	0.16	3.43	5.50	5.83	8.33	12.00
WWA	0.08	1.66	2.91	3.13	4.50	10.91	WWA	2.33	2.95	3.79	4.39	5.06	10.16

* Codes are defined in Table C2.

APPENDIX C — continued

Table C8: Percentage of effort where changes were made to TCEPR distance data (as measured between start and fishing positions), by fishing year and target species group.

Fishing year	Group1	Group2	Group3	Group4	Group5	Group6	Group7	Group8
1990	0.4	0.6	0.7	0.6	0.0	2.2	2.3	
1991	0.2	0.3	0.4	0.7	0.8	0.4	0.7	0.0
1992	0.6	0.4	1.0	0.9	0.0	0.2	0.5	1.8
1993	0.6	0.5	0.6	1.1	0.3	0.1	1.2	0.0
1994	0.6	0.5	2.9	0.8	0.3	0.4	1.0	0.6
1995	0.3	0.4	0.5	0.9	0.9	0.8	1.0	0.0
1996	0.6	0.8	1.1	1.3	1.8	1.2	1.1	0.8
1997	0.6	1.3	0.3	1.9	2.1	0.9	1.3	0.0
1998	0.7	1.1	2.0	1.5	2.7	0.8	1.5	0.0
1999	0.6	0.7	2.9	1.3	1.4	0.8	1.2	0.0
2000	0.6	0.6	2.5	1.2	1.1	0.7	1.0	0.0
2001	0.4	0.6	0.9	0.7	0.3	0.4	0.4	0.0
2002	0.4	0.4	2.5	0.6	0.7	0.3	0.9	0.0
2003	0.3	0.8	3.1	0.9	1.1	0.3	1.5	0.0
2004	0.5	1.0	3.0	0.5	0.9	0.2	1.5	0.0
2005	0.7	1.0	3.0	0.6	0.5	0.3	0.7	0.0
All	0.5	0.7	1.5	1.0	1.0	0.6	1.0	0.5

A measure of the distance between the trawl doors was not collected on the TCEPR forms, but because doorspread gives a better measure of the contact with the seafloor for the bottom trawls, we applied generic doorspread values to target species and vessel category groupings for bottom trawl effort (Table C9). These measures were based on discussions and knowledge of fishers, net makers, and researchers and agreement on their use, in the absence of real data, was granted by the Aquatic Environment Working Group. Note that the doorspread value for twin-rigs will not be catered for adequately in this work. We have assigned 200 m to a hoki trawl for doorspread, but if the vessel operated a twin-rig, this value could be more like 400–450 m. The groomed wingspread values for midwater gear flown near the seafloor were considered to approximate the doorspread values and were assigned to doorspread field (see Appendix D figures).

1.9 Speed

We applied similar rules as described above to the reported tow speed data. We determined an appropriate range (by target species and vessel category) and assigned median speeds to those tows that fell outside the range. Few records were changed. Median values are given in Table C10.

APPENDIX C — *continued*

Table C9: Number of TCEPR bottom trawl nets in each species group*, by assigned vessel categories† and generic doorspread values, for all years 1989–90 to 2004–05. Ranges of values for midwater nets are shown in species group summaries in Appendix C.

Species group	Vessel A doorspread (m)		Vessel B doorspread (m)			Vessel C doorspread (m)				Vessel D doorspread (m)		
	70	90	70	90	100	70	100	150	200	100	150	200
1	0	38 190	0	0	19 306	0	2 710	78 806	0	245	20 866	0
2	0	4 715	0	0	29 565	0	0	7 820	177 847	0	801	25 352
3	0	0	0	0	0	0	0	820	0	0	138	0
4	0	12 918	0	0	84 062	0	0	43 911	0	0	2 388	0
5	0	390	0	0	6 156	0	516	0	0	4	0	0
6	0	115 354	0	21 799	11	0	0	54	0	0	10	0
7	62 574	0	6243	0	0	953	0	0	0	0	0	0
8	0	1 304	0	0	0	0	0	0	0	0	0	0
Other	0	920	0	0	354	0	0	212	0	0	65	0

* Species groups are defined in Tables 2 & C2.

† Vessel A: < 28 m. Vessel B: 28–46 m. Vessel C: 46–80 m. Vessel D: > 80 m.

APPENDIX C — continued

Table C10: Summary data for tow speed (kn.), including medians used to correct records, by main target species* for bottom and midwater trawl gear.

Species	Bottom trawl						Species	Midwater trawl					
	Minimum	1st quartile	Median	Mean	3rd quartile	Maximum		Minimum	1st quartile	Median	Mean	3rd quartile	Maximum
BAR	0.5	3.2	3.5	3.6	4.0	5.0	BAR	2.0	4.0	4.4	4.5	4.8	7.7
BNS	2.3	3.0	3.5	3.3	3.5	4.0	BNS	2.6	3.3	3.5	3.4	3.5	4.0
BYX	0.2	3.0	3.5	3.5	3.5	5.0	BYX	0.3	3.0	3.5	3.3	3.5	5.0
CDL	2.0	3.0	3.0	3.1	3.5	4.0	CDL	2.8	3.0	3.1	3.3	3.5	4.0
GUR	1.5	2.9	3.0	3.1	3.3	4.0	GUR	—	—	—	—	—	—
HAK	2.4	3.9	4.0	4.1	4.2	5.0	HAK	2.8	4.0	4.0	4.1	4.2	5.0
HOK	0.5	4.0	4.4	4.2	4.5	5.0	HOK	0.1	3.9	4.0	4.0	4.3	5.0
JDO	1.9	2.8	3.0	2.9	3.0	3.7	JDO	—	—	—	—	—	—
JMA	1.5	4.2	4.5	4.5	4.8	6.0	JMA	2.0	4.7	5.1	5.0	5.4	9.0
LIN	1.5	3.6	4.0	3.9	4.2	5.0	LIN	3.5	4.0	4.0	4.0	4.0	4.5
OEO	1.7	3.0	3.0	3.1	3.4	4.0	OEO	2.0	3.1	3.1	3.2	3.9	4.0
ORH	1.2	3.0	3.0	3.0	3.0	4.0	ORH	2.4	3.0	3.0	3.1	3.5	4.8
RCO	1.5	3.0	3.2	3.3	3.5	5.0	RCO	3.5	4.1	4.5	4.3	4.5	4.5
SCI	0.4	2.4	2.7	2.6	2.8	3.0	SCI	—	—	—	—	—	—
SKI	1.8	3.0	3.0	3.1	3.2	4.9	SKI	1.8	3.4	3.5	3.4	3.5	4.8
SNA	0.3	3.0	3.0	3.1	3.2	5.5	SNA	—	—	—	—	—	—
SQU	1.0	3.9	4.2	4.1	4.5	5.0	SQU	0.8	4.0	4.3	4.3	4.5	5.0
SWA	1.0	3.8	4.0	4.0	4.3	5.0	SWA	3.0	3.8	4.3	4.2	4.5	5.3
TAR	0.5	2.8	3.0	3.0	3.1	4.5	TAR	—	—	—	—	—	—
TRE	0.8	3.0	3.3	3.3	3.5	4.0	TRE	—	—	—	—	—	—
WAR	1.8	3.4	3.5	3.6	4.0	5.0	WAR	2.0	4.1	4.3	4.4	4.6	5.5
WWA	2.0	4.0	4.0	3.9	4.0	4.5	WWA	2.6	3.9	4.1	4.0	4.3	4.4

* Species codes are defined in Table C2.

APPENDIX D: TARGET SPECIES GROUP VARIABLES REPORTED ON TCEPRS

GROUP 1

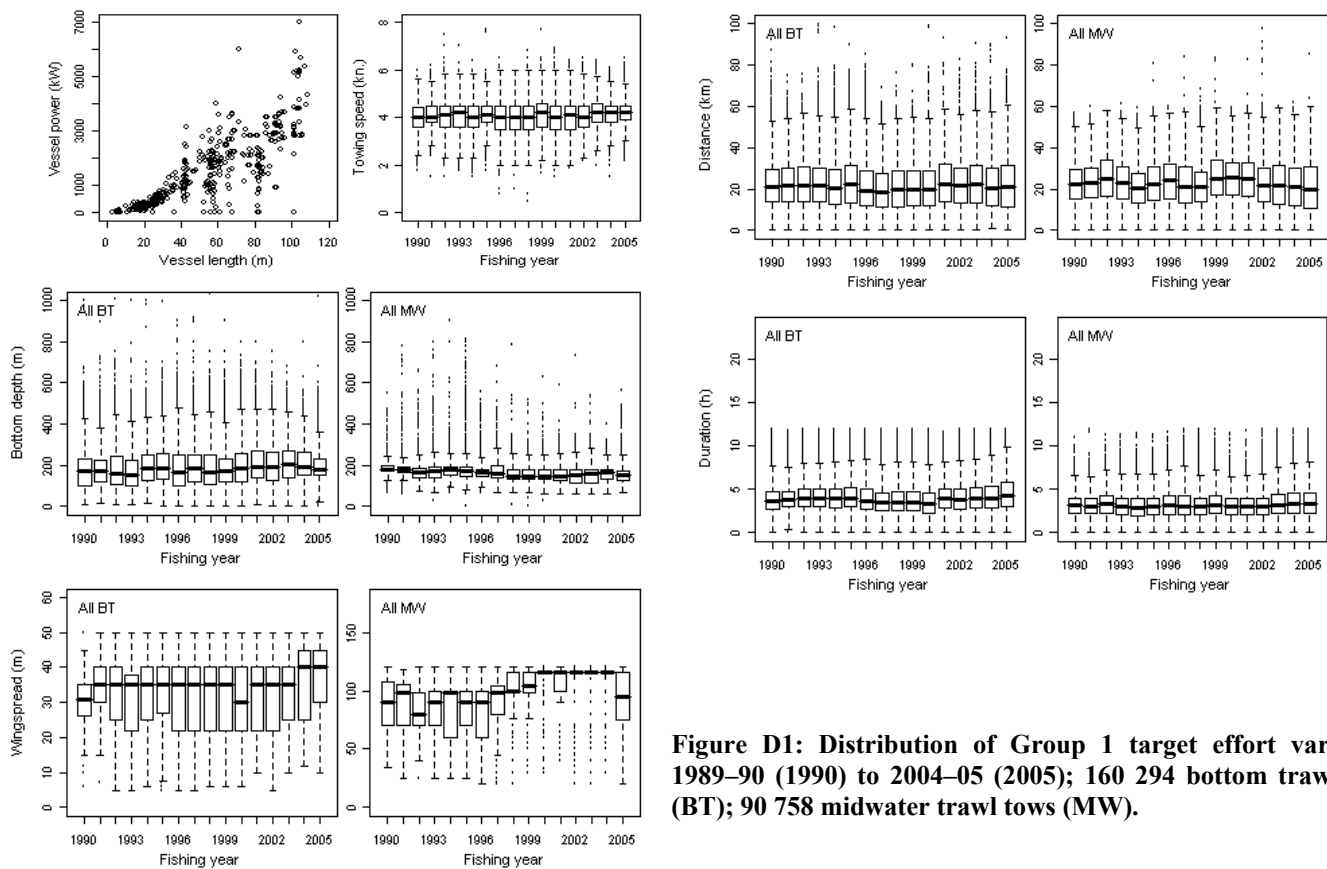


Figure D1: Distribution of Group 1 target effort variables, 1989–90 (1990) to 2004–05 (2005); 160 294 bottom trawl tows (BT); 90 758 midwater trawl tows (MW).

GROUP 2

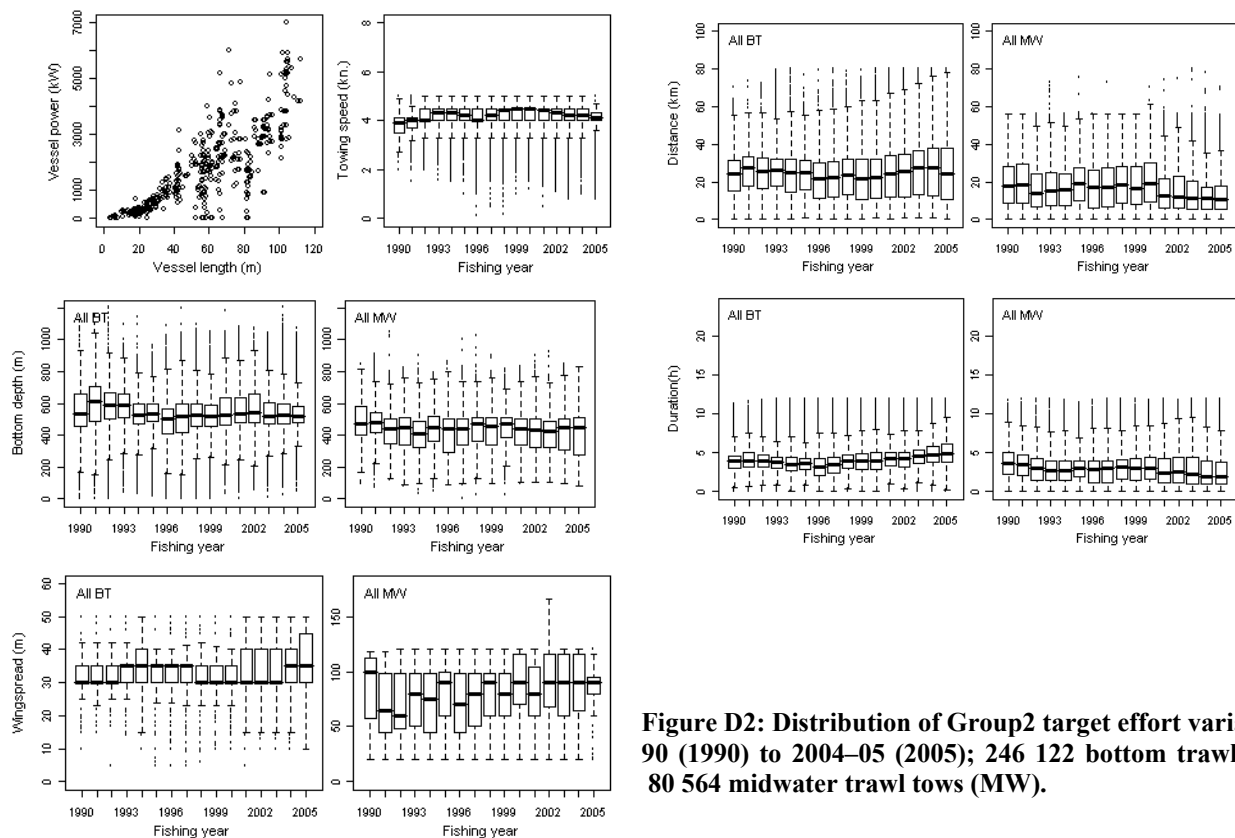


Figure D2: Distribution of Group 2 target effort variables, 1989–90 (1990) to 2004–05 (2005); 246 122 bottom trawl tows (BT); 80 564 midwater trawl tows (MW).

APPENDIX D — continued

GROUP 3

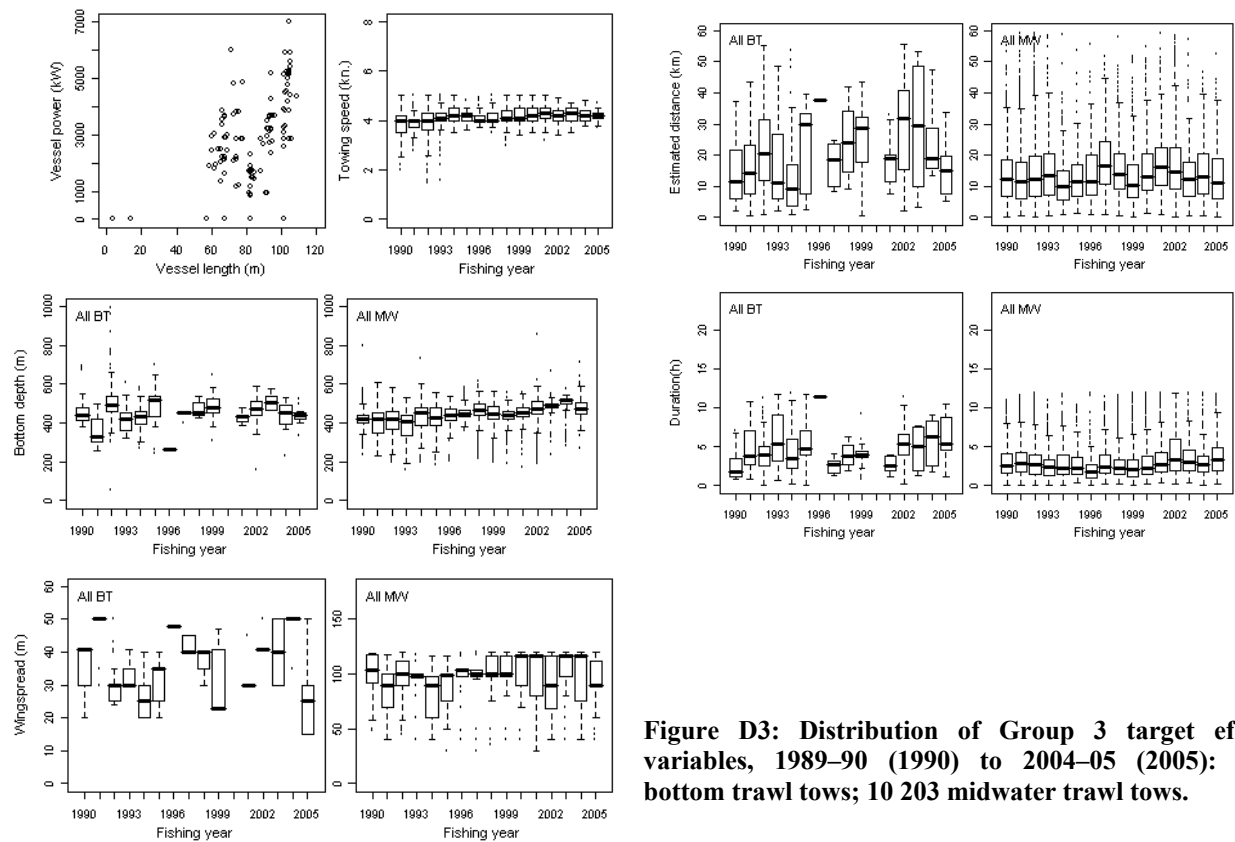


Figure D3: Distribution of Group 3 target effort variables, 1989-90 (1990) to 2004-05 (2005): 958 bottom trawl tows; 10 203 midwater trawl tows.

GROUP 4

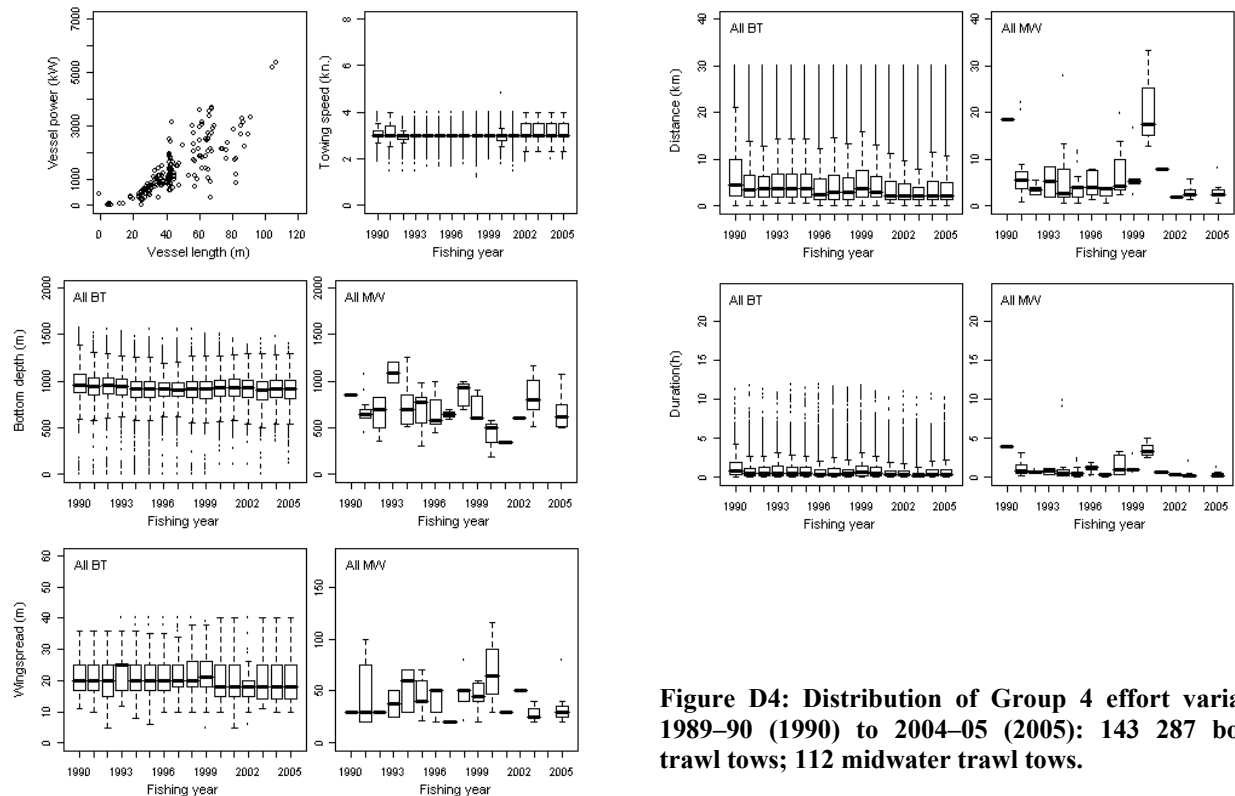


Figure D4: Distribution of Group 4 effort variables, 1989-90 (1990) to 2004-05 (2005): 143 287 bottom trawl tows; 112 midwater trawl tows.

APPENDIX D — continued

GROUP 5

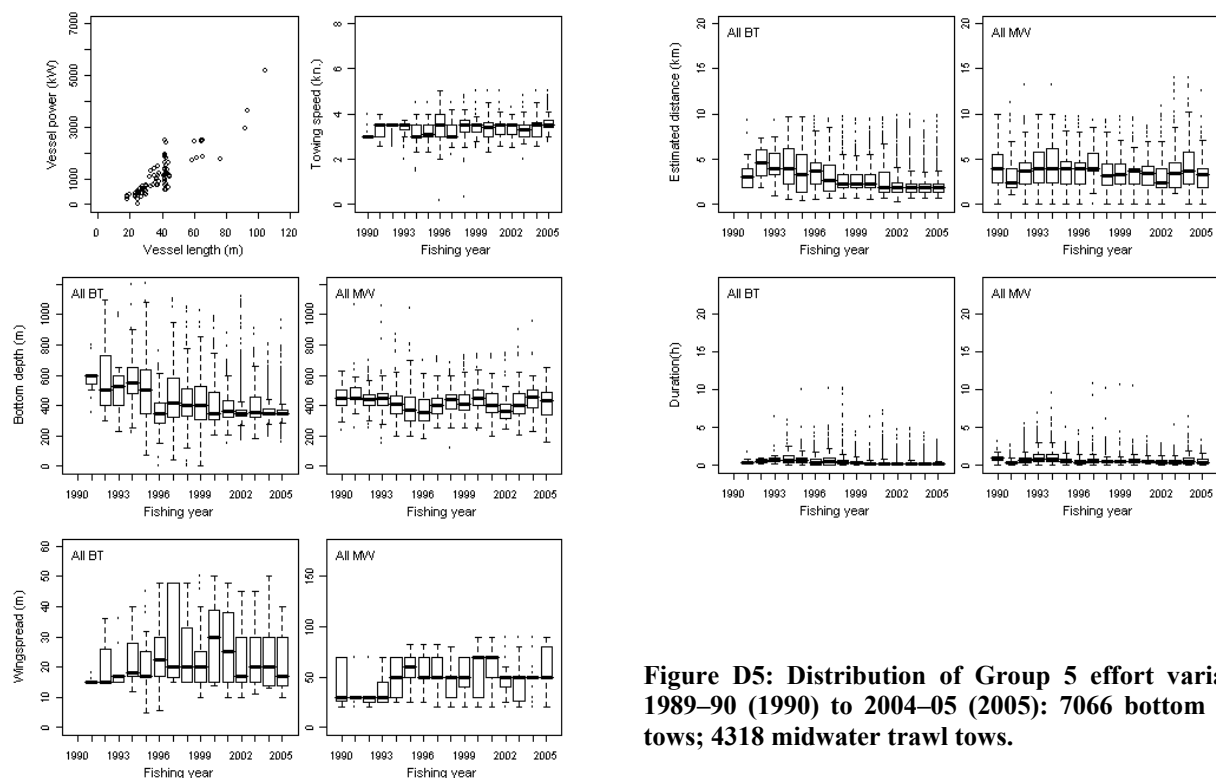


Figure D5: Distribution of Group 5 effort variables, 1989-90 (1990) to 2004-05 (2005): 7066 bottom trawl tows; 4318 midwater trawl tows.

GROUP 6

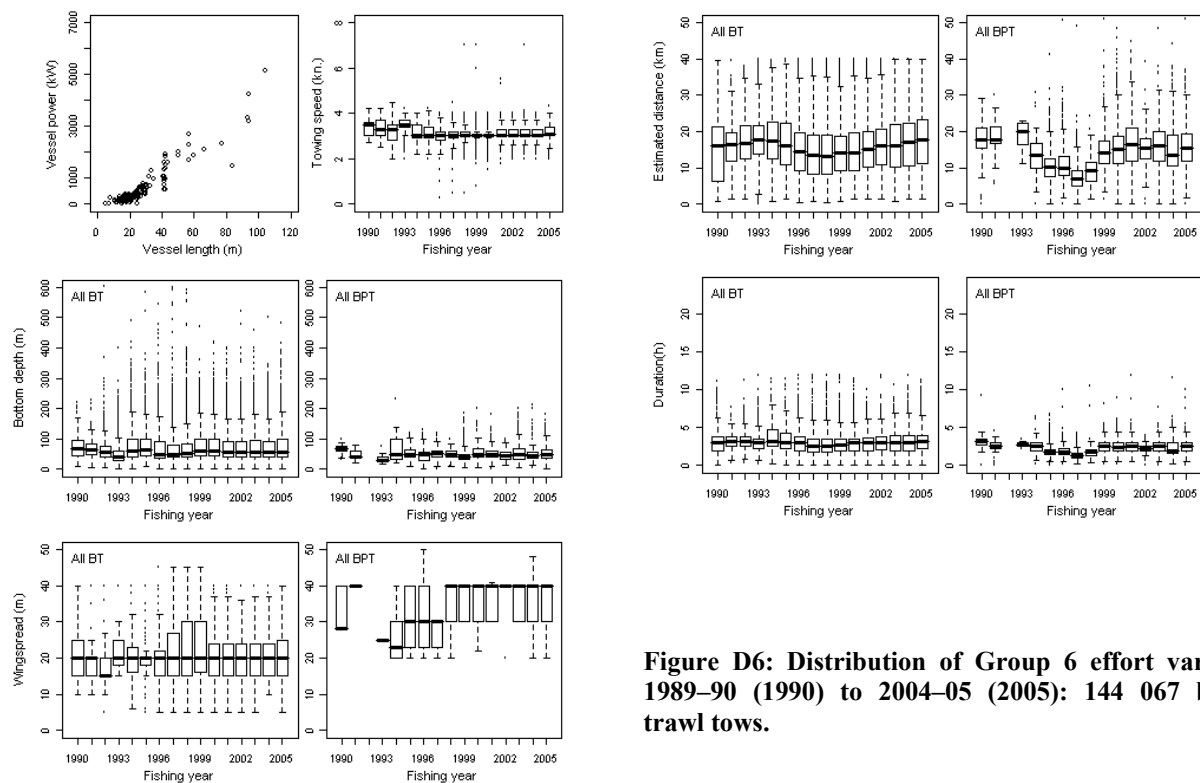


Figure D6: Distribution of Group 6 effort variables, 1989-90 (1990) to 2004-05 (2005): 144 067 bottom trawl tows.

APPENDIX D — *continued*

GROUP 7

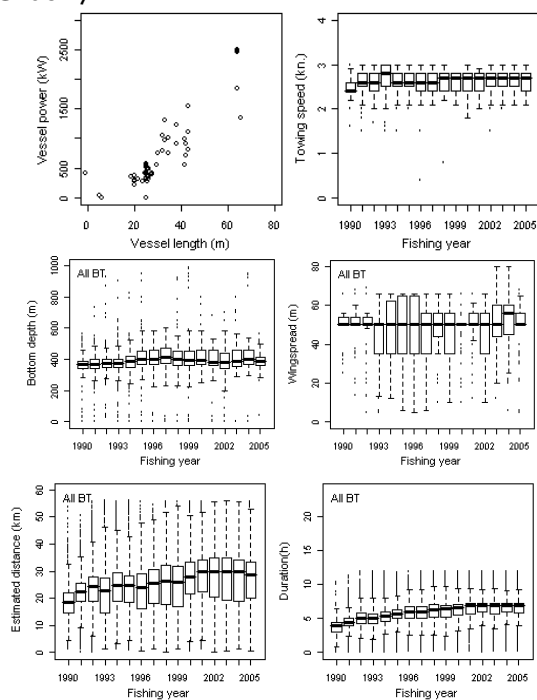


Figure D7: Distribution of Group 7 (scampi) effort variables, 1989–90 (1990) to 2004–05 (2005): 69 771 bottom trawl tows.

GROUP 8

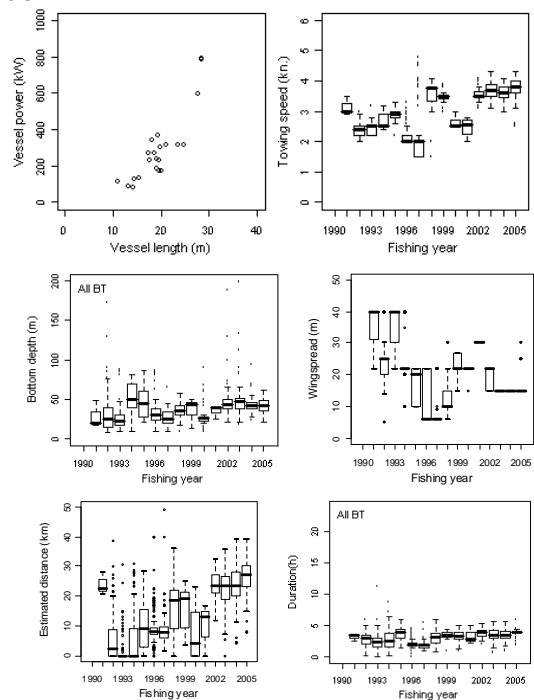


Figure D8: Distribution of Group 8 (flatfish) effort variables, 1989–90 (1990) to 2004–05 (2005): 1299 bottom trawl tows.

APPENDIX E: DISTRIBUTION OF TCEPR TRAWL EFFORT ON OR NEAR THE SEAFLOOR, BY AREA, TARGET SPECIES GROUP, AND DEPTH ZONE, 1989–90 TO 2004–05

Table E1: Numbers of reported TCEPR tows on or near the seafloor by FMAs shown in Figure A1 and fishing years, 1989–90 (1990) to 2004–05 (2005).

Fishing year	FMA 1	FMA 2	FMA 3	FMA 4	FMA 5	FMA 6	FMA 7	FMA 8	FMA 9	FMA 10	No area	Total tows
1990	1 133	2 693	8 466	4 965	5 126	7 136	6 554	1 122	253	2	100	37 550
1991	1 720	5 041	8 669	5 639	9 940	7 043	6 277	845	199	2	104	45 479
1992	1 357	5 282	9 855	7 808	9 526	8 246	6 040	1 664	456	5	102	50 341
1993	1 130	6 081	12 191	7 376	10 836	4 694	7 527	1 930	1 472	1	165	53 403
1994	1 969	7 893	12 087	6 572	6 061	7 128	8 555	1 665	1 032	6	249	53 217
1995	3 369	8 522	11 298	9 116	7 933	6 804	8 507	1 004	1 716	6	239	58 514
1996	8 759	9 114	16 817	6 024	6 881	7 647	7 535	847	3 548	4	426	67 602
1997	10 105	9 261	15 255	7 394	7 752	8 010	8 378	1 055	4 220	3	342	71 775
1998	12 071	8 933	16 746	10 458	8 911	7 201	7 855	1 727	4 472	16	220	78 610
1999	10 729	8 342	13 046	10 824	9 007	5 928	7 545	1 112	4 218	6	215	70 972
2000	9 583	7 718	13 478	8 773	6 144	8 074	6 673	1 165	3 993	0	292	65 893
2001	9 558	6 538	11 490	9 283	6 513	7 530	7 069	1 908	4 227	0	258	64 374
2002	9 356	7 085	9 698	9 018	6 785	10 220	7 414	2 171	3 492	0	159	65 398
2003	8 818	6 024	10 463	9 910	7 024	8 546	7 244	2 396	3 516	0	247	64 188
2004	8 960	4 844	7 716	9 004	5 846	8 664	6 168	1 810	4 919	0	258	58 189
2005	8 513	5 120	5 997	8 833	7 481	7 286	4 942	1 920	4 629	0	194	54 915
All	107 130	108 491	183 272	130 997	121 766	120 157	114 283	24 341	46 362	51	3 570	960 420

Table E2: Estimated aggregate swept area (km²) by FMAs shown in Figure A1 and fishing years, 1989–90 (1990) to 2004–05 (2005).

Fishing year	FMA 1	FMA 2	FMA 3	FMA 4	FMA 5	FMA 6	FMA 7	FMA 8	FMA 9	FMA 10	No area	Total
1990	1 502.1	2 467.9	22 196.6	9 513.7	17 482.8	15 720.6	17 934.9	3 873.2	437.7	2.1	0.2	91 317.8
1991	2 592.0	5 354.7	23 858.5	14 632.2	29 952.8	20 913.8	15 590.3	3 138.9	301.1	2.1	0.1	116 453.9
1992	2 344.1	5 052.8	27 880.4	23 590.9	29 779.5	25 141.8	14 092.6	6 167.2	712.7	6.2	0.1	134 946.4
1993	1 877.0	5 712.0	32 538.8	22 702.4	31 064.8	14 603.0	18 695.6	7 514.3	2 368.7	0.6	0.2	137 325.8
1994	3 138.4	8 375.7	28 747.4	11 950.3	16 299.5	15 771.2	19 816.6	5 308.9	1 563.7	2.9	0.3	111 272.3
1995	4 356.3	8 030.9	32 052.0	24 877.2	25 148.1	16 476.6	20 784.8	2 498.1	2 907.5	5.0	0.3	137 519.9
1996	10 713.1	8 981.5	48 661.4	14 950.9	21 382.7	16 713.9	19 621.4	2 388.1	5 846.8	2.7	0.4	149 810.8
1997	11 188.5	10 094.1	42 890.4	22 484.4	24 253.7	20 095.6	18 730.1	2 230.4	6 967.5	3.8	0.3	159 381.4
1998	13 431.8	9 344.7	49 527.9	30 918.2	29 110.2	18 367.9	17 260.1	4 315.4	7 800.0	4.7	0.2	180 439.1
1999	12 443.2	9 027.5	38 669.6	33 633.1	30 208.0	12 519.0	17 328.0	2 835.8	6 575.2	7.8	0.2	163 573.8
2000	11 232.4	8 250.7	42 085.8	25 855.5	24 282.4	22 026.0	15 938.0	2 711.8	6 959.7	—	0.2	159 679.0
2001	12 279.1	8 062.2	40 150.5	29 633.4	22 953.6	21 574.2	17 760.8	4 700.2	7 570.8	—	0.2	165 028.6
2002	12 529.0	10 373.7	32 111.3	28 360.5	24 223.6	31 017.0	22 466.7	5 068.9	6 227.8	—	0.1	172 624.8
2003	11 415.2	7 653.6	37 573.1	31 653.3	22 390.8	28 000.7	23 549.5	5 696.1	6 278.4	—	0.2	174 487.3
2004	12 147.9	6 401.6	26 160.0	32 205.7	17 474.5	25 111.7	17 683.7	4 222.1	9 257.9	—	0.1	150 866.9
2005	11 414.4	6 434.2	19 895.0	24 828.3	23 145.1	16 528.9	15 428.2	4 088.9	8 908.6	—	0.1	130 811.7
All	134 604.5	119 617.8	544 998.6	381 790.0	389 152.2	320 581.8	292 681.3	66 758.3	80 684.0	37.9	0.2	2 335 539.4

APPENDIX E — continued

Table E3: Total number of tows reported by species groups listed in Table C2 by fishing years, 1989–90 (1990) to 2004–05 (2005).

Fishing year	Group1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Other	Total tows
1990	16 300	9 356	962	8 063	199	359	2 126	0	185	37 550
1991	16 712	14 508	1 385	7 872	261	523	4 067	3	148	45 479
1992	15 883	16 917	2 363	7 547	350	1 227	5 782	206	66	50 341
1993	17 255	18 329	482	9 261	384	2 051	5 316	265	60	53 403
1994	17 508	14 463	447	12 030	497	2 866	5 183	170	53	53 217
1995	19 053	18 587	185	10 604	665	5 471	3 876	33	40	58 514
1996	19 543	22 763	353	8 645	669	11 762	3 487	236	144	67 602
1997	18 070	26 180	338	9 160	784	13 447	3 584	69	143	71 775
1998	17 703	28 608	807	11 927	664	15 255	3 459	68	119	78 610
1999	14 093	25 403	772	11 589	779	14 128	4 065	25	118	70 972
2000	11 245	26 211	551	10 004	830	12 388	4 610	39	15	65 893
2001	12 122	25 018	459	7 800	850	13 307	4 783	4	31	64 374
2002	13 718	23 576	830	7 079	1 056	12 438	6 546	60	95	65 398
2003	14 517	23 474	359	7 709	1 373	12 112	4 549	45	50	64 188
2004	13 005	19 534	471	6 966	966	13 341	3 697	44	165	58 189
2005	14 325	13 759	397	7 143	1 057	13 392	4 641	37	164	54 915
All	251 052	326 686	11 161	143 399	11 384	144 067	69 771	1 304	1 596	960 420

APPENDIX E — continued

Table E4: Number of tows reported on TCEPRs where Group 1 species were reported as the target and the percent of the annual Group 1 tow totals for each Group 1 species, by fishing years, 1989–90 (1990) to 2004–05 (2005). Species codes are given in Table C2.

Fishing year	Group 1 no. tows	Group 1 tows (%)													
		SQU	BAR	JMA	RCO	SKI	SWA	WAR	STA	RBY	SPD	SPE	FRO	GSH	EMA
1990	16 300	50.9	20.4	13.7	5.9	2.1	5.7	0.3	2.3	0.0	0.6	0.1	0.0	0.0	0.0
1991	16 712	61.6	19.2	9.5	3.3	1.2	3.6	0.7	1.3	0.0	0.5	0.1	0.0	0.0	0.1
1992	15 883	47.0	15.9	17.1	9.2	2.9	4.5	1.0	11.6	0.2	0.4	0.2	0.0	0.0	0.0
1993	17 255	42.2	16.8	15.4	11.6	4.6	5.4	0.4	16.7	0.4	1.0	0.2	0.0	0.0	0.0
1994	17 508	53.5	9.5	16.2	8.0	6.9	4.8	0.4	1.0	0.3	0.0	0.2	0.0	0.0	0.0
1995	19 053	53.5	15.5	10.8	6.7	5.4	5.6	1.0	0.5	0.5	0.6	0.2	0.1	0.0	0.0
1996	19 543	48.6	14.3	10.3	11.6	8.7	4.2	1.1	1.6	0.4	0.5	0.1	0.0	0.0	0.0
1997	18 070	54.6	13.4	8.9	10.3	8.4	2.2	1.3	3.9	0.2	0.1	0.0	0.0	0.0	0.1
1998	17 703	44.5	12.8	18.5	11.6	8.2	1.9	1.0	4.2	0.1	0.5	0.3	0.1	0.0	0.0
1999	14 093	51.3	14.0	17.8	6.7	6.2	1.3	0.9	0.7	0.3	0.1	0.0	0.8	0.1	0.3
2000	11 245	47.1	17.5	15.0	5.9	8.5	3.1	0.8	6.6	0.7	0.0	0.0	0.1	0.1	0.0
2001	12 122	56.3	16.8	13.1	1.9	6.7	2.4	1.0	0.1	1.0	0.0	0.0	0.6	0.0	0.0
2002	13 718	51.2	15.5	17.3	2.2	4.4	3.8	1.7	9.7	0.6	0.5	0.6	0.5	0.2	0.0
2003	14 517	55.4	13.4	17.2	3.9	3.8	1.6	1.7	1.8	0.3	0.1	2.1	0.0	0.1	0.0
2004	13 005	60.9	12.0	14.4	5.0	3.6	1.0	0.8	4.8	0.5	0.1	1.1	0.0	0.0	0.0
2005	14 325	66.2	8.9	13.2	2.9	1.6	2.8	2.1	6.8	0.8	0.3	0.1	0.0	0.0	0.1
Total	251 052	131 973	36 943	35 398	17 618	13 165	8 770	2 536	1 468	942	891	791	346	119	92

APPENDIX E — continued

Table E5: Number of tows reported on TCEPRs where Group 2, Group 4, and Group 5 species were reported as the target and the percent of the annual group tow totals for each group species, by fishing years, 1989–90 (1990) to 2004–05 (2005). Species codes are given in Table C2.

Fishing year	Group 2 no. tows	Group 2 tows (%)				Group 4 no. tows	Group 4 tows (%)			Group 5 no. tows	Group 5 tows (%)	
		HOK	HAK	LIN	no. tows		ORH	OEO	CDL		BYX	BNS
1990	9 356	88.0	2.6	7.4	9.1	8 063	72.9	25.8	1.3	199	99.5	0.5
1991	14 508	92.3	0.5	6.9	2.2	7 872	62.7	32.5	4.8	261	94.3	5.7
1992	16 917	92.7	3.3	3.9	0.8	7 547	80.8	16.9	2.3	350	98.3	1.7
1993	18 329	91.6	5.3	3.0	0.2	9 261	77.0	21.0	2.0	384	95.6	4.4
1994	14 463	93.1	4.0	2.9	0.0	12 030	84.4	13.1	2.5	497	98.8	1.2
1995	18 587	94.6	4.1	1.3	0.2	10 604	81.4	15.8	2.8	665	97.4	2.6
1996	22 763	96.0	2.3	1.7	0.0	8 645	58.9	33.2	7.9	669	98.7	1.3
1997	26 180	96.8	1.8	1.3	0.1	9 160	57.6	36.3	6.1	784	91.7	8.3
1998	28 608	97.2	1.6	1.2	0.4	11 927	69.6	25.6	4.8	664	93.4	6.6
1999	25 403	95.4	2.8	1.6	3.1	11 589	66.1	27.6	6.3	779	97.4	2.6
2000	26 211	96.3	1.6	1.9	3.7	10 004	60.7	31.1	8.3	830	95.7	4.3
2001	25 018	96.0	2.2	1.4	4.7	7 800	53.6	38.9	7.4	850	85.6	14.4
2002	23 576	93.6	3.4	1.9	11.7	7 079	53.6	36.8	9.6	1 056	53.4	46.6
2003	23 474	92.7	3.9	2.0	16.8	7 709	56.4	30.2	13.3	1 373	66.3	33.7
2004	19 534	88.0	8.3	2.2	15.3	6 966	61.4	31.2	7.5	966	66.0	34.0
2005	13 759	82.1	10.3	5.0	17.7	7 143	59.1	31.8	9.1	1057	74.9	25.1
Total	326 686	305 934	11 090	7 945	1 717	143 399	96 053	39 081	8 265	11 384	9 478	1 906

APPENDIX E — continued

Table E6: Number of tows reported on TCEPRs where Group 6 species were reported as the target and the percent of the annual group tow totals for the group species, by fishing years, 1989–90 (1990) to 2004–05 (2005). Species codes are given in Table C2.

Fishing year	Group 6 no. tows	Group 6 tows (%)				
		SNA	TAR	TRE	JDO	GUR
1990	359	54.0	29.0	17.0	0.0	0.0
1991	523	18.9	40.5	31.4	0.0	9.2
1992	1 227	26.7	35.6	24.3	0.4	13.0
1993	2 051	51.8	13.7	29.8	0.0	4.7
1994	2 866	46.1	31.3	11.7	0.6	10.4
1995	5 471	50.3	29.1	13.9	0.9	5.9
1996	11 762	56.7	21.2	8.0	7.8	6.2
1997	13 447	51.5	18.4	9.8	12.3	7.9
1998	15 255	51.5	17.1	11.2	15.2	5.0
1999	14 128	50.0	18.9	14.1	12.4	4.7
2000	12 388	40.3	18.4	23.0	13.7	4.6
2001	13 307	31.7	19.2	25.6	13.7	9.8
2002	12 438	32.3	20.9	22.4	12.2	12.2
2003	12 112	30.2	24.9	21.7	10.7	12.5
2004	13 341	33.3	24.0	22.9	6.3	13.5
2005	13 392	31.5	29.3	21.3	3.4	14.4
Total	144 067	59 819	31 360	25 751	14 355	12 782

Table E7: Total annual aggregate swept area (km²) and percentage reported by species groups listed in Table C2, by fishing years, 1989–90 (1990) to 2004–05 (2005).

Fishing year	Total (km2)	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Other
1990	91 317.8	48.2	37.6	1.4	8.4	0.0	0.6	3.0		0.7
1991	116 453.9	39.0	48.5	1.4	4.7	0.0	0.7	5.5	0.0	0.3
1992	134 946.4	32.5	52.2	3.3	3.4	0.0	1.4	6.9	0.2	0.1
1993	137 325.8	33.2	53.5	0.5	4.1	0.1	2.5	5.8	0.2	0.1
1994	111 272.3	39.8	41.0	0.4	6.5	0.2	4.1	7.8	0.2	0.1
1995	137 519.9	37.1	47.7	0.2	4.4	0.2	5.8	4.6	0.0	0.0
1996	149 810.8	31.9	49.9	0.3	3.2	0.2	10.6	3.7	0.1	0.2
1997	159 381.4	27.1	54.2	0.4	3.6	0.2	10.6	3.8	0.0	0.1
1998	180 439.1	24.9	56.1	0.7	3.9	0.1	10.9	3.3	0.1	0.1
1999	163 573.8	23.5	55.3	0.7	4.6	0.2	11.4	4.2	0.0	0.1
2000	159 679.0	19.5	60.1	0.6	3.7	0.2	10.6	5.3	0.0	0.0
2001	165 028.6	20.9	59.1	0.5	2.4	0.2	11.3	5.6	0.0	0.0
2002	172 624.8	21.7	57.1	0.9	2.3	0.1	10.5	7.2	0.1	0.1
2003	174 487.3	23.4	58.6	0.3	2.1	0.2	10.3	4.9	0.1	0.1
2004	150 866.9	23.3	54.9	0.5	2.7	0.2	13.5	4.5	0.1	0.3
2005	130 811.7	30.0	43.2	0.4	3.2	0.2	16.2	6.5	0.1	0.3
All	2 335 539.4	28.5	52.8	0.7	3.7	0.1	8.7	5.1	0.1	0.1

APPENDIX E — *continued*

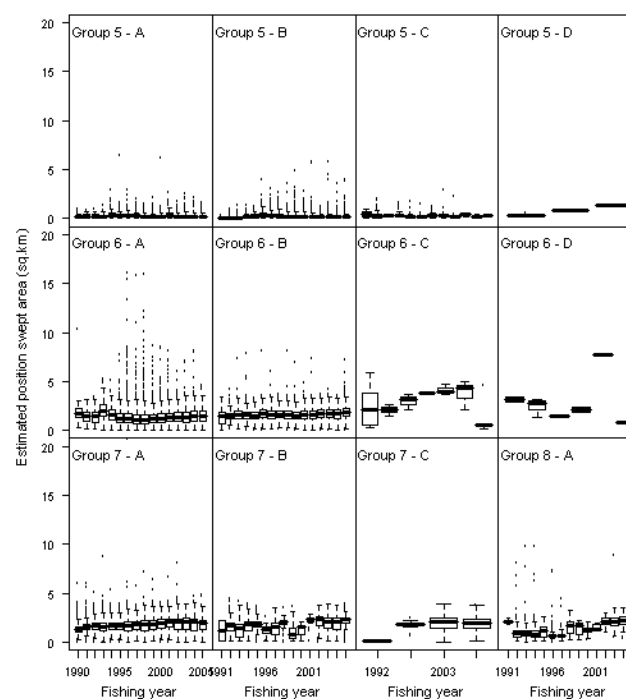
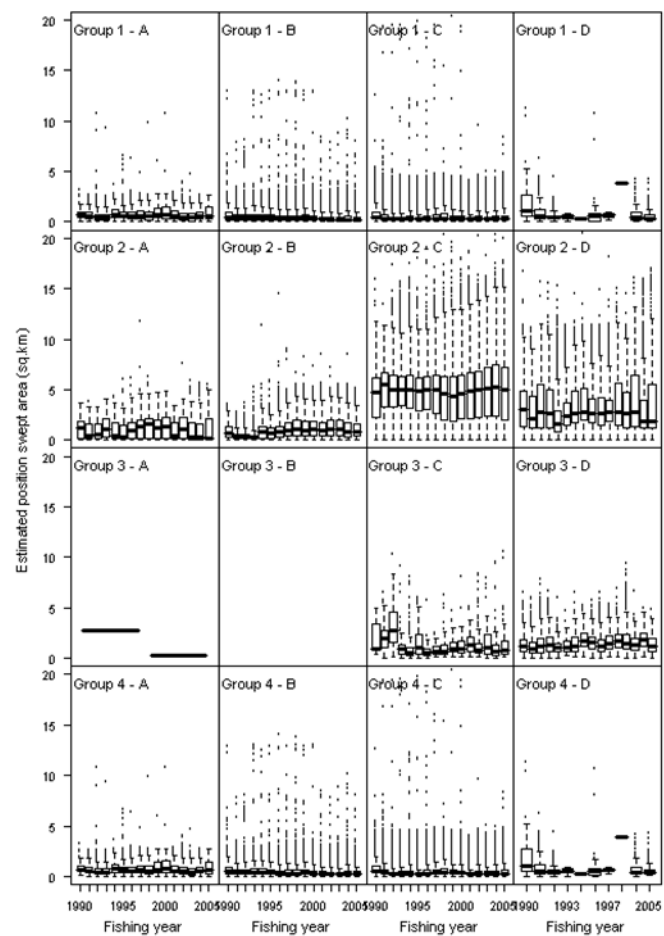


Figure E1: Distribution of estimated *position swept area* values, for each species group and vessel category (A–D), by fishing year, 1989–90 (1990) to 2004–05 (2005).

APPENDIX E — continued

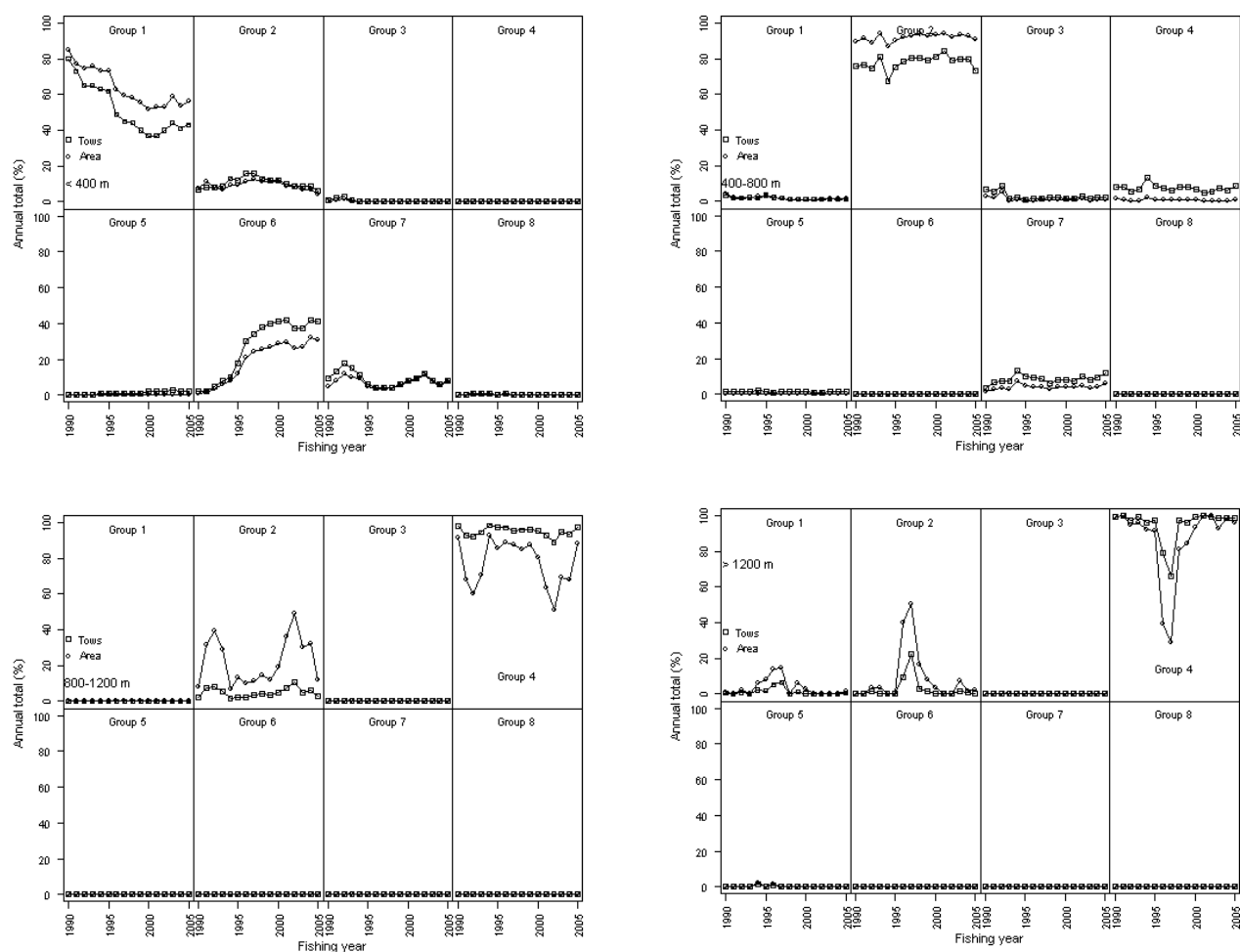
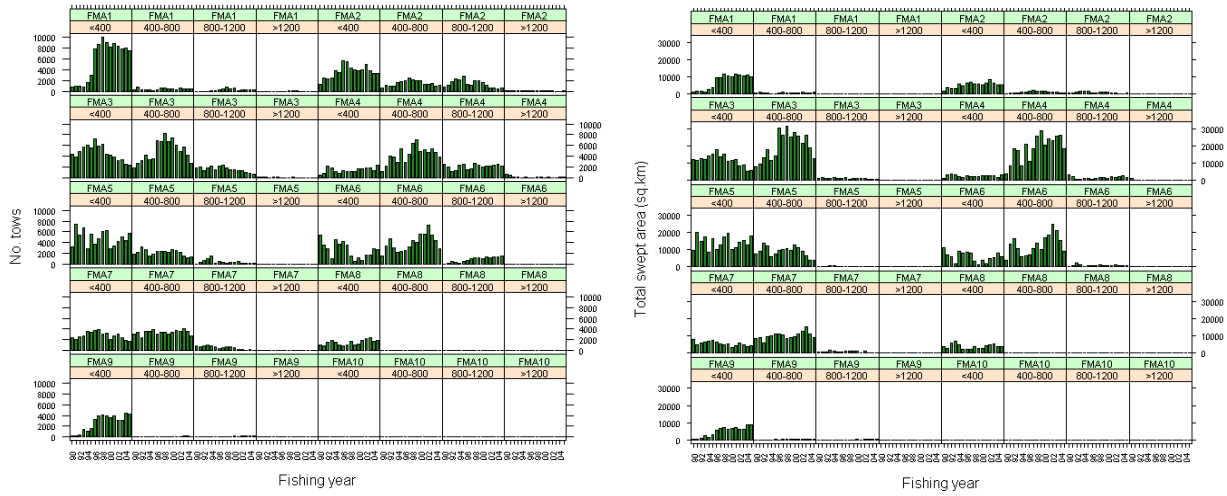


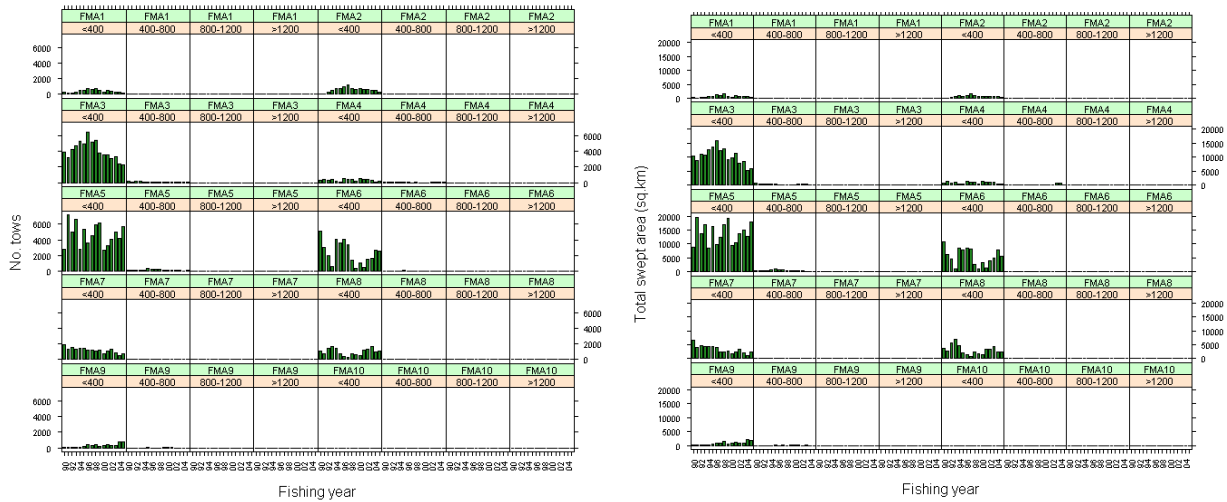
Figure E2: Relative proportions of the annual number of tows and aggregate swept area in 400-m depth zones, by species groups and fishing year, 1989–90 (1990) to 2004–05 (2005).

APPENDIX E — continued

ALL GROUPS



GROUP 1



GROUP 2

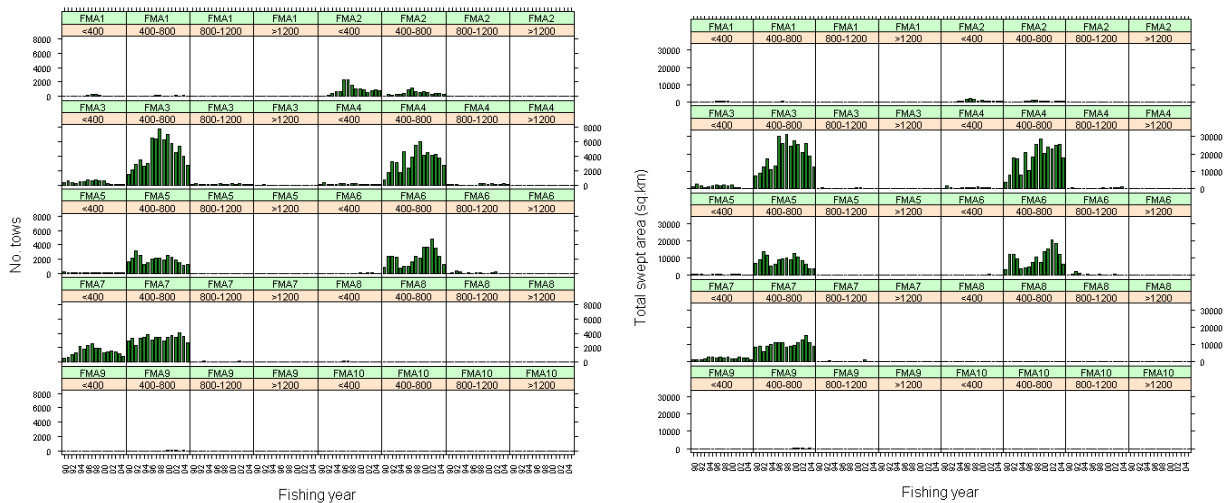
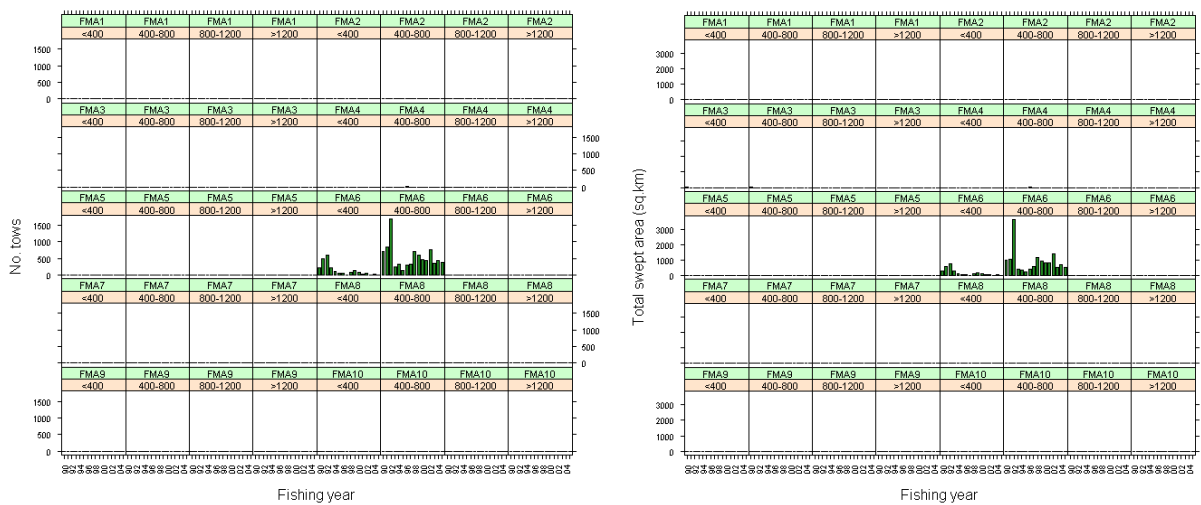


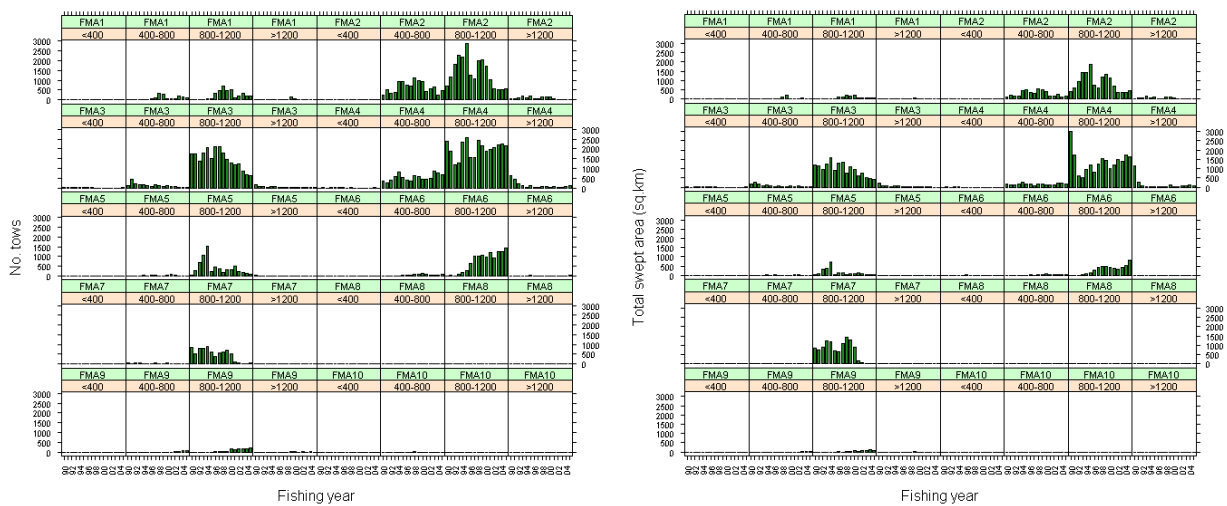
Figure E3: Number of TCEPR tows (left) and aggregate (total) swept area (right) on or near the seafloor, for all groups combined (upper) and Group 1 (centre), and Group 2 (lower) by FMA and depth zone, 1989–90 (90) to 2004–05 (05).

APPENDIX E — continued

GROUP 3



GROUP 4



GROUP 5

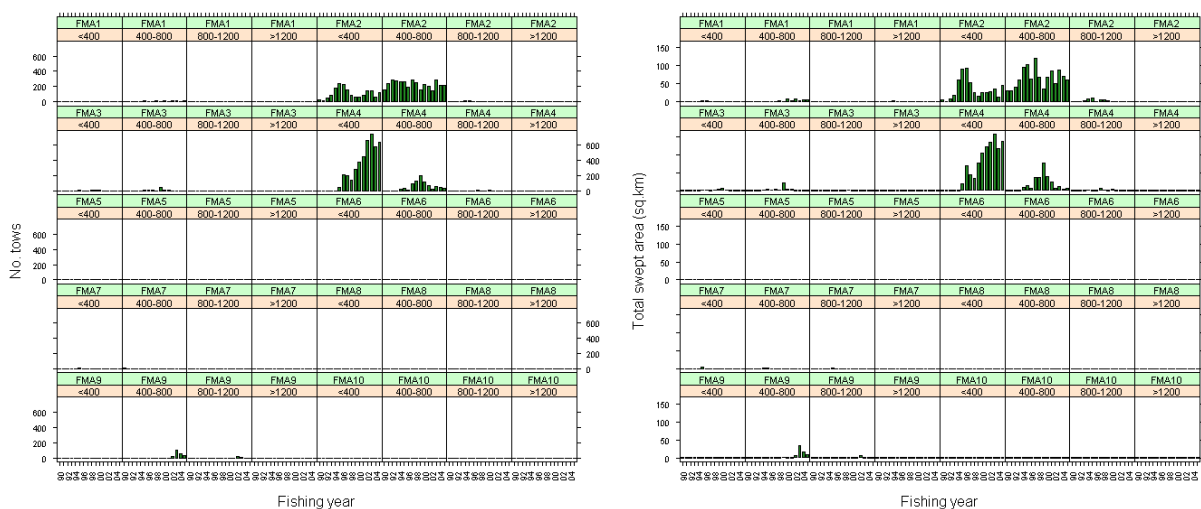
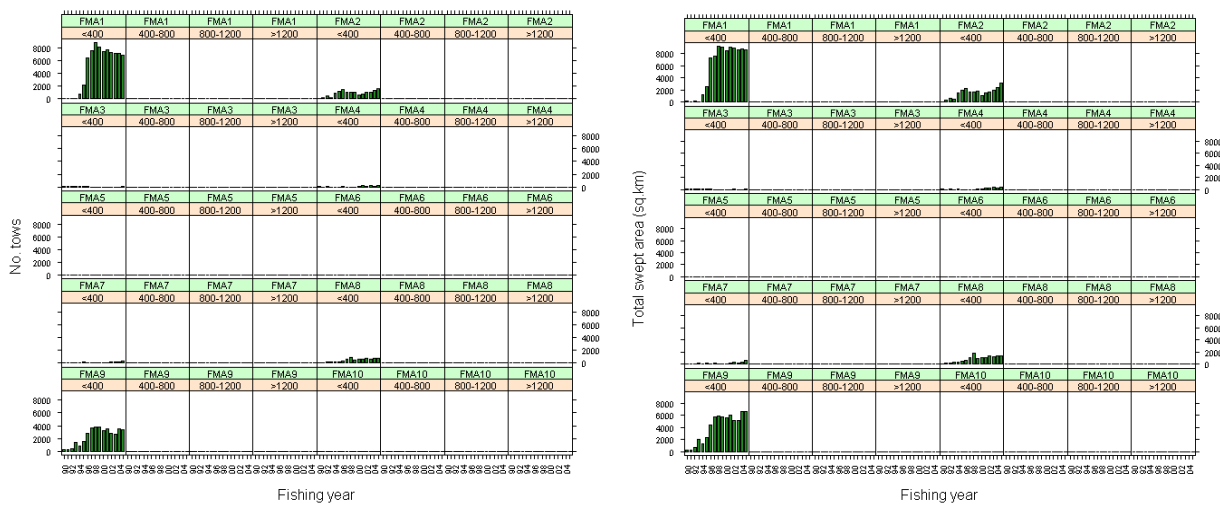


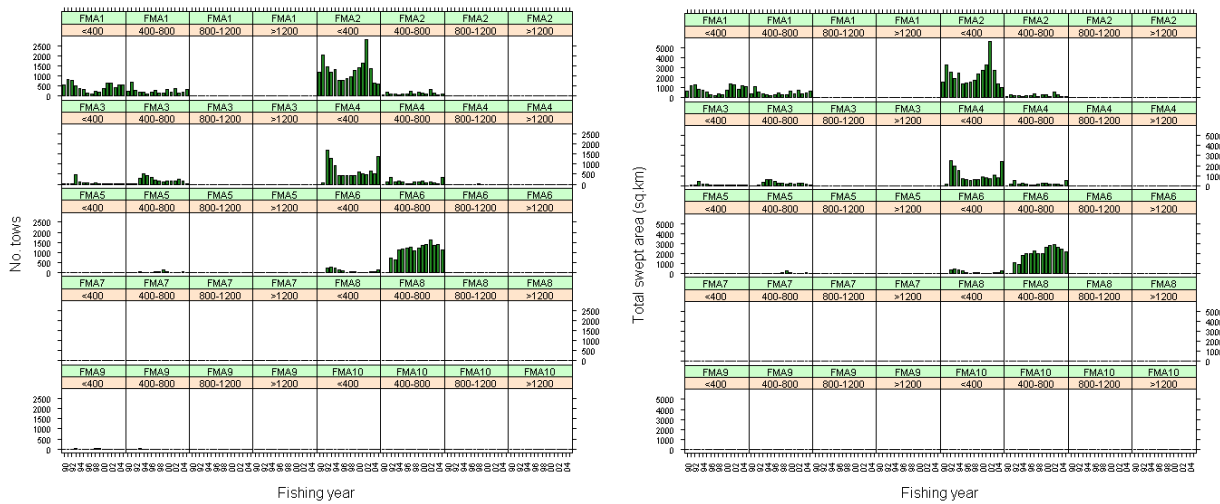
Figure E3: continued for Group 3 (upper), Group 4 (centre), and Group 5 (lower), by FMA and depth zone, 1989-90 (90) to 2004-05 (05).

APPENDIX E — continued

GROUP 6



GROUP 7



GROUP 8

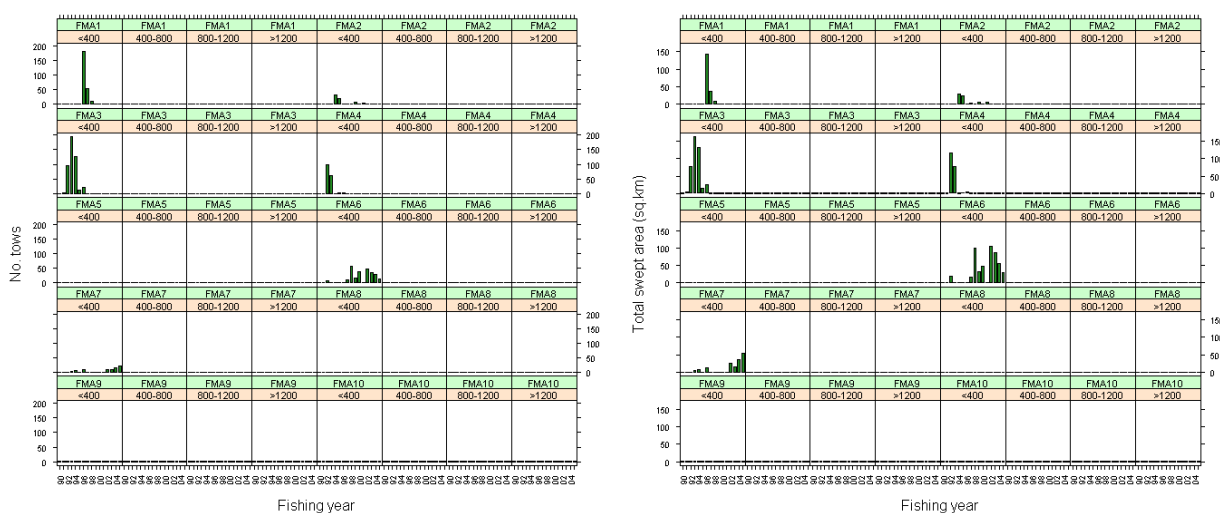


Figure E3: continued for Group 6 (upper), Group 7 (centre), and Group 8 (lower), by FMA and depth zone, 1989–90 (90) to 2004–05 (05).

APPENDIX F: SPATIAL DISTRIBUTION OF TCEPR TRAWL EFFORT FOR ALL TARGET SPECIES, BY FISHING YEARS 1989–90 TO 2004–05

The following figures show the distribution of the distance-derived swept area values as the aggregate swept area in each 25 km² cell where the cell midpoint depth is < 1600 m. Each map represents the effort for a fishing year (for example, 1990 is 1989–90), for all trawl methods combined. The total number of fished cells in each plot has been divided into five groups of equal numbers of cells; these are represented by the colour bands for each map and the number of cells in each band is given in the legend. Thus, each map shows a different range of swept area values in the colour bands.

The minimum swept area values are represented by zero, but in fact are very close to zero and typically represent a trawl polygon that has just touched the edge of a cell. The top 0.5% of cell aggregate swept areas are shown by hollow black circles on each map.

Maps by target species groups and individual target species are included on the accompanying DVD. A brief summary of the geographic distribution of these groups over time is given in this appendix.

APPENDIX F — continued

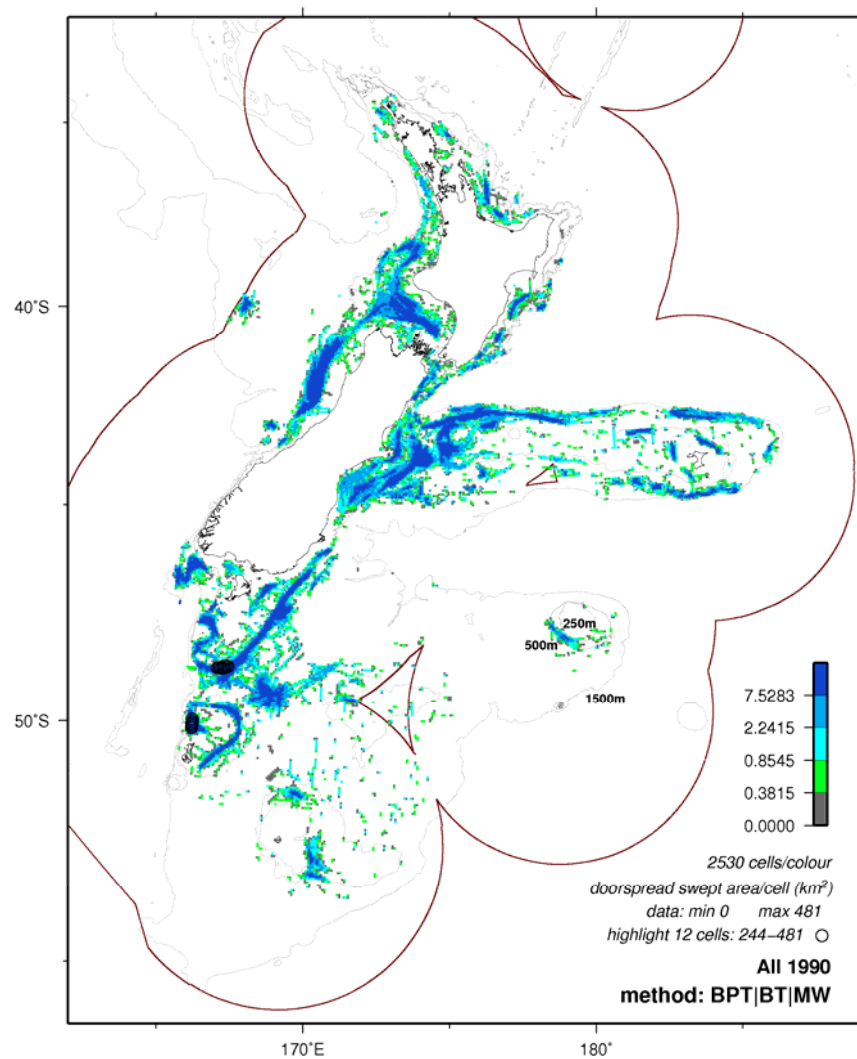


Figure F1: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1989–90.

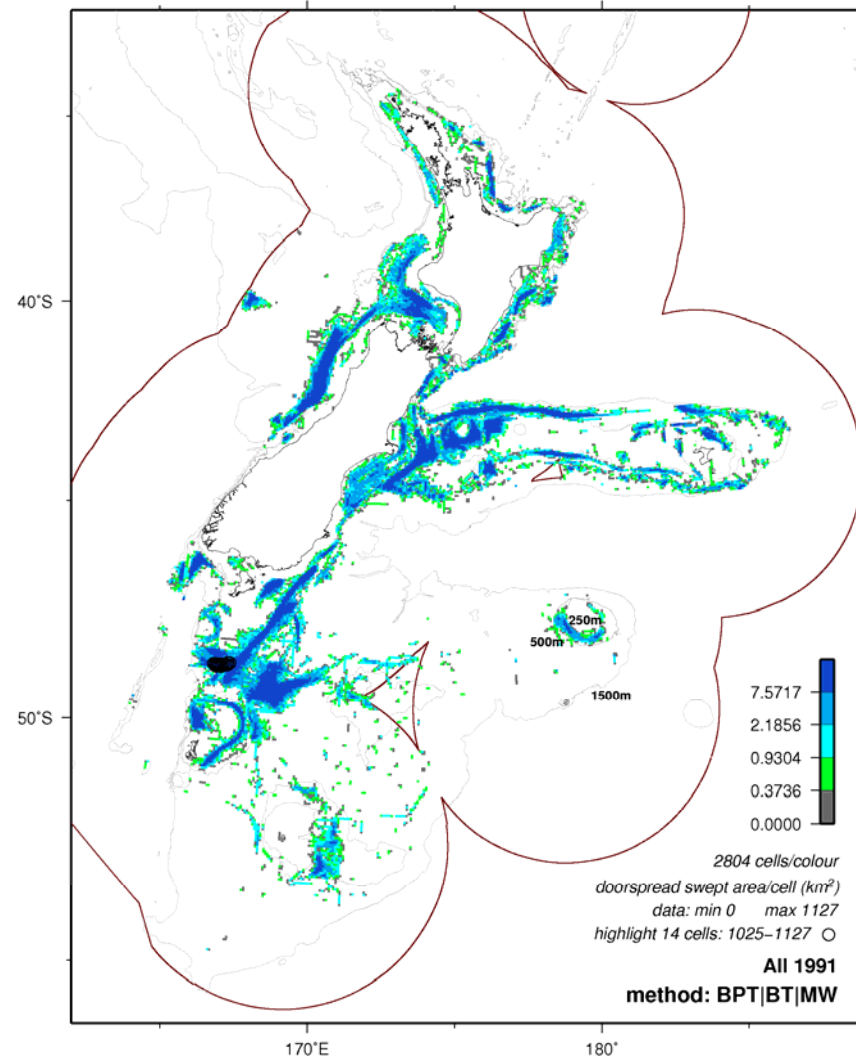


Figure F2: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1990–91.

APPENDIX F — continued

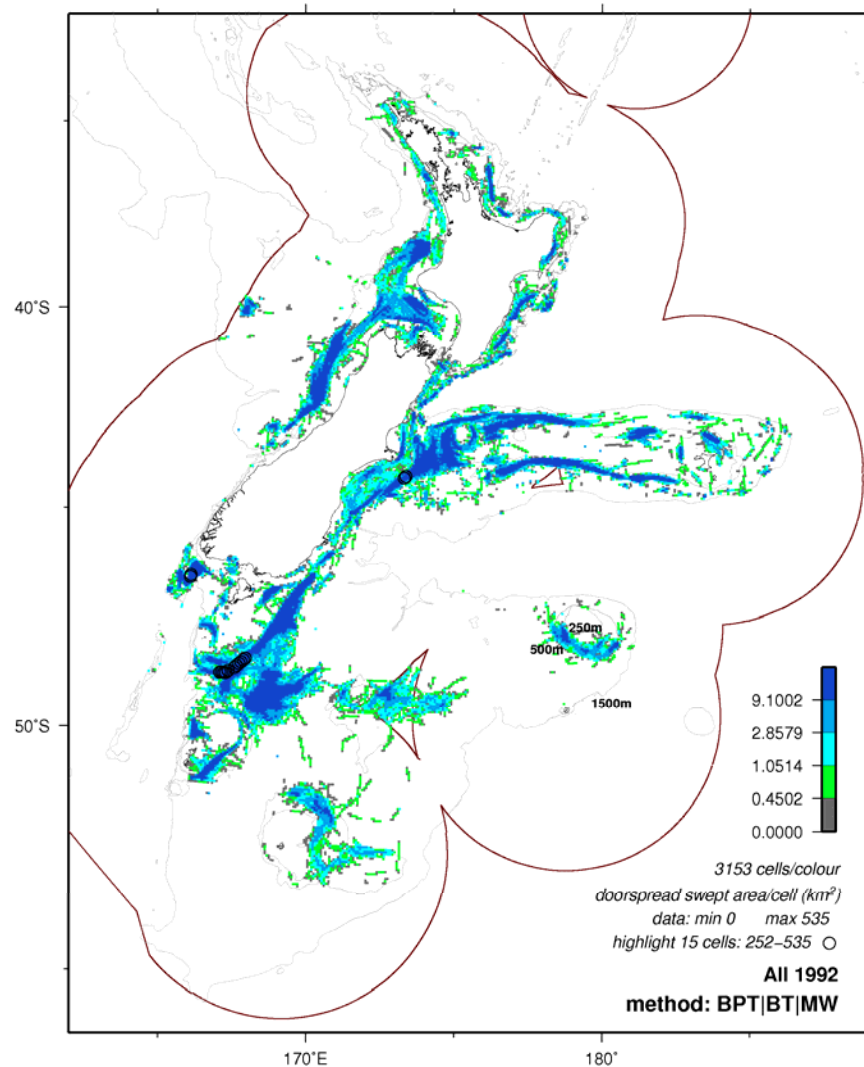


Figure F3: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1991-92.

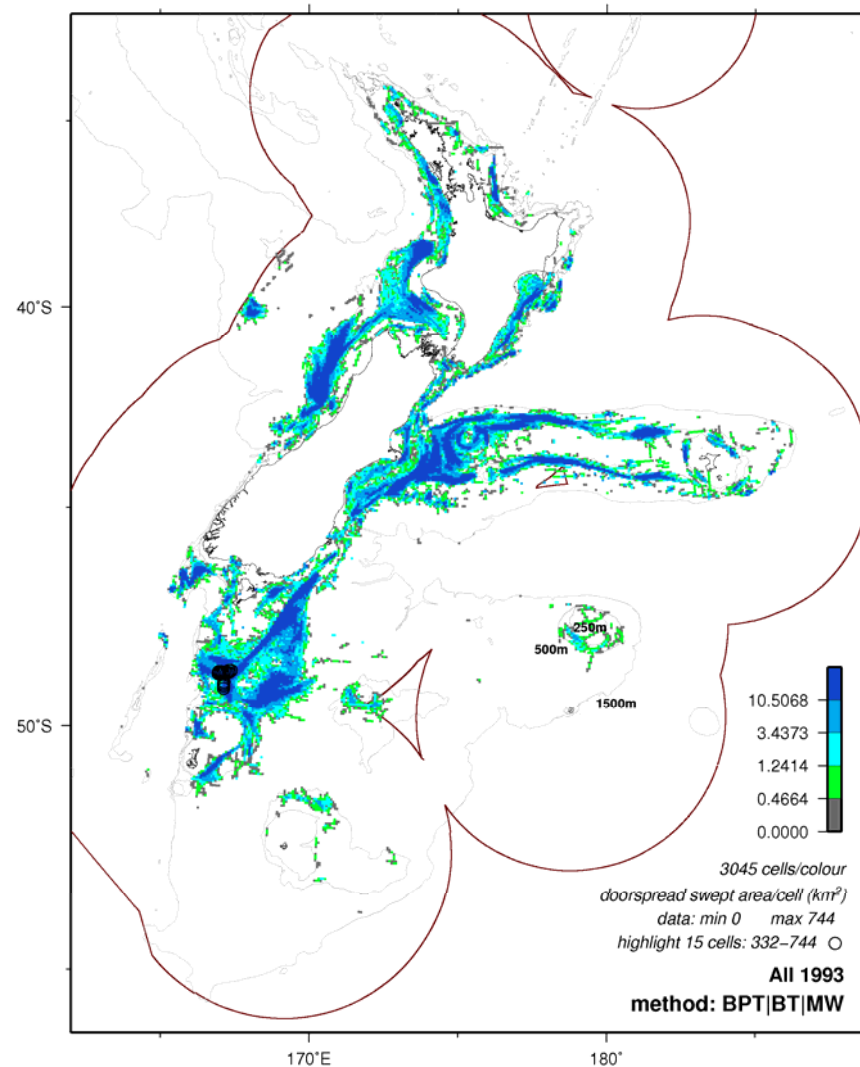


Figure F4: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1992-93.

APPENDIX F — continued

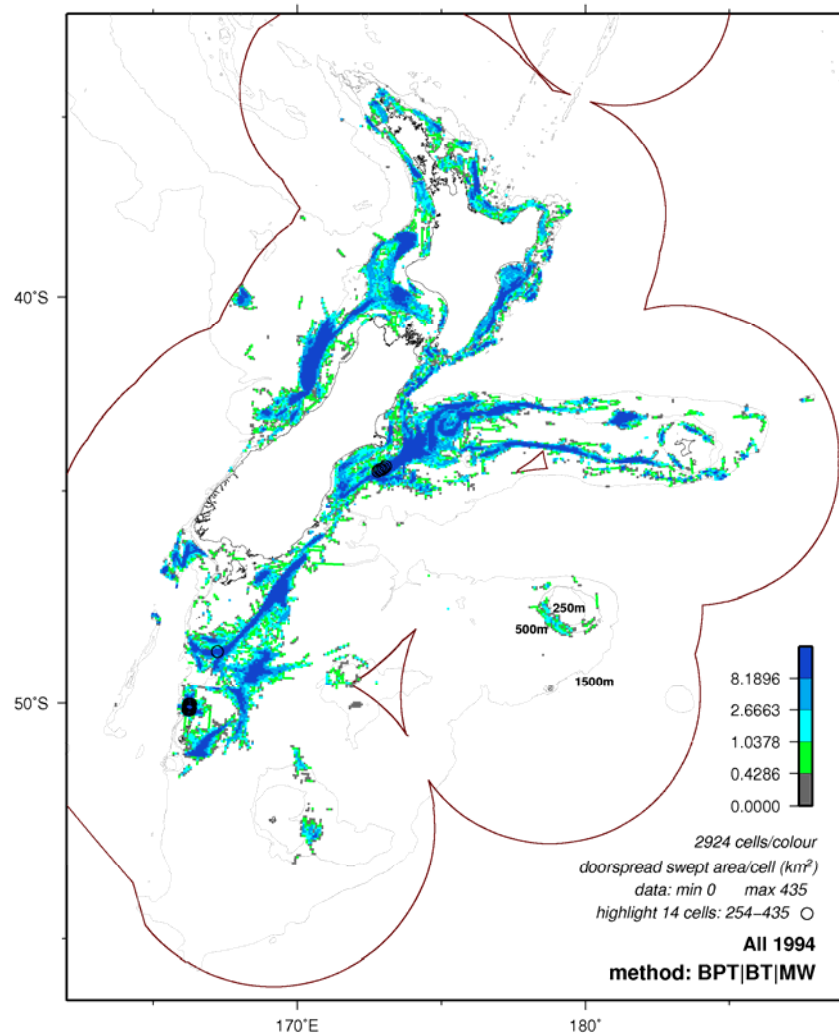


Figure F5: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1993–94.

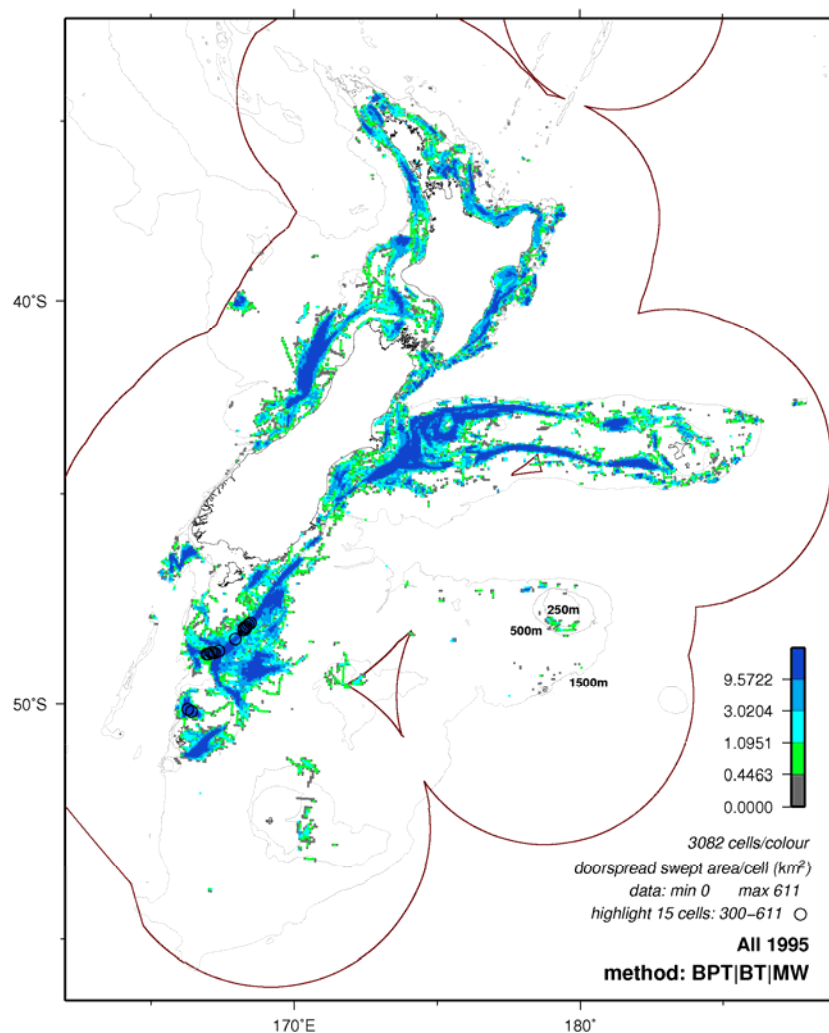


Figure F6: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1994–95.

APPENDIX F — continued

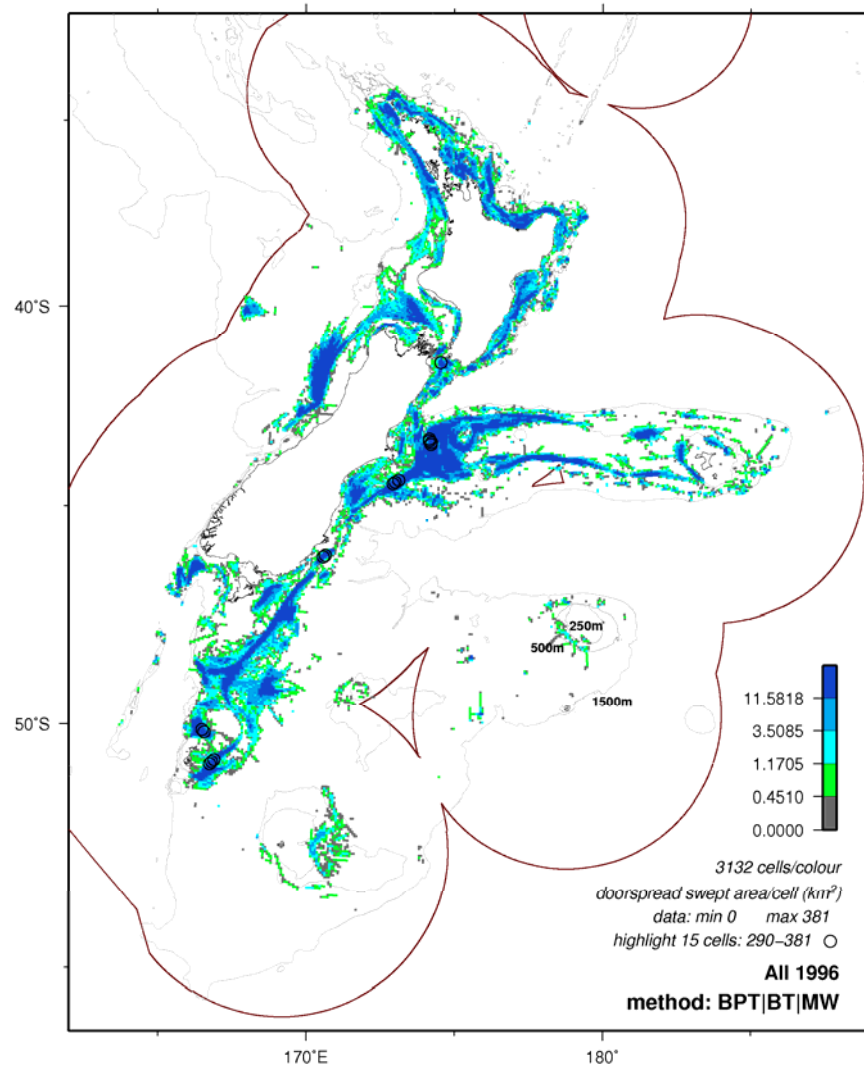


Figure F7: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1995–96.

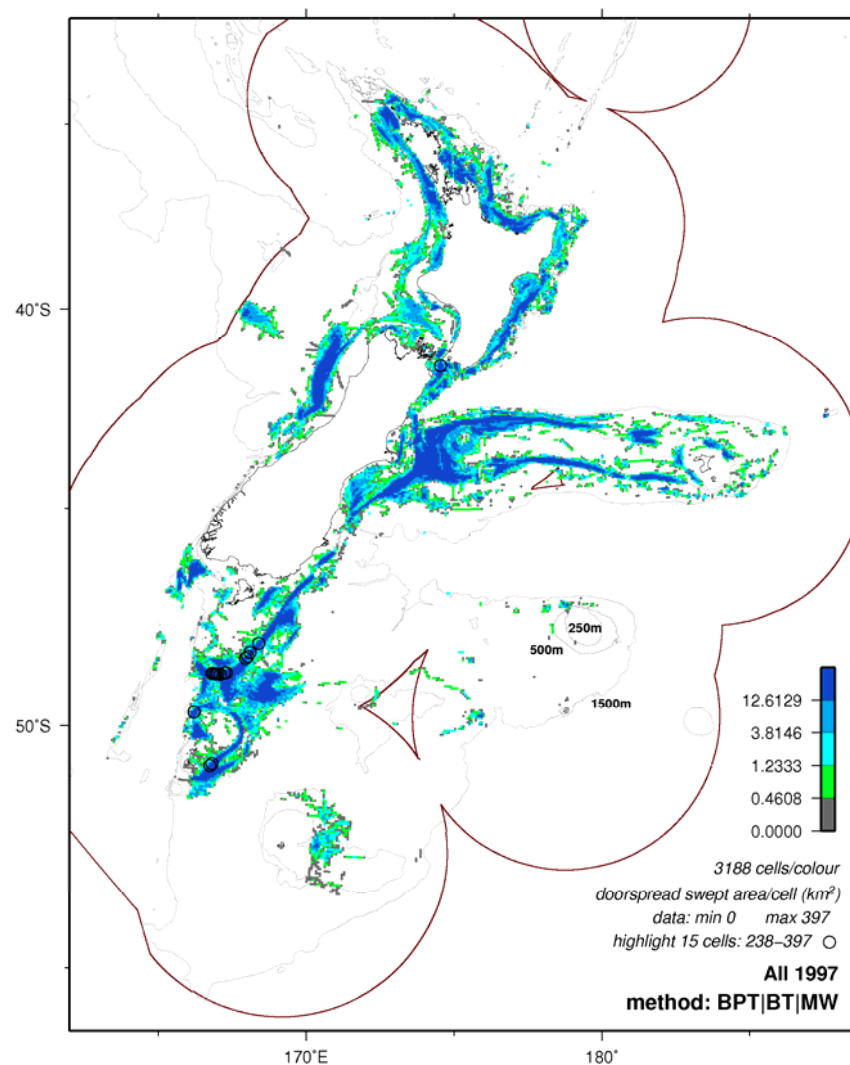


Figure F8: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1996–97.

APPENDIX F — continued

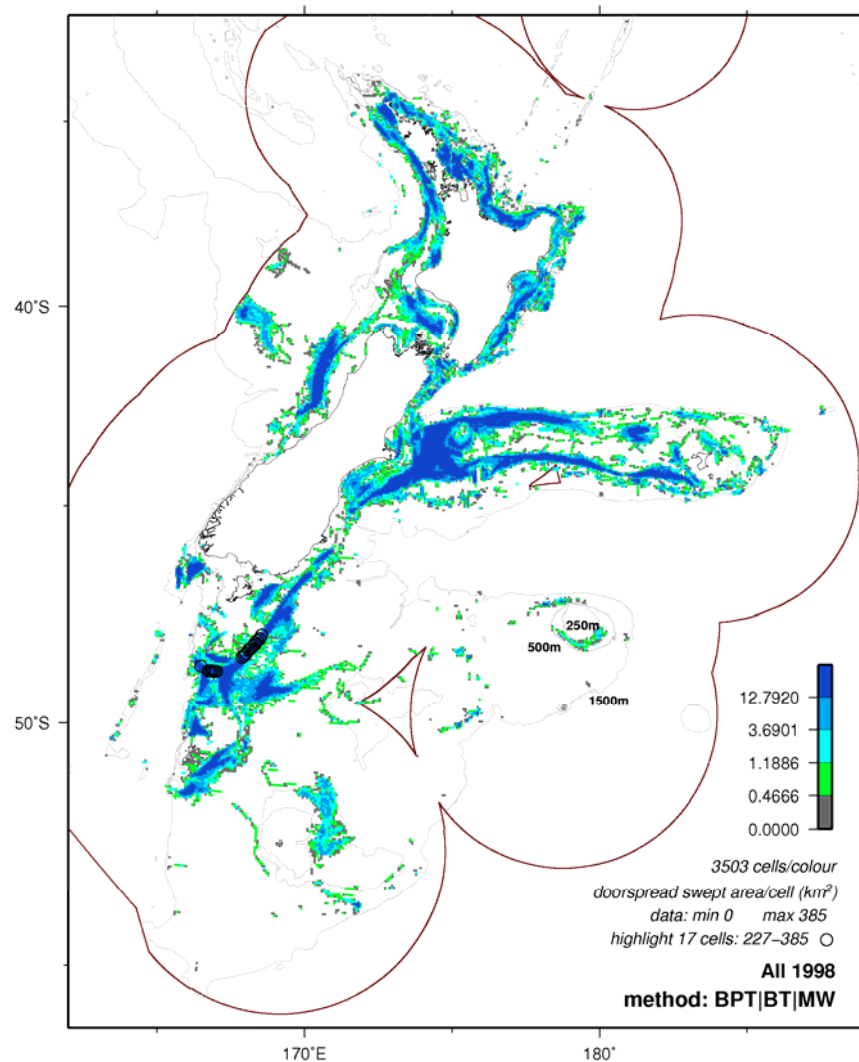


Figure F9: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1997–98.

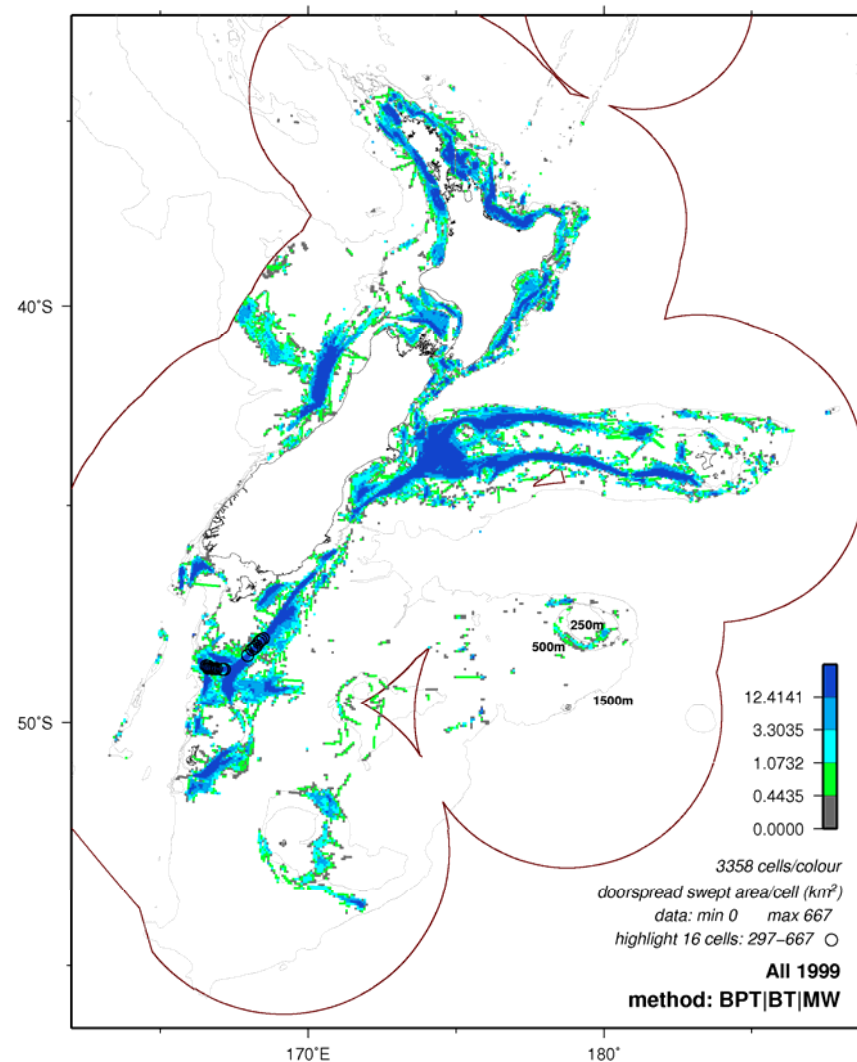


Figure F10: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1998–99.

APPENDIX F — continued

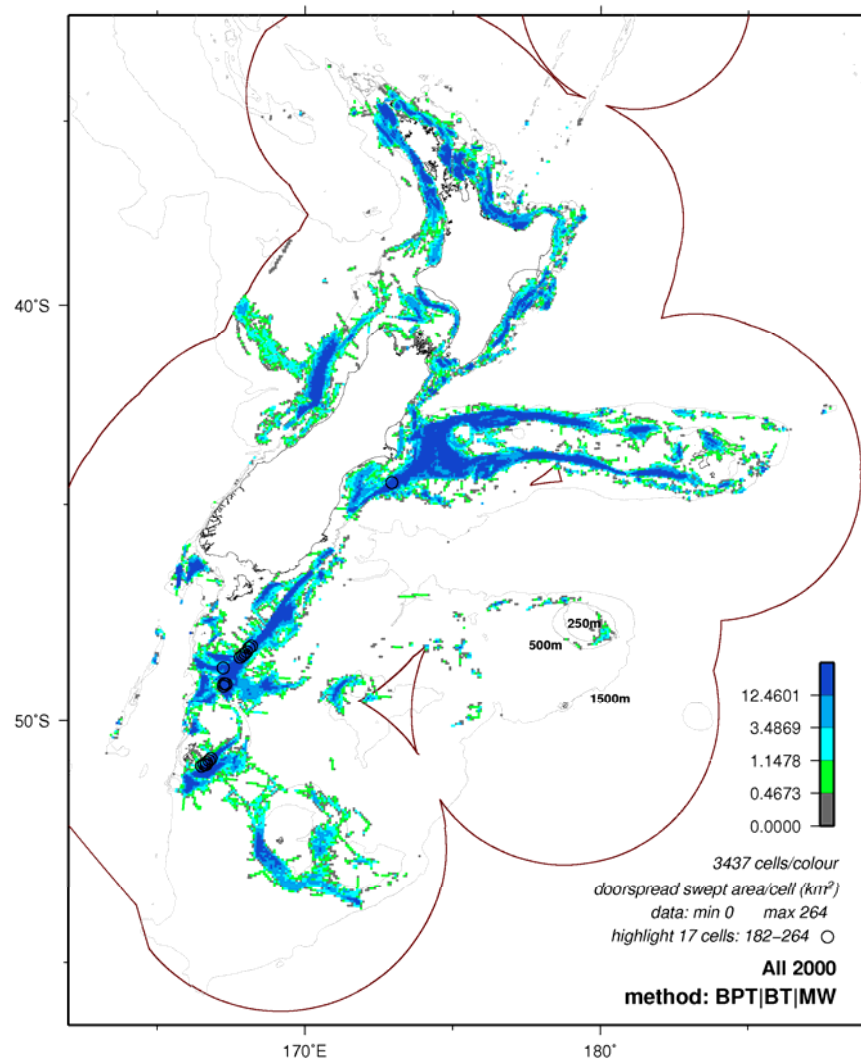


Figure F11: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 1999–2000.

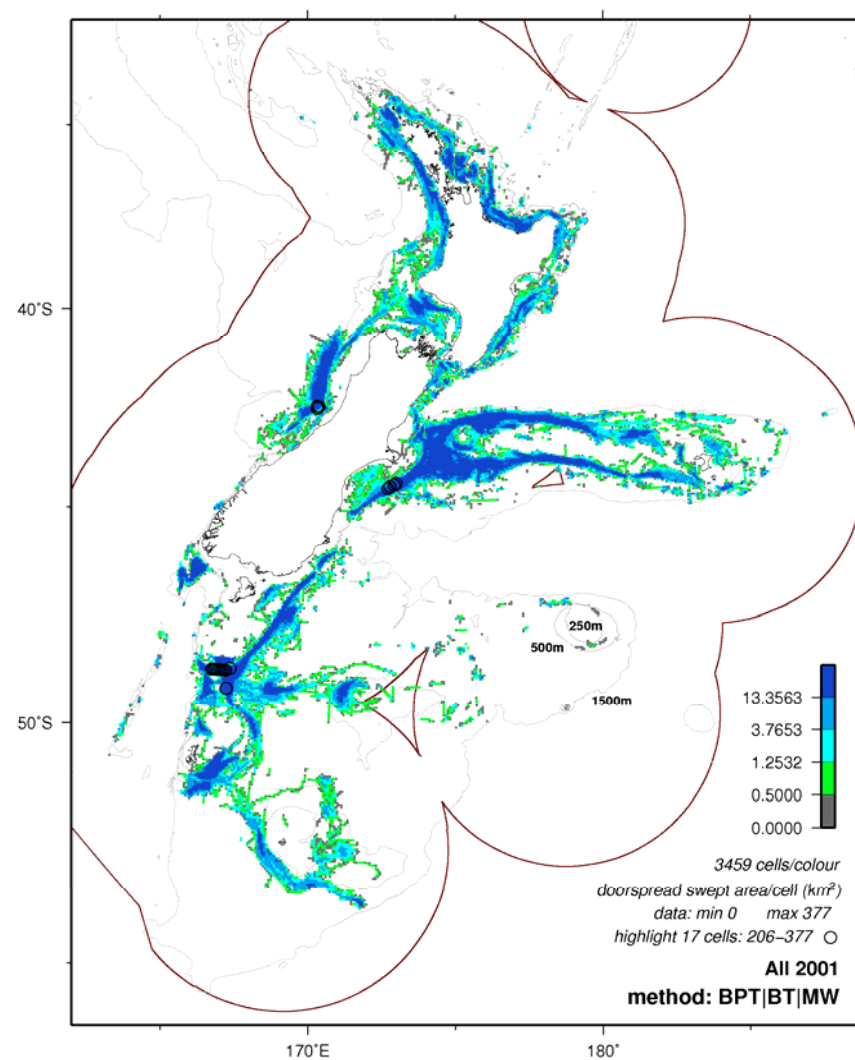


Figure F12: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 2000–01.

APPENDIX F — continued

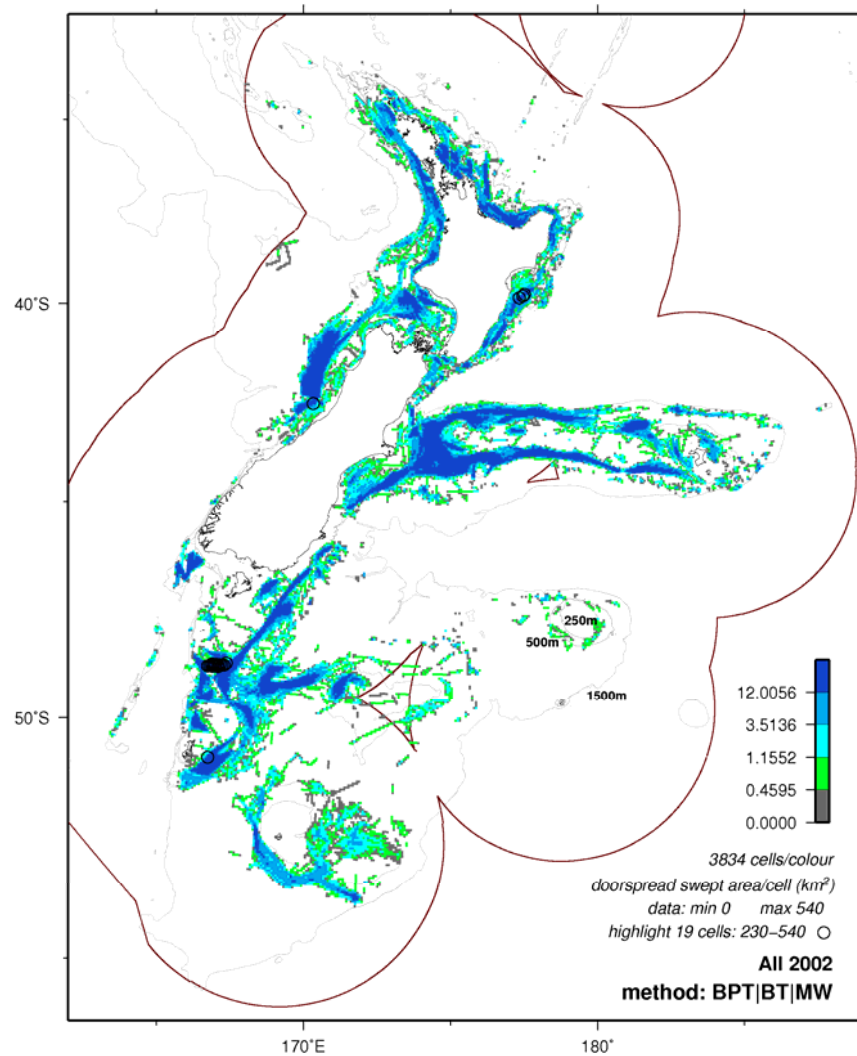


Figure F13: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 2001–02.

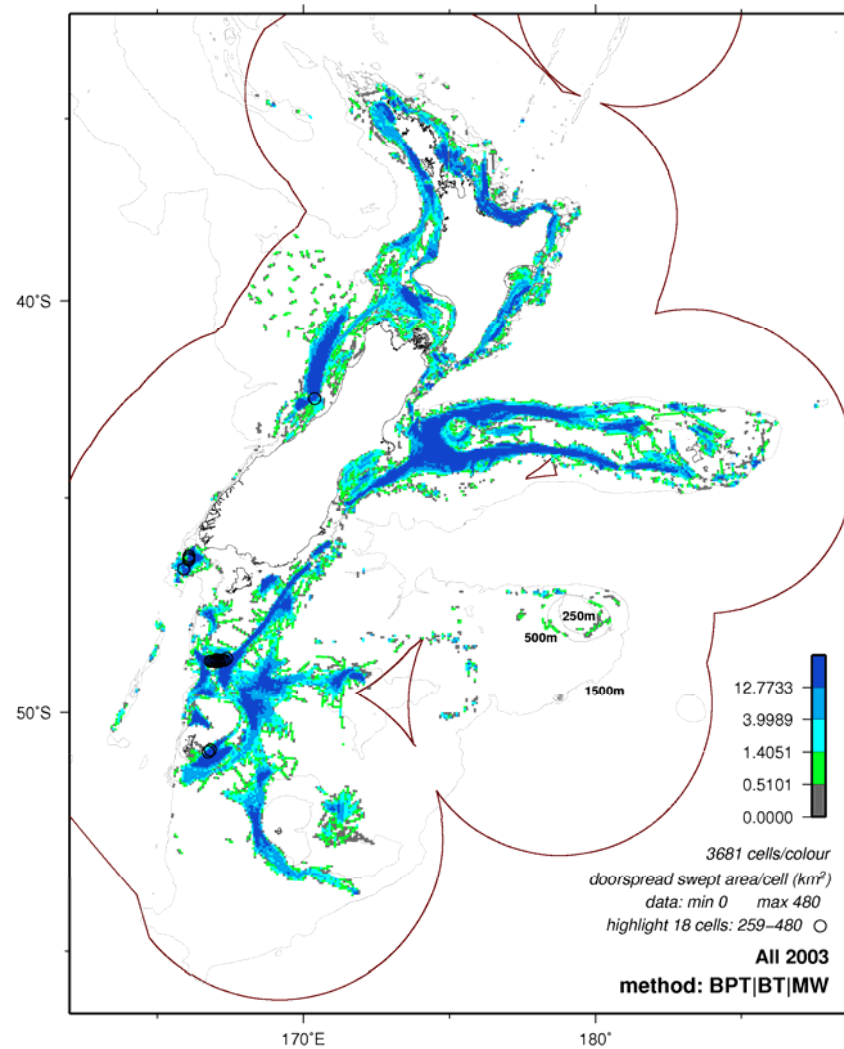


Figure F14: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 2002–03.

APPENDIX F — continued

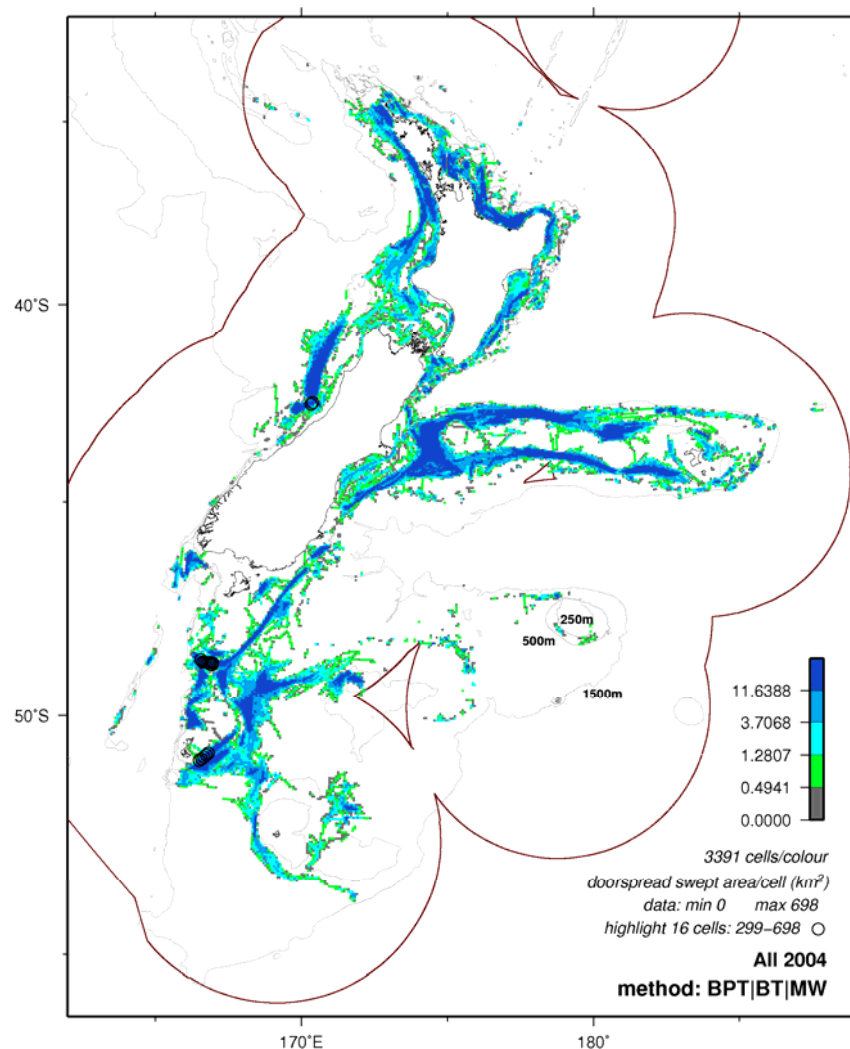


Figure F15: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 2003–04.

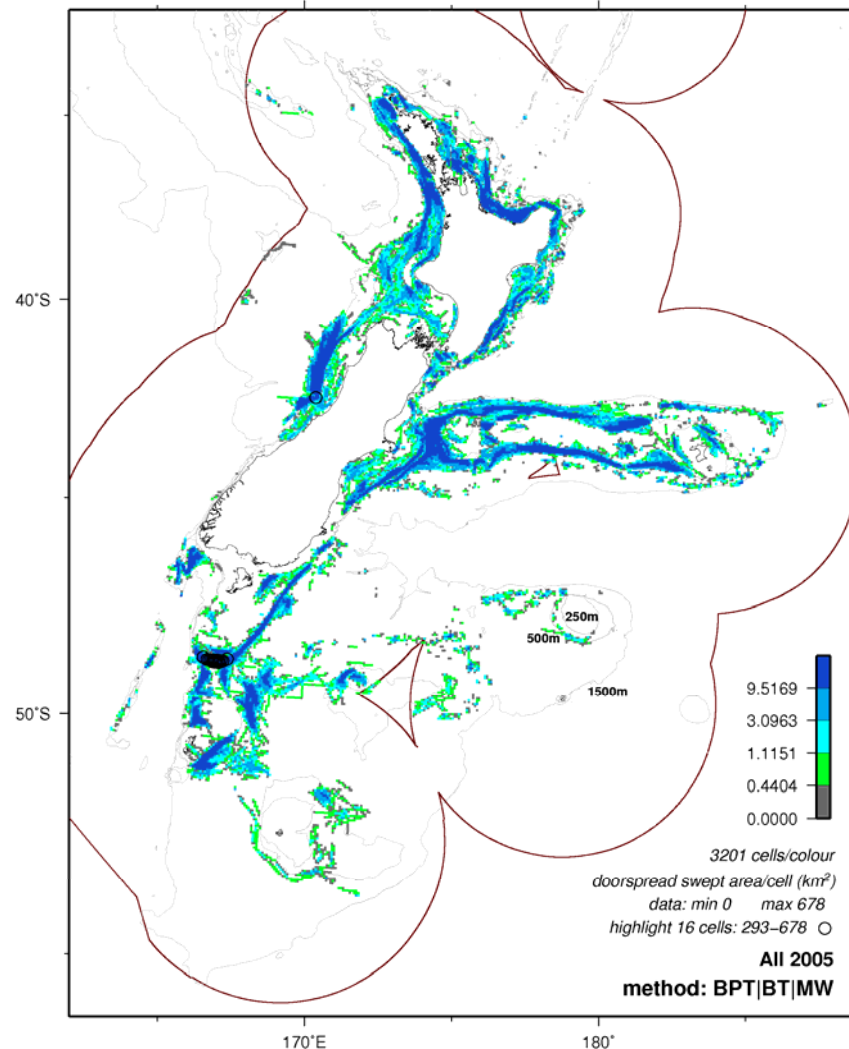


Figure F16: Distribution of aggregate swept area (km²) of bottom trawl effort and midwater trawl effort (within 1 m of the seafloor) for all species, 2004–05.

APPENDIX F — *continued*

Summary of distributions of TCEPR trawl effort as shown in the maps of aggregate swept area by fishing year for each target species group and individual targets on the accompanying DVD.

Group 1 species

This large group of target species had effort distributed throughout the fished areas of New Zealand, particularly on the continental shelf, except for the Chatham Rise, other than around the Mernoo Bank and after 2001–02 along the northern slope. A large proportion of this effort was for arrow squid. The distribution of squid effort follows the edge of the continental shelf off the east coast South Island south from about 42° S to the southwestern edge of the Stewart-Snares shelf, and off the Auckland Islands Shelf, with other effort at Mernoo Bank, Verman Bank, and off Puysegur. During the late 1990s a small amount of effort was reported from around the Chatham Islands, and from 1998–99, vessels reported squid effort from off the North Island west coast, especially south of the Taranaki Bight. In the 2000s squid was also targeted with bottom trawls off the South Island west coast, Pukaki Rise, and the Reserve Bank on Chatham Rise.

Effort for barracouta was concentrated off the west, north, and east coasts of the South Island, Stewart-Snares shelf, and around the Chatham Islands. As more effort was reported on TCEPRs, the barracouta target fishing in some distinct areas off the west and east coasts of the North Island was apparent after the mid 1990s. Other dominant target species in this group, jack mackerels, were fished by bottom trawl and midwater trawl gear. Effort was mainly in western waters between 39° S and 43° S, particularly around the Taranaki Bight. Other effort was around the Mernoo Bank, off the Canterbury Bight and on the Stewart-Snares shelf. There was very little bottom trawl effort for jack mackerels in 1999–2000, and although effort increased for a few subsequent years, there was little bottom trawl effort there after 2001–02, when vessels with midwater gear fished this coast.

Off the South Island east coast, red cod was targeted in inshore waters between about 42° and 45° S, particularly to the south of this zone. Some effort was made off Puysegur and the Stewart-Snares shelf. Effort reported on TCEPRs dropped off after 1997–98 and the distribution was more offshore in the 2000s until 2004–05, when there was also effort reported from further inshore. Effort also increased in inshore waters off the South Island west coast in that year.

Gemfish effort was mainly from the South Island west coast and the North Island east coast and northern west coast. The change in form use is the main reason for the increased distribution in these waters. This distribution has shrunk in recent years and in 2002–03 there was a small amount of effort off the South Island west coast. By 2004–05 there was very little effort for this species.

Targeting of spiny dogfish was mainly distributed off the South Island east coast (including the Mernoo Bank) and Chatham Islands in the early 1990s. Effort varied from year to year, but there was very little in 1998–99 and in subsequent years, there little or no effort until 2004–05 when this target was reported from off the South Island east coast down to the southeastern edge of the Stewart-Snares shelf.

Sea perch was mainly targeted off the South Island east coast, in distinct areas, until 2001–02 when there was directed effort off the Mernoo Bank, Reserve Bank, and northern Chatham Rise. After a peak in 2002–03, this spread decreased in subsequent years. Stargazer was reported on TCEPRs from inshore waters off the South Island east and south coasts, Mernoo Bank, around Chatham Islands, and a small amount off the west coast. Fishing at Chatham Islands was not consistent each year, though it was generally the area most fished after 1997–98 until 2003–04. Some effort was made off the South Island west coast during recent years.

APPENDIX F — *continued*

Silver warehou bottom trawl effort was similar to the spread of squid effort, though it did not extend as far south as the Auckland Islands Shelf, and was more concentrated off the Mernoo Bank. The extent of the distribution began to shrink after 1995–96 and in recent years was limited mainly to the west coast South Island and the continental shelf area off the east coast. Blue warehou were targeted with bottom trawls on the continental shelf in specific areas around the South Island, particularly the west coast and Stewart-Snares shelf, as well as the east coast North Island south of 39° S. In more recent years, the bottom trawl distribution has been largely constrained to these areas and waters northwest of Marlborough Sounds.

Group 2 species

Initially effort targeting these species was mainly distributed off the South Island west coast, along the Chatham Rise, especially in western waters, off and southeast of the Stewart-Snares shelf, and south of Puysegur Point. In the early 1990s this effort spread across the Chatham Rise and out to Pukaki Rise (in 1991–92) only. In the mid 1990s, more effort was reported from northern waters, off the North Island east coast. In the mid-late 1990s, effort also spread around the northern and southern edges of the Auckland Islands shelf and down the western edge of the Campbell Rise. In the early 2000s the distribution off the Stewart-Snares shelf moved east towards Pukaki Rise and increased its spread off the Campbell Rise. The Pukaki Rise effort decreased slightly in subsequent years, but the distribution of the Campbell Rise effort was greatly reduced by 2004–05. This distribution reflects the spread of the hoki effort and was affected by various management changes, including a lowering of the TACC in the 2000s (Ministry of Fisheries 2009a).

Hake effort was reported from several specific areas on the northern Chatham Rise, off the South Island west coast and in some years off the southern edge, and southeast, of the Stewart-Snares shelf. Waters southeast of the Stewart-Snares shelf were also important for ling target fishing, with lesser areas including off Puysegur, the Mernoo Bank, the northern Chatham Rise, and from 1999–2000 the Pukaki Rise. Targeting of white warehou was restricted to the northern Chatham Rise, Puysegur, and the Stewart-Snares shelf, and there was little or no effort in most years.

Group 3 species

Southern blue whiting effort with bottom trawls was generally very restricted in its distribution to the Bounty Platform, Pukaki Rise, and east of Campbell Rise. The main year of effort was 1991–92, but since then the effort has largely used midwater gear.

Group 4 species

Effort targeting Group 4 species was concentrated in deeper waters off the east coast of New Zealand south of about 39° to about 42°, off the northern and southern slopes of the Chatham Rise, off the lower east coast and southwest of the South Island, and north off the west coast to about 40° S following the 1000 m contour to beyond the EEZ.

From the mid 1990s, effort was reported from more northern waters, south across the Challenger Plateau, and in waters south of 47° S on the edges of the southern plateau and Macquarie Ridge. The effect of lowering the orange roughy TACC to 1 t, which effectively closed the Challenger Plateau fishery in 2000–01, is evident and the small amount of effort shown on the 2004–05 map represents some research tows undertaken there by a commercial vessel (Ministry of Fisheries 2009a). Similarly, the lowering of the TACC in the Cook Canyon off the South Island west coast from 1708 t to 430 t in 1995–96 and again to 110 t in 2001–02, has impacted on the distribution of orange roughy effort (Ministry of Fisheries 2009a).

APPENDIX F — *continued*

Some distributional differences are seen for the species in this group. Oreo species were targeted off the southern slope of the Chatham Rise from the South Island east coast to just east of the Chatham Islands, with some effort off the lower South Island east coast and in deeper areas on the southern plateau and Macquarie Ridge. Apart from the orange roughy fisheries mentioned above, the effort for this species was mainly distributed off the North Island east coast, the northern slope and southern slope (east of 180°) of the Chatham Rise, and south of the Solander Trough. Cardinal fish were targeted off the North Island east coast.

Group 5 species

Effort targeting beryx and bluenose was mainly off the east coast North Island, with some effort east of the Chatham Islands and in isolated areas off the Chatham Rise. Effort was primarily between 39° and 45° S.

Group 6 species

In the early years of the time series, most of this effort was reported on CELRs. Primarily the effort is close inshore off the east and west coasts of the North Island and lesser effort off the South island. There was reasonably consistent effort north of 40° S, with cells of highest fishing intensity from the Hauraki Gulf in most years.

The effort seen off the South Island decreased markedly after about 1992–93, after which few cells, relative to North Island wasters, were fished for Group 1 targets. In 2002–03, there was increased effort off the north-western coast of the South Island and this increase was maintained in the following years. In 2004–05, there was increased reporting of effort targeted at these species off the South Island west coast. There was also increased effort around the Chatham Islands during 2000–01 and subsequent years, after sporadic activity in earlier years.

Gurnard targeting was reported mainly from off the east coast North Island south of about 37° S and Canterbury Bight during the early 1990s. In later years effort as reported mainly from around the North Island coast and generally in waters north of 41°S, apart from some around the Chatham Islands.

Effort targeting john dory was concentrated between 35.5° and 38° S and most reporting for John dory on TCEPR began in 1995–96. TCEPR effort for snapper was at first concentrated on the west coast of the North Island, but after the mid 1990s both coasts in waters north of 40° S were consistently fished, particularly off the main harbours and in the Bay of Plenty. The snapper fisheries were affected by various TACC changes in the different fishstock areas over the years of this study (Ministry of Fisheries 2009a). Tarakihi reporting initially was in eastern waters but by the mid 1990s TCEPR effort was reported mainly from waters north of about 41° S until the early 2000s when vessels reported effort off the northwest of the South Island and the west coast to about 43.5° S and around the Chatham Islands. Trevally effort was initially reported from off the North Island west coast (particularly, off the harbours and the north and south Taranaki Bight), with some off the east coast North Island. In the mid 1990s more effort was reported on TCEPRs from the Bay of Plenty.

APPENDIX F — continued

Group 7 species

In 1989–90, scampi effort was concentrated off the east coast North Island in the northern Bay of Plenty to about 36° S and off Hawke Bay south to the Wairarapa coast, with a small amount of effort off the west coast South Island. In the following years, new areas were fished, including around the Chatham Islands, the northern Chatham Rise (west of 180°), Mernoo Bank, and the southeastern slope of the Auckland Islands Shelf. This distribution was maintained in most years, and in the late 1990s there was some effort near the western boundary of the EEZ on the Challenger Plateau. In 2004–05, scampi were reported from just east of 180° on the Chatham Rise. Competitive TACCs have been the s=reason for some of the changes in scampi distribution (Ministry of Fisheries 2009a).

Group 8 species

Few bottom trawls for flatfish were reported on TCEPRs. Their distribution included the inshore waters off the South Island east and south coasts, especially south of 44°S, South Island northwest coast, north of 43° S to Marlborough Sounds, and North Island west coast (south of 40° S).

APPENDIX G: CELL SUMMARIES

Table G1: Total number of *fished cells* by fishing year and proportion of the annual totals by 100-m depth zone, for 1989–90 (1990) to 2004–05 (2005).

Fishing year	No. <i>fished</i> <i>cells</i>	Depth (m)															
		100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
1990	12 673	16.1	19.2	8.6	6.5	8.3	8.2	6.7	8.8	2.9	4.3	3.7	2.2	2.0	1.2	0.8	0.5
1991	14 045	13.9	16.8	8.0	7.9	8.3	9.0	8.6	10.5	3.6	4.5	3.4	1.9	1.6	1.0	0.6	0.4
1992	15 777	15.3	17.0	8.0	7.1	11.2	10.8	8.7	10.0	2.4	3.2	2.5	1.2	1.2	0.6	0.5	0.4
1993	15 241	17.2	18.5	7.7	6.8	9.1	9.7	8.1	9.5	2.7	3.9	2.6	1.3	1.2	0.7	0.6	0.4
1994	14 647	19.3	18.9	8.0	6.0	8.3	9.3	7.4	7.5	2.4	3.8	3.3	1.7	1.8	0.8	0.9	0.5
1995	15 423	20.1	18.3	7.7	6.3	8.2	9.4	7.9	7.9	2.4	3.8	3.0	1.5	1.6	0.8	0.6	0.5
1996	15 785	21.6	18.0	7.9	6.3	8.4	9.7	7.7	6.4	2.5	3.9	3.0	1.5	1.4	0.8	0.6	0.3
1997	15 967	19.7	16.5	7.2	6.5	8.7	9.5	8.4	7.0	3.3	4.6	3.1	1.6	1.4	1.0	0.9	0.5
1998	17 529	18.2	15.4	7.2	6.9	9.3	10.2	7.5	7.3	3.2	5.4	3.5	1.8	1.8	0.9	0.9	0.6
1999	16 796	17.7	13.5	7.0	6.9	10.1	10.5	7.6	6.5	3.3	6.6	4.2	2.0	1.9	1.0	0.8	0.5
2000	17 189	16.4	14.1	7.1	7.0	10.6	11.2	8.3	6.5	2.7	6.2	4.3	1.9	1.5	0.9	0.8	0.5
2001	17 318	16.4	15.0	7.5	6.8	10.7	11.8	9.2	7.9	2.5	3.6	3.3	1.7	1.5	0.8	0.8	0.5
2002	19 187	16.3	15.4	7.4	6.7	10.8	13.4	9.0	7.7	2.3	3.3	2.7	1.5	1.3	0.8	0.8	0.4
2003	18 452	16.6	16.3	7.2	6.4	9.9	12.5	9.6	8.3	2.4	3.3	2.8	1.5	1.3	0.8	0.7	0.4
2004	17 003	17.9	16.0	6.3	5.8	9.7	13.1	9.3	7.7	2.4	3.7	3.1	1.8	1.5	0.8	0.7	0.4
2005	16 060	18.1	18.2	6.9	6.2	9.6	12.1	7.5	5.4	2.5	4.1	3.4	1.9	1.7	0.9	0.9	0.5
All	36 792	14.0	21.3	6.6	5.9	9.4	11.5	8.1	8.8	3.9	5.8	4.5	2.5	2.7	1.4	1.4	1.1

APPENDIX G — continued

Table G2: Proportions of *fished cells* for given tow densities (upper) and for percentages of a cell area (25 km²) that was trawled (lower) by 100-m depth zone, for all fishing years combined (1989–90 to 2004–05). The maximum values per cell and the total number of cells in each depth zone are also given.

No. tows per fished cell	Depth zone (m)																All
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	
1–2	13.9	10.9	16.2	15.2	19.1	26.4	25.8	29.8	36	24.3	34.5	42.3	52.1	42.1	49.4	55.0	23.5
3–5	8.3	7.7	12.1	9.9	12.4	11.9	12.6	12.9	15	15.6	15.8	14.4	11.1	15.5	16.5	18.3	11.7
6–10	8.8	7.4	9.0	9.0	9.3	9.3	8.4	10.2	10.7	14.2	10.7	9.0	7.9	10.0	8.8	7.3	9.3
11–20	9.5	9.0	8.5	10.8	8.2	9.1	7.6	9.6	8.7	12.3	10.3	8.5	7.8	7.0	6.7	4.0	9.1
21–50	13.4	16.4	13.7	16.5	13.1	11.1	12.4	12.6	10.6	13.6	10.5	7.3	7	8.2	6.4	6.7	12.7
51–100	9.9	14.2	10.7	11.9	9.0	5.4	8.7	7.5	7.0	6.9	6.5	6.4	5.7	5.3	3.4	3.5	9.1
101–250	15.8	16.8	10.7	10	8.3	6.4	10.1	8.2	7.3	8.5	7.6	8.2	4.8	7.4	5.4	3.2	10.3
251–500	11.7	9.7	6.5	5.2	8.0	8.3	7.7	5.5	3.2	3.4	2.6	2.5	2.1	2.9	2.2	1.1	7.0
501–1000	7.4	3.9	4.4	3.8	6.5	6.6	4.7	2.8	1.1	0.8	1.0	1.2	1.4	1.0	0.9	0.3	4.3
> 1000	1.4	3.9	8.2	7.8	6.1	5.5	2.0	0.9	0.3	0.2	0.5	0.2	0.2	0.6	0.2	0.5	3.2
Maximum	3229	14156	14311	6783	5306	5716	2342	1853	2151	2053	2727	1144	1818	2767	1021	3263	14311
Total cells	5138	4535	2418	2185	3446	4245	2985	3252	1456	2130	1668	929	989	511	534	371	36792
% cell area	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	All
0.1–4.0	16.5	11.0	16.3	14.2	18.1	22.6	19.8	24.7	35.1	27.6	38.4	45.3	52.0	47.0	52.7	60.9	23.0
4.1–20.0	20.2	19.1	25.1	23.4	24.9	25.1	24.9	26.0	30.2	34.0	30.3	25.5	24.7	25.4	30.7	26.6	24.7
20.1–40.0	10.6	10.7	9.6	11.1	9.9	8.6	8.2	10.0	8.7	12.8	10.2	8.7	7.3	8.4	5.8	5.4	9.8
40.1–60.0	6.3	7.4	6.5	8.6	5.5	5.2	4.9	4.8	5.2	5.3	4.1	2.8	3.5	4.3	1.5	1.4	5.6
60.0–80.0	3.7	6.1	4.2	5.5	3.2	3.2	4.0	5.0	3.3	3.2	2.7	2.6	1.6	2.7	2.0	0.8	3.9
80.1–100.0	3.5	4.2	4.0	4.5	2.9	2.1	2.6	3.0	1.8	2.1	1.7	1.5	1.3	2.3	1.5	1.1	2.9
100.1–200.0	10.4	14.7	9.3	9.8	7.3	6.1	9.2	7.4	6.3	6.3	5.7	7.7	4.4	5.5	3.2	1.9	8.6
200.1–300.0	7.5	7.3	4.7	3.8	3.0	2.3	4.9	3.8	2.5	3.3	2.9	2.3	1.9	1.0	0.7	0.5	4.3
300.1–400.0	5.3	4.6	2.5	2.2	2.5	1.7	3.4	2.8	1.5	2.0	1.7	1.3	1.1	1.0	0.7	0.5	2.9
400.1–800.0	11.2	8.2	6.0	5.9	7.8	6.7	6.3	5.0	3.2	2.7	1.4	2.2	1.7	1.8	1.1	0.3	6.3
800.1–1200.0	3.1	2.1	2.4	2.6	4.4	4.6	5.0	3.1	1.0	0.5	0.4	0.2	0.2	0.2	0.0	0.3	2.7
1200.1–1600.0	1.0	1.0	2.2	1.6	3.0	2.5	1.9	1.9	1.0	0.0	0.2	0.0	0.1	0.2	0.0	0.0	1.4
1600.1–2000.0	0.4	0.7	1.0	1.2	1.6	1.9	1.6	0.9	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.9
> 2000.0	0.2	2.8	6.2	5.6	5.9	7.5	3.5	1.6	0.1	0.2	0.1	0.0	0.0	0.2	0.0	0.3	3.0
Maximum	1314	6586	6569	3190	2020	2364	1487	1002	514	605	624	286	415	551	174	736	6586

APPENDIX G — continued

Table G3: Footprint or coverage area (1000 km²) by 100-m depth zone and fishing years 1989–90 (1990) to 2004–05 (2005).

Fishing	Depth zone (m)																
year	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	All
1990	5.1	9.2	5.7	3.8	5.1	5.1	3.2	4.0	1.0	1.5	1.1	0.6	0.5	0.4	0.1	0.1	46.3
1991	4.5	8.1	5.7	5.4	5.5	6.4	4.5	8.1	1.7	1.4	0.7	0.3	0.3	0.2	0.0	0.0	52.9
1992	5.9	9.8	5.8	5.8	9.6	9.5	8.4	9.1	0.9	1.1	0.5	0.3	0.3	0.1	0.1	0.1	67.3
1993	7.1	11.2	5.5	4.9	8.2	10.4	8.5	8.8	1.1	1.3	0.6	0.3	0.4	0.2	0.1	0.1	68.4
1994	6.4	10.2	5.9	4.7	6.9	9.1	4.7	4.0	0.8	1.2	0.8	0.4	0.4	0.2	0.1	0.1	55.8
1995	8.4	9.9	6.0	4.9	7.9	11.9	7.2	5.1	0.6	1.0	0.7	0.3	0.3	0.2	0.1	0.1	64.8
1996	12.7	11.6	7.0	5.2	9.0	12.1	6.7	4.2	0.8	1.2	0.7	0.3	0.2	0.1	0.1	0.0	71.9
1997	11.8	10.2	7.0	5.7	9.2	13.7	8.4	5.2	1.2	1.5	0.7	0.4	0.2	0.1	0.1	0.1	75.8
1998	13.4	11.6	6.4	6.7	11.7	16.6	8.7	5.3	1.2	1.9	0.9	0.5	0.4	0.2	0.1	0.1	85.6
1999	11.7	10.0	5.2	5.9	12.4	16.4	7.8	4.0	1.1	2.0	1.1	0.6	0.4	0.2	0.1	0.1	79.1
2000	10.8	9.6	5.5	6.0	13.1	16.9	9.6	4.7	1.3	1.8	1.0	0.4	0.3	0.2	0.2	0.1	81.4
2001	11.9	9.7	5.7	6.0	13.9	18.0	9.7	5.9	1.4	1.2	0.7	0.4	0.2	0.1	0.1	0.1	84.8
2002	13.0	10.2	6.2	6.1	13.6	18.5	9.6	8.4	1.3	1.3	0.7	0.4	0.3	0.1	0.1	0.1	89.9
2003	12.0	10.8	6.3	6.1	15.3	19.5	10.4	6.7	1.2	1.0	0.7	0.4	0.3	0.1	0.1	0.1	90.9
2004	12.1	9.3	5.6	5.0	12.2	16.4	8.2	5.6	1.1	1.2	0.8	0.6	0.3	0.1	0.1	0.1	78.7
2005	12.0	10.7	5.8	4.5	9.1	12.6	5.6	2.6	0.8	1.0	0.8	0.4	0.3	0.1	0.1	0.0	66.4
All	54.3	54.1	24.4	22.5	36.7	42.0	31.2	27.9	7.6	11.2	6.8	3.5	3.0	1.5	1.1	0.6	328.4

APPENDIX G — continued

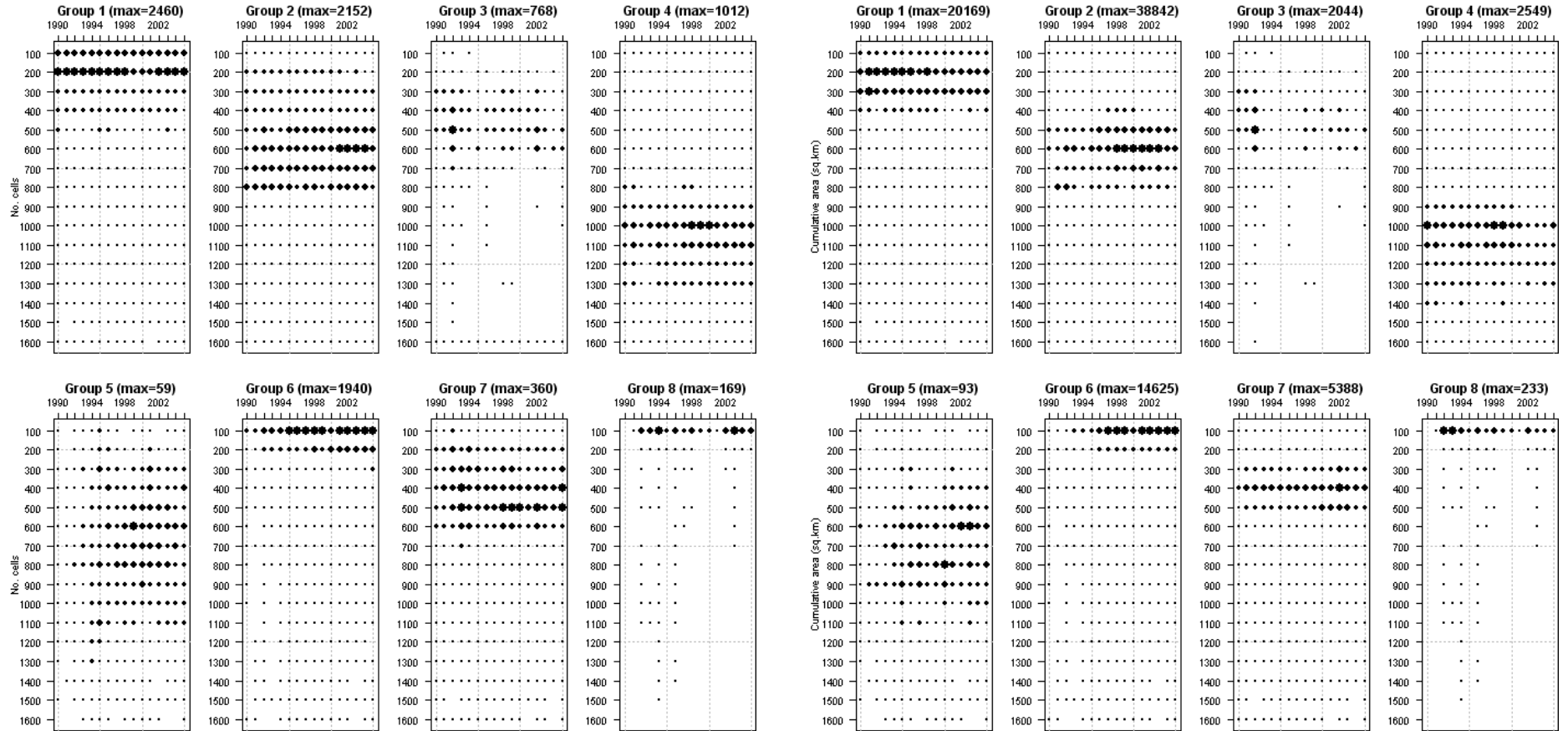


Figure G1: The numbers of cells contacted by tows (left) or by aggregate swept area (right) for each species group, by 100-m depth zone and fishing year. Note that different scales are used for each plot, the largest circle in each plot being the maximum number of cells (or aggregate swept area) per depth zone in a year.

APPENDIX G — continued

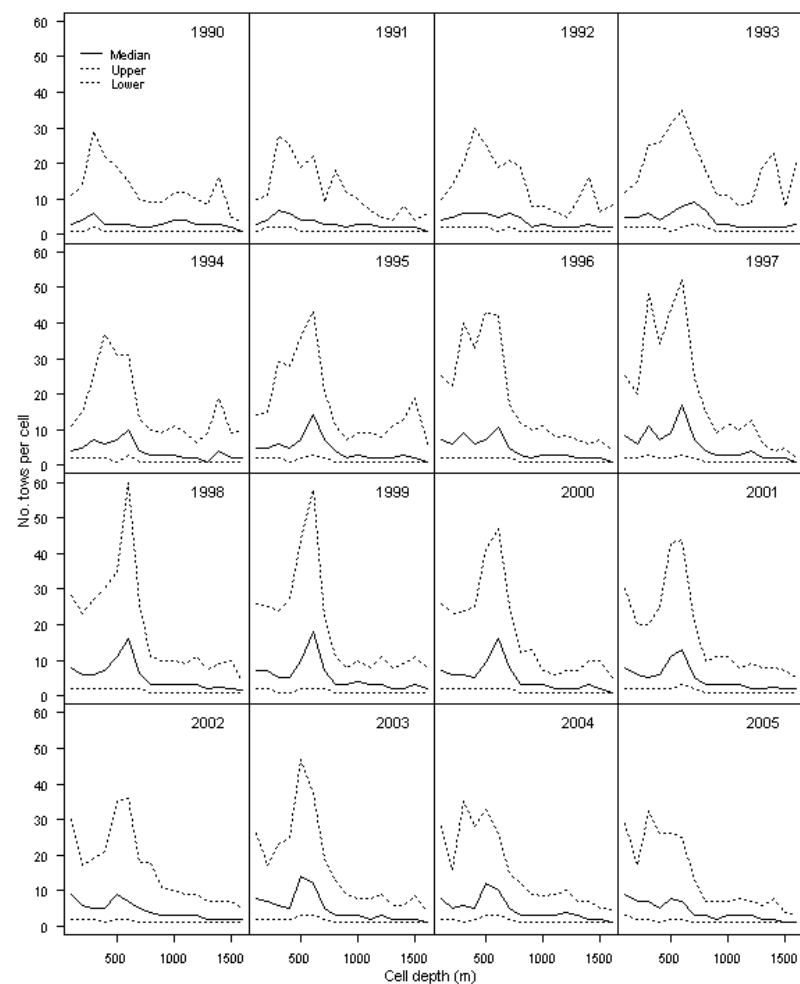
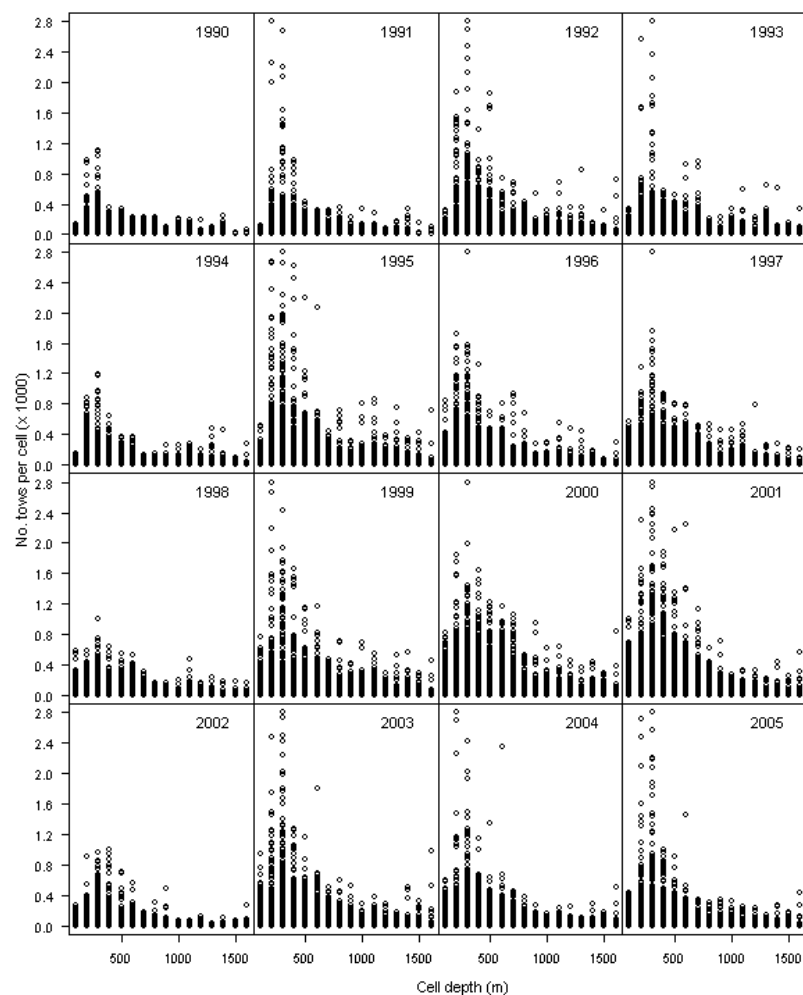


Figure G2: Distribution of the numbers of cells contacted by tows (left) and the median numbers of tows per cell (with upper and lower quartiles) (right), by 100-m depth zone and fishing year, 1989–90 (1990) to 2004–05 (2005).

APPENDIX G — continued

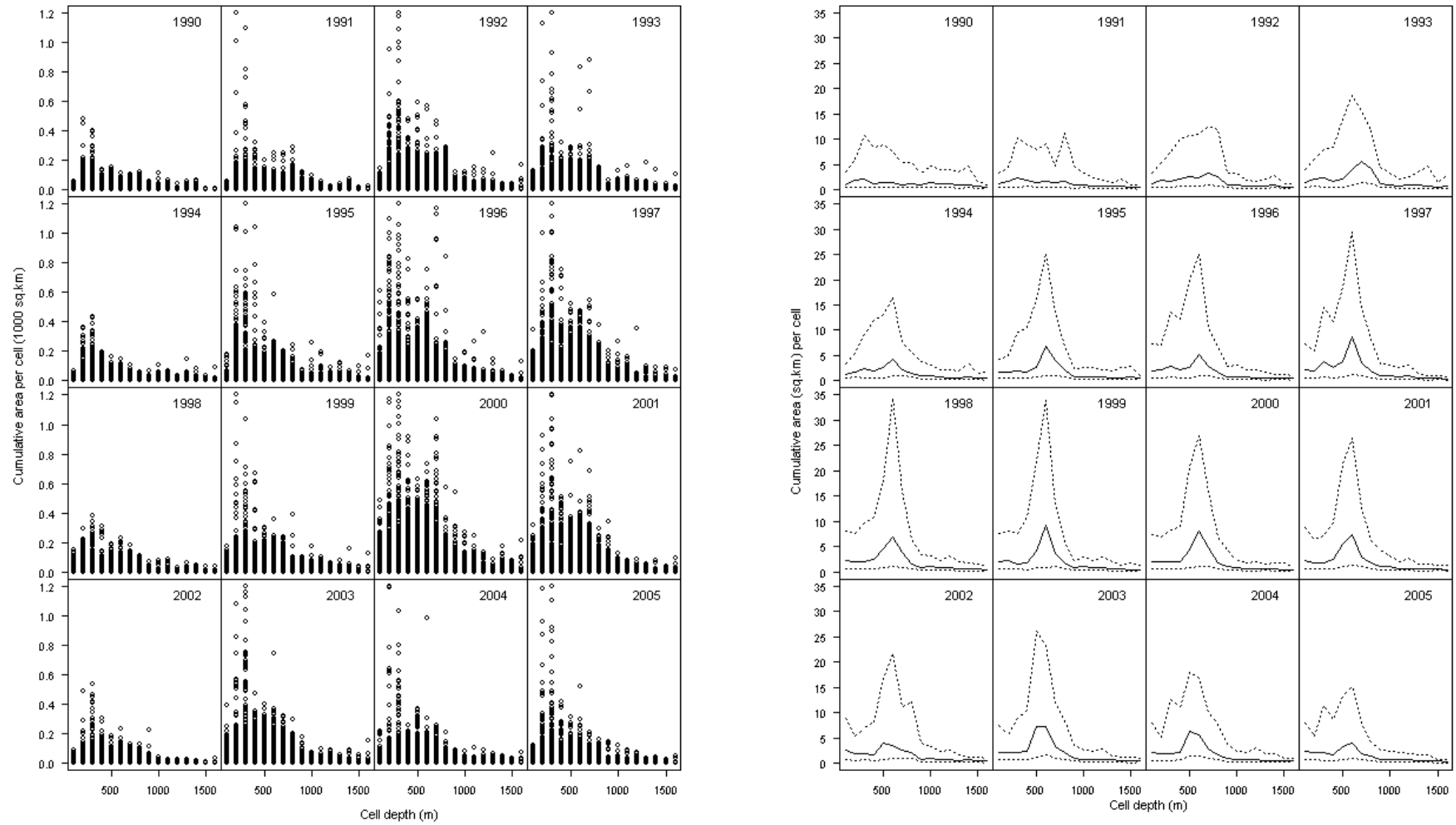


Figure G3: Distribution of the aggregate swept area values per cell (left) and the median numbers of tows per cell (with upper and lower quartiles) (right), by 100-m depth zone and fishing year, 1989–90 (1990) to 2004–05 (2005).

APPENDIX H: Trawl effort reported by Statistical Area, 1989–90 to 2004–05

Table H1: Number of bottom trawl gear tows, by target species, reported on CELRs, 1989–90 (1990) to 2004–05 (2005). Species codes are defined in Table C2.

Target species	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
BAR	3127	5129	4585	4906	3169	3180	4370	6037	2949	4673	5597	5736	4031	4026	3545	2958	68018
BCO	349	193	109	112	46	22	12	33	97	79	91	39	57	23	28	49	1339
BNS	26	105	49	50	0	3	6	3	27	8	0	3	9	2	0	0	291
BYX	28	38	5	4	3	5	5	1	0	0	5	0	0	0	15	0	109
CDL	376	301	18	82	107	60	94	47	48	33	36	0	0	0	0	1	1203
ELE	566	224	272	154	170	136	196	121	100	118	125	135	238	441	568	572	4136
FLA	26450	25666	26102	35976	30821	33351	34108	38682	36066	33986	25752	24180	22980	25715	25695	25891	471421
GSH	590	642	152	178	203	358	246	74	74	77	170	139	361	337	251	280	4132
GUR	3688	5683	6646	6281	5107	3744	3143	3454	3793	5648	6709	6318	6556	5804	4238	5195	82007
HOK	749	711	392	732	946	1509	1120	1305	842	368	433	188	133	123	111	67	9729
HPB	19	25	12	12	7	15	0	0	4	20	32	28	25	17	18	8	242
JDO	1174	1507	1438	1816	1925	1523	1027	781	651	973	1008	700	643	1006	1723	1790	19685
JMA	17	39	3	19	5	3	2	2	0	62	35	17	2	32	13	3	254
LDO	34	16	18	7	8	0	2	0	0	2	0	10	3	7	1	30	138
LEA	271	88	51	12	12	0	10	14	0	20	7	0	5	12	95	92	689
LIN	343	350	339	273	175	156	58	58	49	64	84	42	117	157	130	291	2686
MOK	12	10	6	2	15	3	29	38	56	39	61	76	49	46	24	18	484
OEO	14	27	52	79	46	119	13	4	106	255	527	246	260	328	271	245	2592
ORH	1703	1843	1578	1218	1058	1061	574	575	621	1187	1189	428	423	288	355	605	14706
QSC	853	903	748	324	967	834	498	431	433	312	713	221	355	276	226	123	8217
RBY	11	17	21	8	18	0	10	4	6	0	0	6	0	0	0	0	101
RCO	6581	6775	9601	11816	10923	12011	10409	11184	11666	8271	6826	8548	7762	6968	6145	6374	141860
SCH	69	56	50	39	13	19	35	9	23	64	23	37	49	5	12	0	503
SCI	0	54	4	0	0	0	1	0	19	236	154	195	172	586	56	0	1477
SKI	1854	1915	2379	2653	1057	841	617	683	296	218	79	111	45	112	48	79	12987
SNA	10412	11565	12222	8722	8076	6016	2090	702	813	736	694	372	804	894	1197	2419	67734
SPD	419	684	121	46	17	41	63	48	14	17	78	7	74	6	3	190	1828
SPE	137	53	256	330	216	341	338	154	413	302	494	407	327	138	131	81	4118
SPO	77	133	128	38	90	76	76	39	42	12	36	12	38	11	23	17	848
SQU	13	17	38	99	189	75	76	74	55	324	174	733	197	320	114	402	2900
STA	2524	2199	1756	1425	2606	2450	2180	1855	762	1651	2045	2190	1576	1321	1924	1958	30422
SWA	0	3	10	0	0	6	1	0	0	6	5	30	5	36	19	21	142
TAR	7620	10642	10546	8850	8993	7503	5204	5393	5020	6558	5983	4879	4646	5133	5272	6330	108572
TRE	1829	2145	1384	2144	2058	1255	731	1272	1494	1795	1482	793	619	641	406	336	20384
WAR	447	523	681	610	393	494	494	389	460	673	664	714	661	1090	1006	1021	10320
Other	497	225	130	62	41	72	172	243	302	131	102	42	30	20	22	30	2121
All	72879	80506	81902	89079	79480	77282	68010	73709	67301	68918	61413	57582	53252	55921	53685	57476	1098395

APPENDIX H — continued

Table H2: Main target species codes reported on CELRs, for bottom trawl effort, 1989–90 to 2004–05.
The target species summaries are presented in the species order listed below (see tables H4–H35).

Code	Scientific name	Common name
BAR	<i>Thyrsites atun</i>	barracouta
BCO	<i>Parapercis colias</i>	blue cod
BNS	<i>Hyperoglyphe antarctica</i>	bluenose
BYX	<i>Beryx splendens</i> , <i>B. decadactylus</i>	alfonsino, long-finned beryx
CDL	<i>Epigonus</i> spp.	cardinalfishes
ELE	<i>Callorhinchus milii</i>	elephant fish
FLA		flatfish
GSH	<i>Hydrolagus novaezealandiae</i>	ghost shark
GUR	<i>Chelidonichthys kumu</i>	red gurnard
HOK	<i>Macruronus novaezealandiae</i>	hoki
HPB	<i>Polyprion oxygeneios</i> , <i>P. americanus</i>	hapuku, bass
JDO	<i>Lepidorhynchus denticulatus</i>	John dory
JMA	<i>Trachurus</i> spp.	jack mackerel
LDO	<i>Cyttus traversi</i>	lookdown dory
LEA	<i>Parika scaber</i>	leatherjacket
LIN	<i>Genypterus blacodes</i>	ling
MOK	<i>Latridopsis ciliaris</i>	moki
OEO	<i>Allocytus niger</i> , <i>A. verrucosus</i> , <i>Neocyttus rhomboidalis</i> , <i>Pseudocyttus maculatus</i>	oreo
ORH	<i>Hoplostethus atlanticus</i>	orange roughy
QSC	<i>Zygochlamys delicatula</i>	queen scallop
RBV	<i>Plagiogeneion rubiginosus</i>	rubyfish
RCO	<i>Pseudophycis bachus</i>	red cod
SCH	<i>Galeorhinus galeus</i>	school shark
SCI	<i>Metanephrops challenger</i>	scampi
SKI	<i>Rexea solandri</i>	gemfish
SNA	<i>Pagrus auratus</i>	snapper
SPD	<i>Squalus acanthias</i>	spiny dogfish
SPE	<i>Helicolenus</i> spp.	sea perch
SPO	<i>Mustelus lenticulatus</i>	rig
SQU	<i>Nototodarus</i> spp.	arrow squid
STA	<i>Kathetostoma giganteum</i>	giant stargazer
SWA	<i>Seriotelella punctata</i>	silver warehou
TAR	<i>Nemadactylus macropterus</i>	tarakihi
TRE	<i>Pseudocaranx dentex</i>	trevally
WAR	<i>Seriotelella brama</i>	common warehou

APPENDIX H — continued

Table H3: Number of bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	476	541	334	326	289	314	221	344	259	14	12	5	0	0	0	0	3135
2	470	658	637	521	683	531	183	300	215	245	459	88	105	49	18	121	5283
3	2271	2271	2616	2883	2054	1173	765	543	489	621	558	654	918	382	1247	2324	21769
4	461	937	830	243	362	374	64	68	26	59	24	11	89	71	10	2	3631
5	2831	3901	3888	2227	1657	1306	679	235	137	224	335	211	106	333	599	963	19632
6	2264	2514	3370	2125	1929	1509	48	13	66	58	129	20	32	135	189	273	14674
7	344	74	106	75	59	252	813	988	612	491	222	181	122	96	141	140	4716
8	1012	1036	1942	1843	942	630	160	226	223	461	465	137	369	246	130	443	10265
9	1774	2624	2696	2552	1819	1305	558	798	267	355	449	133	316	285	315	252	16498
10	1671	2244	1848	1576	1608	1264	305	498	259	373	768	469	422	475	379	419	14578
11	475	752	860	871	898	681	378	501	509	498	491	223	149	239	184	163	7872
12	989	1345	926	1201	1307	1564	1148	1122	1212	906	1056	796	487	584	694	536	15873
13	4470	5802	6645	6366	5894	6640	5719	5386	5735	6078	5665	5132	5769	5333	4769	5705	91108
14	2235	1883	2570	3075	2355	1695	1620	1880	1722	1454	1594	1693	1240	1592	920	1127	28655
15	822	1034	617	469	315	361	364	253	376	391	195	230	263	151	110	173	6124
16	677	754	1065	809	784	784	889	780	768	965	960	743	633	815	851	781	13058
17	3392	3351	2303	3226	4520	5219	4208	4907	3807	3245	2753	2304	2760	2264	2491	1913	52663
18	1511	2078	1554	2206	2212	2566	2116	1917	1791	1727	1560	2176	1921	889	694	763	25681
19	43	74	8	102	13	7	1	0	23	9	36	3	13	11	8	29	380
20	5480	5174	5793	5772	5523	5312	4713	5108	5799	5790	5901	6930	4917	5119	4699	5424	87454
21	61	19	40	57	77	26	6	37	40	31	61	171	241	14	65	13	959
22	7204	8110	7237	8098	7242	7304	7858	8742	9313	9155	7866	6562	5602	6817	6316	6670	120096
23	7	15	5	36	3	6	11	23	10	28	177	166	81	20	19	2	609
24	7378	6396	6149	7510	8047	7015	5629	6255	6281	6122	5682	4634	4778	6189	4435	4596	97096
25	523	460	652	1072	1551	1575	1966	1279	2088	1497	922	1024	1060	1122	975	1135	18901
26	3191	2426	2891	2993	3284	3260	3865	5479	4245	3028	2851	3662	3624	4568	4846	4172	58385
27	28	20	11	29	2	73	176	121	59	82	52	91	124	76	28	77	1049
28	2	0	2	3	3	1	19	27	13	12	2	10	0	0	3	9	106
29	431	288	211	172	132	157	74	288	78	334	526	260	181	69	90	112	3403
30	2254	2799	2185	1970	2509	2536	2325	2299	1701	2762	2847	3402	2966	2817	2244	2699	40315
31	7	33	10	10	19	46	33	48	24	50	32	27	59	77	43	93	611
32	1	158	80	59	107	283	107	201	65	84	275	192	134	209	58	118	2131
33	759	1393	1768	2318	1380	1142	1336	2274	1359	2152	1641	1367	982	1878	1421	2189	25359
34	3253	3490	5181	6461	4141	4645	5753	6364	3971	5552	3990	4851	3906	3756	4164	3804	73282
35	1284	1040	1859	4127	2154	2099	1588	1927	1904	2802	1069	1277	830	836	1439	1489	27724
36	185	186	233	315	179	133	352	380	192	527	489	469	276	327	525	543	5311
37	663	360	348	827	1056	844	951	1037	484	695	892	574	396	338	428	327	10220
38	7041	7855	6910	7932	5673	7424	6589	7337	7140	5000	4175	3880	4676	5503	6313	6321	99769
39	623	876	414	427	705	974	1115	807	608	712	639	557	686	892	1102	807	11944
40	158	172	89	99	118	123	61	75	72	144	458	80	156	40	126	111	2082
41	1099	1313	987	1256	845	624	847	1021	919	1794	1368	803	715	673	379	345	14988
42	770	1019	1066	1266	1306	993	858	898	1191	983	738	588	476	33	38	20	12243
43	7	37	18	1	55	4	45	38	18	61	62	0	4	0	0	2	352
44	0	24	15	16	9	0	4	16	8	11	0	0	0	0	0	0	103
45	379	1297	1223	1254	1313	717	299	34	153	139	220	326	210	184	61	25	7834
46	200	264	76	409	388	195	59	34	17	63	59	24	23	69	9	7	1896
47	1114	642	1059	1525	1436	1091	245	123	81	439	363	209	78	107	0	52	8564
48	7	21	2	23	17	7	6	0	0	2	0	0	2	0	0	2	89
49	3	0	10	1	6	78	5	0	3	0	0	0	8	62	22	51	249
50	293	410	235	8	186	88	351	218	556	242	0	72	113	62	21	76	2931
51	0	29	0	0	6	1	6	0	0	0	12	0	5	0	0	0	65
52	0	0	16	1	4	11	10	0	0	0	0	37	14	17	3	5	118
91	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	34
93	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	5
94	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	3
101	6	2	0	0	0	0	0	3	0	4	4	0	0	0	0	0	19
103	0	0	0	0	0	0	2	0	4	0	0	9	8	2	3	3	31
104	0	0	0	0	0	0	2	0	4	1	0	0	0	0	0	0	7
105	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
106	0	6	2	0	3	0	2	1	5	2	0	0	0	3	0	0	24
107	0	0	0	0	0	1	0	0	0	3	0	0	0	1	0	0	5
201	0	4	4	0	0	0	0	0	0	0	0	0	0	1	0	0	9
202	0	0	1	0	0	0	0	0	14	3	0	0	0	0	0	3	21
203	0	0	0	0	0	0	0	0	16	12	0	0	0	0	0	0	28
204	131	55	2	31	5	0	0	0	0	0	19	7	0	0	0	0	250
205	0	1	0	0	0	0	0	3	4	0	0	4	0	0	0	0	12
301	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	6
302	0	0	0	3	0	0	0	0	4	0	0	0	0	5	0	0	12
303	0	0	0	0	3	3	0	0	4	14	0	0	0	1	0	0	25
401	0	0	0	0	0	0	0	0	8	0	77	8	83	36	36	7	255
402	0	0	0	0	3	0	0	0	0	1	18	55	52	8	18	20	175
403	0	0	0	0	0	0	0	0	0	0	11	0	7	7	12	37	7
404	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	3	7
406	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	6
407	0	0	0	0	0	0	3	0	0	5	0	9	2	0	0	0	19
409	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
410	0	0	0	0	0	0	0	23	0	0	0	0	0	2	0	0	25
502	0	0	0	0	0	2	2	0	0	10	0	0	0	0	0	0	14
602	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
603	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
604	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
605	0	0	0	0	0	6	0	0	2	0	0	0	0	0	0	0	8
606	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	5
607	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
610	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
613	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
616	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
624	0	0	0	0	0	0	0	0	2	0	2	0	6	0	0	0	10
702	0	6	0	0	0	0	0	0	3	87	14	0	0	0</			

APPENDIX H — continued

Table H4: Number of barracouta bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	10	0	0	41	42	12	17	14	4	0	0	0	0	0	0	0	140
2	18	7	1	24	9	27	12	0	0	0	26	15	0	0	0	0	139
3	41	85	61	44	2	0	1	7	17	5	12	8	2	7	0	0	292
4	0	3	1	4	1	0	1	0	0	3	3	0	0	0	0	0	16
5	8	5	6	0	3	7	11	0	0	0	0	0	0	0	0	0	40
6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
7	47	0	30	10	1	0	20	81	24	43	37	0	0	0	4	0	297
8	19	10	27	36	18	11	0	1	3	36	6	3	0	0	0	0	170
9	98	136	498	232	58	57	8	18	26	22	14	4	0	0	0	0	1171
10	42	39	46	51	44	22	0	3	17	1	4	11	7	0	2	0	289
11	6	6	1	8	10	1	2	0	11	0	9	2	0	0	8	0	64
12	10	9	8	20	67	29	6	5	31	20	28	16	5	3	3	4	264
13	31	67	97	169	119	52	46	31	20	46	30	38	46	14	31	11	848
14	76	29	37	93	122	45	45	48	93	143	38	37	5	33	12	0	856
15	18	22	0	21	11	0	13	12	0	2	12	6	0	0	0	2	119
16	0	15	30	37	20	44	43	82	0	20	103	8	14	1	7	5	429
17	224	251	77	96	146	393	487	1226	291	417	549	520	238	218	264	169	5566
18	248	363	398	312	253	429	379	453	306	197	511	656	346	206	241	162	5460
19	0	0	0	0	6	0	0	0	0	0	0	0	2	0	0	0	8
20	92	187	71	9	30	53	51	59	38	65	109	272	186	113	122	149	1606
21	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
22	867	1325	442	403	127	251	441	382	354	519	371	474	325	987	302	265	7835
23	0	4	0	0	0	2	0	5	0	0	0	0	0	0	0	0	11
24	154	249	131	97	21	45	29	30	29	2	0	0	6	3	3	0	799
25	0	1	0	0	0	2	3	0	0	0	0	0	0	5	38	34	83
26	13	0	0	0	2	0	0	0	0	0	0	0	0	0	5	10	30
27	0	4	0	2	0	0	0	0	6	0	0	0	0	20	0	0	32
29	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6
30	6	5	0	7	1	3	3	0	0	0	2	0	0	2	10	26	65
31	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4
32	0	0	2	0	0	3	6	40	0	0	9	0	6	0	3	0	69
33	118	339	569	619	324	157	380	919	300	717	857	659	228	440	396	420	7442
34	330	476	345	815	359	226	849	1270	845	1489	1627	1694	1232	824	632	296	13309
35	29	97	26	125	62	110	21	70	12	66	47	90	176	109	81	162	1283
36	55	46	87	121	86	53	64	155	47	164	162	205	138	92	127	156	1758
37	62	118	209	453	498	112	179	242	71	108	186	242	191	161	185	109	3126
38	380	1040	1268	923	536	765	881	633	308	482	615	655	618	575	835	733	11247
39	31	33	18	25	10	197	235	176	56	28	108	68	131	160	199	152	1627
40	0	0	7	4	0	18	5	27	3	2	76	13	30	12	6	37	240
41	1	1	16	2	6	0	2	25	13	25	21	12	94	40	28	55	341
42	8	24	5	8	13	0	5	0	0	1	16	22	0	1	0	1	104
43	0	0	0	0	0	0	21	0	0	0	0	0	3	0	0	0	24
45	1	42	0	8	17	0	0	0	6	5	6	0	0	0	0	0	85
46	0	0	0	9	35	0	0	0	2	0	0	0	0	0	0	0	46
47	27	62	63	62	82	43	8	0	11	27	3	2	0	0	0	0	390
48	0	0	0	1	1	0	0	0	0	0	0	0	2	0	0	0	4
49	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	7
50	4	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	10
205	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
301	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
303	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
402	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
703	0	0	3	0	5	0	0	0	0	0	0	0	0	0	0	0	8
705	0	0	0	0	6	0	5	0	0	0	0	0	0	0	0	0	11
Unknown	1	21	3	11	10	7	86	23	5	18	0	0	0	0	0	0	185
All	3127	5129	4585	4906	3169	3180	4370	6037	2949	4673	5597	5736	4031	4026	3545	2958	68018

APPENDIX H — continued

Table H5: Number of blue cod bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
17	245	107	20	19	10	8	0	3	13	5	63	1	26	0	2	0	522
18	0	0	0	3	5	0	0	11	37	32	7	13	7	0	0	2	117
19	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
20	0	3	0	0	0	0	2	2	6	3	18	16	5	5	8	0	68
22	7	0	5	2	2	2	2	7	14	24	3	2	8	4	1	0	83
24	2	0	4	0	15	3	0	4	3	0	0	7	1	2	14	47	102
25	0	0	1	4	6	0	0	3	0	3	0	0	6	10	3	0	36
26	0	0	1	0	0	0	1	0	24	0	0	0	0	0	0	0	26
27	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
30	16	23	20	23	0	0	1	0	0	0	0	0	2	0	0	0	85
32	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	4
33	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
34	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	6
35	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
38	79	55	50	44	5	9	0	0	0	8	0	0	0	0	0	0	250
50	0	0	8	0	0	0	0	0	0	0	0	0	2	0	0	0	10
51	0	0	0	0	0	0	4	3	0	0	0	0	0	0	0	0	7
All	349	193	109	112	46	22	12	33	97	79	91	39	57	23	28	49	1339

Table H6: Number of bluenose bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
10	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
13	0	0	27	23	0	0	0	0	0	0	0	3	0	0	0	0	53
14	25	95	13	18	0	0	0	0	27	3	0	0	0	0	0	0	181
15	1	7	8	6	0	0	0	0	0	4	0	0	0	0	0	0	26
16	0	1	1	3	0	0	0	3	0	1	0	0	0	0	0	0	9
18	0	0	0	0	0	3	6	0	0	0	0	0	0	0	0	0	9
22	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
43	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
50	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
404	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
All	26	105	49	50	0	3	6	3	27	8	0	3	9	2	0	0	291

Table H7: Number of alfonsino bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
13	2	0	0	3	0	0	0	0	0	0	3	0	0	0	5	0	13
14	13	31	5	1	1	2	2	0	0	0	0	0	0	0	9	0	64
15	6	0	0	0	2	2	3	1	0	0	0	0	0	0	1	0	15
16	3	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	6
18	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
19	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
All	28	38	5	4	3	5	5	1	0	0	5	0	0	0	15	0	109

Table H8: Number of cardinalfish bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
5	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
8	0	3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	7
9	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
11	0	3	0	5	0	8	3	0	0	0	2	0	0	0	0	0	21
12	3	27	0	1	40	20	20	2	0	0	0	0	0	0	0	0	113
13	316	200	16	65	58	32	62	45	48	33	33	0	0	0	0	0	908
14	31	33	0	7	9	0	0	0	0	0	1	0	0	0	0	1	82
15	13	23	0	4	0	0	0	0	0	0	0	0	0	0	0	0	40
18	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
204	9	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	11
Unknown	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
All	376	301	18	82	107	60	94	47	48	33	36	0	0	0	0	1	1203

APPENDIX H — continued

Table H9: Number of elephant fish bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
3	22	0	1	0	0	9	0	0	0	0	0	0	0	0	0	0	32
4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
5	0	0	0	0	15	15	0	0	0	0	0	0	0	0	0	0	30
7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
16	0	0	0	0	0	0	0	2	1	5	0	2	0	0	0	0	10
17	0	1	0	3	3	3	0	0	0	0	16	5	1	3	0	0	35
18	0	0	0	0	0	0	0	0	6	28	9	3	17	0	0	0	63
20	40	8	0	3	14	24	2	2	7	1	0	0	50	22	52	50	275
21	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	29
22	294	94	179	121	125	62	82	77	16	56	62	91	117	250	401	371	2398
24	96	89	46	21	0	12	0	21	31	13	27	27	15	78	19	51	546
25	17	3	0	2	0	0	20	3	0	2	0	0	0	23	21	18	109
26	9	0	9	0	0	0	3	0	0	0	10	7	0	4	39	28	109
27	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
29	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
30	51	29	35	0	10	8	68	14	13	1	1	0	5	45	36	54	370
32	0	0	0	1	0	3	11	0	0	0	0	0	0	0	0	0	15
33	6	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	15
34	12	0	0	3	3	0	3	2	17	12	0	0	0	8	0	0	60
35	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
38	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
39	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5
Unknown	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
All	566	224	272	154	170	136	196	121	100	118	125	135	238	441	568	572	4136

APPENDIX H — continued

Table H10: Number of flatfish bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	0	0	0	0	0	6	10	8	13	0	0	0	0	0	0	0	37
2	2	8	7	6	12	13	9	29	5	9	31	5	7	15	6	13	177
3	208	332	116	359	73	91	161	103	30	15	13	205	67	41	68	23	1905
4	0	0	0	0	2	4	5	0	13	27	0	0	0	0	10	1	62
5	10	93	67	180	110	66	35	0	4	0	0	4	0	0	0	0	569
6	0	0	0	3	8	6	0	0	0	0	0	0	0	0	0	0	17
7	112	0	0	0	10	192	727	621	389	345	145	181	118	92	121	121	3174
8	0	0	0	0	0	23	0	6	17	0	0	0	0	0	0	0	46
9	12	16	3	4	26	10	93	121	0	0	0	0	0	0	2	0	287
10	6	83	4	2	116	118	20	0	0	0	78	2	1	0	0	1	431
11	0	0	0	0	2	8	3	0	0	0	0	0	3	0	0	0	16
12	16	38	0	0	11	22	15	6	2	21	15	4	0	0	3	0	153
13	961	1040	1044	1554	1473	2997	2890	2507	2678	1943	808	623	587	511	666	677	22959
14	406	85	498	826	397	394	616	861	775	497	796	570	451	380	131	181	7864
15	1	0	0	3	4	48	1	4	0	14	0	1	1	0	0	0	77
16	19	12	11	59	92	43	53	28	41	20	5	3	19	3	3	20	431
17	1266	1301	1202	1507	2485	2677	2273	2618	2388	1769	1067	804	937	832	916	886	24928
18	135	174	57	160	40	38	238	172	114	418	176	41	129	63	80	225	2260
19	3	5	0	4	3	0	0	0	2	0	6	0	0	0	0	2	25
20	3012	3012	3286	2822	2304	2393	2555	2420	2290	3342	3508	2986	1979	2102	2175	2005	42191
21	10	19	38	46	70	20	0	30	4	5	25	21	46	0	4	8	346
22	1788	2904	2387	2860	1725	1684	1969	2448	3024	3397	2101	1170	1448	2018	2191	2347	35461
23	7	8	1	36	2	4	9	15	2	14	139	114	54	10	3	2	420
24	5187	4125	3711	6195	6368	5486	4680	4853	5231	5060	4493	3833	4023	5374	3871	4147	76637
25	263	286	437	942	627	495	1037	778	1673	1171	756	879	884	838	756	790	12612
26	2995	2333	2828	2943	3235	3102	3795	5307	3832	2886	2624	3502	3534	4463	4693	4060	56132
27	0	0	2	27	0	66	172	79	41	76	31	80	95	23	9	12	713
28	2	0	0	3	0	0	16	18	13	12	2	6	0	0	0	6	78
29	60	56	4	24	0	5	12	26	65	36	126	46	18	0	0	0	478
30	963	1414	1156	836	888	890	887	1272	1111	1707	1762	1932	1828	1520	581	856	19603
31	0	6	0	10	3	1	0	0	0	26	0	0	0	0	0	0	46
32	0	56	1	7	61	152	5	28	35	2	111	91	28	21	0	12	610
33	181	43	4	493	358	477	277	963	619	826	407	328	386	527	269	658	6816
34	1724	1903	2719	3794	2745	3241	3457	4126	2525	3105	1665	2627	1731	2045	2514	2287	42208
35	1084	723	1516	3396	1941	1920	1451	1738	1841	2364	795	963	508	566	1122	964	22892
36	41	99	105	141	21	36	266	139	132	188	101	172	53	24	43	94	1655
37	402	115	124	298	488	639	758	584	402	523	567	151	50	21	138	78	5338
38	5499	5247	4648	6274	4699	5654	4889	6124	6476	3888	3250	2723	3749	4159	4918	5119	77316
39	33	61	109	55	310	212	423	124	74	81	81	93	162	63	335	283	2499
40	0	0	4	2	0	9	3	0	11	0	0	0	0	0	0	5	34
41	0	0	1	3	0	0	3	18	6	29	0	0	0	0	64	4	128
42	0	0	0	0	0	1	25	151	59	55	0	1	72	0	3	0	367
43	0	0	0	0	0	4	21	38	3	37	55	0	0	0	0	0	158
44	0	0	0	0	0	0	3	0	0	6	0	0	0	0	0	0	9
45	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	6
47	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
48	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2	6
49	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
50	0	0	0	5	0	0	3	0	0	0	0	0	0	0	0	0	8
93	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
103	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
104	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	4
202	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	9
205	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	6
301	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
302	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
303	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
407	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
409	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
410	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	23
502	0	0	0	0	0	0	2	0	0	10	0	0	0	0	0	0	12
603	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
604	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
605	0	0	0	0	0	4	0	0	2	0	0	0	0	0	0	0	6
610	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
624	0	0	0	0	0	0	0	0	2	0	2	0	6	0	0	0	10
705	0	0	0	0	0	0	17	40	0	0	0	0	0	0	0	0	57
Unknown	39	69	12	91	110	100	217	247	87	53	11	19	6	4	0	0	1065
All	26450	25666	26102	35976	30821	33351	34108	38682	36066	33986	25752	24180	22980	25715	25695	25891	471421

APPENDIX H — continued

Table H11: Number of ghost shark bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
15	3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
16	3	27	0	0	0	0	0	0	0	0	0	0	16	11	5	1	63
17	429	551	139	174	144	357	244	74	71	61	140	70	257	241	155	198	3305
18	10	9	0	4	59	0	0	0	3	2	18	38	40	2	3	6	194
20	45	4	0	0	0	0	0	0	0	0	0	0	16	3	1	0	69
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
22	42	12	2	0	0	0	2	0	0	0	4	3	28	43	62	49	247
24	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
26	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	6
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
35	0	0	0	0	0	0	0	0	0	0	3	0	0	6	6	0	15
36	0	0	0	0	0	0	0	0	0	11	0	0	0	20	0	0	31
37	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	18	19
38	33	30	7	0	0	0	0	0	0	0	0	28	4	2	17	4	125
39	0	0	0	0	0	0	0	0	0	0	5	0	0	7	0	0	12
41	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
107	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
All	590	642	152	178	203	358	246	74	74	77	170	139	361	337	251	280	4132

APPENDIX H — continued

Table H12: Number of red gurnard bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	12	52	11	8	9	9	14	12	5	2	4	0	0	0	0	0	138
2	0	1	3	2	9	1	2	54	49	8	109	22	30	16	3	0	309
3	123	359	256	473	40	2	6	6	4	77	27	25	9	2	39	160	1608
4	4	175	300	3	2	0	3	2	1	3	0	0	0	0	0	0	493
5	92	169	367	143	22	6	0	8	0	65	21	19	0	1	46	180	1139
6	11	61	29	21	11	1	0	0	0	36	85	20	0	0	35	89	399
7	5	0	3	11	2	0	4	0	0	3	2	0	2	0	8	8	48
8	1	12	25	15	2	3	20	126	40	75	256	60	5	0	29	147	816
9	23	68	128	245	117	87	25	54	41	13	27	0	1	11	23	0	863
10	72	57	118	74	172	62	3	29	45	6	67	18	7	24	8	3	765
11	8	3	4	13	7	7	10	16	18	38	30	69	5	6	0	0	234
12	93	144	92	185	74	91	88	173	309	139	207	160	67	55	16	35	1928
13	835	1631	2332	2199	2359	1889	1581	1266	1609	2404	2998	2824	3582	2974	2269	2968	35720
14	423	474	812	895	825	521	533	435	430	530	439	629	571	711	538	445	9211
15	54	75	103	68	43	63	20	48	29	63	38	36	66	12	0	12	730
16	35	51	80	39	29	25	37	22	34	45	47	11	15	47	84	74	675
17	89	145	212	120	210	27	9	8	15	2	45	97	22	9	26	17	1053
18	10	41	5	107	18	52	58	18	0	22	0	61	6	0	0	1	399
19	0	0	0	37	0	0	0	0	0	0	0	0	1	0	0	0	38
20	228	221	42	32	51	85	45	28	23	14	49	246	218	139	27	26	1474
21	0	0	0	0	0	0	0	0	0	3	0	12	6	6	0	0	27
22	259	279	102	80	59	65	53	30	27	103	47	26	116	162	111	115	1634
24	22	4	19	11	3	8	3	0	4	18	12	17	15	60	23	20	239
25	0	0	0	1	3	0	0	0	0	4	9	10	40	33	21	11	132
26	20	0	0	0	0	2	0	15	0	0	0	3	7	4	7	12	70
27	0	3	0	0	0	0	0	3	0	0	0	0	8	5	0	0	19
29	0	0	0	0	0	0	0	0	4	3	27	6	0	0	0	0	40
30	38	45	22	21	27	4	4	4	3	0	32	8	113	66	49	152	588
31	0	0	0	0	0	0	0	1	0	0	0	2	0	3	0	0	6
32	0	5	6	0	1	6	13	17	0	0	0	0	0	6	0	0	54
33	26	51	59	87	21	2	0	0	0	0	3	0	14	48	58	4	373
34	96	109	145	10	12	22	47	8	3	7	2	16	81	72	47	12	689
35	49	36	16	17	6	0	4	19	8	3	21	19	40	44	47	24	353
36	1	4	3	0	0	3	0	8	5	21	21	6	11	28	39	38	188
37	20	24	0	12	12	18	0	119	7	11	10	16	39	27	11	1	327
38	160	307	273	119	59	91	21	30	15	47	13	156	97	177	140	66	1771
39	35	66	36	112	127	199	215	250	297	234	192	116	237	246	133	265	2760
40	69	38	8	38	8	39	0	7	44	106	228	20	70	9	70	51	805
41	438	512	500	397	251	141	254	333	331	1004	870	602	491	418	228	208	6978
42	290	398	423	372	242	56	39	180	231	253	531	482	296	32	33	3	3861
43	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	10
44	0	0	0	3	0	0	0	0	0	5	0	0	0	0	0	0	8
45	19	12	3	58	29	10	5	21	114	43	74	312	183	175	59	10	1127
46	0	13	0	14	29	4	6	30	2	4	28	22	23	69	8	7	259
47	8	21	77	235	215	143	9	50	12	144	127	164	57	105	0	28	1395
48	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
49	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
50	2	10	24	0	0	0	5	0	0	14	0	0	0	0	0	0	55
51	0	0	0	0	0	0	2	0	0	0	4	0	0	0	0	0	6
91	0	0	0	0	0	0	0	0	5	29	0	0	0	0	0	0	34
93	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
94	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
103	0	0	0	0	0	0	2	0	0	0	0	6	5	2	3	3	21
104	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
106	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
201	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
203	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	12
606	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	5
705	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Unknown	4	7	4	4	0	0	3	22	24	23	2	0	0	0	0	0	93
All	3688	5683	6646	6281	5107	3744	3143	3454	3793	5648	6709	6318	6556	5804	4238	5195	82007

APPENDIX H — continued

Table H13: Number of hoki bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	0	12	7	6	9	6	10	69	40	0	0	0	0	0	0	0	159
2	2	0	8	8	2	7	0	0	16	0	3	2	0	0	0	0	48
3	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
4	0	0	0	13	0	0	0	2	0	0	0	0	0	0	0	0	15
7	15	0	0	3	0	11	5	14	41	0	0	0	0	0	0	0	89
8	13	8	96	12	30	28	12	2	1	7	13	0	0	0	0	4	226
9	0	0	38	76	15	123	3	258	20	11	51	0	0	3	0	2	600
10	1	3	5	31	19	13	0	50	41	24	12	0	0	6	3	0	208
11	8	9	9	29	10	89	23	72	125	10	26	5	0	4	9	2	430
12	0	0	0	0	2	38	11	13	10	0	5	0	0	3	0	0	82
13	103	74	48	22	89	82	29	58	74	4	6	0	2	4	0	3	598
14	71	77	24	46	62	74	54	85	57	30	11	0	5	6	1	0	603
15	40	14	22	3	10	15	56	57	16	21	4	0	0	0	1	0	259
16	41	76	6	69	78	38	121	60	9	38	37	7	8	0	4	12	604
17	125	67	1	48	313	811	492	355	229	22	62	7	3	17	4	9	2565
18	125	189	47	118	117	121	88	62	14	26	10	26	1	0	3	0	947
19	0	0	0	0	0	3	1	0	0	7	0	0	0	0	0	0	11
20	4	12	1	15	16	7	0	13	11	3	56	96	8	0	36	0	278
22	0	2	0	6	0	0	4	0	9	3	41	0	0	0	0	0	65
32	0	0	0	0	0	0	9	0	6	0	6	0	0	0	0	0	21
33	0	95	57	84	70	0	38	54	42	117	53	21	55	34	26	21	767
34	112	64	12	105	96	43	83	66	55	39	34	24	51	46	24	14	868
35	6	0	0	35	5	0	10	0	0	0	0	0	0	0	0	0	56
36	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
37	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
38	74	4	8	3	0	0	3	8	0	0	0	0	0	0	0	0	100
39	0	3	1	0	3	0	17	6	7	6	0	0	0	0	0	0	43
42	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
44	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	6
47	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	5
94	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
205	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Unknown	0	1	0	0	0	0	47	0	7	0	0	0	0	0	0	0	55
All	749	711	392	732	946	1509	1120	1305	842	368	433	188	133	123	111	67	9729

Table H14: Number of hapuku/bass bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
10	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
13	0	7	5	0	0	0	0	0	0	0	0	0	0	0	0	0	12
15	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
16	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	5
17	0	0	0	0	0	1	0	0	0	0	21	14	24	0	0	3	63
18	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4
20	3	0	3	0	2	0	0	0	0	18	0	0	0	0	1	5	32
22	9	5	0	3	0	0	0	0	1	0	11	0	0	4	0	0	33
24	2	0	0	0	5	0	0	0	0	0	0	1	0	0	12	0	20
25	0	0	0	0	0	0	0	0	0	0	0	13	1	7	0	0	21
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
27	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
30	0	2	0	0	0	14	0	0	0	0	0	0	0	0	2	0	18
32	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
34	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
47	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
50	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	9
All	19	25	12	12	7	15	0	0	4	20	32	28	25	17	18	8	242

APPENDIX H — continued

Table H15: Number of John dory bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	11	96	4	6	9	29	0	10	0	4	0	1	0	0	0	0	170
2	0	6	27	2	5	0	0	0	0	15	0	7	0	0	4	4	70
3	338	462	641	832	915	412	370	387	381	368	315	327	149	141	523	804	7365
4	0	196	93	66	115	132	3	43	0	3	0	0	0	0	0	0	651
5	465	384	350	256	319	396	486	209	119	148	230	153	51	311	535	518	4930
6	145	96	66	119	166	64	10	10	25	4	15	0	0	119	143	85	1067
7	0	3	2	31	7	8	0	0	0	0	0	0	0	4	4	9	68
8	40	25	61	214	136	106	13	21	31	180	106	56	272	124	95	227	1707
9	21	21	88	161	119	168	23	3	29	31	26	0	25	32	125	3	875
10	18	4	12	3	8	24	0	0	1	0	29	0	4	32	10	6	151
12	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	6
13	68	162	32	58	65	49	22	24	0	25	90	15	22	19	25	41	717
14	24	10	46	15	4	28	4	36	23	23	18	18	2	1	11	0	263
15	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	6
16	3	1	2	27	22	12	18	13	14	34	31	28	14	94	26	23	362
17	10	14	3	4	0	0	0	0	0	13	74	55	50	0	30	38	291
18	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
30	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
31	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
33	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	4
35	0	0	0	0	0	0	0	0	0	0	8	0	0	0	1	0	9
36	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	7
37	0	7	0	0	0	0	0	0	0	3	0	0	0	5	0	1	16
38	7	3	2	0	0	0	0	0	0	3	21	7	9	10	12	19	93
39	18	8	2	4	2	22	38	16	28	103	9	0	19	95	176	9	549
40	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
41	3	0	1	15	2	0	17	5	0	6	18	15	0	1	0	0	83
42	0	0	0	0	0	0	0	0	0	0	3	0	4	0	0	0	7
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
44	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	6
45	0	6	0	0	1	3	0	0	0	0	0	0	15	0	0	0	25
46	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
47	0	0	0	0	27	5	8	0	0	3	8	18	0	0	0	1	70
105	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
106	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Unknown	0	3	0	2	0	57	11	3	0	7	2	0	0	9	0	0	94
All	1174	1507	1438	1816	1925	1523	1027	781	651	973	1008	700	643	1006	1723	1790	19685

Table H16: Number of jack mackerel bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9	4	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	11
12	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
13	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
16	0	2	0	0	0	0	0	0	0	0	1	0	2	0	0	0	5
17	1	0	2	0	0	0	0	0	0	0	6	13	0	0	0	0	22
18	1	0	0	0	0	0	0	0	0	22	21	0	0	0	0	0	44
24	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	29
33	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	9
34	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	5
36	0	0	0	0	0	0	0	0	0	9	0	0	0	0	2	0	11
37	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
38	2	35	0	0	1	3	0	2	0	2	7	4	0	12	8	0	76
39	0	0	0	0	0	0	2	0	0	0	0	0	0	8	0	0	10
45	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0	5
46	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
47	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
All	17	39	3	19	5	3	2	2	0	62	35	17	2	32	13	3	254

APPENDIX H — continued

Table H17: Number of lockdown dory bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
16	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
24	0	0	3	0	4	0	0	0	0	2	0	4	0	7	0	0	20
26	0	0	0	0	0	0	0	0	0	0	0	6	3	0	0	0	9
33	12	16	8	5	0	0	0	0	0	0	0	0	0	0	1	27	69
34	22	0	7	0	4	0	0	0	0	0	0	0	0	0	0	3	36
37	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
All	34	16	18	7	8	0	2	0	0	2	0	10	3	7	1	30	138

Table H18: Number of leatherjacket bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	0	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	6
3	1	2	14	0	0	0	0	0	0	0	0	0	0	0	1	0	18
5	68	16	5	2	0	0	0	0	0	0	0	0	0	0	1	0	92
6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
8	12	28	6	0	0	0	0	1	0	0	0	0	0	0	0	0	47
9	0	1	4	2	0	0	0	0	0	0	0	0	0	0	0	0	7
17	33	25	2	0	4	0	0	5	0	0	0	0	5	0	22	5	101
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
22	34	0	0	0	0	0	6	0	0	0	2	0	0	0	0	3	45
24	17	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	22
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	7
30	6	0	0	0	0	0	0	0	0	0	0	0	0	0	31	59	96
32	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
36	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
37	16	6	3	0	4	0	0	0	0	3	0	0	0	0	0	4	36
38	2	7	10	0	0	0	3	5	0	0	0	0	0	8	21	11	67
39	75	0	0	1	1	0	0	3	0	16	0	0	0	0	8	0	104
40	0	0	0	1	2	0	0	0	0	0	5	0	0	0	5	6	19
41	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	5
47	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
All	271	88	51	12	12	0	10	14	0	20	7	0	5	12	95	92	689

APPENDIX H — continued

Table H19: Number of ling bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	0	0	0	0	4	5	0	0	0	0	0	0	0	0	0	0	9
2	0	0	1	5	0	0	0	0	0	0	28	0	0	0	0	0	34
3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
5	9	0	0	0	5	6	0	0	0	0	0	0	0	0	0	0	20
7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
9	2	0	0	11	4	1	0	0	0	2	0	2	30	14	0	0	66
10	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
12	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
13	0	9	6	0	0	0	0	0	0	0	0	0	0	0	0	0	15
14	48	32	22	22	17	6	0	0	3	0	0	0	1	0	0	0	151
15	1	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5
16	0	3	4	0	2	3	0	12	0	0	0	0	0	0	0	0	24
17	0	3	0	8	9	4	1	0	9	22	5	4	14	0	0	0	79
18	6	2	3	8	0	3	3	0	3	12	0	0	0	0	0	0	40
20	2	7	6	0	3	0	0	0	8	0	5	0	18	5	0	23	77
22	95	90	9	2	13	18	3	10	0	0	5	0	0	2	12	0	259
23	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
24	125	124	87	15	48	25	1	16	0	18	17	8	12	10	2	12	520
25	0	0	0	0	2	0	0	0	0	0	0	0	4	3	0	0	9
26	3	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	10
29	0	0	0	3	0	7	0	3	0	0	0	11	0	5	0	0	29
30	7	1	0	41	13	7	6	3	5	0	0	12	24	59	57	76	311
31	0	0	0	0	0	0	0	0	0	0	0	0	3	28	31	61	123
32	0	3	0	3	1	1	6	0	0	0	0	0	0	9	0	0	23
33	14	47	77	61	19	28	11	7	15	0	9	0	0	4	5	15	312
34	23	25	67	82	25	23	12	6	6	4	10	0	11	18	21	103	436
35	0	0	8	3	0	1	0	0	0	0	0	0	0	0	0	0	12
38	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
43	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
46	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
47	0	0	20	6	7	17	0	0	0	0	4	0	0	0	0	0	54
50	0	2	24	0	0	0	0	0	0	0	0	0	0	0	0	1	27
52	0	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	5
107	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
705	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Unknown	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
All	343	350	339	273	175	156	58	58	49	64	84	42	117	157	130	291	2686

Table H20: Number of moki bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
10	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
11	0	3	0	0	0	0	0	0	4	0	0	0	0	0	0	0	7
12	0	0	0	0	4	0	0	0	3	0	0	0	0	0	0	0	7
13	0	3	0	0	0	3	17	26	37	8	25	25	22	20	5	3	194
14	3	0	2	0	6	0	0	10	0	9	0	0	0	0	0	0	30
16	5	1	4	2	3	0	4	0	0	15	27	19	22	25	13	8	148
17	4	0	0	0	2	0	5	2	4	3	7	2	0	0	6	1	36
18	0	0	0	0	0	0	0	0	8	4	0	2	3	0	0	0	17
20	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
25	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
34	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
39	0	0	0	0	0	0	0	0	0	0	0	28	2	0	0	5	35
All	12	10	6	2	15	3	29	38	56	39	61	76	49	46	24	18	484

APPENDIX H — continued

Table H21: Number of oreo bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2
13	6	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
14	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4
15	2	11	0	0	0	27	0	0	0	6	0	0	0	0	0	0	46
16	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
17	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
18	0	3	0	69	31	56	0	0	0	72	0	0	0	0	0	0	231
19	0	0	0	0	1	4	0	0	18	2	0	0	2	0	2	0	29
20	0	0	0	3	0	0	0	0	11	39	0	0	0	0	2	0	55
21	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
22	1	7	23	5	14	30	12	0	35	53	467	207	203	242	212	221	1732
23	0	0	0	0	0	0	0	0	4	12	38	32	27	0	16	0	129
24	0	0	29	2	0	0	0	4	6	49	11	0	0	39	14	13	167
26	0	0	0	0	0	0	0	0	0	0	0	0	27	33	23	11	94
33	0	0	0	0	0	0	0	0	9	0	8	7	0	0	0	0	24
34	1	0	0	0	0	0	0	0	23	2	0	0	0	0	0	0	26
48	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
52	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
302	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5
303	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
407	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
410	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
704	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	15
Unknown	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	5
All	14	27	52	79	46	119	13	4	106	255	527	246	260	328	271	245	2592

APPENDIX H — continued

Table H22: Number of orange roughy bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	5	22	1	0	0	1	0	0	0	0	0	0	0	0	0	0	29
3	34	35	4	0	0	0	0	0	0	9	0	0	0	0	3	0	85
7	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
8	0	0	0	5	0	1	15	0	0	0	0	0	0	0	0	0	21
9	0	0	8	23	3	0	0	0	3	0	0	0	0	0	0	0	37
10	31	27	6	8	3	0	0	0	3	0	0	0	0	0	0	0	78
11	7	18	6	21	22	4	24	59	81	69	59	0	0	0	0	0	370
12	48	45	28	11	82	187	106	70	33	22	21	0	0	0	0	0	653
13	558	635	735	428	339	306	81	119	20	88	111	6	0	0	0	0	3426
14	224	206	49	67	4	3	0	7	0	0	6	0	0	0	0	26	592
15	252	177	121	41	36	3	11	20	29	12	18	14	8	0	3	3	748
16	27	29	27	0	6	15	20	14	7	2	7	0	0	0	0	0	154
17	2	3	0	0	0	0	0	30	0	0	0	0	0	0	0	0	35
18	109	160	79	43	181	378	47	25	26	55	64	9	17	0	0	30	1223
19	40	47	3	0	2	0	0	0	0	0	30	3	8	8	1	27	169
20	0	0	0	44	13	0	0	0	17	16	63	15	28	1	0	2	199
21	0	0	0	0	0	0	0	0	0	0	18	16	4	3	32	2	75
22	106	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	109
23	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
26	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
30	0	0	0	3	0	0	0	0	0	4	0	0	0	0	0	0	7
31	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	4	11
32	0	0	0	0	0	0	0	0	0	0	0	5	7	48	36	87	183
33	101	202	117	266	154	68	163	187	232	321	146	156	77	108	127	235	2660
34	25	115	208	96	95	33	95	44	114	168	276	116	130	83	100	143	1841
35	0	0	0	0	0	0	0	0	0	243	110	0	0	0	0	0	353
36	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
40	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
42	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
43	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
101	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
202	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
203	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	16
204	122	54	0	31	5	0	0	0	0	0	19	7	0	0	0	0	238
401	0	0	0	0	0	0	0	0	0	0	77	8	57	7	27	7	183
402	0	0	0	0	0	0	0	0	0	0	18	55	52	8	18	20	171
403	0	0	0	0	0	0	0	0	0	0	0	11	0	7	7	12	37
404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
702	0	0	0	0	0	0	0	0	3	87	14	0	0	0	0	0	104
703	0	0	0	0	0	0	0	0	0	4	23	0	0	0	0	0	27
704	0	0	0	0	0	0	0	0	9	48	40	0	0	0	0	0	97
705	0	61	128	131	113	54	5	0	25	21	4	0	0	0	0	0	542
Unknown	6	0	51	0	0	8	4	0	3	11	63	0	33	14	0	0	193
All	1703	1843	1578	1218	1058	1061	574	575	621	1187	1189	428	423	288	355	605	14706

Table H23: Number of queen scallop bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
3	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	11
5	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5
24	850	903	748	315	511	48	42	53	51	22	669	221	355	271	226	74	5359
25	0	0	0	9	456	781	456	366	371	167	0	0	0	0	0	0	2606
26	0	0	0	0	0	0	0	0	0	63	41	0	0	0	0	29	133
27	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	20	25
29	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
30	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
303	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	14
Unknown	0	0	0	0	0	0	0	12	0	46	0	0	0	0	0	0	58
All	853	903	748	324	967	834	498	431	433	312	713	221	355	276	226	123	8217

APPENDIX H — continued

Table H24: Number of rubyfish bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	0	0	0	0	0	0	0	4	6	0	0	0	0	0	0	0	10
2	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6
8	0	0	7	0	6	0	0	0	0	0	0	0	0	0	0	0	13
9	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
10	1	0	0	0	3	0	0	0	0	0	0	4	0	0	0	0	8
11	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
12	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
13	0	0	6	3	0	0	0	0	0	0	0	2	0	0	0	0	11
14	8	12	5	5	0	0	0	0	0	0	0	0	0	0	0	0	30
15	2	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	7
18	0	3	0	0	0	0	5	0	0	0	0	0	0	0	0	0	8
All	11	17	21	8	18	0	10	4	6	0	0	6	0	0	0	0	101

Table H25: Number of red cod bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	4	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	10
2	0	0	0	7	4	22	21	16	8	9	0	5	3	16	4	12	127
3	165	11	41	61	145	143	65	28	12	7	0	18	467	24	0	3	1190
4	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	6
5	0	0	0	17	0	3	4	0	0	0	0	0	0	0	0	0	24
6	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
7	27	0	0	0	0	3	15	170	132	68	0	0	0	0	0	0	415
10	4	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	10
11	0	0	0	3	0	0	0	4	0	0	0	0	0	0	0	0	7
12	0	0	2	0	0	7	0	0	0	0	0	0	3	0	0	0	12
13	0	0	2	50	39	26	37	2	0	11	3	0	3	0	0	0	173
14	0	0	11	3	3	3	0	2	0	4	10	0	3	0	0	0	39
15	2	9	0	0	0	0	0	0	0	2	3	4	0	0	0	0	20
16	7	7	3	5	12	24	14	21	8	9	8	34	26	4	2	4	188
17	342	461	261	822	776	520	368	332	322	396	202	239	739	592	391	302	7065
18	341	559	453	696	837	716	680	684	711	276	216	806	789	484	294	128	8670
19	0	0	5	45	0	0	0	0	0	0	0	0	0	0	0	0	50
20	1460	1369	2063	2567	2581	2537	1683	2043	3148	1509	1485	2656	1967	2216	1738	2082	33104
21	18	0	2	11	7	6	5	3	29	8	0	116	125	0	1	0	331
22	2881	2868	3677	4257	4614	4976	5383	5620	4486	4304	3911	2927	2632	2729	2389	62624	
23	0	0	4	0	1	0	0	3	4	0	0	0	0	0	0	0	12
24	600	749	1039	721	929	1196	831	1213	804	757	349	353	196	228	174	98	10237
25	3	0	56	5	0	22	11	6	23	0	11	0	16	20	9	2	184
26	56	30	21	8	33	149	59	156	378	71	117	59	27	17	26	8	1215
27	0	0	0	0	0	7	2	14	0	6	18	11	16	11	0	0	85
28	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
29	0	0	0	0	0	0	0	0	0	1	4	0	0	0	2	0	7
30	155	36	129	48	6	17	4	12	17	0	4	7	0	33	4	7	479
31	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
32	0	51	18	5	0	0	2	7	0	0	0	2	0	0	4	6	95
33	75	47	187	336	52	68	153	13	26	13	3	34	24	299	316	484	2130
34	284	348	1157	1180	433	780	669	548	277	368	58	153	281	264	305	532	7637
35	95	170	264	527	128	47	57	22	20	36	0	45	39	28	69	234	1781
36	0	0	10	48	33	9	10	3	0	13	2	3	16	2	19	9	177
37	2	1	0	32	32	38	14	70	0	14	0	10	5	5	5	0	228
38	21	44	174	327	179	652	640	394	88	203	21	71	67	53	48	64	3046
39	0	0	2	16	25	5	16	2	0	2	0	7	12	40	5	4	136
40	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
41	0	4	12	0	0	0	0	3	0	0	0	0	0	0	0	0	19
43	0	0	0	0	48	0	3	0	0	0	0	0	0	0	0	0	51
47	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3
48	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
202	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	3	8
205	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
302	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4
401	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
406	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	6
407	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3
605	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
703	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	7
705	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Unknown	31	11	5	13	3	21	73	20	26	0	8	0	5	0	0	3	219
All	6581	6775	9601	11816	10923	12011	10409	11184	11666	8271	6826	8548	7762	6968	6145	6374	141860

APPENDIX H — continued

Table H26: Number of school shark bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
5	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
7	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
16	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
17	0	0	0	0	0	0	0	0	18	4	20	16	37	5	4	0	104
18	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	5
20	0	12	0	0	1	0	0	3	0	4	0	0	1	0	0	0	21
22	23	12	10	9	0	19	25	0	0	16	0	0	0	0	3	0	117
24	2	0	2	0	0	0	0	0	0	23	0	1	3	0	0	0	31
25	9	8	11	8	7	0	0	0	0	0	0	0	0	0	1	0	44
26	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
30	5	8	10	2	1	0	0	0	0	0	0	8	0	0	0	0	34
31	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
34	0	4	0	0	0	0	0	3	0	0	0	0	0	0	1	0	8
35	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
36	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	8
37	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	5
38	12	0	3	0	0	0	0	0	0	0	0	0	5	0	0	0	20
39	0	0	0	0	0	0	0	0	0	0	0	4	3	0	3	0	10
41	0	0	0	3	0	0	0	0	0	4	3	0	0	0	0	0	10
42	9	0	0	6	0	0	6	0	0	0	0	6	0	0	0	0	27
45	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	7
46	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
47	1	3	3	4	0	0	0	0	0	0	0	0	0	0	0	0	11
50	0	2	0	0	4	0	2	0	0	5	0	0	0	0	0	0	13
All	69	56	50	39	13	19	35	9	23	64	23	37	49	5	12	0	503

Table H27: Number of scampi bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
3	0	0	0	0	0	0	0	0	0	9	76	19	5	0	0	0	109
4	0	0	0	0	0	0	0	0	0	0	0	0	81	71	0	0	152
5	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	36
8	0	0	0	0	0	0	0	0	0	0	0	0	6	86	0	0	92
9	0	6	4	0	0	0	0	0	0	0	0	0	0	73	0	0	83
14	0	37	0	0	0	0	0	0	0	0	0	0	14	121	0	0	172
15	0	0	0	0	0	0	0	0	0	0	0	0	26	26	0	0	52
17	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
20	0	0	0	0	0	0	0	0	0	0	0	6	0	2	0	0	8
21	0	0	0	0	0	0	0	0	0	13	13	0	12	5	28	0	71
23	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	16
30	0	0	0	0	0	0	0	0	19	204	29	154	0	166	19	0	591
32	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
46	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
47	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	8
106	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	6
201	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
401	0	0	0	0	0	0	0	0	0	0	0	0	26	29	9	0	64
706	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Unknown	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
All	0	54	4	0	0	0	1	0	19	236	154	195	172	586	56	0	1477

APPENDIX H — continued

Table H28: Number of gemfish bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	41	0	28	51	21	24	52	59	7	0	0	0	0	0	0	0	283
2	3	16	16	12	15	24	3	1	0	21	7	1	0	0	0	0	119
3	111	214	109	89	22	14	0	0	2	11	1	0	0	0	0	0	573
4	0	0	9	36	20	0	0	18	0	0	0	0	0	0	0	0	83
5	3	0	3	1	0	0	4	0	0	0	0	0	0	0	0	0	11
7	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
8	292	91	363	583	83	63	1	31	5	23	2	8	0	8	3	0	1556
9	279	416	400	336	108	50	3	34	2	5	11	35	4	11	0	0	1694
10	200	261	163	107	34	37	14	6	1	1	10	4	14	6	0	0	858
11	3	3	51	21	20	17	6	15	19	3	12	0	5	12	10	0	197
12	0	30	27	6	16	38	60	112	31	45	9	0	3	9	16	67	469
13	71	129	179	120	79	34	74	63	51	2	13	14	0	31	9	12	881
14	466	326	598	621	433	275	221	271	105	24	0	15	12	29	1	0	3397
15	133	222	187	164	91	108	110	28	32	36	2	14	7	5	4	0	1143
16	21	6	54	4	10	15	11	0	0	4	0	0	0	1	0	0	126
17	0	39	16	19	5	3	0	5	0	0	0	0	0	0	0	0	87
18	57	21	74	60	19	29	29	6	5	4	0	0	0	0	0	0	304
19	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
20	5	6	0	162	1	0	0	0	0	0	0	0	0	0	0	0	174
22	121	119	12	184	8	0	0	0	0	0	0	0	0	0	0	0	444
34	32	0	0	12	7	0	5	0	0	0	0	0	0	0	5	0	61
39	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
45	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
46	0	0	0	0	15	11	0	0	10	0	0	0	0	0	0	0	36
47	0	11	86	64	50	96	22	34	8	39	12	14	0	0	0	0	436
48	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
104	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Unknown	0	3	0	1	0	0	0	0	18	0	0	0	0	0	0	0	22
All	1854	1915	2379	2653	1057	841	617	683	296	218	79	111	45	112	48	79	12987

APPENDIX H — continued

Table H29: Number of snapper bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	269	143	204	125	47	5	17	0	0	0	0	0	0	0	0	0	810
2	140	95	221	51	77	21	8	0	0	5	36	0	3	0	0	58	715
3	949	432	790	779	744	294	134	0	4	6	10	20	191	165	540	1105	6163
4	371	417	316	64	154	175	46	0	0	0	0	0	4	0	0	0	1547
5	1977	2876	2863	1449	1093	748	127	7	0	9	7	0	49	20	2	248	11475
6	2032	2283	3257	1914	1702	1434	38	3	15	0	25	0	32	16	11	99	12861
7	7	4	24	7	23	0	4	18	12	0	6	0	2	0	0	2	109
8	474	674	707	650	548	236	88	4	8	6	16	0	30	17	3	65	3526
9	871	974	689	326	299	48	128	65	4	2	0	0	94	38	1	141	3680
10	787	856	561	407	210	330	44	47	0	19	5	24	137	69	97	215	3808
11	8	4	27	79	102	68	45	31	5	53	25	3	7	30	3	3	493
12	20	26	11	15	164	73	65	54	31	67	68	74	39	95	62	36	900
13	152	81	55	95	185	66	21	33	62	101	42	36	48	98	142	146	1363
14	12	0	13	3	10	3	0	4	0	0	0	0	0	0	0	0	45
15	0	0	0	11	0	5	0	0	0	0	0	0	0	0	0	0	16
16	7	9	1	0	0	0	2	0	5	8	0	1	2	14	9	7	65
17	258	145	19	56	2	9	0	1	20	26	126	43	25	34	55	23	842
18	15	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	17
20	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	7
28	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	5
30	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2
32	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4
33	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
34	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
35	0	0	0	4	0	0	0	0	0	5	4	0	0	0	2	0	15
36	43	4	0	4	0	2	0	24	0	5	0	0	0	0	5	3	90
37	54	21	3	8	2	4	0	0	0	0	16	1	0	3	0	0	112
38	384	343	197	150	120	148	93	79	148	231	191	153	80	217	194	150	2878
39	106	261	102	117	90	159	14	6	51	61	39	4	14	11	35	36	1106
40	56	22	2	0	3	11	0	0	0	0	22	0	0	0	0	0	116
41	278	258	181	369	309	339	262	115	170	42	13	12	35	67	36	46	2532
42	404	466	521	737	873	653	476	189	259	14	13	0	11	0	0	10	4626
43	7	32	18	0	0	0	0	0	4	0	0	0	0	0	0	0	61
44	0	24	10	3	0	0	1	5	0	0	0	0	0	0	0	0	43
45	139	830	961	675	765	592	291	0	4	14	0	0	0	0	0	12	4283
46	24	38	12	88	77	106	48	0	0	0	0	0	0	0	0	0	393
47	554	237	410	519	461	456	136	4	8	58	27	1	0	0	0	14	2885
48	7	0	2	3	0	0	2	0	0	0	0	0	0	0	0	0	14
49	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
51	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	6
106	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
401	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
Unknown	3	8	38	4	4	29	0	10	1	4	3	0	0	0	0	0	104
All	10412	11565	12222	8722	8076	6016	2090	702	813	736	694	372	804	894	1197	2419	67734

Table H30: Number of spiny dogfish bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
3	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	4
17	40	22	2	5	0	0	0	0	0	0	0	0	0	0	0	0	69
18	55	11	0	8	0	0	8	16	1	13	8	0	0	0	0	1	121
20	46	55	5	12	12	37	33	26	13	3	66	0	33	6	3	23	373
22	7	21	2	2	3	2	17	2	0	0	0	0	40	0	0	47	143
24	19	3	11	11	2	1	3	4	0	1	4	5	1	0	0	7	72
25	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	61
26	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	7
30	13	0	0	1	0	0	0	0	0	0	0	2	0	0	0	54	70
32	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
34	0	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	8
35	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
36	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
38	216	567	93	3	0	0	2	0	0	0	0	0	0	0	0	6	887
39	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
All	419	684	121	46	17	41	63	48	14	17	78	7	74	6	3	190	1828

APPENDIX H — continued

Table H31: Number of sea perch bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
15	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
17	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
18	26	1	190	282	211	333	333	112	350	250	362	363	227	4	0	2	3046
19	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
20	57	16	2	0	0	0	0	0	0	0	0	21	66	23	4	2	191
22	17	25	4	0	2	4	0	24	53	52	117	6	21	52	65	54	496
23	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10
24	33	0	60	8	3	2	1	18	8	0	10	17	10	41	62	23	296
25	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
26	0	0	0	40	0	0	0	0	0	0	0	0	3	8	0	0	51
30	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Unknown	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
All	137	53	256	330	216	341	338	154	413	302	494	407	327	138	131	81	4118

Table H32: Number of rig bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
3	0	0	32	11	0	4	0	0	0	0	0	0	0	0	0	4	51
4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
5	19	2	5	0	21	21	2	0	0	0	0	0	0	0	0	0	70
6	6	0	3	0	1	0	0	0	0	0	4	0	0	0	0	0	14
7	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	8
8	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	7
13	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
15	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	6
16	0	0	0	0	0	2	1	0	0	2	0	0	0	0	0	0	5
17	4	16	0	4	7	0	0	0	8	0	10	4	6	0	2	0	61
18	0	8	2	0	0	0	0	0	4	0	0	0	2	0	0	0	16
20	0	5	0	0	3	0	0	6	0	0	5	0	0	0	0	0	19
22	5	19	41	13	26	13	13	16	7	4	3	0	29	6	12	0	207
24	0	2	6	0	0	0	0	0	0	0	0	5	0	0	0	0	13
25	0	3	3	0	6	0	0	0	0	0	0	0	0	2	1	0	15
27	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4
30	6	43	8	0	16	9	7	0	0	0	0	0	0	0	6	13	108
33	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	5
34	0	0	3	0	0	0	6	2	0	2	3	0	0	0	0	0	16
35	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
37	0	11	3	3	0	0	0	0	0	0	0	0	0	0	0	0	17
38	29	19	12	7	0	20	21	0	0	0	0	0	0	0	2	0	110
39	1	0	0	0	10	7	17	6	17	4	2	0	0	3	0	0	67
40	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	4
41	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
703	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	9
Unknown	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
All	77	133	128	38	90	76	76	39	42	12	36	12	38	11	23	17	848

APPENDIX H — continued

Table H33: Number of squid bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	0	0	0	6	0	2	0	0	0	0	0	3	0	0	0	0	11
3	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	12
7	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	9
15	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
16	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
17	0	0	0	0	0	0	10	0	0	0	0	13	0	0	0	0	23
18	0	0	0	27	0	7	5	0	1	38	0	8	0	3	0	0	89
20	0	0	0	8	3	0	0	0	0	57	3	86	28	10	42	18	255
22	13	17	11	49	162	48	61	65	43	202	142	611	122	219	70	354	2189
24	0	0	0	2	0	1	0	0	4	15	0	0	46	29	0	30	127
25	0	0	0	0	0	0	0	0	4	8	11	0	0	0	0	0	23
26	0	0	0	0	0	0	0	0	0	4	0	0	0	8	0	0	12
32	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4
33	0	0	12	0	0	0	0	0	0	0	0	12	0	0	0	0	24
34	0	0	1	0	0	1	0	0	3	0	0	0	1	51	0	0	57
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
36	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
37	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	5
38	0	0	0	7	5	6	0	0	0	0	0	0	0	0	0	0	18
39	0	0	0	0	9	4	0	0	0	0	0	0	0	0	0	0	13
40	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	18
41	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
All	13	17	38	99	189	75	76	74	55	324	174	733	197	320	114	402	2900

Table H34: Number of stargazer bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
3	85	0	0	3	0	0	0	8	0	6	48	5	9	0	19	29	212
4	19	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	53
5	45	59	34	40	11	16	7	0	0	0	40	35	0	0	15	17	319
7	25	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	29
10	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	6
11	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	4
14	0	0	23	0	0	8	0	0	0	0	0	0	0	0	0	0	31
15	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
17	21	0	0	12	11	5	0	0	3	14	0	5	12	0	0	0	83
18	9	14	21	45	65	43	48	54	49	44	29	38	10	4	0	12	485
20	19	1	113	3	35	7	99	103	48	5	90	222	109	61	21	16	952
22	97	82	83	3	16	0	9	38	28	61	44	3	52	22	1	5	544
23	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5
24	2	10	10	38	27	13	0	8	0	6	6	24	0	0	0	1	145
25	214	159	138	101	440	267	387	123	17	140	131	122	96	123	97	205	2760
26	59	62	20	0	14	4	0	0	2	0	59	77	17	8	14	5	341
27	28	4	7	0	2	0	0	23	12	0	3	0	1	6	19	45	150
28	0	0	0	0	0	1	3	7	0	0	0	0	0	0	3	3	17
29	371	228	202	145	132	137	60	259	9	294	362	197	163	64	88	112	2823
30	954	1174	781	988	1540	1572	1332	991	521	843	1017	1279	978	905	1443	1402	17720
31	0	27	0	0	16	45	32	47	24	24	32	25	56	19	11	12	370
32	0	16	2	3	29	111	55	91	13	72	86	31	0	8	4	0	521
33	74	49	135	13	27	79	3	2	6	2	16	0	10	37	30	17	500
34	226	126	63	15	53	46	64	47	6	67	47	97	25	50	131	75	1138
35	0	2	0	5	6	6	2	0	0	0	2	7	8	0	9	1	48
36	0	0	0	0	0	0	0	3	0	9	33	2	0	0	15	0	62
37	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4
38	5	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	9
39	0	4	0	0	0	2	0	3	0	12	0	0	0	0	0	0	21
44	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	11
45	2	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	9
46	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
47	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	19
49	0	0	0	0	6	23	0	0	0	0	0	0	0	14	0	0	43
50	221	167	79	0	147	22	67	11	23	47	0	0	25	0	0	0	809
51	0	8	0	0	0	1	0	0	0	0	0	0	2	0	0	0	11
52	0	0	0	1	4	6	5	0	0	0	0	0	3	0	0	0	19
502	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
602	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
607	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
703	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
705	31	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
Unknown	14	0	3	10	21	12	3	17	1	5	0	14	0	0	0	0	100
All	2524	2199	1756	1425	2606	2450	2180	1855	762	1651	2045	2190	1576	1321	1924	1958	30422

APPENDIX H — continued

Table H35: Number of silver warehou bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
14	0	0	0	0	0	6	0	0	0	0	0	3	0	0	0	0	9
16	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	3	7
17	0	0	0	0	0	0	0	0	0	0	1	6	0	7	0	0	14
18	0	0	3	0	0	0	1	0	0	6	4	0	0	0	0	0	14
20	0	0	0	0	0	0	0	0	0	0	0	21	3	6	4	3	37
22	0	3	0	0	0	0	0	0	0	0	0	0	0	10	5	5	23
33	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	4	7
38	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
49	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	2	22
52	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4	6
All	0	3	10	0	0	6	1	0	0	6	5	30	5	36	19	21	142

Table H36: Number of tarakihi bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	101	212	78	87	74	121	91	85	48	8	4	0	0	0	0	0	909
2	243	484	297	374	462	372	91	183	128	109	163	24	25	0	1	32	2988
3	101	321	476	223	102	198	22	1	21	73	34	16	15	0	48	190	1841
4	60	131	74	48	60	57	6	0	3	19	21	11	0	0	0	1	491
5	87	182	131	20	30	7	0	4	0	0	0	0	0	0	0	0	461
6	27	28	8	8	1	1	0	0	0	0	0	0	0	0	0	0	73
7	52	50	44	9	7	35	0	14	0	22	12	0	0	0	0	0	245
8	134	181	640	311	103	140	7	7	95	95	23	10	44	2	0	0	1792
9	319	791	727	848	697	646	274	189	112	159	186	42	115	71	122	0	5298
10	408	852	837	828	864	564	212	279	116	184	279	135	182	273	230	161	6404
11	435	703	762	688	722	479	259	299	246	317	315	138	129	187	154	158	5991
12	774	1013	727	933	824	1037	770	678	762	589	692	540	364	404	588	394	11089
13	1217	1590	1837	1354	961	880	804	1106	1026	1344	1395	1474	1429	1593	1535	1812	21357
14	357	351	309	304	390	260	118	114	188	183	256	386	155	295	212	457	4335
15	252	420	153	102	72	43	89	75	254	191	89	98	122	101	98	145	2304
16	350	382	583	360	336	380	322	330	377	416	371	273	288	353	285	313	5719
17	197	142	311	294	357	375	297	199	360	432	211	326	301	244	463	186	4695
18	255	432	185	234	307	327	161	232	94	147	97	96	269	95	64	188	3183
19	0	2	0	0	0	0	0	0	0	0	0	0	0	3	5	0	10
20	435	183	181	87	443	169	231	399	152	651	330	188	119	196	314	729	4807
21	4	0	0	0	0	0	1	0	7	0	5	0	19	0	0	0	36
22	422	166	239	99	343	127	184	201	62	160	129	55	160	136	137	385	3005
24	153	131	227	46	110	167	30	16	93	73	63	63	61	37	12	59	1341
25	0	0	6	0	0	7	45	0	0	0	0	0	13	34	15	5	125
26	23	0	12	2	0	0	0	0	3	4	0	3	2	6	25	0	80
27	0	0	0	0	0	0	0	0	0	0	0	0	4	6	0	0	10
28	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
30	16	7	6	0	4	1	0	0	0	0	0	0	7	21	3	0	65
31	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	16	43
32	1	25	51	30	12	3	0	16	11	10	63	63	93	115	11	13	517
33	140	448	487	299	344	252	311	119	88	156	135	150	181	220	157	208	3695
34	341	275	429	326	299	207	330	171	78	266	264	118	198	206	261	301	4070
35	17	7	28	14	6	12	14	57	12	76	79	149	49	69	93	87	769
36	17	12	25	1	33	21	5	43	8	94	168	81	38	136	258	232	1172
37	4	20	0	4	7	0	0	18	4	26	108	139	37	40	67	74	548
38	65	46	9	3	46	13	10	17	0	20	19	43	24	22	35	10	382
39	19	203	83	47	93	120	126	212	39	141	148	66	51	115	36	29	1528
40	15	2	10	16	48	20	17	13	0	10	6	11	8	7	6	4	193
41	33	21	34	77	58	10	27	74	60	208	137	51	3	4	0	10	807
42	0	4	18	24	33	8	0	4	0	24	27	13	6	0	0	0	161
43	0	0	0	0	0	0	0	0	0	15	1	0	0	0	0	0	16
44	0	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0	6
45	35	198	82	198	181	45	3	0	0	1	2	0	0	0	0	0	745
46	85	101	10	131	156	42	5	0	3	16	3	0	0	0	1	0	553
47	358	219	274	388	347	222	60	20	21	132	130	7	18	0	0	6	2202
48	0	13	0	7	12	2	0	0	0	0	0	0	0	0	0	0	34
49	0	0	6	1	0	53	0	0	0	0	0	0	8	38	12	49	167
50	66	220	96	3	35	64	274	207	533	176	0	72	82	62	21	75	1986
51	0	21	0	0	0	0	0	3	0	0	4	0	3	0	0	0	31
52	0	0	15	0	0	5	1	0	0	0	0	37	9	13	3	1	84
101	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	5
103	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
106	0	2	0	0	3	0	2	0	4	2	0	0	0	1	0	0	14
107	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
201	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
202	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
204	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
303	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
407	0	0	0	0	0	0	0	0	0	0	5	0	5	0	0	0	10
613	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
616	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
702	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
703	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
705	2	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0	7
801	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4
Unknown	0	31	36	15	10	7	3	3	10	3	9	0	7	0	0	0	134
All	7620	10642	10544	8850	8993	7503	5204	5393	5020	6558	5983	4879	4646	5133	5272	6330	108570

APPENDIX H — continued

Table H37: Number of trevally bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	28	17	2	2	72	93	10	77	130	0	4	4	0	0	0	0	439
2	53	3	44	23	82	41	35	17	9	67	56	4	37	2	0	0	473
3	16	4	48	3	11	6	5	0	0	32	21	9	4	2	6	6	173
4	1	3	3	6	8	3	0	0	9	4	0	0	0	0	0	0	37
5	15	96	50	111	20	7	1	7	14	2	1	0	6	1	0	0	331
6	16	37	3	60	40	0	0	0	26	17	0	0	0	0	0	0	199
7	0	0	3	4	7	2	0	46	9	3	0	0	0	0	0	0	74
8	13	0	5	16	16	19	0	27	22	39	33	0	12	9	0	0	211
9	105	192	102	273	370	115	1	56	30	109	134	50	47	30	42	106	1762
10	87	58	92	65	135	88	10	84	34	138	279	261	70	57	29	32	1519
11	0	0	0	4	0	0	3	3	0	8	10	4	0	0	0	0	32
12	19	13	25	30	20	18	5	9	0	3	6	2	6	12	6	0	174
13	142	115	122	139	123	158	10	53	48	41	64	23	26	42	74	25	1205
14	27	64	44	40	31	20	13	0	7	0	2	6	3	10	3	5	275
15	6	12	5	19	7	3	9	5	9	6	7	9	12	0	0	2	111
16	23	24	17	6	13	15	1	9	5	13	7	17	18	9	17	12	206
17	8	1	11	0	19	0	0	0	8	6	14	12	3	6	7	0	95
18	11	15	0	0	0	0	0	0	1	0	22	0	3	0	0	0	52
19	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
21	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4
22	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
35	0	5	0	0	0	0	0	0	0	0	0	0	0	8	0	0	13
36	16	18	0	0	3	0	3	3	0	0	0	0	13	25	7	8	96
37	97	37	1	5	0	13	0	0	0	0	0	5	74	54	18	29	333
38	20	42	12	4	0	14	0	6	6	17	13	15	2	105	41	52	349
39	276	234	57	50	15	26	9	0	38	24	38	145	49	107	92	17	1177
40	18	110	58	35	57	26	36	28	6	26	94	36	45	12	39	8	634
41	345	514	232	390	219	134	279	436	337	459	306	111	92	139	23	22	4038
42	59	124	99	119	144	271	298	374	619	633	148	64	87	0	2	6	3047
43	0	0	0	1	7	0	0	0	11	0	0	0	0	0	0	0	19
44	0	0	0	5	9	0	0	0	0	0	0	0	0	0	0	0	14
45	171	203	171	315	316	67	0	0	29	76	138	8	10	9	0	3	1516
46	91	107	50	164	73	26	0	4	0	41	28	2	0	0	0	0	586
47	166	89	126	235	236	90	0	15	21	24	49	3	0	2	0	3	1059
48	0	8	0	12	3	0	0	0	0	0	0	0	0	0	0	0	23
51	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
101	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	6
103	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
401	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
402	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Unknown	0	0	1	8	1	0	3	9	63	4	0	0	0	0	0	0	89
All	1829	2145	1384	2144	2058	1255	731	1272	1494	1795	1482	793	619	641	406	336	20384

APPENDIX H — continued

Table H38: Number of common warehou bottom trawl tows reported on CELRs by Statistical Area and fishing year, 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	7
3	0	0	12	0	0	0	0	0	0	3	0	0	0	0	0	0	15
6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
7	26	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	33
9	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	4
10	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
11	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
12	0	0	0	0	0	1	0	0	0	0	5	0	0	0	0	0	6
13	4	53	96	77	5	63	32	44	38	25	37	49	1	22	4	2	552
14	18	15	57	106	41	47	14	3	3	5	17	29	18	6	0	3	382
15	29	29	15	27	37	35	41	0	4	34	22	45	21	7	3	9	358
16	129	106	238	198	161	165	240	183	267	332	314	340	188	247	396	299	3803
17	52	51	12	35	17	26	22	37	48	53	113	48	58	56	143	76	847
18	85	61	34	30	69	29	23	72	47	57	5	16	55	22	7	6	618
19	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3
20	4	51	13	0	3	0	12	0	7	55	92	97	80	202	149	288	1053
21	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
22	36	7	4	0	3	0	0	6	8	0	0	0	0	25	2	58	149
24	0	0	2	0	0	0	2	2	4	0	5	15	25	7	0	2	64
25	0	0	0	0	0	0	0	0	0	0	0	0	0	24	5	25	54
26	0	0	0	0	0	0	0	0	0	0	0	0	4	14	7	0	25
30	14	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
33	12	40	39	48	11	11	0	3	0	0	0	0	7	153	30	93	447
34	19	39	16	16	8	23	90	24	0	2	2	6	165	85	121	37	653
35	0	0	1	0	0	0	0	0	0	0	0	4	10	3	4	17	39
36	0	3	0	0	0	9	4	0	0	0	0	0	0	0	10	3	29
37	4	0	0	10	4	19	0	2	0	7	5	8	0	16	3	13	91
38	15	59	131	61	23	45	13	3	28	99	25	25	21	163	42	83	836
39	0	0	0	0	10	21	1	3	1	0	15	26	6	32	80	7	202
40	0	0	0	0	0	0	0	0	2	0	4	0	0	0	0	0	6
45	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
703	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Unknown	0	3	6	0	1	0	0	0	0	0	0	0	0	0	0	0	10
All	447	523	681	610	393	494	494	389	460	673	664	714	661	1090	1006	1021	10320

APPENDIX H — continued

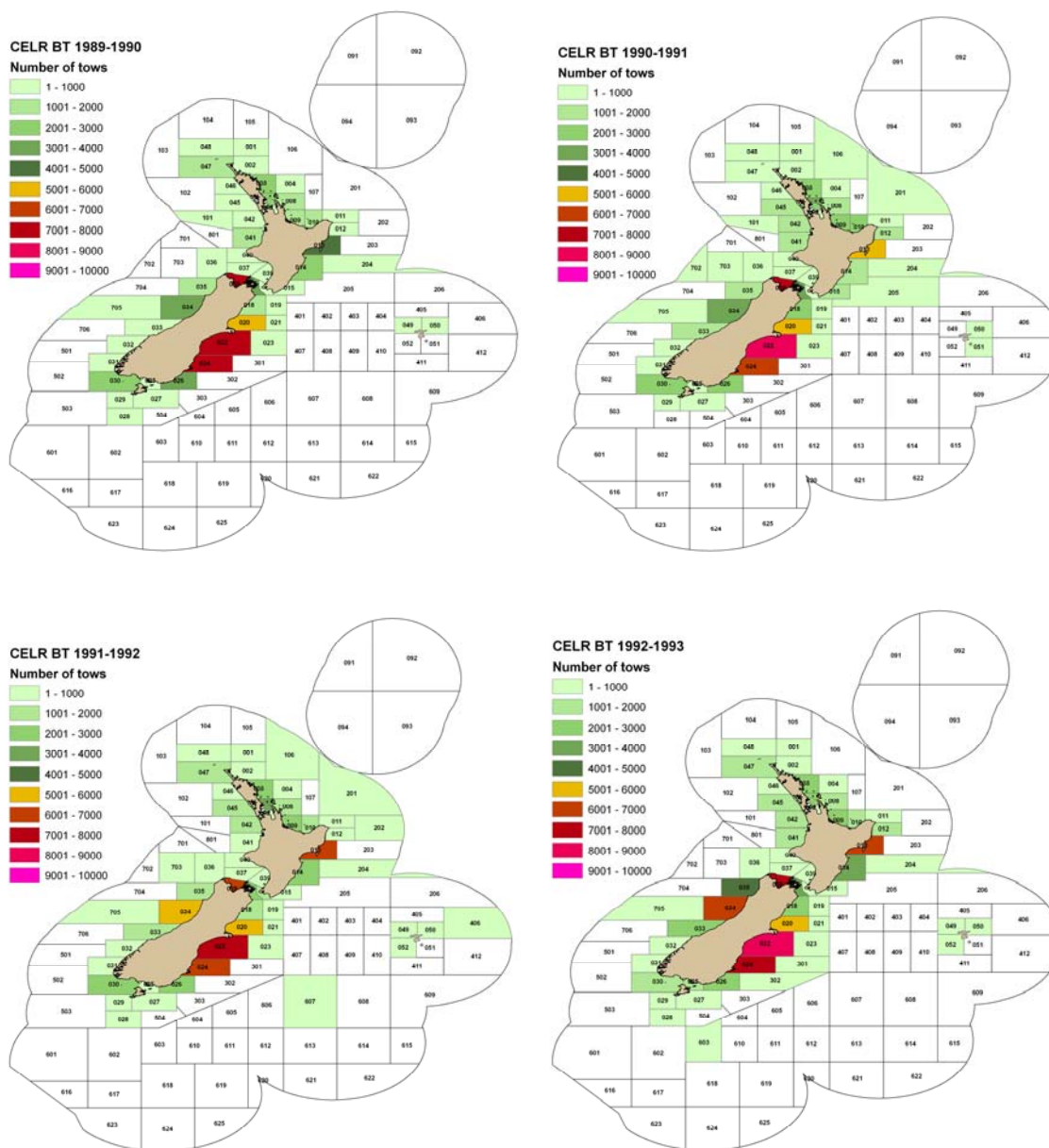


Figure H1: Distribution of bottom trawl tows reported on CELRs, by Statistical Area, for fishing years 1989–90 to 1992–93.

APPENDIX H — continued

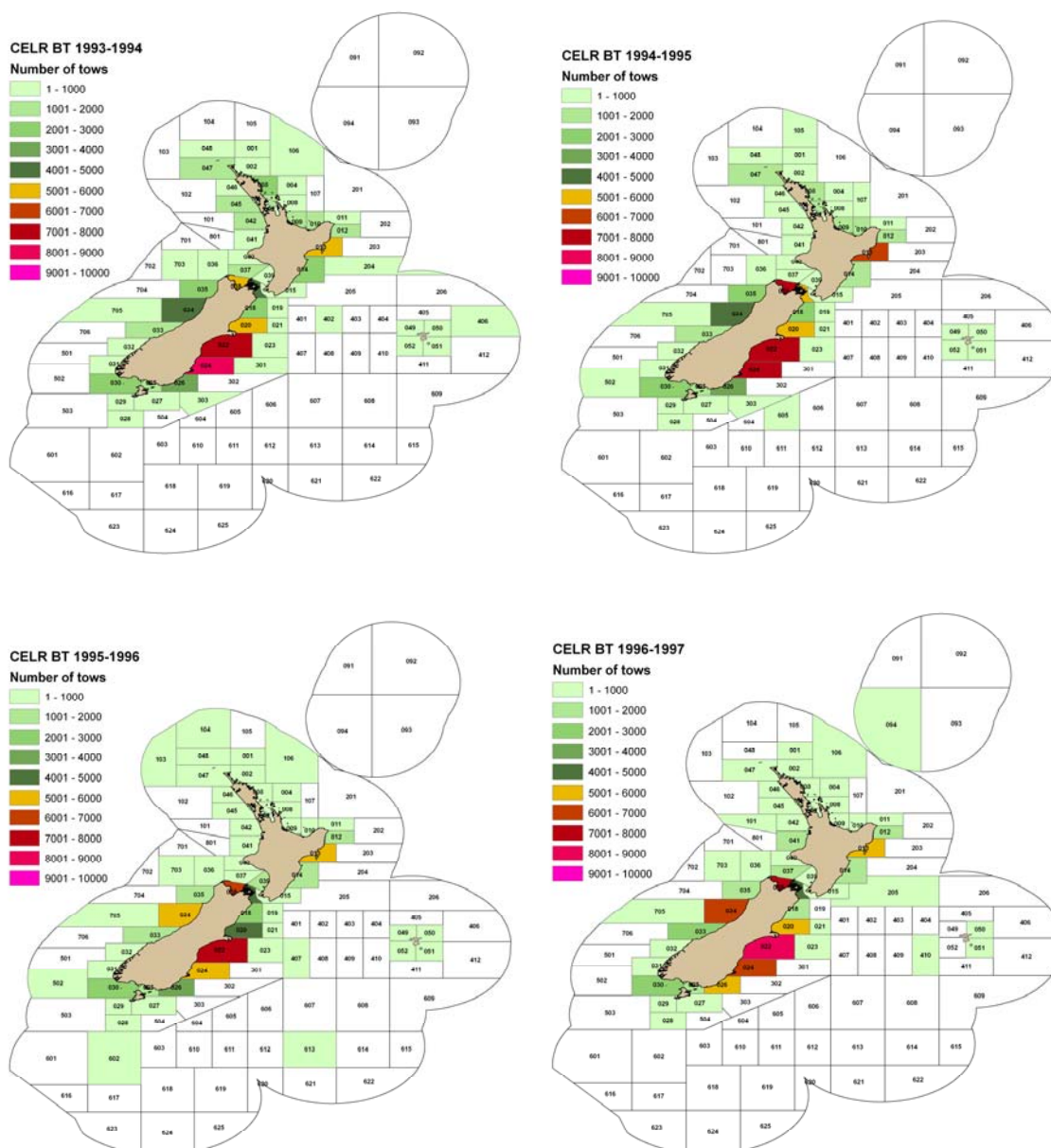


Figure H2: Distribution of bottom trawl tows reported on CELRs, by Statistical Area, for fishing years 1993–94 to 1996–97.

APPENDIX H — continued

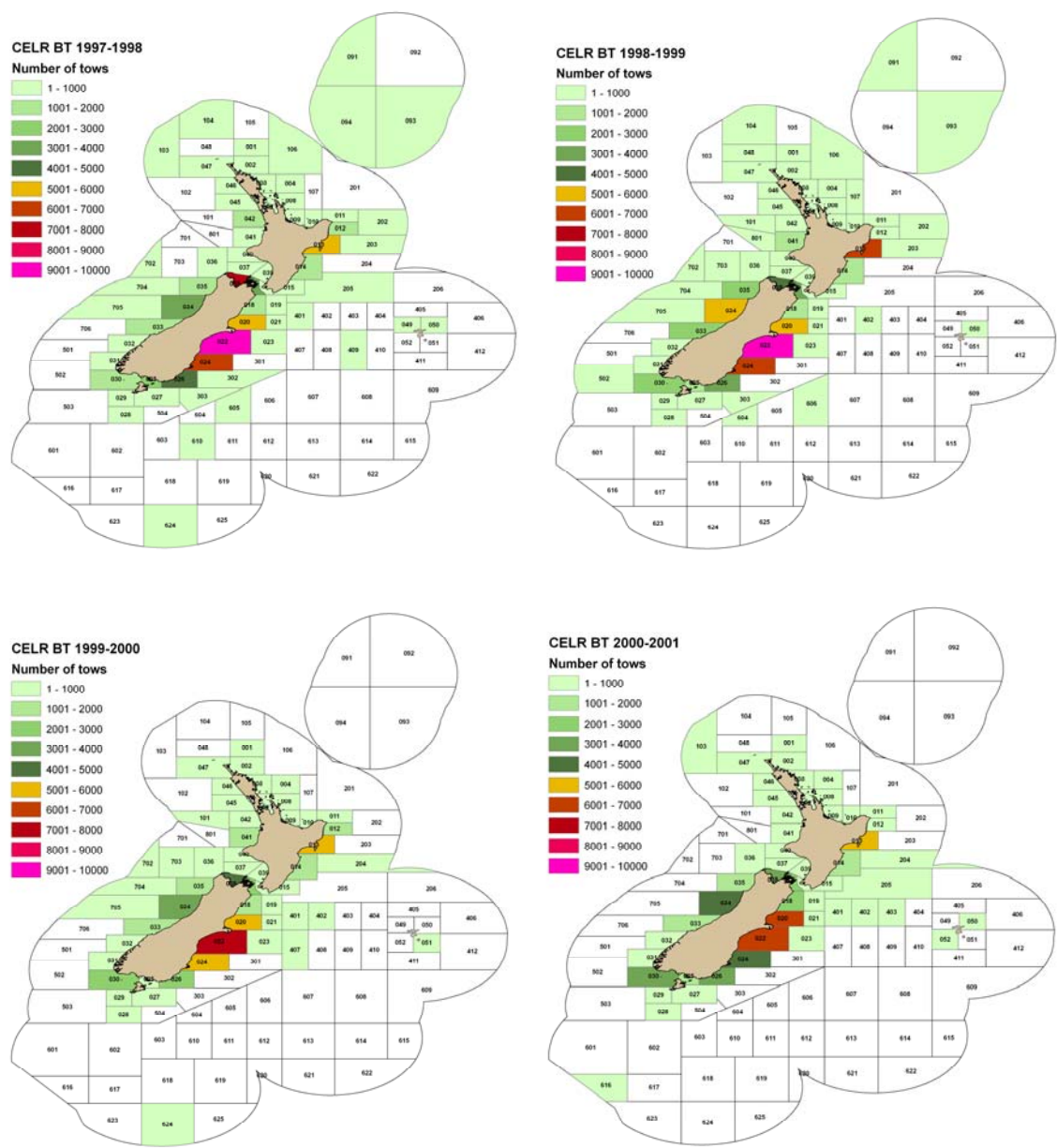


Figure H3: Distribution of bottom trawl tows reported on CELRs, by Statistical Area, for fishing years 1997–98 to 2000–01.

APPENDIX H — continued

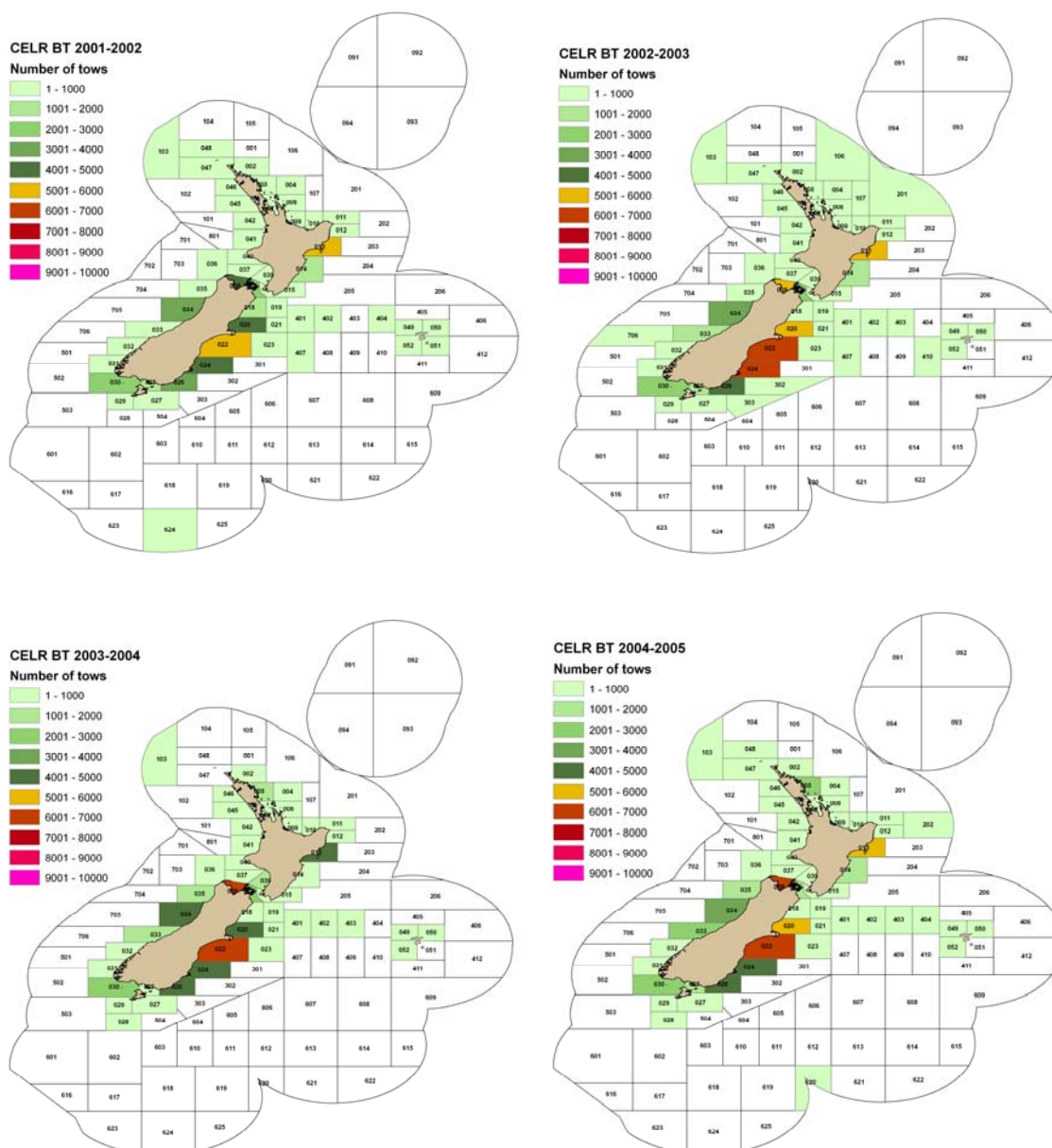


Figure H4: Distribution of bottom trawl tows reported on CELRs, by Statistical Area, for fishing years 2001–02 to 2004–05.

APPENDIX H — continued

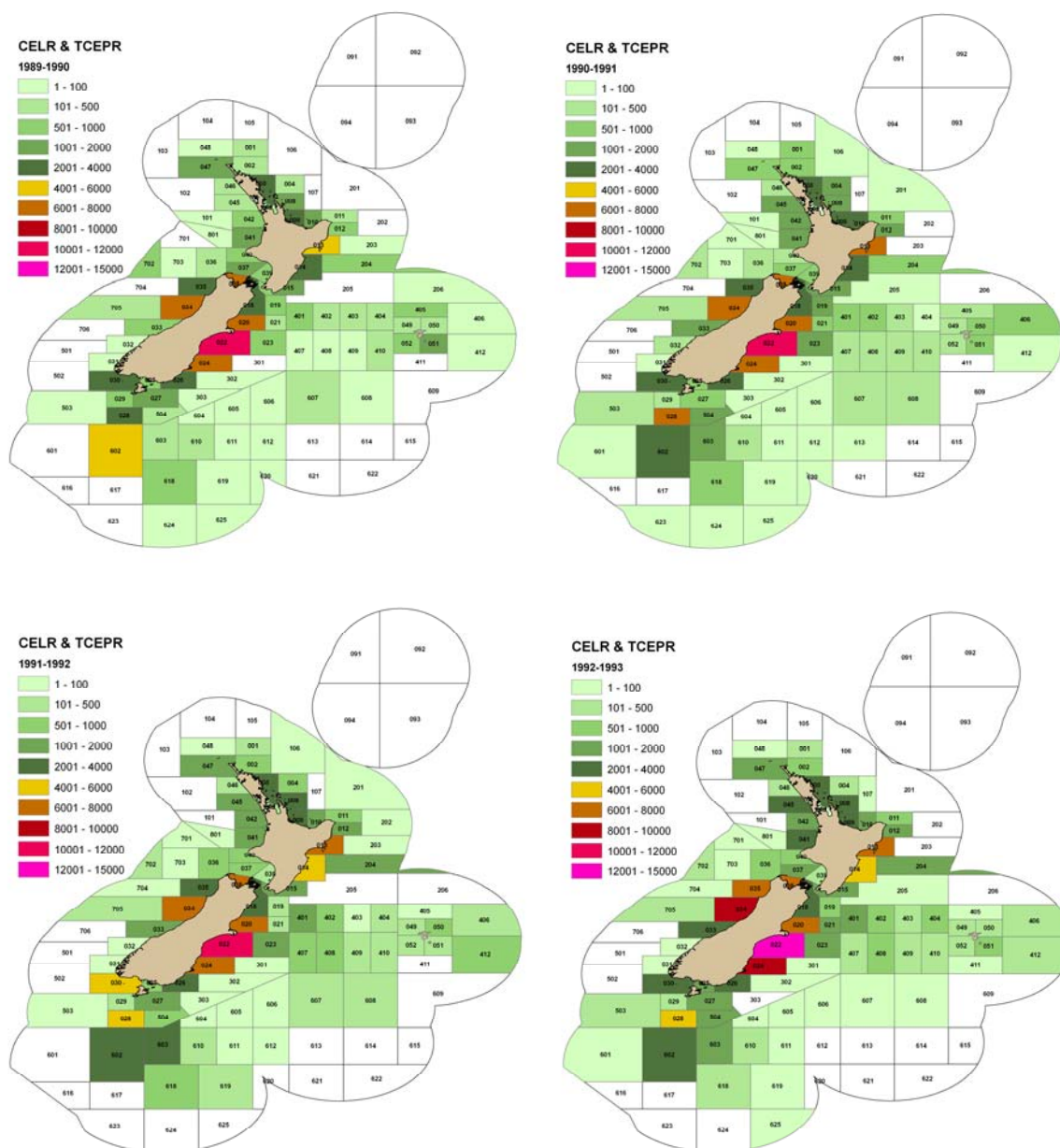


Figure H5: Distribution of all trawl effort on or near the seafloor reported on CELRs and TCEPRs, by Statistical Area, for fishing years 1989–90 to 1992–93.

APPENDIX H — continued

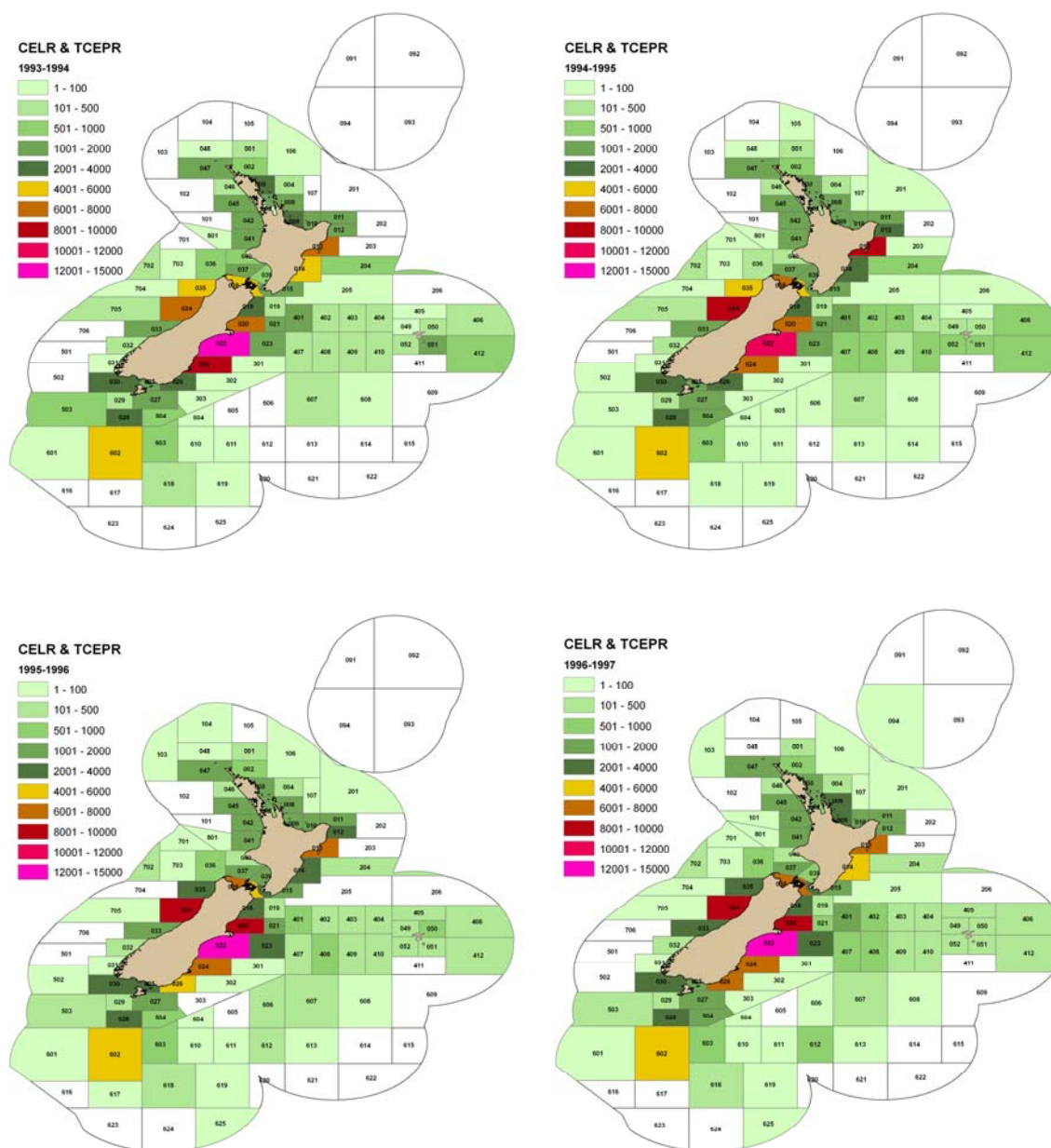


Figure H6: Distribution of all trawl effort on or near the seafloor reported on CELRs and TCEPRs, by Statistical Area, for fishing years 1994–95 to 1996–97.

APPENDIX H — continued

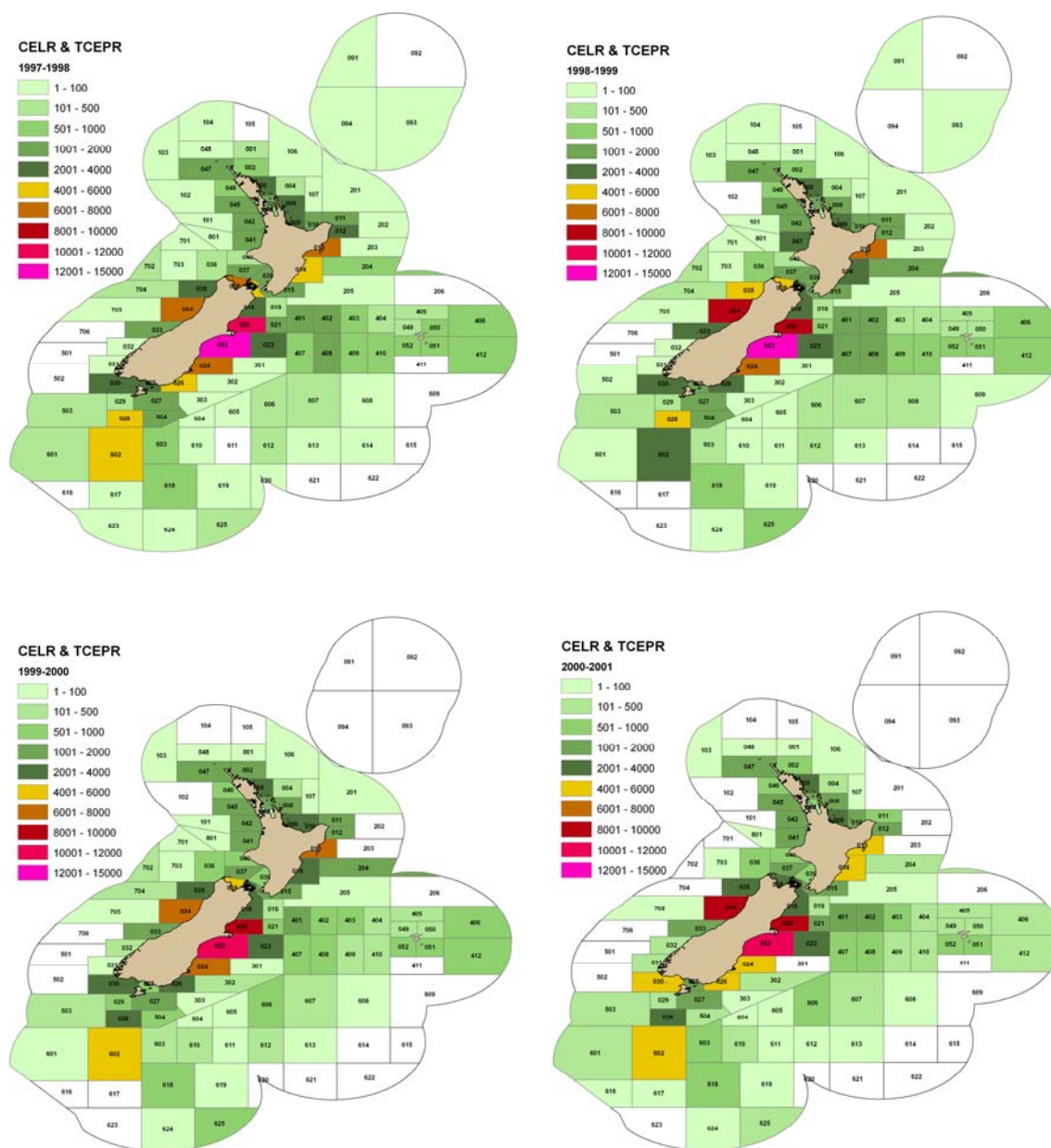


Figure H7: Distribution of all trawl effort on or near the seafloor reported on CELRs and TCEPRs, by Statistical Area, for fishing years 1997–98 to 2000–01.

APPENDIX H — continued

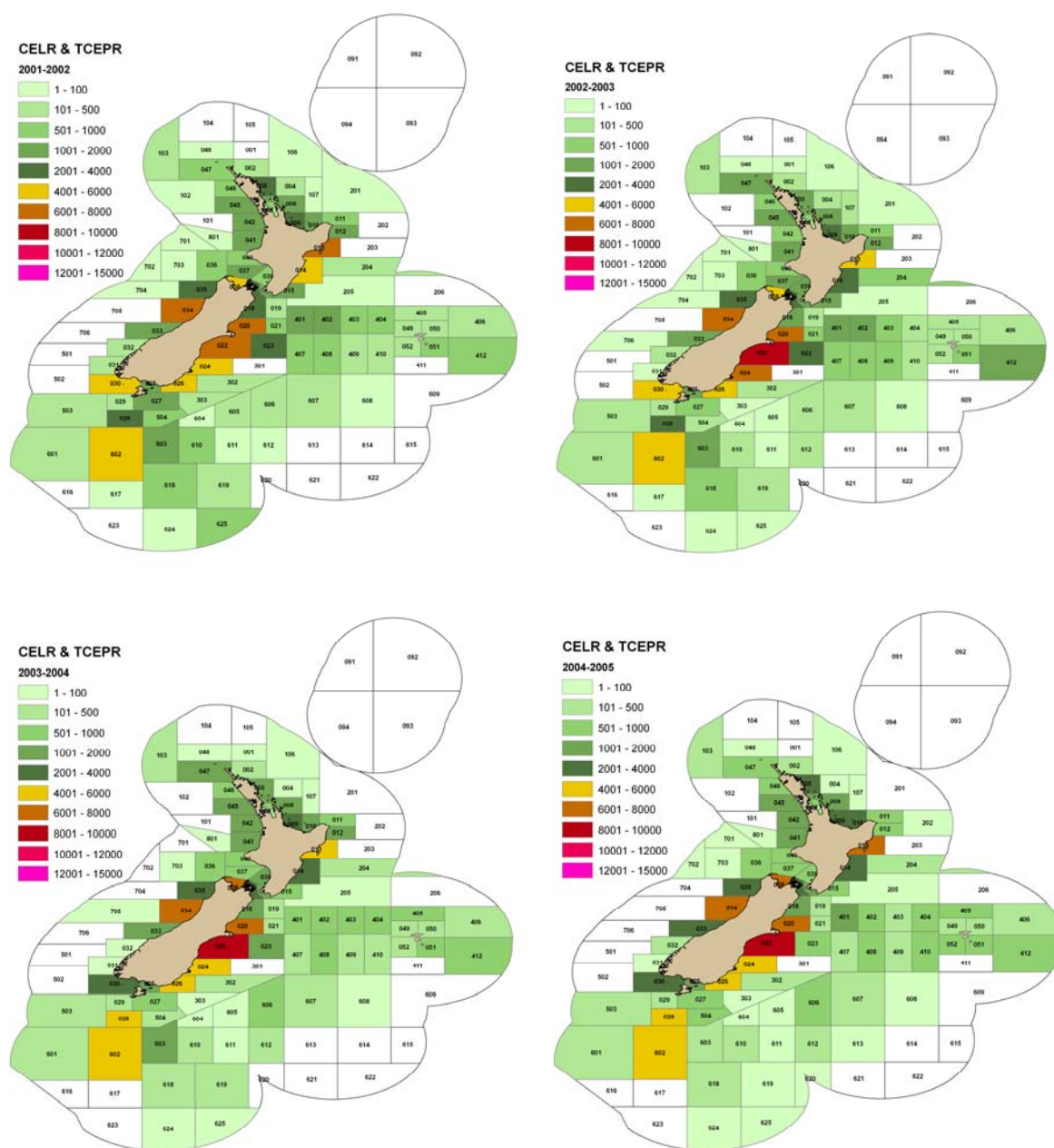


Figure H8: Distribution of all trawl effort on or near the seafloor reported on CELRs and TCEPRs, by Statistical Area, for fishing years 2001–02 to 2004–05.

APPENDIX I: DREDGE EFFORT REPORTED ON CELR, BY STATISTICAL AREA, 1989–90 TO 2004–05

Scallop dredge data

These data are reported here as the number of dredge tows in each fishing year in each fishery area. Thus, little grooming was done other than to ensure the Statistical Area was correct and that the number of daily tows feasible. The Statistical Areas reported for the Nelson-Marlborough fishery included variations on the codes in current use. They are reported here as in the fishers' data. Other records that could contribute to measures of fishing effort, such as the effort width and the hours fished, were checked to describe the extent of the values, but were not used to describe the effort further.

The number of dredge tows reported per CELR form (that is, daily effort) ranged from 1 to 24 040. Opinion from researchers suggested that 40 could be the maximum possible number of dredge tows completed by one vessel per day. The data indicated that a sensible median number of tows per day for all areas combined was 20 and this number was assigned to daily records where more than 40 tows were reported. Table I1 gives the values for the groomed effort data.

Gear width records varied from 0 to 4608, with measurements apparently recorded in millimetres, centimetres, and metres. About 8% of scallop daily records had no value for effort width, with 50% lying between 2.0 and 2.5 m and a median value of 2.2 m.

Reported duration (daily hours fished) ranged from 0.03 to 98.0 decimal hours (median was 8.75 hours), and 50% of the data records were between 6 and 11 hours per day. Less than 1% of scallop CELR records had null values for fishing duration. A median of 8 hours was assigned to records over 20 hours (Table I2). Although the Chathams data showed few daily tows, the number of hours spent fishing in a day were generally longer than for the other areas.

Tables I3–I7 give the numbers of dredge tows for each scallop fishery area and Table I8 gives the numbers of tows where reported by Statistical Area. Fewer tows per day were made in the Chatham Islands fishery, though this fishery has few data compared with the main fisheries. The seasonal spread of effort for the main fisheries is given in Tables I9–I13.

Oyster dredge data

The oyster data were assigned to the main oyster areas: Foveaux Strait and Nelson-Marlborough. The variations of codes used in Nelson-Marlborough are as reported. Effort for these areas was also reported by generic Statistical Area codes, and these are kept separate because it is not possible to distinguish subareas for those data.

Of the oyster records, 11% had null effort width values and less than 1% had null duration or effort number values. The Foveaux Strait data were assigned a median value of 30 when the number of tows reported for a day was greater than 70 and a fishing duration of 5 hours when the daily fishing duration was greater than 20 hours (Table I13). For the Nelson-Marlborough fishery, the daily numbers of tows were accepted as reported and records with a fishing duration of greater than 20 hours were assigned a median value of 9 hours.

Reported gear width values for Foveaux Strait ranged from zero to 6385 for a form field which requires the width in metres. The median for this fishery was 3.3 m (which reflects the fishery regulations which allow the use of two dredges per tow, each 3.35 m wide. Elsewhere, fishers are able to use one dredge of up to 2.5 m width or two dredges of 1.4 m per tow. The data for Nelson-Marlborough gave a median of 2.5 m: 50% used dredges between 2.4 and 4.4 m.

APPENDIX I — continued

Table I1: Distribution of scallop effort number data by fishery area, for all years 1989–90 to 2004–05.

Area	Minimum	1 st quartile	Median	Mean	3 rd quartile	Maximum	No. records
Number of tows per day							
All*	1	14	20	18.95	24	40	77 830
Northland	1	15	20	20.14	24	40	20 265
West coast	1	12	18	16.93	20	40	3 360
Coromandel	1	19	21	23.34	30	40	11 615
Nelson-Marlborough	1	12	18	17.31	22	40	34 716
Chatham Is.	1	6	10	9.47	12	21	1 158
Number of hours fished per day							
All	0.03	6.0	8.5	8.24	11.0	20.0	77 830
Northland	0.08	7.0	9.8	8.87	11.0	20.0	20 265
West coast	0.15	4.0	7.5	7.27	10.5	15.0	3 360
Coromandel	0.25	4.0	6.0	6.27	8.0	17.25	11 615
Nelson-Marlborough	0.03	6.0	9.0	8.56	11.0	20.0	34 716
Chatham Is.	0.33	7.2	10.0	9.32	12.0	18.0	1 158

* 'All' includes those dredge tows reported by Statistical Area rather than scallop target fishery area.

Table I2: Distribution of oyster effort variables by fishery area, for 1989–90 to 2004–05.

Area	Minimum	1 st quartile	median	mean	3 rd quartile	maximum	No. records
No. tows per day							
Foveaux Strait	1	20	30	31.7	42	70	12 028
Nelson-Marlborough	1	12	16	15.18	19	30	15 540
No. hours fished per day							
Foveaux Strait	0	3.5	5.0	5.2	7.0	20.0	12 028
Nelson-Marlborough	0	8.0	9.0	8.6	10.0	20.0	15 540

APPENDIX I — continued

Table I3: Number of scallop dredge tows reported by Northland Scallop Statistical Areas (see Figure G1), for fishing years 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1A	1 684	1 204	1 418	0	352	282	226	413	155	46	98	0	8	44	0	0	5 930
1B	206	1 011	25	84	53	4 446	2 407	1 283	0	10	0	0	0	0	0	0	9 525
1C	1 735	76	0	0	0	593	407	96	0	0	0	0	0	0	0	0	2 907
1D	15 084	8 212	15 904	24 323	34 676	26 921	13 827	14 214	15 017	8 397	5 579	7 657	6 469	4 887	7 954	590	209 711
1E	0	56	0	95	0	0	0	0	0	0	0	0	0	700	84	0	935
1F	344	426	1 025	2 970	2 435	658	873	228	0	0	0	186	0	0	0	0	9 145
1G	0	0	0	30	20	12	0	0	0	0	0	0	0	0	0	0	62
1H	504	581	1 087	7 327	6 754	3 589	2 187	372	295	0	0	0	0	0	3	0	22 699
1I	0	0	0	0	0	438	383	0	0	0	0	0	0	0	0	0	821
1J	349	431	1 262	1 025	1 731	1 530	981	360	153	0	0	0	0	0	0	0	7 822
1K	0	0	0	0	69	0	0	0	0	0	0	0	0	0	0	0	69
1L	0	0	27	540	297	62	0	0	0	0	0	0	0	0	0	0	926
1O	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	10
1P	0	0	0	0	30	0	0	0	0	0	0	0	428	111	42	0	611
1Q	156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	159
1R	14 312	30 611	38 029	7 431	5 510	17 629	4 256	2 942	982	0	113	563	706	493	185	5 199	128 961
1S	1 031	2 699	3 492	92	0	18	270	81	0	0	0	24	55	98	3	0	7 863
Total	35 405	45 307	62 269	43 917	51 937	56 178	25 817	19 989	16 602	8 453	5 790	8 430	7 666	6 333	8 271	5 792	408 156

Table I4: Number of scallop dredge tows reported by West Coast Scallop Statistical Areas (see Figure G1), for fishing years 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
9A	0	0	0	0	23	2 945	12 317	12 454	13 096	3 158	3 364	590	3 961	14 84	2 076	22	55 490
9B	0	0	0	0	0	0	0	2	0	0	0	0	19	0	0	0	21
9C	0	0	0	0	0	0	0	0	75	0	0	0	18	0	0	0	93
9D	0	0	0	0	0	0	1 280	0	0	0	0	0	0	12	0	0	1 292
Total	0	0	0	0	23	2 945	13 597	12 456	13 171	3 158	3 364	590	3 998	1 496	2 076	22	56 896

Appendix I — continued

Table I5: Number of scallop dredge tows reported by Hauraki–Great Barrier–Bay of Plenty Scallop Statistical Areas (see Figure G1), for fishing years 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
2A	0	30	95	749	2 291	3 448	406	27	0	234	2 089	2 347	3 132	44	579	517	15 988
2B	0	0	0	120	0	0	0	0	0	0	0	0	0	0	0	0	120
2C	0	21	0	0	111	0	52	445	282	90	211	0	387	0	0	0	1 599
2D	0	0	0	0	580	0	0	0	0	0	0	0	0	0	667	1 161	2 408
2E	0	0	664	1 562	1 907	1 031	0	0	0	0	0	0	161	2 096	3 207	2 507	13 135
2F	0	0	35	184	417	90	0	0	0	0	0	0	51	512	380	40	1 709
2G	0	0	0	0	0	0	80	0	0	0	105	0	0	0	53	601	839
2H	0	0	70	951	1 050	514	585	76	132	0	0	0	0	0	0	163	3 541
2I	0	0	0	20	223	35	138	147	0	0	0	0	0	0	0	0	563
2J	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	40
2K	0	0	200	40	68	369	0	0	0	0	0	0	0	0	0	0	677
2L	12 443	26 837	22 469	7 694	9 619	10 050	11 806	16 181	15 949	7 181	1 581	3 782	4 518	3 858	5 671	7 106	166 745
2M	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	36
2N	0	30	224	18	357	0	0	0	0	0	0	0	0	0	0	0	629
2P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	18
2Q	0	0	0	2	0	12	0	0	38	0	0	0	0	0	0	0	52
2R	1 395	3 216	4 198	2 206	148	4 006	3 485	3 423	885	886	300	1 983	1 076	337	619	566	28 729
2S	57	54	0	86	121	151	727	40	0	35	0	0	27	2	0	0	1 300
2W	770	2 530	3 148	170	124	719	1 718	676	152	91	0	0	0	1 310	0	456	11 864
2X	2 995	4 585	12 195	1	0	0	0	134	0	461	0	40	20	489	0	101	21 021
2Y	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	35	47
Total	17 660	37 303	43 298	13 803	17 016	20 461	18 997	21 189	17 438	8 990	4 286	8 152	9 372	8 648	11 176	13 271	271 060

Appendix I — continued

Table I6: Number of scallop dredge tows reported by Nelson–Marlborough Scallop Statistical Areas (see Figure G1 for current areas), for 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
7A	7 241	3 125	54	288	12	0	921	44	319	330	0	0	36	0	0	0	12 370
7AA	0	0	0	2 887	11 653	204	7 939	1 545	4 064	3 829	0	4 307	5 452	11 811	3 983	704	58 378
7B	2 191	8 196	13 406	4 840	0	42	343	188	1 208	1 397	681	121	0	0	0	0	32 613
7BB	0	0	0	19	27	1 676	4 935	1 100	8 115	7 626	2 736	23 538	41 350	19 325	42	3 038	113 527
7C	0	3 509	4 057	0	0	448	123	1 632	675	1 623	5 707	27	0	0	0	0	17 801
7CC	0	0	0	0	12 171	15 146	10 839	11 085	2 663	2 189	14 230	10 947	4 554	6 272	9	5	90 110
7D	201	109	0	124	0	0	162	208	22	20	457	0	0	0	0	0	1 303
7DD	0	0	0	36	20	0	1 517	1 847	38	261	2 624	1 082	916	69	151	70	8 631
7E	0	0	0	13	0	17	335	0	178	861	1 593	0	0	0	0	0	2 997
7EE	0	0	0	0	15 027	2 084	2 833	0	1 545	1 493	4 453	4 133	79	145	4	3 679	35 475
7F	0	11	0	1 258	0	0	938	269	0	181	246	0	17	0	0	0	2 920
7FF	0	40	0	15 653	17 443	84	6 918	1 973	0	972	854	17	1 006	2 511	15 739	5 368	68 578
7G	1 237	365	325	1 981	0	177	820	40	0	769	52	0	0	0	0	0	5 766
7GG	0	0	0	0	0	881	4 592	0	0	6 470	222	111	3 187	7 088	2 820	1 307	26 678
7H	350	227	12	958	0	18	78	0	0	657	0	0	0	0	0	0	2 300
7HH	0	0	0	0	93	609	356	0	20	2 648	96	593	0	47	23	0	4 485
7I	225	0	870	209	0	0	0	0	0	852	0	0	0	0	0	0	2 156
7II	0	0	0	0	0	15	0	0	10	4 697	38	724	719	864	310	6	7 383
7J	345	0	3 602	2 367	0	0	169	0	0	22	28	0	0	0	0	0	6 533
7JJ	0	0	0	170	3 167	728	6 601	1 864	842	1 393	12	44	0	108	88	420	15 437
7K	0	0	14	0	0	20	1 527	166	0	405	0	0	0	0	0	0	2 132
7KK	0	0	0	530	7 963	782	6 830	2 911	3 488	8 942	360	1 737	3 392	7 808	7 971	6 271	58 985
7L	0	0	0	0	0	0	100	26	35	137	372	0	0	0	0	0	670
7LL	0	0	0	0	572	118	482	560	366	261	1 261	372	53	837	892	0	5 774
7M	240	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	259
7MM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
7N	50	201	110	0	0	0	0	0	0	0	0	0	0	0	0	0	361
7O	2 373	3 119	6 491	1 135	0	0	0	0	0	0	0	0	0	0	0	0	13 118
7P	430	506	1 271	134	0	0	0	0	0	0	0	0	0	0	0	0	2 341
7Q	1 403	188	95	0	0	0	0	0	0	0	0	0	0	0	0	0	1 686
7R	0	0	0	0	0	0	38	12	0	0	0	0	0	0	0	0	50
Total	16 286	19 596	30 307	32 602	68 148	23 049	59 396	25 470	23 588	48 054	36 022	47 753	60 761	56 885	32 033	20 868	600 818

Appendix I — continued

Table I7: Number of scallop dredge tows reported by Chatham Islands Scallop Statistical Areas (see Figure G1), for 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
4A	501	183	0	13	0	64	15	54	130	12	0	0	0	0	0	0	972
4B	337	20	0	0	0	12	0	0	78	0	0	0	0	0	0	0	447
4C	0	12	0	0	0	0	0	183	135	0	0	0	0	0	0	0	330
4E	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	16
4F	0	6	0	0	0	0	3	0	0	0	0	0	0	0	0	0	9
4G	22	379	385	708	0	671	934	2 330	842	152	179	6	43	220	0	0	6 871
4H	233	492	310	0	0	491	510	2	66	119	0	0	0	46	0	51	2 320
Total	1 093	1 092	695	721	16	1 238	1 462	2 569	1 251	283	179	6	43	266	0	51	10 965

Appendix I — continued

Table 18: Number of dredge tows reported by Statistical Area other than those reported in Tables G1–G5, where SCA (scallop) was the target, for fishing years 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
1	6960	6581	654	778	154	162	198	1380	1363	137	0	0	0	0	0	0	18367
2	367	1711	12646	7290	149	0	647	0	112	52	0	0	0	0	0	8	22982
3	652	20	0	800	78	11	23	20	0	0	0	0	0	372	60	0	2036
4	80	0	9	247	0	0	146	18	21	0	0	0	0	0	0	0	521
5	0	480	0	968	804	142	0	375	154	0	0	0	0	276	0	0	3199
6	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
7	628	8	34	0	90	404	1739	1503	69	82	0	0	72	0	0	0	4629
8	1576	902	16	0	0	0	97	958	2364	2127	80	0	152	0	67	0	8339
9	27	0	59	0	0	61	1300	717	927	0	35	0	0	0	0	0	3126
10	36	31	46	0	0	5	39	218	190	496	20	0	0	0	0	0	1081
11	0	0	0	82	0	0	0	0	0	25	0	0	0	0	0	0	107
12	54	0	0	8	0	0	0	20	0	0	0	0	0	0	0	0	82
13	17	28	0	0	0	0	78	0	0	0	0	0	0	0	0	0	123
14	0	22	43	0	0	0	0	40	0	0	0	0	0	0	0	0	105
15	1986	544	134	2	0	0	222	60	36	0	0	0	0	0	0	0	2984
16	25	0	0	0	0	0	24	40	0	0	0	0	0	0	0	0	89
17	109	23	232	762	7	0	546	566	580	818	110	184	0	68	1	0	4006
18	265	0	0	0	0	0	0	24	27	0	0	0	0	0	0	0	316
20	24	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	30
21	0	34	0	0	0	0	0	262	0	27	0	0	0	0	0	0	323
22	20	0	38	0	0	0	180	262	781	81	0	0	0	0	0	0	1362
23	163	0	0	0	0	0	0	28	60	0	0	0	0	0	0	0	251
24	55	3	31	18	0	0	0	0	35	58	0	0	0	0	0	0	200
25	7	0	0	0	0	0	80	20	0	0	186	0	0	0	0	0	293
26	0	0	0	200	0	0	0	65	0	0	0	0	0	0	0	0	265
27	0	0	0	0	0	0	0	0	57	0	0	0	0	0	0	0	57
28	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	9
29	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
30	12	0	0	0	0	0	0	0	0	7	20	0	0	0	0	0	39
31	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
32	8	40	0	0	0	0	0	0	0	0	14	0	0	0	0	0	62
33	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	9
34	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
35	0	0	0	0	20	0	0	6	0	22	28	0	0	0	0	0	76
36	0	0	0	0	0	0	0	0	22	40	0	0	0	0	0	0	62
37	0	30	22	1	87	0	45	0	239	0	0	0	0	0	0	0	424
38	909	24	168	722	780	660	2794	3167	3841	8486	7814	50	102	105	8	0	29630
41	0	0	0	0	0	380	0	0	0	0	0	0	0	0	0	0	380
42	0	0	0	0	0	0	0	20	0	74	0	0	0	0	0	0	94
43	0	0	0	0	0	0	0	0	0	80	0	0	0	0	1	22	103
44	0	20	0	0	0	0	16	0	0	18	0	0	0	0	0	0	54
45	0	0	0	0	0	0	0	8	126	0	0	0	0	0	0	0	134
46	0	0	0	0	0	102	18	25	40	10	0	0	0	0	0	0	195
47	0	53	10	0	0	41	331	0	0	0	0	0	0	0	0	0	435
48	0	8	0	0	0	0	37	0	0	0	0	0	0	0	0	0	45
49	0	0	0	10	0	0	0	190	6	0	0	0	0	0	0	0	206
50	0	0	262	0	8	150	0	0	27	1	45	0	0	0	0	0	493
51	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
Other	8515	514	432	292	20	492	1656	1001	774	1942	474	0	9	92	335	0	16548
Total	22534	11076	14836	12180	2197	2612	10222	11002	11860	14586	8826	234	335	915	472	30	123917

Appendix I — continued

Table I9: Number of scallop dredge tows by month and fishing year for the Northland fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing	Months of fishing year												
year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
1990	626	4 871	5 762	6 789	1 735	20	0	0	4	2 795	5 751	7 052	35 405
1991	5 856	5 595	4 825	1 904	2 094	0	0	0	0	6 690	9 474	8 869	45 307
1992	10 258	8 410	8 760	6 175	2 648	0	0	0	22	7 650	11 051	7 295	62 269
1993	8 599	7 426	5 426	2 270	19	0	0	0	0	4 624	9 070	6 483	43 917
1994	8 378	7 212	7 764	5 904	1 475	0	0	0	0	4 815	11 654	4 735	51 937
1995	7 193	7 556	5 138	3 958	3 176	0	0	32	0	7 555	12 639	8 931	56 178
1996	6 253	4 224	1 916	1 691	1 445	0	0	0	0	2 316	3 707	4 265	25 817
1997	4 063	2 365	2 518	2 264	952	0	0	0	0	3 300	2 044	2 483	19 989
1998	1 579	3 285	2 209	1 720	717	0	0	0	0	1 891	3 632	1 569	16 602
1999	792	1 262	987	989	11	0	0	0	0	93	3 052	1 212	8 398
2000	1 239	777	538	479	263	0	0	0	0	563	1 233	665	5 757
2001	1 072	666	705	903	501	0	0	0	0	0	1 590	2 993	8 430
2002	702	464	765	1 406	411	0	0	0	0	1 968	817	1 133	7 666
2003	1 914	798	522	50	0	0	0	0	0	1 044	1 375	630	6 333
2004	1 080	886	1 120	1 034	496	0	0	0	0	1 203	1 397	1 055	8 271
2005	1 271	714	336	140	121	0	0	0	0	1 032	1 259	919	5 792
All	60 875	56 511	49 291	37 676	16 064	20	0	32	26	47 539	79 745	60 289	408 068

Table I10: Number of scallop dredge tows by month and fishing year for the West Coast North Island fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing	Months of fishing year												
year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	14	9	0	0	0	0	0	0	0	23
1995	708	407	576	595	634	0	0	0	0	0	0	25	2 945
1996	2 486	1 534	2 405	1 433	1 787	0	0	0	16	812	2 053	1 071	13 597
1997	1 423	2 210	719	1 235	369	0	0	0	0	1 838	3 107	1 555	12 456
1998	3 261	1 725	852	1 478	368	0	0	0	0	85	2 335	2 990	13 094
1999	823	877	317	204	0	0	0	0	0	0	0	937	3 158
2000	90	337	638	428	454	0	0	0	0	0	490	927	3 364
2001	158	263	62	74	0	0	0	0	21	0	0	12	590
2002	759	856	231	566	290	0	0	0	0	30	856	410	3 998
2003	189	577	68	0	0	0	0	0	0	97	324	241	1 496
2004	434	607	67	27	49	0	0	0	0	0	307	585	2 076
2005	0	0	0	22	0	0	0	0	0	0	0	0	22
All	10 331	9 393	5 935	6 076	3 960	0	0	0	37	2 862	9 472	8 753	56 819

Appendix I — continued

Table I11: Number of scallop dredge tows by month and fishing year for the Coromandel fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing	Months of fishing year												
year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
1990	145	131	32	0	0	0	0	0	0	3 803	3 516	10 033	17 660
1991	3 246	5 647	4 403	0	0	0	111	0	0	3 816	10 259	9 821	37 303
1992	9 093	10 056	7 292	312	64	0	0	0	0	5 090	4 566	6 825	43 298
1993	6 798	2 527	49	0	0	0	0	0	0	0	1 093	3 336	13 803
1994	3 810	2 942	2 368	0	0	0	0	0	0	1 932	3 046	2 918	17 016
1995	5 406	2 628	2 258	0	0	0	0	0	0	0	5 131	5 038	20 461
1996	3 449	2 635	638	0	0	0	0	0	0	3 287	4 265	4 723	18 997
1997	4 361	1 757	854	0	0	0	0	0	0	3 276	5 704	5 237	21 189
1998	3 770	3 191	1 700	16	0	0	0	0	0	2 276	1 541	4 944	17 438
1999	2 843	3 062	1 384	0	12	0	0	0	0	0	234	1 455	8 990
2000	953	497	0	0	0	0	0	0	0	434	1 582	820	4 286
2001	1 023	666	640	0	0	0	0	0	0	0	3 733	2 090	8 152
2002	1 283	0	0	0	0	0	0	0	0	1 566	3 681	2 842	9 372
2003	387	1 516	666	0	0	0	0	0	0	1 640	2 017	2 422	8 648
2004	2 392	1 772	622	0	0	0	0	0	0	1 173	2 764	2 453	11 176
2005	2 728	2 549	897	0	0	0	0	0	0	1 304	2 806	2 987	13 271
All	51 687	41 576	23 803	328	76	0	111	0	0	29 597	55 938	67 944	271 060

Table I12: Number of scallop dredge tows by month and fishing year for the Nelson-Marlborough fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing	Months of fishing year												
year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
1990	3 155	1 182	151	0	0	0	10	0	0	0	0	11 788	16 286
1991	5 599	1 248	12	0	0	0	0	0	7	6	3 628	9 096	19 596
1992	5 965	62	0	0	0	0	0	0	0	0	6 328	17 952	30 307
1993	8 366	1 171	3 647	0	0	18	0	0	15	90	2 885	16 410	32 602
1994	17 223	17 287	5 786	0	0	0	0	12	0	0	11 786	16 054	68 148
1995	4 061	13	0	0	0	17	0	0	0	10	1 499	17 449	23 049
1996	20 695	12 829	1 511	0	16	40	0	0	52	0	1 978	22 275	59 396
1997	8 707	15	12	0	0	0	0	0	0	20	44	16 672	25 470
1998	8 180	1 075	0	0	0	0	0	0	0	0	12	14 321	23 588
1999	13 471	14 308	4 487	3 952	3 301	37	0	0	0	0	1	8 497	48 054
2000	14 444	16 615	4 910	38	0	0	0	0	0	0	0	15	36 022
2001	7 710	18 978	5 313	1 656	3 004	4 387	0	0	14	17	0	6 674	47 753
2002	20 729	19 757	3 796	1 654	0	0	20	0	0	0	0	14 805	60 761
2003	23 306	16 452	8 739	2 506	933	0	0	0	0	0	13	4 936	56 885
2004	18 934	8 898	2 616	1 103	481	0	0	0	0	1	0	0	32 033
2005	8 896	9 632	1 551	691	97	0	0	0	0	0	0	1	20 868
All	189 441	139 522	42 531	11 600	7 832	4 499	30	12	88	144	28 174	176 945	600 818

Appendix I — continued

Table I13: Number of scallop dredge tows by month and fishing year for the Chatham Islands fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing	Months of fishing year												
year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	All
1990	77	35	0	0	0	0	0	0	0	0	286	695	1 093
1991	208	0	0	0	0	0	0	0	0	0	829	55	1 092
1992	0	0	0	0	0	0	0	0	0	0	391	304	695
1993	177	544	0	0	0	0	0	0	0	0	0	0	721
1994	0	16	0	0	0	0	0	0	0	0	0	0	16
1995	0	17	478	212	10	0	0	0	0	0	0	521	1 238
1996	328	146	1	0	0	0	0	0	0	0	0	987	1 462
1997	1 063	124	10	0	0	0	0	0	0	0	520	852	2 569
1998	687	130	62	0	0	0	0	0	0	0	198	174	1 251
1999	105	22	4	0	0	0	0	0	0	0	0	152	283
2000	163	16	0	0	0	0	0	0	0	0	0	0	179
2001	0	0	0	0	0	0	0	0	0	0	0	6	6
2002	37	4	2	0	0	0	0	0	0	0	0	0	43
2003	0	221	45	0	0	0	0	0	0	0	0	0	266
2004	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	51	0	0	0	0	0	0	0	0	0	0	51
All	2 845	1 326	602	212	10	0	0	0	0	0	2 224	3 746	10 965

Table I14: Number of dredge tows reported by Statistical Area where OYS was the target, for fishing years 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
1	41	0	71	229	16	296	3477	1784	393	59	130	0	0	0	0	0	6 496
2	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	15
3	0	0	4	0	0	138	0	0	0	0	0	0	0	0	0	0	142
4	0	6	0	0	0	14	0	0	20	0	0	0	0	0	0	0	40
5	0	0	0	0	0	0	0	8	6	0	0	0	0	0	0	0	14
6	0	0	64	0	0	0	0	11	13	34	0	0	0	0	0	0	122
7	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
8	50	0	0	63	212	970	3 698	2 933	597	2 221	0	0	0	0	0	0	10 744
9	0	0	0	0	0	0	70	0	0	0	0	0	0	0	0	0	70
10	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	40
11	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10
14	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	9
15	0	0	0	12	0	0	0	19	0	0	0	0	0	0	0	0	31
16	0	0	0	0	0	20	0	0	25	0	20	0	0	0	0	0	65
17	33	141	0	12	0	17	0	0	0	1 240	0	0	0	0	0	0	1 443
22	0	3	0	77	0	0	0	0	0	0	0	0	0	0	0	0	80
25	0	0	829	32	44	0	168	285	374	273	127	56	0	0	0	0	2 188
26	0	0	0	0	48	0	18	0	0	0	0	0	0	0	0	0	66
27	0	0	0	0	0	0	0	0	36	81	0	0	0	0	0	0	117
32	0	0	0	0	0	0	0	0	73	0	0	0	0	0	0	0	73
33	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	27
35	13	0	0	44	0	0	0	20	44	21	0	0	0	0	0	0	142
36	0	0	0	0	0	0	32	14	0	0	33	0	0	0	0	0	79
37	0	0	10	155	0	169	31	36	12	30	0	102	0	0	0	0	545
38	2 118	1 055	1 322	6 988	827	4 513	2 893	6 628	10 484	6 707	153	106	0	0	19	0	43 813
46	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
48	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	44
49	0	0	0	0	0	0	56	0	0	0	0	0	0	0	0	0	56
1J	0	0	814	73	0	0	0	0	0	0	0	0	0	0	0	0	887
1L	0	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	90
205	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
206	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	14
4G	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	4
5	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	24
7	0	0	0	0	0	0	0	0	0	37	33	65	25	0	0	0	160
938	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	21
All	2 285	1 205	3 114	7 724	1 237	6 162	10 445	11 805	12 121	10 750	496	329	27	0	19	0	67 719

APPENDIX I — continued

Table 15: Number of oyster dredge tows reported by Foveaux Strait Statistical Areas for 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
A	210	3 913	2 461	329	65	96	420	30	62	10	0	0	4 621	7 432	7 633	13 369	40 651
B5	9 204	13 564	76	529	451	288	298	26	37	34	19	0	2 570	3 921	1 930	4 372	37 319
C5	2 956	4 541	116	331	394	212	0	22	0	0	10	146	1 950	2 590	3 650	2 308	19 226
D6	829	3 861	0	60	48	126	0	0	0	0	0	0	895	59	93	186	6 157
D7	52	0	0	28	28	0	4	18	993	554	249	0	656	78	266	2	2 928
E6	428	878	0	98	25	227	42	0	114	395	204	318	1 997	147	385	124	5 382
E7	556	32	40	0	324	487	1 337	4 043	2 681	2 609	3 459	3 206	3 905	728	36	868	24 311
F8	51	67	0	0	3	5	6	0	34	28	0	0	10	0	1 721	1 309	3 234
F9	22	50	0	10	0	0	0	0	0	0	0	0	0	0	177	136	395
G8	383	396	0	0	218	578	1 332	2 300	7 229	5 349	2 506	677	663	52	0	99	21 782
G9	3 813	2 877	0	567	595	357	710	167	145	316	70	0	0	0	0	44	9 661
H	0	8 579	5 588	40	186	169	0	0	8	0	50	0	102	0	0	0	14 722
K	32	36	3 549	152	324	157	0	0	0	0	0	0	42	1 368	440	278	6 378
L	0	0	86	0	0	0	0	0	0	0	0	0	0	0	0	0	86
S5	1 952	3 732	0	0	92	120	55	0	0	0	0	0	1 778	1 238	1 166	1 225	11 358
S6	10 974	4 815	329	329	555	510	2 502	2 128	939	332	838	2 364	5 065	730	0	12	32 422
S7	5 579	13 352	311	609	595	472	10 645	6 414	2 904	4 973	10 225	10 270	8 108	821	56	1 114	76 448
S8	1 972	3 803	0	416	561	423	1 948	1 356	1 654	1 288	291	513	100	0	12	0	14 337
All	39 013	64 496	12 556	3 498	4 464	4 227	19 299	16 504	16 800	15 888	17 921	17 494	32 462	19 164	17 565	25 446	326 797

APPENDIX I — continued

Table I6: Number of oyster dredge tows reported by Nelson-Marlborough Oyster Statistical Areas (see Figure G1), for 1989–90 (1990) to 2004–05 (2005).

Area	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
7A	0	3	0	270	0	0	0	0	0	0	0	0	0	0	0	0	273
7AA	0	0	0	0	16	0	27	31	0	0	12	83	0	0	5	26	200
7B	8	34	26	52	0	0	0	0	0	0	0	0	0	0	0	0	120
7BB	0	0	0	32	22	563	1 242	0	0	16	55	797	0	18	0	0	2 745
7C	8	0	749	1 078	0	0	0	0	790	283	0	0	0	0	0	0	2 908
7CC	0	0	0	70	689	628	54	0	0	16	5	101	0	68	30	0	1 661
7D	0	38	0	48	0	0	410	1 044	426	885	0	0	0	0	0	0	2 851
7DD	0	0	0	0	10 782	5 466	7 321	8 116	3 768	4 251	3 202	230	0	148	1 507	1 502	46 293
7E	0	20	21	0	0	0	20	30	108	287	155	35	0	0	0	0	676
7EE	0	0	0	0	813	2 042	1 595	2 564	2 368	1 697	3 111	1 373	0	6 125	4 077	2 814	28 579
7F	2 802	2 308	2 163	2 763	0	0	33	389	951	186	18	0	0	0	0	0	11 613
7FF	0	0	0	301	11 778	4 600	4 933	2 446	3 389	497	3 054	4 443	27	1 498	672	647	38 285
7G	1 127	1 486	2 248	1 942	0	0	0	0	0	65	20	0	0	0	0	0	6 888
7GG	0	0	0	0	1 857	2 266	1 333	278	1 030	947	1 381	1 963	112	451	127	661	12 406
7H	412	2 053	1 464	1 365	0	0	478	0	0	282	0	0	0	8	0	0	6 062
7HH	0	0	0	60	1 302	8 148	3 598	1 024	1 153	1 970	2 454	1 171	0	5 929	1 868	4 051	32 728
7I	378	1 065	612	404	0	0	0	0	161	203	0	0	0	0	0	0	2 823
7II	0	0	0	0	857	1 948	1 279	0	2 841	4 148	725	58	0	413	122	1 278	13 669
7J	1 079	2 485	5 550	7 046	0	0	0	0	0	0	0	0	0	0	0	0	16 160
7JJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7K	471	1 160	1 328	1 273	0	0	0	0	0	0	0	0	0	0	0	0	4 232
7KK	0	0	0	0	0	0	106	125	307	0	0	0	0	0	0	0	538
7L	0	157	0	101	0	0	0	0	0	71	0	0	0	0	0	0	329
7LL	0	0	0	0	814	152	14	0	76	10	408	0	0	0	2	0	1 476
7M	62	1 525	85	474	0	0	0	0	0	0	0	0	0	0	0	0	2 146
7MM	0	0	0	0	0	0	0	0	0	0	0	0	0	16	3	1	20
7N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7O	17	119	15	7	0	0	0	0	0	0	0	0	0	0	0	0	158
7P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7Q	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7R	0	6	34	0	0	0	0	0	0	0	0	0	0	0	0	0	40
All	6 364	12 459	14 295	17 286	28 930	25 813	22 443	16 047	17 368	15 814	14 600	10 254	139	14 674	8 413	10 980	235 879

APPENDIX I — continued

Table I17: Number of oyster dredge tows by month and fishing year for the Foveaux Strait fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing year	Tows per month of fishing year											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1990	0	0	0	0	0	14 881	7 377	5 735	9 583	1 437	0	0
1991	0	0	0	70	0	2 975	6 046	12 004	14 608	16 692	12 101	0
1992	0	0	0	0	20	2 209	3 879	2 337	2 036	1 203	126	746
1993	972	1 762	764	0	0	0	0	0	0	0	0	0
1994	785	2 298	1 351	0	30	0	0	0	0	0	0	0
1995	0	0	0	2 487	1 740	0	0	0	0	0	0	0
1996	0	0	0	470	509	0	0	0	3 720	8 058	6 542	0
1997	0	0	0	201	0	0	0	36	7 097	6 235	2 935	0
1998	0	68	0	773	258	0	251	6 160	5 004	3 381	905	0
1999	0	0	0	0	0	234	5 146	5 614	2 920	1 561	297	116
2000	454	290	178	282	0	5 297	3 691	4 344	2 049	687	649	0
2001	0	0	0	0	0	1 167	5 027	5 485	3 322	2 236	257	0
2002	0	0	0	0	0	1 598	9 132	5 051	4 971	6 660	5 050	0
2003	0	0	0	0	0	2 619	5 316	3 793	3 348	2 970	1 118	0
2004	0	0	0	0	0	773	5 306	5 295	3 056	2 679	456	0
2005	0	0	0	0	0	1 297	5 359	7 055	4 510	5 598	1 627	0
All	2 211	4 418	2 293	4 283	2 557	33 050	56 530	62 909	66 224	59 397	32 063	862

Table I18: Number of oyster dredge tows by month and fishing year for the Nelson-Marlborough fishery, where the start date was not null, for 1989–90 (1990) to 2004–05 (2005).

Fishing year	Tows per month of fishing year											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1990	0	0	0	0	0	440	84	1 630	1 699	1 971	536	4
1991	0	6	0	0	0	534	1 555	3 407	3 269	2 706	982	0
1992	0	0	0	0	24	752	3 787	2 978	3 319	2 110	1 310	15
1993	0	0	0	0	0	1 004	3 970	2 967	2 524	4 441	2 380	0
1994	0	0	0	0	0	4 323	6 630	7 078	6 318	4 054	527	0
1995	0	0	0	16	0	5 651	6 140	6 621	3 759	2 211	1 400	15
1996	0	0	0	0	0	7 072	6 644	5 076	1 792	1 023	817	19
1997	0	0	0	0	0	2 894	5 279	4 283	2 153	1 364	74	0
1998	1 379	2 983	0	0	0	3 743	4 567	1 959	1 711	856	140	30
1999	260	502	291	36	2 354	3 477	3 498	1 370	1 252	1 373	1 401	0
2000	253	297	149	314	409	607	1 203	1 943	1 180	1 658	3 159	3 428
2001	1 402	178	30	60	0	0	992	2 148	1 934	2 086	1 029	395
2002	0	23	116	0	0	0	0	0	0	0	0	0
2003	179	60	0	0	128	266	701	1 881	2 950	4 223	2 719	1 567
2004	0	1	543	0	577	2 004	2 651	2 448	186	3	0	0
2005	0	0	0	0	154	1 381	2 117	2 997	1 942	1 044	1 304	41
All	3 473	4 050	1 129	426	3 646	34 148	49 818	48 786	35 988	31 123	17 778	5 514

APPENDIX I — continued

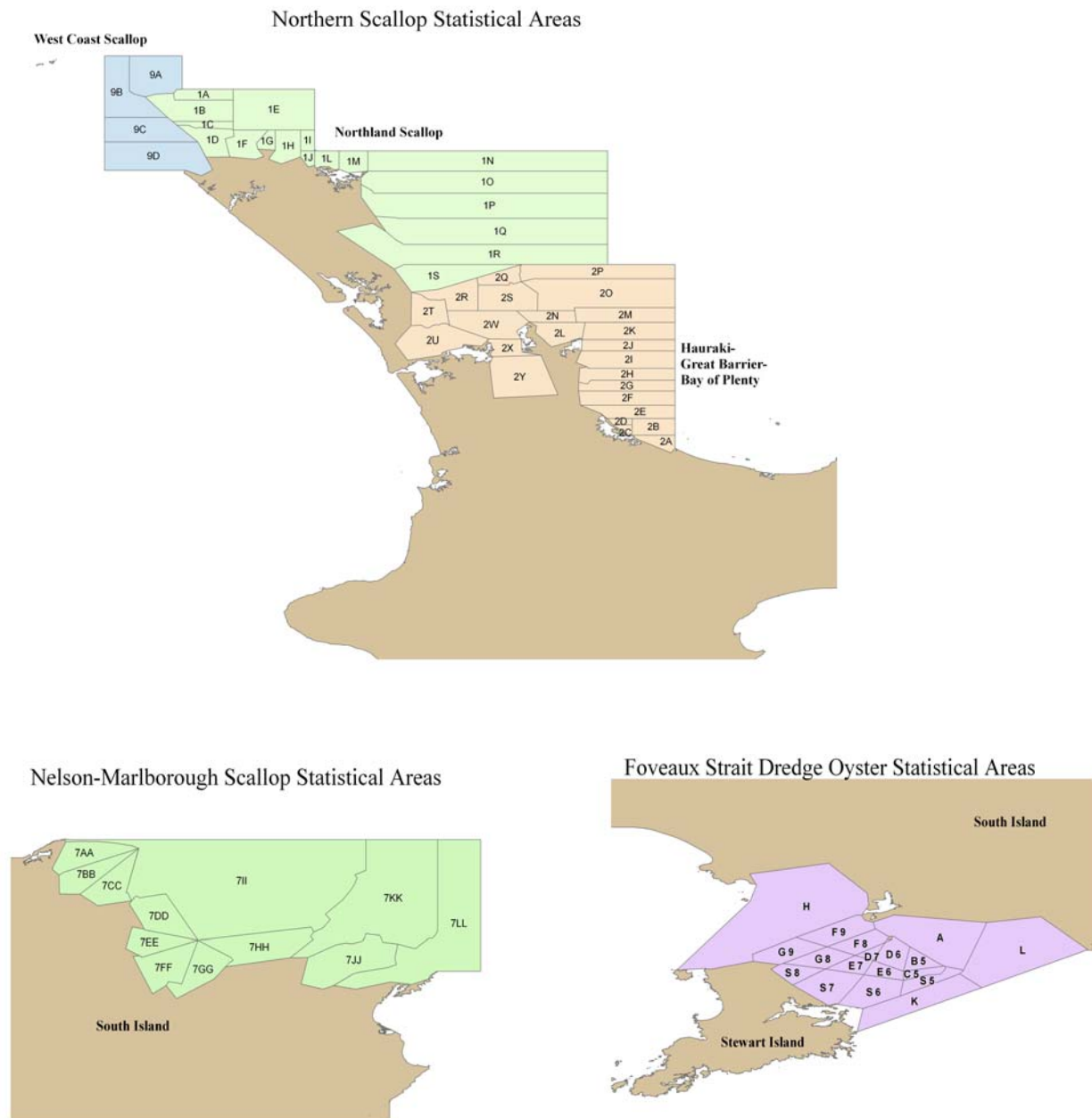


Figure 11: Maps showing the subareas of the main scallop and oyster fishery areas.