

Harvest patterns of the “Other Species” quota group in the Coral Reef Fin Fish Fishery

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Background

The Coral Reef Fin Fish Fishery (CRFFF) is a multi-sector line fishery that operates in the waters of the Great Barrier Reef World Heritage Area. The main sectors of the fishery are: commercial, charter and recreational. The main target species in the commercial fishery are the coral trouts (*Plectropomus* and *Variola* spp.), which until the mid 1990s were landed dead, but thereafter have mostly been landed alive for export to Asia. In addition to the coral trouts, there is a substantial amount of catch of a large number of other fin fish species, with Mapstone *et al.* (1996) reporting at least 125 species or species groups. The majority of this non-coral trout catch in most regions of the Great Barrier Reef is made up of red throat emperor (*Lethrinus miniatus*). The diversity of the catch in the fishery, however, means that the fishery impacts occur across a wide range of species with a wide range of life histories, and hence variable resiliencies to exploitation. The main target species in the charter and recreational fisheries are more diverse because of differences in fishing areas and targeting practices (Mapstone *et al.* 2004).

The management of the fishery has changed substantially over time. Minimum sizes for many species have been used for decades to ensure some level of protection. However, the largest changes in the fishery occurred with the implementation of the Coral Reef Fin Fish Fishery Management Plan in late 2003. This plan introduced a Total Allowable Catch (TAC) and Individual Transferable Quota (ITQ) system for the commercial sector starting in 2004. In addition new size and bag limits were introduced that affected the charter and recreational sectors, as well as the commercial sector. In addition to fisheries regulations, the rezoning of the Great Barrier Reef in 2004 to substantially increase the area of non-extractive “Green” zones resulted in the need for all sectors to change the areas in which they fished. At the same time a restructuring package was implemented that resulted in the removal of a substantial number of commercial operators from the fishery in recognition of the hardship suffered by restricting the area in which fishers could work.

The scientific level of understanding of the CRFFF and the main species exploited by it is the result of a large research initiative called the Effects of Line Fishing (ELF) Project. This project ran for more than a decade and had several main components. Primary among them was the ELF Experiment which was a manipulative experiment on four clusters of six reefs that was used to determine the changes that resulted from line fishing. In addition several components examined the catches of CRFFF operators and biology of the major species caught.

Objectives

The objective of this report is to document the harvest patterns of the “other species” component of the CRFFF. To meet this objective, available data from the different sectors of the fishery (commercial, charter and recreational) were gathered and analysed to provide information on catch and species composition of each sector, both regionally and temporally. To provide a comparison to the catch data from the sectors in the

CRFFF, data from the Effects of Line Fishing (ELF) Project were used to provide detailed species composition data to determine how species identification problems, different targeting behaviour and fishing gear may have affected species composition data from each of the sectors. The key species in the “other species” category will be determined from the results of the species composition analysis.

Methods

Data sources

Commercial fishery

Data on commercial catches in the Coral Reef Fin Fish Fishery were obtained from the CFISH database maintained by the Queensland Department of Primary Industries and Fisheries (QDPI&F). Data have been collected since 1988, and were available through to the middle of 2005. For analyses of annual catches, data from 2005 were excluded. Data from 1988 and 1989 are incomplete, but were retained to determine if they suggested differences in harvest patterns. Data were standardised using the methodology described by Little et al. (in review). The data are only for retained species (i.e. those kept for commercial sale), with discarded fish or those used as bait not recorded. The ability of fishers to identify species, and the ability of data reporting systems to reflect the reported catches are variable, and at times the data were aggregated into species groups. For the purposes of examining the “other species” component of the catch, only those species specifically included in this quota group were analysed. Catches were assigned to one of six regions within the GBR – Capricorn Bunker group (CB), Swains (SWN), Mackay (MKY), Townsville (TSV), Cairns (CNS) and far northern (FN) (Figure 1).

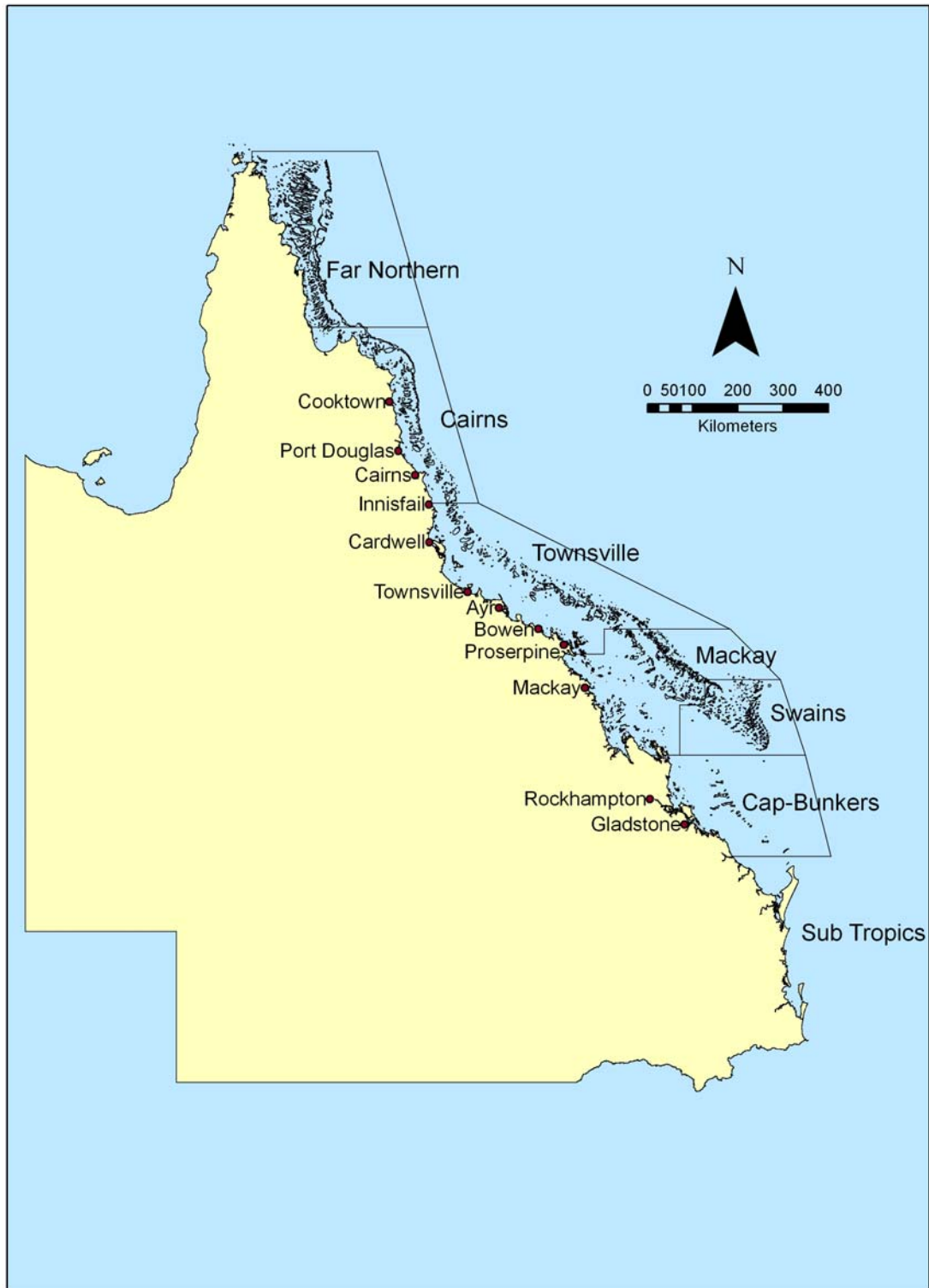


Figure 1. Regions used in the analysis of commercial, charter and recreational harvest patterns of the “other species” component of the CRFFF.

Charter fishery

Data on the charter fishery were obtained from QDPI&F log-books used by charter operators. Log-books have been used since 1994, and have been compulsory since 1996. Only data from 1996 were utilized in this analysis. Similar issues exist in terms of species identification and aggregation into species group, as occur with the CFISH data. Data were assigned to the same six regions as those used in the commercial fishery data.

Recreational fishery

Data on the recreational line fishery were obtained from surveys conducted by QDPI&F in 1997, 1999 and 2002 (Higgs 2001). These surveys involved an initial telephone survey to determine the participation rate in the fishery, a daily fishing diary maintained by a sub-sample of the positive telephone survey respondents, and a statistical weighting of the diary results that accounts for regional participation rates (Higgs 2001). Again, species identification issues arise, with misidentification and aggregation occurring. Data were assigned to the same six regions as those used in the commercial and charter fishery data.

Effects of Line Fishing Project

Detailed data on the species composition of the CRFFF were obtained from data collected during the Effects of Line Fishing (ELF) Project (see Mapstone *et al.* 2001, 2004). Several different data types were collected in the ELF Project, three of which were used in this report. Firstly, size and species composition data were collected during structured research fishing surveys of 6 reefs within each of 4 regions of the GBR (Mapstone *et al.* 2004). These surveys were structured by location, depth and time and were conducted in the spring of each year from 1995 to 2005. Data from these surveys give an approximation of the species composition of the overall catch for the CRFFF and an indication of the relative abundance of each species, as fishing gear and sampling was consistent across all reefs and years. Secondly, species composition and size information was recorded during observer surveys carried out onboard commercial fishing vessels in 1997 and 1998 (see Mapstone *et al.* 2001). These data provide information on the species composition of the whole catch during normal fishing activities (as opposed to the structured research fishing surveys). Finally, the fate of individuals was also recorded during observer surveys so that the composition of the retained catch could be determined.

Data were assigned to the same six regions as identified in Figure 1. The reefs sampled during the structured research fishing surveys fell within the Cairns, Townsville and Mackay regions.

Data analysis

Harvest patterns

Harvest patterns within each sector of the fishery (commercial, charter and recreational) were examined using the data sources listed above. The species composition was determined for each sector across the entire GBR and within each region. In addition, the species composition for the commercial and charter sectors were examined among years. The species composition data were used to identify the most important species by sector and region. Changes in harvest patterns over time and between regions were also investigated using multidimensional scaling (MDS) to determine the relatedness of individual years or regions. Data were standardised and square-root transformed before similarity was calculated using the Bray Curtis index. MDS plots were constructed in Primer version 6, and the results of cluster analysis (also conducted in Primer v6) overlaid on the plots to show a level of 75% similarity.

Biological information

Biological information that was used in the analysis of the harvest patterns were determined from data collected during the ELF Project. For this report, length-weight relationships were estimated to enable the conversion of catches by number and length to be converted to weight. Length-weight relationships were determined by fitting a power curve:

$$w = al^b,$$

where w is weight (g), l is fork length (mm) and a and b are constants.

In addition to these data, future research in this project will examine the biological characteristics of the “other species” component of the CRFFF catch from samples collected mostly during the ELF experiment. To identify data that was available, a query of the ELF data was carried out to determine the number of individuals for which otoliths (for estimates of age, growth and mortality) and reproductive tissues were available.

Results and Discussion

Harvest patterns

Catch

Commercial sector

The commercial catch in the CRFFF is dominated by two species or species groups – coral trout (a complex of several species of the genera *Plectropomus* and *Variola*) and red throat emperor (*Lethrinus miniatus*) (Figure 2). The remainder of the catch is made up of

a variety of other species, mostly from the families Lethrinidae, Lutjanidae and Serranidae. The total commercial catch increased over the period from 1988 to 2002, with a proportionally larger increase in the “other species” group during this period (from approximately 15% to 35%). Substantial drops in the reported catch in all components were recorded in 2003 and 2004. Catches also showed a distinct seasonal pattern, with a steady increase through the year, reaching a peak in spring (September – November) (Figure 3). The rise in annual catch during the period from 1988 to 2002 corresponded to several major changes in the CRFFF. The two most notable being the transition to a fishery dominated by the live export of coral trout (most boats participated in the “live” fishery by 1995) and the development and implementation of a major management plan for the fishery in which a transition to a quota management system occurred. The management plan was implemented in late 2003, but the period for qualification for quota allocation occurred prior to this date, and may have changed the way in which fishermen reported their catch. No data are available on what if any changes in reporting occurred, but in other fisheries has included over-reporting (to obtain a larger potential share of the TAC) or more accurate reporting (minor species that may not normally have been reported, are fully reported). Given that there was a disproportionate change in the reported catch of the main components (“other species” versus coral trout and red throat emperor) may suggest that commercial fishers more diligently reported their catch of less common species. However, over-reporting cannot be ruled out as a factor in the increase in the reported commercial catch from 1995 to 2002.

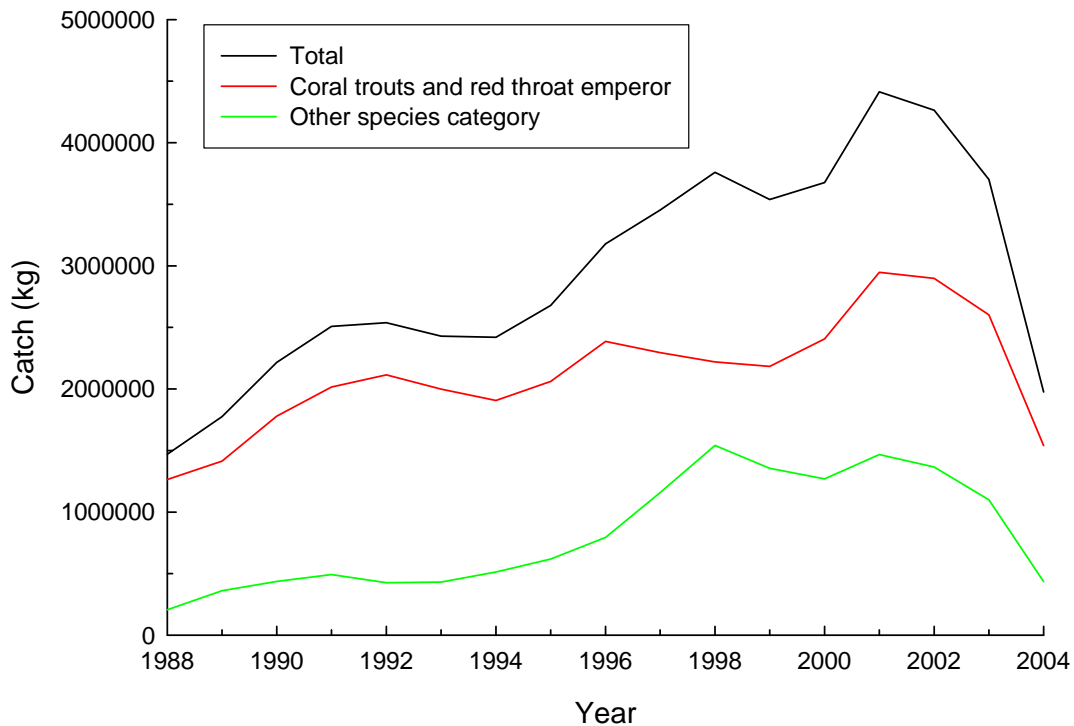


Figure 2. Annual catches of the major components of the commercial sector in the CRFFF. Data derived from QDPI&F compulsory logbooks.

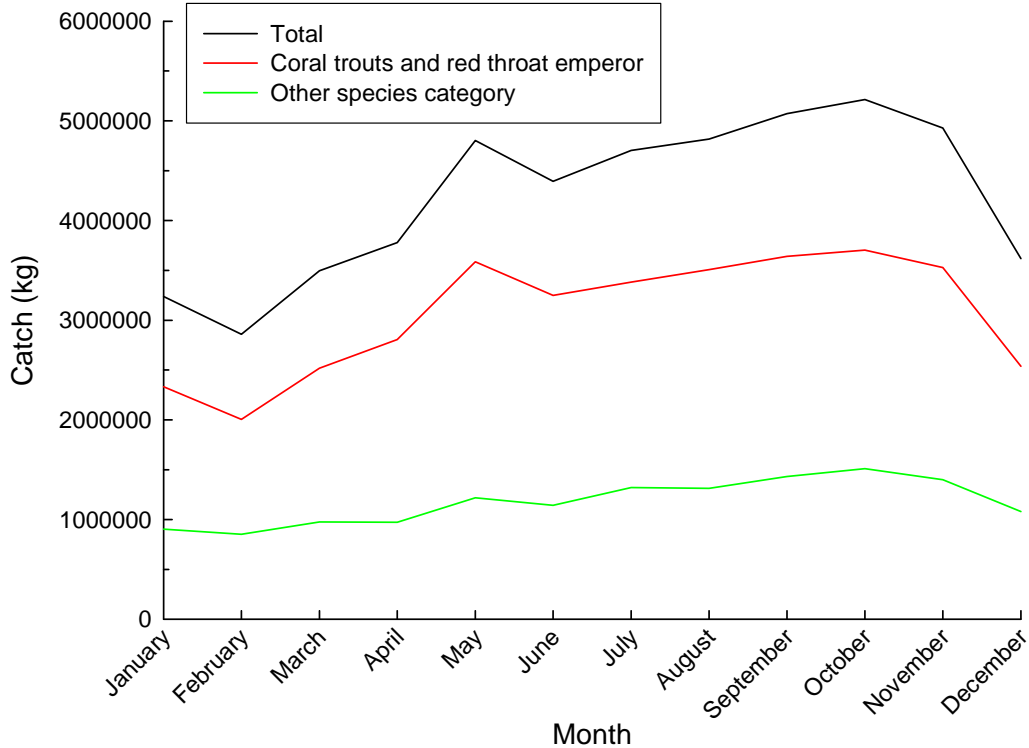


Figure 3. Monthly commercial catch of major components of the CRFFF. Data derived from QDPI&F compulsory logbooks and summed across all years (1988 – 2004).

The reported commercial catch of “other species” by region within the GBR followed a similar pattern to the overall catch (Figure 4). There was a general increase in all regions from 1995 through 2002, followed by a substantial drop at the end of the time series. Prior to 1995, reported catches of the “other species” group were relatively constant at around 400,000 kg. The increases during the second half of the 1990s were most pronounced in the Capricorn Bunker, Swains, Townsville and Cairns regions. Peak catches during the late 1990s and early 2000s were in the order of 1,400,000 kg, more than triple what they had been in early 1990s.

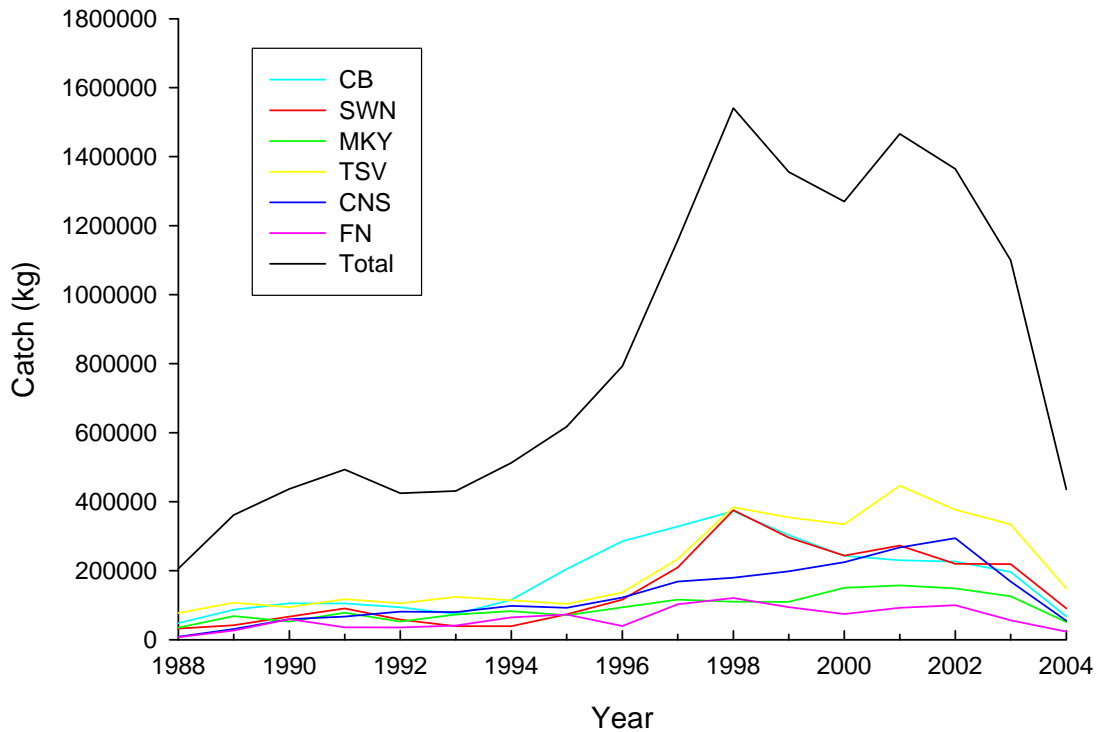


Figure 4. Annual commercial catch of the “other species” group in the CRFFF by region. Data derived from QDPI&F compulsory logbooks.

Charter sector

The annual charter catch of “other species” increased slightly during the period that logbook data were available, with reported catches increasing from approximately 100,000 kg in the mid 1990s to 130,000 kg in the mid 2000’s (Figure 5). The trends in charter catches were similar across regions to the overall trend, with the Capricorn Bunker, Swains and Cairns regions providing the majority of the catch. The charter sector also underwent significant changes at the end of 2003 with the implementation of the new management, and this may have resulted in the lower catch that was observed in 2004. The changes that affected the charter sector were mostly in relation to bag and trip limits for a variety of reef species.

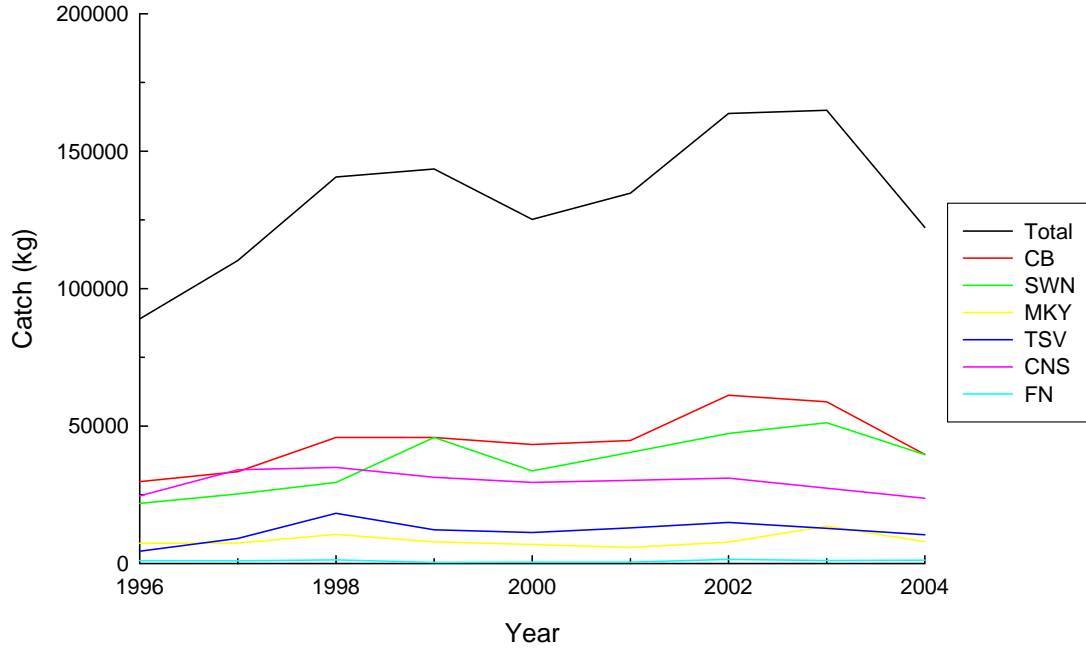


Figure 5. Annual charter catches of the “other species” group in the CRFFF by region. Data derived from QDPI&F compulsory logbooks.

Recreational sector

Three estimates of recreational catch of the “other species” group were available, from surveys in 1997, 1999 and 2002. Estimated catches in these three years for this group were 3,913,482 kg, 4,247,703 kg and 4,024,083 kg. Unlike the commercial fishery where “other species” made up a relatively small component of the overall catch, in the recreational fishery they made up between 76% and 80% of the overall reef fish catch. The catch appears to have been relatively stable over the period that surveys have been conducted.

A comparison of reported catches by sector for years in which comparable data are available (i.e. years in which recreational surveys were conducted) (Figure 6) show that recreational fishers take the majority of this species group. Given that there are no recreational data available outside of the period when commercial catch had dramatically increased prior to the finalisation of the new management, it seems likely that the current recreational proportion of the catch is even greater than the 75-80% indicated by the available data.

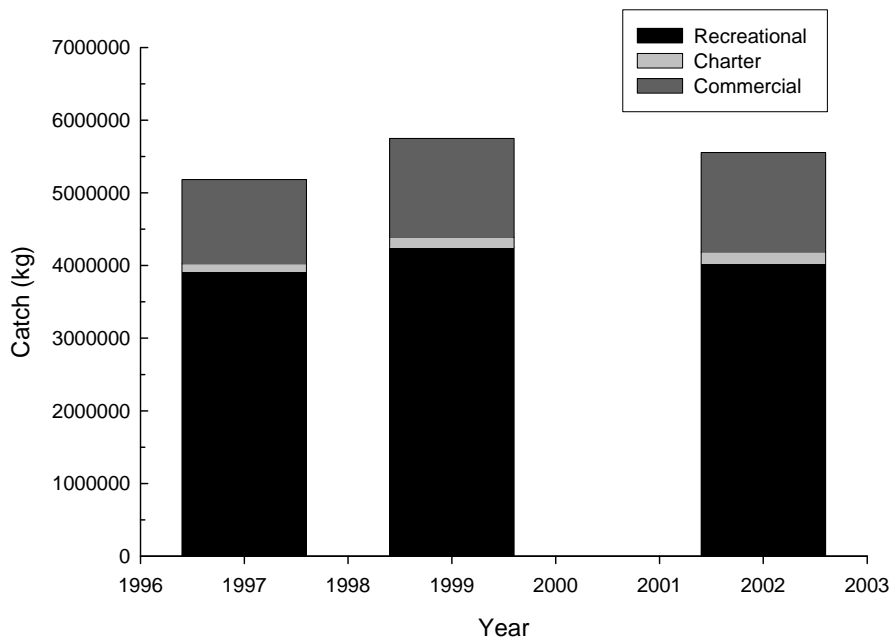


Figure 6. Annual catch of the “other species” group of reef fish by sector for years in which comparative data are available. Data derived from QDPI&F compulsory logbooks for commercial and charter fishers and RFISH surveys for recreational fishers.

Annual and regional trends in catch composition

An examination of the annual commercial catches for the main components of the “other species” group was undertaken to provide a more detailed understanding of the regional and temporal trends in harvest patterns. The species (or species groups) selected had at least one annual catch of greater than 10,000 kg during the period from 1998 to 2004. This produced 12 species or species-groups (Figure 7). The annual catches of the majority of the species (Mixed reef [a general reef fish category], reds [red emperor, small mouth nannygai and large mouth nannygai], emperor [unspecified], cods [unspecified], hussar, jobfish [unspecified], rosy jobfish, goldband jobfish, parrotfish [unspecified] barramundi cod and wrasse [unspecified]) followed a similar trend over the period from 1998 to 2004 – general increasing trend, especially after 1995, and a substantial decline from 2003. The species that did not conform to this pattern were goldband jobfish (no data were available prior to 1997), spangled emperor (substantial catches early in the time series) and wrasse (early increase in catches and then a decline from 1998). Barramundi cod and wrasses (unspecified, but mostly Maori wrasse) had no reported catch in 2004 because they were prohibited species under the management plan introduced in that year.

There were regional differences in the harvest patterns of many of the species. Hussar, parrotfish and all of the jobfish groups (unspecified, rosy and goldband) were most commonly caught in the southern regions (Capricorn Bunker and Swains) (Figure 7).

Mixed reef, spangled emperor and barramundi cod were mostly caught in the central regions (Mackay, Townsville and Cairns). The only group that was caught predominantly in the northern regions (Cairns and Far Northern) was wrasse. A number of factors may have contributed to these regional patterns. Firstly, the biogeography of reef fish varies among species, with some species more common in different sections of the reef. Secondly, the vessels that operate in different parts of the reef have different fishing practices. For example, some vessels in the southern regions fish deeper waters (i.e. L8 Fishery) and harvest species that occur more commonly in deeper areas (e.g. rosy and goldband jobfish). Thirdly, there are differences in the way fishers report their catch on a regional basis. For example, the mixed reef category, a catch-all group that does not identify fish even to broad groups, was more commonly used in the Townsville region than in any of the others. This may suggest that some fishers in this region do not provide as detailed information on the species composition of their catch than those in other regions.

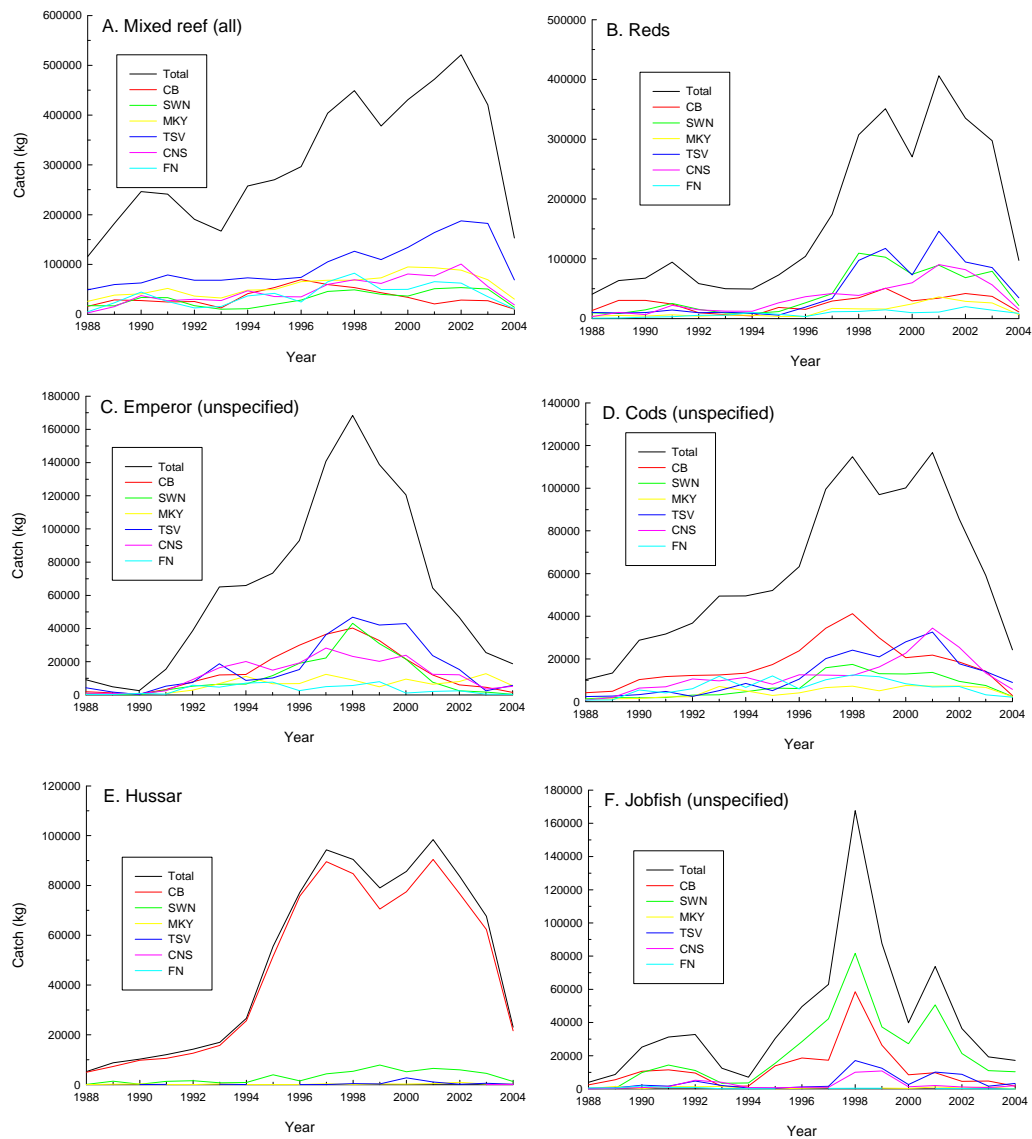
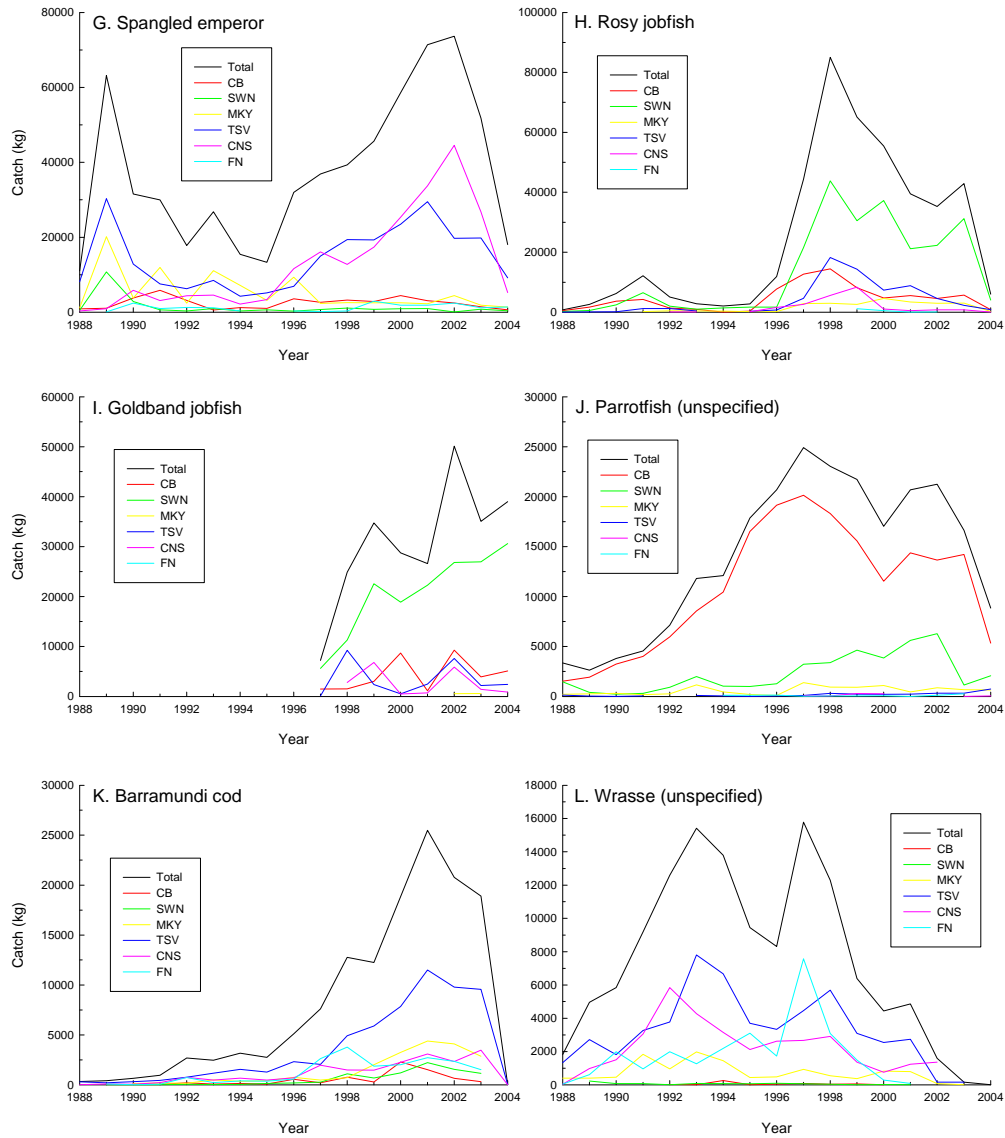


Figure 7. Annual commercial catches of the main components of the “other species” group in the CRFFF by region. Data derived from QDPI&F compulsory logbooks.

Figure 7 cont...



Species composition

Commercial sector

The species composition of the commercial sector of the CRFFF is dominated by coral trout and red throat emperor (Table 1). The one exception to this is the Capricorn Bunker region, where coral trout are less abundant, although still common, and hussar are an equally important part of the catch. Hussar are a very minor component of the commercial catch in other regions. MDS analysis of the species composition on a regional basis indicates that the Capricorn Bunker region is significantly different, while there is a greater than 75% similarity between all other regions (Figure 8). MDS analysis

of annual species composition data identified two distinct groups of years (Figure 9). Catch composition in earlier years (1988-1993) was distinct from the catch composition in later years (1994 – 2004). The early years corresponds to a period prior to the development of the live fish trade, and probably reflects a difference in the harvest patterns of fishers between these periods. In the later period, the early years (1994-1998) are more similar to each other than to the later years (1999-2004), suggesting some degree of change in species composition over time. However, the degree of similarity within the later period, even after the implementation of the new management plan suggests that harvest patterns did not change substantially.

Table 1. Species composition (by weight) of the reported commercial catch, all years combined 1988 to 2004, by region. Greyed rows indicate non-“other species”. Data derived from QDPI&F compulsory logbooks.

Common_name	CB	SWN	MKY	TSV	CNS	FN	Total
CORAL TROUT	14.5367	47.2081	57.0852	52.5605	54.5784	69.5137	50.3346
EMPEROR - RED THROAT	19.6083	26.7842	27.8518	26.2470	3.2810	0.6555	21.9267
FISH - MIXED REEF	7.6325	2.7417	4.2065	4.7674	7.6513	8.3280	5.0747
FISH - MIXED REEF B	1.9244	1.3862	4.1152	3.5204	4.6615	5.5311	3.3452
NANNYGAI - LARGE MOUTH	4.1525	5.1538	0.9691	1.6624	3.0116	0.3783	2.4657
EMPEROR - RED	4.6709	2.1978	0.9879	1.9225	5.1484	3.1884	2.4568
EMPEROR - UNSPECIFIED	5.2381	1.8996	1.0050	1.7098	4.1123	1.5920	2.1669
COD - UNSPECIFIED	6.2583	1.2767	0.7446	1.2560	4.0625	3.3208	2.0503
FISH - MIXED REEF A	2.6748	1.3376	0.9844	1.5847	2.7734	4.6933	1.8524
PERCH - HUSSAR	16.8424	0.5498	0.0319	0.0338	0.0045	0.0004	1.6848
JOBFISH - UNSPECIFIED	4.3796	3.9178	0.1096	0.4226	0.8193	0.1852	1.4156
EMPEROR - SPANGLED	0.9039	0.2383	0.8612	1.4547	4.1761	0.5366	1.2660
JOBFISH - ROSY	1.6333	2.3715	0.2343	0.3822	0.4109	0.0617	0.8276
GOLD BANDED JOBFISH	0.7604	1.8640	0.0120	0.1566	0.3613	0.0007	0.5185
PARROT FISH - UNSPECIFIED	3.9676	0.4196	0.1012	0.0212	0.0131	0.0272	0.4791
NANNYGAI - SMALL MOUTH	0.0315	0.0069	0.0202	0.5330	1.5836	0.1916	0.3649
NANNYGAI - UNSPECIFIED	0.1591	0.0541	0.0367	0.4657	1.3204	0.1985	0.3398
COD - BARRAMUNDI	0.1550	0.0897	0.1933	0.3485	0.3731	0.5492	0.2656
WRASSE - UNSPECIFIED	0.0116	0.0088	0.1138	0.3095	0.6457	0.7490	0.2492
COD - MAORI UNSPECIFIED	1.1720	0.1565	0.0031	0.0486	0.0049	0.0085	0.1566
BREAM - CORAL	1.4547	0.0128	0.0448	0.0147	0.0019	0.0024	0.1519
BASS - STRIPEY	0.0752	0.0280	0.1198	0.1904	0.1035	0.0677	0.1167
SLATEY BREAM	0.6270	0.1006	0.0356	0.0240	0.0188	0.0128	0.0956
PERCH - SEA UNSPECIFIED	0.3135	0.0240	0.0336	0.0490	0.1393	0.0225	0.0730
EMPEROR - LONG NOSE	0.0004	0.0003	0.0000	0.0321	0.1865	0.0317	0.0324
BREAM - FINGERMARK	0.1297	0.0232	0.0011	0.0268	0.0120	0.0120	0.0278
TUSK FISH - VENUS	0.0229	0.0464	0.0632	0.0069	0.0008	0.0100	0.0271
FLAME TAIL JOBFISH/SNAPPER	0.0542	0.0039		0.0226	0.1011	0.0037	0.0241
RUBY SNAPPER	0.0056		0.0008	0.0392	0.0878	0.0114	0.0237
BASS - RED	0.0006	0.0009		0.0074	0.1852	0.0194	0.0231
JOBFISH - GREEN	0.0088	0.0099	0.0043	0.0182	0.0479	0.0536	0.0184
COD - GOLD SPOT	0.0606	0.0206	0.0045	0.0128	0.0104	0.0026	0.0161
COD- BAR	0.0929	0.0038		0.0102	0.0291	0.0017	0.0159

Common_name	CB	SWN	MKY	TSV	CNS	FN	Total
COD - REEF UNSPECIFIED	0.0841	0.0050	0.0070	0.0061	0.0020	0.0021	0.0126
BREAM - MAORI	0.0057		0.0005	0.0257	0.0156	0.0028	0.0111
COD - HAPOKA	0.0519	0.0236		0.0004	0.0012		0.0096
BREAM - SEA	0.0864	0.0002	0.0000	0.0012	0.0020		0.0087
FUSILIER - UNSPECIFIED				0.0251			0.0085
SPECKLE FIN COD	0.0623	0.0086		0.0010			0.0078
COD - CORAL	0.0586	0.0004		0.0024	0.0045		0.0068
COD - FLOWERY	0.0004	0.0010	0.0086	0.0070	0.0104	0.0106	0.0062
COD - GROPER UNSPECIFIED	0.0176	0.0042		0.0087	0.0034	0.0003	0.0058
CATTLE DOG COD	0.0059	0.0008	0.0000	0.0121	0.0079	0.0019	0.0057
COD - BLACK-FINNED	0.0069		0.0000	0.0113	0.0004	0.0020	0.0046
SMALL-TOOTHED JOBFISH	0.0016	0.0007		0.0046	0.0177		0.0037
COD - BLUE SPOT	0.0008	0.0001	0.0001	0.0084	0.0011	0.0007	0.0031
GROPER - COMET	0.0011	0.0102	0.0000	0.0017			0.0027
COD - FOOTBALLER	0.0166	0.0001	0.0006	0.0005	0.0001	0.0063	0.0023
MOZAMBIQUE BREAM	0.0003			0.0047	0.0026	0.0001	0.0019
EIGHT BAR GROPER	0.0186						0.0017
CHINAMAN				0.0019	0.0075	0.0029	0.0016
BLUE SPOT TROUT	0.0001	0.0005	0.0009	0.0010	0.0034	0.0080	0.0015
EMPEROR - RETICULATED			0.0048				0.0010
COD - TOMATO	0.0081	0.0002	0.0000	0.0000			0.0008
COD - BLUE SPOT ROCK		0.0036		0.0003			0.0008
PERCH - MAORI SEA	0.0001			0.0019	0.0008	0.0003	0.0007
BLUE-BONED TUSKFISH			0.0014	0.0013			0.0007
COD - ROCK UNSPECIFIED	0.0057			0.0002		0.0001	0.0006
COD - BIRDWIRE	0.0011			0.0010	0.0002		0.0004
SNAPPER - PALE				0.0011			0.0004
YELLOWTAILED SWEETLIP	0.0003			0.0010			0.0004
WRASSE - GOLD SPOT	0.0018			0.0002	0.0002		0.0002
BREAM - BLUBBER LIP	0.0019			0.0001			0.0002
CAMOUFLAGE ROCKCOD			0.0006	0.0002			0.0002
TUSK FISH - BLACK SPOT	0.0013			0.0000			0.0001
PURPLE TUSK FISH				0.0003			0.0001
EMPEROR - RED SPOT	0.0003			0.0000	0.0004		0.0001
BLACKSPOT PIGFISH	0.0001	0.0000		0.0001	0.0001		0.0001
SADDLE-BACK SNAPPER				0.0002	0.0000		0.0001
SEAPERCH - SWALLOWTAIL				0.0001	0.0001		0.0000
FUSILIER - YELLOW TAIL	0.0005						0.0000
COD - WHITE LINED			0.0000	0.0001			0.0000
FUSILIER - SOUTHERN	0.0001		0.0001	0.0000			0.0000
BASS GROPER				0.0001			0.0000
VARIEGATED SWEETLIP					0.0002	0.0002	0.0000
COD - POTATO	0.0003						0.0000
BREAM - JAPANESE LARGE-EYE		0.0001					0.0000
EMPEROR - RED EAR	0.0002						0.0000
EMPEROR - THREADFIN	0.0001						0.0000

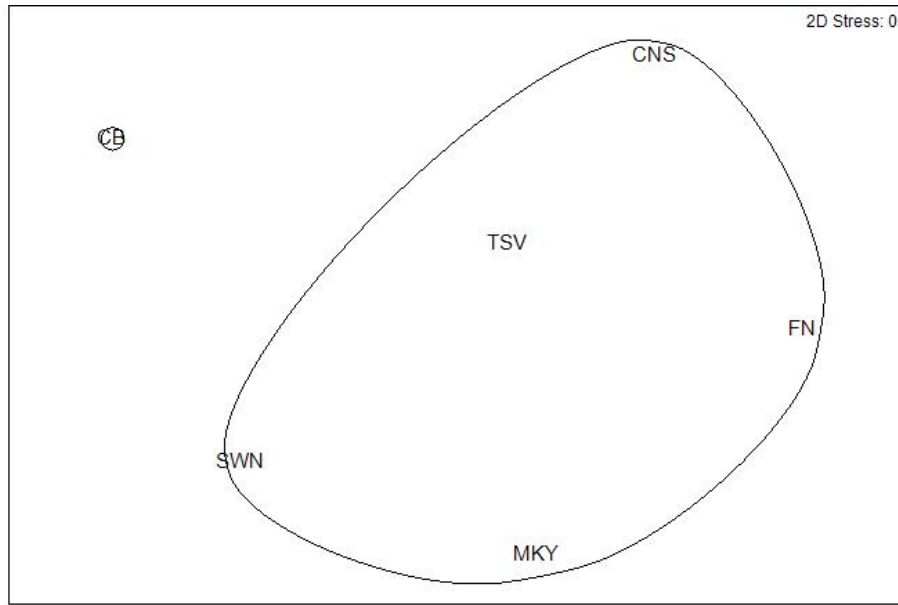


Figure 8. Multidimensional scaling plot of species composition by region for reported commercial catches, all years combined 1988 to 2004. Lines indicate 75% similarity based on Bray-Curtis similarity index. Data derived from QDPI&F compulsory logbooks.

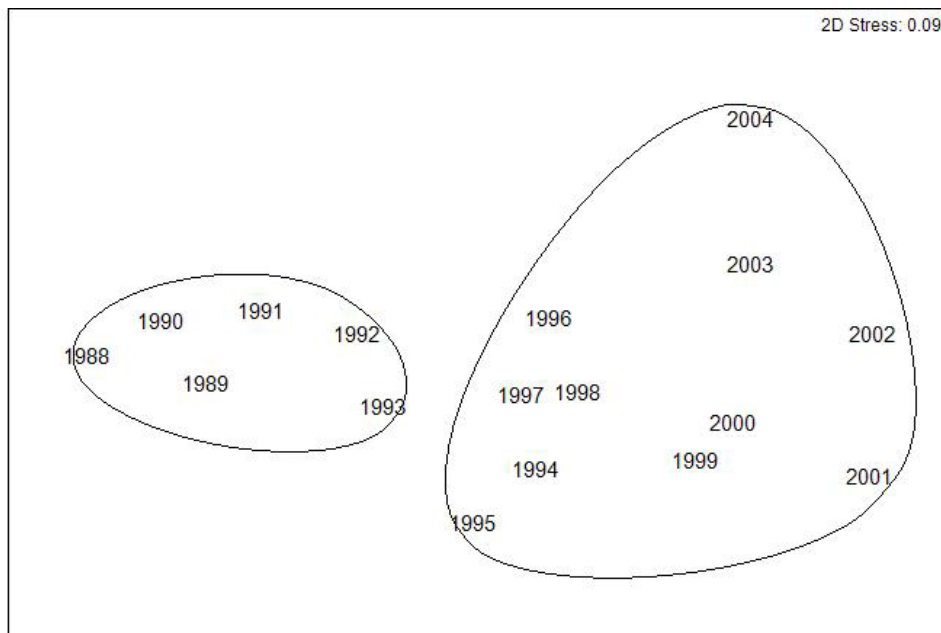


Figure 9. Multidimensional scaling plot of species composition by year for reported commercial catches, all years combined 1988 to 2004. Lines indicate 75% similarity based on Bray-Curtis similarity index. Data derived from QDPI&F compulsory logbooks.

Charter sector

The species composition of the charter sector of the CRFFF was less dominated by coral trout and red throat emperor than the commercial catch. However, these species were still the main components of the catch in most regions (Table 2). Hussar, cods, red emperor and parrotfish all made up more than 10% each of the catch in the Capricorn Bunker region. In the other regions, the only species to make up more than 10% of the catch in a region were emperor (unspecified) (Swains), large mouth nannygai (Townsville and Cairns) and small mouth nannygai (Cairns). MDS analysis by region identified three distinct groups: (1) Capricorn Bunker, (2) Mackay and Swains, and (3) Townsville, Cairns and Far Northern (Figure 10). Each of these groups comprise adjacent sections of the GBR and the differences between groups most likely occur because of regional differences in biogeography and fishing practices. Annual MDS analysis did not separate years at the 75% level (Figure 11), suggesting that harvest patterns have remained relatively stable over time.

Table 2. Species composition (by weight) of the reported charter catch, all years combined 1996 to 2004, by region. Greyed rows indicate non-“other species”. Data derived from QDPI&F compulsory logbooks.

Common name	CB	SWN	MKY	TSV	CNS	FN	Total
CORAL TROUT	7.8051	33.3480	30.0155	28.8890	32.8072	29.8436	26.7582
EMPEROR - RED THROAT	16.9267	32.1260	28.8758	14.3819	2.6122	8.6719	21.4370
EMPEROR - UNSPECIFIED	8.4612	13.0135	7.1735	7.8617	1.4118	1.7860	8.9244
PARROT FISH - UNSPECIFIED	19.3557	6.9270	3.6085	2.3009	0.2102	3.6361	7.9686
EMPEROR - RED	12.2548	4.9258	9.0747	6.5173	8.7070	8.5147	7.8324
NANNYGAI - LARGE MOUTH	0.5647	1.3576	8.0172	10.0523	15.1629	5.4638	4.9749
COD - UNSPECIFIED	11.6179	2.0869	3.4338	3.2731	2.9973	5.3432	4.7125
EMPEROR - SPANGLED	1.7806	2.2834	3.8724	5.1548	9.4089	7.8283	3.8785
PERCH - HUSSAR	12.5591	0.6481	0.6863	0.6032	0.1725	0.9050	3.3486
NANNYGAI - SMALL MOUTH	0.0197	0.0144	0.3491	5.1742	14.2896	4.1767	3.1159
NANNYGAI - UNSPECIFIED	0.0634	0.1171	0.3125	7.1352	2.9923	3.4978	1.2400
TUSK FISH - VENUS	0.6873	1.8714	0.3581	0.0721	0.0021		0.9822
JOBFISH - ROSY	1.9362	0.2670	0.9309	0.0947	0.0827	0.2122	0.6622
JOBFISH - UNSPECIFIED	1.0076	0.5162	0.5454	0.2822	0.5030	0.9441	0.6166
BREAM - FINGERMARK	0.3168	0.0029	0.2202	1.4949	1.3977	6.5662	0.5094
COD - MAORI UNSPECIFIED	1.6675	0.0045	0.0011	0.0204	0.0526		0.4031
JOBFISH - GREEN	0.4866	0.2805	0.0199	0.2420	0.3659	6.6934	0.3589
SLATEY BREAM	0.1483	0.0188	0.3653	0.4345	1.0447	0.0341	0.2993
COD - GOLD SPOT	0.2621		0.5910	1.0423	0.5205	1.1796	0.2951
BASS - STRIPEY	0.1283	0.0496	0.2601	1.2129	0.5951	0.0981	0.2801
EMPEROR - LONG NOSE		0.0078	0.0294	0.3067	0.7793	0.2921	0.1758
PERCH - SEA UNSPECIFIED	0.0620	0.0158	0.0004	0.5179	0.5488		0.1644
WRASSE - UNSPECIFIED	0.3208	0.0298	0.0487	0.1486	0.1175	0.0146	0.1252
BREAM - CORAL	0.4959	0.0024	0.0010	0.0072	0.0152	0.6545	0.1242
FISH - MIXED REEF	0.1203		0.5625	0.3190	0.0074	0.9419	0.1050
COD - BARRAMUNDI	0.0998	0.0176	0.1266	0.2118	0.1278	0.3413	0.0834

Common name	CB	SWN	MKY	TSV	CNS	FN	Total
CHINAMAN	0.0048		0.0449	0.6131	0.0130	0.0364	0.0571
WRASSE - GOLD SPOT	0.2260	0.0038	0.0022				0.0546
COD - FLOWERY	0.0267	0.0204	0.0429	0.2562	0.0800	0.0301	0.0539
COD - GROPER UNSPECIFIED				0.4280		1.0923	0.0411
COD - REEF UNSPECIFIED	0.1385	0.0090			0.0005		0.0362
COD - CORAL	0.0788	0.0018	0.0031	0.0673	0.0361	0.2577	0.0330
SPECKLE FIN COD	0.1200		0.0037		0.0060		0.0295
EMPEROR - RED SPOT	0.0005				0.1558	0.0230	0.0290
FISH - MIXED REEF A	0.0335		0.0742	0.0681	0.0447	0.0874	0.0279
BREAM - MAORI	0.0127	0.0155		0.0378	0.0533	0.0756	0.0228
COD - BLUE SPOT	0.0259				0.0610	0.6720	0.0212
CATTLE DOG COD	0.0768	0.0009		0.0004	0.0075		0.0198
FISH - MIXED REEF B	0.0158		0.0363		0.0541		0.0165
TUSK FISH - BLACK SPOT	0.0018		0.1157	0.0863			0.0165
BLUE-BONED TUSKFISH		0.0027	0.1660	0.0203	0.0021	0.0073	0.0162
COD - ROCK UNSPECIFIED	0.0027	0.0001	0.0003	0.0144	0.0517	0.0106	0.0115
COD - BLACK-FINNED	0.0306		0.0032	0.0045	0.0192		0.0113
INDONESIAN SNAPPER				0.1172			0.0095
PERCH - STRIPED SEA	0.0002		0.0021	0.1015	0.0021		0.0089
BASS - RED				0.0134	0.0336	0.0275	0.0074
FUSILIER - UNSPECIFIED	0.0007	0.0016	0.0056	0.0689	0.0009		0.0070
COD - POTATO				0.0645			0.0052
PERCH - MAORI SEA	0.0047			0.0370	0.0042	0.0407	0.0051
COD - TOMATO	0.0126	0.0012	0.0053	0.0013	0.0035		0.0046
SURGEON FISH				0.0475			0.0039
SADDLEBACK PIGFISH	0.0119						0.0028
COD - BLUE SPOT ROCK	0.0117				0.0002		0.0028
EMPEROR - RETICULATED		0.0051		0.0054			0.0026
PERCH - DARK TAILED SEA PERCH				0.0036	0.0115		0.0024
COD - FOOTBALLER	0.0022			0.0227			0.0024
COD- BAR	0.0061			0.0112			0.0023
PADDLE TAIL					0.0116		0.0021
COD - WHITE LINED				0.0222	0.0011		0.0020
PERCH - SPOTTED SCALE SEA		0.0030			0.0039		0.0020
BREAM - BLUBBER LIP			0.0045	0.0080	0.0046		0.0018
VARIEGATED SWEETLIP	0.0033	0.0012			0.0009		0.0014
BLUE SPOT TROUT		0.0017	0.0041	0.0020			0.0012
GOLD BANDED JOBFISH	0.0027						0.0006
YELLOWTAILED SWEETLIP			0.0016	0.0037			0.0004
COD - QUEENSLAND GROPER			0.0043	0.0010			0.0004
COD - FRECKLED				0.0031			0.0003
FUSILIER - SOUTHERN				0.0026			0.0002
PIGFISH-UNSPECIFIED	0.0006						0.0001
ORANGE STRIPED EMPEROR					0.0007		0.0001
FUSILIER - YELLOW TAIL				0.0009			0.0001
YELLOW SPOTTED ROCK COD				0.0005			0.0000

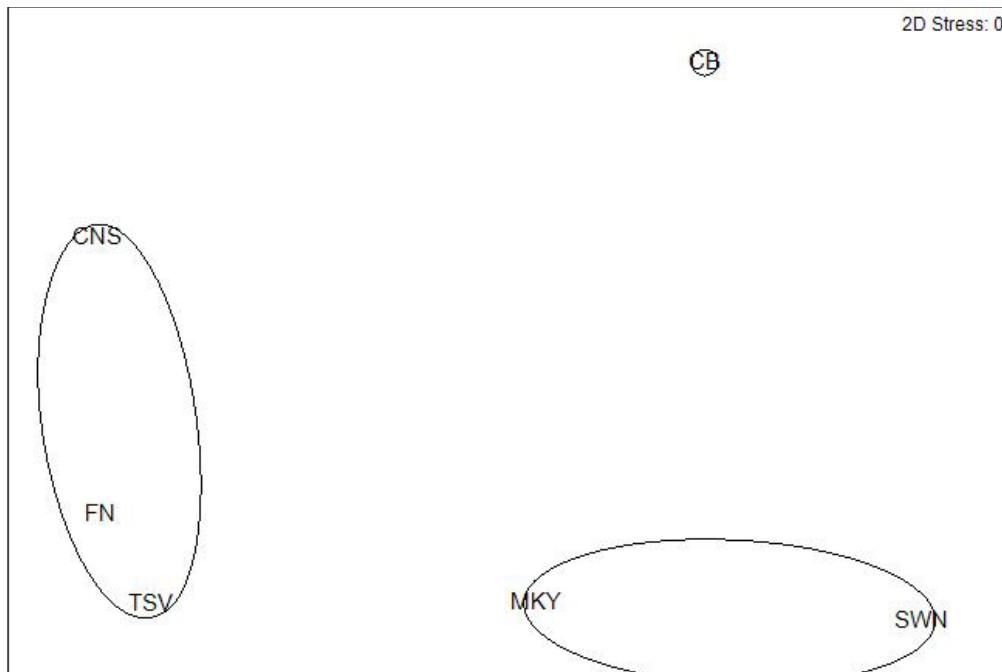


Figure 10. Multidimensional scaling plot of species composition by region for reported charter catches, all years combined 1996 to 2004. Lines indicate 75% similarity based on Bray-Curtis similarity index. Data derived from QDPI&F compulsory logbooks.

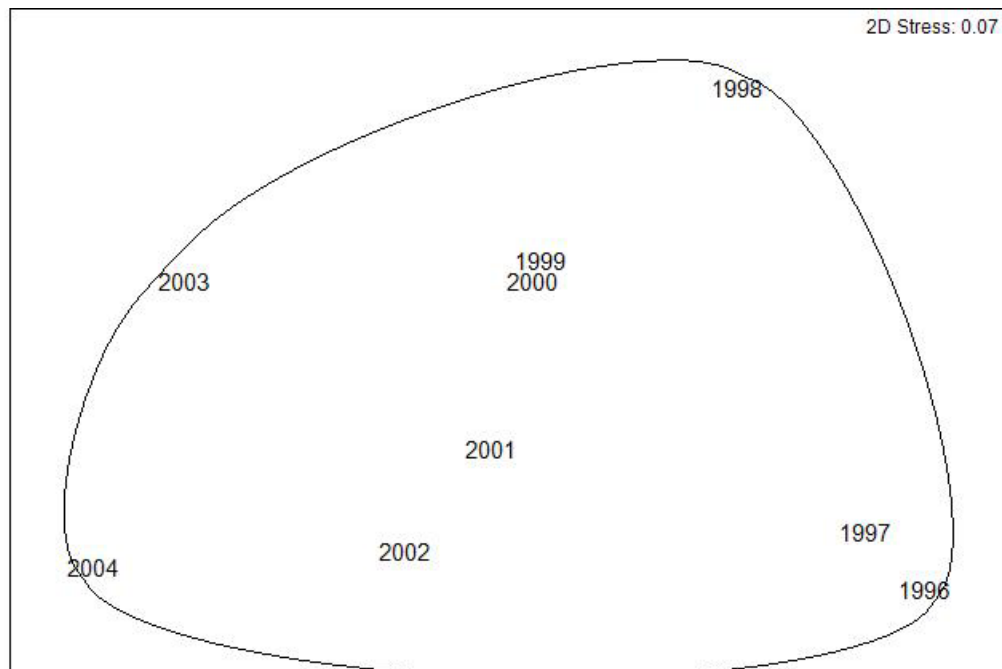


Figure 11. Multidimensional scaling plot of species composition by year for reported charter catches, all years combined 1996 to 2004. Lines indicate 75% similarity based on Bray-Curtis similarity index. Data derived from QDPI&F compulsory logbooks.

Recreational sector

Coral trout and red throat emperor were less important in the recreational catch of the CRFFF, making up between 12 and 36% of the overall catch by region (Table 3). Other species that were important included emperor (unspecified), red emperor, cod (unspecified), Moses perch and nannygai (unspecified). There was a very small number of species reported in the Far Northern region, with five species or species groups making up the reported catch. This may have been a result of the survey technique that used diary information to scale up regional effort information. These results suggest that diary information was limited for this region, and as such the species composition may not be representative. Recreational fishing effort in this region is limited, however, due to its remoteness and, therefore, overall catches are low. MDS analysis of regional species composition data identified four groups: (1) Capricorn Bunker and Mackay, (2) Swains, (3) Townsville and Cairns, and (4) Far Northern. Regions that group together are adjacent, and the results, therefore, may reflect biogeographical differences. However, regional groupings were not the same as those for the commercial and charter sectors. In particular, the charter sector grouped Mackay and the Swains together. The differences in the regional results suggest that harvest patterns may vary among sectors. These differences probably exist in large part due to the fact that recreational fishers areas closer to shore than the commercial and charter sectors, and hence a different suite of species is available to them. No analysis of annual recreational species composition patterns was undertaken as only three years of data were available.

Table 3. Species composition of the reported recreational catch, data for 1997, 1999 and 2002 combined, by region. Greyed rows indicate non-“other species”. Data derived from RFISH surveys.

Common name	CB	SWN	MKY	TSV	CNS	FN	Total
EMPEROR - UNSPECIFIED	11.2202	21.1197	26.4268	11.4540	4.0674	26.1092	12.7807
EMPEROR - RED	12.6972	17.3371	6.9773	9.4096	7.4275	27.9891	10.1417
CORAL TROUT	3.6348	14.7611	7.4009	12.8863	22.5401	17.2776	10.4831
EMPEROR - RED THROAT	10.0492	12.8796	4.3002	6.8460	13.5131	0.0000	8.6265
COD - UNSPECIFIED	13.8678	4.5792	16.6188	7.3028	5.1569	0.0000	10.3630
FINGERMARK	2.9891	0.2010	1.3447	3.1319	5.1311	23.4837	3.0456
NANNYGAI - LARGE MOUTH	2.6131	7.7548	7.1921	7.1404	6.0605	0.0000	5.5305
NANNYGAI - UNSPECIFIED	1.4201	2.3933	2.0930	12.0084	8.8943	0.0000	6.4219
TUSK FISH - VENUS	8.1433	1.4489	6.2500	1.4216	0.7106	0.0000	4.1944
BASS - STRIPEY	1.2426	0.2076	4.3722	2.1963	3.9774	5.1404	2.3758
COD - GOLD SPOT	4.1330	0.0000	3.7434	5.0597	2.0937	0.0000	4.0031
EMPEROR - SPANGLED	0.9394	2.3167	0.6903	4.0688	6.3750	0.0000	2.8300
PARROT FISH - UNSPECIFIED	3.7104	5.1904	2.5853	0.9042	0.3339	0.0000	2.1094
PERCH - HUSSAR	7.1518	3.5657	0.7422	0.7689	0.0885	0.0000	2.8422
BREAM - CORAL	6.7484	3.9412	0.0869	0.2632	0.4492	0.0000	2.4956
SLATEY BREAM	2.7956	0.0000	3.9634	1.9659	0.9986	0.0000	2.3205
NANNYGAI - SMALL MOUTH	0.3090	0.0000	0.0412	3.3909	2.3579	0.0000	1.6644
JOBFISH - ROSY	0.6266	0.7795	0.5885	1.0456	0.9913	0.0000	0.8277

Common name	CB	SWN	MKY	TSV	CNS	FN	Total
FUSILIER - SOUTHERN	0.0161	0.0000	0.3437	2.5350	0.8002	0.0000	1.0861
PERCH - SEA UNSPECIFIED	0.9280	0.0000	0.2377	0.8338	1.3010	0.0000	0.8182
BLACKSPOT PIGFISH	0.8603	0.0000	1.6733	0.4814	0.0000	0.0000	0.6905
COD - BARRAMUNDI	0.0443	0.2028	0.0742	1.5632	1.1260	0.0000	0.7546
JOBFISH - GREEN	0.4461	0.3728	0.3278	0.2404	1.1935	0.0000	0.4541
TUSK FISH - BLACK SPOT	0.4510	0.1981	0.8963	0.4453	0.0000	0.0000	0.4411
CHINAMAN	0.0271	0.7505	0.0840	0.6316	0.0000	0.0000	0.2738
COD - MAORI UNSPECIFIED	1.0973	0.0000	0.1185	0.0000	0.0000	0.0000	0.3750
COD - FLOWERY	0.1443	0.0000	0.1253	0.1908	0.6150	0.0000	0.2184
BREAM - MAORI	0.0000	0.0000	0.0000	0.0592	0.9886	0.0000	0.1570
COD - CORAL	0.1721	0.0000	0.0836	0.3723	0.3443	0.0000	0.2507
INDONESIAN SNAPPER	0.0000	0.0000	0.1395	0.7528	0.0000	0.0000	0.2937
PERCH - MAORI SEA	0.0000	0.0000	0.0000	0.1453	0.5747	0.0000	0.1316
BASS - RED	0.0628	0.0000	0.0000	0.0000	0.6563	0.0000	0.1104
YELLOWTAILED SWEETLIP	0.3718	0.0000	0.0000	0.0000	0.1038	0.0000	0.1357
COD - BLACK-FINNED	0.0406	0.0000	0.2025	0.0000	0.1447	0.0000	0.0614
BREAM - JAPANESE LARGE-EYE	0.3662	0.0000	0.0000	0.0000	0.0000	0.0000	0.1196
WRASSE - UNSPECIFIED	0.0189	0.0000	0.1474	0.1105	0.0797	0.0000	0.0780
EMPEROR - RED SPOT	0.2988	0.0000	0.0000	0.0000	0.0000	0.0000	0.0976
COD - BLUE SPOT ROCK	0.0000	0.0000	0.0000	0.0049	0.2736	0.0000	0.0393
PURPLE TUSK FISH	0.0977	0.0000	0.1288	0.0000	0.0000	0.0000	0.0499
EMPEROR - LONG NOSE	0.0000	0.0000	0.0000	0.0279	0.1861	0.0000	0.0357
JOBFISH - UNSPECIFIED	0.0731	0.0000	0.0000	0.0000	0.1322	0.0000	0.0420
FISH - MIXED REEF A	0.0000	0.0000	0.0000	0.0000	0.1600	0.0000	0.0219
FUSILIER - YELLOW TAIL	0.0000	0.0000	0.0000	0.1073	0.0000	0.0000	0.0391
COD - POTATO	0.0519	0.0000	0.0000	0.0432	0.0000	0.0000	0.0327
COD - TOMATO	0.0093	0.0000	0.0000	0.0358	0.0495	0.0000	0.0229
EMPEROR - RETICULATED	0.0000	0.0000	0.0000	0.0000	0.0900	0.0000	0.0123
SMALL-TOOTHED JOBFISH	0.0000	0.0000	0.0000	0.0799	0.0000	0.0000	0.0291
BLUE SPOT TROUT	0.0351	0.0000	0.0000	0.0000	0.0138	0.0000	0.0133
COD - BLUE SPOT	0.0488	0.0000	0.0000	0.0000	0.0000	0.0000	0.0159
GOLD BANDED JOBFISH	0.0000	0.0000	0.0000	0.0464	0.0000	0.0000	0.0169
EMPEROR - THREADFIN	0.0328	0.0000	0.0000	0.0000	0.0000	0.0000	0.0107
COD - RED FLUSHED	0.0000	0.0000	0.0000	0.0165	0.0000	0.0000	0.0060
SURGEON FISH	0.0141	0.0000	0.0000	0.0000	0.0000	0.0000	0.0046
PERCH - DARK TAILED SEA							
PERCH	0.0000	0.0000	0.0000	0.0117	0.0000	0.0000	0.0043

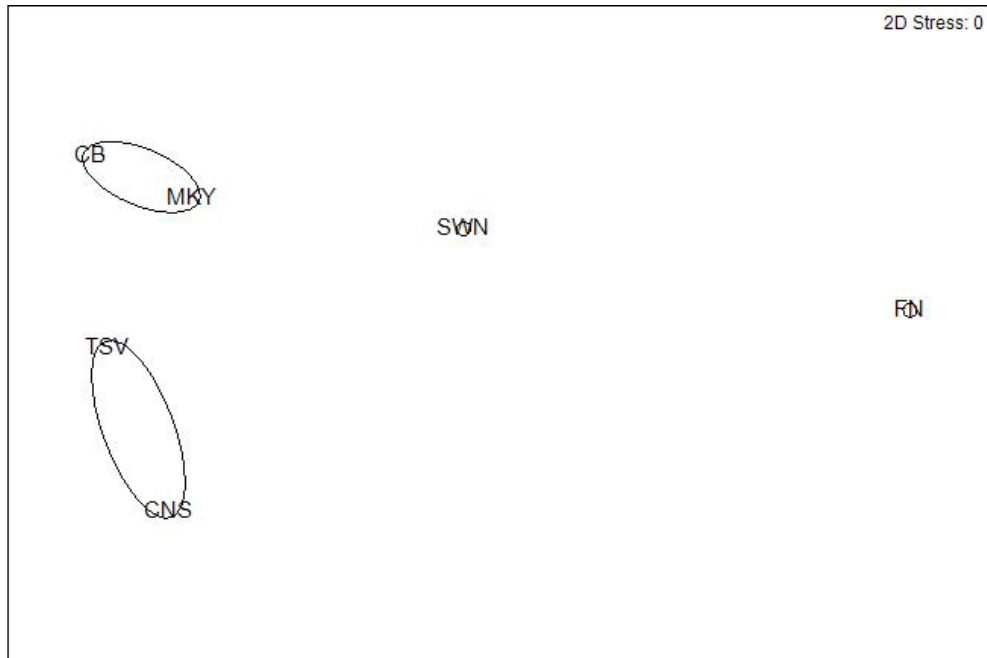


Figure 12. Multidimensional scaling plot of species composition by region for reported recreational catches, data combined for 1997, 1999 and 2002. Lines indicate 75% similarity based on Bray-Curtis similarity index. Data derived from RFISH surveys.

Effects of Line Fishing Project

Data from the ELF experiment provide comparative information for the commercial, charter and recreational components of the CRFFF. The species composition of the structured surveys provides a good approximation of the overall line catch, including a wide range of species not counted in any of the quota groups in the fishery as they are likely to be discarded (Table 4). The results demonstrate that coral trout and red throat emperor were the main species caught. The next most commonly caught species were stripey, bommie cod, yellow-tailed emperor, red bass, black-tipped cod and speckle-finned cod. Since the ELF experiment occurred on reefs in the Mackay, Townsville and Cairns regions, these data are unlikely to be representative of all other regions (Capricorn Bunker, Swains and Far Northern). MDS analysis of regional species composition data indicated that the two clusters of reefs in the Mackay region grouped together, while all regions showed significant differences (Figure 13). Annual MDS analysis showed that there were no significant differences in the species composition by year from 1995 to 2005 (Figure 14). This result indicates that species composition on reefs monitored by the ELF experiment remained stable over time. Although the ELF experiment monitored a small subset of reefs, some of which remained closed to fishing and others that were opened to fishing during various periods, the data suggest that the species composition available to the line fishery remain relatively stable over time. Thus the observed changes in species composition in the various sectors of the fishery may have been the results of other factors such as changes in reporting, areas fished, species targeted or retention practices.

Table 4. Species composition of the Effects of Line Fishing structured fishing surveys. Data pooled across all reefs and years (1995-2005). Greyed rows indicate non-“other species”

Common name	% composition
Coral Trout	57.29
Red-throat Emperor	12.679
Stripey	5.9298
Bommie cod	3.9250
Yellow-Tailed Emperor	2.8470
Red Bass	1.5467
Black-tipped Cod	1.3108
Trevally	1.2610
Speckle-Finned Cod	1.0916
Black-Spot Emperor	0.925
Spangled Emperor	0.7892
Blue-spot Trout	0.6803
Wire-Netting cod	0.6441
Grey Reef Shark	0.5624
Flowery Cod	0.5322
Tuskfish	0.4989
Red Emperor	0.4596
Paddle-tail	0.4309
Footballer Trout	0.4082
Camouflage Rock Cod	0.3855
Grass Sweetlip	0.3765
Longfin Rockcod	0.3508
Hussar	0.3387
Shark	0.3387
Chinaman-fish	0.3054
Peacock Cod	0.2994
Barramundi Cod	0.2873
Black-Spot Sea-Perch	0.2283
Shark Mackerel	0.2086
Coronation Trout	0.1799
Moses Perch	0.1587
Hump-headed Maori Wrasse	0.1482
Green Job-fish	0.1376
Gold Banded Fusilier	0.1345
Trout Cod	0.1345
Blue Maori	0.1315
Pink-eared Emperor	0.1315
White-tip Shark	0.1255
Other cods	0.1224
Striped Sea-perch	0.1058

White-Lined Cod	0.0937
Bar-cheeked Trout	0.0892
Common name	% composition
Black-tip Shark	0.0877
Coral-Trout Cod	0.0816
Passionfruit Trout	0.0741
Blue tuskfish	0.0695
Long-nosed Emperor	0.0695
Venus Tusk-Fish	0.0650
Lunartail Trout	0.0620
Honeycomb Cod	0.0529
Slender Remora	0.0453
Spanish Mackerel	0.0408
Barracuda	0.0393
Triggerfish	0.0393
Chocolate Cod	0.0348
Other wrasse	0.0348
Parrotfish	0.0332
Estuary Cod	0.0302
Red-Spot Emperor	0.0242
Gold-Spot Cod	0.0211
Maori Seabream	0.0211
Orange-Striped Emperor	0.0211
Variegated Emperor	0.0211
Spotted Sea Bream	0.0196
Yellow-Spotted Emperor	0.0181
Crocodile Longtom	0.0166
Flagtail Rock Cod	0.0166
Yellow-Striped Emperor	0.0166
Big-Eye Bream	0.0151
Scarlet Sea-perch	0.0151
Blacksaddle Rockcod	0.0136
Redmouth Rockcod	0.0136
Bronze Whaler Shark	0.0121
Blue-Banded Hussar	0.0106
Coral Rockcod	0.0106
grassy sweetlip	0.0106
Slatey Bream	0.0106
garfishes	0.0091
Giant Moray Eel	0.0091
Grinner	0.0091
Queenfish	0.0091
Six Spot Rockcod	0.0091
Tomato Rockcod	0.0091
Hexagon Rockcod	0.0075
Mangrove Jack	0.0075
Octopus	0.0075

White-Spotted Rockcod	0.0075
Bass	0.0060
<u>Common name</u>	<u>% composition</u>
Cheeklined maori wrasse	0.0060
Midnight Seaperch	0.0060
Tripletail Maori Wrasse	0.0060
bream	0.0045
Collared Sea-Bream	0.0045
Fussilier	0.0045
Goatfish	0.0045
Moari Sea Perch	0.0045
Other sweetlip	0.0045
Silvertip Shark	0.0045
Squirrel Fish	0.0045
Crescent Tail Bigeye	0.0030
Dogtooth Tuna	0.0030
Golden Trevally	0.0030
Large mouth Rockcod	0.0030
Onespot seaperch	0.0030
Other lutjanid	0.0030
Rainbow runner	0.0030
Red-Lined Triggerfish	0.0030
Reef Stonefish	0.0030
Thumbprint Emperor	0.0030
Tuna	0.0030
Wobbegong	0.0030
Bludger Trevally	0.0015
Cobia	0.0015
coral bream	0.0015
Dark-tailed Seaperch	0.0015
Diamond Trevally	0.0015
Dothead Rockcod	0.0015
emperor unspecified	0.0015
Four saddle Rockcod	0.0015
Gold-spotted Trevally	0.0015
Grey mackerel	0.0015
Japanese Sea Bream	0.0015
Mackarel Tuna	0.0015
Reptile	0.0015
Small-Toothed Jobfish	0.0015
Spotted mackerel	0.0015

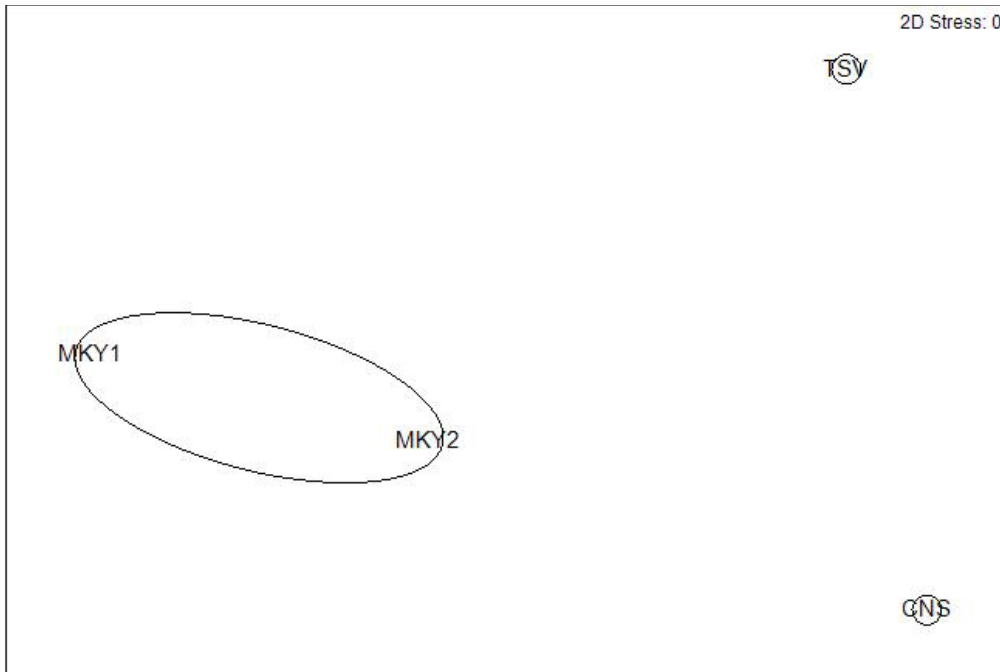


Figure 13. Multidimensional scaling plot of species composition by region for Effects of Line Fishing structured surveys, all years combined 1995 to 2005. Lines indicate 75% similarity based on Bray-Curtis similarity index.

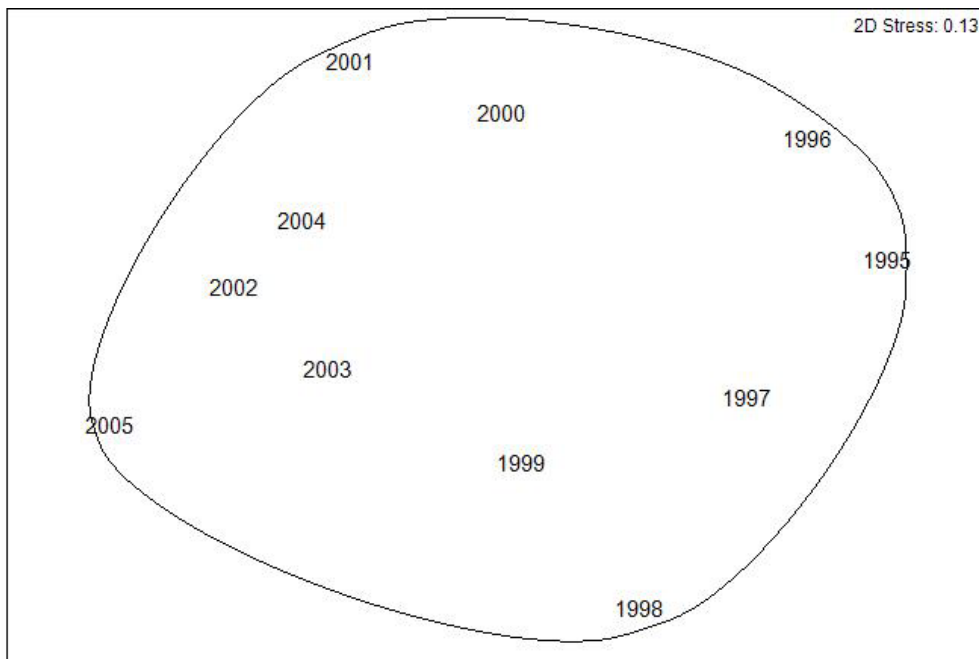


Figure 14. Multidimensional scaling plot of species composition by year for Effects of Line Fishing structured surveys, all years combined 1995 to 2005. Lines indicate 75% similarity based on Bray-Curtis similarity index.

The retained portion of the ELF observer catch indicated that there were a large number of species that were discarded by fishers, or that were misidentified (Table 5). Given that the ELF data included all animals caught, including undersized and prohibited species, there is likely to be a component of both. MDS analysis of regional ELF observer catch indicated significant similarity between Mackay and Swains regions, while the Townsville and the Far Northern regions were different from all other regions (Figure 15).

Table 5. Species composition of Effects of Line Fishing observer surveys, for species that were retained, all years combined 1995 to 2005. Greyed rows indicate non-“other species”.

Common name	% composition
Coral Trout	43.5715
Red-throat Emperor	26.5527
Stripey	7.5173
Spangled Emperor	4.1781
Hussar	2.0003
Bommie cod	1.9681
Yellow-Tailed Emperor	1.7906
Flowery Cod	1.3228
Black-tipped Cod	1.2099
Speckle-Finned Cod	0.8388
Tuskfish	0.6937
Black-Spot Emperor	0.5969
Gold Banded Fusilier	0.5646
Red Bass	0.5162
Red Emperor	0.5001
Wire-Netting cod	0.4839
Other cods	0.4678
Footballer Trout	0.3710
Coral-Trout Cod	0.3549
Coronation Trout	0.3549
Parrotfish	0.3549
Variegated Emperor	0.3549
Blue-spot Trout	0.3065
Camouflage Rock Cod	0.3065
Venus Tusk-Fish	0.2904
Chinaman-fish	0.2742
Barramundi Cod	0.2258
Moses Perch	0.2258
Bar-cheeked Trout	0.1936
Green Job-fish	0.1774
Black-Spot Sea-Perch	0.1452
White-Lined Cod	0.1291

Common name	% composition
Hump-headed Maori Wrasse	0.1129
Blue Maori	0.0968
Scarlet Sea-perch	0.0968
Long-nosed Emperor	0.0968
Striped Sea-perch	0.0807
Yellow-Spotted Emperor	0.0807
Peacock Cod	0.0645
Slatey Bream	0.0645
Other wrasse	0.0645
Maori Seabream	0.0484
Yellow-Striped Emperor	0.0484
Other sweetlip	0.0484
Pink-eared Emperor	0.0484
Paddle-tail	0.0323
Redmouth Rockcod	0.0323
Trout Cod	0.0323
bream	0.0161
Bluestripe Seaperch	0.0161
Chocolate Cod	0.0161
Collared Sea-Bream	0.0161
Lunartail Trout	0.0161
Passionfruit Trout	0.0161
Tomato Rockcod	0.0161

Summary

The data on catches and species composition of the CRFFF shows that there are substantial differences in harvest patterns between the commercial, charter and recreational sectors. MDS analysis of species compositions between sectors indicates that sector differences are much greater than inter-annual differences within sectors (Figure 16). The differences between sectors was most likely due to differences in fishing behaviour (e.g. recreational fishers can't usually access all reefs fished by commercial and charter and usually fish inshore reefs), species targeted, gear and bait types used etc. The overall results were used to produce a list of key species within the "other species" quota group. These are listed in Table 6.

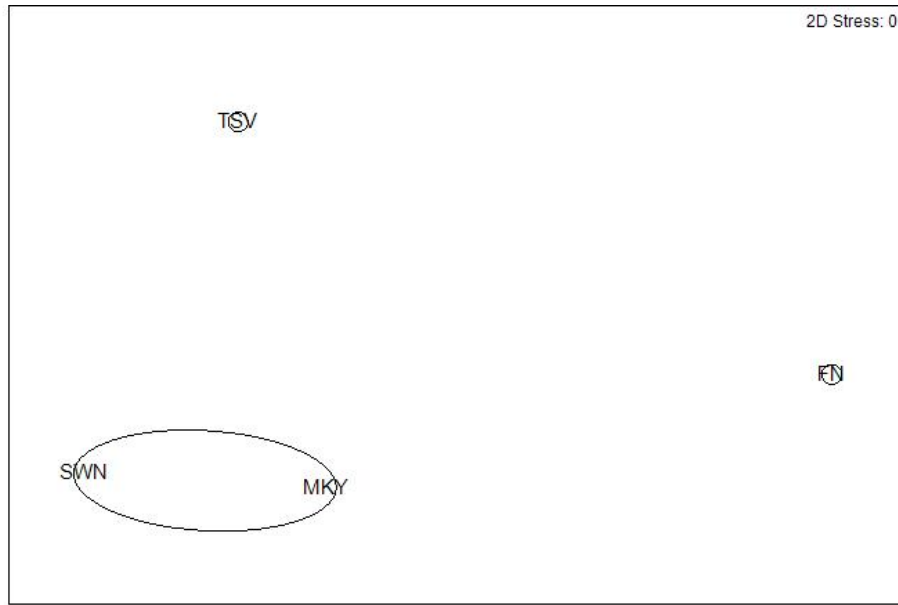


Figure 15. Multidimensional scaling plot of species composition by region for Effects Line Fishing observer surveys (retained portion). Lines indicate 75% similarity based on Bray-Curtis similarity index.

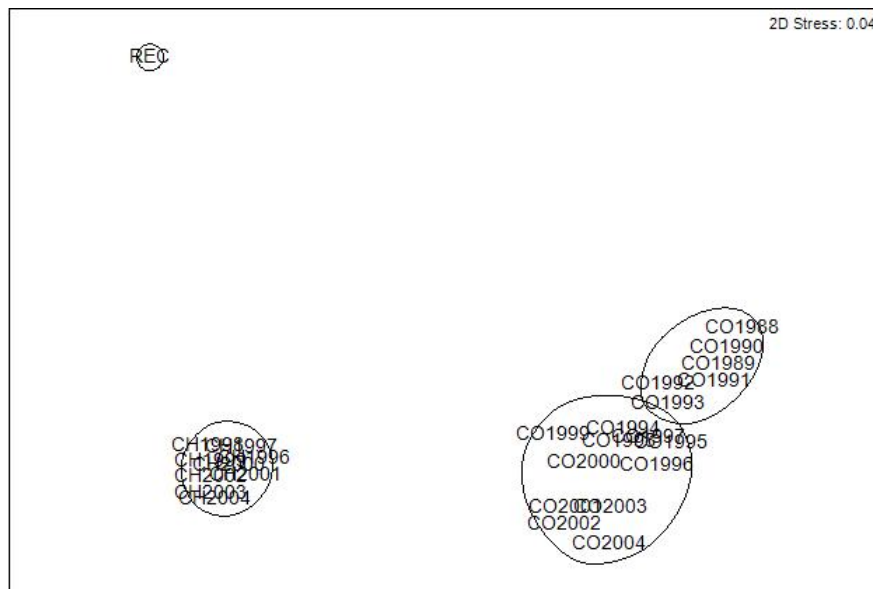


Figure 16. Multidimensional scaling plot of species composition for the three main sectors (Commercial, CO; Charter, CH; Recreational, REC) of the Coral Reef Fin Fish Fishery. Annual compositions are used when available. Recreational species composition was for 1997, 1999 and 2002 surveys combined. Lines indicate 75% similarity based on Bray-Curtis similarity index.

Table 1. Key components of the “other species” group in the Coral Reef Fin Fish Fishery as determined by analysis of harvest patterns in the major sectors. Names in square brackets are codes from the QDPI database that do not match accepted common names. Shaded species indicate those for which samples are available from the Effects of Line Fishing Project.

Common name	Species name
Yellow-Tailed Emperor	<i>Lethrinus atkinsoni</i>
Spangled Emperor	<i>Lethrinus nebulosus</i>
Hussar (pink)	<i>Lutjanus adetii</i>
Stripey bass	<i>Lutjanus carponotatus</i>
Small-mouth nannygai	<i>Lutjanus erythropterus</i>
Black-spot snapper [Black-Spot Emperor]	<i>Lutjanus fluviflamma</i>
Large-mouth nannygai	<i>Lutjanus malabaricus</i>
Moses perch	<i>Lutjanus russelli</i>
Red emperor	<i>Lutjanus sebae</i>
Rosy jobfish	<i>Pristipomoides filamentosus</i>
Goldband jobfish	<i>Pristipomoides multidens</i>
Blue-spotted rockcod [Bommie cod]	<i>Cephalopholis cyanostigma</i>
Gold-spot cod	<i>Epinephelus coioides</i>
Black-tipped cod	<i>Epinephelus fasciatus</i>
Flowery cod	<i>Epinephelus fuscoguttatus</i>
Speckle-finned cod	<i>Epinephelus ongus</i>
Longfin rockcod [Wire-netting cod]	<i>Epinephelus quoyanus</i>
Maori cod [Cod – maori unspecified]	<i>Epinephelus undulatostratus</i>
Bream coral	<i>Gymnocranius audleyi</i>
Venus tusk fish	<i>Choerodon venustus</i>
Tusk fish [Parrotfish ¹]	Family Labridae

¹ fish identified as parrotfish in the QDPI database are almost all tusk fish caught in the Capricorn Bunker Group

Biological data

Length-weight relationships were determined for 24 of the “other species” group (Table 7, Figure 17). These relationships enable the relatively accurate prediction of fish weights based on length measurements. These relationships have not previously been available for many of these species.

Table 7. Length weight relationship parameters for 21 “Other Species” and three minor coral trout species (indicated by *) based on data from the Effects of Line Fishing experiment database. Relationship is of the form: $w = a \cdot l^b$.

Species code	Species name	a	b	R^2
MWR	<i>Cheilinus undulatus</i>	7.085×10^{-9}	3.141	0.991
YTE	<i>Lethrinus atkinsoni</i>	1.201×10^{-8}	3.080	0.868
GSL	<i>Lethrinus laticaudis</i>	3.328×10^{-9}	3.285	0.956
PEE	<i>Lethrinus lentjan</i>	8.877×10^{-9}	3.109	0.928
SPE	<i>Lethrinus nebulosus</i>	2.586×10^{-8}	2.927	0.968
LNE	<i>Lethrinus olivaceus</i>	3.786×10^{-9}	3.203	0.991
PSL	<i>Lethrinus semicinctus</i>	6.348×10^{-8}	2.740	0.756
GJF	<i>Aprion virescens</i>	9.102×10^{-9}	3.079	0.981
RDB	<i>Lutjanus bohar</i>	6.110×10^{-9}	3.187	0.970
STB	<i>Lutjanus carponotatus</i>	5.381×10^{-9}	3.203	0.856
BSB	<i>Lutjanus fluviflamma</i>	2.000×10^{-8}	2.976	0.819
REM	<i>Lutjanus sebae</i>	4.673×10^{-9}	3.237	0.982
WLC	<i>Anyperodon leucogrammicus</i>	6.230×10^{-10}	3.458	0.944
BRC	<i>Cephalopholis cyanostigma</i>	4.000×10^{-8}	2.810	0.664
CCD	<i>Cephalopholis miniata</i>	8.802×10^{-9}	3.092	0.941
FBC	<i>Epinephelus fasciatus</i>	2.000×10^{-8}	2.938	0.926
FLC	<i>Epinephelus fuscoguttatus</i>	5.761×10^{-9}	3.173	0.973
MRC	<i>Epinephelus ongus</i>	8.250×10^{-9}	3.091	0.812
CRC	<i>Epinephelus polyphkadion</i>	1.901×10^{-9}	3.344	0.979
LRC	<i>Epinephelus quoyanus</i>	6.000×10^{-8}	2.734	0.910
BST	<i>Plectropomus laevis*</i>	3.371×10^{-9}	3.234	0.988
CRT	<i>Variola louti*</i>	2.100×10^{-8}	2.956	0.971
LTT	<i>Variola albimarginata*</i>	5.567×10^{-9}	3.180	0.947
TSK	<i>Choerodon spp.</i>	1.025×10^{-8}	3.096	0.921

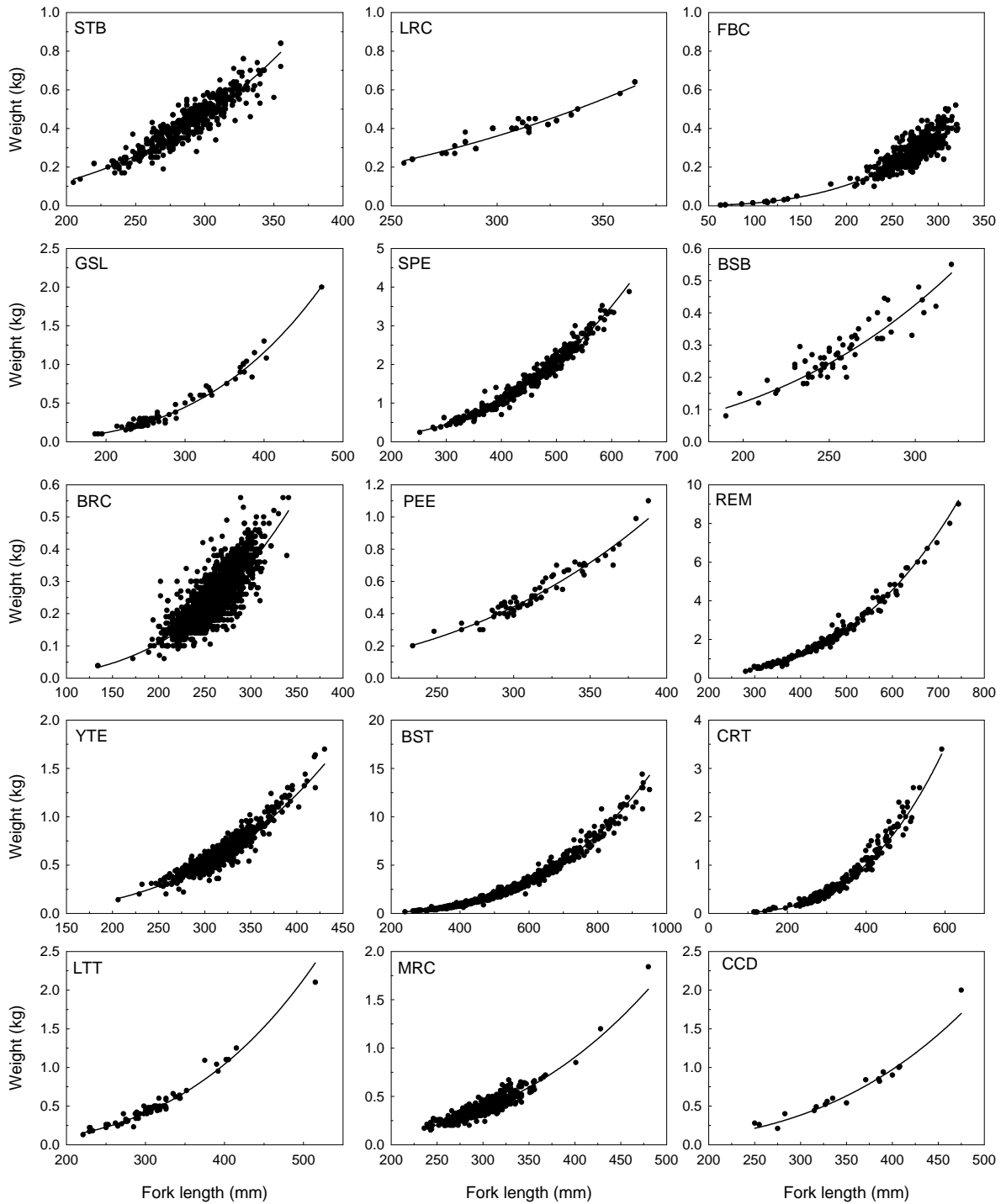
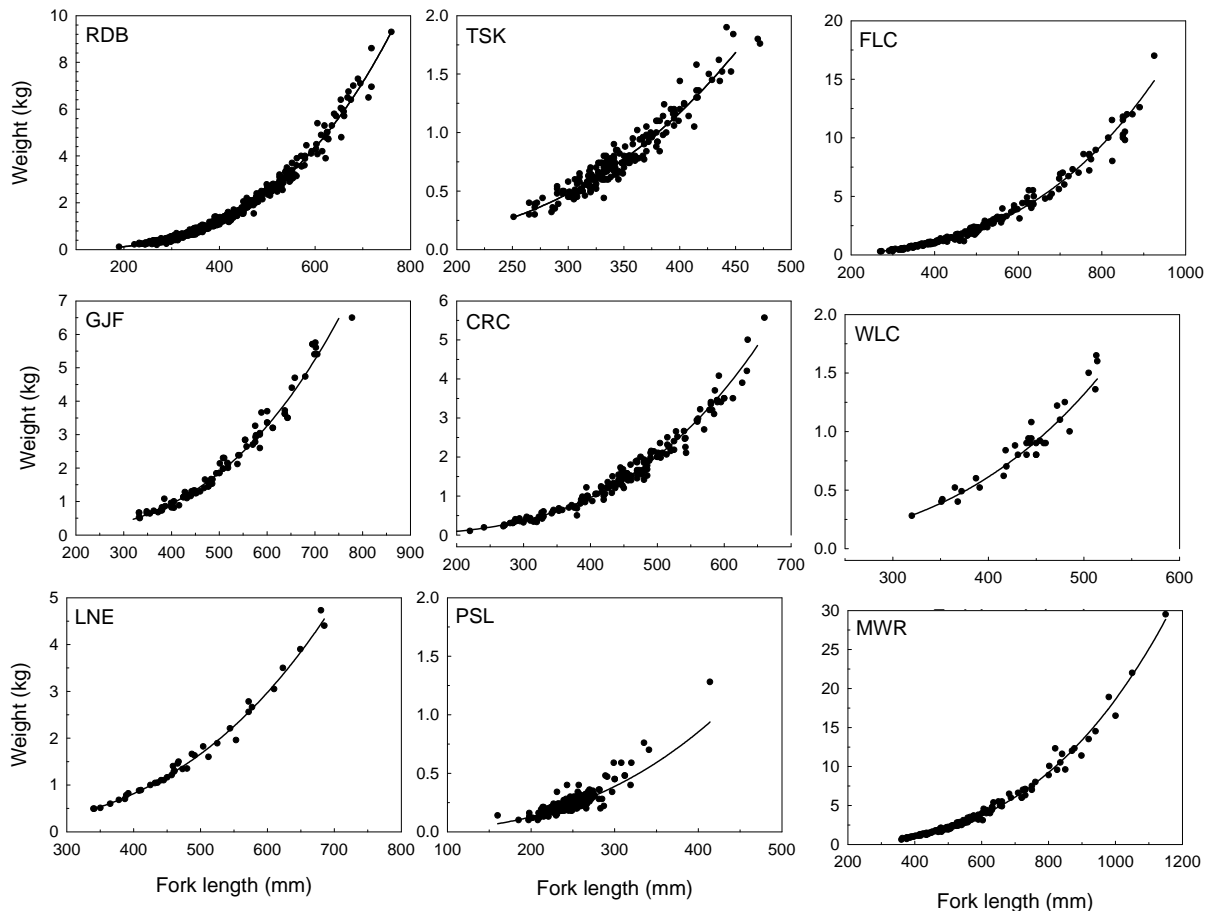


Figure 17. Length – weight relationships for 24 “other species” in the reef line fishery. Data from the Effects of Line Fishing Experiment database. Three letter species code corresponds to species in Table 7.

Figure 17 cont....



Conclusions

The results presented in this report provide the basis for the continued development of the biological aspects of this study. Twenty one species or species groups are identified as the key components of the “other species” catch in the CRFFF that will be the focus for further investigation. The results also provide an understanding of the harvest patterns within all sectors of the fishery. The largest take of “other species” is by recreational fishers, with more than 70% in the three years for which comparative data were available. Thus where management of these species is required action must be taken across sectors.

All sectors of the fishery showed regional differences in the species composition, indicating that management strategies need to recognise these differences. The ELF and charter sector data showed no changes in species composition over time, while the commercial fishery demonstrated a significant change in harvest pattern with the development of “live” export practices. This result suggested that harvest patterns can change with changes in the management strategy of the fishery. Further analysis of the data for subsequent years (2005 and 2006) will provide for an understanding of changes

that may have occurred with the introduction of the quota management system for the CRFFF and also the new zoning plan for the Great Barrier Reef.

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