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An update of commercial catch and effort information on the orange roughy (*Hoplostethus atlanticus*) fishery on the Louisville Ridge for the 1995–96 and 1996–97 fishing years

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This series documents the scientific basis for stock assessments and fisheries management advice in New Zealand. It addresses the issues of the day in the current legislative context and in the time frames required. The documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

An update of commercial catch and effort information for the orange roughy (*Hoplostethus atlanticus*) fishery on the Louisville Ridge for the 1995–96 and 1996–97 fishing years

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1. EXECUTIVE SUMMARY

1. A fishery for orange roughy developed on the Louisville Ridge in mid 1994. This area is to the east of New Zealand, about 600 km outside the New Zealand 200 n.mile EEZ. The fishery has consisted of primarily New Zealand and Australian vessels.

2. Catch summaries have been compiled for the New Zealand fishery using data from the Quota Management System (QMS). Estimates of catch are updated for fishing years 1995–96 and 1996–97, based on records from Trawl-Catch-Effort-Processing>Returns. Australian catches are summarised for the first time, with data provided by the Bureau of Resource Sciences in Canberra.

3. Reported New Zealand catch increased rapidly from about 200 t in 1993–94, to peak at over 11 000 t in 1994–95, before decreasing to 8000 t in 1995–96 and further to 1500 t in 1996–97. Effort in the fishery changed in a similar pattern, with 4, 30, 17, and 7 vessels working the grounds in the four fishing years.

4. Australian effort was significant for the first two years of the fishery. Catch data are not available for 1993–94, but catch in 1994–95 reached about 2000 t. In 1995–96 this dropped to 50 t. Participation in the fishery was mainly by one vessel.

5. Information on catch and effort of the New Zealand fleet is presented for three regions within the general fishery area. The fishery developed in the central region, where almost all the reported catch was taken in 1994–95. Fishing grounds to the north and south were also discovered, and in 1995–96 most catch was from the northern region. During 1996–97 the focus of catch shifted back to central areas.

2. INTRODUCTION

2.1 Overview

The Louisville Ridge is a chain of seamount features extending from the Kermadec Ridge, north of New Zealand, to east of the Chatham Islands. The Ridge is outside the New Zealand EEZ in international waters.

A fishery for orange roughy developed in 1994, mainly by Australian and New Zealand vessels. A general summary of the fishery through to 1995–96 was given by Clark (1998). In this report, available data from New Zealand sources are updated for 1995–96 and new

information from 1996–97 is added. Catch totals from Australian vessels working the area are incorporated for the first time.

This work was carried out by NIWA as part of the Ministry of Fisheries research project ORH9703 (“Orange roughy fisheries outside the EEZ”) for the 1997–98 year.

3. REVIEW OF THE FISHERY

3.1 Data sources

Data on catch and effort are recorded by all New Zealand registered deepwater fishing vessels, including charter vessels, on Trawl-Catch-Effort-Processing>Returns (TCEPRs). These give tow by tow information, with specific location and estimated catch for each trawl. These data have been regularly extracted from the Ministry of Fisheries catch-effort database for use in a number of orange roughy and oreo fisheries. They have been loaded into a relational database at NIWA (*dw_cdb*). This database was the source of all catch and effort information presented here. Other fishing return types (e.g., Catch-Effort-Landing>Returns) are not used in this fishery, so were not examined. Data were extracted from the NIWA database into an EXCEL spreadsheet for analysis. No data were available for other countries that have fished the area at times (e.g., China, Russia).

Data have not been error-checked in great detail. However, obvious mistakes in position (e.g., large differences in start and finish coordinates, positions well outside any other fished area) were corrected. A large number of tows had misreported longitude, with east and west being mixed. This meant tows carried out on the Louisville Ridge were reported from off the west coast of the South Island, and some tows from Lord Howe Rise were recorded as the northern Louisville. These mistakes were corrected before analysis.

Information on Australian catches has been provided by the Bureau of Resource Sciences (BRS, Canberra). Data for the 1995 calendar year were obtained from the principal fishing company working the Louisville Ridge. There was previously no requirement for vessels working outside the Australian EEZ to provide tow by tow logs to the Australian Fisheries Management Authority (AFMA), and so details are not readily available. The data from BRS are incomplete, in particular the last part of 1994 when it is believed that substantial catches were taken. No position coordinates were given, and so analysis beyond presentation of general catch totals has not been undertaken. On at least one occasion, an Australian vessel was chartered by a New Zealand company and landed Louisville fish in New Zealand. New Zealand commercial fishing logbooks were used for this trip, and so the data are included in the New Zealand analyses.

3.2 Distribution of the fishery

Fishing activity on the Louisville Ridge has extended from almost 30° S to over 45° S, and a range of longitude from 172° W to 155° W. The fishery is distant from those within the New Zealand EEZ, with separation of the Louisville Ridge grounds from those on the Chatham Rise by about 300 n.miles. Apart from two knolls on the ‘Arrow Plateau’ just inside the EEZ, there is deep water (over 1500 m) between the Chatham Rise and the Louisville Seamount Chain.

The distributions of trawls and catch rate of orange roughy taken by New Zealand vessels during 1995–96 and 1996–97 are shown in Figures 1 and 2. The number of trawls carried out in 1996–97 was considerably less than during 1995–96, with less effort in 1996–97 being expended in southern parts of the Ridge.

Trawls on the Ridge have been clustered in three general areas, which are separated in a number of analyses in this report (following the division by Clark 1998):

- **North:** From latitudes 35° S to 39.9° S, longitudes 165° W to 171° W.
- **Central:** Latitudes 40° S to 44.9° S, longitudes 160° W to 167° W.
- **South:** Latitudes 45° S to 50° S, longitudes 150° W to 159° W.

3.3 Catches in the fishery

New Zealand vessels first fished the Louisville Ridge in the 1993–94 fishing year. Reported catch rose from about 200 t in that year, to over 11 000 t the following year (Table 1). Catches have since dropped to 8700 t and 1500 t in the last two years. The Australian catch is believed to be substantial in 1993–94 (primarily August 1994 onwards) when the fishery first developed. This increased to about 2000 t in 1994–95 before Australian vessels left the fishery. Other nations (e.g., China, Russia) are known to have had vessels in the area, but their catch is unknown.

Table 1: Reported catch (t) of orange roughy (ORH), smooth oreo (SSO) and black oreo (BOE) from the Louisville Ridge, 1993–94 to 1996–97, by New Zealand and Australian vessels (figures are rounded to the nearest tonne, catches estimated from fishing returns)

Year/Region	AusORH	NZORH	TotORH	SSO	BOE
1993–94					
Total	2500	192	2700	9	<1
North		1		0	0
Central		187		9	<1
South		3		0	0
1994–95					
Total	>1 912	11 228	>13 140	226	140
North		39		0	<1
Central		10 846		162	8
South		343		64	132
1995–96					
Total	52	8 764	8 816	175	308
North		*3 920		3	2
Central		2 960		70	48
South		1 882		102	258
1996–97					
Total	0	1 579	1 579	3	68
North		461		<1	<1
Central		1 090		3	64
South		28		<1	4

* 2 t was reported north of 35°, so area totals are less than the overall total.

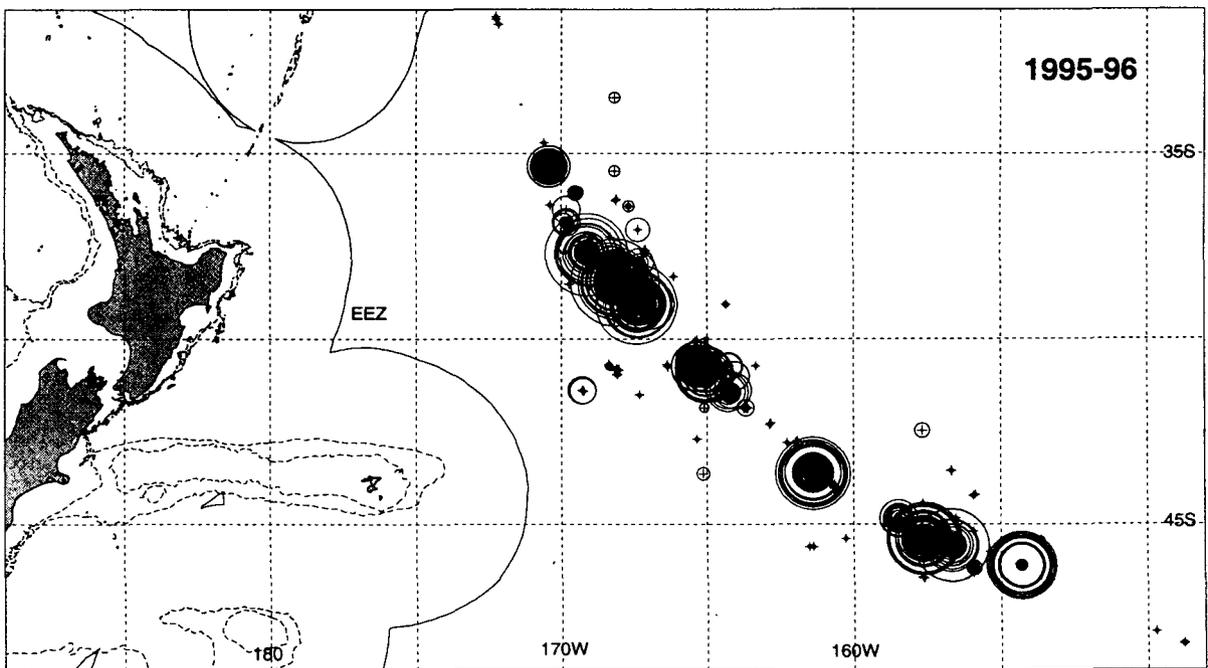
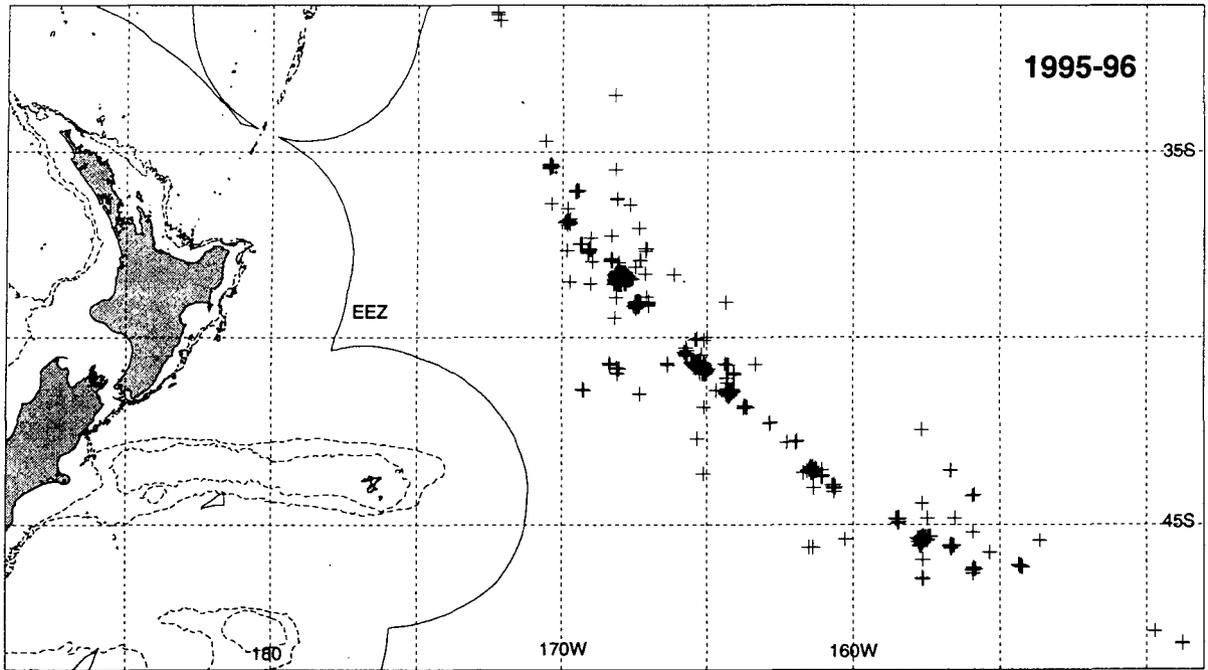


Figure 1: Distribution of trawls for orange roughy (top panel), and of orange roughy catch per tow (lower panel, maximum circle size = 70 t) by New Zealand vessels on the Louisville Ridge during 1995–96 (number of trawls = 4000).

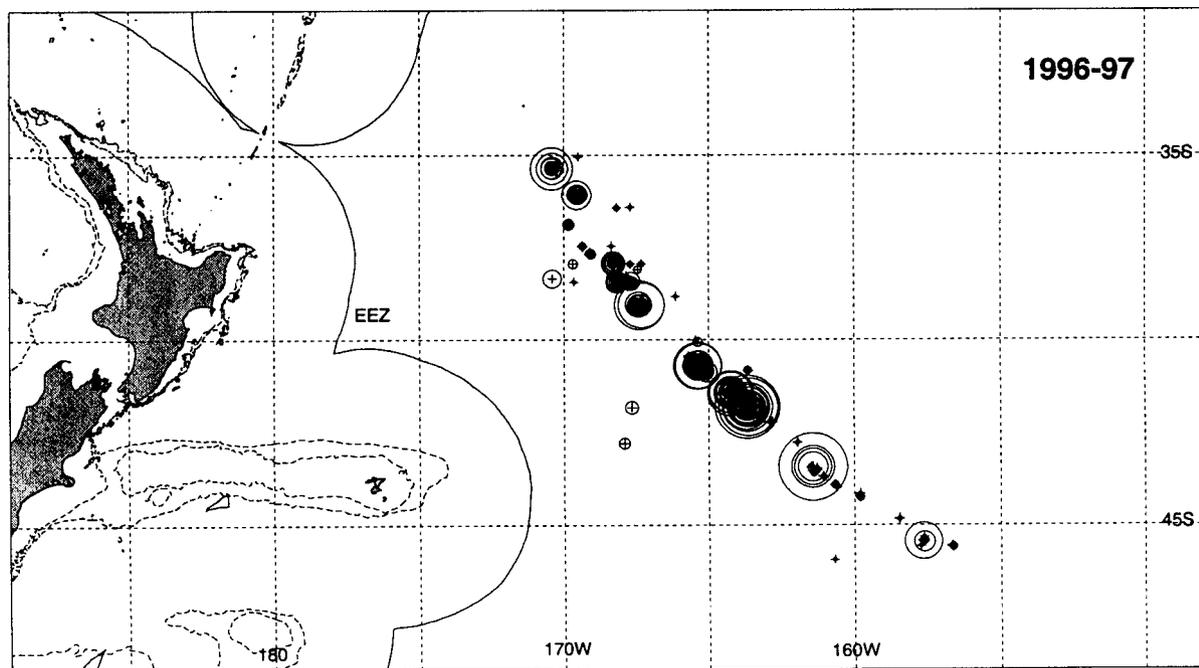
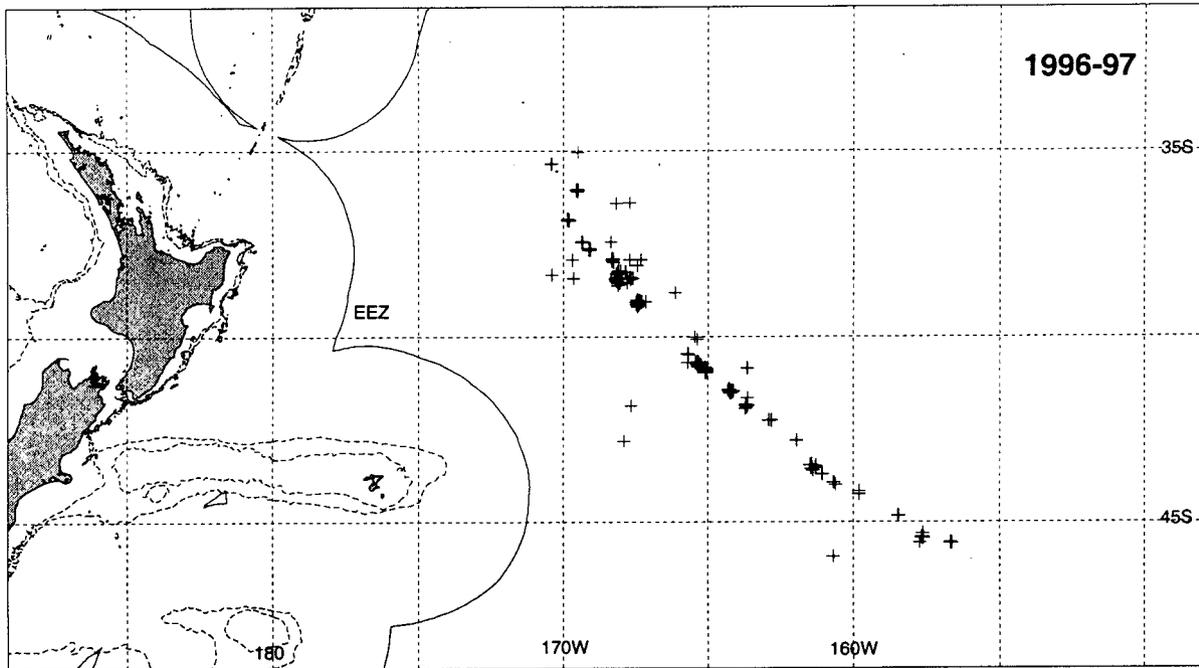


Figure 2: Distribution of trawls for orange roughy (top panel), and of orange roughy catch per tow (lower panel) by New Zealand vessels on the Louisville Ridge during 1966–97. Circle size scale is the same as Figure 1 (number of tows \approx 1250).

New Zealand catch has varied between years and areas. Distribution of catch has shifted from the central region to northern and southern regions (Figures 3 and 4). There was a marked decrease in catch from the central region between 1994–95 and 1995–96, as the other grounds developed. Most catch in 1995–96 came from new grounds worked in the northern region of the Ridge, with southern hills also yielding good catch rates. In 1996–97, the catch from the north decreased, and the southern area hardly features at all.

Oreos have been taken as bycatch in the fishery. Several hundred tonnes were caught in 1994–95 and 1995–96, but catches were small in 1996–97 (*see* Table 1). This is probably a reflection of the small effort in southern parts of the ridge, where most oreo (especially black oreo) had been taken previously (Clark 1998).

3.4 Catch and effort

Levels of effort in the fishery have varied considerably between years and between regions. The number of vessels and number of tows increased in 1994–95, and then decreased in 1995–96 and 1996–97. Plots of catch and effort (represented by number of trawls) by month for the three regions are presented in Figure 5. The main changes in the 1996–97 year are a marked drop in catch from northern and southern areas, despite effort levels remaining relatively high. The southern hills were not fished much at all.

Available data are not sufficient to carry out a detailed or robust analysis of catch-per-unit-effort. The time period of data is short, with effectively only three years of a developed fishery which has varied between areas. There has also been considerable variation between years in the number of vessels, their fishing power, experience of skippers and crew on the grounds, and the number of tows carried out each year. However, to determine if any overall trends are evident, unstandardised catch per unit effort has been analysed. Mean catch per trawl (i.e., total catch divided by number of tows) is summarised in Table 2.

Peak catch rates were reached in 1995–96 for the North and South, and in 1994–95 for Central Louisville fisheries, showing declines thereafter. The total catch rate has declined since 1994–95. Although the time period of the fishery is very short (only three years), because it is based largely on aggregations of fish on seamounts, it would be expected that catch rates would remain high for the first part of fishing down, as aggregations could be targeted even though biomass was decreasing. The magnitude of these catch rates is also much lower than normally experienced in the main New Zealand orange roughy fisheries.

Table 2: Average catch rate (tonnes per tow) of orange roughy from the Louisville Ridge, 1993–94 to 1996–97; and by sub-area (– fewer than 20 tows, so not calculated)

Area	1993–94	1994–95	1995–96	1996–97
Total	1.4	2.6	2.2	1.3
North	–	0.5	3.0	0.8
Central	1.5	2.7	1.4	1.7
South	–	2.3	2.8	0.6

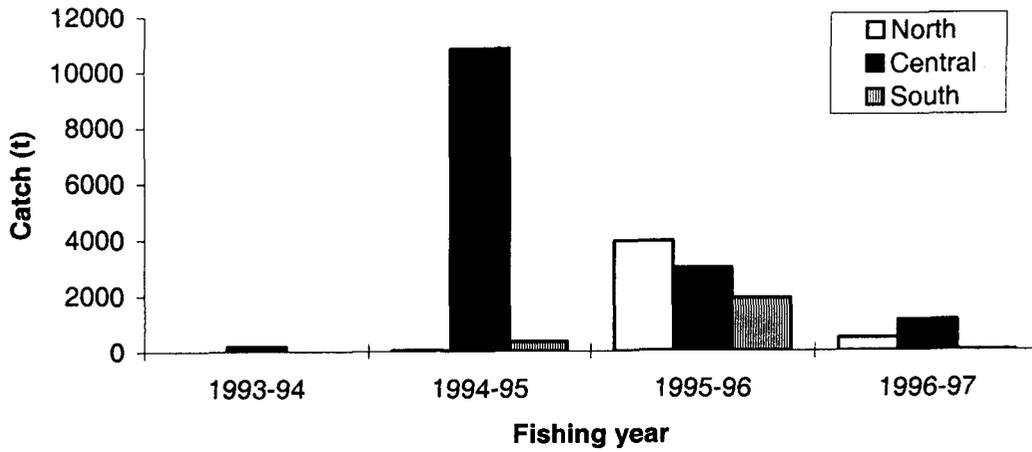


Figure 3: Reported New Zealand catch of orange roughy (t) from the three regions of the Louisville Ridge by fishing year from 1993-94 to 1996-97.

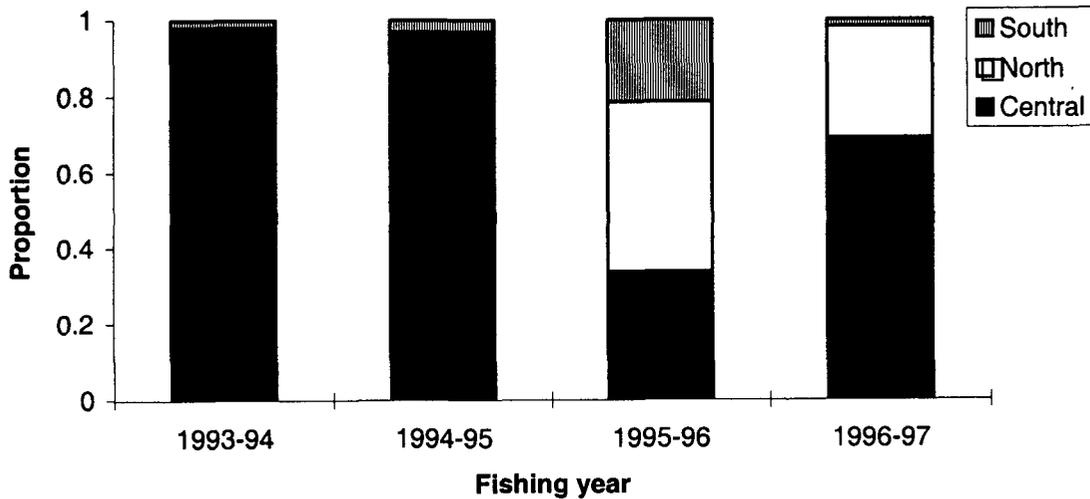


Figure 4: Relative proportion of New Zealand orange roughy catch from the three regions of the Louisville Ridge by fishing year from 1993-94 to 1996-97.

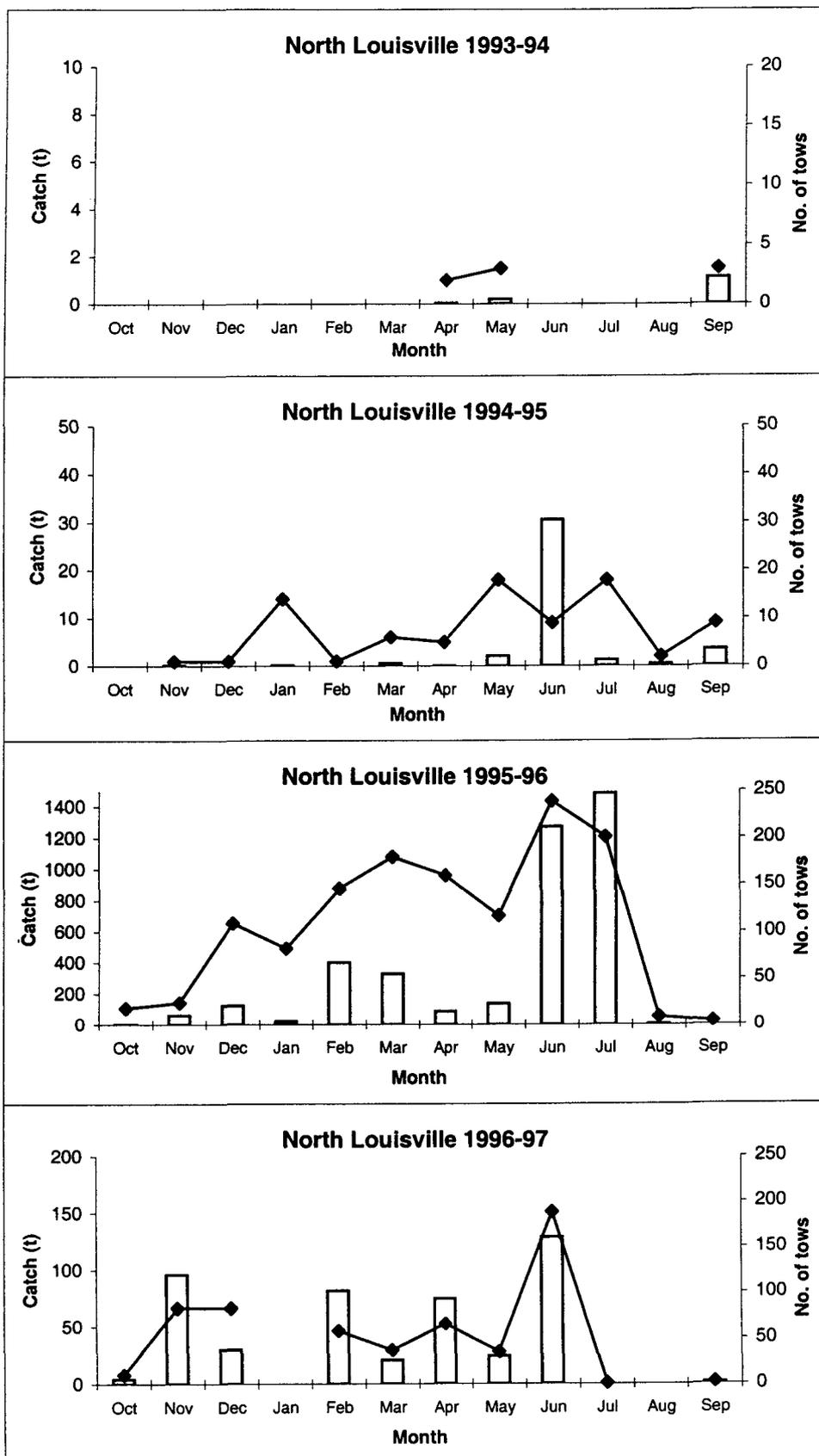


Figure 5a: Plot of monthly catch (bars, t) and effort (lines, number of tows) for the orange roughy fishery on the north Louisville Ridge (note different scales for each year).

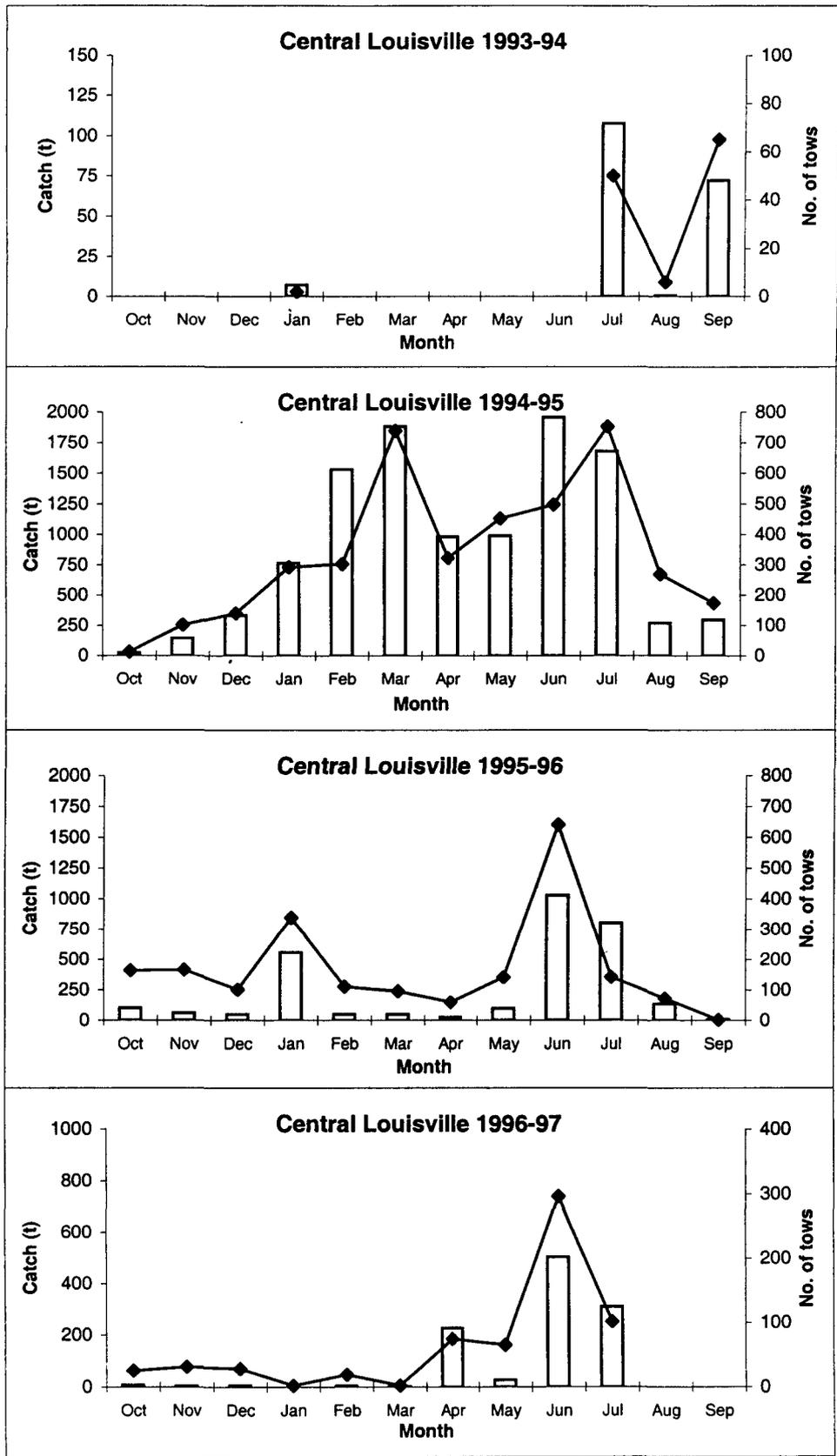


Figure 5b: Plot of monthly catch (bars, t) and effort (lines, number of tows) for the orange roughy fishery on the central Louisville Ridge (note different scales for each year).

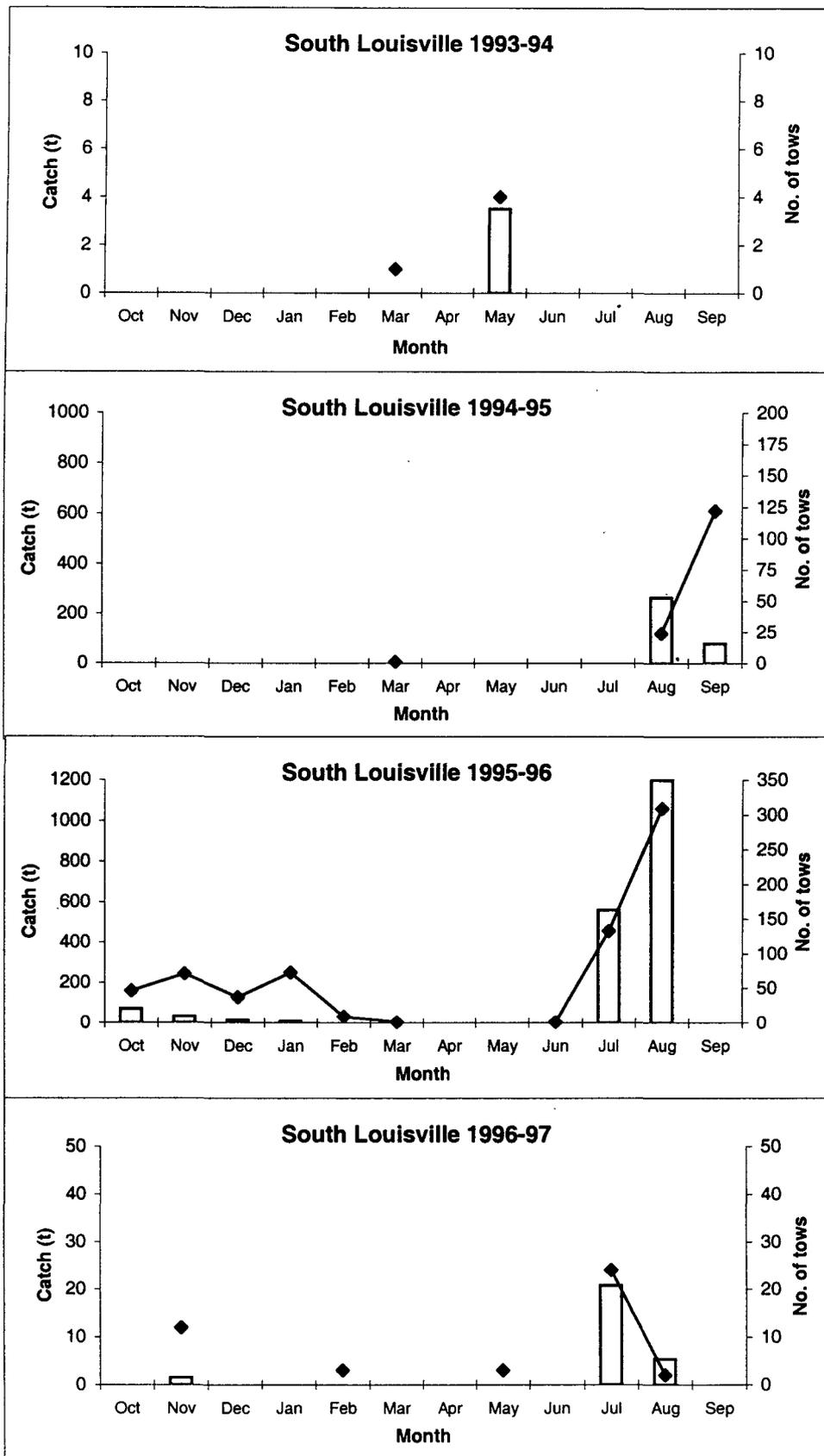


Figure 5c: Plot of monthly catch (bars, t) and effort (lines, number of tows) for the orange roughy fishery on the southern Louisville Ridge (note different scales for each year).

A common pattern in the development of orange roughy fisheries is a period of good fishing and large catches throughout a large part of the year. As the stock size declines, with fishing down of possible 'resident' fish, the fishery becomes more seasonal. Although data are limited, I have looked at quarters of the fishing year to see if the overall trend in CPUE is being caused by the collapse of the non-winter fishery (Table 3). The grouping of months tries to follow sensible biological periods so that, for example, June–July–August are combined for defining the winter spawning period.

CPUE has declined between 1995–96 and 1996–97 in all periods in the northern region. Catch rates in winter are higher than in other months, but these have decreased markedly between 1995–96 and 1996–97 in both north and south areas. Catch rates have been maintained during winter in the central region, but have fallen in spring and summer months.

The frequency of catches of a certain size has been examined over the last three years of the fishery (Figure 6). In north Louisville there was a high proportion of small catches in 1994–95, as the fishery was developed. This decreased substantially in 1995–96, when there were many tows with catches over 5 t. Large catches have since dropped away in frequency, and the proportion of small catches has increased again. Changes in the central Louisville region have been minor. In southern areas, the proportion of small catches has remained constant, although large catches have become less frequent.

Table 3: Average catch rate (t/tow) of orange roughy by region of the Louisville Ridge in 3-month periods of the fishing year (data from N.Z. vessels, – indicates less than 20 tows)

Area/months	1993–94	1994–95	1995–96	1996–97
NORTH				
S-O-N	–	–	1.4	1.1
D-J-F	–	–	1.6	0.8
M-A-M	–	0.1	1.2	0.9
J-J-A	–	1.1	6.1	0.7
Total		0.5	3.0	0.8
CENTRAL				
S-O-N	1.1	1.6	0.5	0.2
D-J-F	–	3.6	1.2	0.2
M-A-M	–	2.5	0.6	1.8
J-J-A	1.9	2.6	2.2	2.0
Total	1.5	2.7	1.4	1.7
SOUTH				
S-O-N	–	0.6	0.9	–
D-J-F	–	–	0.2	–
M-A-M	–	–	–	–
J-J-A	–	11.0	4.0	1.0
Total	–	2.3	2.8	0.6

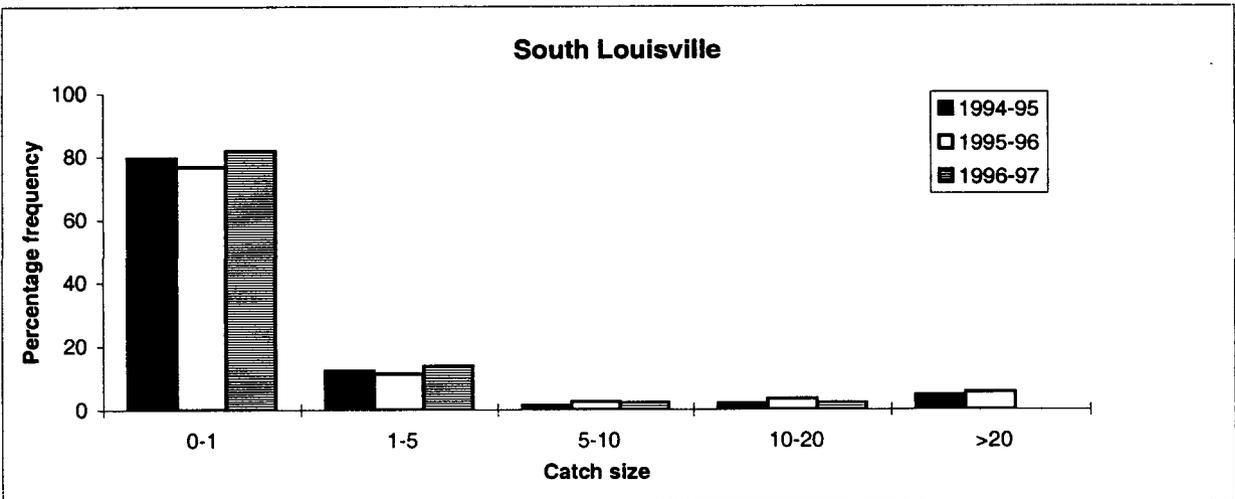
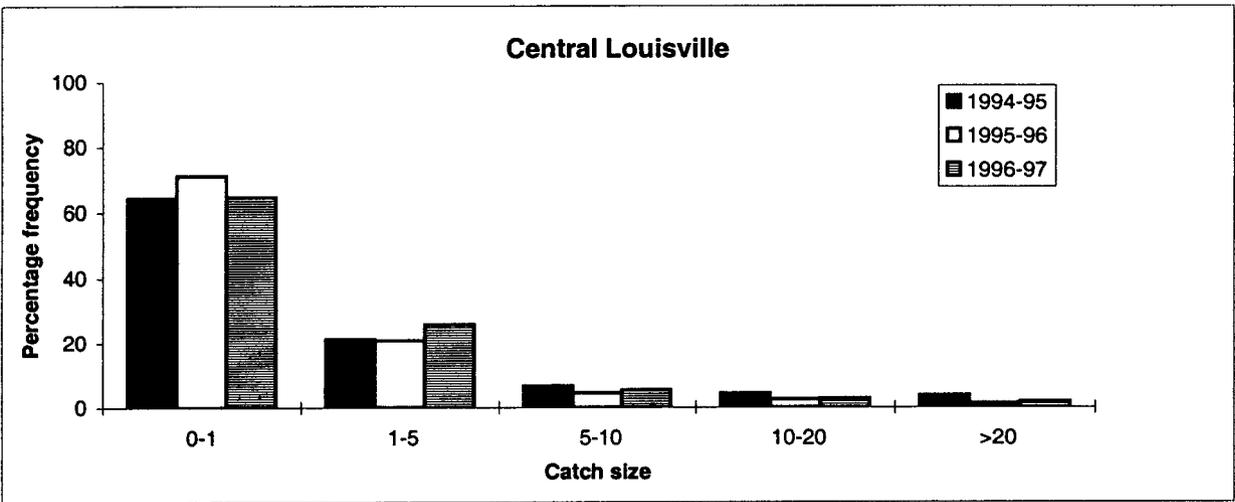
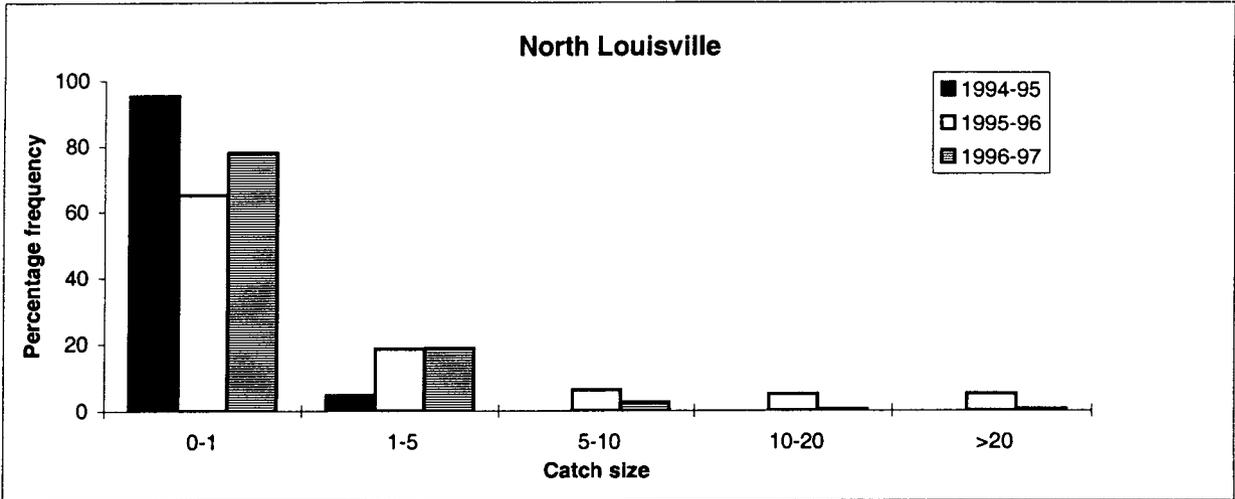


Figure 6: Frequency distribution of catch size of orange roughy on the Louisville Ridge by sub-area and fishing year 1994-95 to 1996-97 (N.Z. vessels only).

4. DISCUSSION

The status of the stock/stocks is uncertain. There are no estimates of biomass and yield. With only three years of fishing it could be expected that the fishery is still largely in the 'fishing-down' phase. However, the marked decreases in catch and catch-per-unit-effort in the northern and southern grounds in 1996–97 may be cause for concern. The level of fishing pressure on some of the main grounds has been very intense, with many vessels and trawls being carried out in a small area.

Comparison of the distribution of catch rate over time (Figure 7) perhaps gives the simplest picture of the likely status of the fishery. The actual catch in 1996–97 has decreased substantially, the area of high catch rates has contracted, and the general level of catch rate is lower than in previous years. These are not characteristic of a healthy stock or fishery. Continued monitoring of catch and effort by area is important, although it appears likely that some of the fishing grounds are already overexploited. Research planned by the Ministry of Fisheries in 1998–99 will involve a detailed analysis of standardised CPUE, and this, together with a further year of fishing data, may enable a preliminary stock assessment to be carried out.

ACKNOWLEDGMENTS

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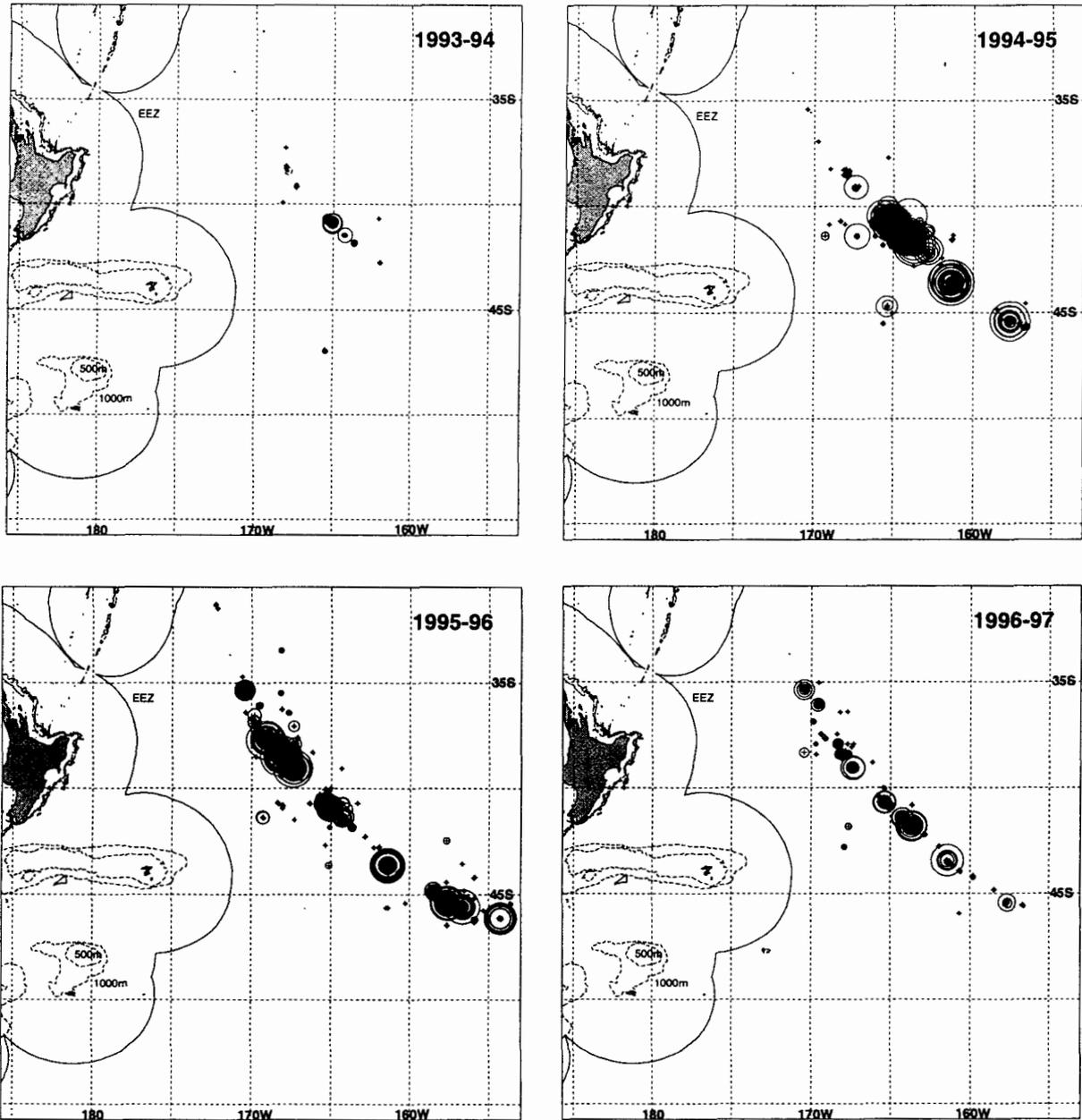


Figure 7: Distribution of New Zealand catch of orange roughy (catch per trawl) on the Louisville Ridge by fishing year, 1993–94 to 1996–97 (maximum circle size = 90 t).