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New Zealand Fisheries Assessment Research Document 88/41

Blue cod

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December 1988

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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.

BLUE COD (*Parapercis colias*)

I. INTRODUCTION

(a) Biology

Blue cod are a native species and distributed widely throughout the waters around New Zealand's coasts, banks, and outlying islands. They are most abundant in the Southland FMA and around the Chatham Islands, and are found in rocky habitats to a depth of 150 m. (Armitage et al. 1981).

Blue cod spawn from late winter to spring, and many remain within their normal home range to do so. However, there have been unconfirmed reports of large migrating or breeding shoals (Mace and Johnston 1983). Spawning is probably most successful on the outer continental shelf. The eggs are pelagic for about five days after spawning, and the larvae are so for about the same period before settling on the sea bed (Rapson 1956).

The young fish grow rapidly, to reach a length of 12-20 cm at the end of their first year (Ayling and Cox 1982). Thereafter, their growth rate is slower, and it varies between regions. Blue cod are hermaphrodites, and they change in colour with maturity and change in sex. They are typically rusty brown as juveniles up to 25 cm, iridescent grey or green as females between 30 cm and 35 cm, and deep blue on the back and sides as males when longer than 35 cm in length (Rapson, 1956). They are voracious carnivores, and feed on a wide variety of prey (Ayling and Cox 1982).

(b) Description of Present Fishery

National landings since 1983 are given in Table 1, and landings by statistical area for 1983-86 are shown in Fig. 1. Landings of blue cod by fishing region, 1931-83 are given in Fig. 2.

The major blue cod fisheries in New Zealand are off Southland and the Chatham Islands, with smaller, but regionally significant, fisheries off Otago, the Marlborough Sounds, and Wanganui.

The commercial fishery for blue cod has a long history (see Voller and McGregor 1985), but it declined with the development of the rock lobster fishery. During the 1980s the southern region blue cod fishery has redeveloped, and it has passed from earlier reliance on handlining to the use of specially designed cod pots. In 1986 cod pots caught 87% of the total catch by weight in Southland, 98% at the Chatham Islands, and 72% in Otago (Fisheries Statistics Unit, Wellington). Only in the Wanganui fishery is lining the preferred method. The national catch by method for 1983-86 is given in Fig. 3.

The amount of unrecorded blue cod used for bait was assessed through 80 bait diaries received monthly from throughout the southern region from June 1986 to May 1987. These diaries recorded the proportion of each bait species used and the amount of bait contained in an average rock lobster pot set, for each area. The estimated annual use for bait by FMA was then extrapolated from 1985 data for rock lobster pot effort (Sanders 1986): South-East Coast, 34 t; Chatham Islands, 116 t; Southland, 161 t.

(c) Present Management

Blue cod have a minimum fish length of 30 cm. There is an amateur daily bag limit of 30 except in the Marlborough Sounds, Golden Bay and Tasman Bay where 12 is the daily limit.

The present TACs and recent catches are:

	Fish Stock	1986 Catch (1)	1986-87 Catch (2)	1987-88 TAC
Auckland				
- East)	1	18	7.8	30.1
- West)	1			
Central				
- East	2	2	0.7	10.1
- Egmont	8	40	22.5	60
Challenger	7	80	78.8	110
South-East				
- Coast	3	79	79.8	120
- Chatham Rise	4	323	396.9	600 (3)
Southland)	5	810	849.0	1190
Sub-Antarctic)	5			
Kermadec	10	0	0	10

(1) 1986 calendar year from Fisheries Statistics Unit

(2) 1986-87 fishing year from Quota Monitoring System

(3) Not fully allocated during 1987-88

II. REVIEW OF THE FISHERY

(a) Recent Trends

Trends in cod pot catch rates, catch, and effort are shown in Fig. 4. The unit of effort was pot lift, and the criteria for data inclusion were:

1. Only periods longer than one day per month were to be reported.

2. The number of pot lifts was to be reported (many fishers reported only the number of pots used).

The unit of Catch Per Unit of Effort (CPUE) was kilogram (greenweight) per pot lift. The method of analysis was generally similar to that used by Francis (1986) except that he was analysing set net data. The blue cod catch was not clearly seasonal; however, because the greatest effort was expended during the rock lobster "off season", the period from March to August inclusive was used to calculate peak CPUE. Effort was calculated by dividing the reported annual pot catch by the annual CPUE.

Southland landings have steadily increased, from 370 t in 1980 to 810 t in 1986. Cod pot effort increased from 1980 to 1983 and then appears to have remained steady. The Southland peak CPUE increased from 1982 to 1986, probably because of improvements in the techniques used by the cod pot fishers as the fishery developed.

The Chathams fishery has only redeveloped since 1982, after many years of inactivity. The recorded catch increased from 10 t in 1982 to 325 t in 1986. Cod pot effort developed quickly during 1982-83 and remained stable between 1983 and 1986. Catch rates here are the highest in the southern region. The 1987-88 TAC was based on the 700 t which had been sustained in the past, with an allowance of 100 t for estimated use as rock lobster bait.

The Otago recorded catch and estimated effort declined between 1980 and 1985, probably because the effort was redirected into the local squid jig fishery. The Otago blue cod fishery has a long history and is closely associated with the rock lobster fishery because the same pots are used. Catch rates have remained constant.

(b) Review of Research

1. Rapson's Ph.D. thesis 1956: A general description of blue cod biology and the line fishery during the 1930s and 40s. His age data is unvalidated and suspect. He describes the difficulty in tagging the species. Most of his work was done in the Marlborough Sounds.
2. Mace, Johnston and others: FMD undertook tagging experiments on blue cod in the Marlborough Sounds during the 1970s. They concluded that reef dwelling blue cod probably do not undertake spawning migrations, however the experiments suffered high shedding rates of external tags and low numbers of recaptures.
3. Robertson, D.A. Ph.D. thesis 1973: Described the morphology of blue cod eggs and their larvae. He mapped spatial and seasonal distribution of blue cod eggs in Otago continental shelf waters. The thesis concluded that they spawn in late winter to early summer, and egg distribution suggested an adult spawning migration from inshore to deepwater.
4. Trawl surveys by Shinkai Maru, Akebono 1 Maru # 2 and # 73 at Chatham Islands December 1984, December 1985 and Snares Shelf February 1981, March 1982, October 1983, June 1986 and November 1986. Because blue cod prefer an untrawlable habitat this method was found unreliable in providing a blue cod biomass estimate.

5. Cod pot escapement trials 1985-87. This work has provided length frequency, length-weight, length-girth data; but is limited to Southland.

Estimation of Maximum Constant Yield (MCY)

MCY was calculated from the equation $MCY = cY$. Historical blue cod catch levels were closely correlated with fishing effort, and variations in recorded catch is probably due to changed fishing patterns. The parameter c was estimated at 1.0 as there is no evidence of stock depletion or large natural variations in stock size. Yield estimates were derived on a regional basis, as follows:

South-East Coast - Fish stock 3

$$MCY = 1.0 \times 80 = 80$$

Y = average landings 1964-74. These years were chosen because of stable catches, before the advent of a local squid fishery. In this area blue cod is important as a "cash" fish and therefore is likely to be under-reported.

Chatham Islands - Fish stock 4

$$MCY = 1.0 \times 700 = 700 - 100 \text{ (bait)} = 600$$

Y = average landings 1953-1965. These years were chosen because of stable catches, after World War II and before the development of the rock lobster fishery. Bait usage in rock lobster pots is estimated at 100 tonnes/year.

Southland - Fish stock 5

$$MCY = 1.0 \times 800 = 800$$

Y = average landings 1983-86. These years were chosen because of stable effort, with relatively little effect from the rock lobster fishery. There is probably a large degree of under-reporting.

Challenger/Central (Plateau) - Fish stock 7

$$MCY = 1.0 \times 85 = 85$$

Y = average landings 1973-83. These years were chosen because of stable catches.

Estimation of Current Annual Yield (CAY)

CAY cannot currently be estimated for blue cod. There are no biomass data for this species and an ageing study undertaken in the 1940s is unvalidated.

(c) Maori and Recreational Fisheries

Recreational fishery

Blue cod are the most important recreational fish in Marlborough, Otago, Southland, and the Chatham Islands (Anon, 1987). Good catches are sustained, though the level of fishing effort is unknown.

Maori fishery

Blue cod bones have been found in pre-European middens along Palliser Bay and at D'Urville Island. The variety of fish species in middens is generally typical of that along the nearby coast, and so blue cod could have been Maori fisheries along the Wellington coast, Kaikoura, Southland, and the Chatham Islands.

III. PRESENT RESEARCH

There is no new research on this species.

IV. MANAGEMENT IMPLICATIONS

Insignificant information is available on which to assess any management implications.

However, blue cod cannot be regarded as a unit stock in some of the designated management areas. For example, it is unlikely that the fisheries of the Puysegur Bank and Traps are influenced by fishing in Foveaux Strait, or that on the Mernoo Bank by fishing in Otago or Kaikoura. These under-utilised areas are potentially productive fisheries; however, with no recent recorded landings they have been effectively omitted from the yield assessments. Carefully monitored exploratory fishing could therefore be allowed in these areas.

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TABLE 1: Blue cod landings (t), 1970-87

	Domestic	Deepwater (1)	Total
1970	1022		
1971	644		
1972	459		
1973	846		
1974	696		
1975	356		
1976	524		
1977	383		
1978	378		
1979	437		
1980	536		
1981	694	2	696
1982	536	3	539
1983	1105	30	1135
1983-84	1417	25	1442
1984-85	1603	18	1621
1985-86	1522	10	1532
1986-87	(2) 1436 (1440)	-	1436

(1) Includes New Zealand chartered and foreign licensed vessels.

(2) Sum of Quota Monitoring Returns (Licensed Fish Receivers).

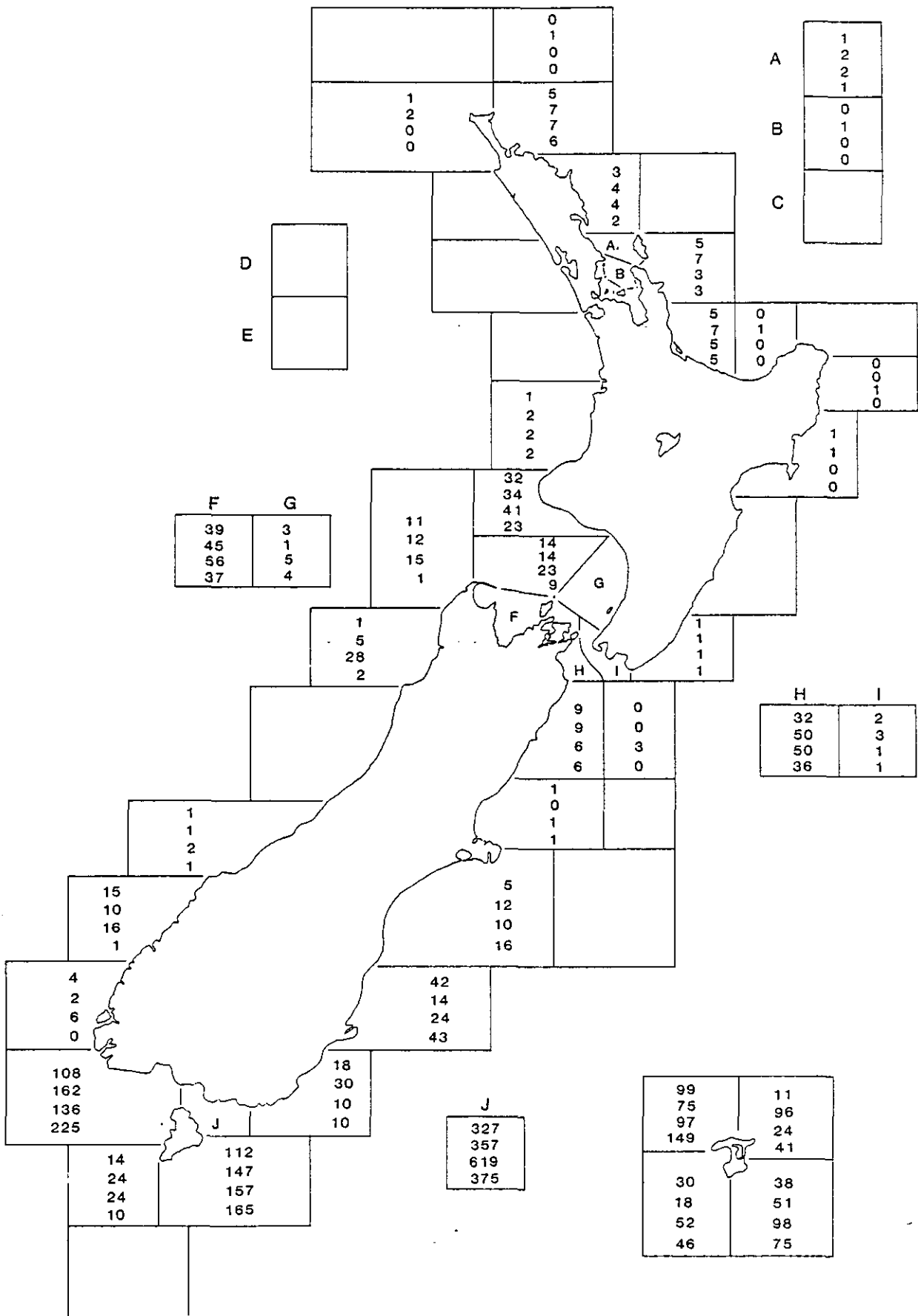


Fig. 1: Domestic landings (t) of blue cod for 1983, 1984, 1985, and 1986 (provisional) by fishing return area. (Area not known, 1983 = 79 t, 1984 = 173 t, 1985 = 19 t, 1986 = 57 t.)

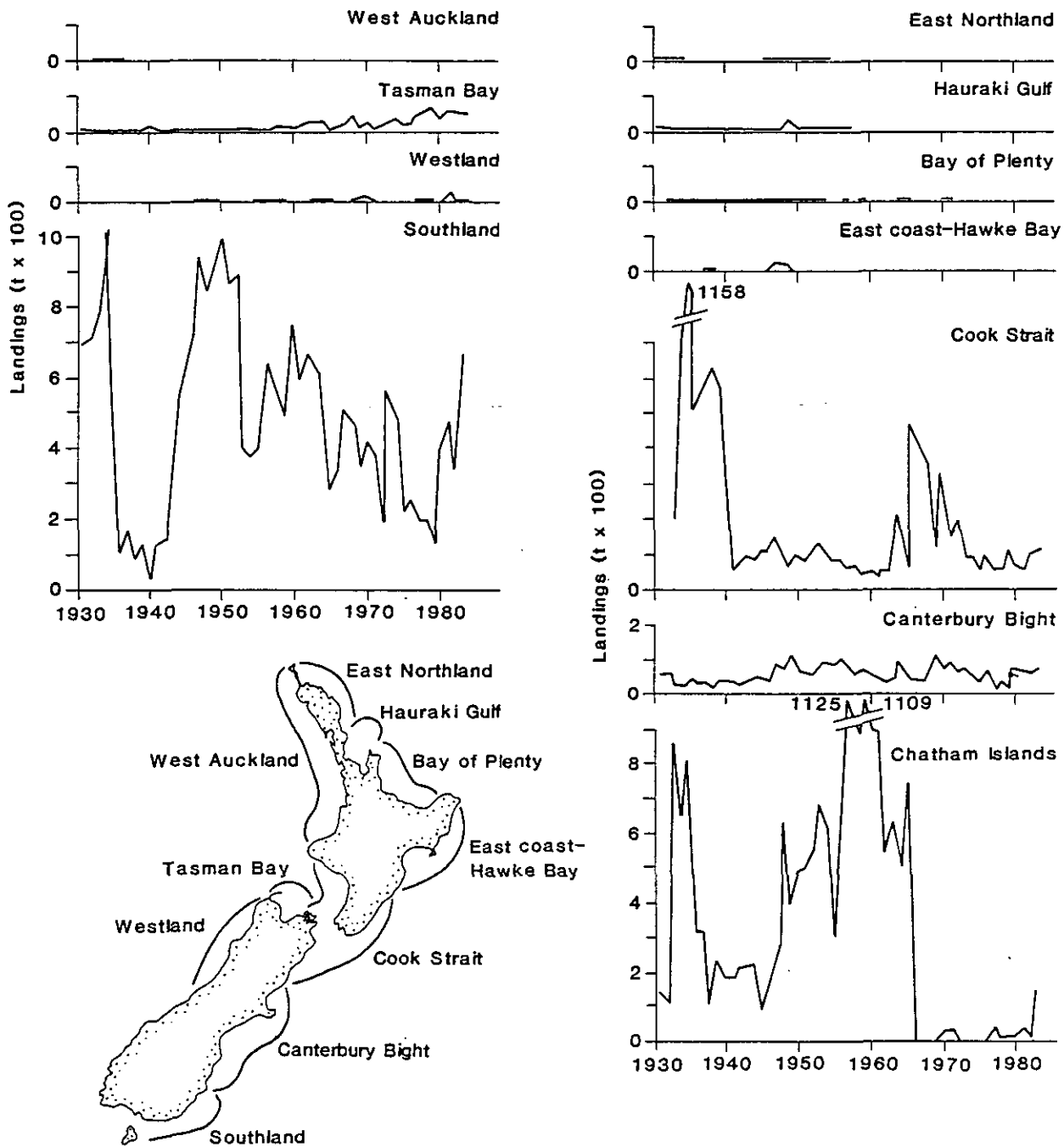


Fig. 2: Blue cod landings (t) by region, 1930-83.

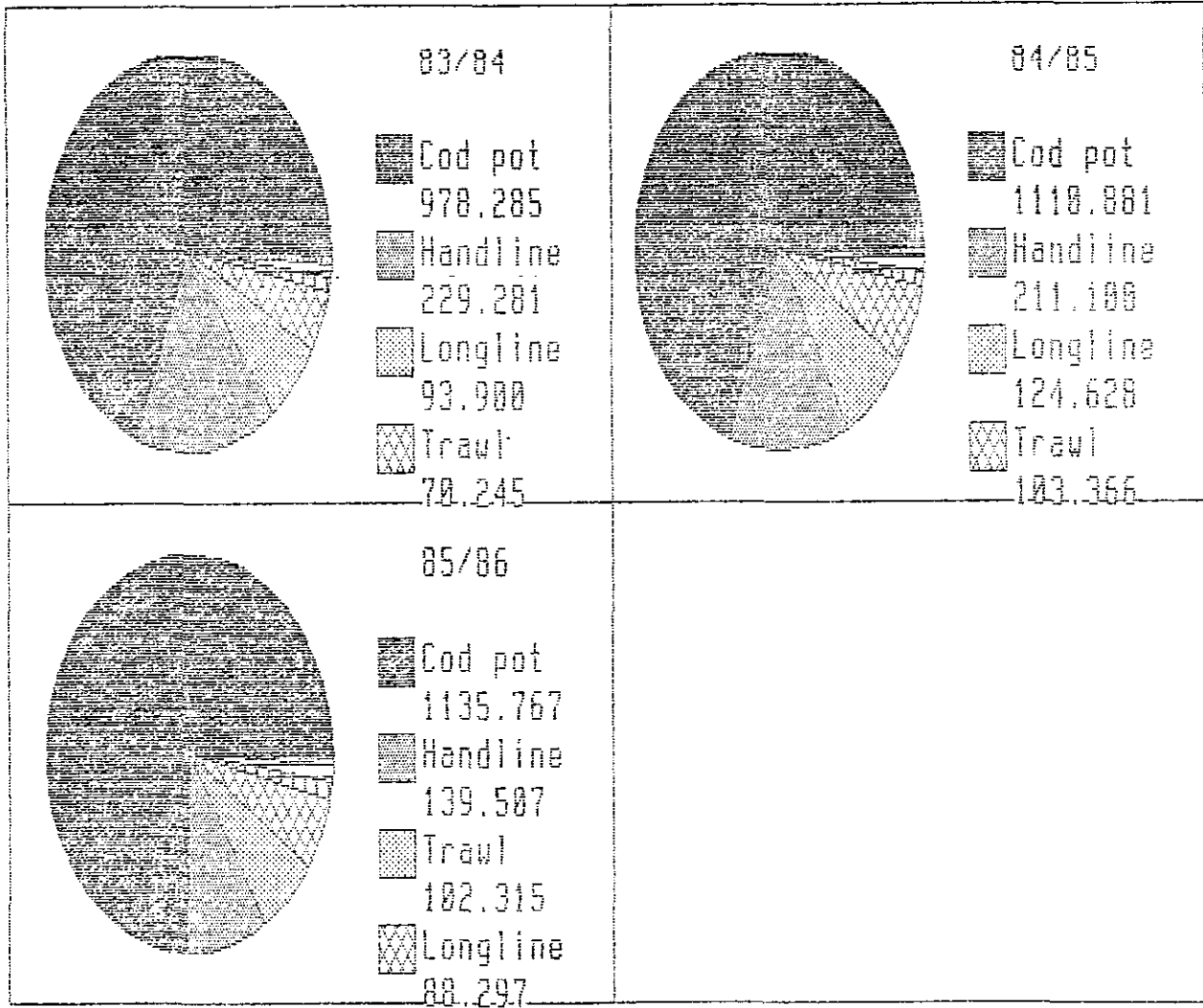


Fig. 3: National blue cod catch by fishing method

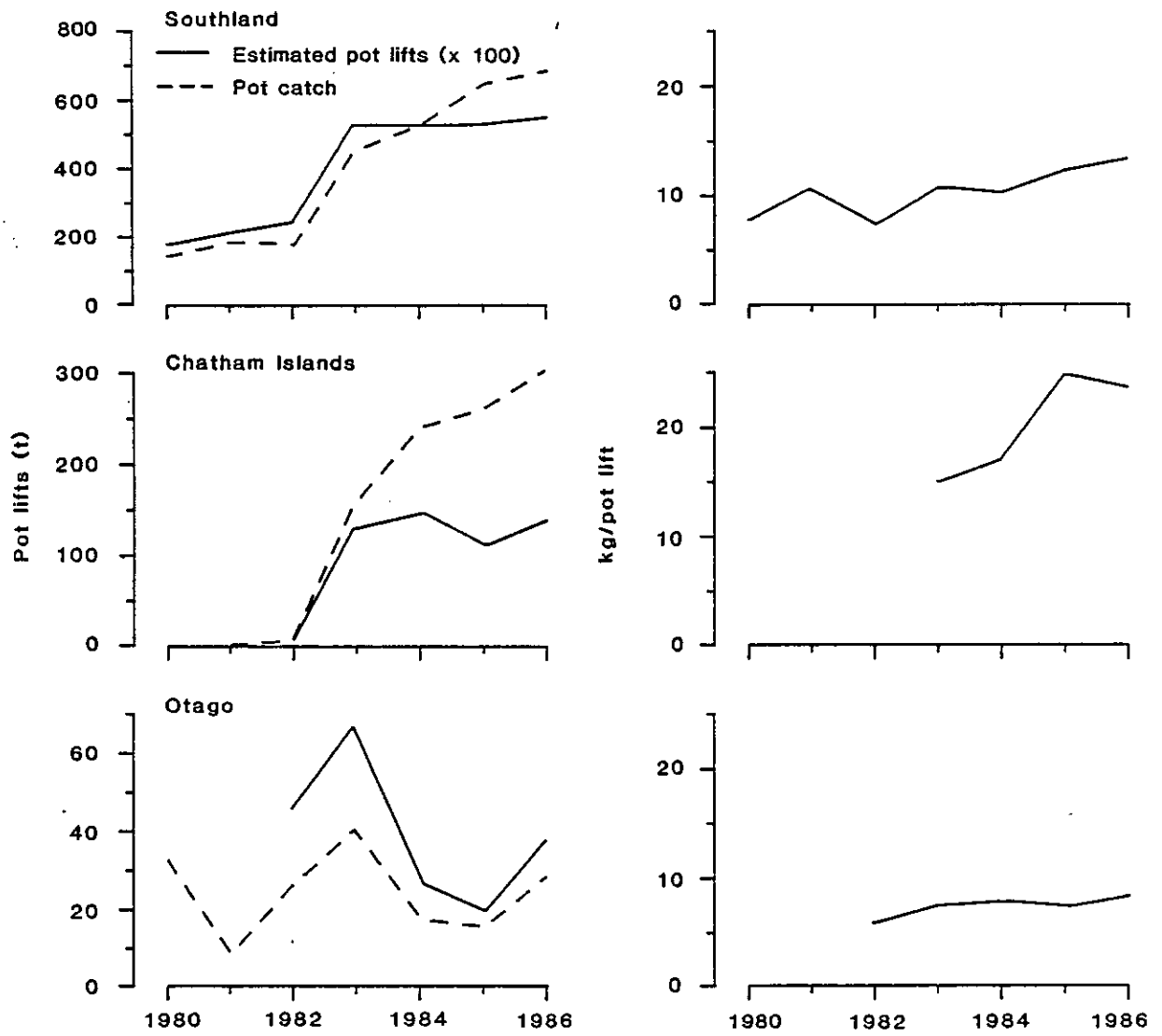


Fig. 4: Catch and effort data for the blue cod fisheries off Southland, the Chatham Islands, and Otago, 1980-86.