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## EXECUTIVE SUMMARY

**Kendrick, T.H. (2006). Characterisation of the New Zealand tuna fisheries in 2002–03 and 2003–04.**

***New Zealand Fisheries Assessment Report 2006/28.* 78 p.**

This report describes the New Zealand domestic tuna fisheries in the 2002–03 and 2003–04 fishing years, in detail, and in the context of the six most recent fishing years, from 1998–99. During this period the domestic fleet expanded rapidly to replace licensed foreign vessels fishing in the New Zealand Exclusive Economic Zone (EEZ), and tuna fisheries were the last significant free-entry fisheries left outside of the Quota Management System (QMS) in New Zealand waters. Increased participation, and increased targeting of albacore during these years may have been partly in anticipation of future quota allowances based on fishing history. Swordfish were a valuable component of the catch but could not legally be targeted.

In October 2004, bigeye, Pacific bluefin, southern bluefin, and yelloweye tunas, and swordfish were introduced into the QMS, with swordfish becoming a legal target species. The number of vessels targeting tunas had already declined markedly with the expected rationalisation of the fleet, and these changes mark a regime shift that will affect most time series of nominal tuna CPUE, especially where it is based on fisher nominated target species. It is timely for a comprehensive characterisation study to describe the operation of these fisheries during the years leading up to their introduction into the QMS.

Tunas and swordfish, except for Southern bluefin tuna, were not subject to any catch restrictions or to compulsory reporting requirements up to October 2004, except that all retained catch from longlining, targeted at tuna species, was required to be reported on Tuna Longline Catch Effort Returns (TLCER), but the commercially valuable species that are the focus of this report have generally been well reported.

For other methods such as troll and purse-seine that are reported on the general Catch Effort Landing Return (CELR), tuna species generally dominate the catch and are also well reported (among the top five species in the catch), but several problems have historically compromised the catch effort data for tunas reported on CELRs, most importantly, that catches estimated on CELRs are reported in an intractable mixture of weight and of numbers of fish. About half of the annual catch of tunas and swordfish is taken in methods that are reported on the Catch Effort and Landing Return (CELR) form.

Clean CPUE data that have been verified as reported in numbers of fish are held in a secondary research database "*tuna*", maintained by the MFish data manager (NIWA). It is from this database that annual summaries and operational data are supplied to offshore agencies tasked with management of migratory species.

This study included an evaluation of the *tuna* database (reported separately) and concluded it was not ideal for use in a characterisation study. The degree to which CPUE data are representative of the various fisheries varies with formtype, and has been reported to be poor for some minor methods, and the temporal and spatial resolution of descriptive statistics, that must be derived from stratified CPUE estimates converted to weight using average fish size, are necessarily coarse.

Only the landings, available at the end of a trip, represent 'total catches', and this study is based on those data, extracted independently from the primary database "*warehou*", and linked to effort strata using methodology developed for monitoring bycatch and other poorly reported species. The main advantages of this approach for a characterisation study are: a) inclusion of all records, whether estimated in weight or in numbers of fish; b) 'seamless' combination of data across all formtypes; c) use of verified landed weight; d) more accurate description of

minor and poorly reported methods; and e) finer spatial and temporal scale of descriptive statistics, more appropriate for describing seasonal availability of migratory species.

This approach also allowed the reconstruction of activity for individual vessels where there was poor linkage in the primary *warehou* database between fishing events and landing events. These observations are excluded when populating the *tuna* database and had been reported by the data manager as an increasingly serious concern. The data-audit part of this project is reported separately, but the work done identified systematic errors (both software and fisher-induced) that caused NULL trip number fields in the MFish "*warehou*" database. These in turn led to some important data gaps in the secondary database "*tuna*", which mainly compromised longline data reported on the new TLCER form. Simple fixes were designed and tested, and have subsequently been implemented by MFish.

This report describes the patterns of effort for each main fishing method in terms of latitude and season, with additional observations on the fleets and the fishing practices to the extent that can be derived from the various catch effort forms. It also describes the annual catches and catch-rates of each of the seven species of interest, in terms of fishing method, declared target species, and seasonal availability with latitude.

The longline fishery takes place throughout the year in the northern half of the zone targeted mainly at bigeye, and in two distinct latitude/seasonal windows targeted at southern bluefin, but the bycatch of swordfish and albacore far exceeds the landings of these two target species. Swordfish was not a legal target before its introduction into the QMS, though targeting almost certainly happened, and in recent years there has been a sharp increase in the amount of longline effort reported to be targeted at albacore, though that may have been more a shift in reporting practice than in actual fishing practice as fishers sought to prove a fishing history in anticipation of the inclusion of tuna fisheries into the QMS. Yellowfin, and Pacific bluefin tunas are generally reported as a bycatch of the longline fisheries, and skipjack is caught in only small numbers by this method.

Albacore and swordfish catch rates are high and reasonably consistent throughout longline fisheries, except for the southern of the two southern bluefin fisheries. Bigeye is caught at similar rates in either target or albacore sets, except where albacore sets overlap, in colder waters, with southern bluefin sets.

Nominal target species is therefore not a consistent delineator of longline fisheries, either for target or non-target species, but is nevertheless useful, with some judicious interpretation, for the partitioning of effort when estimating nominal CPUE series for each of the main species caught. Nominal CPUE series are estimated for both target fishing (bigeye, albacore, and southern bluefin), and alternatively, for each of the main longline-caught species, in more broadly defined fisheries based on combinations of target species, month, and latitude. The effect of fishing depth on the observed distributions is likely to be important but is not accounted for.

Troll effort is almost exclusively targeted at albacore, and catches smaller fish than by longline. Skipjack is a small bycatch. Troll is largely a west coast activity, with effort extending southward as the summer advances, finishing in April when longline targeting of southern bluefin begins. Many vessels in recent years have switched gear from troll to longline depending on the season. Nominal CPUE series using all troll effort is presented for albacore.

Purse-seine is almost completely targeted at skipjack tuna, and although the landings show some ancillary catch of albacore, this is rarely reported in the estimated catch, and yellowfin is not a component of the purse-seine catch in New Zealand waters. Purse-seine is not a very suitable fishing method for monitoring CPUE as it is targeted on schools in New Zealand waters, but catches are described across all targeted purse-seine effort. Purse-seine effort and consequently skipjack catches increased markedly in 2003–04 with the increased participation of New Zealand flagged class-6 seiners in home waters, but greater catches were reported by all seine vessels in 2003–04 compared with the previous year.

In 2002–03 and 2003–04, a few large foreign vessels continued to fish in the EEZ under charter to New Zealand companies, and generally carried observers. These vessels all fished by longline, mainly for southern bluefin tuna off the west coast of the South Island, but also, during 2002–03, in more northern waters for albacore. One large domestic longliner tended to fish in company with these vessels and is described with them in this report, although for reporting to offshore agencies it is considered to be part of the domestic fleet. Smaller domestic vessels, with consequently low observer coverage, dominated other methods, including the southern bluefin longline fishery off the east coast of the North Island. Observer coverage of domestic vessels increased markedly in 2003–04. Length frequencies of fish measured by observers are presented.

## INTRODUCTION

**Specific objective: To characterise the New Zealand tuna fisheries for albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), Pacific bluefin tuna (*T. orientalis*), skipjack tuna (*Katsuwonus pelamis*), southern bluefin tuna (*Thunnus maccoyii*), yellowfin tuna (*T. albacares*), and swordfish (*Xiphias gladius*) in the New Zealand EEZ and adjacent areas for the 2002–03 and 2003–04 fishing years.**

These species are all wide ranging and their availability within New Zealand's Exclusive Economic Zone (EEZ), and hence potential catches, varies from year to year in response to overall stock size, large scale environmental factors, and, possibly, the effects of fishing outside the New Zealand EEZ. Stock assessments are coordinated at an international level, and New Zealand government agencies supply a) annual catches, b) catch and effort data, c) length data, and d) observer data for the target species – albacore (*T. alalunga*), bigeye (*T. obesus*), skipjack (*Katsuwonus pelamis*) and yellowfin tuna (*T. albacares*) – to the Standing Committee on Tuna and Billfish (SCTB) each year (from 2005, this role has been taken over by the newly formed Western and Central Pacific Fisheries Commission (WCPFC) based in Pohnpei, Micronesia) and for southern bluefin tuna (*Thunnus maccoyii)* to the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) based in Canberra, Australia. Stock assessments for some of these species are as yet embryonic, but New Zealand actively cooperates in research on highly migratory fish stocks throughout their range with scientists of the Secretariat of the Pacific Community's Oceanic Fisheries Programme (SPC), Australia's CSIRO, the US National Marine Fisheries Service, Japan's National Research Institute of Far Seas Fisheries, and the National Taiwan University.

Most tunas and swordfish were included in the QMS from October 2004, but for the period covered by this report, only southern bluefin tuna was subject to catch restrictions. Monitoring of availability within the New Zealand EEZ of tuna species is important because New Zealand is at the fringe of their range (e.g., pacific and southern bluefin, bigeye, yellowfin and skipjack tunas), and hence may provide early indicators of changes in stock abundance.

Within the New Zealand EEZ, catch rates are determined by the tendency of vessels to follow the migratory patterns of the most desirable species (southern bluefin and bigeye tuna), and by their ability to expend effective effort, that is, coincident with the habitat (including depth) preferences of the target species. Bycatch of other species including other tunas, which are oceanic migratory species though not necessarily with the same migratory patterns as the target species, will depend on how well their migratory pattern and/or habitat preferences match the migratory patterns of the tuna species targeted.

All species are likely to be following food supplies, thus these fish population are not static, and neither are the positions of the oceanic currents and the upwellings that bring nutrients to the surface. Within the New Zealand EEZ, previous studies of catch rates on tuna longlines have shown that for most species there are large differences in CPUE between the domestic, foreign and charter fleets and/or between northern and southern New Zealand (Bradford 2003, Francis et al. 1997). The shorter lines used by domestic vessels may enable them to fish highly productive convergence zones more effectively than the foreign & charter vessels which tend to fish in groups and set their lines along a straight course (Michael et al.1987). Other factors shown to be significant in explaining variance in catch rates for various species include sea surface temperature, the use of Cyalume© "light sticks" on lines, the moon stage (illumination of the disc), species diversity, and vessel (Richardson et al. 2000). Therefore, we need to monitor trends in fleet composition and behaviour, as well as know a good deal about fish behaviour before we can be assured that the results of any statistical analysis of catch rates are meaningful.

Outside the New Zealand EEZ, large scale changes in catch rates of bigeye tuna are shown to have been the result of systematic changes in the depth at which lines are set, which has seen more effective targeting of the species, and there is a move towards habitat-based models that relate the effort to the preferred habitat of the species to calculate effective effort (Bigelow et al. 2002).

Catch per effective effort (CPEE), that is estimated by coupling general habitat (temperature and oxygen) requirements with oceanographic data for the strata using information on longline gear depth, can demonstrate markedly different trajectories of abundance indices to those of nominal effort for bigeye and yellowfin tuna in the Pacific Ocean (Maunder et al. in press).

Habitat preferences are imperfectly understood for most species, and many of these data (including ambient temperature and depth of longline sets) are not routinely collected by the commercial fleets however, temperatures at depth and dissolved oxygen profiles have been modelled or estimated at a global level by climatological agencies, and there have been attempts, for example, Suzuki et al. (1977), to estimate the approximate depth distribution of longline hooks based on the spacing of hooks to floats, so that a degree of sophistication is available *post hoc*. In the future, the results of depth recorders deployed on longlines may be used to extrapolate this information (Ministry of Fisheries Medium Term Research Plan for Pelagic Fisheries Research – September 2005). It is clear that all available data should be monitored for trends that may prove indicative of larger processes and be useful in the longer term as assessment methodology evolves.

Environmental factors measurable over the period such as the Southern Oscillation Index (as a proxy for ENSO events), sea surface temperatures, moon stage (disc illumination) etc are more appropriately investigated in analyses of standardised CPUE, and this has been done most recently for troll-and longline-caught albacore (Unwin et al. 2004), and for longline-caught bigeye and southern bluefin tunas (Murray et al. 2004, Griggs & Richardson 2005) and currently for swordfish (MFish project SWO2003/01).

Status of the wider Pacific stocks of these species were described by Langley et al. (2005), and Williams & Reid (2005), and summarised by Sullivan et al. (2005).

## 1. DATA SOURCES AND METHODS

### 1.1 Catch, effort, and landing forms

The Tuna Longline Catch & Effort (TLCER) form records catch information (measured in numbers of fish), and effort, at the resolution of a single fishing event (i.e., a longline set), and almost all (over 98% in 2002–03) bigeye, yellowfin, Pacific bluefin, southern bluefin, and swordfish caught in the New Zealand EEZ are reported on that form. However, the remaining catch of those species, as well as much of the albacore (65% in 2002–03), and most of the skipjack (99% in 2002–03) is reported on the Catch, Effort & Landing form (CELR), which is used in New Zealand for most other fishing methods (Table 1). The CELR form records total catch and effort information at a daily resolution, and while fishers are required to record tunas as numbers of fish (except for purse-seine catches), they have often been recorded as estimated greenweight, as is required for other species. Additionally, there has been ambiguity in the instructions to fishers regarding swordfish, and that species has been variously reported on CELRs in number of fish or in wholeweight. Small amounts of most species are also occasionally taken in deepwater trawls, and they are reported (in weight) on the Trawl, Catch Effort and Processing form (TCEPR).

The spatial resolution of fishing effort also necessarily differs with formtype: detailed positional data are recorded on the longline form, but the days fishing reported on CELR forms is usually described only by MFish Statistical Area, although most purse-seine sets include latitude/longitudes.

Other well documented problems with the estimated catch in CELR and TCEPR format include: where large fish are partially dressed at sea, the processed weight may be recorded rather than the wholeweight, and when a species is not among the top five species caught, it need not be reported at all.

For all fishing within the EEZ, however, the actual weight by species (converted back to wholeweight) is available at the end of the trip from Landing Returns (CLRs and CELs) and this study is based primarily on those data, referred to in this report as the characterisation dataset.

While CPUE for tunas is conventionally expressed in numbers of fish, those data are available for only a subset of the entire fishery that varies considerably with fishing method, and it is appropriate for a characterisation study to be done based on wholeweight, as those data are available across all fishing methods and form types.

Total landed weights are checked against and adjusted to totals from Monthly Harvest Returns (MHRs), which are filled out by permit holders, and are subject to rigorous checking and verification in support of the Quota Management System (QMS). MHRs are a form introduced in October 2001 to replace the Quota Management Returns (QMRs). The main difference between them is that MHRs include information on non-quota species as well as QMS species, and therefore provide an alternative to Licensed Fish Receiver Returns (LFRRs) for tuna species in recent years.

MHRs include catch that is lost, discarded, eaten, or retained on board, and therefore provide a more complete account of removals than the summaries historically provided by Licensed Fish Receivers (LFRRs). They must also identify the catch by fishstock, and while this is not so important for tuna species, which are considered to belong to single stocks within the EEZ, it is useful for differentiating fish caught outside the New Zealand Exclusive Economic Zone (EEZ) from those caught inside.

From March 2003, a completely redesigned Tuna Longlining Form (TLCER) has been in use, and, along with clearer instructions to fishers, has markedly improved the quality of data available from longlining. Data verification standards administered by the MFish data management group have also greatly improved the quality of all catch effort data since about 2000. This study primarily characterises the tuna fisheries in 2002–03 and 2003–04, but where possible, puts information in the context of the six most recent years, 1998–99 to 2003–04, a period during which reporting practices have improved greatly.

High seas versions of the TLCER and CELR forms have been required for all fishing effort by New Zealand flagged vessels on the high seas or in the EEZs of other nations since March 2001. It is not clear that landed wholeweights must be provided or indeed whether that is possible, as catch is generally landed outside New Zealand and receipts are not always provided immediately. To date a reliable database of these returns has not been developed, and the ones that are entered into the MFish Catch effort database *Warehou*, are often without trip number or associated landings information.

This project therefore characterises only fishing within the New Zealand EEZ, and it is hoped that high seas fishing will be described in subsequent reports.

**Table 1: Source of EEZ catch and effort data by species in 2002-03 and 2003–04, percent by weight for formtype.**

| Formtype | Albacore | Bigeye | Skipjack | Pacific. bluefin | Swordfish | Southern bluefin | Yellowfin |
|---|---|---|---|---|---|---|---|
| **2002-03** | | | | | | | |
| TLCER | 31.5 | 99.4 | 0.4 | 100.0 | 99.4 | 98.4 | 98.0 |
| CELR | 68.5 | 0.4 | 99.6 | 0.0 | 0.5 | 1.4 | 0.9 |
| TCEPR | 0.0 | 0.2 | 0.0 | 0.0 | 0.1 | 0.2 | 1.1 |
| **2003-04** | | | | | | | |
| TLCER | 16.9 | 98.0 | 0.1 | 44.6 | 97.4 | 65.3 | 98.7 |
| CELR | 83.1 | 2.0 | 99.9 | 54.9 | 0.8 | 34.7 | 0.6 |
| TCEPR | 0.0 | 0.0 | 0.0 | 0.5 | 1.8 | 0.0 | 0.7 |

## 1.2 Primary and secondary catch-effort databases

Data from the primary sources (catch effort and landing returns) are entered into the MFish database *warehou* and this study is based on a series of extracts made from that database.

A Secondary research database maintained by the MFish contract data manager (NIWA) is populated from *warehou* using a set of business rules to determine whether the estimated catch was recorded in numbers of fish or in greenweight (Murray et al. 2001, Wei 2004). This is done, for CELR format data, at trip level, by comparing the sum of estimated catches of a species with the landed weight of that species. The linkage is achieved using a *trip_number* field, which is generated by MFish during population of the warehou primary database, and is based largely on fishing event dates, and trip, start/end dates.

The research database *tuna* is designed to identify and retain clean CPUE data, i.e., Numbers of fish per unit of effort, and it is the source of the operational data and summaries that New Zealand supplies to the offshore agencies coordinating regional stock assessments of tunas.

Part of this study was an evaluation of the *tuna* database that was done by comparison with extracts from *warehou*, and will be reported separately (Kendrick, unpublished results) along with the data grooming and error-checking procedures developed for this report.

Several large gaps in the data set retained in *tuna* led to this characterisation being performed on the *warehou* extract, and to an investigation that required the detailed reconstruction of fishing activity for individual vessels where the linkage provided by *trip_number* was poor.

The missing data fell into three groups – 1) All records for two large Phillipines-flagged chartered longliners that fished in the NZ EEZ for the first time during 2002-03, almost exclusively targeting albacore, were excluded. They represented a new and significant development in the longline fishery. 2) More insidiously, the first day's fishing in each trip by many of the smaller domestic longliners was also systematically excluded. 3) High seas fishing, including some records incorrectly reported on CELRs, were excluded.

The first was the result of large vessels retaining their catch on board for the entire season (for subsequent conveyance outside New Zealand) giving an apparent trip length (which is based on landing dates) of more than 90 days, and thereby failing the range check for *trip_length*. Fishers wrongly using the day they hauled their first longline set as the trip-start date caused the second: with longlines often set the night before, this put the first fishing event outside the trip start/end dates and consequently generated a NULL *trip_number* value.

Simple fixes were designed, tested, and suggested to MFish and changes to the database software have subsequently been made.

The other inconsistency noted was that catch-effort reported on high seas forms existed in the *warehou* database without any associated landing event, and hence, with NULL *trip_number* values. This is because landings forms are often not forthcoming for catch landed outside New Zealand. The *warehou* database included some, but not all, high seas catch effort data, a situation that will need to be clarified, and the *tuna* database does not include the high seas forms in the selection criteria.

A new database is being established for high seas catch effort data, but was not available at time of writing this report.

## 1.3 Linking methodology

A method for linking the landed catch with effort, has been developed for describing bycatch species that are not well reported on catch effort forms, and allows the actual landed wholeweight (available by species for the entire fishing trip) to be described at the more informative level of a fishing trip stratum; that portion of a vessel-fishing trip that uses a single fishing method within a single month, and statistical area, and is targeted at just one species.

The procedure summarises the effort and estimated catches for a trip by statistical area, month, target species, and fishing method (designated a trip stratum). Landed weight obtained at the end of each fishing trip for each species is apportioned among trip strata proportionate to the estimated catch. The procedure is equally effective, whether the fisher has recorded estimated catch in weight or in numbers of fish. For trips that did not report any estimated catches of a landed species, the landed weight is allocated proportionately to the number of fishing events (sets or lines) in each trip stratum.

The method is widely used for describing inshore bycatch species in order to overcome the problem of shortfall and bias in the estimated catch, and was comprehensively described in Manning et al.(2004). It is relevant to tuna because of the intractable mix of weight and fish numbers used to record estimated catch on CELR forms, and the degree to which data quality varies with fishing method.

The main advantages of this approach are a) inclusion of all records, whether estimated in weight or in numbers of fish and the 'seamless' combination of data from all formtypes; b) use of verified landed weight; c) more accurate description of minor and poorly reported methods; and d) finer spatial and temporal scale of descriptive statistics more appropriate for describing seasonal availability of migratory species.

The method is very simply applicable to tunas because there are no intra-zone Fishstock boundaries (tunas are all considered to belong to single Fishstocks within the NZ EEZ), and catches for all statistical areas, including those that straddle more than one FMA, can be fully described.

### 1.4 Graphical representation of seasonal migratory distributions

Species differ in their temperature range preferences and therefore in their availability throughout the EEZ with season. The extent to which they overlap is difficult to visualise from data summaries. Patterns in catch are often a function of effort directed at other species, and only an examination of catch rates suggests the degree to which they coincide. Distributions are described by season and latitude. There are almost certainly differences between species in depth range preferences, but the depth of capture is not collected (beyond the rather coarse assumptions based on fishing method). Interpolating fishing depth from gear configuration of longlines will be the subject of other work (proposed MFish project starting 2006), and is not attempted here.

The migrational behaviour and thus seasonal availability of each species shows more contrast with latitude than longitude in the NZ EEZ, with many species extending their range into higher latitudes in the summer months. For comparability, this report presents much of its information in a common graphical format that requires some explanation.

For clarity, the statistical areas that are reported on the daily form are grouped into 11 latitudinal bands that are roughly similar on both coasts of New Zealand, with an additional band on the east coast for the Kermadecs. Effort from the longline form, which is reported in latitudes/longitudes, is also combined into the same bands so that seasonal distribution of catch, effort, and CPUE with latitude, from all formtypes and across all methods, can be displayed in a common and informative format.

The distributions of effort, catch, or CPUE are displayed in latitude x month cells, for the east and west coasts separately, using separate symbols for the two fleets; Large/charter vessels (over 50 m) and smaller domestic vessels. The latitudes are indicative of the lower boundary of each band, shown in Figure 1. The month is the month of fishing (not landing as is used in some other studies), and the circle areas are proportional to the average value for the coast/latitude/month set of observations, and are equivalently scaled among panels, unless otherwise noted.

The plots are useful for comparing a lot of related information in one view. The same format is used to compare target fisheries within a fishing method, the catch of each species within a fishing method irrespective of target species, and catch rates as a more informative indicator of availability. Actual values for each cell are not provided and are of arbitrary interest, but are relative to annual totals or averages as provided in tables.

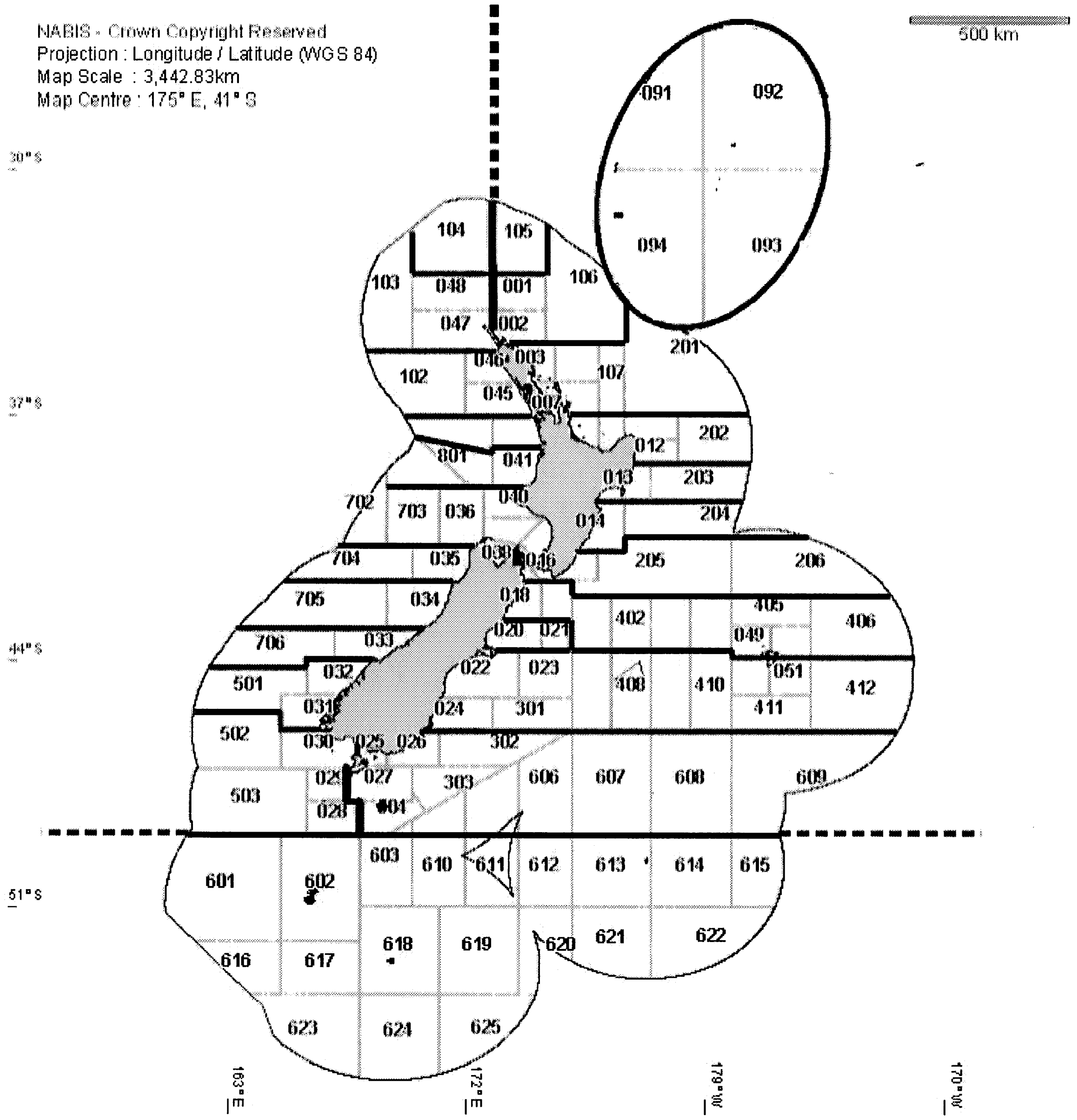



**Figure 1: Grouping of statistical reporting areas into latitudinal bands for graphical display of catch, effort and CPUE statistics in this report. Eleven similar latitudinal bands are defined for the west and east coasts of New Zealand (boundaries in bold), with the Kermadecs (areas 091 to 094), differentiated in an additional (first) band for the east coast.**

## 2. THE COMMERCIAL FISHERY

### 2.1 Domestic catch history, by species, all gears combined

The catch of all tunas and swordfish inside the EEZ peaked in 1999–2000 at over 17 000 t, dropping by about a third in 2000–01 to return to previous levels with the decline almost entirely due to lower catches of skipjack (from 10 561 t in 1999–2000, to 4020 t in 2000–01). Catches of all other species, except southern bluefin tuna, increased in 2000–01.

Total catches have been about 11 000 t since 2000–01, but peaked again in 2003–04 at near to 16 000 t, as skipjack catches more than doubled due to the increased presence in the EEZ of two large NZ flagged purse-seiners that usually fish most of the year outside the zone.

In the most recent four years there have been sustained declines in the catch of bigeye (from 578 to 217 t), yellowfin (from 168 to 21 t) and of swordfish (from 1102 to 544 t). Catches of albacore, Pacific, and southern bluefin tuna have all increased slightly (Table 2).

**Table 2: Landed whole weight (tonnes) of fish caught inside the New Zealand EEZ, by all fishing methods, and vessels combined, for fishing years 1986–87 to 2002–03. Scaled to totals from Licensed Fish Receivers in New Zealand for 1986–87 to 2000–01, and to totals of Monthly Harvest Returns from permit holders since 2001–02.**

| Fishing year | Albacore | Bigeye | Skipjack | Pacific bluefin | Southern bluefin | Yellowfin | Swordfish | EEZ total (t) |
|---|---|---|---|---|---|---|---|---|
| 86/87† | 1 265 | 0 | 3 763 | 0 | 60 | 6 | 5 | 5 098 |
| 87/88† | 410 | 0 | 3 509 | 0 | 94 | 12 | 1 | 4 026 |
| 88/89† | 5 000 | 4 | 5 769 | 0 | 437 | 13 | 11 | 11 234 |
| 89/90† | 3 144 | 31 | 3 972 | 0 | 529 | 19 | 79 | 7 774 |
| 90/91† | 2 451 | 36 | 5 371 | 2 | 165 | 6 | 41 | 8 071 |
| 91/92† | 3 434 | 50 | 988 | 0 | 279 | 20 | 32 | 4 803 |
| 92/93† | 3 323 | 49 | 946 | 6 | 216 | 12 | 79 | 4 630 |
| 93/94† | 5 315 | 89 | 3 136 | 2 | 277 | 70 | 102 | 8 992 |
| 94/95† | 6 195 | 50 | 861 | 2 | 435 | 114 | 102 | 7 759 |
| 95/96† | 6 316 | 79 | 4 520 | 4 | 140 | 193 | 187 | 11 439 |
| 96/97† | 3 728 | 105 | 6 571 | 13 | 333 | 157 | 283 | 11 189 |
| 97/98† | 6 525 | 340 | 7 308 | 21 | 331 | 105 | 534 | 15 165 |
| 98/99† | 3 727 | 391 | 5 347 | 18 | 458 | 175 | 965 | 11 081 |
| 99/00† | 4 697 | 466 | 10 561 | 23 | 381 | 101 | 976 | 17 204 |
| 00/01† | 5 509 | 578 | 4 020 | 52 | 366 | 168 | 1102 | 11 795 |
| 01/02* | 5 531 | 277 | 3 581 | 54 | 465 | 63 | 942 | 10 913 |
| 02/03* | 6 300 | 195 | 3 867 | 41 | 392 | 40 | 672 | 11 507 |
| 03/04* | 4 969 | 217 | 9 565 | 70 | 394 | 21 | 544 | 15 780 |

† Licensed Fish Receiver returns (LFRR)

* Monthly Harvest Returns from permit holders (MHR).

### 2.2 Domestic fleet structure, total landings, by method, 1998–99 to 2003–04

The domestic longline fleet increased in numbers exponentially after the start of that fishery in 1991, and from 1998–99 to 2001–02 the number of longline vessels targeting tuna continued to increase from about 80 vessels in 1998–99 to a peak of about 155 vessels in 2001–02. The increase during those years largely included vessels that fished more than one method, switching between troll gear and longline gear, but the number of dedicated longline vessels also peaked in 2000–01 at 100. In 2002-03 about 130 vessels targeted tunas using longline, and

79 of those vessels also fished using troll gear, many of them switching completely from one to the other depending on season. In 2003–04, the number using longline had declined to 109, with 58 of those vessels also fishing using troll gear during the year.

The number of vessels trolling for tunas increased from 187 in 1998–99, to a peak of 320 in 2000–01, and then declined to about 253 vessels in 2003–04. The number of dedicated longline vessels also dropped by more than half after 2001–02, with a net loss of 112 vessels from the longline and troll fleets combined between 2001–02 and 2003–04.

The number of purse-seiners has been low and stable over the period at fewer than 10 vessels in each year, though they account for a disproportionately high proportion of the tuna catch. Very few vessels have reported fishing using pole-&-line; handlining, which had had been almost non-existent since 1997 (Murray et al. 2004), was once again reported as an occasional activity by 12 vessels in 2003–04. Vessels that reported using either pole-&-line or handline are most often also included in one of the other categories (i.e. are double-counted) as these methods are now only sporadic activities in New Zealand waters (Table 3).

Apart from vessels targeting tuna, a further 20 to 45 vessels landed small amounts of tuna or swordfish in each year by other methods, or as a bycatch in other fisheries, bottom trawl or handlining for snapper, etc. (Table 3).

**Table 3: Number of vessels that targeted tunas by the main tuna methods and landed tunas as bycatch of other fisheries from inside the New Zealand EEZ for fishing years 1998–99 to 2003–043. "Longline & troll" indicates the number of vessels that used both methods within the year depending on season.**

| Fishing method | 1998-99 | 1999-2000 | 2000-01 | 2001-02 | 2002-03 | 2003-04 |
|---|---|---|---|---|---|---|
| Troll | 181 | 254 | 267 | 251 | 194 | 195 |
| Longline | 73 | 85 | 76 | 100 | 52 | 41 |
| Longline & troll | 6 | 22 | 53 | 55 | 78 | 58 |
| Purse-seine | 6 | 7 | 8 | 8 | 7 | 9 |
| Pole-&-line | 4 | 3 | 2 | 3 | 2 | 4 |
| Handline | 2 | 2 | 2 | 2 | 1 | 12 |
| Other & non-targeted | 21 | 2 | 44 | 29 | 39 | 16 |
| Total vessels | 293 | 375 | 452 | 448 | 373 | 335 |

**Table 4: Percentage of the total annual catch (landed whole weight) of all species combined (tunas and swordfish) by method, from inside the New Zealand EEZ, for fishing years 1998–99 to 2003–04. Annual landed wholeweight (tones), all species combined. 0 = less than 1%.**

| Fishing method | 1998-99 | 1999-2000 | 2000-01 | 2001-02 | 2002-03 | 2003-04 |
|---|---|---|---|---|---|---|
| Troll | 19 | 20 | 30 | 30 | 36 | 26 |
| Longline | 33 | 19 | 37 | 37 | 31 | 13 |
| Purse-seine | 48 | 61 | 33 | 32 | 33 | 60 |
| Pole-&-line | 0 | 0 | 0 | 0 | 0 | 0 |
| Handline | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Total (t) | 11 081 | 17 204 | 11 795 | 10 912 | 11 506 | 15 780 |

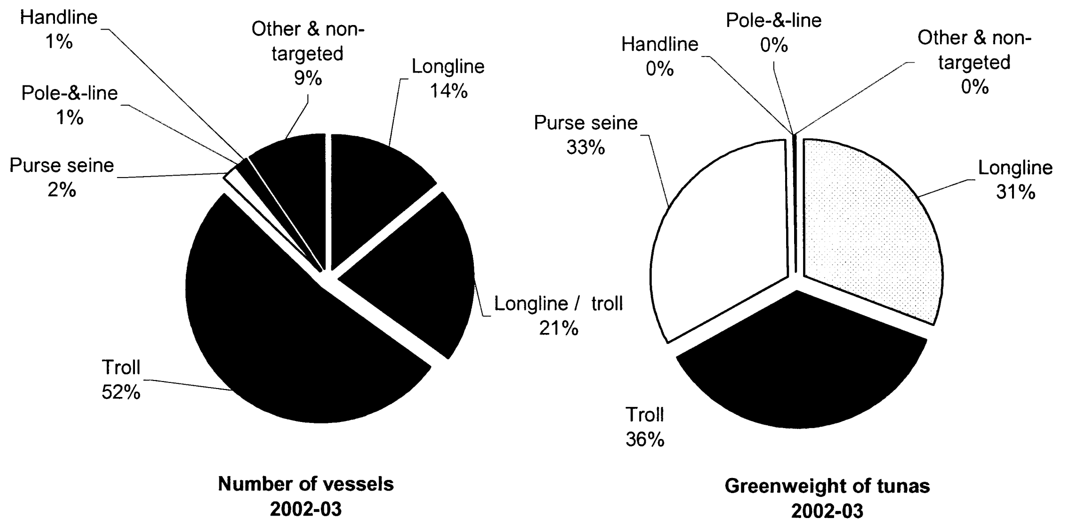
In 2002–03, the number of vessels declined by 16% while total catch increased by 5% compared to the previous year. In 2003–04, the number of vessels declined by a further 11% while catch increased by 37% compared with the previous year. The increased catch in 2003–04 was almost entirely taken by purse-seine, by one or two vessels (Table 4).

Longline and troll vessels together made up 87% of the fleet each year, with about a quarter of those vessels using both methods during the year. Between them, they accounted for 67% and 38% of the total catch in the two years respectively.

Purse-seiners made up just 2% and 3% of the fleet, but accounted for 33% and 62% of the overall catch in the two years respectively (Figure 2).

Two chartered Philippine longliners were among the top catching vessels of 2002–03, ranking 5th and 6th among the eight highest catching vessels (the others being purse-seiners), and, as in the previous year, 55% of the vessels landed 95% of tuna and swordfish caught in the EEZ. Those two vessels did not return in 2003–04, and the seven highest catching vessels in that year were all purse-seiners, and accounted for 60% of the total catch in that year.

**2002–03**




**2003–04**

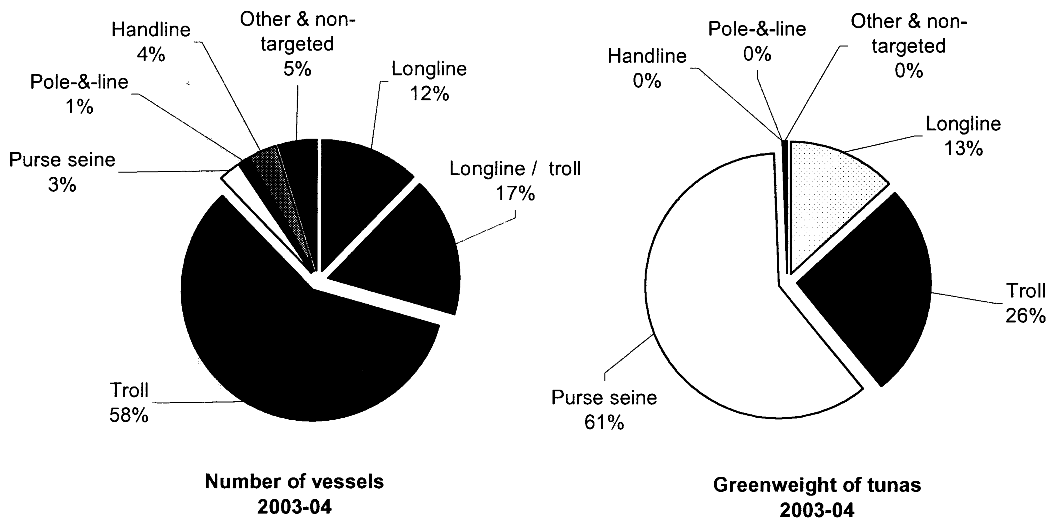



**Figure 2: Percentage of vessels that targeted tunas by the main tuna fishing methods inside the New Zealand EEZ in 2002–03 and in 2003-04, or landed tunas as a bycatch of other fisheries. Percentage of landed whole weight of all species combined (tunas and swordfish) taken by targeted longline, troll, purse-seine, pole-&-line fishing, and as a bycatch of other fisheries. Longline/troll indicates vessels that used both methods within the year depending on season.**

## 2.3 Vessels by method and season in 2002–03 and 2003–04

The number of vessels targeting tuna varies markedly throughout the fishing year, with many vessels participating for no more than a month or two depending on gear type, location, and presumably other opportunities. The greatest number of vessels fishing at any time occurs between January and March, when trolling for juvenile albacore and purse-seining for skipjack are at their peak, and effort is beginning to be expended by longliners targeting southern bluefin. In the following 2–3 months, troll vessels begin leaving the fishery or switching to longlining, and the number of longliners peaks in May-June, until the catch limit for southern bluefin is reached in June-July. Trolling is largely finished in May, and after June longliners begin leaving the fishery or shifting their effort further north to the all-year fishery targeted at bigeye. In 2003–04 purse-seining extended into June, a much longer season than in the previous year (Figures 3 and 4).

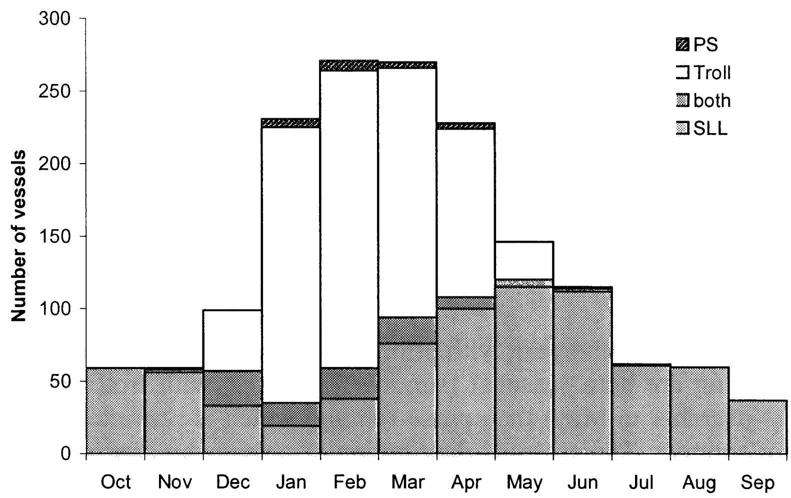



**Figure 3: The number of vessels targeting tunas in 2002–03 by month and method.**

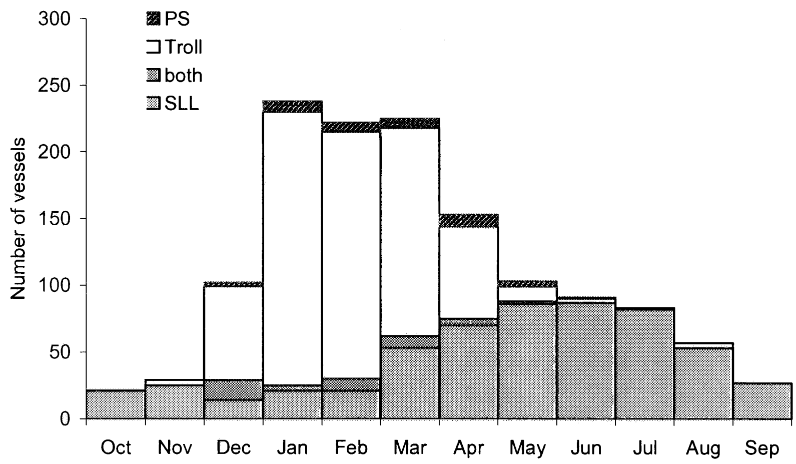



**Figure 4: The number of vessels targeting tunas in 2003–04 by month and method.**

## 2.4 Species by method, target fishery, and season in 2002–03 and in 2003–04

Longline effort in New Zealand is largely targeted at bigeye and southern bluefin tunas, and accounts for almost all of the catch of those species. About 90% of the catch by weight for both species is targeted and the remainder is a bycatch of longline effort directed at other tuna species.

Most albacore is taken by targeted trolling (68% by weight in 2002–03, and 83 % in 2003–04), with most of the balance taken by longline, mainly as bycatch.

Skipjack was taken almost entirely (more than 99%) by targeted purse-seine in both years. Small amounts of skipjack are also taken as bycatch in longline and trolling.

Pacific bluefin was mostly a bycatch of longline effort in 2002–03, particularly of the bigeye fishery, but in the following year more than 40% was landed in targeted handline fishing.

Yellowfin tuna was almost entirely a bycatch of longline sets directed at albacore and bigeye in 2002–03, but in 2003–04, about 30% of the yellowfin landed was a bycatch of troll effort, with most of the remainder a bycatch of longline fishing directed at bigeye.

Swordfish is almost entirely taken as bycatch of longline fishing. During the period covered by this report it was illegal to target swordfish, and more than 50% of the catch in each year was a bycatch of bigeye sets, and about 30% a bycatch of southern bluefin sets, with the balance from longline effort directed at albacore. About 2–3% of swordfish (by weight) is taken in fisheries not targeting tunas, primarily bottom and midwater trawls. These methods also have a small bycatch of other tuna species (Table 5–7).

Longline fishing is carried out throughout the year, with effort peaking during autumn and early winter. Trolling and purse-seining are both seasonal (summer) fisheries, with trolling taking place over a longer period (November to May) than purse-seining, which is restricted in most years to the 3 to 4 months of summer. The seasonal distribution of catches by species reflects the seasonal patterns of effort for the main fishing methods. Skipjack catches are greatest during January to April, as are catches of albacore. Albacore is caught December through to October or November. Trolling for juveniles finishes after May, but larger albacore are caught throughout the year by longline. Swordfish are caught throughout the year, but peak during early winter as a function of the greater longline effort in those months. Bigeye and yellowfin are caught in small numbers throughout the year, but are least available during May and June when the fleet is further south, and effort is directed at southern bluefin (Figure 5).

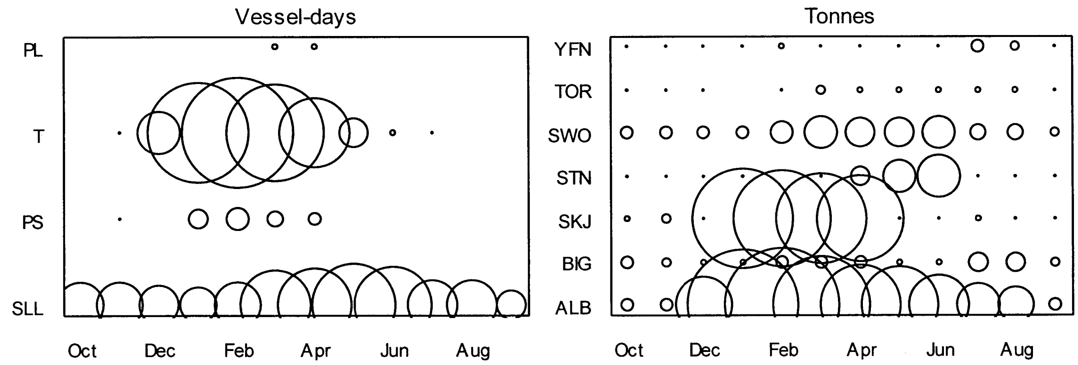
**Table 5: Domestic catch (whole weight, t) for 2002–03 by species and gear type adjusted to MHR totals for all tunas caught inside the New Zealand EEZ, (0.0 refers to catches < 100 kg, - is no recorded catch).**

| 2002/03 Fishing Method | Albacore | Bigeye | Skipjack | Pacific bluefin | Southern bluefin | Yellowfin | Swordfish |
|---|---|---|---|---|---|---|---|
| Troll | 4 073.1 | 0.8 | 13.8 | 0.0 | 0.5 | 0.5 | 1.2 |
| Longline | 2 219.8 | 193.6 | 14.7 | 41.4 | 389.9 | 39.1 | 658.9 |
| Purse-seine | 3.1 | - | 3 838.5 | - | - | - | - |
| Pole-&-line | 3.0 | - | 0.0 | - | - | - | - |
| Handline | 0.3 | - | 0.0 | - | 0.2 | - | - |
| Other | 1.1 | 0.3 | 0.0 | - | 1.1 | 0.1 | 11.6 |
| Total (t) | 6 300.4 | 194.7 | 3 867.1 | 41.4 | 391.7 | 39.7 | 671.8 |

**Table 6: Domestic catch (whole weight, t) for 2003–04 by species and gear type adjusted to MHR totals for all tunas caught inside the New Zealand EEZ, (0.0 refers to catches < 100 kg, - is no recorded catch).**

| 2003/04 Fishing Method | Albacore | Bigeye | Skipjack | Pacific bluefin | Southern bluefin | Yellowfin | Swordfish |
|---|---|---|---|---|---|---|---|
| Troll | 4112.5 | 4.3 | 31.3 | 7.0 | 1.7 | 6.5 | 0.1 |
| Longline | 841.8 | 213.0 | 5.5 | 31.2 | 383.8 | 13.8 | 536.8 |
| Purse-seine | 3.0 | 0.1 | 9524.4 | - | - | 0.3 | - |
| Pole-&-line | 0.9 | - | 3.3 | - | - | - | 0.0 |
| Handline | 0.1 | - | - | 31.3 | 1.3 | | 0.0 |
| Other | 10.3 | - | 0.3 | 0.3 | 7.2 | 0.5 | 7.0 |
| Total (t) | 4968.6 | 217.4 | 9564.7 | 69.8 | 394.1 | 21.1 | 543.9 |

**2002–03**




**2003–04**

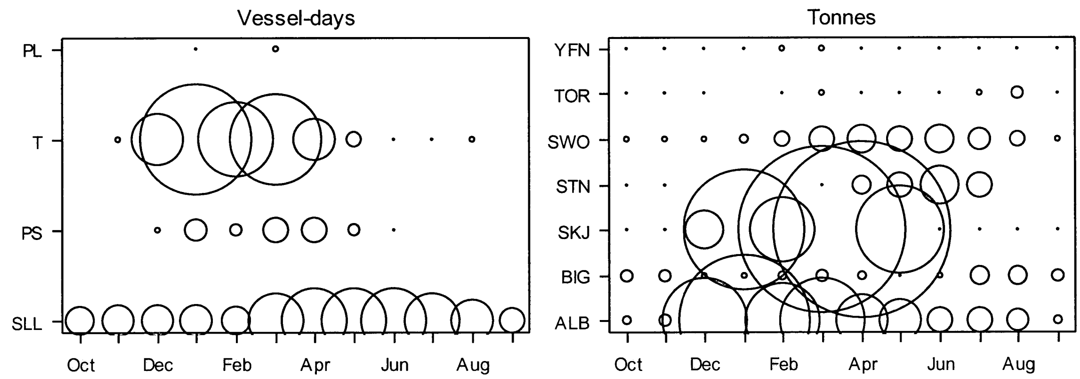



**Figure 5: Relative seasonal targeted effort (vessel-days fished; successful w.r.t. any of the seven species of interest) by method; and seasonal catch (tonnes) by species in 2002–03 and in 2003–04.**

**Table 7: Percent of annual landings by fishing method and target species for albacore, bigeye, skipjack, southern bluefin, Pacific bluefin, yellowfin, and swordfish, in 2002–03 and in 2003–04. Target fisheries are shaded; fisheries accounting for most of the annual catch are in bold. Swordfish could not legally be targeted at this time.**

**Albacore**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 11 | 13 | - | 11 | 0 | 0 | 0 |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | **65** | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 0 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 2 | 10 | - | 4 | 0 | 0 | - |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | **83** | - | 0 | 0 | 0 | 0 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | 0 | - | - |
| Other | 0 | - | - | - | - | - | 0 |

**Bigeye**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 8 | **88** | - | 2 | 1 | 0 | 0 |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 0 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 1 | **94** | - | 1 | 1 | 1 | - |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 2 | - | 0 | 0 | 0 | 0 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | 0 | - | - |
| Other | 0 | - | - | - | - | - | 0 |

**Skipjack**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 0 | 0 | - | 0 | 0 | 0 | 0 |
| Purse seine | - | - | **99** | - | - | - | - |
| Troll | 0 | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 0 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 0 | 0 | - | 0 | 0 | 0 | - |
| Purse seine | - | - | **100** | - | - | - | - |
| Troll | 0 | - | 0 | 0 | 0 | 0 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | 0 | - | - |
| Other | 0 | - | - | - | - | - | 0 |

**Southern Bluefin**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 6 | 7 | - | **86** | 0 | 0 | 0 |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 0 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 3 | 4 | - | **91** | 0 | 0 | - |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | - | 0 | 0 | 0 | 0 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | - | - | - |
| Other | 0 | - | - | - | - | - | 2 |

**Pacific Bluefin**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 10 | **63** | - | 20 | 7 | 0 | 0 |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 1 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 1 | 31 | - | 4 | 8 | 0 | - |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | - | 0 | 0 | **10** | 0 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | **44** | - | - |
| Other | 0 | - | - | - | - | - | 0 |

**Yellowfin**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | **68** | 27 | - | 1 | 0 | 2 | 0 |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 1 | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 0 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 0 | **58** | - | 1 | 1 | 6 | - |
| Purse seine | - | - | 2 | - | - | - | - |
| Troll | 29 | - | 0 | 0 | 0 | 2 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | 0 | - | - |
| Other | 0 | - | - | - | - | - | 2 |

**Swordfish**

2002-03

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 12 | **56** | - | 27 | 3 | 0 | 0 |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | 0 | 0 | 0 | - | 0 | 0 |
| Pole-&-line | 0 | - | - | - | - | - | - |
| Handline | 0 | - | - | 0 | - | - | - |
| Other | - | - | - | - | - | - | 2 |

2003-04

| | Target species | | | | | | |
|---|---|---|---|---|---|---|---|
| | ALB | BIG | SKJ | STN | TOR | YFN | Other |
| Longline | 11 | **53** | - | 31 | 3 | 0 | - |
| Purse seine | - | - | 0 | - | - | - | - |
| Troll | 0 | - | 0 | 0 | 0 | 0 | 0 |
| Pole-&-line | 0 | - | 0 | - | - | - | - |
| Handline | - | - | - | 0 | 0 | - | - |
| Other | 0 | - | - | - | - | - | 2 |

## 2.5 Longline fisheries for albacore, bigeye, and southern bluefin tunas

The number of longline hooks set in the New Zealand EEZ peaked in 2002–02 at almost 11 million. That level of effort was maintained in 2002–03 but dropped by more than 30 % in 2003–04 to just over 7 million hooks. Most of the effort in each year has been directed at bigeye tuna, but was almost equalled in 2003–04 by effort targeted at southern bluefin, most of the increase in that year occurring in the southwestern part of that fishery. The number of hooks targeted at albacore doubled in 2001–02 and then doubled again in 2002–03, returning to previous levels of about 4 million hooks in 2003–04. Pacific bluefin and yellowfin have each been targeted by less than 200 000 hooks in most years (Table 8).

In 2002–03, the longline fleet comprised seven large vessels (over 50 m overall length) that have previously been described as the charter fleet, although they include one New Zealand flagged vessel, and 124 smaller vessels (generally between 15 and 25 m), all of which are domestically owned and operated.

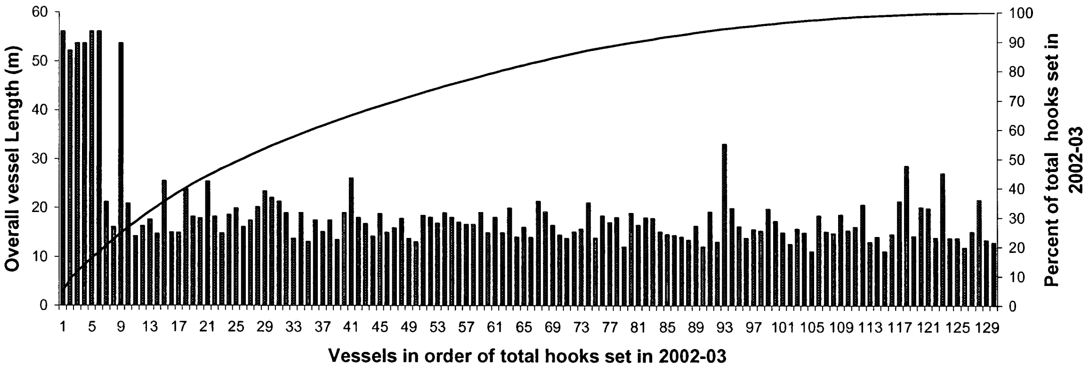
Five of the large vessels almost exclusively targeted southern bluefin tuna (STN) off the west coast of the South Island in both years, and the other two large vessels (Philippine-flagged) were on their first year of charter in New Zealand in 2002–03, exclusively targeting albacore off the east coast of the North Island. They did not return the following year and in 2003–04 the large vessels (including the domestic vessel over 50 m) numbered just 5 and the domestic fleet had declined to 94 vessels (Figure 6).

The seasonal nature of the longline fishery varies with target species and was similar in both years, with bigeye and albacore targeted throughout the year, and southern bluefin a very seasonal fishery (Table 9 and 10). The two southern bluefin fisheries operate at the same time (April to June), but are spatially discreet. The west coast South Island (WCSI) STN fishery is exposed to the prevailing westerly winds and colder weather of high latitudes. In 2002–03 and 2003–04, it was dominated by the larger longliners, which included four Japanese-flagged vessels on charter to New Zealand companies, and a large domestic longliner, but smaller domestic vessels also participated. The east coast North Island (ECNI) STN fishery operates in lower latitudes off the more sheltered coast of New Zealand, and was fished exclusively by smaller domestic longliners in 2002–03 and 2003–04.

**Table 8: Total annual longline effort (thousands of hooks) by the declared target species for the fishing years 1998–99 to 2002–03.**

| Fishing | | | | | | | Target species | Total hooks |
|---|---|---|---|---|---|---|---|---|
| Year | YFN | ALB | BIG | TOR | STN (SW) | STN (NE) | Other | (thousands |
| 98/99 | 120 | 541 | 4 237 | 17 | 1 212 | 689 | 20 | 6 837 |
| 99/00 | 63 | 651 | 5 776 | 9 | 964 | 781 | 4 | 8 247 |
| 00/01 | 228 | 499 | 7 032 | 53 | 798 | 1 130 | 6 | 9 746 |
| 01/02 | 97 | 882 | 6 901 | 164 | 1 212 | 1 595 | 0 | 10 850 |
| 02/03 | 16 | 1 908 | 5 207 | 157 | 1 255 | 2 267 | 2 | 10 812 |
| 03/04 | 20 | 463 | 3 516 | 160 | 1 852 | 1 353 | 0 | 7 365 |

2002-03




2003-04

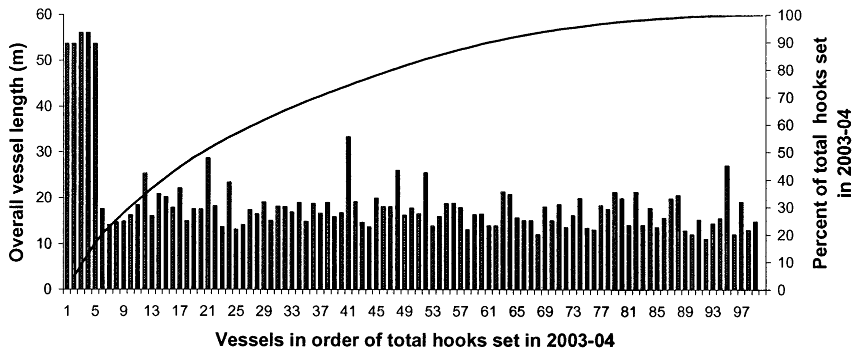



**Figure 6: Comparison of the longline fleets operating inside the New Zealand EEZ in 2002–03 and 2003–04. Overall length of each vessel, in order of total annual effort (hooks) set, and the cumulative percentage of the total annual hooks set.**

**Table 9: Percent of total annual longline effort (thousands of hooks) by month and by declared target species in 2002–03. (0.0 is less than 0.1% of annual effort, - is no recorded effort).**

| Month of | Target species | | | | | Total Hooks |
|---|---|---|---|---|---|---|
| 2002-03 | YFN | ALB | BIG | TOR | STN | (thousands) |
| Oct | - | 0.1 | 4.8 | - | 0.3 | 560 |
| Nov | 0.0 | 0.1 | 4.9 | - | 0.0 | 553 |
| Dec | 0.0 | 0.4 | 3.3 | - | 0.1 | 411 |
| Jan | 0.0 | 0.3 | 2.6 | 0.1 | - | 328 |
| Feb | 0.1 | 0.4 | 4.3 | 0.1 | 0.1 | 542 |
| Mar | 0.0 | 1.7 | 7.6 | 0.5 | 1.0 | 1 179 |
| Apr | 0.0 | 2.5 | 5.7 | 0.3 | 5.2 | 1 485 |
| May | - | 4.3 | 2.4 | 0.3 | 13.1 | 2 182 |
| Jun | - | 3.2 | 1.5 | 0.1 | 12.7 | 1 894 |
| Jul | - | 2.6 | 4.8 | 0.1 | - | 810 |
| Aug | - | 1.9 | 4.6 | - | - | 703 |
| Sep | - | 0.1 | 1.4 | - | - | 162 |

**Table 10: Percent of total annual longline effort (thousands of hooks) by month and by declared target species in 2003–04. (0.0 is less than 0.1% of annual effort, - is no recorded effort).**

| Month of | Target species | | | | | Total hooks |
|---|---|---|---|---|---|---|
| 2003-04 | YFN | ALB | BIG | TOR | STN | (thousands) |
| Oct | 0.0 | - | 2.6 | - | 0.1 | 199 |
| Nov | 0.0 | 0.0 | 3.6 | 0.1 | - | 272 |
| Dec | - | 0.1 | 3.3 | 0.1 | - | 254 |
| Jan | 0.0 | 0.5 | 2.7 | 0.1 | - | 241 |
| Feb | 0.1 | 0.2 | 2.9 | 0.1 | - | 237 |
| Mar | 0.0 | 0.5 | 8.2 | 1.2 | 0.8 | 792 |
| Apr | 0.0 | 2.0 | 7.6 | 0.5 | 7.5 | 1 296 |
| May | - | 1.9 | 2.7 | 0.1 | 13.1 | 1 306 |
| Jun | - | 1.0 | 1.5 | 0.0 | 16.5 | 1 401 |
| Jul | - | 0.2 | 5.1 | - | 5.5 | 799 |
| Aug | - | 0.0 | 5.6 | 0.0 | - | 415 |
| Sep | - | 0.0 | 2.1 | - | - | 152 |

### 2.5.1 Distribution of longline effort 1998–99 to 2003–04

The distribution of longline effort (number of hooks set) for latitudinal band and month is shown for the six fishing years 1998–99 to 2003–04 in Figure 7–12. Each figure is divided into three horizontal panels to separate the effort into the three main target fisheries, albacore, bigeye, and southern bluefin tuna.

- The distributions of the albacore and bigeye fisheries are almost identical in each year, except that any fishing effort in the uppermost band (Kermadecs) was more likely to be directed at bigeye than at albacore.
- The albacore/bigeye effort extends throughout the year above about 37° S, with the most concentrated effort expended in a band above 35° S over the winter (the beginning and end of each fishing year). During the summer, effort disperses down through higher latitudes, presumably as the sea temperatures rise, as far south as 42° S between February and May of each year.
- There is more albacore/bigeye activity down the east coast of New Zealand than off the west in each year, and the shift southwards in east coast fisheries is also more pronounced. This is not surprising as the fishery is mainly the domain of the smaller domestic vessels, and the east coast is the more sheltered and has access to more ports than the exposed west coast.
- In 2002–03 there was an unusual pattern of charter vessel activity in the northern part of the zone targeted at albacore. This was accounted for by two large vessels, Phillipine-flagged longliners. They targeted albacore almost exclusively and didn't participate in either of the southern bluefin fisheries. They moved north up the east coast from April, and departed the zone via the Kermadecs at the end of the fishing year.
- There is very little overlap between albacore/bigeye fisheries and the southern bluefin fisheries. Off the west coast they are separated by latitude, occurring north and south of about 42° S respectively. Off the east coast they each extend into the middle latitude between 42° S and 38° S, but in different months. Albacore/bigeye fishing extends south into this band during summer as sea temperatures there rise, and southern bluefin fishing extends north into this band in winter as the sea temperatures drop again. Bigeye/albacore effort starts to retreat north after about April, and southern bluefin effort fills the gap, also trending north after a couple of months. In June/July when the bluefin quota is filled, effort shifts north of 37 ° S to avoid further southern bluefin catches and switches to targeting bigeye.

- Large and chartered vessels have dominated the bluefin fishery off the west coast of the South Island in each year, though domestic vessels also participate, but the northeastern bluefin fishery has been entirely the domain of domestic vessels since 2000–01.
- In earlier years there was some activity by large vessels in the high latitudes off the east coast. This is the remains of what was described in the past as a separate fishery, but which has diminished further each year and is now an insignificant feature of the year's fishing.
- In Figures 11 and 12, the two latitude/month windows of opportunity for southern bluefin longline activity are outlined, and are referred to throughout this report as the southwestern and northeastern (SW and NE) southern bluefin (STN) fisheries.

In 2002–03, the charter fleet accounted for about 20% of total longline hooks set, that was almost equally split between the albacore target fishing in the north of the zone, and southern bluefin target fishing off the west coast of the South island. In the following year, the two vessels that targeted albacore in 2002–03 did not return, but the decline in the domestic fleet meant that the charter fleet still accounted for about 20% of the effort, almost entirely expended in the southwest bluefin fishery.

The domestic fleet expended most of the balance of longline effort targeted at bigeye tuna (47% in both years), with a further 20% of the total annual hooks targeted at southern bluefin in the NE fishery. In 2003–04, a slightly greater proportion of the annual total longline effort was expended by domestic vessels in the SW bluefin fishery (Table 11 and 12).

**Table 11: Percentage of total longline effort (hooks) in 2002–03 by fleet and target species. The southern bluefin tuna target fishery is split by location, east of the North Island STN (NE) and west of the South Island STN (SW).**

| 2002–03 | Target longline fishery | | | | | |
|---|---|---|---|---|---|---|
| Fleet | YFN | ALB | BIG | TOR | STN (SW) | STN (NE) |
| Domestic | 0 | 9 | 47 | 1 | 1 | 21 |
| Charter | - | 9 | 1 | - | 10 | 0 |

**Table 12: Percentage of total longline effort (hooks) in 2003–04 by fleet and target species. The southern bluefin tuna target fishery is split by location, east of the North Island STN NE) and west of the South Island STN (SW).**

| 2003–04 | Target longline fishery | | | | | |
|---|---|---|---|---|---|---|
| Fleet | YFN | ALB | BIG | TOR | STN (SW) | STN (NE) |
| Domestic | 0 | 6 | 47 | 2 | 6 | 18 |
| Charter | - | - | 1 | - | 19 | 0 |

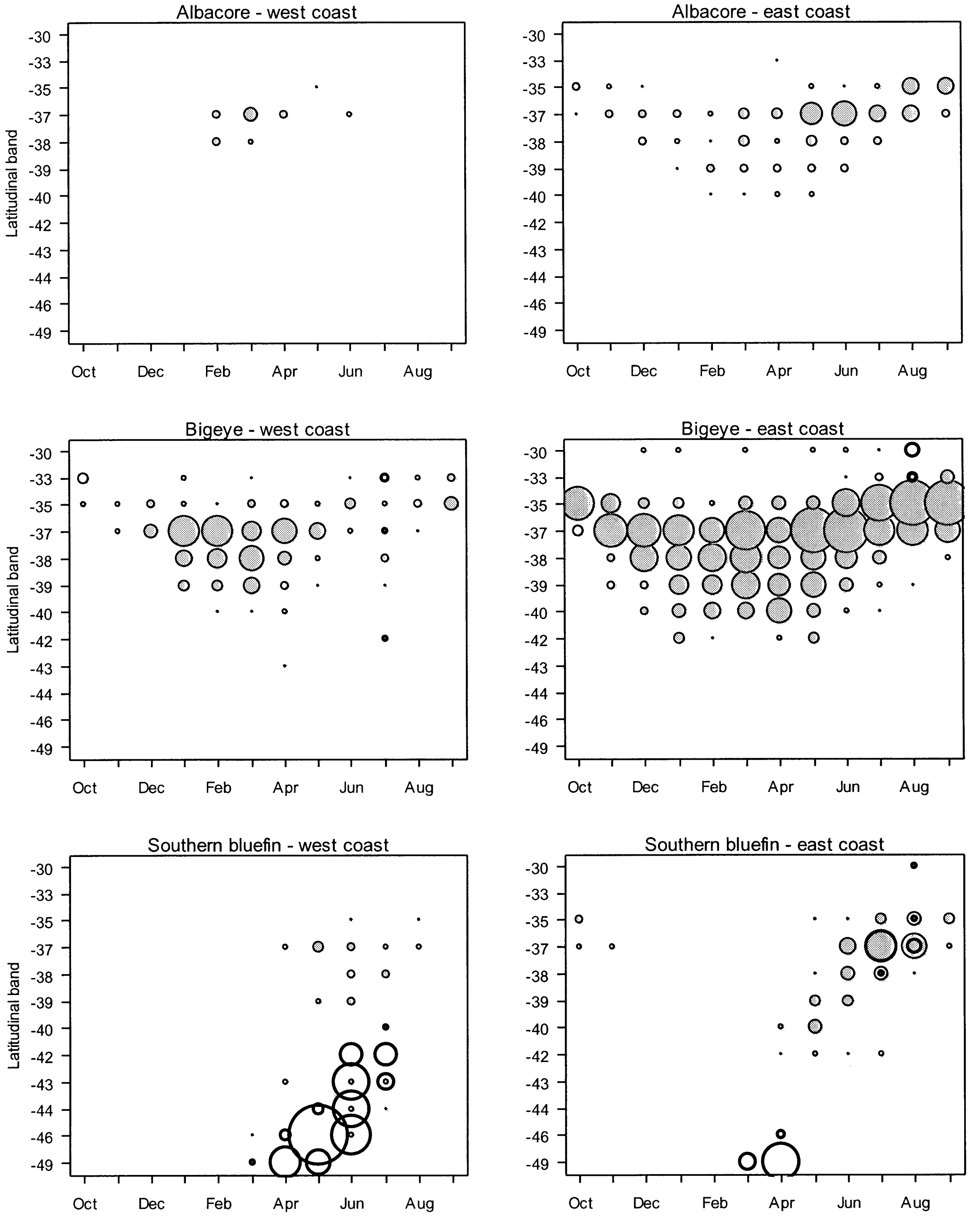



**Figure 7: Relative longline effort (hooks) by latitude, season for the main target fisheries in the EEZ in 1998–99, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. The participation of the large charter vessels is shown overlaid in bold.**

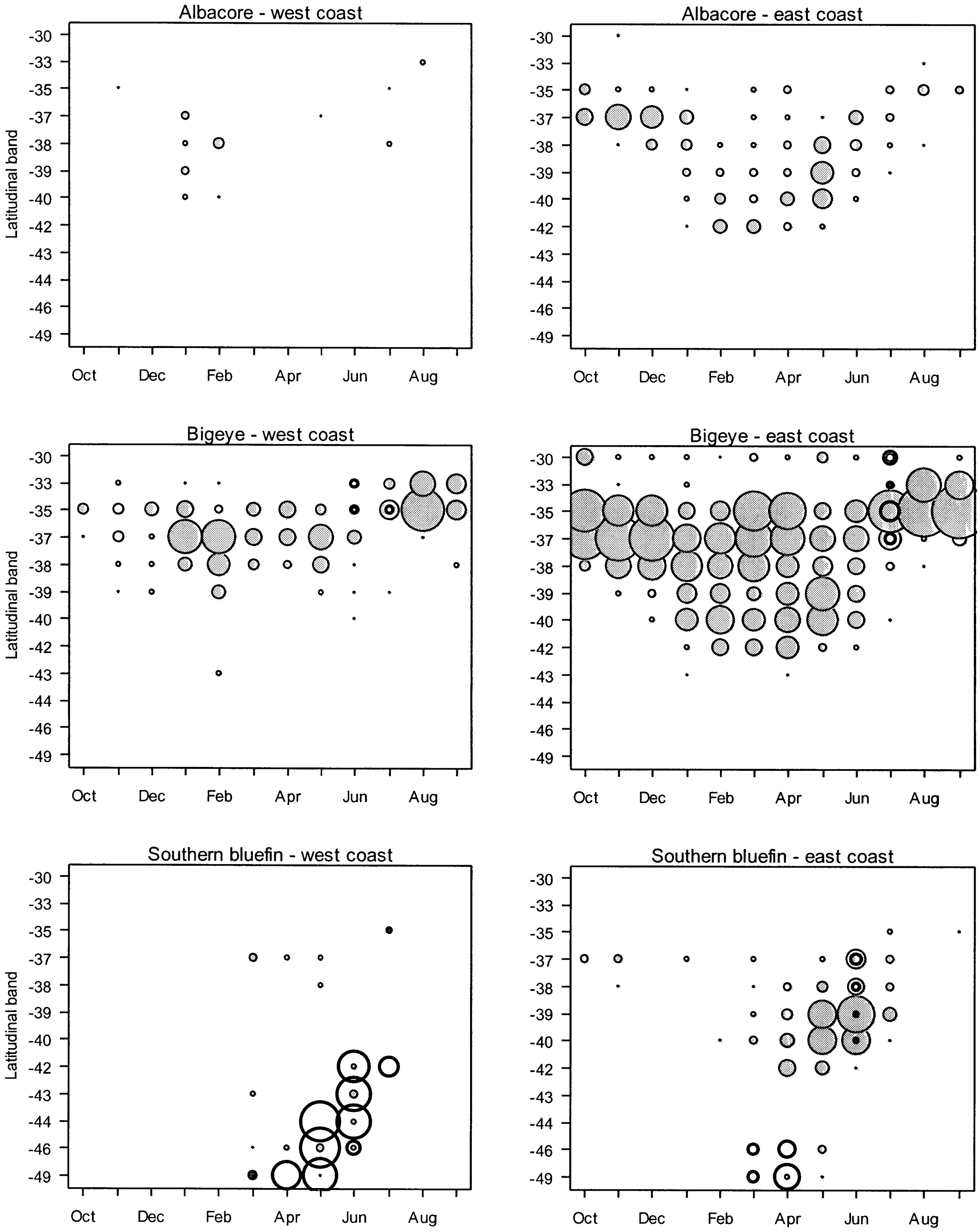



**Figure 8: Relative longline effort (hooks set) by latitude, season for the main target fisheries in the EEZ in 1999–2000, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. The participation of the large charter vessels is shown overlaid in bold.**

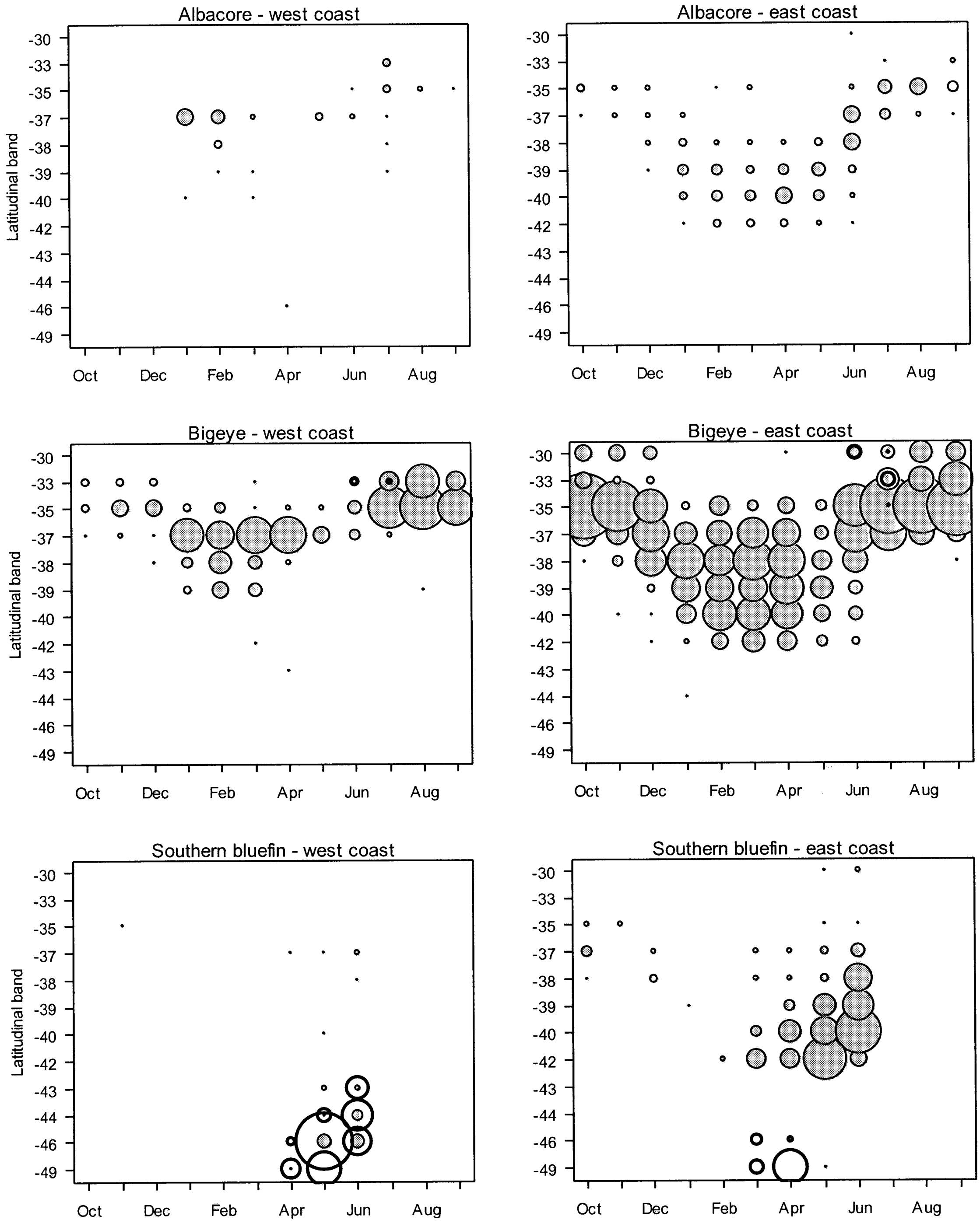



**Figure 9: Relative longline effort (hooks set) by latitude, season for the main target fisheries in the EEZ in 2000–01, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. The participation of the large charter vessels is shown overlaid in bold.**

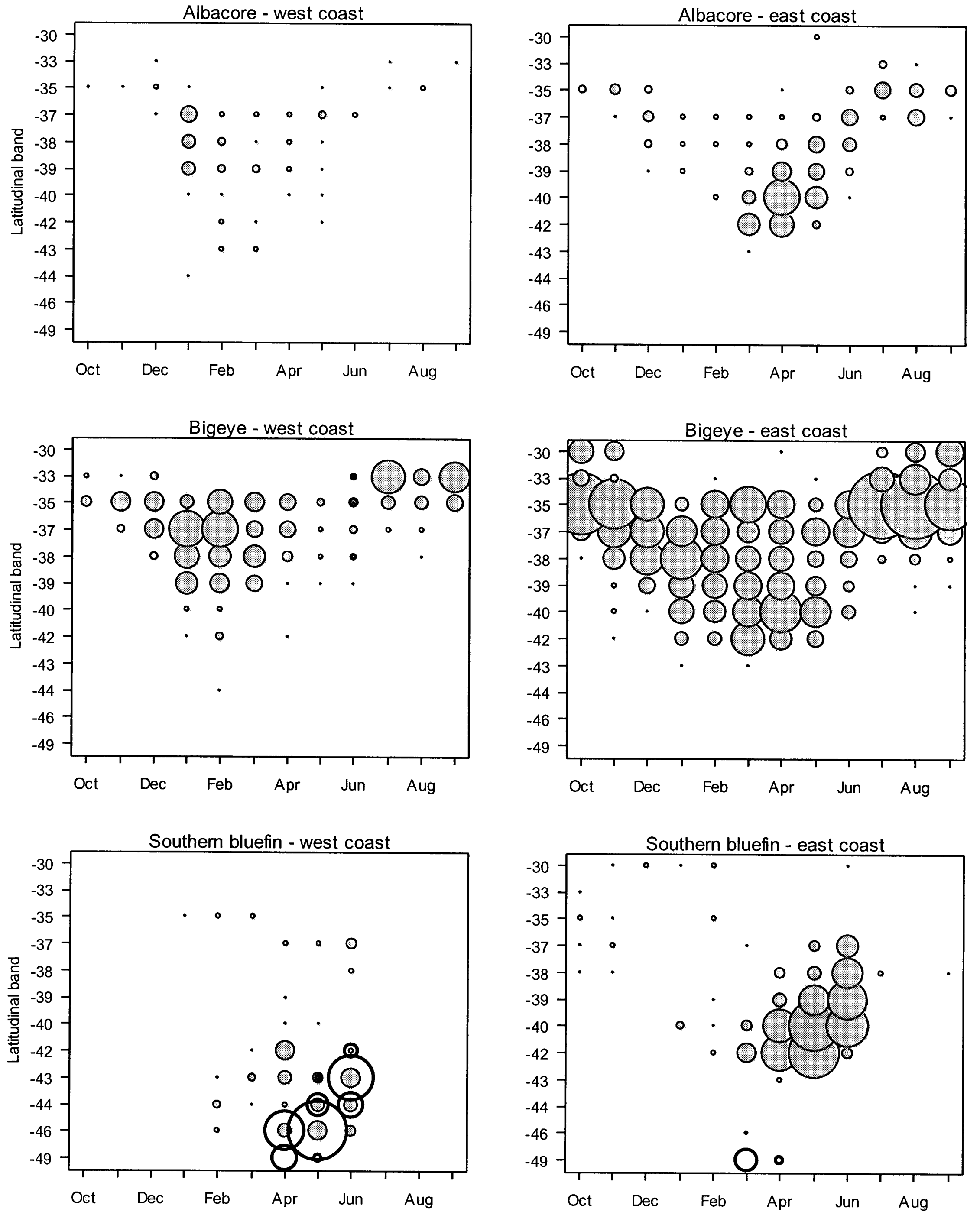



**Figure 10: Relative longline effort (hooks set) by latitude, season for the main target fisheries in the EEZ in 2001–02, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. The participation of the large charter vessels is shown overlaid in bold.**

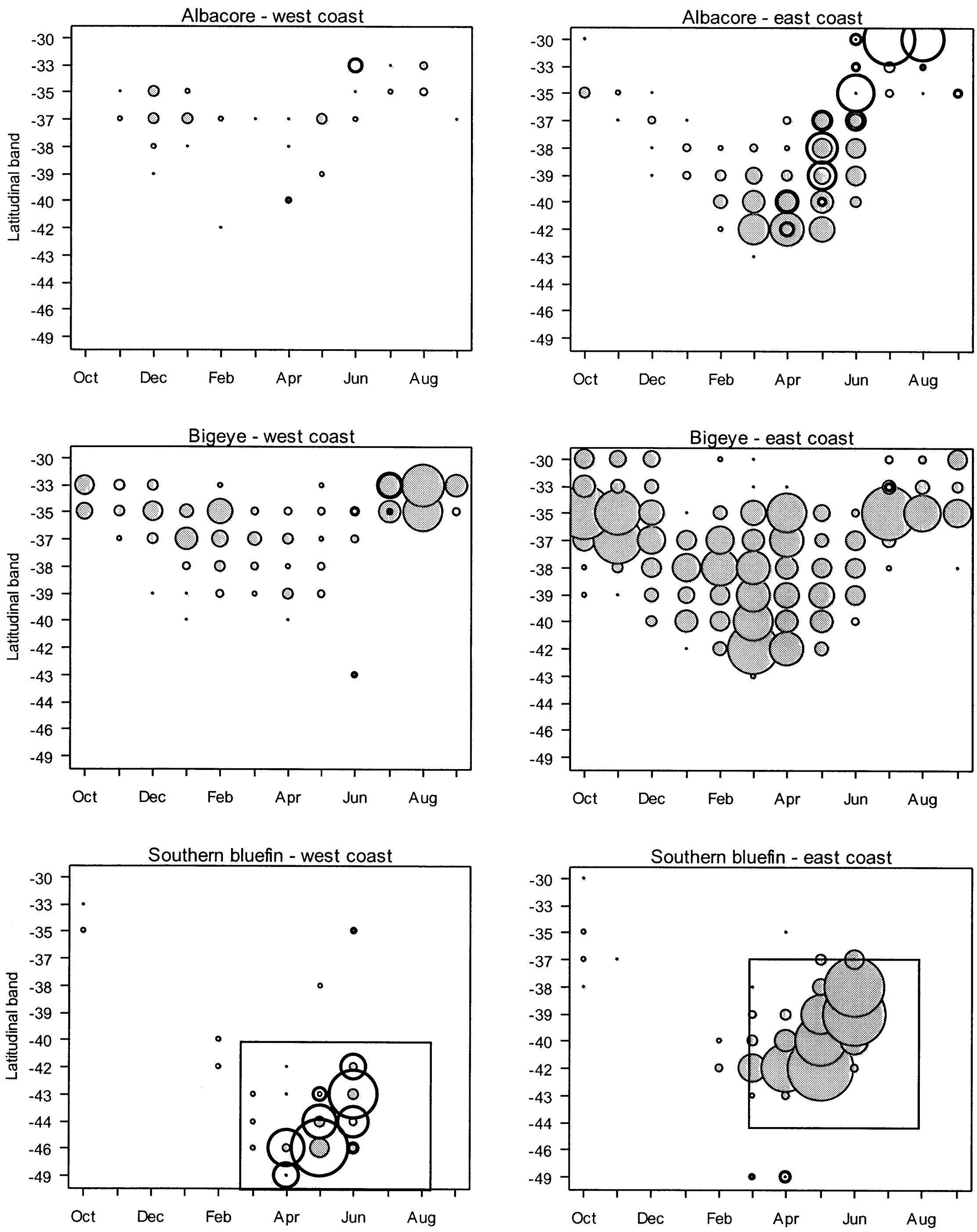



**Figure 11: Relative longline effort (hooks set) by latitude, season for the main target fisheries in the EEZ in 2002–03, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. The participation of the large charter vessels is shown overlaid in bold. The two windows of opportunity that describe the SW and NE fisheries for southern bluefin are overlaid.**

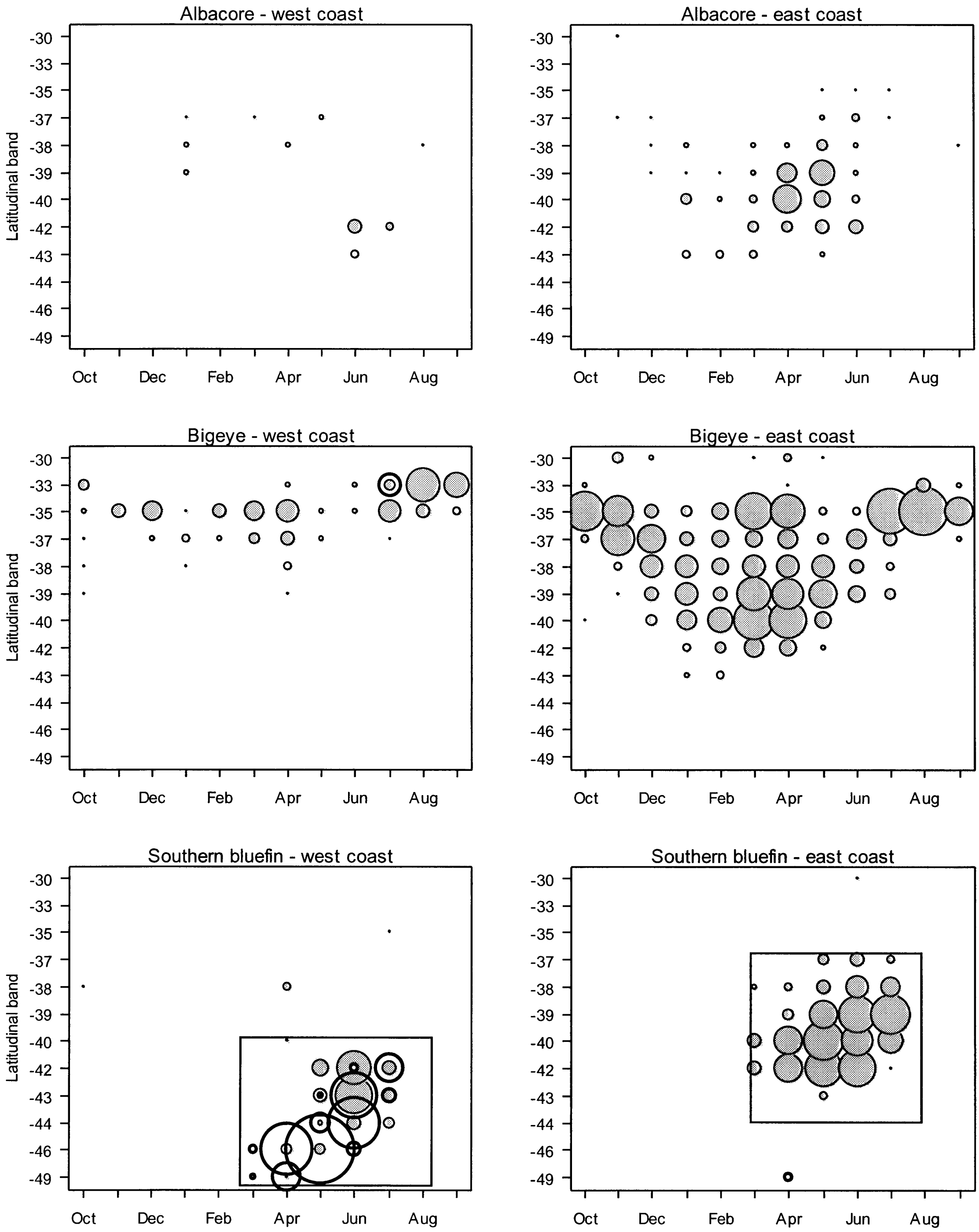



**Figure 12: Relative longline effort (hooks set) by latitude, season for the main target fisheries in the EEZ in 2003–04, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. The participation of the large charter vessels is shown overlaid in bold. The two windows of opportunity that describe the SW and NE fisheries for southern bluefin are overlaid.**

### 2.5.2 Longline catches 1998–99 to 2002–03

Although longlining in New Zealand waters is mostly targeted at bigeye and southern bluefin tunas, the catch of albacore and swordfish has far exceeded that of either target species in every year since 1998–99. About twice as much albacore is caught as swordfish, and about twice as much swordfish as either bigeye or southern bluefin (Table 13). In 2002–03, albacore comprised a greater proportion of the longline catch than in other years, due to the presence of two large charter vessels that targeted it, but otherwise the catch composition in recent years has been relatively stable, with no trends that might indicate systematic shifts in fishing practices.

**Table 13: Total landed greenweight of longline catch by species for the fishing years 1998-99 to 2003-04. Totals scaled to LFRRs or MHRs.**

| Fishing | Landed wholeweight (t) | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| year | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish | catch (t) |
| 98/99 | 1 686 | 391 | 2 | 18 | 452 | 173 | 953 | 3 675 |
| 99/00 | 1 344 | 464 | 2 | 23 | 377 | 97 | 958 | 3 265 |
| 00/01 | 2 069 | 577 | 12 | 51 | 364 | 157 | 1 084 | 4 313 |
| 01/02 | 2 272 | 276 | 15 | 53 | 462 | 60 | 931 | 4 071 |
| 02/03 | 2 220 | 194 | 15 | 41 | 390 | 39 | 659 | 3 557 |
| 03/04 | 842 | 213 | 5 | 31 | 384 | 14 | 537 | 2 026 |

### 2.5.3 Distribution of longline catches in 2002–03 and 2003–04

The percentage of longline catch of the seven species of interest is given for 2002–03 and 2003–04, by declared target species in Table 14 and 15, and by month in Table 16 and 17. All species, except southern bluefin, were mainly caught in the bigeye target fishery in each year, but there are seasonal differences in the availability of each species that suggest that the overlap is not very informative.

Bigeye effort is expended fairly evenly throughout the year, but bigeye catches for 2002–03 and 2003–04, peaked during July-August, when longline effort had shifted north to avoid further southern bluefin catch. Other species that are mainly taken in bigeye sets don't show the same seasonal distribution, except for yellowfin in 2002–03 and skipjack in 2003–04, both of which are caught in only small amounts.

Albacore and swordfish are mainly taken during March to June when effort is further south, and the catch of Pacific bluefin peaks twice, coinciding with both geographical centres of longline effort: March to May when effort is further south, and August when it has shifted north.

In 2002–03, yellowfin was taken largely as a bycatch of albacore sets, and mostly in July and August. The two Philippines-flagged vessels, were north of 30° S, in the Kermadecs in those two months and account for this peak in catch. In 2003–04, yellowfin was mostly a bycatch of bigeye sets and was taken mostly in February-March i.e., before water temperatures had dropped. In both years the actual tonnage landed was small, 40 t in 2002–03 and just 14 t in the following year.

Albacore and swordfish are also a significant bycatch of southern bluefin, and their catches increase proportional to the amount of effort expended at that target, but only in the NE fishery, not in the SW fishery.

This is clearly seen in Figures 13–16, which show the distributions of catch for the six main longline-caught species (skipjack is excluded), regardless of target species, in the fishing years; 2002–03 to 2003–04, by latitudinal band and month. Note that each horizontal panel shows the pattern of catch of an individual species.

Although the distributions of bigeye and albacore effort appeared to be similar across latitude and season, the catches of the two species are not. Albacore is a significant bycatch of southern bluefin, and the greatest catches of albacore come out of the NE southern bluefin window, as a function of the concentrated effort expended in those latitudes and months. The catch of bigeye in that window does not increase, but declines markedly.

Catches of albacore, Pacific bluefin, and swordfish increase proportionately to the concentrated effort targeted at southern bluefin in the NE window, whereas catches of bigeye and yellowfin do not. In the SW window, only the catch of southern bluefin increases as a function of the increased effort expended, and although there is some accumulation of catch of albacore, it is not marked.

The distribution of catches of some species is more a function of the pattern of effort expended against the target species than it is of the pattern of their availability, and the importance of a target species in explaining catch of other species does not necessarily indicate that all effort directed at that target is relevant (effective).

**Table 14: Longline catch in 2002–03 by target species (percent of annual landings). Total annual Catch is scaled to MHR totals.**

| Target | Percent of longline landed catch (by weight) | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish |
| YFN | 0 | 0 | - | - | - | 2 | 0 |
| ALB | 30 | 8 | 37 | 10 | 6 | 69 | 12 |
| BIG | 37 | 89 | 61 | 63 | 7 | 28 | 57 |
| TOR | 2 | 1 | 0 | 7 | 0 | 0 | 3 |
| STN | 31 | 2 | 2 | 20 | 87 | 1 | 28 |
| Other | 0 | - | - | 1 | - | - | 0 |
| Annual total (t) | 2 220 | 194 | 15 | 41 | 390 | 39 | 659 |

**Table 15: Longline catch in 2003–04 by target species (percent of annual landings). Total annual Catch is scaled to MHR totals.**

| Target | Percent of longline landed catch (by weight) | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish |
| YFN | 0 | 1 | 0 | - | - | 9 | 0 |
| ALB | 13 | 1 | 5 | 3 | 3 | 0 | 11 |
| BIG | 58 | 96 | 89 | 70 | 4 | 88 | 54 |
| TOR | 3 | 1 | 2 | 17 | 0 | 2 | 3 |
| STN | 25 | 1 | 4 | 9 | 93 | 1 | 32 |
| Other | 0 | - | - | - | 0 | - | 1 |
| Annual total (t) | 842 | 213 | 5 | 31 | 384 | 14 | 537 |

**Table 16: Seasonal distribution (percent of annual landings) of longline catch in 2002–03 by species. Total annual catch is scaled to MHR totals.**

| Month of 2002-03 | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish |
|---|---|---|---|---|---|---|---|
| | Percent of longline landed catch (by weight) | | | | | | |
| Oct | 1 | 9 | 16 | 4 | 0 | 6 | 3 |
| Nov | 1 | 7 | 3 | 4 | 0 | 3 | 3 |
| Dec | 2 | 2 | 2 | 2 | 0 | 3 | 3 |
| Jan | 3 | 4 | 1 | - | 0 | 3 | 3 |
| Feb | 4 | 8 | 4 | 1 | - | 8 | 9 |
| Mar | 10 | 9 | 9 | 23 | 0 | 5 | 18 |
| Apr | 16 | 9 | 6 | 15 | 13 | 2 | 16 |
| May | 27 | 2 | 4 | 15 | 32 | 0 | 17 |
| Jun | 18 | 2 | 8 | 8 | 54 | 1 | 18 |
| Jul | 10 | 20 | 25 | 7 | 0 | 47 | 5 |
| Aug | 6 | 22 | 18 | 16 | 0 | 22 | 4 |
| Sep | 1 | 6 | 5 | 4 | 0 | 2 | 2 |
| Annual total (t) | 2 220 | 194 | 15 | 41 | 390 | 39 | 659 |

**Table 17: Seasonal distribution (percent of annual landings) of longline catch in 2003–04 by species. Total annual catch is scaled to MHR totals**

| Month of 2003-04 | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish |
|---|---|---|---|---|---|---|---|
| | Percent of longline landed catch (by weight) | | | | | | |
| Oct | 1 | 7 | 3 | 0 | 0 | 9 | 1 |
| Nov | 2 | 12 | 4 | 7 | 0 | 11 | 1 |
| Dec | 6 | 3 | 2 | 6 | - | 2 | 1 |
| Jan | 5 | 2 | 6 | - | - | 7 | 2 |
| Feb | 3 | 4 | 16 | 2 | - | 26 | 5 |
| Mar | 11 | 9 | 14 | 17 | 0 | 20 | 17 |
| Apr | 24 | 5 | 14 | 8 | 11 | 8 | 20 |
| May | 22 | 1 | 6 | 8 | 23 | 2 | 17 |
| Jun | 9 | 2 | 1 | 4 | 46 | 0 | 21 |
| Jul | 9 | 24 | 11 | 12 | 20 | 0 | 10 |
| Aug | 7 | 22 | 22 | 31 | - | 6 | 5 |
| Sep | 1 | 8 | 1 | 6 | - | 9 | 1 |
| Annual total (t) | 842 | 213 | 5 | 31 | 384 | 14 | 537 |

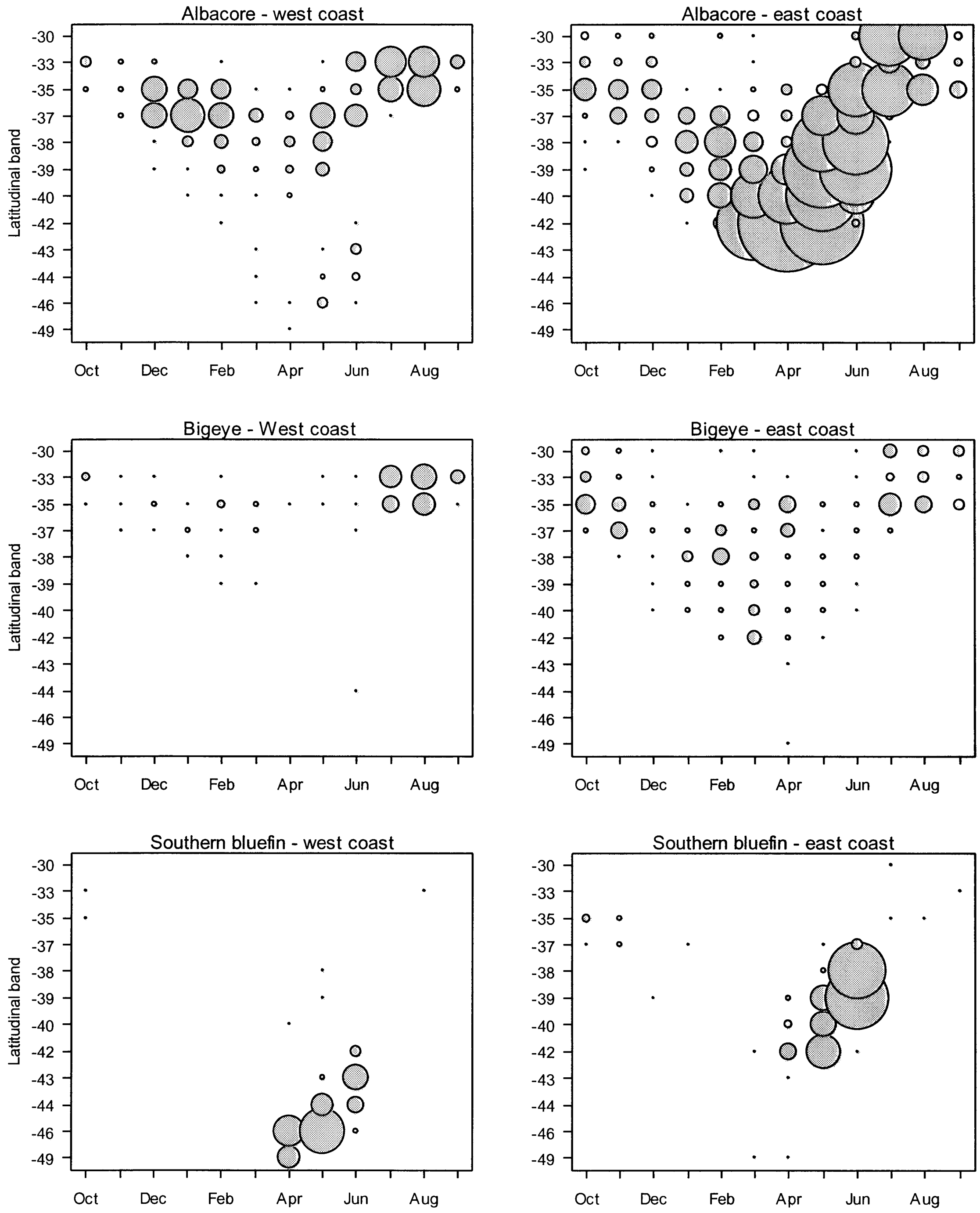



**Figure 13: Relative longline catch (landed wholeweight) of albacore, bigeye and southern bluefin tunas in 2002–03 by latitude, season regardless of target species, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

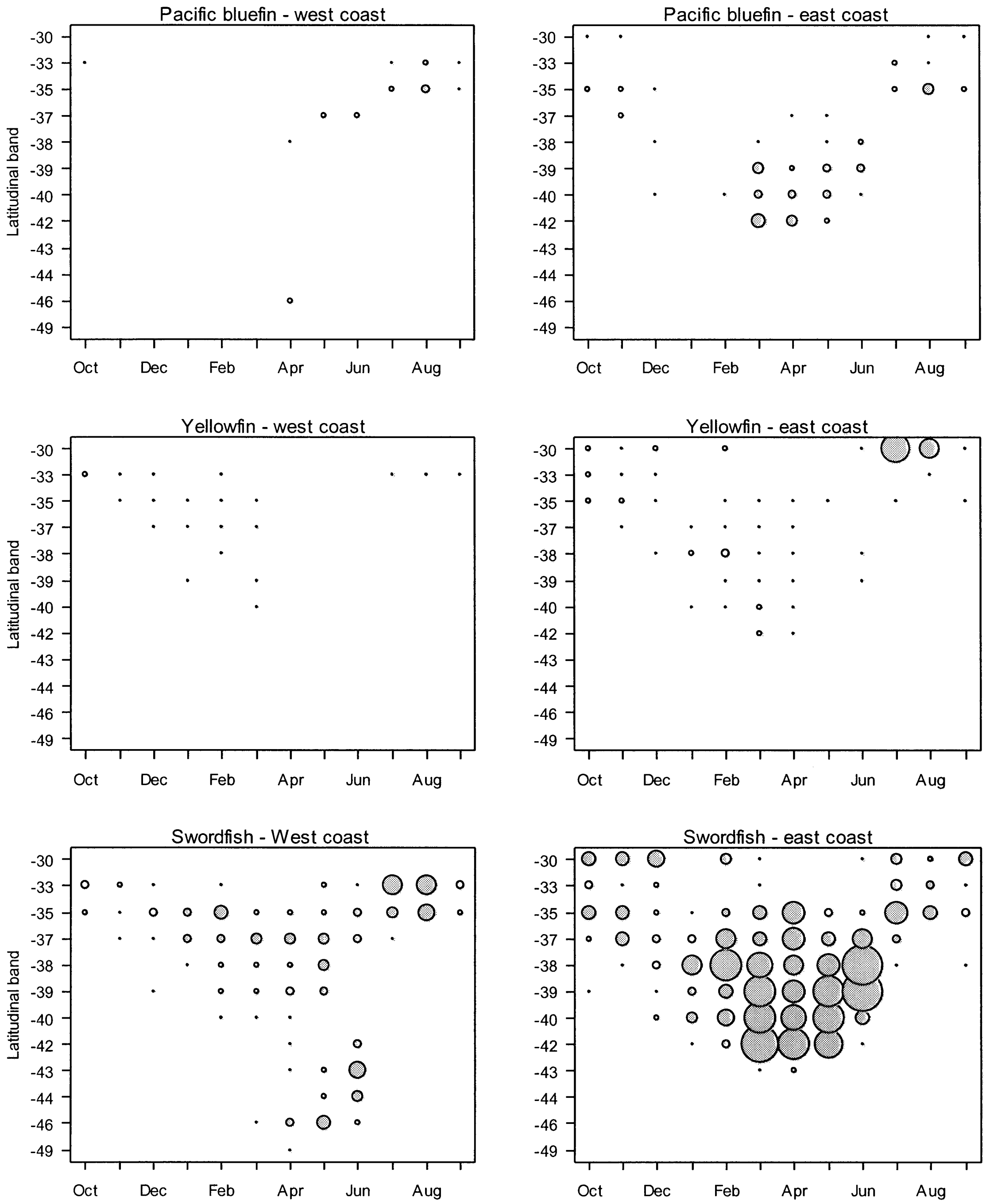



**Figure 14: Total longline catch (landed wholeweight) of Pacific bluefin tuna, yellowfin tuna, and swordfish in 2002–03 by latitude, season regardless of target species, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas**

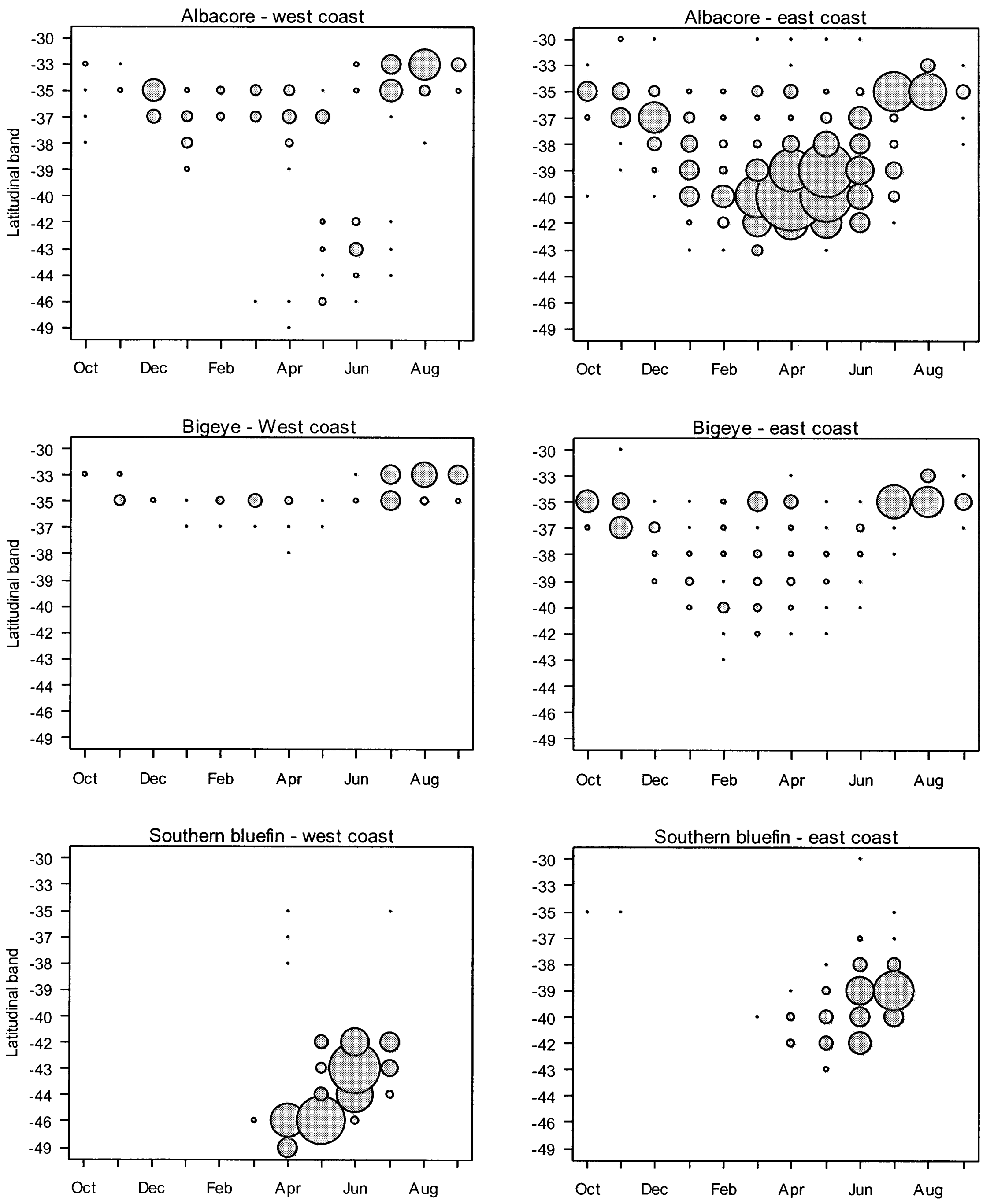



**Figure 15: Total longline catch (landed wholeweight) of albacore, bigeye, and southern bluefin tunas in 2003–04 by latitude, season regardless of target species, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

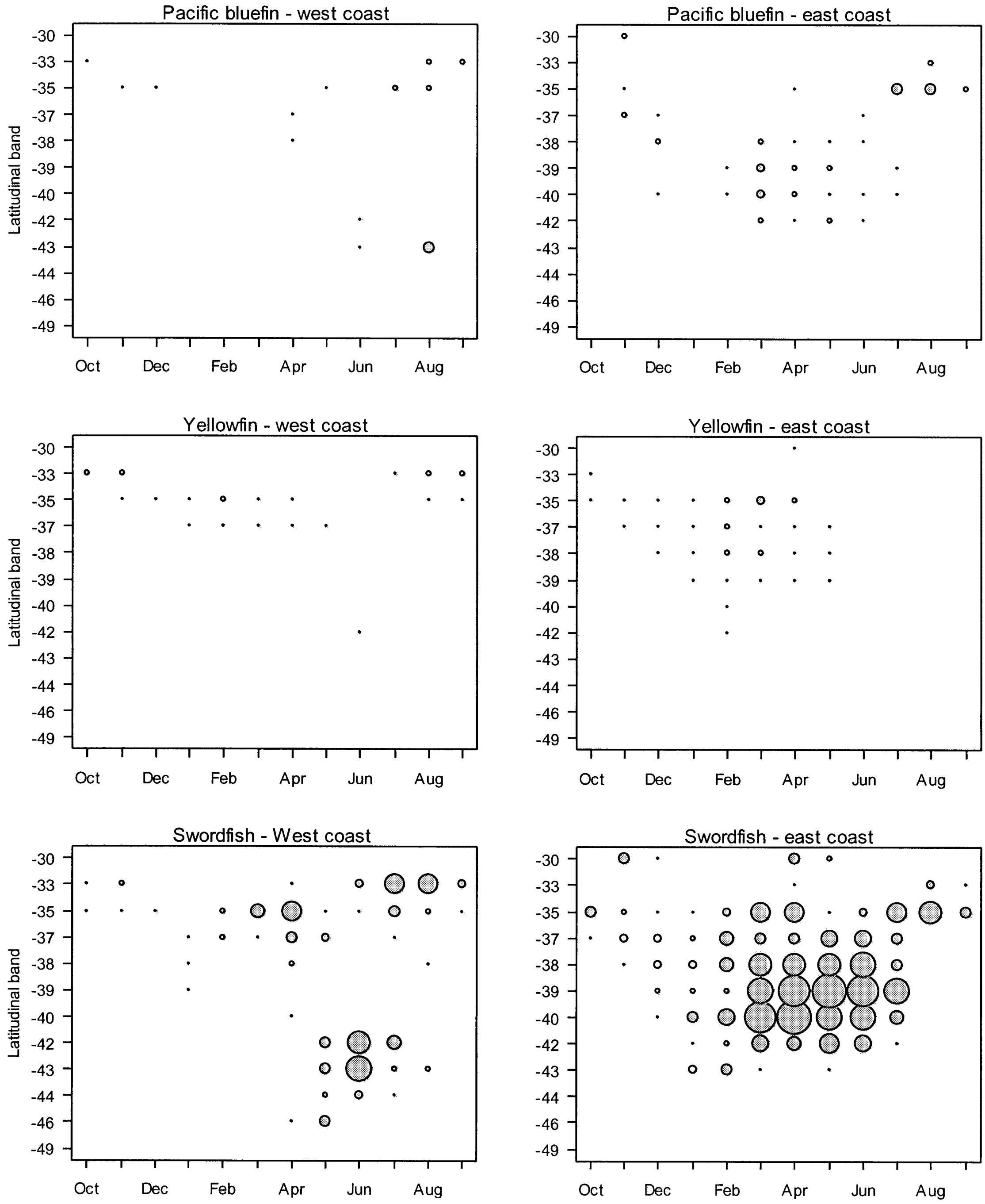



**Figure 16: Total longline catch (landed wholeweight) of Pacific bluefin tuna, yellowfin tuna, and swordfish in 2003–04 by latitude, season regardless of target species, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

## 2.5.4 Longline catch-rates in 2002–03 and 2003–04

Unstandardised longline catch rates (ratio of annual catch : annual effort) for each of the seven species of interest are compared across target fisheries and fleet in Table 18 and 19. The STN fishery is split into SW and NE parts. The large/charter fleet includes a single large domestic vessel, and the domestic fleet is comprised of all smaller domestic vessels.

The target fisheries described for large charter vessels are combined in a way that describes the activity of more than three vessels in the northern half of the zone, but in 2002–03, the two Phillipines-flagged vessels that fished for albacore account for most of that effort.

Catch rates for the domestic fleet are described for both the SW and the NE parts of the STN fishery; only catch rates in the SW part of the STN fishery are described for large/charter vessels because that reflects their participation. Catch rates are expressed in numbers of fish per thousand hooks, but alternatively, for the large/charter vessels, in number of fish per day.

It has previously been observed that the large vessels often achieve lower catch rates per hook than the smaller vessels (Michael et al.1987), presumably because the longer lines set by these vessels cannot be as targeted on thermoclines, convergence zones, or other features where fishing is optimal, as the shorter lines set by domestic vessels, resulting in a smaller proportion of the hooks in any set being equally as effective.

- Both albacore and swordfish show fairly consistent catch rates whether the target species is albacore, bigeye, Pacific bluefin, or southern bluefin (in the NE fishery), but they are an order of magnitude lower in the SW fishery for southern bluefin.
- Bigeye catch rates are insignificant in sets target at southern bluefin (and visa versa)

This is investigated further in Figure 17–20 where catch rates for each of the main longline-caught species (skipjack is excluded) are compared, regardless of target species, in the two fishing years 2002–03 to 2003–04, by latitudinal band and month. Note that each horizontal panel shows the pattern of catch-rate for an individual species. The SW and NE windows of opportunity for southern bluefin, that were described in Section 2.5.1, are overlaid on each plot for reference.

- Abundance of bigeye is greatest throughout the year in a band through lower latitudes (above 37° S). Although we have seen that bigeye effort extends further south during the summer, it must be for other considerations than the availability of bigeye.
- One of the reasons may include greater catches of albacore, which are most abundant in a front that does drop further south in summer, and suggests that albacore have a cooler, temperature range preference compared to bigeye.
- This is confirmed by the maintenance of catch rates for albacore through the NE latitude/month window for STN, contrasted with the sudden decline in catch rates of bigeye.
- This distinction between the range of albacore and bigeye was not evident from the distributional plots of effort nominally targeted at the two species, which seemed to overlap completely, and suggests that fishers may not make this distinction.
- Yellowfin shows a similar pattern to bigeye, with highest catch rates observed at the northern extreme of longline effort in any month, and negligible catch rates once southern bluefin begins to be targeted.
- Catches of Pacific bluefin are sparse, but catch rates suggest a similar distribution to albacore: following a temperature front southwards in summer, with catch rates maintained through the NE STN window, but almost complete absence from the SW STN window. We may be seeing both the cool and the warm extremes of the preferred temperature range for albacore and for Pacific bluefin within the EEZ.
- Swordfish is the most ubiquitous of the longline-caught species, with high and mostly homogeneous catch rates irrespective of season and latitude, except that they decline at the southern extreme of longline effort in any month, and are not maintained into the SW STN fishery.

**Table 18: The average catch rates (numbers of fish per 1000 hooks) in longline sets for 2002–03, by species, by target fishery, and by fleet. Catch rates for the large vessels are also shown in catch per day.**

**Small vessels**

| Target | Number of fish per 1000 hooks | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | Swordfish | S bluefin | Yellowfin |
| YFN | 1.6 | 0.1 | 0.0 | 0.0 | 3.4 | 0.0 | 2.3 |
| ALB | 36.4 | 0.2 | 0.2 | 0.0 | 1.1 | 0.0 | 0.0 |
| BIG | 18.3 | 0.7 | 0.3 | 0.0 | 1.1 | 0.0 | 0.1 |
| TOR | 26.1 | 0.1 | 0.0 | 0.1 | 1.6 | 0.0 | 0.0 |
| STN (NE) | 31.8 | 0.0 | 0.0 | 0.0 | 1.0 | 1.2 | 0.0 |
| STN (SW) | 1.6 | 0.0 | 0.0 | 0.0 | 0.4 | 1.1 | 0.0 |

**Large/charter vessels**

| Target | Number of fish per 1000 hooks | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | Swordfish | S bluefin | Yellowfin |
| ALB/BIG | 35.7 | 0.9 | 1.3 | 0.0 | 0.1 | 0.0 | 2.4 |
| STN (SW) | 0.7 | 0.0 | 0.0 | 0.0 | 0.1 | 1.5 | 0.0 |

| Target | Number of fish per day | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | Swordfish | S bluefin | Yellowfin |
| ALB/BIG | 142.1 | 3.7 | 5.2 | 0.0 | 0.6 | 0.0 | 9.6 |
| STN (SW) | 2.2 | 0.0 | 0.0 | 0.0 | 0.2 | 4.9 | 0.0 |

**Table 19: The average catch rates (numbers of fish per 1000 hooks) in longline sets for 2003–04, by species, by target fishery, and by fleet. Catch rates for the large vessels are also shown in catch per day.**

**Small vessels**

| Target | Number of fish per 1000 hooks | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | Swordfish | S bluefin | Yellowfin |
| YFN | 2.9 | 2.5 | 0.0 | 0.0 | 1.8 | 0.0 | 4.2 |
| ALB | 26.6 | 0.3 | 0.2 | 0.0 | 1.5 | 0.0 | 0.0 |
| BIG | 16.8 | 1.6 | 0.3 | 0.0 | 1.1 | 0.0 | 0.2 |
| TOR | 19.5 | 0.4 | 0.2 | 0.0 | 2.0 | 0.0 | 0.0 |
| STN (NE) | 17.5 | 0.0 | 0.0 | 0.0 | 1.3 | 1.0 | 0.0 |
| STN (SW) | 2.2 | 0.0 | 0.0 | 0.0 | 0.4 | 2.5 | 0.0 |

**Large/charter vessels**

| Target | Number of fish per 1000 hooks | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | Swordfish | S bluefin | Yellowfin |
| ALB/BIG | 14.2 | 4.2 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 |
| STN (SW) | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 0.0 |

| Target | Number of fish per day | | | | | | |
|---|---|---|---|---|---|---|---|
| fishery | Albacore | Bigeye | Skipjack | P. bluefin | Swordfish | S bluefin | Yellowfin |
| ALB/BIG | 45.8 | 13.7 | 0.1 | 0.0 | 3.3 | 2.0 | 0.0 |
| STN (SW) | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 4.7 | 0.0 |

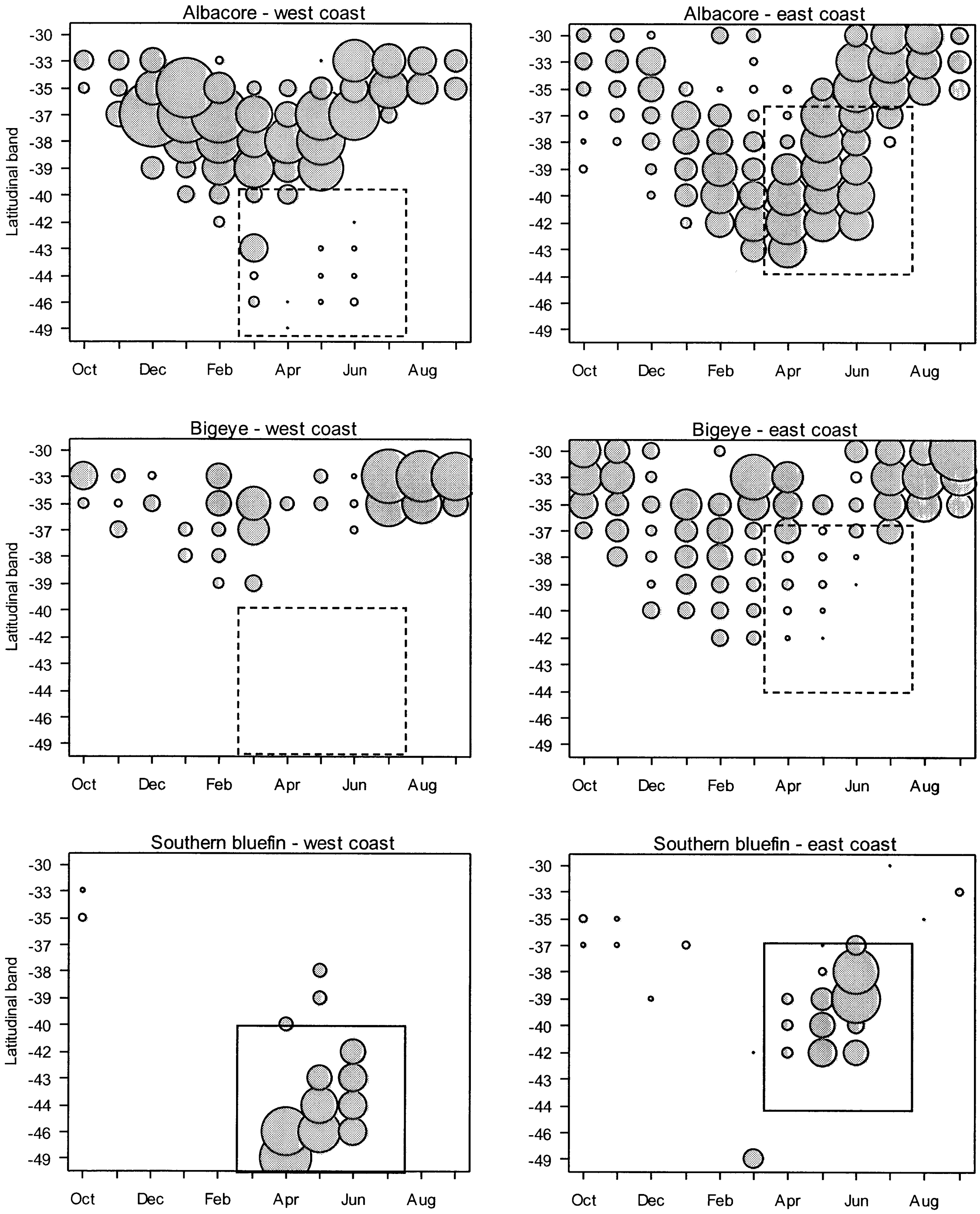



**Figure 17: CPUE (number of fish per 1000 hooks) in 2002–03, of albacore, bigeye, and southern bluefin tunas by latitudinal band and season, regardless of reported target species or fleet. Circle areas are proportionate between plots except that albacore is scaled at 1/5 of the other species for clarity. Overlaid on each plot are the latitude/month windows that describe the southern bluefin fisheries.**

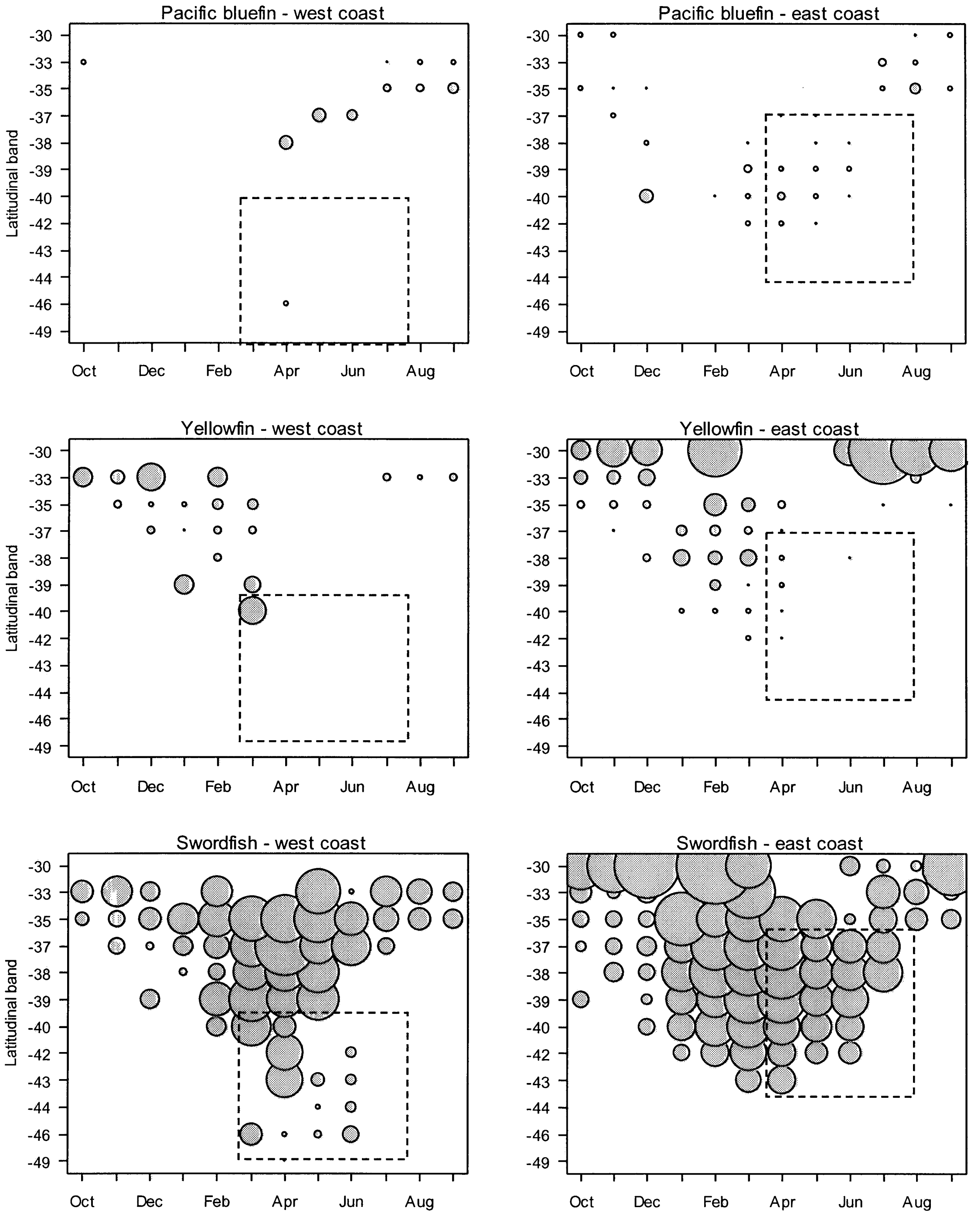



**Figure 18: CPUE (number of fish per 1000 hooks) in 2002–03, of Pacific bluefin, yellowfin tunas and swordfish by latitudinal band and season, regardless of reported target species or fleet. Circle areas are proportionate between plots. Overlaid on each plot are the latitude/month windows that describe the southern bluefin fisheries.**

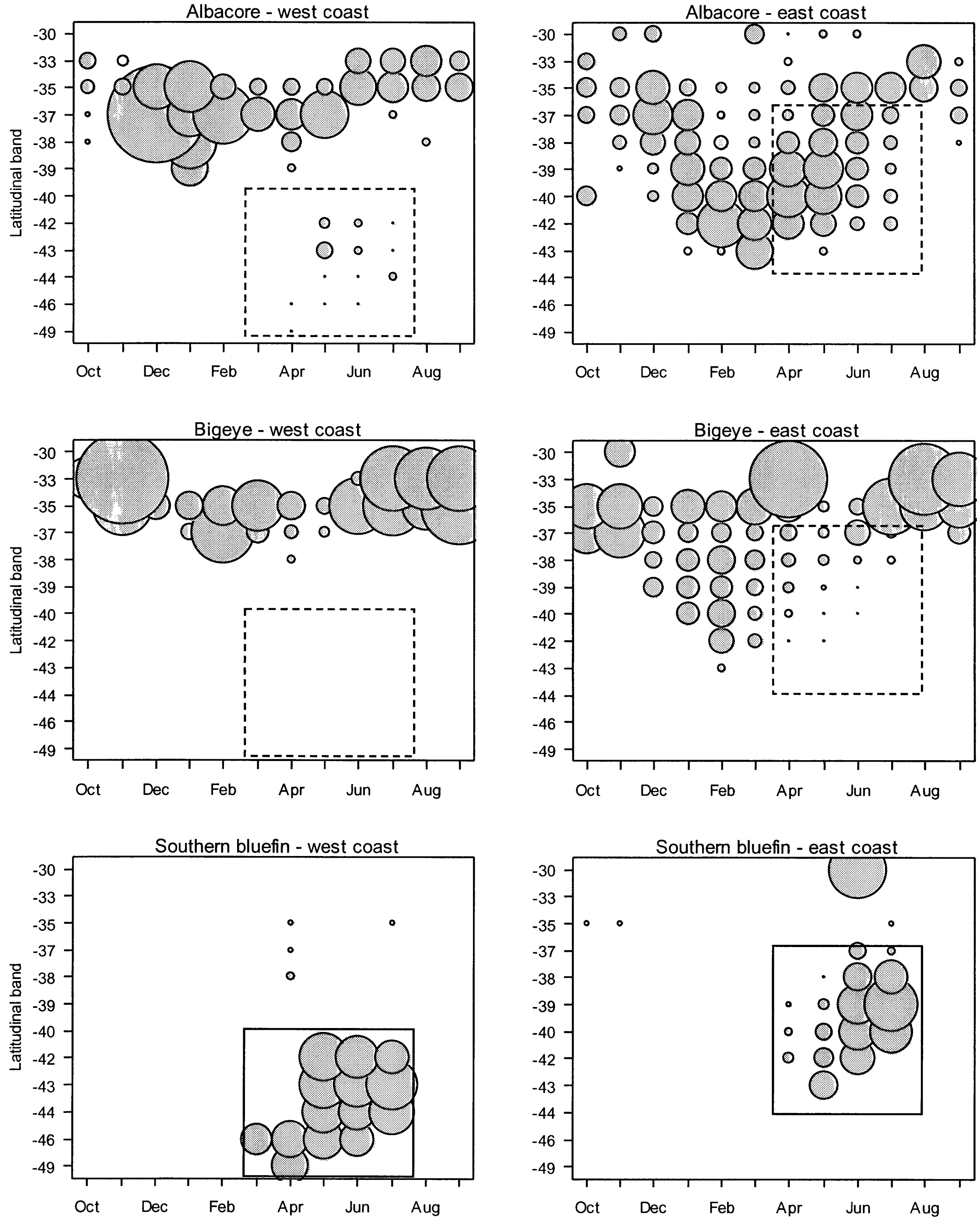



**Figure 19: CPUE (number of fish per 1000 hooks) in 2003–04, of albacore, bigeye, and southern bluefin tunas by latitudinal band and season, regardless of reported target species or fleet. Circle areas are proportionate between plots except that albacore is scaled at 1/5 of the other species for clarity. Overlaid on each plot are the latitude/month windows that describe the southern bluefin fisheries.**

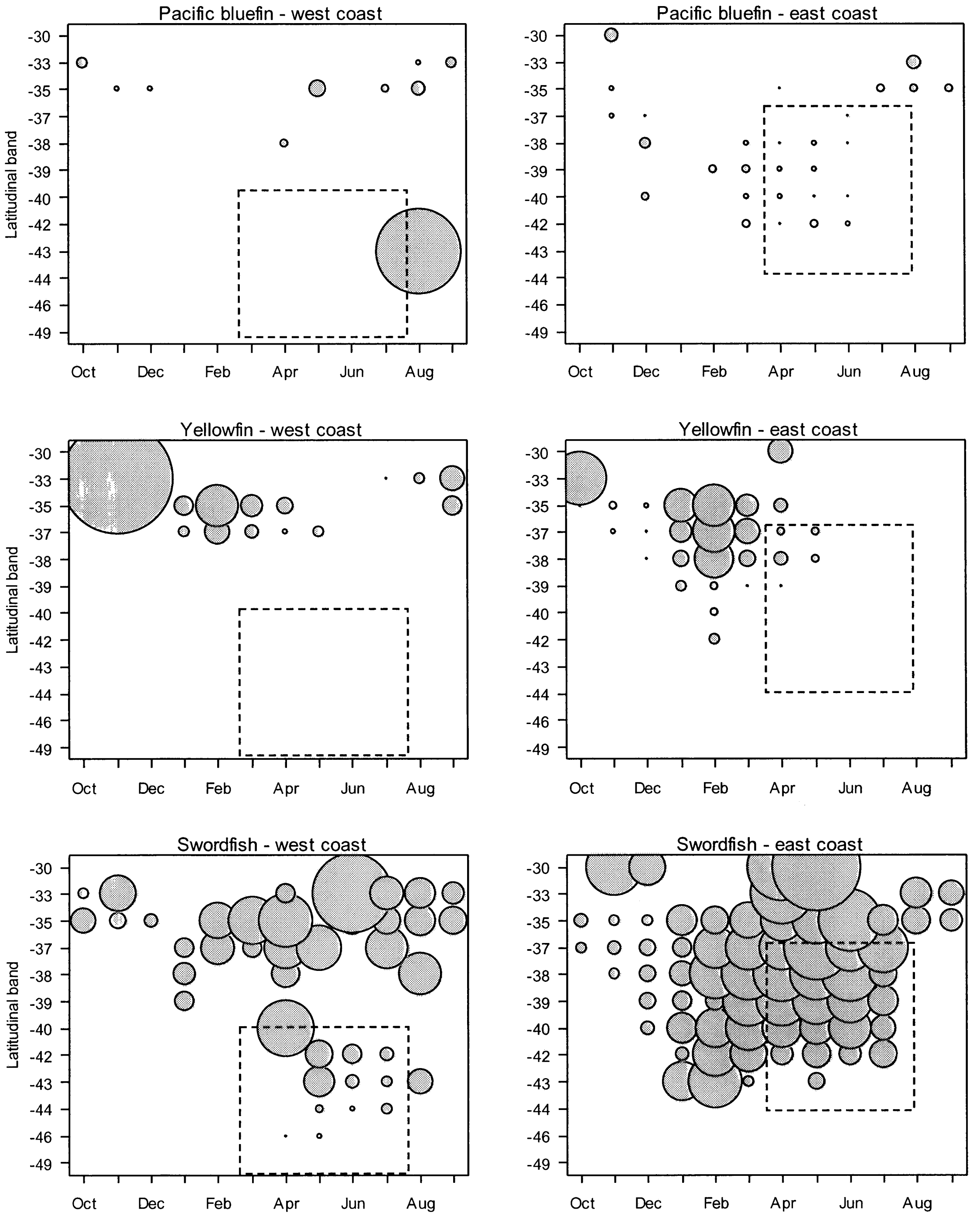



**Figure 20: CPUE (number of fish per 1000 hooks) in 2003–04, of Pacific bluefin, and yellowfin tunas and swordfish by latitudinal band and season, regardless of reported target species. Circle areas are proportionate between plots. Overlaid on each plot are the latitude/month windows that describe the southern bluefin fisheries.**

### 2.5.5 Sea surface temperatures

Sea surface temperatures have been recorded on the new tuna longline form since March 2003, and average values by latitude x month are plotted for 2002–03 (part-year) and 2003–04 in Figure 21 and 22. The distributions of recorded sea surface temperatures with nominal target species are presented for both years in Figure 23.

- A noticeable drop in water temperature occurs in the NE STN window, i.e., once targeting of southern bluefin starts off the east coast of the North Island around April, and considerably lower temperature are recorded in the SW STN window.
- There was little distinction between temperatures in which albacore or bigeye are targeted, especially in 2002–03 when the two Philippines-flagged vessels continued targeting albacore as they departed the zone to the north.
- There is little overlap in terms of temperature, between the BIG/ALB fisheries and the STN fisheries.
- The temperatures in the SW window of opportunity for southern bluefin are considerably lower than in the NE window, and although the target species is the same, these two fisheries must be treated as quite different (not all effort targeted at STN should be included when calculating nominal CPUE for species that are an important bycatch of southern bluefin).
- The observed temperature range of southern bluefin is considerably greater than the geographical boundaries of either of the two fisheries would suggest. Availability of STN is be driven by processes other than sea surface temperature.

**Sea surface temperatures 2002–03**

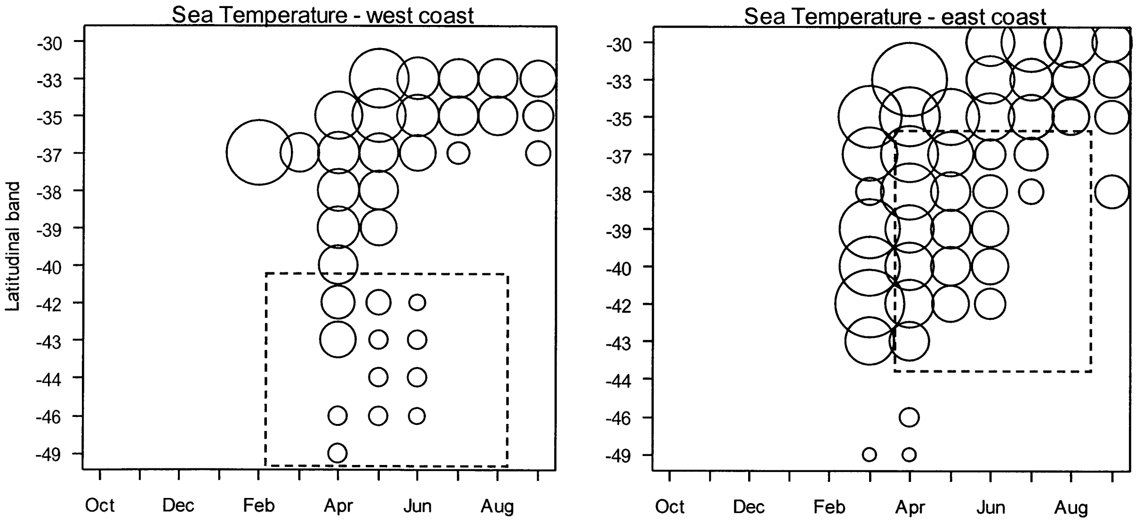



**Figure 21: Average sea surface temperatures recorded at the start of longline sets in 2002–03 for latitudinal band and month. The smallest and largest circles represent 13.4 and 23.3 degrees Celsius respectively. Dashed areas describe the latitude/ month windows of the southern bluefin fisheries.**

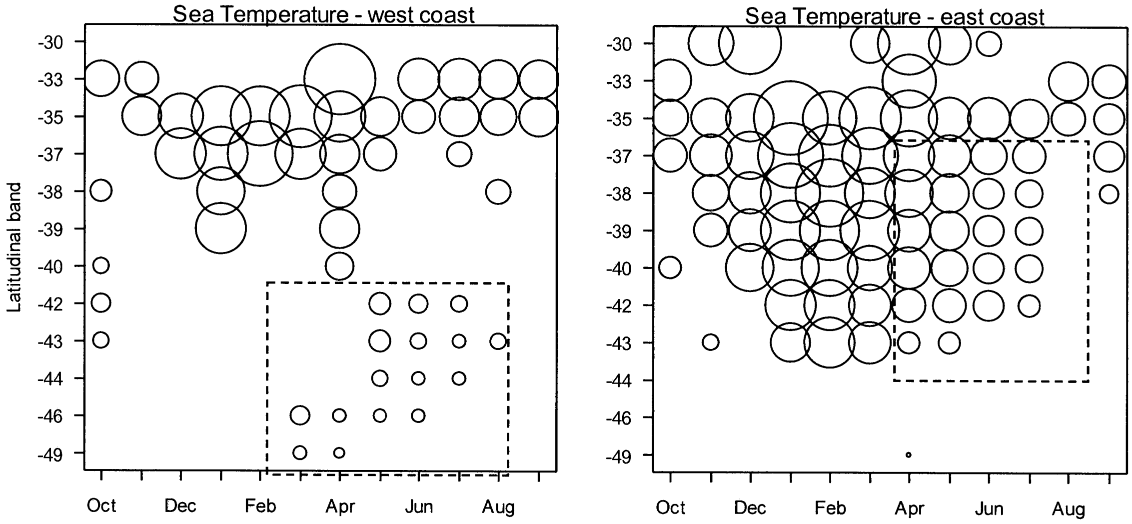



**Figure 22: Average sea surface temperatures recorded at the start of longline sets in 2003–04 for latitudinal band and month. The smallest and largest circles represent 9.1 and 21.4 degrees Celsius respectively. Dashed areas describe the latitude/ month windows of the southern bluefin fisheries.**

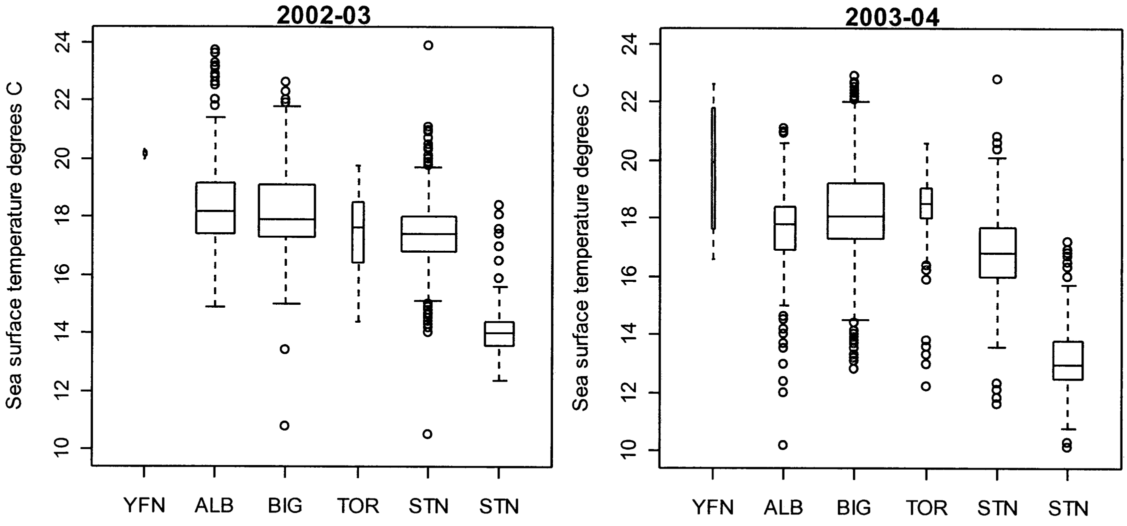



**Figure 23: Distribution of sea surface temperatures in 2002–03 and in 2003–04 recorded at the start of longline sets and grouped by reported target species. The lower and upper boundaries of the box represent the inter-quartile range of the data (the range within which 50% of the data lie), the line inside the box represents the median value (most often recorded value), the whiskers represent 1.5 times the inter-quantile range, and the points represent the outliers beyond 1.5 times the inter-quartile range. The width of the boxes is proportionate to the number of observations.**

### 2.5.6 Defining effective effort in longline fisheries

It is usual to use fisher-nominated target species to define the effort over which CPUE is estimated, but in New Zealand tuna fisheries this is only relevant to the two main target species, bigeye and southern bluefin. Other species are generally a bycatch, although, in the case of albacore (where nominal targeting has created an apparently new and important fishery) and swordfish (which has been an invisible fishery, not legally able to be targeted), that is also subject to changes in management regime.

Yellowfin and Pacific bluefin are only occasionally targeted, and are caught only in the warmer waters of lower latitudes and/or summer months. Skipjack is never targeted by longline and is only an occasional catch.

Targeting of swordfish has been illegal during the time covered by this study, though it has almost certainly occurred, as it forms an important and valuable component of the catch. From October 2004, with its inclusion into the QMS, swordfish can be targeted, and this will cause a significant break in any time series of nominal CPUE based on fisher-nominated target species, reflecting a change in reporting practice, if not in actual fishing practice.

The increased reporting of albacore as the target species of domestic longline sets in recent years may also in part be an anomaly of the pending entry of that species into the QMS as fishers anticipated a quota allowance distributed on the basis of fishing history. It is unclear that there is real targeting of albacore (with the exception of the two large charter vessels that targeted albacore in 2002–03) as it is an unavoidable bycatch of the more valuable bigeye and southern bluefin tunas.

Thus, it is not useful to rely on fisher-nominated target species, as reported, to define the effective effort for either the bycatch or the target species.

Examination of the catch-rate distributions for each species indicates the extent to which they overlap in location and time, and clearly shows that a) not all longline effort is relevant for any of the species, and b) fisher-nominated target species is, nevertheless, a useful proxy for water temperature (which has been recorded on TLCERs only from early in 2003), and can still provide a sensible partitioning of effort, for estimation of nominal CPUE for each of the species of interest.

There is little overlap between the bigeye and the southern bluefin tuna fisheries, which appear to have mutually exclusive temperature ranges. Although some targeting of bigeye off the east coast of the North Island continues after the start of southern bluefin fishing around April of each year, the catch rate of bigeye drops away sharply. Bigeye is rarely caught in the colder waters off the west coast of the South Island where the main southern bluefin fishery occurs. Other species, notably albacore, Pacific bluefin, and swordfish, are caught throughout the albacore/bigeye and the northeastern bluefin fisheries, but at much reduced rates in the south-western bluefin fishery. Yellowfin catch rates suggest that their range does not extend into either of the two southern bluefin fisheries.

The overlap of the albacore and the bigeye effort is almost complete, except that the albacore catch rates are maintained with little change after April off the east coast of the North Island when southern bluefin fishing begins, whereas bigeye catch rates are not. Therefore, whilst bigeye effort appears to be equally as effective as target fishing for albacore (catch rates of albacore are similar in each of the target fisheries), not all the albacore effort is relevant to bigeye.

The spatial-temporal windows for southern bluefin are from April to July, below 42° S off the west coast of South Island (SW window), and below 37° S, off the west coast of North Island (NE window). Both windows are characterised by lower sea surface temperatures than in the surrounding latitudes and/or months. Pacific bluefin and albacore share the NE (but not the SW) window of availability with southern bluefin, while bigeye and yellowfin are markedly less abundant in either, suggesting differences in habitat preference, presumably temperature, between those groups of tunas.

Fishery definitions for calculation of nominal CPUE therefore employ a combination of the spatial-temporal windows to describe the two STN fisheries (SW and NE), and fisher-nominated target to define effective effort for each species of interest. The main target species are monitored alternatively in a) nominally targeted effort, and b) all effort in the relevant spatial-temporal window, regardless of nominated target species.

- **Albacore** are prevalent in all but the SW southern bluefin target fishery and so are monitored in a) all target sets and b) alternatively in all sets, but excluding STN (SW).
- **Bigeye** target fishery largely coincides with the albacore target fishery except that catch rates are not maintained in the STN (NE) window, so bigeye are monitored in a) all target sets and b) alternatively in sets targeted at BIG or ALB, excluding those ALB sets in the STN (NE) window.
- **Swordfish** are prevalent throughout the fishery and catch rates appear consistent and high in all the main target fisheries, except for the SW southern bluefin tuna fishery. Catch rates of swordfish are higher in the yellowfin target sets, but the actual number of sets is very low. Swordfish are therefore monitored in all sets, except STN (SW).
- **Southern bluefin** are monitored in each of the two target fisheries (NE and SW) separately, and alternatively, in the NE window, in all domestic longline sets regardless of target species.

**Yellowfin** is caught sporadically throughout the bigeye range, but catch rates are greater in the few sets in higher latitudes. It appears that even the bigeye effort is on the extreme edge of their range and can't be assumed to represent effective effort. No attempt is made to calculate nominal CPUE for yellowfin.

**Pacific bluefin** is caught only occasionally, and has been reliably identified only in recent years. The time series is probably not yet useful for monitoring.

All estimates of CPUE presented in this report are ratios of total catch to total effort, not averages of ratios and therefore do not include any measure of variance.

### 2.5.7 Nominal CPUE in longline fisheries

Effort targeted at albacore has been low (about 500 000 hooks annually) since 1998–99, except for a rise in 2002–03 to more that twice that number. Catch rates in targeted sets varied around 40 fish per 1000 hooks, but overall declined by about 40% over the six years. When effort targeted at bigeye is included, the number of fishing events is increased by more than an order of magnitude, and the pattern of effort is more hump shaped, increasing steadily to a peak in 2002–03 and then dropping by about 40% in 2003–04. The pattern of CPUE in the more broadly defined fishery is very similar to that in the target fishery however, though somewhat lower, varying around 25 fish per 1000 hooks, but overall shows the same 40% decline (Figure 24).

The patterns of effort and resultant CPUE for bigeye hardly differ between the target bigeye sets and the broader fishery that includes albacore sets, because the albacore fishery is comparatively so much smaller. Effort is hump shaped as described above, increasing steadily from about 4 million hooks in 1998–99 to about 7 million hooks in 2000–01 and 2001–02. It then declines over the following two years by about 40%. CPUE declines by more than 50% from 1.5 fish per 1000 hooks in 1998–99 to nearer 0.7 fish per thousand hooks in 2002–03, and then recovers in the most recent year back to near the previous level (Figure 25).

Targeted effort in the northeastern fishery for southern bluefin increased threefold between 1998–99 to a peak in 2002–03, and then dropped to about 60% of that peak in the most recent year, 2003–04. Targeted effort accounted for an increasing proportion (centred around half) of the total effort in the latitude/month window. CPUE of southern bluefin declined steadily over the six years by about 60% in targeted sets and by about 50% in the more broadly defined fishery that included all effort in the window (Figure 26).

In the southwestern fishery for southern bluefin, effort declined to a low of about 1.5 million hooks in 2000–01, and then more than doubled over the following three years. Almost all effort in the latitude/month window that defines the SW fishery has been targeted at southern bluefin in each year since 1998–99. CPUE for southern bluefin was about 3 fish per 100 hooks in the two years 1998–99 and 1999–2000, it increased to just over 4 fish per 1000 hooks in 2000-01, and then declined over the following two years to a new level between 1 and 2 fish per 1000 hooks, overall, a decline of about 40% over the six years (Figure 27).

Effort in the combination of fisheries that are relevant to swordfish increased steadily by almost 70% between 1998–99 and 2003–04, and then returned to nearer the 1998–99 level in the most recent year, 2003–04. CPUE has been reasonably stable at around 1.5 fish per 1000 hooks, with the lowest point reached in 2002–03 at nearer to 1.0 fish per 1000 hooks. Overall, there has been a 15% decline over the six years Figure 28).

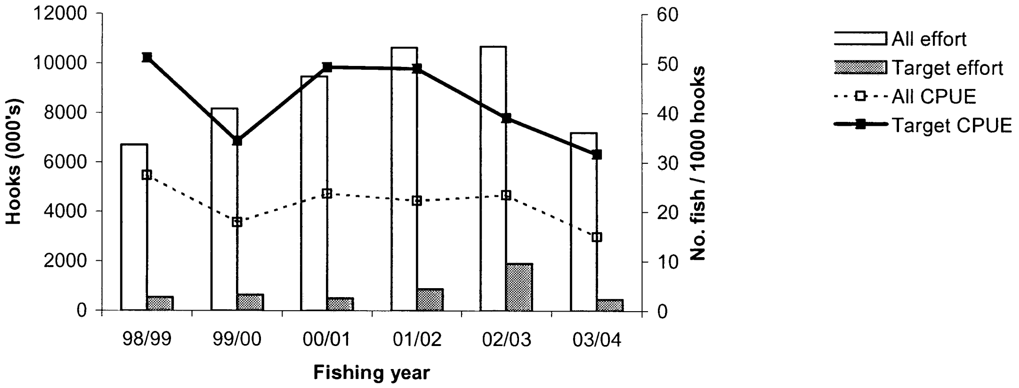



**Figure 24: Albacore nominal CPUE (lines) and effective longline effort (bars) for fishing years 1998–99 to 2002–03 in targeted sets, and all sets regardless of target species, excluding those in the STN (SW) latitude/month window.**

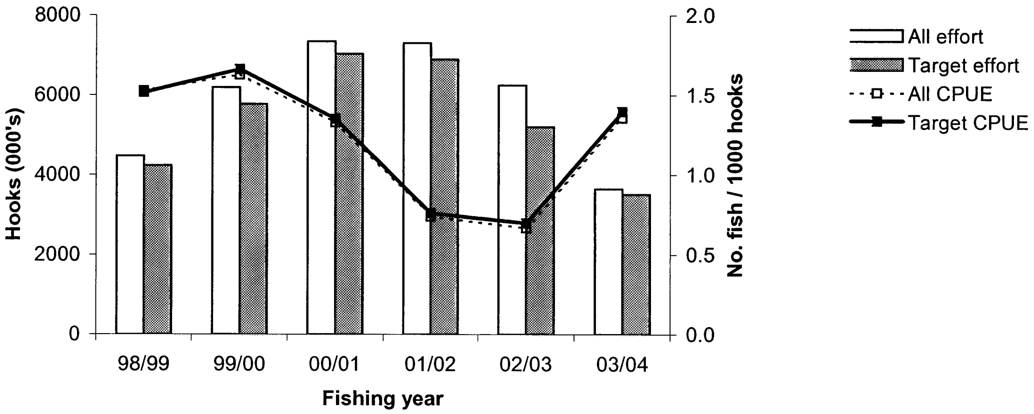



**Figure 25: Bigeye nominal CPUE and effective longline effort for fishing years 1998–99 to 2002–03 in; a) targeted sets, and b) all sets targeted at either bigeye or albacore but excluding those in the STN (NE) latitude/month window.**

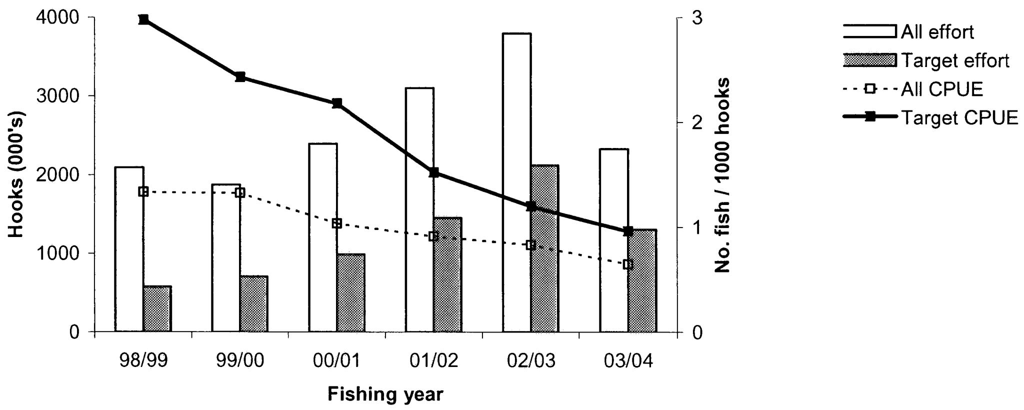



**Figure 26: Southern bluefin (NE) nominal CPUE and effective longline effort for fishing years 1998–99 to 2002–03 in; a) targeted sets, and b) in all sets regardless of reported target species in the STN (NE) latitude/month window.**

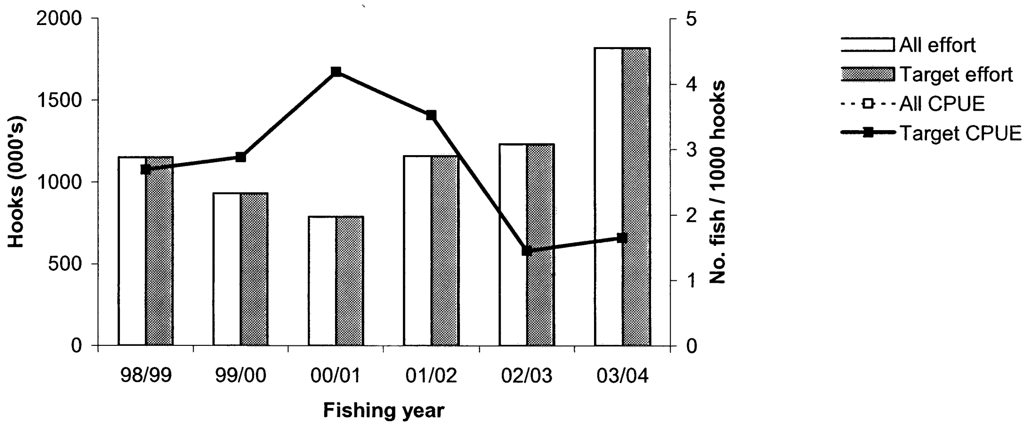



**Figure 27: Southern bluefin (SW) nominal CPUE and effective longline effort for fishing years 1998–99 to 2002–03 in; a) all sets in the latitude/month window regardless of reported target species (almost entirely STN).**

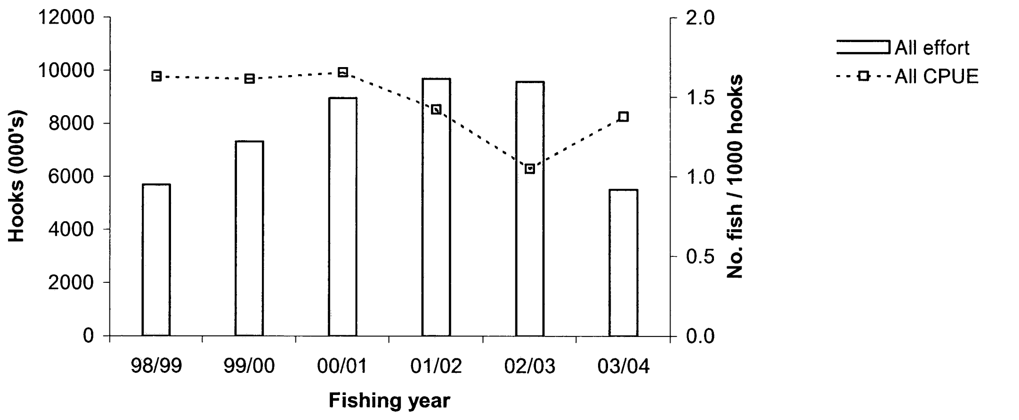



**Figure 28: Swordfish nominal CPUE and effective longline effort for fishing years 1998–99 to 2002–03, in all longline sets except those in the STN (SW) latitude/month window.**

### 2.5.8 Observer coverage in longline fisheries

Details of individual fish sizes are available only from observer data. Tuna longline forms have not collected individual southern bluefin processed weights since introduction of the redesigned form in March 2003.

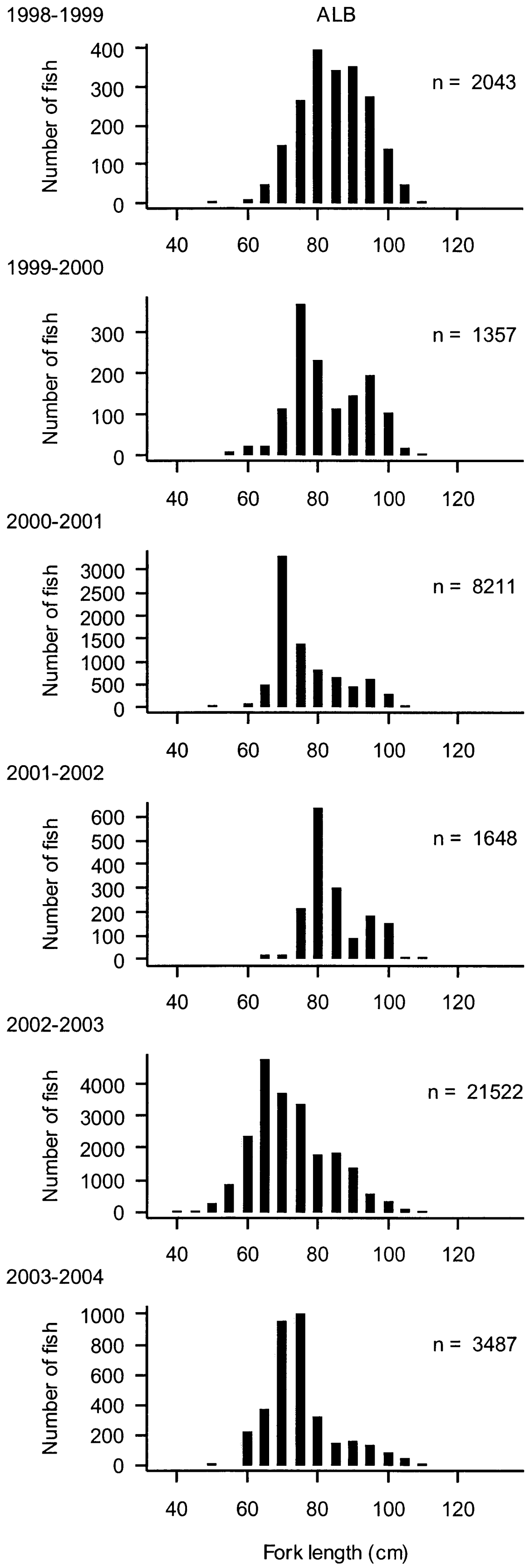
Observer coverage and representativeness is covered comprehensively in reports from other studies, most recently in progress reports for MFish project ENV2004/01. There is some observer coverage of all the main tuna fishing fleets, but the emphasis is on longline because it is the main fishery monitored for CPUE, and is closely monitored for levels of bycatch, including sharks and billfish in accordance with our obligations to the commission (now WCPFC) that oversees the management of highly migratory oceanic species.

Observer coverage is generally very good (about 90%) for the larger and chartered vessels, and much poorer (less than 10%) for domestic vessels, which are smaller and less able to accommodate an observer. In consequence, coverage is also biased geographically towards the SW southern bluefin fishery, which operates in much cooler waters than the NE part of the fishery. Distributions of average fish weight per set (not shown) calculated from catch effort forms do not show any significant differences between the size of southern bluefin from the two parts of the fishery, but certainly the species composition of the commercial catch is different, and therefore bycatch can also be expected to be significantly different.

Observer coverage of tuna longlines continues to improve, and there was a marked improvement in the number of domestic vessels that carried observers, from the one large vessel that fishes in company with the charter fleet in 2002–03, to eleven domestic vessels in 2003–04 (Table 20).

Observer collected length-frequencies for albacore, bigeye, southern bluefin, and yellowfin are presented in 5 cm fork-length bins for the fishing years 1998–99 to 2003–04, (Figures 29, 31, 33, & 35 respectively). There is no apparent dimorphism in these species and measurements for the sexes are combined. Lengths of swordfish measured by observers are presented separately for sex (Figure 37) and a heavily skewed sex ratio, biased toward females, is evident. Measurements of swordfish that were not specifically noted to be fork-eye length were excluded. Lengths are alternatively presented as cumulative proportional plots in Figures 30, 32, 34, 36, & 38 respectively, with the six years overlaid as lines on a single plot for each species. These provide a convenient comparison of average fish size between years, without any modal information.

- In the case of most species the large variation between years does not give any confidence that an underlying population is being effectively monitored in these length frequencies. The exception is southern bluefin tuna for which clear modes can be distinguished and tracked from year to year.
- The most striking feature of the southern bluefin length frequencies is the absence of smaller fish in 2002–03 and in 2003–04.
- 2002–03 is characterised by catches of smaller albacore, bigeye, and yellowfin. The larger number of these species measured in that year is accounted for by sets observed on the two Philippine-flagged vessels that targeted albacore in the northern half of the zone, and thus represent a marked change in sampling for that year.



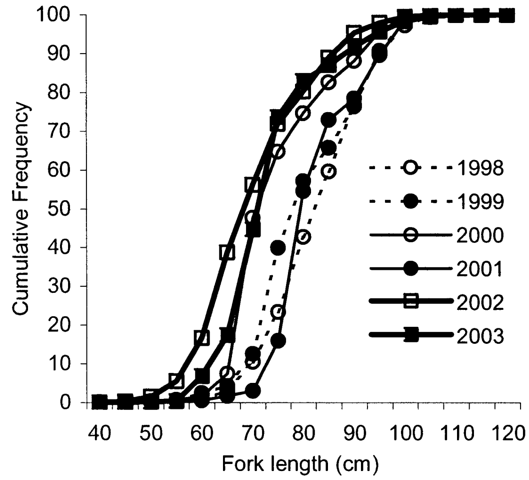
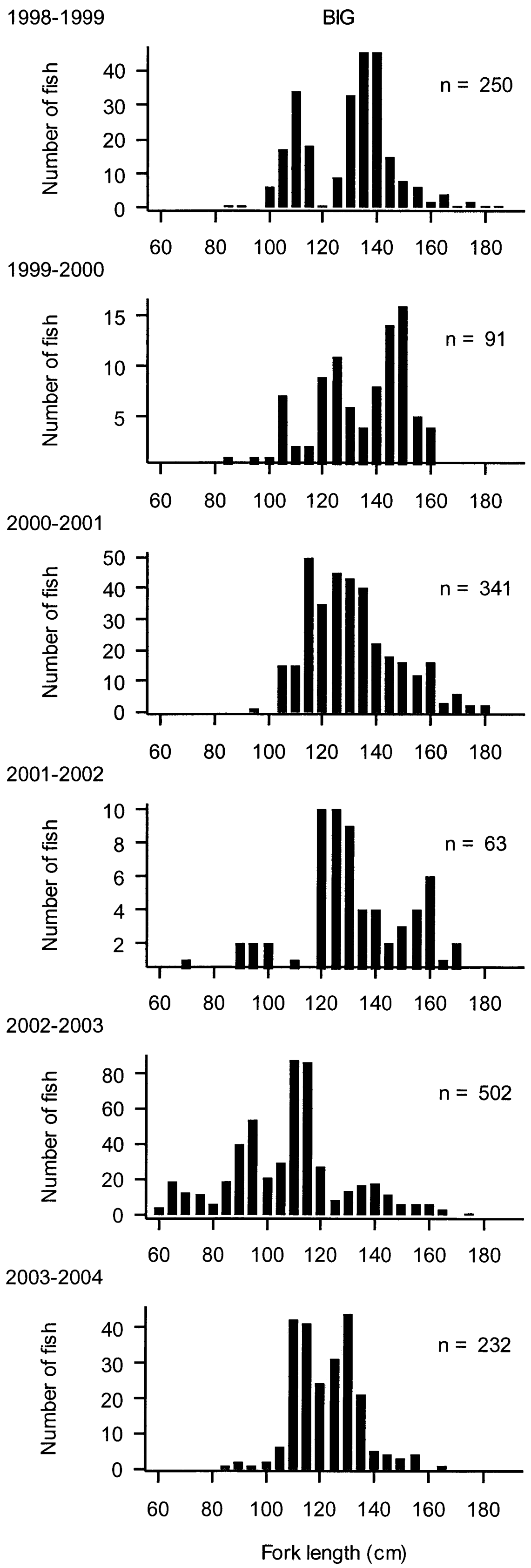




**Figure 30: Cumulative proportional length frequencies for albacore observed in longline catches for 1998–99 to 2003–04.**

**Figure 29: [Left] Length frequencies, in 5 cm bins, for albacore measured in observed longline sets for 1998–99 to 2003–04. Sexes combined.**



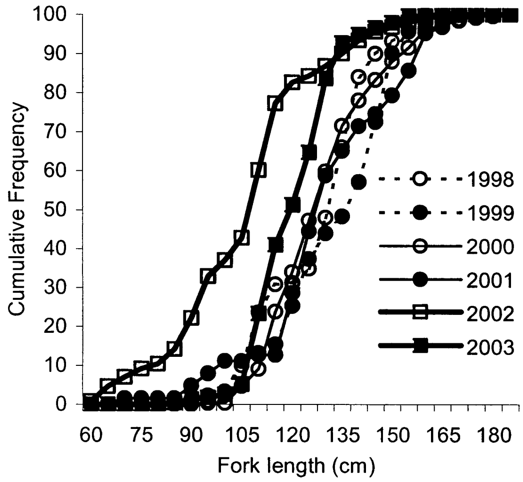
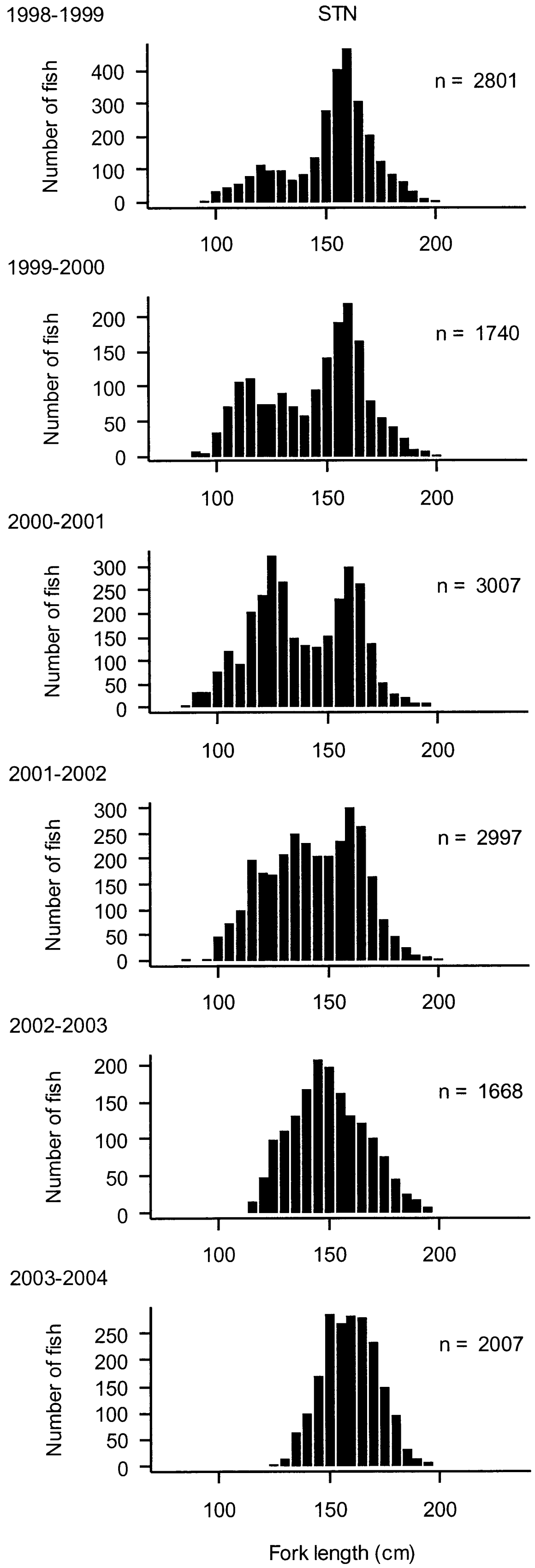




**Figure 32: Cumulative proportional length frequencies for bigeye observed in longline catches for 1998–99 to 2003–04.**

**Figure 31: [Left] Length frequencies, in 5 cm bins, for bigeye measured in observed longline sets for 1998–99 to 2003–04. Sexes combined.**



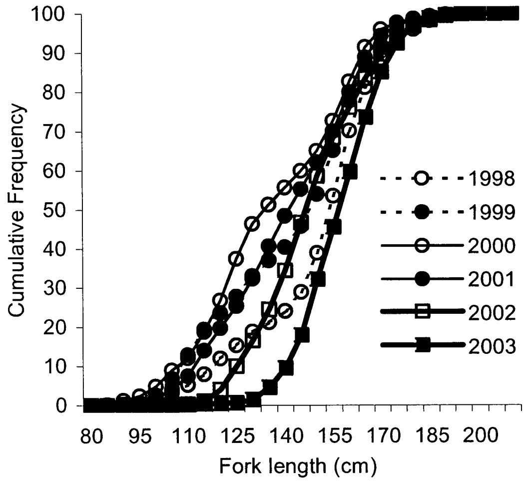
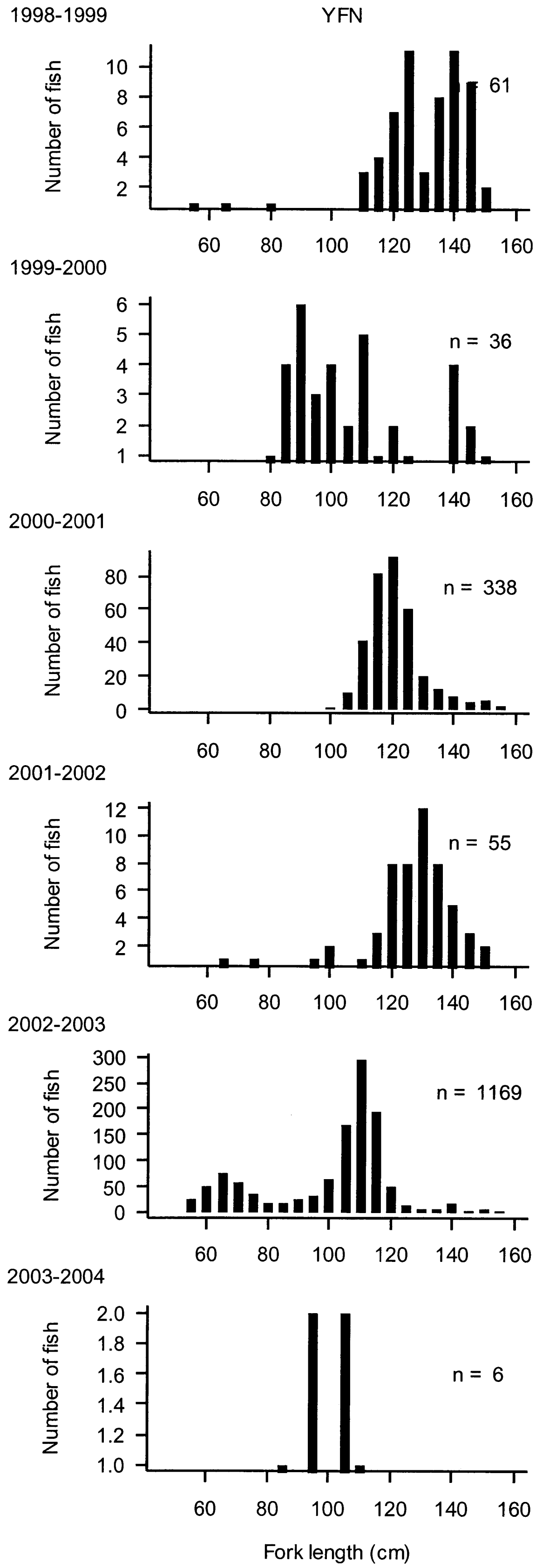




**Figure 34: Cumulative proportional length frequencies for southern bluefin observed in longline catches for 1998–99 to 2003–04.**

**Figure 33: [Left] Length frequencies, in 5 cm bins, for southern bluefin measured in observed longline sets for 1998–99 to 2003–04. Sexes combined.**



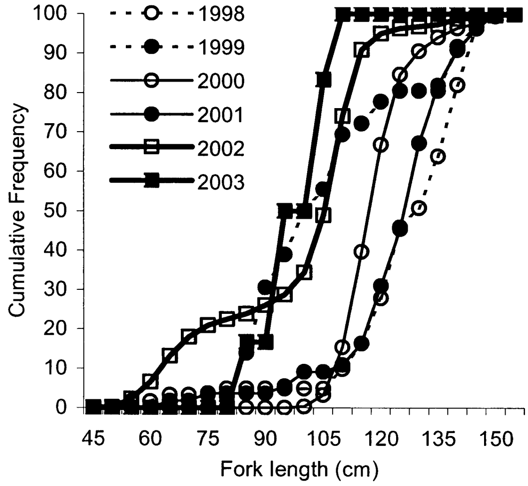




**Figure 36: Cumulative proportional length frequencies for yellowfin observed in longline catches for 1998–99 to 2003–04.**

**Figure 35: [Left] Length frequencies, in 5 cm bins, for yellowfin measured in observed longline sets for 1998–99 to 2003–04. Sexes combined.**

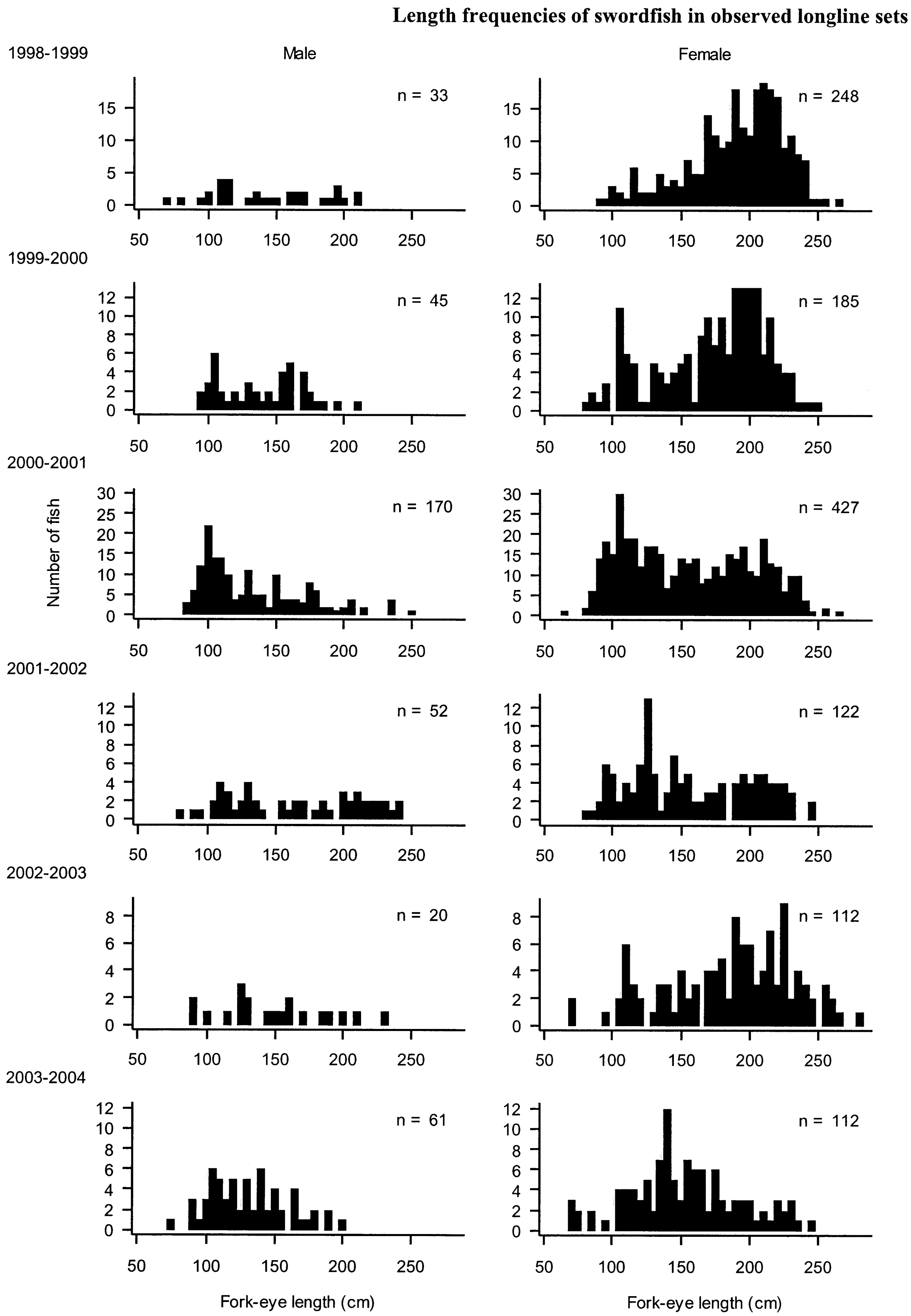



**Figure 37: Length frequencies, in 5 cm bins, for swordfish measured in observed longline sets, by sex, for 1998–99 to 2003–04.**

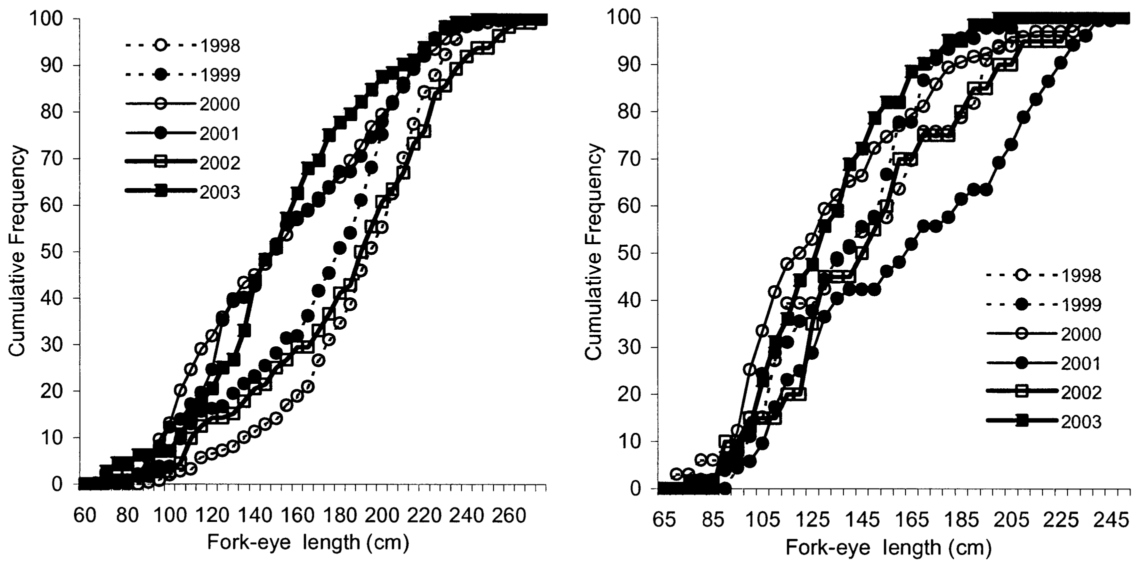



**Figure 38: Cumulative proportional length frequencies for swordfish observed in longline catches, by sex, for 1998–99 to 2003–04.**

**Table 20: Number of vessels on which observers did trips, number of trips observed, number of observed sets and hooks targeted at southern bluefin, or other tuna species, by actual registration type (domestic or charter) in 2002–03 and 2003–04.**

| Fishing year | | 2002-03 | | | | 2003-04 | | |
|---|---|---|---|---|---|---|---|---|
| Reg. type | Domestic | | Charter | | Domestic | | Charter | |
| No. vessels | | 1 | | 6 | | 11 | | 4 |
| No. trips | | 1 | | 8 | | 12 | | 4 |
| Target | STN | Other | STN | Other | STN | Other | STN | Other |
| No. sets | 84 | 0 | 264 | 268 | 334 | 68 | 334 | 16 |
| No. hooks (000's) | 242 | 0 | 809 | 853 | 313 | 80 | 1030 | 41 |

## 2.5.9 Longline fishing practices in 2002–03 and 2003–04

Trips targeted at albacore or bigeye were on average 5 to 6 days long except in the case of the two large charter vessels which retained their catch on board for the entire season in 2002–03. Trip length was about 12–13 days on average in both the southern bluefin fisheries.

The large and charter vessels targeting southern bluefin tuna in the SW fishery set, on average, about 70 km of line and 3200 hooks, at about 4.6 floats per km, and about 10 hooks per float. The reported use of lightsticks was minimal, usually less than 10 sticks reported for the whole set (Figures 39 and 40). Most sets used about 50% fish bait and the balance in squid, but some sets reported 100% squid bait, and in some cases, a small proportion (less than 20% of the hooks) were baited with artificial bait (see Figure 42).

The large and charter vessels targeting other species (mainly albacore in 2002–03), set slightly less backbone, but with a denser spacing of hooks and floats, 5.7 floats per km and 15 hooks per float. This fleet also reported minimal use made of lightsticks, and used 100% fish bait (Figures 39, 40, & 42).

The smaller domestic vessels set on average about 20 km of line at an average of 3.7 floats per kilometre and 15 hooks per float. The use of lightsticks was widespread and variable between vessels (Figures 39 and 40). Bait was usually 50% fish and 50% squid in each set (Figure 42). A breakdown of these statistics for the domestic fleet showed no systematic differences in the number of floats or the number of lightsticks by target fishery (Figure 41).

All else being equal, the number of floats per km might indicate the depth range of the backbone, with a higher density of floats keeping more of the line higher in the water column. However, without any information about the length of the snoods, the distance between float and backbone, and the line tension, very little can be assumed by differences in these statistics.

Line-shooters were used by all vessels in the charter fleet and by 27 of the domestic longliners in 2002–03, increasing to 32 in the following year.

Longline set times centred around midnight across all fleets in both years, with some differences between fleets (Figure 43).

**Length of longline & number of hooks**

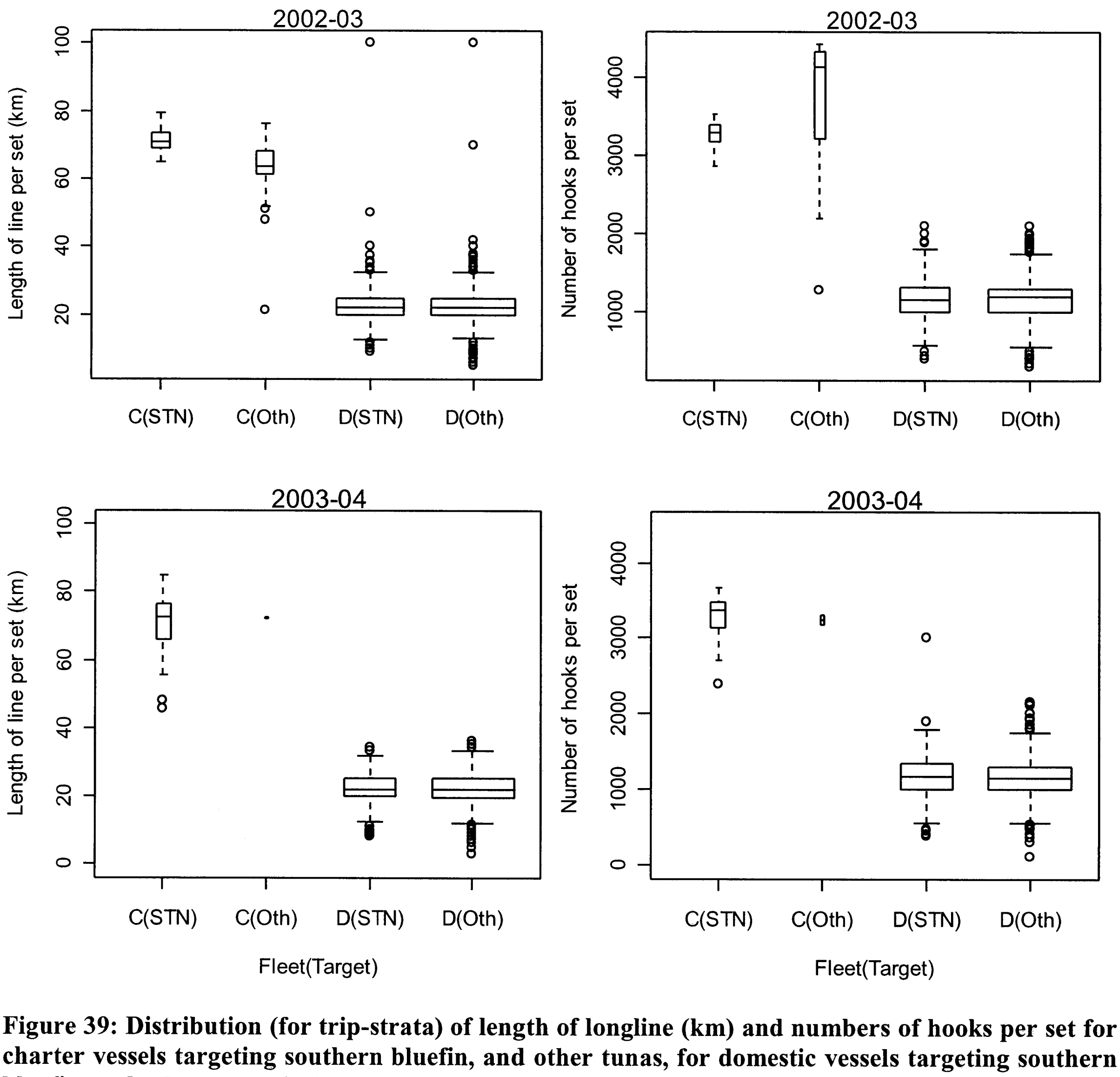



**Figure 39: Distribution (for trip-strata) of length of longline (km) and numbers of hooks per set for charter vessels targeting southern bluefin, and other tunas, for domestic vessels targeting southern bluefin, and other tunas, in 2002–03, and in 2003–04.**

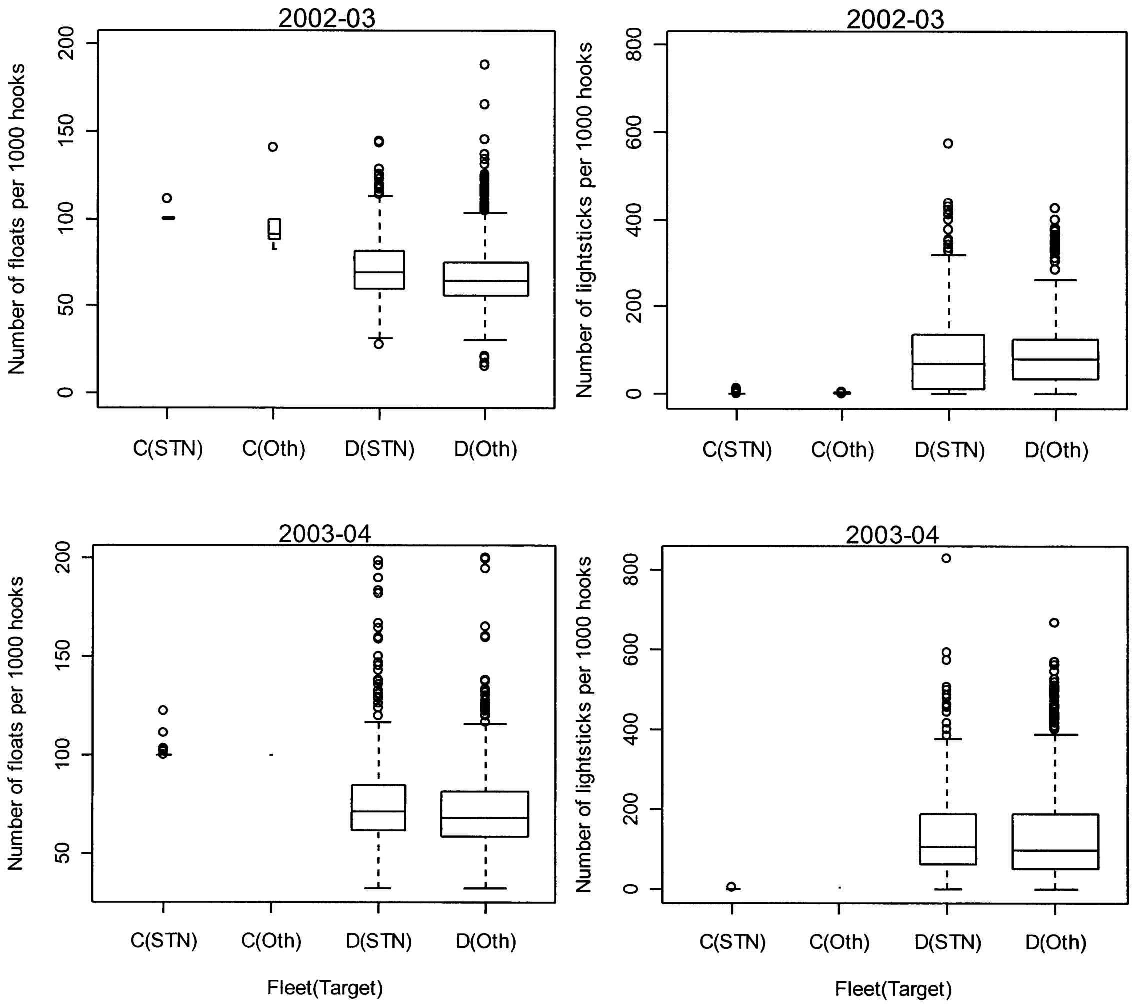



**Figure 40: Distribution (for trip-strata) of number of floats and number lightsticks per 1000 hooks in longline sets for charter vessels targeting southern bluefin, and other tunas, for domestic vessels targeting southern bluefin, and other tunas, in 2002–03, and in 2003–04.**

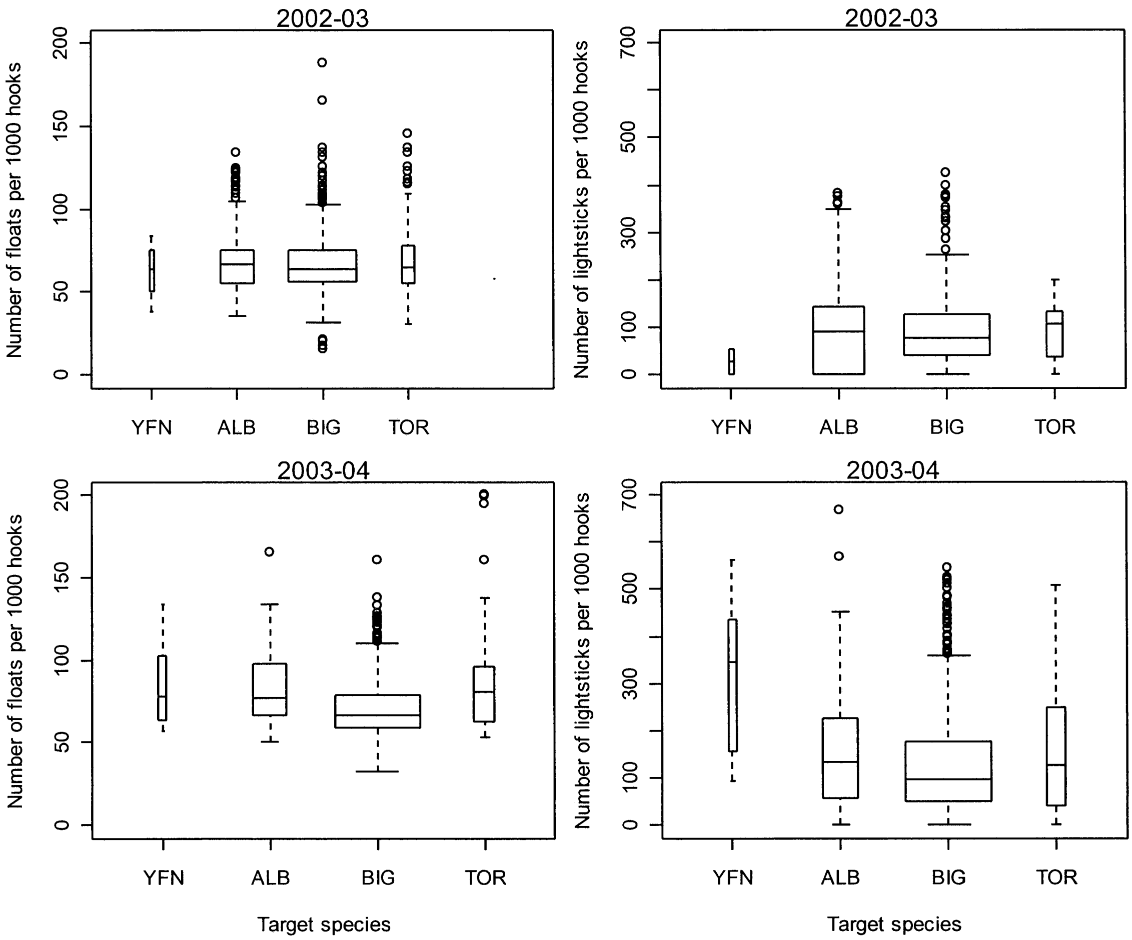



**Figure 41: Distribution (for trip-strata) of numbers of floats and lightsticks per 1000 hooks by target species (other than southern bluefin) in longline sets by domestic vessels in 2002–03 and in 2003–04.**

**Bait type by fleet**

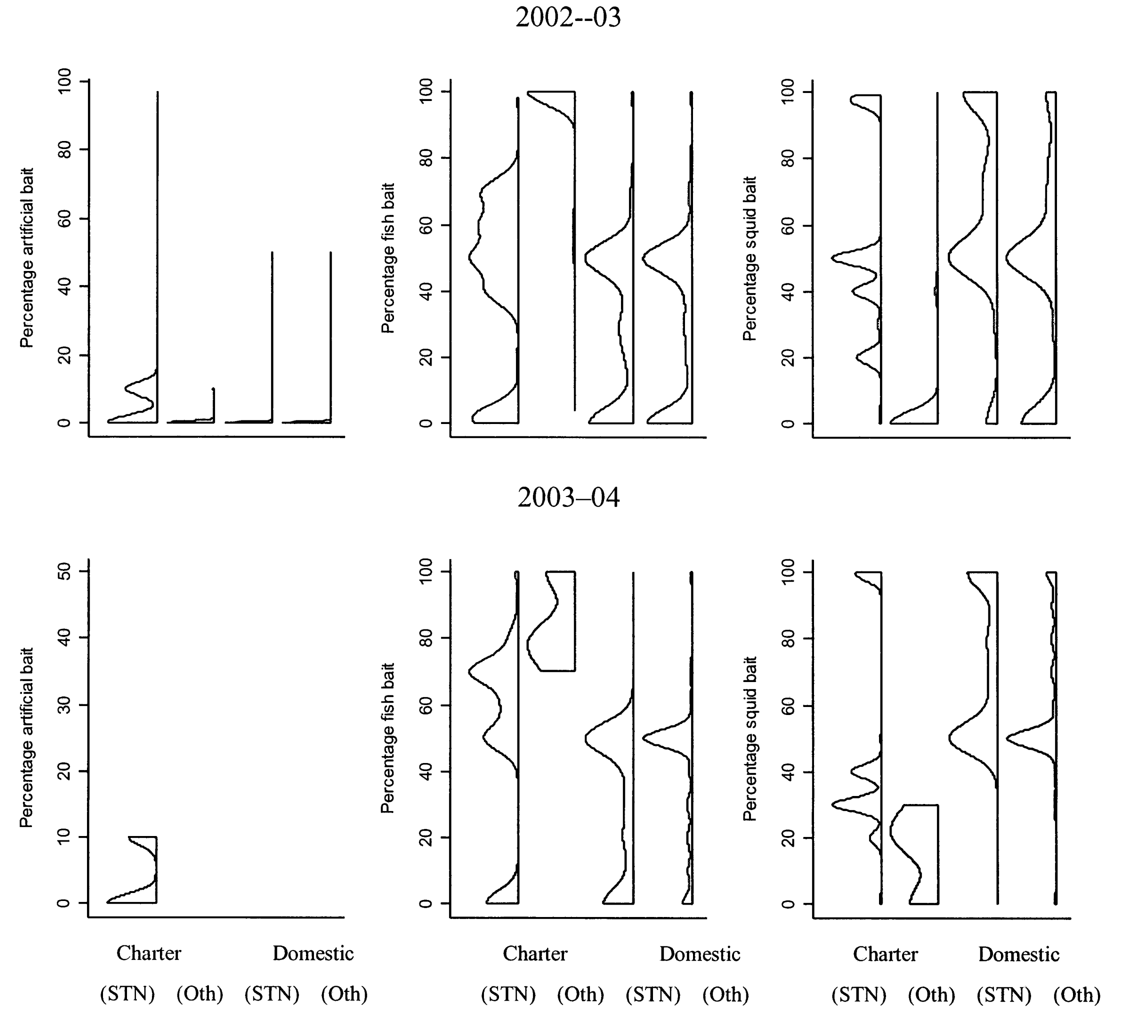



**Figure 42: Distribution of the percent longline hooks baited with artifical bait [left], fish [centre panel] and squid[right panel] in 2002–03 [upper]and in 2003–04[lower] by fleet(target).**

**Set time by fleet**

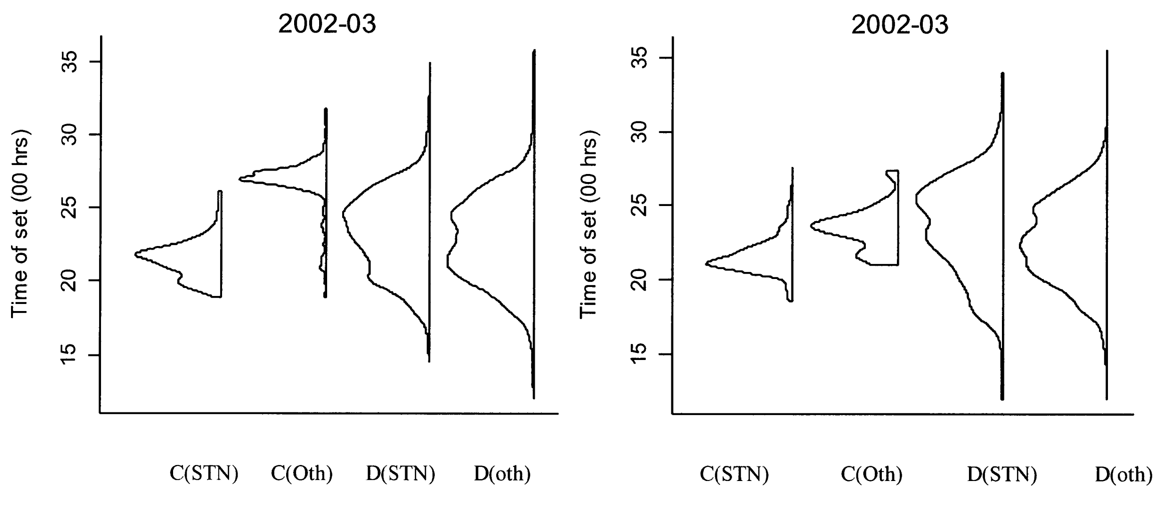



**Figure 43: Distribution of time of set for longline fishing in 2002–03 and in 2003–04 by fleet/target. Vertical axis centred on 2400 h (midnight).**

## 2.6 Troll fisheries for albacore, skipjack, and yellowfin tunas

The troll fleet in 2002–03 consisted of 273 domestically owned and operated vessels between 15 and 25 metres in length, 79 of which also fished by longline during the year. This number was reduced in 2003–04 to 253 vessels, 58 of which also used longline. Practically all (99.9%) of the troll effort is targeted at albacore. The number of vessel-days almost doubled in 1999–2000 to just over 7000, and varied around that level in the subsequent years, peaking in 2002–03 at around 8000 days and dropping back to about 6500 days in 2003–04 (Table 21).

In both 2002–03 and in 2003–04, trolling started in December and finished in May, with about 85% of the albacore taken between January and March (Table 22). The end of trolling coincides with the start of the longline fishery for southern bluefin, and in most years, there was a drift south during the troll season that placed vessels off the west coast of the South Island by early winter; in position for the start of the bluefin fishing (Figure 44 and 45).

Trolling is largely a west coast activity, and the small amount of east coast activity has declined in recent years. In 1998–90 and 1999–2000, the effort off the west coast was largely confined to the higher latitudes, south of about 40° S, but since 2000–01, trolling has started in December and January as far north as 35° S, and then shifted south (Figure 44 and 45).

Albacore is the main tuna species taken, along with small amounts of skipjack (less than 100 tonnes per year), and occasional catches of other tuna species and swordfish (Table 23).

Skipjack catches peaked a little later than albacore in 2002–03, with most caught between March and June, but the actual tonnage was small. There was no obvious seasonal difference between the species in 2003–04 (Table 24).

The pattern of albacore catches is shown for 2002–03 and 2003–04 in Figure 46 and 47, and very closely resembles that of effort. Catch rates of albacore for the two fishing years show very little contrast with latitude or month, declining only after March in 2003–04 through all latitudes (Figure 48 and 49). It does not appear that effort moves south in response to abundance, but the fleet may be monitoring availability almost perfectly, or else the availability of albacore is fairly homogonous, and the fleet is moving south for other reasons, (e.g., as weather permits), in time to participate in the southern bluefin tuna longline fishery starting in April. Catch rates of skipjack are more variable.

It's not clear why these albacore are unavailable to troll after about May, but there may be a change in their depth distribution. They are not likely to be the same fish that are caught in large numbers by surface longline off the east coast after February, as those are much larger fish, closer to 10 kg, whereas these troll-caught albacore average closer to 5 kg each.

**Table 21: Total troll effort (thousands of hooks) for the fishing years 1998–99 to 2002–03. Target species is almost entirely albacore.**

| Fishing year | Hooks (x1000) | Vessel-days |
|---|---|---|
| 98/99 | 41.2 | 3 552 |
| 99/00 | 85.0 | 7 199 |
| 00/01 | 99.5 | 8 265 |
| 01/02 | 95.4 | 7 951 |
| 02/03 | 103.5 | 8 008 |
| 03/04 | 87.6 | 6 517 |

**Table 22: Seasonal distribution of troll effort (percent of annual effort) in 2002–03 and 2003–04. Target species is almost entirely albacore. (0 is less than 1% of annual effort, - is no recorded effort).**

| | % of vessel-days | |
|---|---|---|
| Month of | 2002–03 | 2003–04 |
| Oct | - | - |
| Nov | 0 | 0 |
| Dec | 5 | 9 |
| Jan | 25 | 40 |
| Feb | 31 | 18 |
| Mar | 24 | 26 |
| Apr | 12 | 6 |
| May | 2 | 1 |
| Jun | 0 | 0 |
| Jul | 0 | 0 |
| Aug | - | 0 |
| Sep | - | - |
| Annual total (days) | 8 008 | 6 517 |

**Table 23: Total landed greenweight of troll catch (t) by species, for the fishing years 1998–99 to 2002–03. Totals scaled to LFRRs or MHRs. (0 is less than 1t, - is no recorded catch).**

| Fishing | Landed wholeweight (t) | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| year | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish | catch (t) |
| 98/99 | 2 033 | 0 | 24 | - | 4 | 1 | - | 2 061 |
| 99/00 | 3 336 | 2 | 37 | - | 2 | 3 | 0 | 3 380 |
| 00/01 | 3 431 | 1 | 71 | - | 0 | 10 | 1 | 3 514 |
| 01/02 | 3 255 | 0 | 47 | - | 0 | 1 | 1 | 3 304 |
| 02/03 | 4 305 | 1 | 14 | 0 | 0 | 1 | 1 | 4 322 |
| 03/04 | 4 113 | 4 | 31 | 7 | 2 | 7 | 0 | 4 163 |

**Table 24: Seasonal distribution (percent of annual landings) of troll catch in 2002–03 and 2003–04 by species. Total annual catch is scaled to MHR totals. Target species is almost entirely albacore. (0 is less than 1% of annual effort, - is no recorded catch).**

| | 2002–03 | | 2003–04 | |
|---|---|---|---|---|
| Month of | Albacore | Skipjack | Albacore | Skipjack |
| Oct | - | - | - | - |
| Nov | 0 | 0 | 0 | 0 |
| Dec | 20 | 2 | 10 | 19 |
| Jan | 48 | 19 | 40 | 46 |
| Feb | 15 | 46 | 18 | 15 |
| Mar | 17 | 138 | 26 | 17 |
| Apr | 3 | 32 | 6 | 3 |
| May | 0 | 7 | 1 | 0 |
| Jun | 0 | 0 | - | - |
| Jul | - | 0 | - | - |
| Aug | - | - | - | - |
| Sep | - | - | - | - |
| Annual total (t) | 4 305 | 14 | 4 113 | 31 |

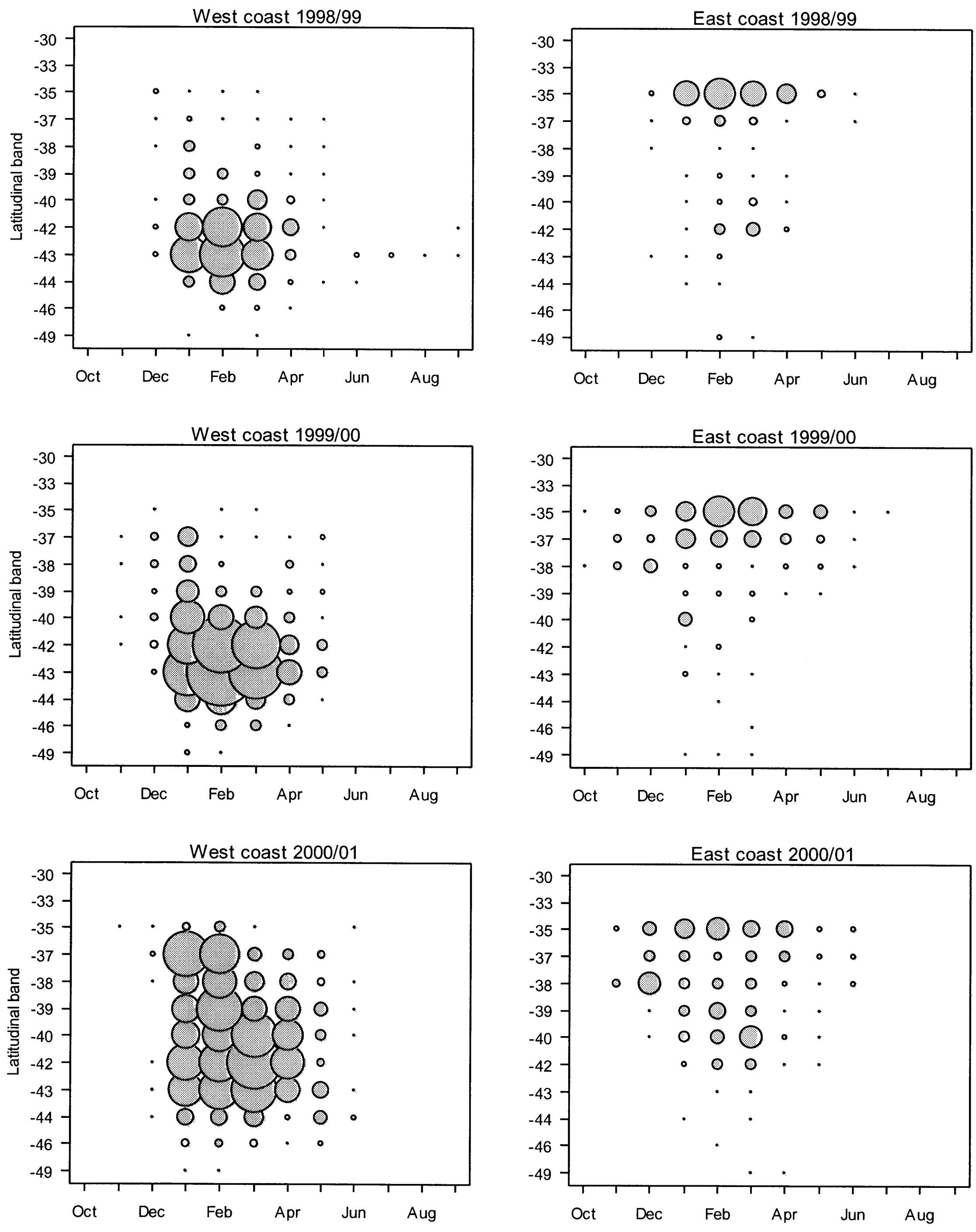



**Figure 44: Relative troll effort (days), for the fishing years 1998–99 to 2000–01, by latitude, season, down the west coast [left] and the east coast [right] of New Zealand. Target species is mainly albacore The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

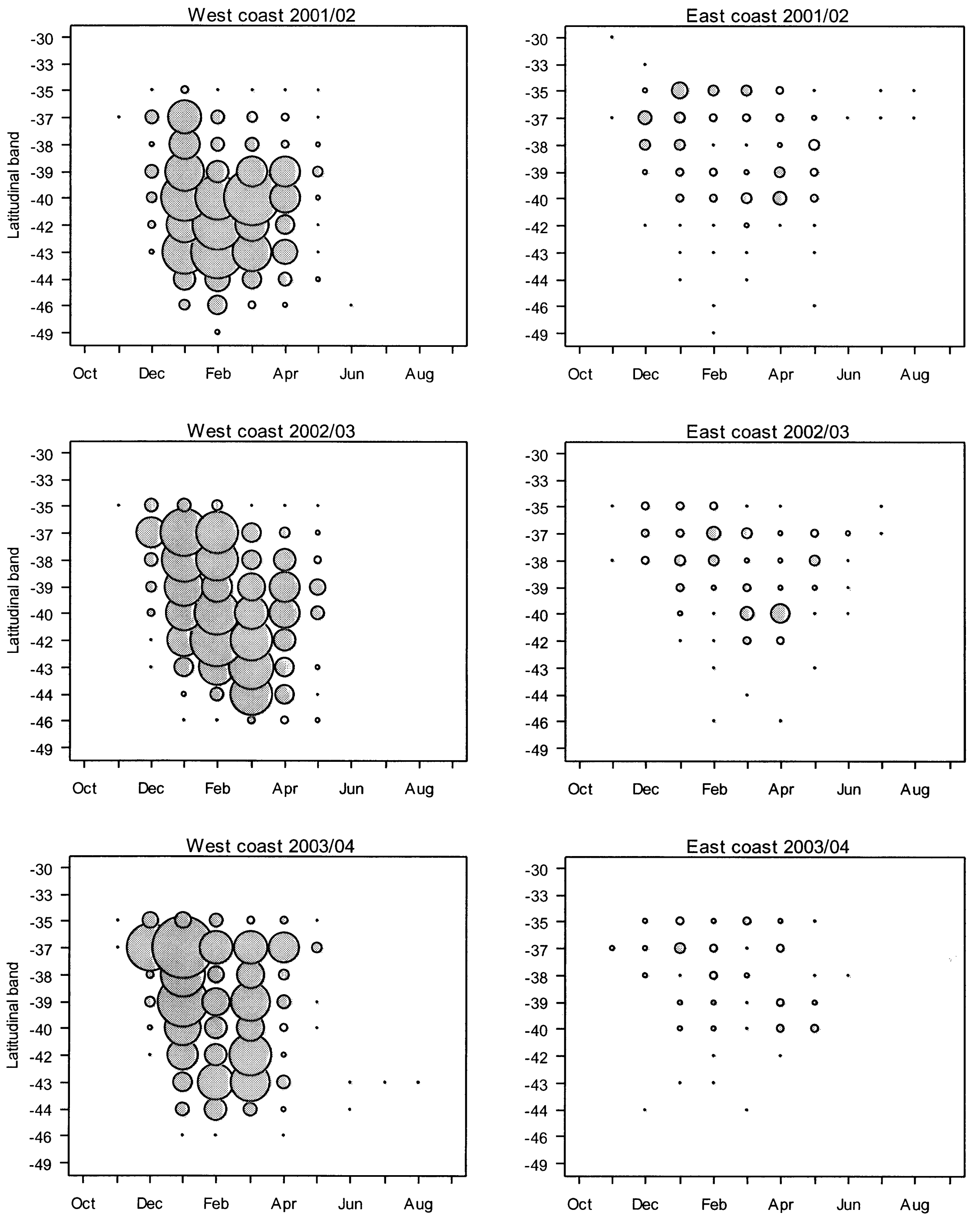



**Figure 45: Relativel troll effort (hook-days), for the fishing years 2001–02 to 2003–04, by latitude, season., down the west coast [left] and the east coast [right] of New Zealand. Target species is mainly albacore. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

Troll catches 2002–03

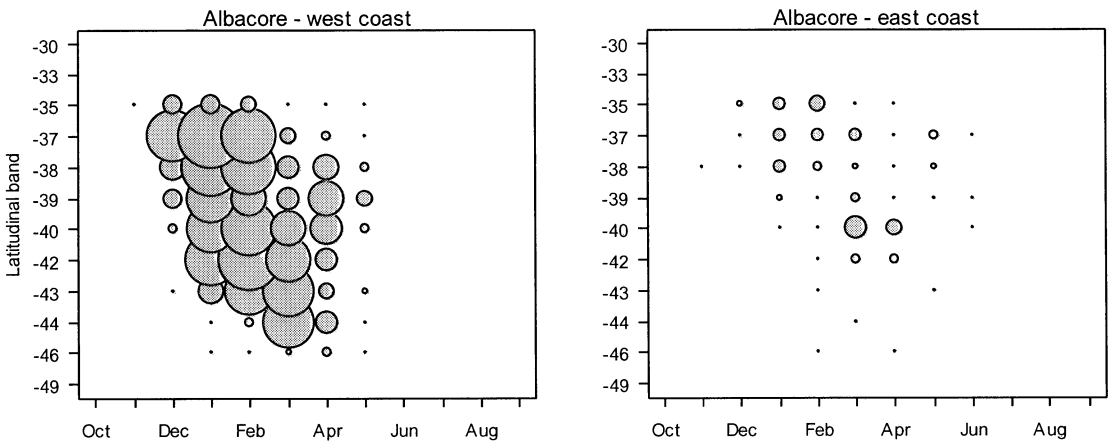



**Figure 46: Total troll catch (landed wholeweight) of albacore in 2002–03 by latitude, season, down the west coast [left] and the east coast [right] of New Zealand. Target species is mainly albacore. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

Troll catches 2003–04

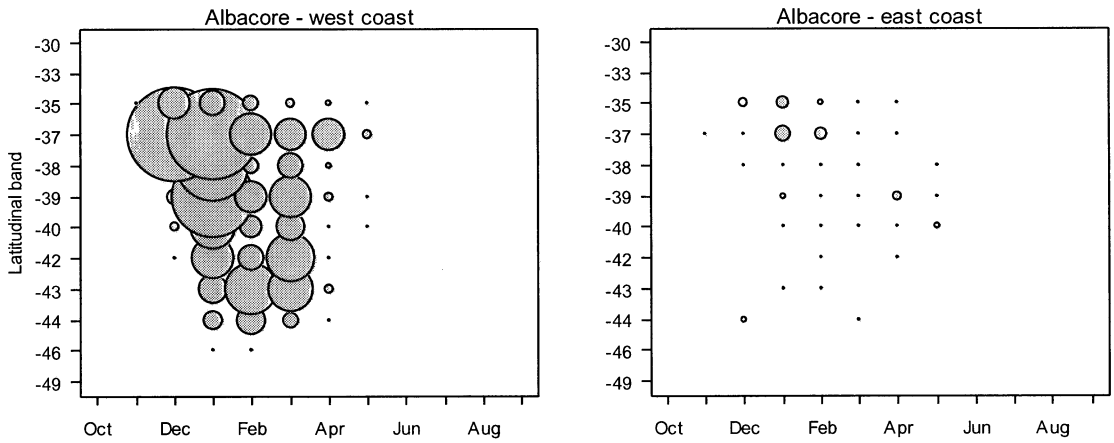



**Figure 47: Total troll catch (landed wholeweight) of albacore in 2003–04 by latitude, season, down the west coast [left] and the east coast [right] of New Zealand. Target species is mainly albacore. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

**Troll catch-rates 2002–03**

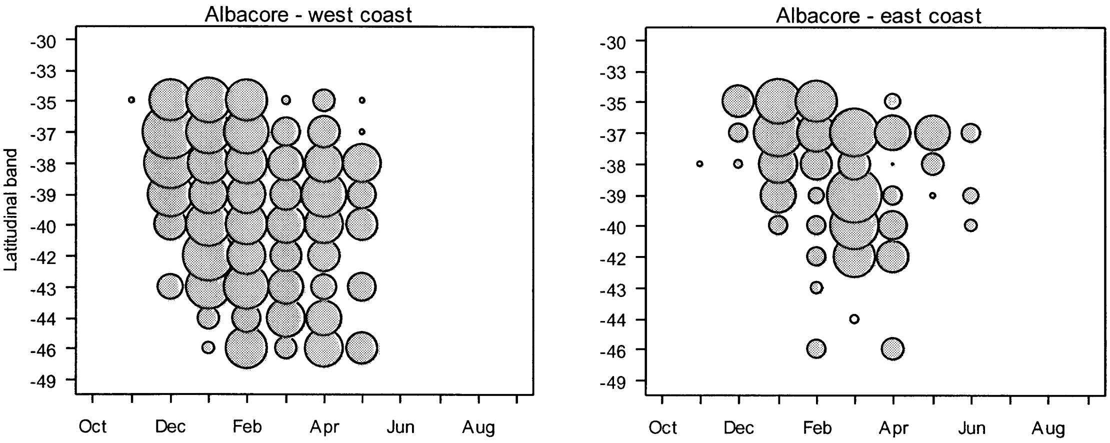



**Figure 48: Troll CPUE (number of fish per vessel-day) of albacore tuna, in 2002–03 by latitude, season, down the west coast [left] and the east coast [right] of New Zealand. Target species is mainly albacore. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

**Troll catch-rates 2003–04**

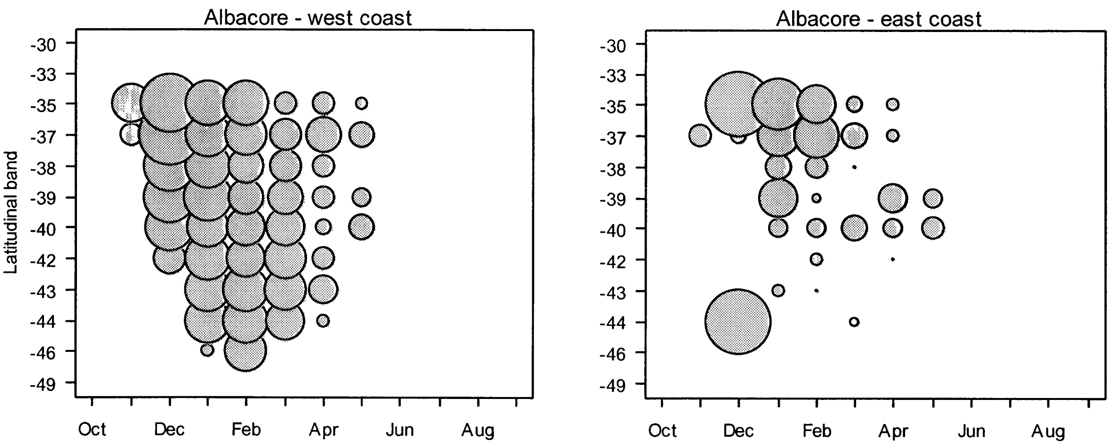



**Figure 49: Troll CPUE (number of fish per vessel-day) of albacore tuna, in 2003–04 by latitude, season, down the west coast [left] and the east coast [right] of New Zealand. Target species is mainly albacore. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

## 2.6.1 Nominal CPUE in the troll fishery

Practically all troll effort is targeted at albacore and is effective for that species. There are many choices for the measure of effort; number of hooks, hook-hours, etc., but they are notoriously badly recorded. For example, the distribution of number of hooks reported for this fishing method shows a node at around 25, which is not likely for small troll vessels and indicates that instructions to record the "maximum number of hooks/lines used at any one time" are not being followed. Also, the effectiveness of fishing by this method is as much a function of the number and experience of the crew as of the number of lines they fish (N. Smith, MFish, pers. comm.). Nominal CPUE of albacore (ratio of annual catch : annual effort) is therefore calculated over all troll effort, as vessel-days fished, and is presented as a short series in Figure 50.

Effort in this fishery more than doubled from 1998–99 to 2000–01, peaking in that year at over 8000 days fished. It then declined in 2003–04 by almost 20%. Nominal CPUE declined to a low of about 80 fish per day in 2000–01 and has since recovered to over 120 fish per day in an almost reciprocal pattern to effort (Figure 50). This may reflect the influx of less experienced fishers and crew during the later years.

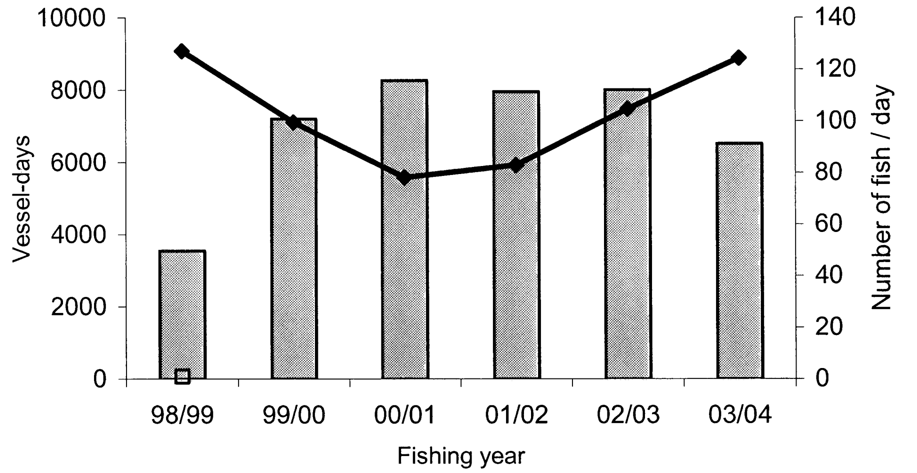



**Figure 50: Albacore nominal CPUE and total effort (vessel-days) in targeted trolling, for fishing years 1998–99 to 2002–03.**

## 2.7 Summer purse-seine fishery for skipjack

The purse-seine fleet that targeted tuna inside the New Zealand EEZ in 2002–03 consisted of seven domestically owned and operated vessels. In 2003–04 this increased to nine. The increased catch of skipjack in 2003–04 was partly due to the increased participation inside the EEZ of two large class 6 seiners, but not entirely, as every purse-seine vessel reported significantly increased catches compared with the previous year (Figure 51).

The number of sets peaked at over 700 in 1999–2000, returned to previous levels of about 500 sets per year for the following three years, and peaked again in 2003–04 at more than 800 sets (Table 25). Likewise, catches of skipjack doubled in 1999–2000 and in 2003–04 compared to the previous year in each case. Practically all (99.9%) the purse-seine effort is targeted at skipjack, and skipjack is the main tuna species taken, along with small amounts of albacore (less than 5 t per year), and only very occasional catches of yellowfin (less than 1 tonne per year, and none reported in 2002–03 (Table 27).

Purse-seine has historically been largely an east coast activity, but effort in 2002–03 and 2003–04 shifted to the west coast, later in the season, with almost equal effort expended off both coasts in those years. In 2002–03, purse-seining started in December and finished in April, with almost 80% of the skipjack taken in February. In 2003–04, the season extended into May (Table 26, Figure 52 and 53).

The pattern of skipjack catches resembles that of effort, with the main catches off the east coast occurring earlier and further north than those made off the west coast. Catches are not described in any further detail. Catch rates in 2002–03 show some of the biggest hits to have occurred off the west coast in April (Figure 54).

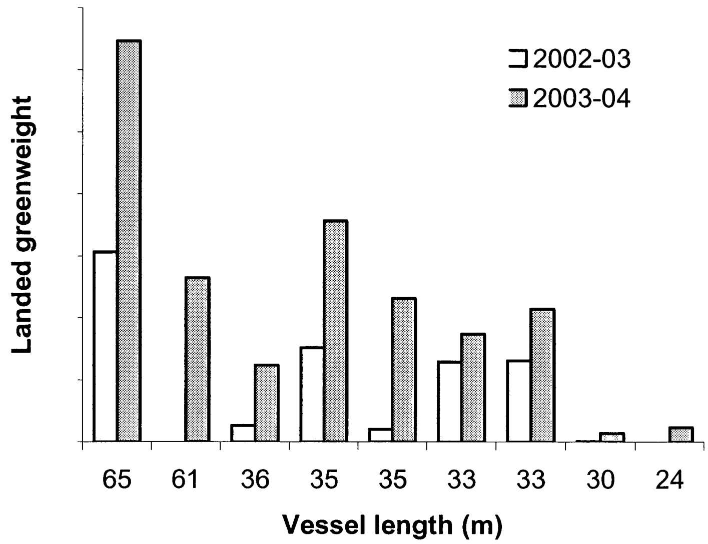



**Figure 51: Comparison of the performance and make-up of the purse-seine fleet for the two fishing years 2002–03 and 2003–04. Catch of skipjack (y-axis intentionally blank) in each year for individual vessels, in order of overall length.**

**Table 25: Total purse-seine effort (number of sets) for the fishing years 1998–99 to 2003–04.**

| Fishing year | Number of Sets |
|---|---|
| 98/99 | 440 |
| 99/00 | 709 |
| 00/01 | 515 |
| 01/02 | 452 |
| 02/03 | 495 |
| 03/04 | 839 |

**Table 26: Seasonal distribution of purse-seine effort targeted at tunas in 2002–03 and in 2003–04. (0 is less than 1% of annual effort, - is no reported effort).**

| Month of | % of annual sets | |
|---|---|---|
| Fishing year | 2002–03 | 2003–04 |
| Oct | - | - |
| Nov | 0 | - |
| Dec | - | 2 |
| Jan | 26 | 19 |
| Feb | 37 | 5 |
| Mar | 25 | 34 |
| Apr | 11 | 33 |
| May | - | 8 |
| Jun | - | 0 |
| Jul | - | - |
| Aug | - | - |
| Sep | - | - |
| Annual total (sets) | 495 | 839 |

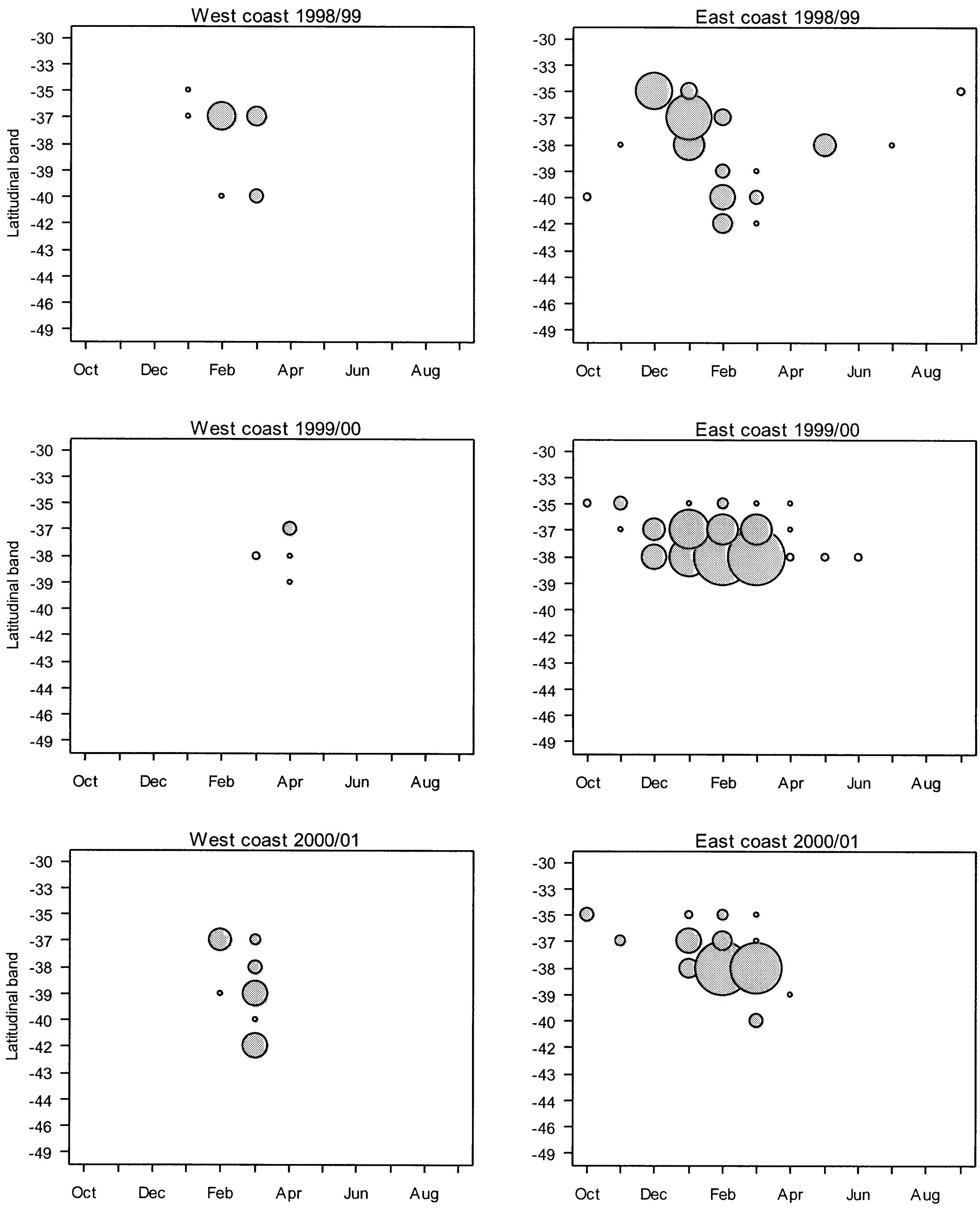



**Figure 52: The spatial and temporal distribution of purse-seine effort (sets) in the EEZ in 1998–99, 1999–2000, and 2000–01, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

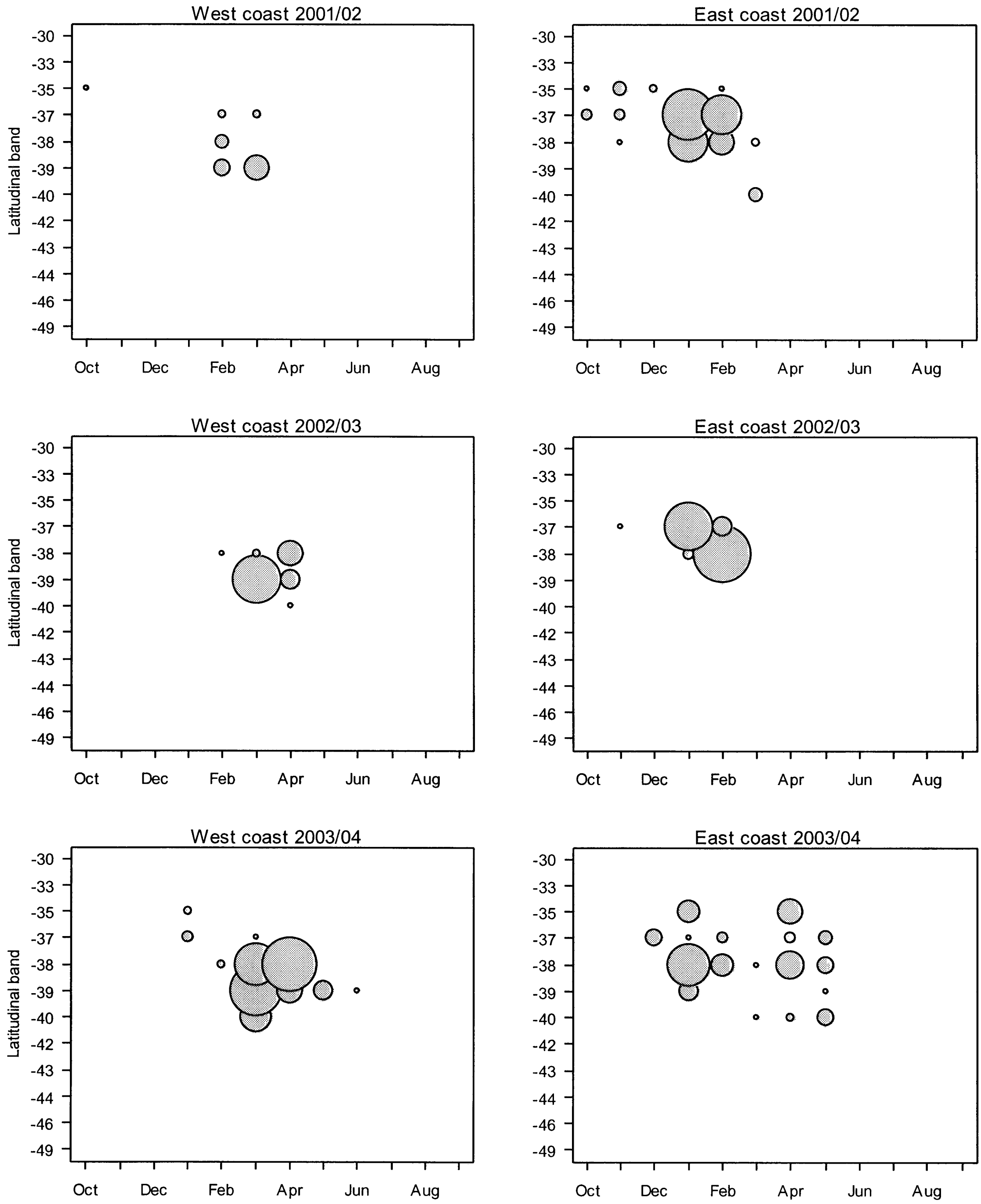



**Figure 53: The spatial and temporal distribution of purse-seine effort (sets) in the EEZ in 2001–02, and 2003–04, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

**Table 27: Total landed greenweight of purse-seine catch (t) by species, for the fishing years 1998-99 to 2002-03. Totals scaled to LFRRs or MHRs. (0is less than 1t, - is no recorded catch).**

| Fishing | Landed wholeweight (t) | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| year | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish | catch (t) |
| 98/99 | 1 | - | 5 313 | - | - | 0 | - | 5 314 |
| 99/00 | 0 | - | 10 517 | - | - | 0 | - | 10 518 |
| 00/01 | 0 | - | 3 935 | - | - | 0 | - | 3 936 |
| 01/02 | 0 | - | 3 519 | - | - | 0 | - | 3 520 |
| 02/03 | 3 | - | 3 839 | - | - | - | - | 3 842 |
| 03/04 | 3 | 0 | 9 524 | - | - | 0 | - | 9 528 |

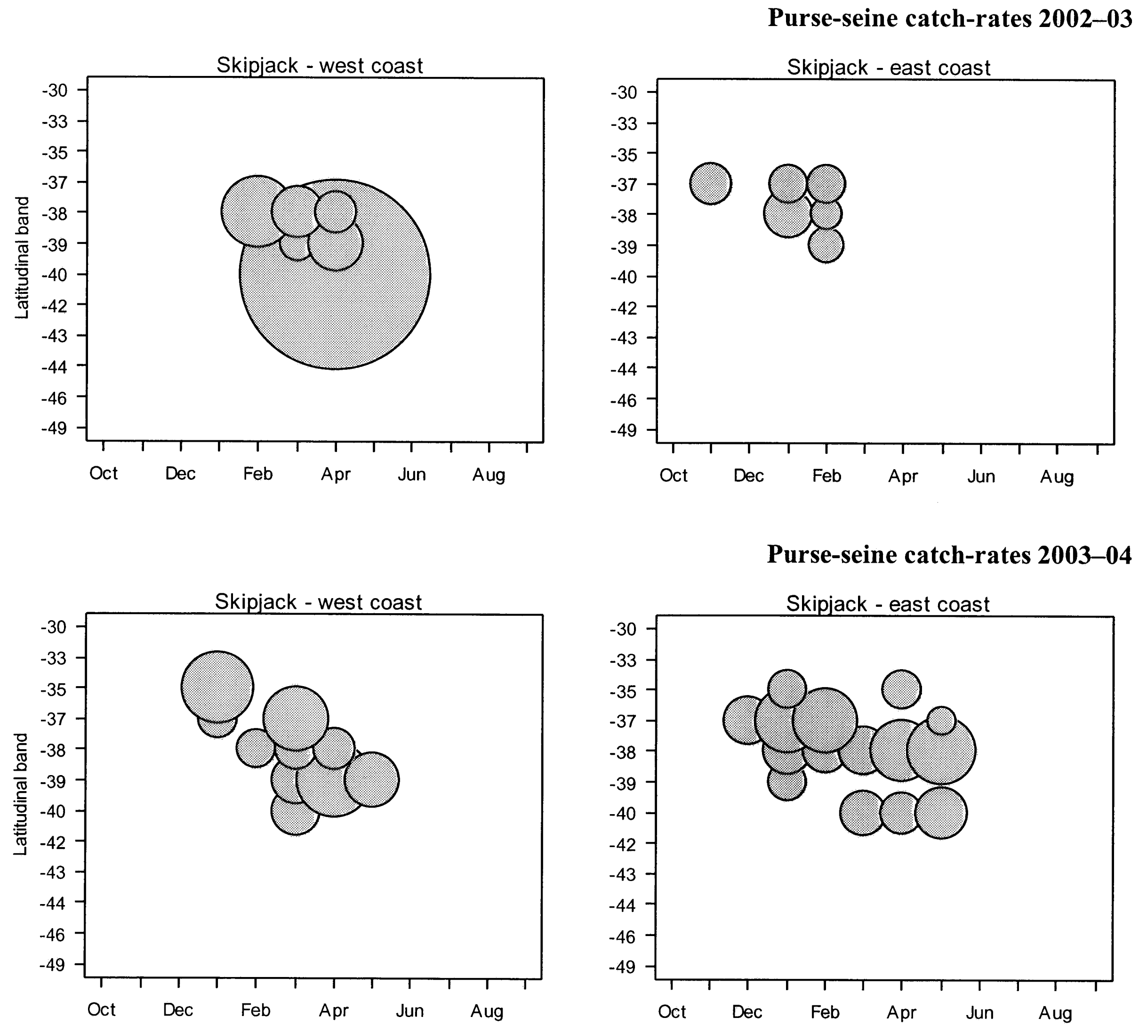



**Figure 54: Purse-seine CPUE (tonnes of fish per set) of skipjack tuna in 2002–03 and 2003–04 by latitude, season, down the west coast [left] and the east coast [right] of New Zealand. Target species and catch is mainly skipjack. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas.**

### 2.7.1 Nominal CPUE in the purse-seine fishery

Purse-seine catches (and therefore CPUE) are reported in weight rather than numbers of fish. A short series of nominal CPUE calculated across all purse-seine effort targeted at skipjack is given in Figure 55. Purse-seine is not a useful method by which to monitor CPUE because it is entirely targeted on schools. Also, the net size varies with the class of vessel so that the measure catch-per-set is not likely to be an equivalent measurement across vessels.

CPUE has varied between about 8 and 16 tonnes per set since 1998–99, peaking in 1999–2000 and in 2003–04, the years when increased participation by large seiners was reported in the EEZ. The higher CPUE may in part be a function of the larger nets deployed by class 6 seiners in those years that they were present longer in the zone.

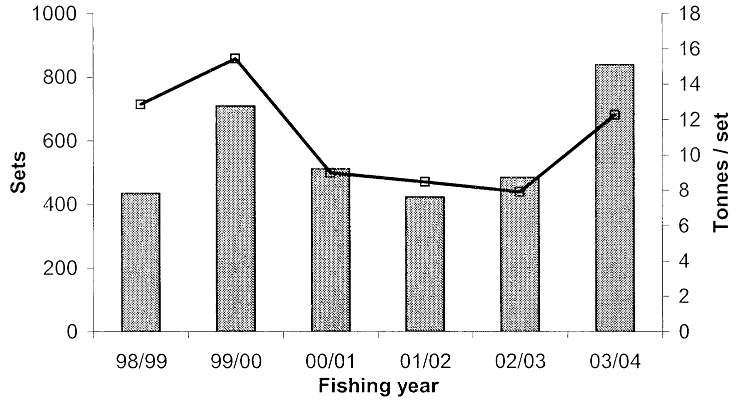



**Figure 55: Purse-seine effort (sets) and annual catch rates for skipjack, for fishing years 1998–99 to 2002–03, in all targeted sets.**

## 2.8 Winter handline fishery for bluefin tunas

A winter handline fishery for southern bluefin has, in the past, been described as a significant fishery in New Zealand waters, accounting for between 6 and 95 t of southern bluefin annually during the 1990s (Murray et al. 2004). It has been effectively non-existent since 2001, but in 2003–04, 1.3 t of southern bluefin, and more than 31 t of Pacific bluefin was reported caught by this method (Table 28). This may be a new feature, or it may indicate that the catch was not correctly identified in the past.

The handline catches of Pacific bluefin in 2003–04 came from off the west coast of the South Island, almost as far south as 43° S during July to September, after the catch limit for southern bluefin had been reached (Figure 56).

Catch by this method was poorly reported on CELRs, with only about half reported in numbers of fish. The landed catch and the estimated catch were in agreement over species identification, and there were also catches of Pacific bluefin taken in targeted longline sets in the same latitude/month.

Small catches of other tuna species are also taken by handline, usually as an occasional activity of longline vessels

**Table 28: Total landed greenweight of handline catch by species for the fishing years 1998-99 to 2003–04. Totals scaled to LFRRs or MHRs. 0.0 is less than 100 kg, - is no reported catch)**

| Fishing | Landed wholeweight (t) | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| year | Albacore | Bigeye | Skipjack | P. bluefin | S. bluefin | Yellowfin | Swordfish | catch (t) |
| 98/99 | 0.1 | - | - | - | 1.7 | - | - | 1.8 |
| 99/00 | - | - | - | - | 0.2 | 0.0 | - | 0.3 |
| 00/01 | 0.2 | - | 0.0 | | 0.0 | - | - | 0.3 |
| 01/02 | 1.2 | - | - | - | - | - | - | 1.2 |
| 02/03 | 0.3 | - | 0.0 | - | 0.2 | - | - | 0.4 |
| 03/04 | 0.1 | - | - | 31.3 | 1.3 | - | 0.0 | 32.7 |

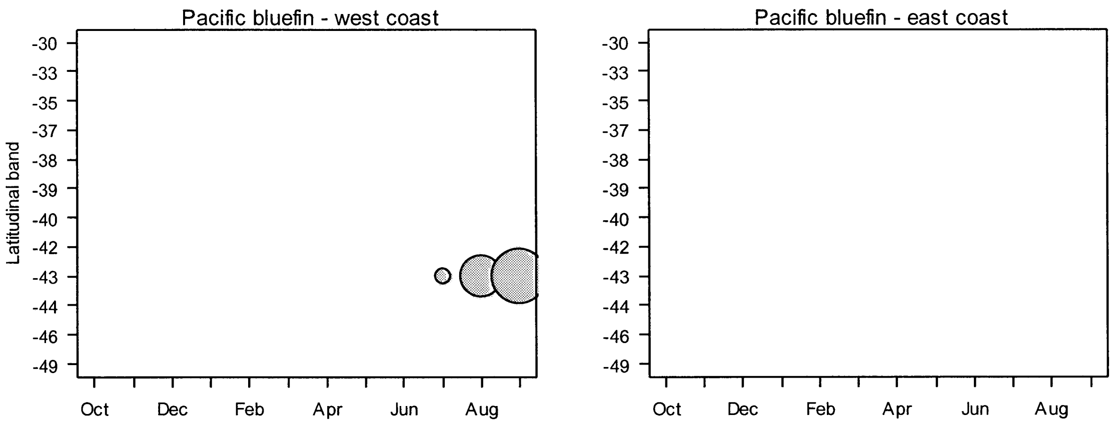



**Figure 56: The spatial and temporal distribution of handline effort targeted at Pacific bluefin in 2003–04, down the west coast [left] and the east coast [right] of New Zealand. The vertical axis labels approximate the lower boundary of latitudinal bands corresponding to statistical reporting areas. (Right hand panel intentionally blank).**

## 2.9 High seas fisheries

Fishing outside the EEZ by New Zealand flagged vessels is reported variously on High Seas Tuna Longlining or HS Catch Effort Landing forms, or, in the case of large purse-seiners on FFA logbooks that are provided directly to the Secretariat of the Pacific Community (SPC).

Some high seas catch effort is included in the MFish database *warehou*, but it is not complete. Landings information is commonly unavailable for fish sold outside the EEZ, but as most of the fishing is by purse-seine (for which catch is well estimated in weight) that is not a problem.

It does mean, however, that no trip number is assigned to those catch effort records, and they are therefore not uploaded into the secondary research database *tuna*.

Copies of the SPC logbooks are held by the MFish Data Manager NIWA, and are being entered into a dedicated database, but these data were not available at time of writing.

Summaries prepared for the Scientific Committee of the newly established Western and Central Pacific Fisheries Commission describe the scale of these catches, for calendar year, at around 15 500 t of skipjack and about 3000 t of yellowfin in 2003, declining to just under 11 000 t of skipjack, and 2500 t of yellowfin in 2004 (Kendrick et al. 2005).

## 3. RECREATIONAL AND CHARTER GAME FISHERIES

There are no quantitative estimates of recreational catch of tunas as they are not included among species monitored in the National Marine Recreational Fishing Surveys.

The main species caught by recreational fishers will be skipjack and albacore, but fishing clubs are unlikely to keep comprehensive statistics for these species (J. Holdsworth, pers comm.), which are often used for bait. New Zealand recreational catches of these species will be extremely low in terms of overall stock removals (Sullivan et al. 2005).

Yellowfin tunas are prized gamefish and tag and release is encouraged for this species. A summary of fish caught and tagged or recaptured by members of national gamefishing clubs is provided in reports of New Zealand billfish and gamefish tagging (Holdsworth & Saul 2004, 2005), but numbers of yellowfin tuna are very low in every year.

## 4. MARKETING OF NEW ZEALAND CAUGHT TUNAS

The total export value of tunas increased from almost NZ$32 million in 2002–03 to almost NZ$ 37 million in 2003–04. Most of the increase was accounted for by the larger volume of skipjack caught in that year, combined with a slightly higher price per kilo achieved for skipjack on average (across processed types and destinations). Volume and price of albacore was slightly lower in 2003–04 compared with the previous year. The higher value species, bluefin and bigeye, achieved higher prices on average in 2003–04.

Detailed export statistics are available from the Seafood Industry Council based on data from Statistics New Zealand. Price achieved is available by processed type and by country of destination. This information is condensed to an average price per kilo by species and the total price achieved for each species and processed type is given in Table 29.

The destination for each species/processed type is also described in abbreviated form in Table 30. Some countries importing small proportions (less than 1% by weight) of any processed type have been excluded, and some nations (e.g., Pacific Islands) have been combined.

Species differentiation is not perfect. Swordfish is partly accounted for in the "Other" category, but the balance is reported elsewhere as "fish" and not included in this summary. Pacific bluefin and butterfly tuna are also included in the "Other" category, and a decreasing amount of product is still identified as northern bluefin. The totals agree reasonably well with landed wholeweight for each year, though there were 80 t more yellowfin exported than was caught in 2003–04.

On average, revenue from these fish species was maintained, though prices vary enormously with destination. The main destination, and the country from which highest prices were generally obtained for most species, was Japan, which imported most of the chilled or frozen whole product. The exceptions are skipjack, which was sent for canning in Australia, Iran, or Thailand, and albacore, which was sent for canning in American Samoa, Spain, and Thailand.

**Table 29: Equivalent wholeweight of tunas exported from New Zealand, by species and processed type. Average value per kg achieved for the year, across processed types and destinations. New Zealand FOB -Free on board. The value of export goods, including raw materal, rocessing, packaging, storage and transportation up to the point where goods are about to leave the country. Export statistics from the Seafood Industry Council ( www.seafood.co.nz ) based on data from Statistics New Zealand.**

| | | 2002-03 | | 2003-04 | |
|---|---|---|---|---|---|
| Species | Processed state | Equivalent Wholeweight (kgs) | Average FOB $NZ per kg | Equivalent Wholeweight (kgs) | Average FOB $NZ per kg |
| Skipjack | Frozen whole | **3 605 080** | **$ 1.07** | **9 812 473** | **$ 1.13** |
| Albacore | Chilled Headed & gutted | - | | 419 | |
| | Chilled whole | 56 381 | | 40 875 | |
| | Frozen whole | 5 748 442 | | 4 747 843 | |
| | **Total albacore** | **5 804 823** | **$ 3.06** | **4 789 137** | **$ 2.78** |
| Bluefin (Southern) | Chilled headed & gutted | 22 689 | | 33 374 | |
| | Chilled.other form | 75 769 | | 123 485 | |
| | Chilled whole | 123 097 | | 14 945 | |
| | Frozen fillets | - | | 831 | |
| | Frozen whole | 73 683 | | 141 454 | |
| | **Total southern bluefin** | **295 238** | **$ 23.43** | **314 089** | **$ 24.09** |
| Bigeye | Chilled Headed & gutted | 49 349 | | 78 740 | |
| | Chilled.other form | 34 831 | | 125 983 | |
| | Chilled whole | 25 481 | | 15 083 | |
| | Frozen whole | 7 185 | | 7 290 | |
| | **Total bigeye** | **116 846** | **$ 12.89** | **227 096** | **$ 15.47** |
| OTHER | Chilled fillets | - | | 594 | |
| Pac. Bluefin | Chilled Headed & gutted | 7 465 | | 24 228 | |
| Butterfly | Chilled.other form | 69 181 | | 5 852 | |
| Swordfish | Chilled whole | 4 151 | | 11 173 | |
| | Frozen fillets | 55 780 | | 16 460 | |
| | Frozen headed & gutted | - | | 47 540 | |
| | Frozen whole | 2 060 | | 1 506 | |
| | Processed cans jars | 4 | | 44 | |
| | Processed packed | 3 092 | | 676 | |
| | **Total (Other tunas)** | **141 733** | **$ 6.62** | **108 073** | **$ 6.24** |
| Yellowfin | Chilled headed & gutted | 5 156 | | 8 249 | |
| | Chilled.other form | 584 | | 1 125 | |
| | Chilled whole | 4 796 | | 2 864 | |
| | Frozen whole | 180 | | 36 200 | |
| | Processed cans jars | 32 051 | | 67 558 | |
| | **Total yellowfin** | **42 767** | **$ 7.42** | **115 996** | **$ 3.82** |
| Bluefin (Northern) | Chilled headed & gutted | 1 348 | | 132 | |
| | Chilled.other form | 3 929 | | 3 095 | |
| | Chilled whole | 9 229 | | 4 174 | |
| | Frozen whole | 18 629 | | - | |
| | **Total Pacific bluefin** | **33 135** | **$ 19.29** | **7 401** | **$ 19.07** |
| | **Total NZ** | **10 039 tonnes** | **$ 31,926,693** | **15 374 tonnes** | **$ 36,715,532** |

**Table 30: Final market destinations of catches by species and processed type. The difference in percent between equivalent wholeweight exprted in 2003-04 compared to 2002-03. Export statistics from the Seafood Industry Council based on data from Statistics New Zealand). Destinations accounting for less than 1% by species/ processed state, have been excluded in this summary**

| | | Wholeweight in 2003-04 as % of 2002-03 | 2002-03 Destination (% of processed type) | | | | | | | | | 2003-04 Destination (% of processed type) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Processed state | | JAP | AUS | USA | EUR | THAIL | SPAIN | PAC.ISL | A.SAMOA | IRAN | JAP | AUS | USA | EUR | THAIL | SPAIN | PAC.ISL | A.SAMOA | IRAN |
| Skipjack | Frozen whole | **172** | | 64 | | | 1 | 1 | | | 34 | | 37 | | | 38 | 9 | | 7 | 9 |
| Albacore | Chilled, Headed & gutted | | | | | | | | | | | 100 | | | | | | | | |
| | Chilled whole | | 100 | | | | | | | | | 100 | | | | | | | | |
| | Frozen whole | | | | | 2 | 9 | 47 | | 41 | | | | | 1 | 11 | 74 | | 14 | |
| | **Total albacore** | **-17** | | | | | | | | | | | | | | | | | | |
| Bluefin (Southern) | Chilled, headed & gutted | | 100 | | | | | | | | | 99 | | 1 | | | | | | |
| | Chilled.other form | | 99 | 1 | | | | | | | | 98 | | | 2 | | | | | |
| | Chilled whole | | 100 | | | | | | | | | 95 | 4 | 1 | | | | | | |
| | Frozen fillets | | | | | | | | | | | 18 | 82 | | | | | | | |
| | Frozen whole | | 100 | | | | | | | | | 100 | | | | | | | | |
| | **Total southern bluefin** | **6** | | | | | | | | | | | | | | | | | | |
| Bigeye | Chilled, Headed & gutted | | 79 | | 21 | | | | | | | 94 | | 6 | | | | | | |
| | Chilled.other form | | 17 | 3 | 80 | | | | | | | 40 | 2 | 58 | | | | | | |
| | Chilled whole | | 91 | 9 | 1 | | | | | | | 88 | | 12 | | | | | | |
| | Frozen whole | | 100 | | | | | | | | | 100 | | | | | | | | |
| | **Total bigeye** | **94** | | | | | | | | | | | | | | | | | | |
| OTHER | Chilled fillets | | | | | | | | | | | 25 | 41 | | 34 | | | | | |
| Pac. Bluefin | Chilled, Headed & gutted | | 100 | | | | | | | | | 72 | | 28 | | | | | | |
| Butterfly | Chilled.other form | | | | 100 | | | | | | | 68 | 7 | 23 | 2 | | | | | |
| Swordfish | Chilled whole | | 67 | | 29 | 4 | | | | | | 51 | 9 | 40 | | | | | | |
| | Frozen fillets | | | 50 | | 4 | | | 46 | | | | | | | 100 | | | | |
| | Frozen, headed & gutted | | | | | | | | | | | | | | 100 | | | | | |
| | Frozen whole | | 100 | | | | | | | | | 100 | | | | | | | | |
| | Processed, cans, jars | | | | | | | | 100 | | | | | | | | | 100 | | |
| | Processed, packed | | | 99 | | | | | 1 | | | | 100 | | | | | | | |
| | **Total (Other tunas)** | **-24** | | | | | | | | | | | | | | | | | | |
| Yellowfin | Chilled, headed & gutted | | 82 | 5 | 7 | 6 | | | | | | 56 | 3 | 33 | 9 | | | | | |
| | Chilled.other form | | 85 | 15 | | | | | | | | 60 | 40 | | | | | | | |
| | Chilled whole | | 97 | 3 | | | | | | | | 52 | 47 | | 1 | | | | | |
| | Frozen whole | | 100 | | | | | | | | | | 100 | | | | | | | |
| | Processed, cans, jars | | | | | | 26 | | 72 | 2 | | | 21 | | | 25 | | 54 | | |
| | **Total yellowfin** | **171** | | | | | | | | | | | | | | | | | | |
| Bluefin (Northern) | Chilled, headed & gutted | | 100 | | | | | | | | | 100 | | | | | | | | |
| | Chilled.other form | | 100 | | | | | | | | | 100 | | | | | | | | |
| | Chilled whole | | 89 | 11 | | | | | | | | 86 | 1 | 13 | | | | | | |
| | Frozen whole | | 100 | | | | | | | | | | | | | | | | | |
| | **Total Pacific bluefin** | **-78** | | | | | | | | | | | | | | | | | | |

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