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New Zealand Fisheries Assessment Research Document 88/23

Red gurnard

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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.

Red gurnard (*Chelidonichthys kumu*)

1. Introduction.

A. Overview.

This paper presents a review of the available biological data and the fishery to the 1986/87 fishing year and presents MCY levels, based on historical landings data.

B. Description of the fishery.

Red gurnard is an important by-catch in the inshore trawl fishery in most areas of New Zealand. It is a major by-catch in the longline and set net fisheries and a minor by-catch for deepwater trawlers. Target fisheries are known in Pegasus Bay, the West Coast South Island and off Mahia.

Red gurnard is managed by separate fishstocks. The areas are shown in Figure 1.

The original TACs were based on 1983 landings for all areas except the Southern region, where the 1984 landings were used. McGregor and Voller (1985) reviewed TAC levels for the 1985/86 fishing year. Sullivan (1986,1987) reviewed TAC levels for the 1986/87 and 1987/88 fishing years respectively.

Current 1987/88 TAC figures (in tonnes green weight) are:

GUR1 (Auckland)	2100
GUR2 (Central East)	610
GUR8 (Central Egmont)	510
GUR7 (Challenger)	610
GUR3 (Chathams, Southland)	480
GUR10 (Kermadec)	10
TOTAL	4310

C. Literature Review.

Red gurnard is part of the Indopacific fauna and is found throughout the tropical and temperate waters of South Korea, China, Japan, Malaysia, South Africa, Australia and New Zealand (Kilner 1983). Major red gurnard fisheries in New Zealand lie north of the subtropical convergence (Kilner 1983) in shallow (< 55m depth) coastal waters over muddy or sandy bottoms (Elder 1976).

Spawning occurs over a widespread area - in shallow waters (Robertson 1980) as well as mid-shelf (Elder 1976) and extends throughout spring and summer (McGregor and Voller 1985). Gurnard have a short pelagic larval life of about 8 days before feeding begins (Robertson 1980). Gurnard are a relatively fast growing and short lived fish species, reaching sexual maturity at between 2 and 3 years of age. They recruit into the fishery at 2 years (males) and 3 years (females) (Elder 1976). The oldest gurnard found were about 15 years old (Elder 1976).

Catch data has been examined for the East Coast fishery (Kilner 1983) and the Wairarapa, Cook Strait and Egmont fisheries by the Central Fishery Management Planning Team (1986). The Southland fishery was reviewed by McGregor and Voller (1985) and Fenaughty and Bagley (1981) examined the fishery on the South Island East Coast. Massey (1988) compared the mesh selectivity of trawl fish species including red gurnard off East Cape.

11. Review of the Fishery.

A. Catch data.

(i) Domestic Landings.

National domestic landings are shown in Figure 2. These data indicate annual landings have increased linearly until the early 1960's when catch was almost 3000t. Catches fluctuated between 2000 and 4000t from the late 1960's to 1986. Recent landings indicate a decline to 2600t (1985/86) but this is within the historical range of fluctuations of this fishery. The cubic regression curve fitted to the data shows a trend of declining annual catch which is of some concern. Red gurnard comprised 11% of the 1965 finfish catch, but landings declined to 3.4% (1982) and approximately 2% for the 1985/86 fishing year (Anon 1965, King 1982, Hurst pers.comm) as fishers target more valuable fish species.

Red gurnard is essentially a bycatch species for the trawl, longline and set net fisheries and landings are affected by changes in fishing effort of the more valuable target species and may not necessarily represent changes in gurnard stocks. Introduction of the ITQ system in 1986 added further complexity

as many fishers may target red gurnard towards the end of the fishing year to fill any remaining quota not used for by-catch.

(ii) Domestic Landings by Method.

Domestic landings by method for the 1983/84 to 1985/86 fishing years are shown in Table 1. Trawling accounts for 85%, longlining 9% and set netting 4% respectively. These proportions remained constant over the three seasons examined.

(iii) Regional Landings.

Regional domestic landings are shown in Figure 3. In general, landings data follow the national trend with a decline in recent years.

In the North Island, gurnard is a major by-catch in the flatfish, trevally, red cod and snapper trawl fisheries. Gurnard has a long catch history in the Hauraki Gulf and East Coast Regions, where it has been an alternative catch to snapper. Catches fluctuated around 400t during the 1970's and have declined in recent years. The use of a 5" cod-end in the Auckland FMA over the last summer (1986/87) may have reduced the size of the red gurnard by-catch.

The East Northland, West Auckland and Bay of Plenty fisheries developed more recently. Red gurnard is a by-catch of the inshore trawl fishery for snapper and tarakihi. Catches peaked around 1983 and have since declined.

Catches in the Cook Strait and East Coast regions have been stable over the 1960's and 1970's, the Cook Strait data indicates a decline in catch throughout the 1980's. A target fishery occurs for red gurnard off Mahia and the East Coast and landings have fluctuated around 500t since the 1970's.

In the South Island, Canterbury Bight landings peaked in the early 1960's and have declined since the late 1970's although a target fishery is known in Pegasus Bay. Gurnard is a by-catch of the rig and school shark fishery also.

In Southland, red gurnard is a by-catch of the rig, elephant fish and red cod fisheries and catches have been stable at a low level with a peak prior to the introduction of ITQs.

On the West Coast of the South Island, landings increased until the early 1970's and have fluctuated at approximately 200t. Red gurnard is a by-catch of the flatfish trawl fishery (18% of catch) in shallow (< 65m depth) water and of the tarakihi fishery (10% of catch) in deeper waters (D. Blyth pers.comm).

In Tasman Bay and the South Taranaki Bight, landings have been

stable at about 300t from the 1960's to the middle 1970's as a by-catch of the snapper flatfish and tarakihi fisheries.

Detailed domestic landings by statistical area are shown in Figure 4. For most areas except Kaipara, landings have declined over the three seasons examined.

(iv) Foreign Licence and Foreign Charter Landings.

Red gurnard is a minor by-catch in the deepwater fishery mainly while targetting jack mackerel off Taranaki. Reported catch is summarised in Table 2. Agreed annual quota for foreign licenced fishing nations is shown in Table 3. Foreign quota is included in regional TACs from the 1987/88 fishing year.

B. Catch-Effort Data.

Red gurnard is a by-catch for different fishing methods and fisheries. CPUE data were analysed for trawl fisheries from seven statistical areas that showed consistently high landings of red gurnard over the period 1984 to 1986 calendar years: Tauranga, Mahia, Pegasus Bay, Greymouth, Kawhia, Raglan and Kaipara. This qualitative analysis assumes that the relationship between target species and by-catch remains constant over this period. The data were log transformed and examined using a moving average technique to separate the trend and cycle components of the data. Percentage change in trend CPUE and annual percentage change are given in Table 4. All regions except Mahia showed a decrease in CPUE. Mahia data indicates an overall increase in CPUE of 26%, but data from the other known target fishery in Pegasus Bay indicates an overall decrease of 15%. These trends reflect changes in target fisheries as well as fluctuations in red gurnard stocks.

The changes following the introduction of the ITQ system make the assumption of a constant by-catch relationship questionable and care is required in any interpretation of trends.

The data indicates an overall decrease in coastal trawl fisheries reflecting the rise in importance of deepwater trawl fisheries during this period.

C. Other Information.

No data are available on current stock size and age composition of the red gurnard catch. Elder (1976) examined stock size and age composition for the Hauraki Gulf fishery.

D. Maori and Recreational Fishing.

Red gurnard are an important Maori fishery. Gurnard occur in shallow coastal waters and are accessible by traditional fishing methods. In most areas around New Zealand, red gurnard support a large recreational fishery, as an alternative to snapper and for general line fishing. 48,215 (+17% std. err.) catches of red gurnard (one or more fish) were reported from the MAFFish National Recreational Fishing Survey in April 1987, ranking as the sixth most commonly reported species. No quantitative data are available on the Maori catch for red gurnard.

111. Research.

A. Stock structure.

No information.

B. Resource surveys.

No information.

C. Other studies.

The growth rate of red gurnard has been examined for the Hauraki Gulf (Elder 1976) and Pegasus Bay fisheries (Staples 1967). Elder (1976) compared growth rates for Hauraki Gulf, Pegasus Bay, and Japanese waters. Growth rate over the first two years was higher for the Japanese fishery than for New Zealand waters. Growth rate was higher in Pegasus Bay than the Hauraki Gulf. Elder (1976) suggested growth differences between New Zealand and the South China Sea were temperature related, but attributed growth differences between the Hauraki Gulf and Pegasus Bay fisheries to food-related factors and inter-specific competition.

D. Estimates of biomass and demographic parameters.

No information.

E. Analysis of short and long term sustainable yield.

(i) Estimation of Maximum Constant Yield (MCY).

MCY values are calculated from the Quota Management Area means (Table 6) multiplied by a variability factor of 0.75. This value reflects the variability in annual landings and the position of red gurnard as a by-catch species.

MCY values by Quota Management Area.

GUR	1	1202
	2	476
	3	210
	7	274
	8	154
	10	not exploited

(ii) Estimation of Current Annual Yield (CAY).

Cannot be estimated.

F. Models of alternative management strategies.

Not applicable.

IV. Management Implications.

A. TAC levels.

Overall catch as percent of TAC taken is described by fishstock in Table 6. The GUR 2 TAC was almost reached in 1986/87 (92%).

Previous reviews of the red gurnard TAC (McGregor and Voller 1985, Sullivan 1986, 1987) suggest yields are sustainable at the level of the current TACs, although reported landings have been generally below TAC levels, and total landings have fallen by 34% since the 1983/84 fishing year. Sullivan (1986) discussed several reasons why red gurnard stocks should increase in abundance:

- decline in effort on the inshore trawling grounds subsequent to the Quota Management System should reduce juvenile mortality and increase recruitment.
- red gurnard are fast growing and stocks could increase within a short time.

These reviewers suggest red gurnard stocks are sustainable in the long term at current TAC levels and highlight the potential for increase in stock levels.

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Table 1: Landings (tonnes green weight) and percentage by method of Red Gurnard by domestic fishers for fishing years 1983/84 to 1985/86. Source: FSU Area Summary printout data.

METHOD	1983/84	1984/85	1985/86
Single Trawl	2398 (63%)	1899 (63%)	1532 (60%)
Pair Trawl	967 (25%)	753 (25%)	631 (25%)
Long Line	259 (7%)	245 (8%)	232 (9%)
Danish Seine	90 (2%)	52 (2%)	50 (2%)
Set Net	94 (2%)	86 (2%)	79 (3%)
Hand line	< 1	< 1	< 1
Midwater trawl	7	0	2
Beach Seine	< 1	< 1	< 1
Total	3820	3035	2535

Table 2: Summary of the deepwater fishery for red gurnard.
 All weights in tonnes greenweight.
 Source: 1 Elder and Taylor (1979)
 2 FSU Logbook summary printout.

YEAR	PERIOD	FOREIGN LICENCED			FOREIGN CHARTER	TOTAL
		JAPAN	KOREA	TOTAL		
1975 ¹	1/1/75-31/12/75	146	.	146	.	146
1976 ¹	1/1/76-31/12/76	147	.	147	.	147
1977 ¹	1/1/77-31/12/77	268	.	268	.	268
1978 ¹	1/1/78-31/03/78	1	3	4	.	4
78-79 ²	1/4/78-31/03/79	2	2	4	<1	4
79-80 ²	1/4/79-31/03/80	10	20	30	1	31
80-81 ²	1/4/80-31/03/81
81-82 ²	1/4/81-31/03/82	25	8	33	42	75
82-83 ²	1/4/82-31/03/83	20	110	130	31	161
83-83 ²	1/4/83-30/09/83	6	48	54	<1	54
83-84 ²	1/10/83-30/9/84	17	74	91	35	126
84-85 ²	1/10/84-30/9/85	27	27	54	29	83
85-86 ²	1/10/85-30/9/86	6	17	23	54	77

Table 3: Red Gurnard Annual Transferable Quota (t) accepted by Licenced Foreign Nations for the 1986-87 fishing year
Source: Sullivan (1987)

AREA	Korea	Japan	Total
Central (Egmont) + Challenger/Central (Plateau)	5	20	25
South East + Southland + Sub Antarctic	70	5	75
TOTAL	75	25	100

Table 4: Red Gurnard Catch Per Unit of Effort data for fishing years 1983/84 to 1985/86, analysed by Moving Average.

Stat. Area	Location	log (CPUE)		% Change (period)	Annual % Change
		start	end		
9	Tauranga	6.664	6.274	- 32.3	- 16.2
13	Mahia	7.099	7.331	26.1	13.0
20	Pegasus Bay	6.166	5.791	- 31.3	- 15.6
34	West Coast SI	6.378	5.681	- 50.2	- 25.1
41	New Plymouth	7.310	6.944	- 30.6	- 15.3
42	Raglan	7.159	6.802	- 30.0	- 15.0
46	Northland	6.007	5.602	- 33.3	- 16.6

Table 5: Recommended TAC levels by Management Area.

Source: (a) McGregor and Voller (1985)

(b) Sullivan (1986)

(c) Sullivan (1987)

AREA	Recommended TAC (tonnes)		
	85/86	86/87	87/88
	a	a	c
Auckland (1)	2000	2000	2100
Central East, Cook St. (2)	600	600	610
Central Egmont (3)	500	500	510
Challenger (7)	600	600	610
Chathams, Southland (3)	250	250	480
Total	3950	3950	4310

Table 6: Percentage of TAC taken in the domestic fishery.
 Source: (a) Fishery Statistics Unit
 (b) Quota Monitoring System

Quota Management Area	Fishing Year	
	86/87	87/88 (at 31/02/88)
GUR 1	50.88	25.80
GUR 2	91.82	43.00
GUR 3	46.79	26.25
GUR 7	69.07	49.88
GUR 8	31.03	14.42
GUR 10	0.00	0.00

Table 7: Landings by Quota Management Area (tonnes green weight reported, 1983/84 to 1986/87 and mean landings for period.

Quota Mgt. Area	83/84	84/85	85/86	86/87	X
GUR 1	2099.0	1531.0	1759.8	1022.6	1603.1
GUR 2	782.0	665.1	495.5	592.3	633.7
GUR 3	365.5	271.7	271.9	210.5	279.9
GUR 7	468.0	332.6	239.2	421.3	365.3
GUR 8	250.7	247.3	162.9	158.3	204.8

Table 8: Quota held, and owned by the Crown.

NOTE: Quota owned by the Crown, but not currently held by the Crown is on Annual Lease to Industry.

Quota Mgt. Area	Quota Held (kg)	Quota Owned (kg)
GUR 1	200	200
GUR 2	10,000	10,000
GUR 3	70,450	83,700
GUR 7	15,300	15,300
GUR 8	257,500	257,500
Gur 10	10,000	10,000

Table 9: Quota Leased to the Crown under the By-Catch Trade-off System.

Quota Mgt. Area	Quota Held (kg)	Quota Owned (kg)
GUR 1	4,139	0
GUR 2	0	0
GUR 3	6,819	0
GUR 7	1,982	0
GUR 8	0	0

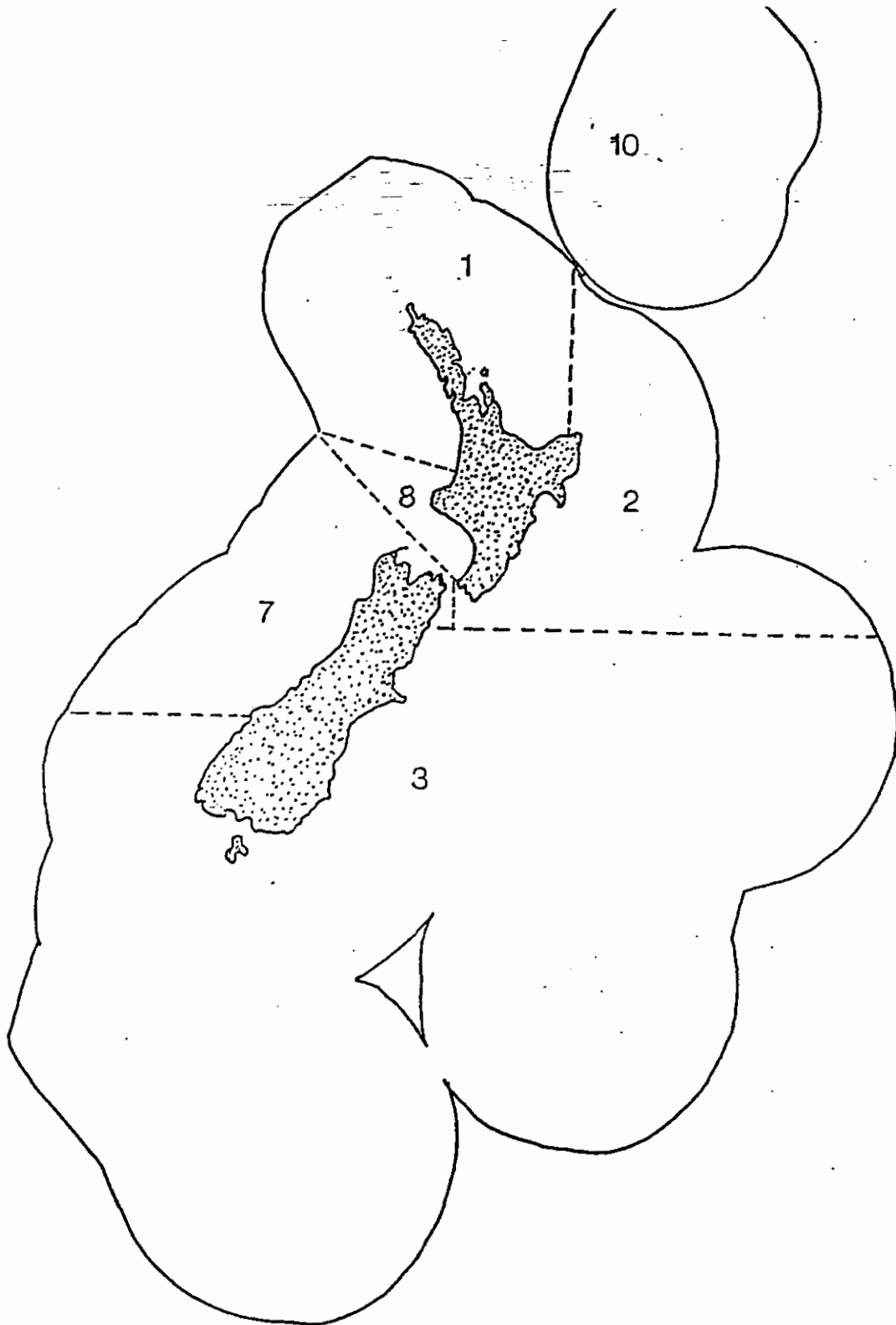


Figure 1. Red gurnard quota management areas and fishstocks.

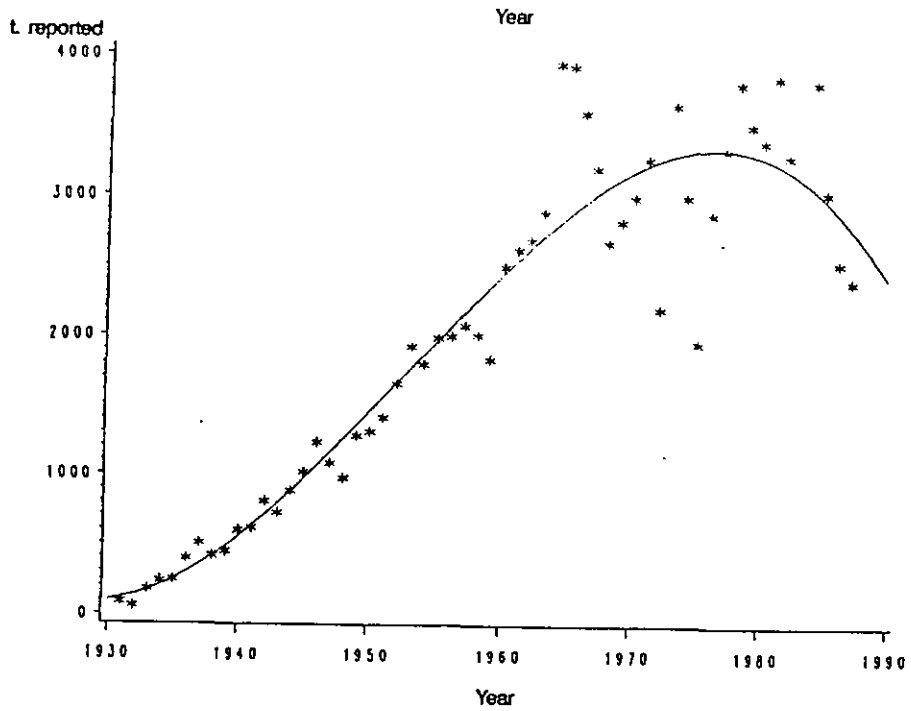
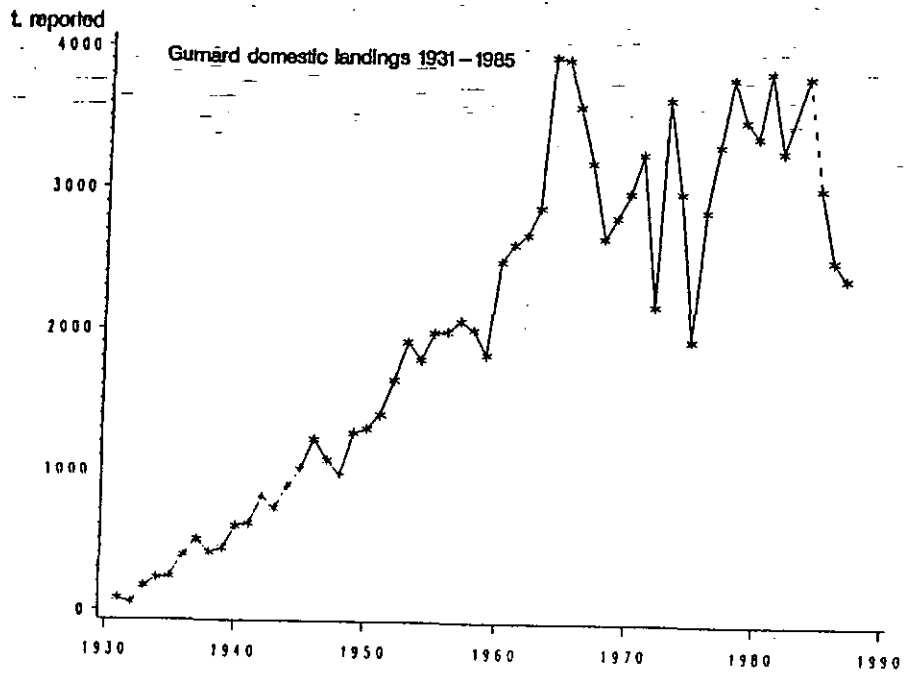
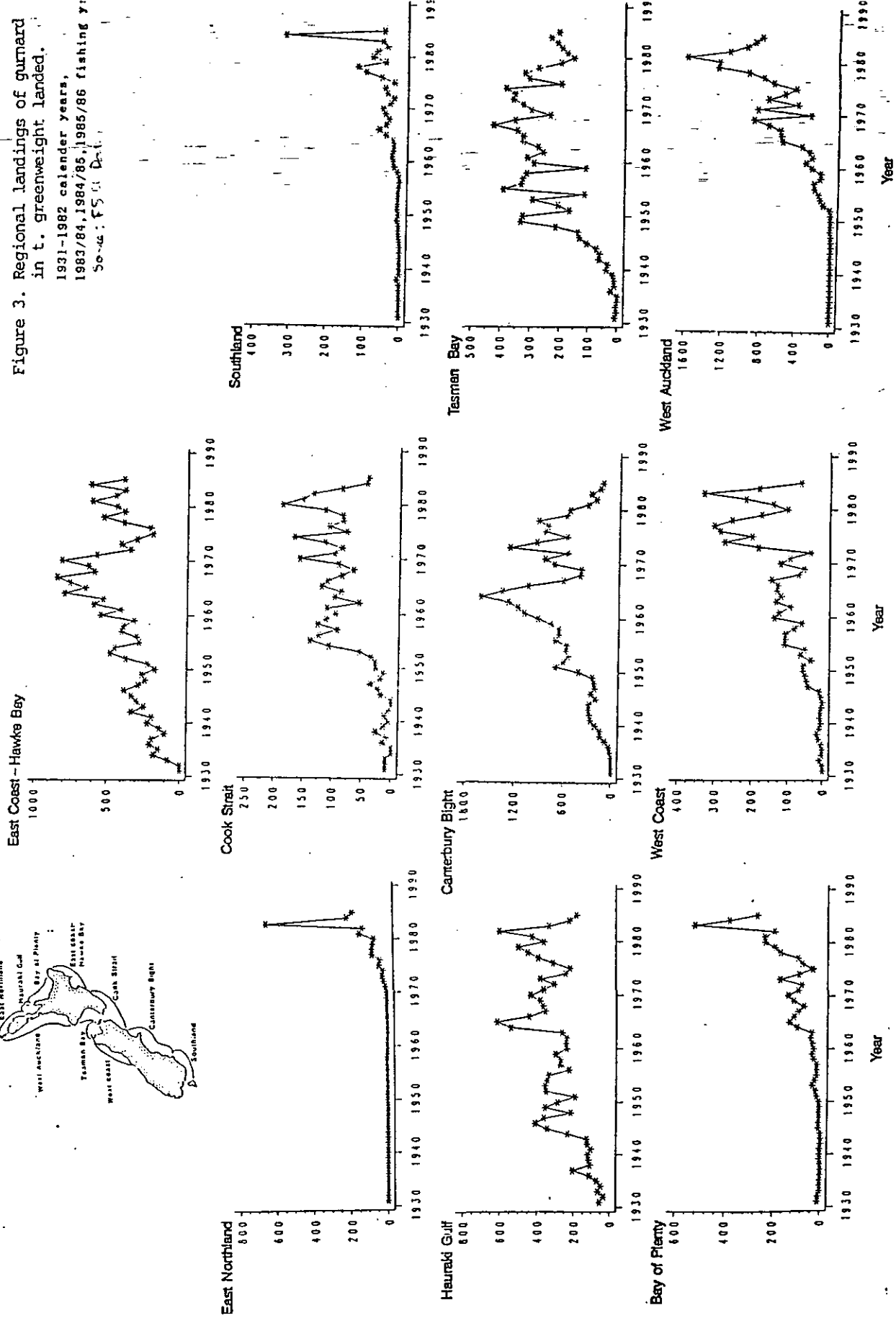


Figure 2. Gurnard domestic landings 1931-1982 calendar years, 1983/84, 1984/85, 1985/86 fishing years in t. green weight reported. Source-FSU data.

Fisheries Regional Areas



Figure 3. Regional landings of gurnard in t. greenweight landed, 1931-1982 calendar years, 1983/84, 1984/85, 1985/86 fishing yr. Source: F.S.C. Data.



No area was recorded for the following catch:
 1985/86 213.2 t
 1984/85 232.5 t
 1983/84 416.5 y

Fishing Year

1985/86
1984/85
1983/84

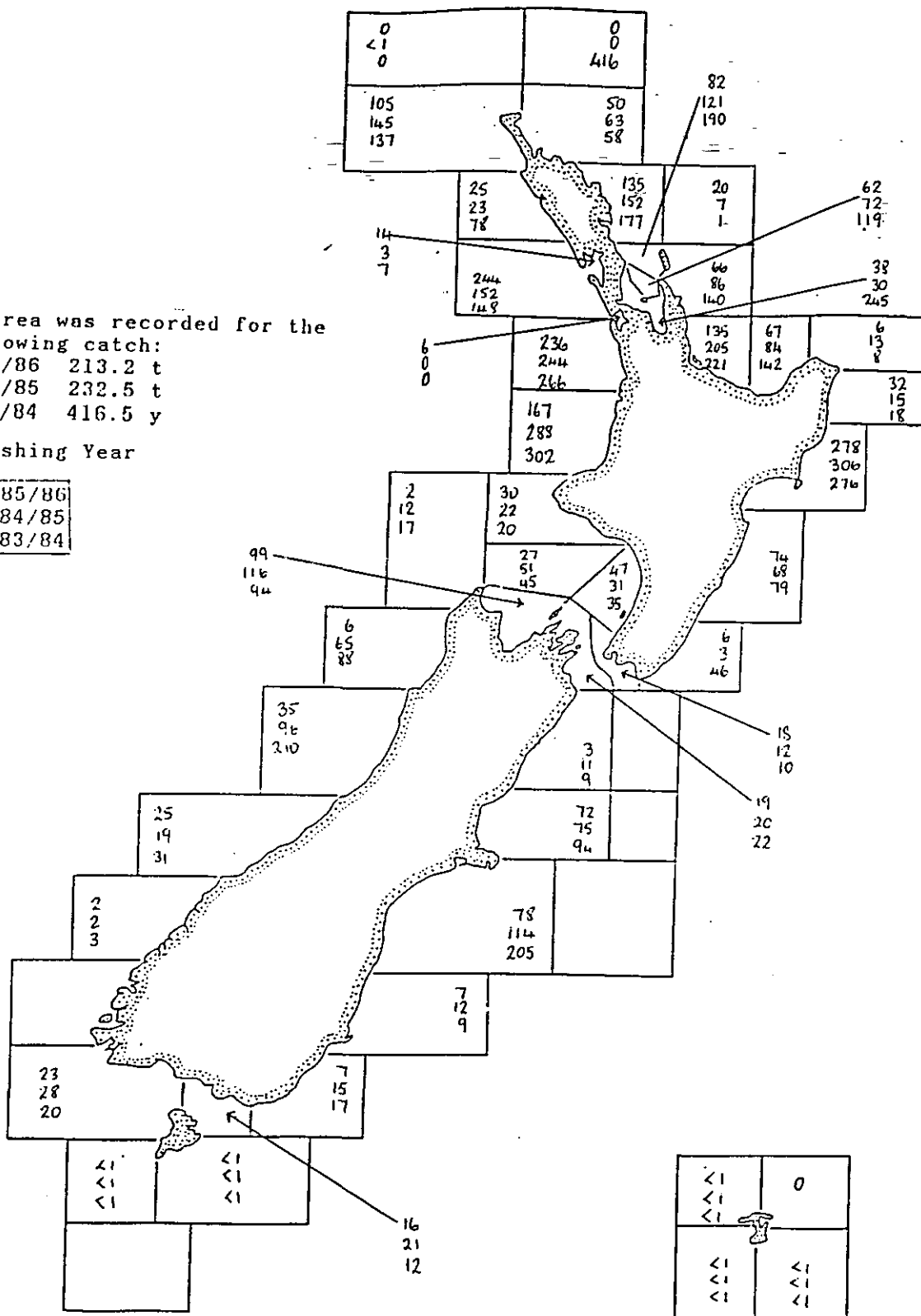


Figure 4. Reported domestic landings by statistical area in tonnes green weight of red gurnard. Source =