SPC/Fisheries 16/WP.25

SOUTH PACIFIC COMMISSION

SIXTEENTH REGIONAL TECHNICAL MEETING ON FISHERIES
(Noumea, New Caledonia, 13-17 Aug. 1984)

COUNTRY STATEMENT - NEW ZEALAND

TUNA RESOURCES AND TUNA RESEARCH IN NEW ZEALAND

by:
Talbot Murray, Patrick Swanson and Carey Carey
Fisheries Research Division
Ministry of Agriculture and Fisheries
P.O. Box 297
Wellington, New Zealand

SUMMARY

The New Zealand exclusive economic zone supports several foreign and domestic tuna fisheries. This paper summarizes existing information on the size of each fishery, the geographical distribution and seasonality of each fishery, the species caught and a brief description of each fishery.

INTRODUCTION

The waters within the New Zealand EEZ support small but increasingly important fisheries for three tuna species: skipjack Katsuwonis pelamis (Linne, 1758), southern bluefin Thunnus maccoyi (Castlenau, 1872) and albacore T. alalunga (Bonnaterre, 1788). In addition significant catches of bigeye T. obesus (Lowe, 1839), yellowfin T. albacares (Bonnaterre, 1788) and occassionaly northern bluefin T. tonggol (Bleeker, 1851) are made incidental to the main fisheries. The magnitude of the various domestic and foreign tuna fisheries is presented in table 1 and 2.

These species, with the exception of southern bluefin, are primarily warm water species and hence the New Zealand fisheries are regarded as seasonal fringe fisheries. At present our knowledge of all but the skipjack fishery is meagre. In this paper we will summarize existing information, previously unpublished fisheries statistics and outline some directions our tuna research will be pursuing in the next few years.

LONGLINE FISHERIES

Two foreign licensed tuna longline fisheries operate within New Zealand waters. The largest is wholly Japanese and has operated 55 to 85 vessels each year since 1980 during the January to September period. These vessels concentrate their fishing activity off the eastern coasts and in a northwestward trending band between the northern tip of New Zealand and Norfolk Island. The target species is southern bluefin which are caught in the greatest number south of 35°S during the March to July period. The second most abundant species, albacore, is primarily caught north of 42°S during the May to August period. Bigeye, the third most abundant species is primarily caught north of 38° S during August and September. Yellowfin, like bigeye, are primarily caught north of 38°S but are less abundant and exhibit no obvious seasonality. Northern bluefin are similar to yellowfin in distribution and occurrence. A catch and effort summary for each species is given in table 3 while the geographical pattern of catches is given in figures 1-12 for 1980-1983 for albacore, bigeye, and yellowfin.

The second foreign licensed tuna longline fishery is predominantly Korean and operates north of 34°S latitude. This small fishery has involved between 5 and 10 vessels since 1981 during the April to September period. Vessels target for albacore and broadbill swordfish (<u>Xiphias gladius</u> (Linne, 1758)). Albacore, the most abundant tuna species is primarily caught between June and August. Bigeye and yellowfin, the second and third most abundant species respectively, tend to be caught in August. There is no clear pattern of distribution of these species, probably due to the concentration of effort in the vicinity of the Kermadec, Colville and Norfolk Ridge and Three Kings Rise systems. Table 4 summarizes the catch and effort while the geographical pattern of catches is depicted in figures 13-21.

PURSE-SEINE FISHERIES

The largest tuna fishery in New Zealand is a purse-seine fishery for skipjack which began in 1974-1975. The foreign catch in all years except 1982 has exceeded the domestic catch. The foreign catch is generally on the order of 4,000-6,000 tonnes while the domestic catch is less than 4,000 tonnes. This fishery operates during the November to May period with most fish being caught between January and March. Vessels may fish as far south as $39^{\circ}40'$S on the east coast and $41^{\circ}30'$S on the west coast of New Zealand. This fishery seldom extends north of 34°S and is usually confined to the area within 30 miles of shore between 35° and 38°S. In most years the domestic fleet of 4 to 6 boats is given exclusive fishing rights to the area within 12 miles of shore although 60-90 % of the catch is generally caught outside the 12 mile limit. The foreign fleet of U.S. based seiners has varied between 3 and 13 vessels with no U.S. vessels fishing during early 1984. This fishery has been extensively studied and details can be found in Habib (1978) and Habib, et al. (1980a,b,c,1981).

DOMESTIC TROLL AND HANDLINE FISHERIES

The domestic troll fishery began in 1968 and is patterned after the California fishery of the late 1950's. The primary tuna caught is albacore although skipjack and yellowfin are caught in northern waters. Albacore are primarily caught during December to March by vessels 6 to 25 metres long fishing up to 50 nm offshore. Vessels typically troll 5 to 12 surface jigs from dawn to dusk with a mid-day lull in activity generally noted. Nearly all catches are made on the west coast between 41° S and 44° S with the best catches made in warm rather than cold summers. The majority of albacore are caught in 17-20° C surface water. Catch rates vary during the season and between boats ranging from 22 to 444 fish per 100 hook hours. Size frequency distributions usually exhibit three major peaks (50, 60, and 70 cm) with the dominant peak at 60 cm. This fishery is of growing importance and is believed to be capable of considerable expansion both in area and season fished. This fishery has been reviewed by Slack (1972), Habib and Cade (1978) and Habib, et al. (1982).

The domestic handline fishery for southern bluefin is a small specialized fishery operating off the west coast of New Zealand between 41° and 44° 30′ S from June to October. This fishery involves from 45 to 64 vessels which fish the 13-14° C surface isotherm up to 50 nm offshore. Fishing coincides with a midwater trawl fishery for hoki (Macruronus novazealandiae) with vessels opportunistically fishing adjacent to large trawlers using trawl waste as groundbait. Vessels normally groundbait while fishing up to 3 single hook handlines to depths of 15m. Catches average 5 fish per boat per day, fish range between 50 and 120 kg each. Maximum daily bluefin catches reach 30-40 fish per boat. Most of the catch is landed onto a freezer mothership with some airfreighted direct to the fresh chilled sashimi market in Japan.

TUNA RESEARCH PROGRAMMES IN NEW ZEALAND

The development of New Zealand tuna fisheries have been extremely rapid following initial exploratory fishing surveys by York (1969), Slack (1969, 1972), Webb (1972) and Roberts (1974, 1975, and 1977). Subsequent cruises by Japanese pole and line vessels have also demonstrated the feasability of this method in New Zealand waters for skipjack (Kearney and Hallier, 1979) and albacore (Ichikawa, 1981 and Iwasa, et al., 1982). Most of New Zealands research effort however, has been directed at characterizing the skipjack fisheries, including investigations of stock composition and size for management purposes (see papers by Habib, *et al.* *loc. cit.*). Minor attention has been directed towards similar questions on albacore (Habib, *et al.* 1978 and 1982).

At present and for the next several years we will continue to monitor the various tuna fisheries through log books and periodic but limited observer programmes. Aerial sighting surveys will continue with the addition of infra-red radiometers to 1-4 commercial tuna spotting aircraft. These data will also be used to provide "sea-truth" data for satellite mapping of sea surface temperature in the area of the northern tuna fishery. The main research thrust will be to define the oceanographic conditions associated with albacore catches and to evaluate satellite imagery as a tuna forecasting tool.

ACKNOWLEDGEMENTS

Appreciation is given to Ms. Margaret King for providing data on the domestic tuna landings and to Mr. David Gibson for providing data summaries for the Japanese longline fishery.

LITERATURE CITED

Habib, G. 1978. Skipjack biology and the 1976-77 purse-seine fishery. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 15:17-26.

Habib, G. and R. Cade 1978. The 1976-77 tuna fishery from small vessels. *ibid*:27-34.

Habib, G., I.T. Clement and K.A. Fisher 1980a. The 1977-78 purse-seine skipjack fishery in New Zealand waters. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 25, 42 pp.

______________________ 1980b. The 1978-79 purse-seine skipjack fishery in New Zealand waters. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 26, 39 pp.

______________________ 1980c. The 1979-80 purse-seine skipjack fishery in New Zealand waters. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 29, 43 pp.

______________________ 1981. The 1980-81 purse-seine skipjack fishery in New Zealand waters. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 36, 52 pp.

Habib, G., R.M. Cade, C.L. Carey, G.J. Voss, and P.M. Swanson 1982. The 1977-78 albacore fishery in New Zealand waters. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. Data Ser. 8, 19 pp.

Ichikawa, W. 1981. Report of the albacore survey by the RV Kaio Maru No. 52 in New Zealand waters, 1981. Japan Mar. Fish. Resource Center Rept. 20, 117 pp.

Iwasa, K., G. Habib and G.I.T. Clement. 1982. Report of the albacore research survey by the RV Kaio Maru No. 52 in New Zealand waters 1982. Japan Mar. Fish. Resource Center Rept. 18, 150 pp.

Kearney, R.E. and J.-P. Hallier. 1979. Interim report of the activities of the skipjack survey and assessment programme in the waters of New Zealand (17 February - 27 March 1979).

S.P.C. Skipjack Survey and Assessment Programme Prelim. Country Rept. 16, 17 pp.

Roberts, P.E. 1974. Albacore off the north-west coast of New Zealand, February 1972. N.Z. Jour. Mar. Freshw. Res. 8:455-472.

______________. 1975. 1971-72 tuna survey west coast South Island. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 8, 16 pp.

______________. 1977. 1973 tuna survey west coast South Island. Fish. Res. Div., N.Z. Min. Ag. & Fish. Occ. Pub. 12, 12 pp.

Slack, E.B. 1969. A commercial catch of albacore in New Zealand, N.Z. Mar. Dept., Fish. Tech. Rept. 46, 26 pp.

____________. 1972. The albacore (Thunnus alalunga (Bonaterre)) fishery in New Zealand, commercial catches at New Plymouth 1970. N.Z. Mar. Dept. Fish. Tech. Rept. 80, 23 pp.

Webb, B.F. 1972. Report on the investigation of the "Lloret Lopez II" 8 January to 2 April 1970. Section 6: Tuna catch analysis and sea water temperatures. N.Z. Min. Ag. & Fish. Fish.Tech. Rept. 108, 105 pp.

York, A.G. 1969. Tuna investigations, East Cape 1965-1967. N.Z. Mar. Dept. Fish. Tech. Rept. 40, 80 pp.

TABLE 1. Domestic tuna fisheries statistics; reported landings for each species (tonnes)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Albacore	898	646	25	621	1,686	814	1,468	2,085	2,434	718
Big Eye	0	0	0	0	0	0	0	0	0	0
Skipjack	659	1,159	291	1,657	2,841	3,129	2,717	3,221	3,723	3,911
Southern Bluefin	4	0	0	5	10	5	130	173	208	112
Yellowfin	1	1	1	1	1	1	1	1	2	0
Total Tuna	1,562	1,806	317	2,284	4,538	3,949	4,316	5,480	6,367	4,741
Total Fish	47,724	36,900	47,029	55,395	69,578	76,693	75,370	87,323	97,462	115,422

TABLE 2. Tuna landings (tonnes) by foreign licensed vessels fishing within N.Z. waters

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Albacore	0	0	0	0	0	0	221	741	881	901
Big Eye	0	0	0	0	0	0	238	453	652	442
Skipjack	0	0	4,424	5,884	6,685	5,846	6,214	5,334	1,507	4,222
Southern Bluefin	0	0	0	0	0	0	6,665	5,074	2,754	1,618
Yellowfin	0	0	0	0	0	0	11	100	90	31
Northern Bluefin	0	0	0	0	0	0	2	5	99	62
Total Tuna	0	0	4,424	5,884	6,685	5,846	13,351	11,707	5,983	7,276

TABLE 3. Catch and effort summary for the Japanese tuna longline fishery 1980-1983

Year	Vessels	Sets	Average hooks/set	Southern Bluefin	Albacore	Bigeye	Yellowfin	Northern Bluefin
1980	85	10,583	2,405	119,463	19,425	5,812	357	9
1981	84	10,281	2,522	89,357	48,980	8,521	2,245	29
1982	73	8,921	2,650	46,898	70,107	13,262	2,120	1,586
1983	55	5,736	2,717	26,202	48,334	12,066	700	1,028

TABLE 4. Catch and effort summary for the Northern tuna longline fishery 1981-1983

Year	Vessels	Sets	Average hooks/set	Southern Bluefin	Albacore	Bigeye	Yellowfin	Northern Bluefin
1981	10	432	2,256	0	24,454	2,668	1,153	0
1982	5	221	2,682	0	11,946	1,364	603	6
1983	5	314	2,618	0	31,853	656	505	0

FIGURE LEGEND

figure 1. Distribution of number of albacore caught per set and number of sets in the 1980 Japanese longline fishery.

figure 2. Distribution of number of albacore caught per set and number of sets in the 1981 Japanese longline fishery.

figure 3. Distribution of number of albacore caught per set and number of sets in the 1982 Japanese longline fishery.

figure 4. Distribution of number of albacore caught per set and number of sets in the 1983 Japanese longline fishery.

figure 5. Distribution of number of bigeye caught per set and number of sets in the 1980 Japanese longline fishery.

figure 6. Distribution of number of bigeye caught per set and number of sets in the 1981 Japanese longline fishery.

figure 7. Distribution of number of bigeye caught per set and number of sets in the 1982 Japanese longline fishery.

figure 8. Distribution of number of bigeye caught per set and number of sets in the 1983 Japanese longline fishery.

figure 9. Distribution of number of yellowfin caught per set and number of sets in the 1980 Japanese longline fishery.

figure 10. Distribution of number of yellowfin caught per set and number of sets in the 1981 Japanese longline fishery.

figure 11. Distribution of number of yellowfin caught per set and number of sets in the 1982 Japanese longline fishery.

figure 12. Distribution of number of yellowfin caught per set and number of sets in the 1983 Japanese longline fishery.

figure 13. Distribution of number of albacore caught per set and number of sets in the 1981 Northern tuna longline fishery.

figure 14. Distribution of number of albacore caught per set and number of sets in the 1982 Northern tuna longline fishery.

figure 15. Distribution of number of albacore caught per set and number of sets in the 1983 Northern tuna longline fishery.

figure 16. Distribution of number of bigeye caught per set and number of sets in the 1981 Northern tuna longline fishery.

figure 17. Distribution of number of bigeye caught per set and number of sets in the 1982 Northern tuna longline fishery.

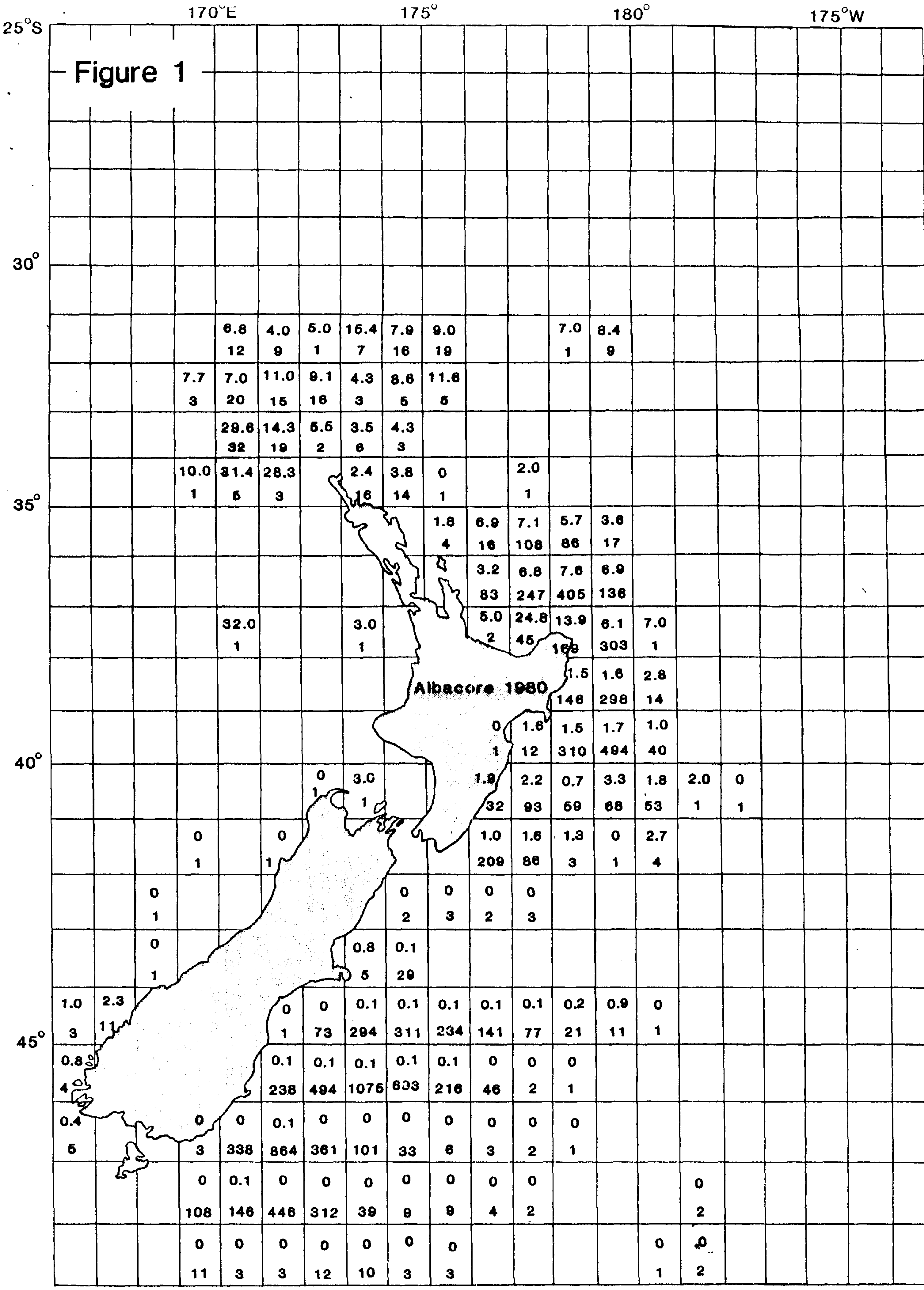


Figure 1
170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Albacore 1980
6.8 4.0 5.0 15.4 7.9 9.0 7.0 8.4
12 9 1 7 16 19 1 9
7.7 7.0 11.0 9.1 4.3 8.6 11.6
3 20 15 16 3 5 5
29.6 14.3 5.5 3.5 4.3
32 19 2 6 3
10.0 31.4 28.3 2.4 3.8 0 2.0
1 5 3 16 14 1 1
1.8 6.9 7.1 5.7 3.6
4 16 108 86 17
3.2 6.8 7.6 6.9
83 247 405 136
32.0 3.0 5.0 24.8 13.9 6.1 7.0
1 1 2 45 169 303 1
1.5 1.6 2.8
146 298 14
0 1.6 1.5 1.7 1.0
1 12 310 494 40
0 3.0 1.9 2.2 0.7 3.3 1.8 2.0 0
1 1 32 93 59 68 53 1 1
0 0 1.0 1.6 1.3 0 2.7
1 1 209 86 3 1 4
0 0 0 0 0
1 2 3 2 3
0 0.8 0.1
1 5 29
1.0 2.3 0 0 0.1 0.1 0.1 0.1 0.1 0.2 0.9 0
3 11 1 73 294 311 234 141 77 21 11 1
0.8 0.1 0.1 0.1 0.1 0.1 0 0 0
4 238 494 1075 633 216 46 2 1
0.4 0 0 0.1 0 0 0 0 0 0 0
5 3 338 864 361 101 33 6 3 2 1
0 0.1 0 0 0 0 0 0 0 0
108 146 446 312 39 9 9 4 2 2
0 0 0 0 0 0 0 0 0
11 3 3 12 10 3 3 1 2

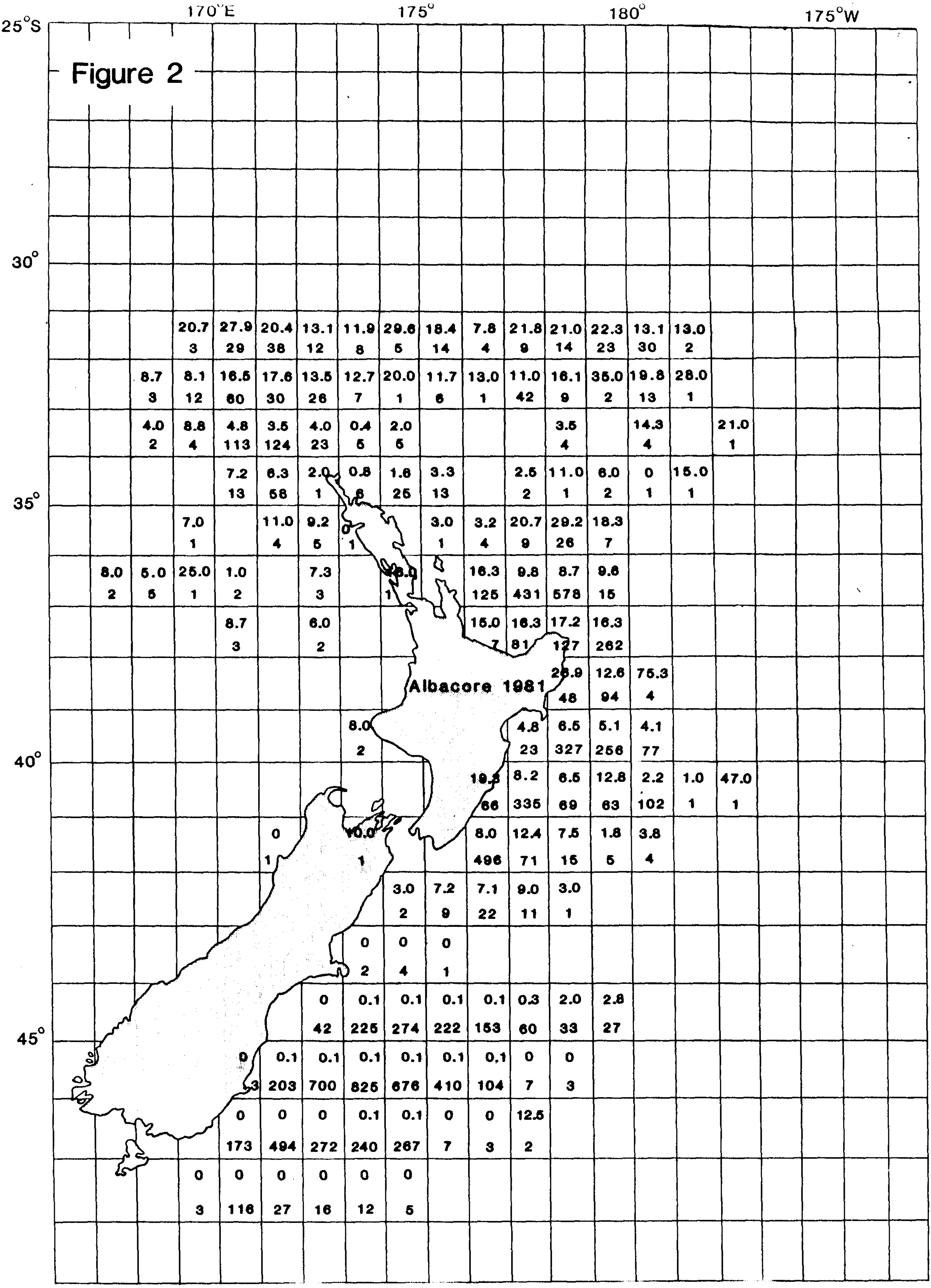

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Albacore 1981
20.7 3 | 27.9 29 | 20.4 38 | 13.1 12 | 11.9 8 | 29.6 5 | 18.4 14 | 7.8 4 | 21.8 9 | 21.0 14 | 22.3 23 | 13.1 30 | 13.0 2
8.7 3 | 8.1 12 | 16.5 60 | 17.6 30 | 13.5 26 | 12.7 7 | 20.0 1 | 11.7 6 | 13.0 1 | 11.0 42 | 16.1 9 | 35.0 2 | 19.8 13 | 28.0 1
4.0 2 | 8.8 4 | 4.8 113 | 3.5 124 | 4.0 23 | 0.4 5 | 2.0 5 | 3.5 4 | 14.3 4 | 21.0 1
7.2 13 | 6.3 56 | 2.0 1 | 0.8 6 | 1.6 25 | 3.3 13 | 2.5 2 | 11.0 1 | 6.0 2 | 0 1 | 15.0 1
7.0 1 | 11.0 4 | 9.2 5 | 0 1 | 3.0 1 | 3.2 4 | 20.7 9 | 29.2 26 | 18.3 7
8.0 2 | 5.0 5 | 25.0 1 | 1.0 2 | 7.3 3 | 1 | 16.3 125 | 9.8 431 | 8.7 578 | 9.6 15
8.7 3 | 6.0 2 | 15.0 7 | 16.3 81 | 17.2 127 | 16.3 262
48 | 12.6 94 | 75.3 4
8.0 2 | 4.8 23 | 6.5 327 | 5.1 256 | 4.1 77
66 | 8.2 335 | 6.5 69 | 12.8 63 | 2.2 102 | 1.0 1 | 47.0 1
0 1 | 1 | 8.0 496 | 12.4 71 | 7.5 15 | 1.8 5 | 3.8 4
3.0 2 | 7.2 9 | 7.1 22 | 9.0 11 | 3.0 1
0 2 | 0 4 | 0 1
0 42 | 0.1 225 | 0.1 274 | 0.1 222 | 0.1 153 | 0.3 60 | 2.0 33 | 2.8 27
0 3 | 0.1 203 | 0.1 700 | 0.1 825 | 0.1 676 | 0.1 410 | 0.1 104 | 0 7 | 0 3
0 173 | 0 494 | 0 272 | 0.1 240 | 0.1 267 | 0 7 | 0 3 | 12.5 2
0 3 | 0 116 | 0 27 | 0 16 | 0 12 | 0 5

Figure 2

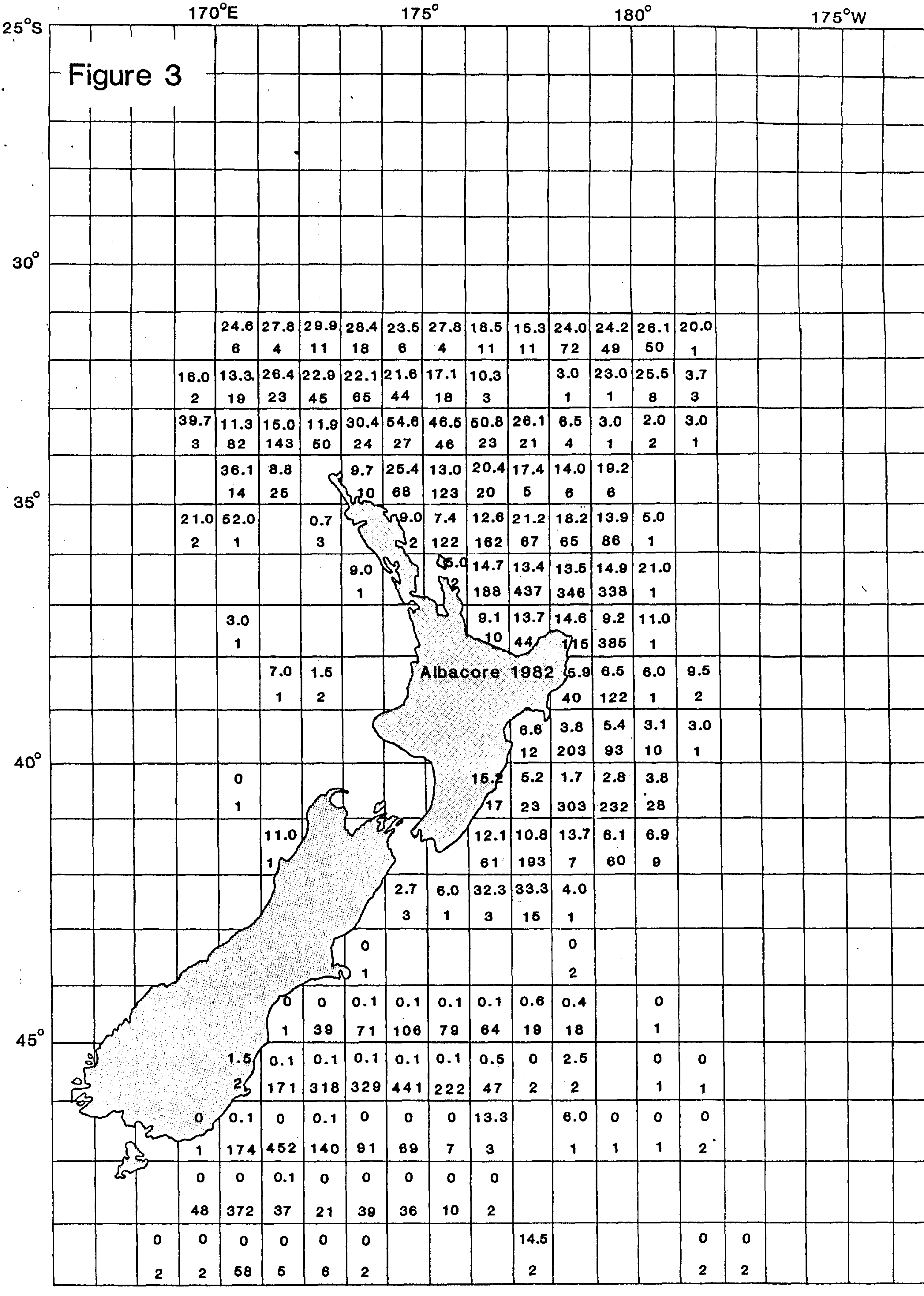


Figure 3
170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Albacore 1982
24.6 6 | 27.8 4 | 29.9 11 | 28.4 18 | 23.5 6 | 27.8 4 | 18.5 11 | 15.3 11 | 24.0 72 | 24.2 49 | 26.1 50 | 20.0 1
16.0 2 | 13.3 19 | 26.4 23 | 22.9 45 | 22.1 65 | 21.6 44 | 17.1 18 | 10.3 3 | 3.0 1 | 23.0 1 | 25.5 8 | 3.7 3
39.7 3 | 11.3 82 | 15.0 143 | 11.9 50 | 30.4 24 | 54.6 27 | 46.5 46 | 50.8 23 | 26.1 21 | 6.5 4 | 3.0 1 | 2.0 2 | 3.0 1
36.1 14 | 8.8 25 | 9.7 10 | 25.4 68 | 13.0 123 | 20.4 20 | 17.4 5 | 14.0 6 | 19.2 6
21.0 2 | 52.0 1 | 0.7 3 | 9.0 2 | 7.4 122 | 12.6 162 | 21.2 67 | 18.2 65 | 13.9 86 | 5.0 1
9.0 1 | 5.0 | 14.7 188 | 13.4 437 | 13.5 346 | 14.9 338 | 21.0 1
3.0 1 | 9.1 10 | 13.7 44 | 14.6 115 | 9.2 385 | 11.0 1
7.0 1 | 1.5 2 | 5.9 40 | 6.5 122 | 6.0 1 | 9.5 2
6.6 12 | 3.8 203 | 5.4 93 | 3.1 10 | 3.0 1
0 1 | 15.2 17 | 5.2 23 | 1.7 303 | 2.8 232 | 3.8 28
11.0 1 | 12.1 61 | 10.8 193 | 13.7 7 | 6.1 60 | 6.9 9
2.7 3 | 6.0 1 | 32.3 3 | 33.3 15 | 4.0 1
0 1 | 0 2
0 1 | 0 39 | 0.1 71 | 0.1 106 | 0.1 79 | 0.1 64 | 0.6 19 | 0.4 18 | 0 1
1.5 2 | 0.1 171 | 0.1 318 | 0.1 329 | 0.1 441 | 0.1 222 | 0.5 47 | 0 2 | 2.5 2 | 0 1 | 0 1
0 1 | 0.1 174 | 0 452 | 0.1 140 | 0 91 | 0 69 | 0 7 | 13.3 3 | 6.0 1 | 0 1 | 0 1 | 0 2
0 48 | 0 372 | 0.1 37 | 0 21 | 0 39 | 0 36 | 0 10 | 0 2
0 2 | 0 2 | 0 58 | 0 5 | 0 6 | 0 2 | 14.5 2 | 0 2 | 0 2

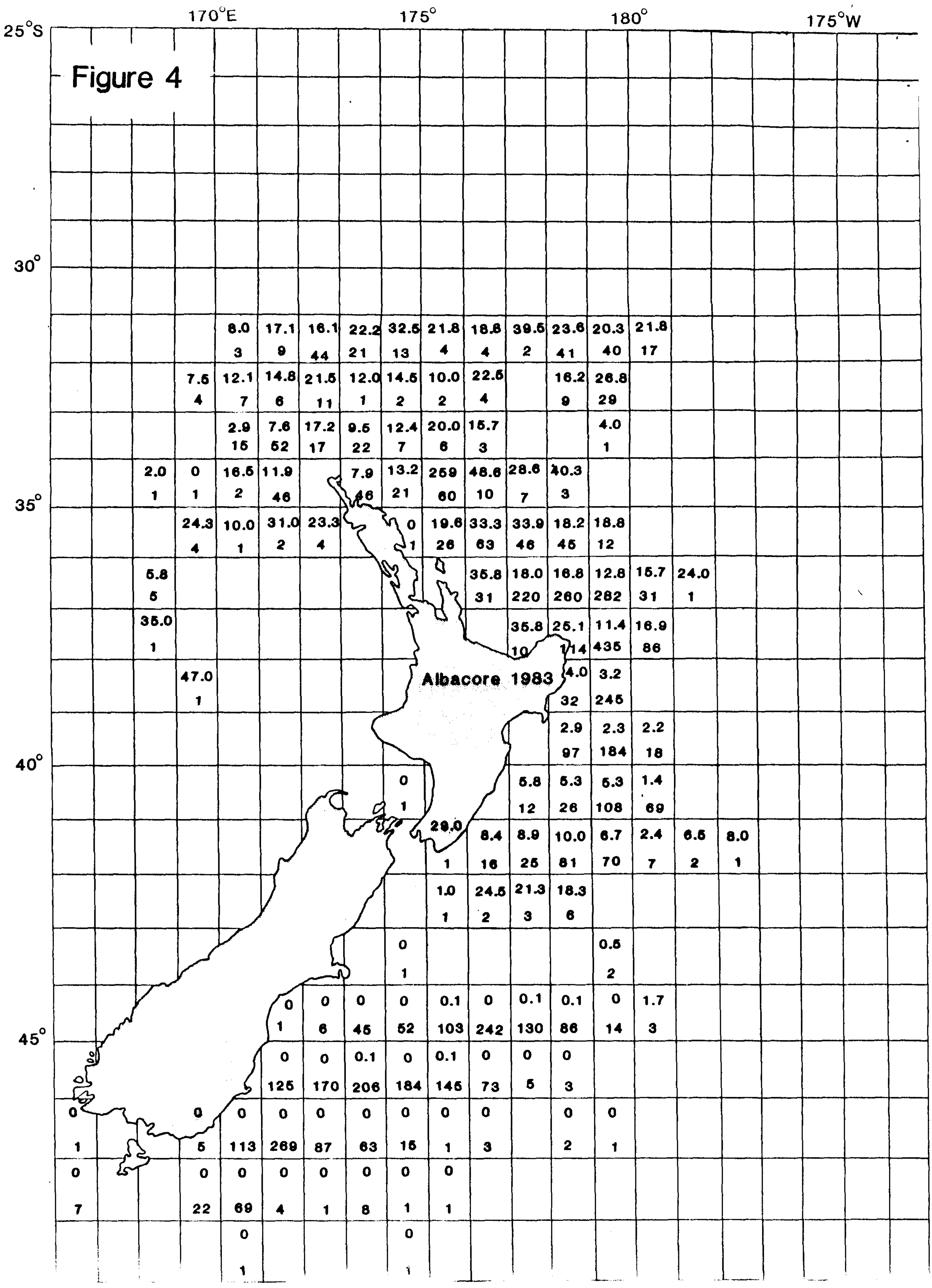
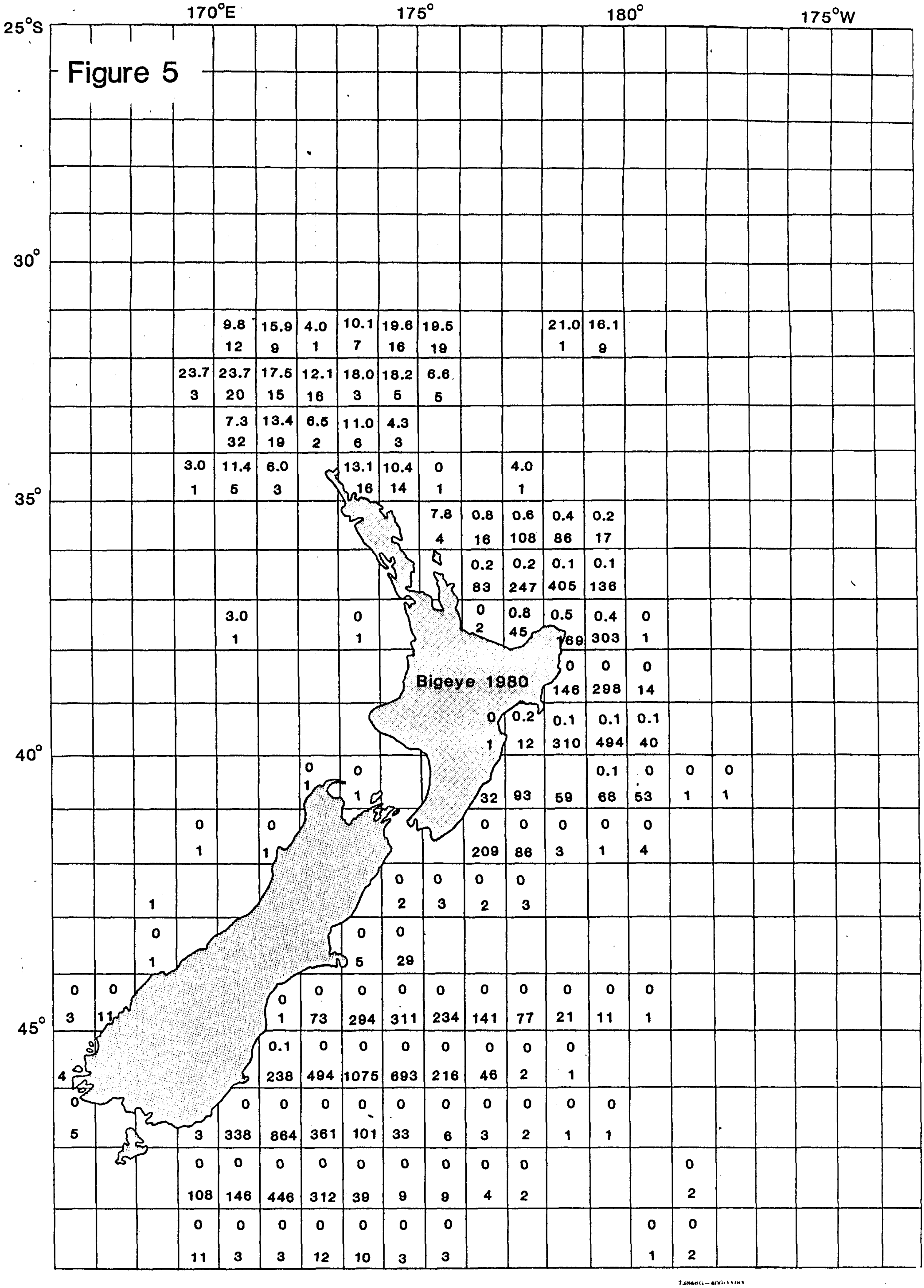


Figure 4
Albacore 1983
170°E
175°
180°
175°W
25°S
30°
35°
40°
45°

Figure 5



73846G-400-11/80

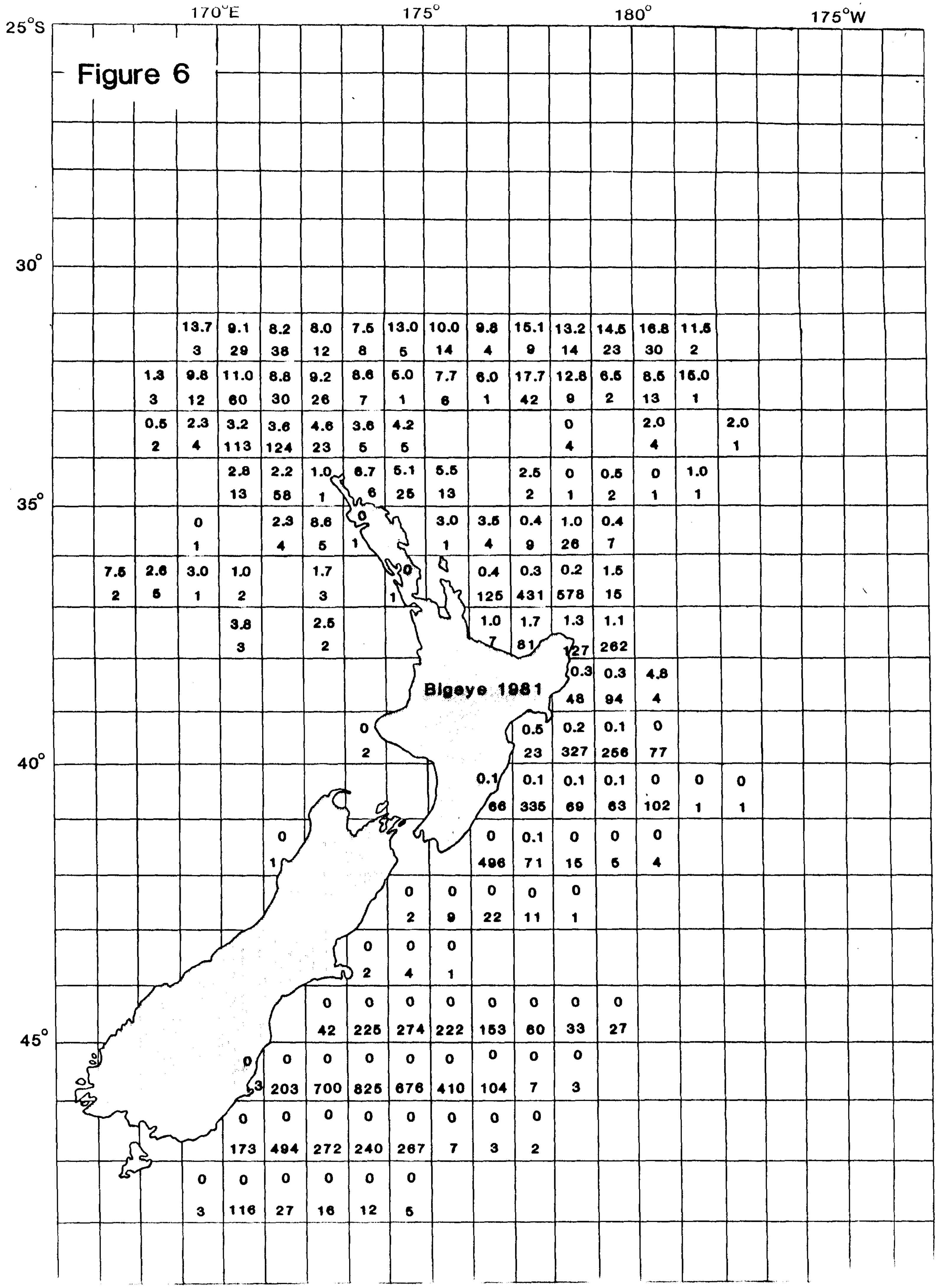


Figure 6
Bigeye 1981
25°S
30°
35°
40°
45°
170°E
175°
180°
175°W

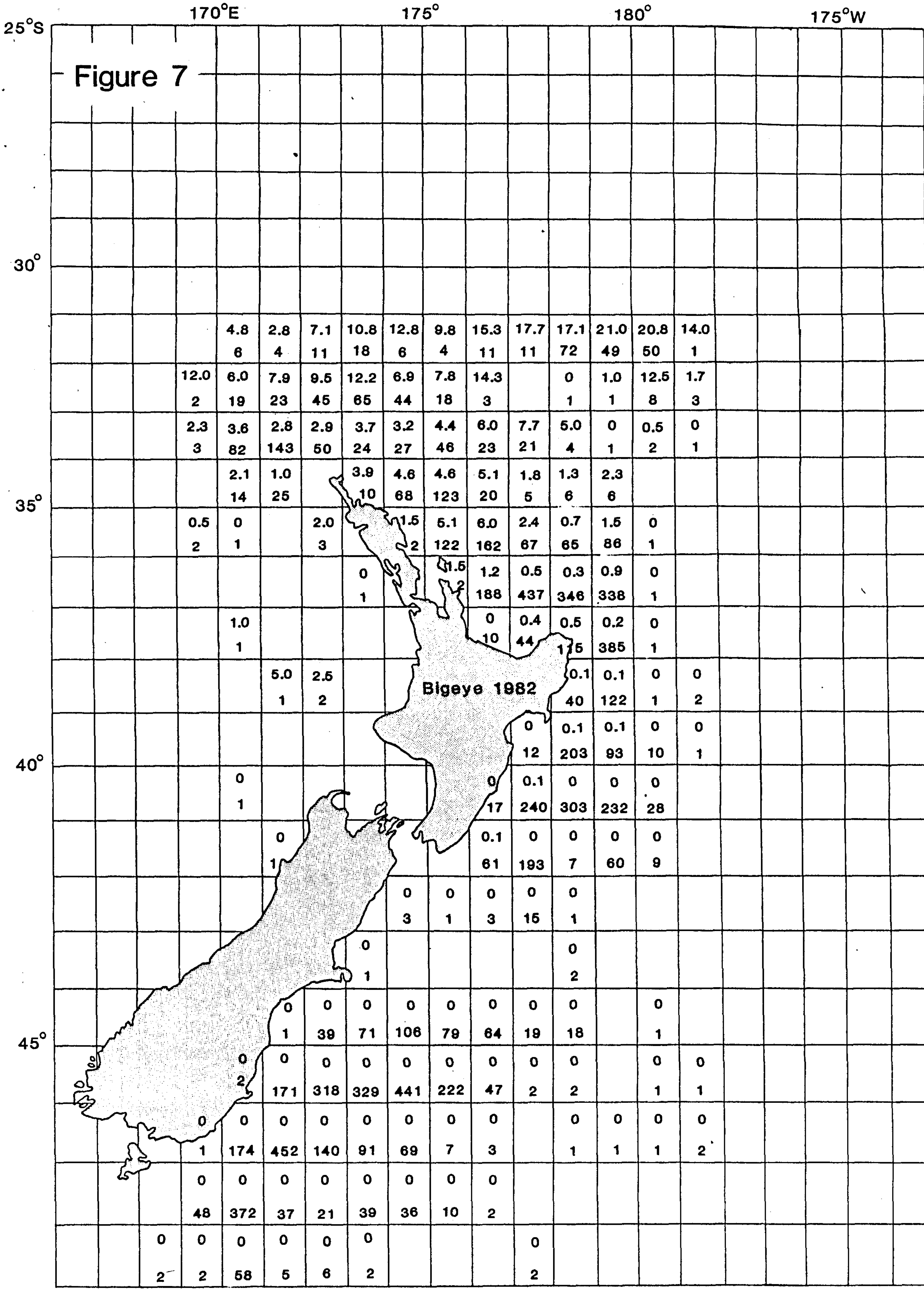

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
4.8 6 | 2.8 4 | 7.1 11 | 10.8 18 | 12.8 6 | 9.8 4 | 15.3 11 | 17.7 11 | 17.1 72 | 21.0 49 | 20.8 50 | 14.0 1
12.0 2 | 6.0 19 | 7.9 23 | 9.5 45 | 12.2 65 | 6.9 44 | 7.8 18 | 14.3 3 | 0 1 | 1.0 1 | 12.5 8 | 1.7 3
2.3 3 | 3.6 82 | 2.8 143 | 2.9 50 | 3.7 24 | 3.2 27 | 4.4 46 | 6.0 23 | 7.7 21 | 5.0 4 | 0 1 | 0.5 2 | 0 1
2.1 14 | 1.0 25 | 3.9 10 | 4.6 68 | 4.6 123 | 5.1 20 | 1.8 5 | 1.3 6 | 2.3 6
0.5 2 | 0 1 | 2.0 3 | 1.5 2 | 5.1 122 | 6.0 162 | 2.4 67 | 0.7 65 | 1.5 86 | 0 1
0 1 | 1.5 2 | 1.2 188 | 0.5 437 | 0.3 346 | 0.9 338 | 0 1
1.0 1 | 0 10 | 0.4 44 | 0.5 175 | 0.2 385 | 0 1
5.0 1 | 2.5 2 | 0.1 40 | 0.1 122 | 0 1 | 0 2
Bigeye 1982
0 12 | 0.1 203 | 0.1 93 | 0 10 | 0 1
0 1 | 0 17 | 0.1 240 | 0 303 | 0 232 | 0 28
0 1 | 0.1 61 | 0 193 | 0 7 | 0 60 | 0 9
0 3 | 0 1 | 0 3 | 0 15 | 0 1
0 1 | 0 2
0 1 | 0 39 | 0 71 | 0 106 | 0 79 | 0 64 | 0 19 | 0 18 | 0 1
0 2 | 0 171 | 0 318 | 0 329 | 0 441 | 0 222 | 0 47 | 0 2 | 0 2 | 0 1 | 0 1
0 1 | 0 174 | 0 452 | 0 140 | 0 91 | 0 69 | 0 7 | 0 3 | 0 1 | 0 1 | 0 1 | 0 2
0 48 | 0 372 | 0 37 | 0 21 | 0 39 | 0 36 | 0 10 | 0 2
0 2 | 0 2 | 0 58 | 0 5 | 0 6 | 0 2 | 0 2

Figure 7

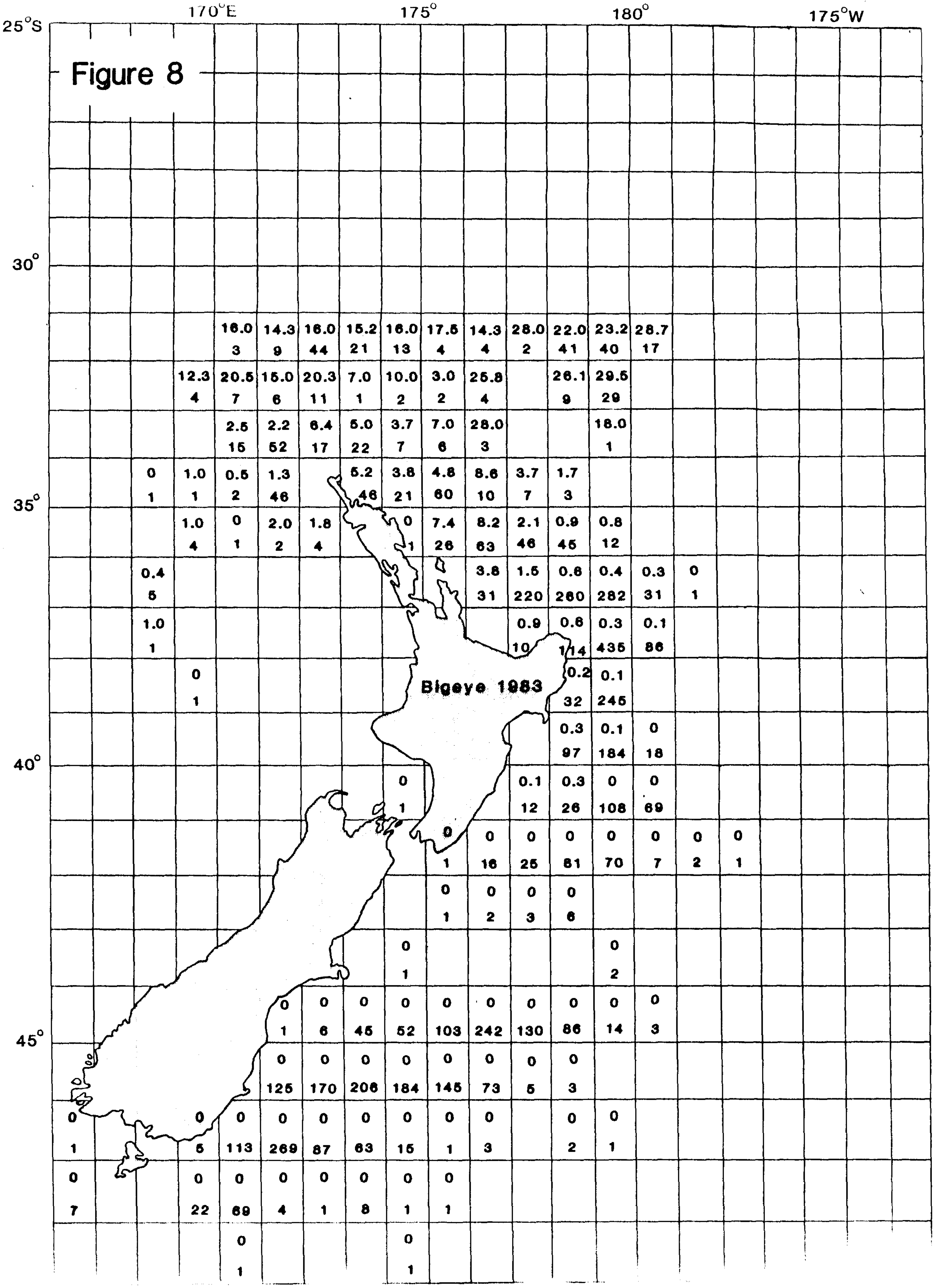

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Bigeye 1983
16.0 3 | 14.3 9 | 16.0 44 | 15.2 21 | 16.0 13 | 17.5 4 | 14.3 4 | 28.0 2 | 22.0 41 | 23.2 40 | 28.7 17
12.3 4 | 20.5 7 | 15.0 6 | 20.3 11 | 7.0 1 | 10.0 2 | 3.0 2 | 25.8 4 | 26.1 9 | 29.5 29
2.5 15 | 2.2 52 | 6.4 17 | 5.0 22 | 3.7 7 | 7.0 6 | 28.0 3 | 18.0 1
0 1 | 1.0 1 | 0.5 2 | 1.3 46 | 5.2 46 | 3.8 21 | 4.8 60 | 8.6 10 | 3.7 7 | 1.7 3
1.0 4 | 0 1 | 2.0 2 | 1.8 4 | 0 1 | 7.4 26 | 8.2 63 | 2.1 46 | 0.9 45 | 0.8 12
0.4 5 | 3.8 31 | 1.5 220 | 0.6 260 | 0.4 282 | 0.3 31 | 0 1
1.0 1 | 0.9 10 | 0.6 114 | 0.3 435 | 0.1 86
0 1 | 0.2 32 | 0.1 245
0.3 97 | 0.1 184 | 0 18
0 1 | 0.1 12 | 0.3 26 | 0 108 | 0 69
0 1 | 0 16 | 0 25 | 0 81 | 0 70 | 0 7 | 0 2 | 0 1
0 1 | 0 2 | 0 3 | 0 6
0 1 | 0 2
0 1 | 0 6 | 0 45 | 0 52 | 0 103 | 0 242 | 0 130 | 0 86 | 0 14 | 0 3
0 125 | 0 170 | 0 206 | 0 184 | 0 145 | 0 73 | 0 5 | 0 3
0 1 | 0 5 | 0 113 | 0 269 | 0 87 | 0 63 | 0 15 | 0 1 | 0 3 | 0 2 | 0 1
0 7 | 0 22 | 0 69 | 0 4 | 0 1 | 0 8 | 0 1 | 0 1
0 1 | 0 1

Figure 8

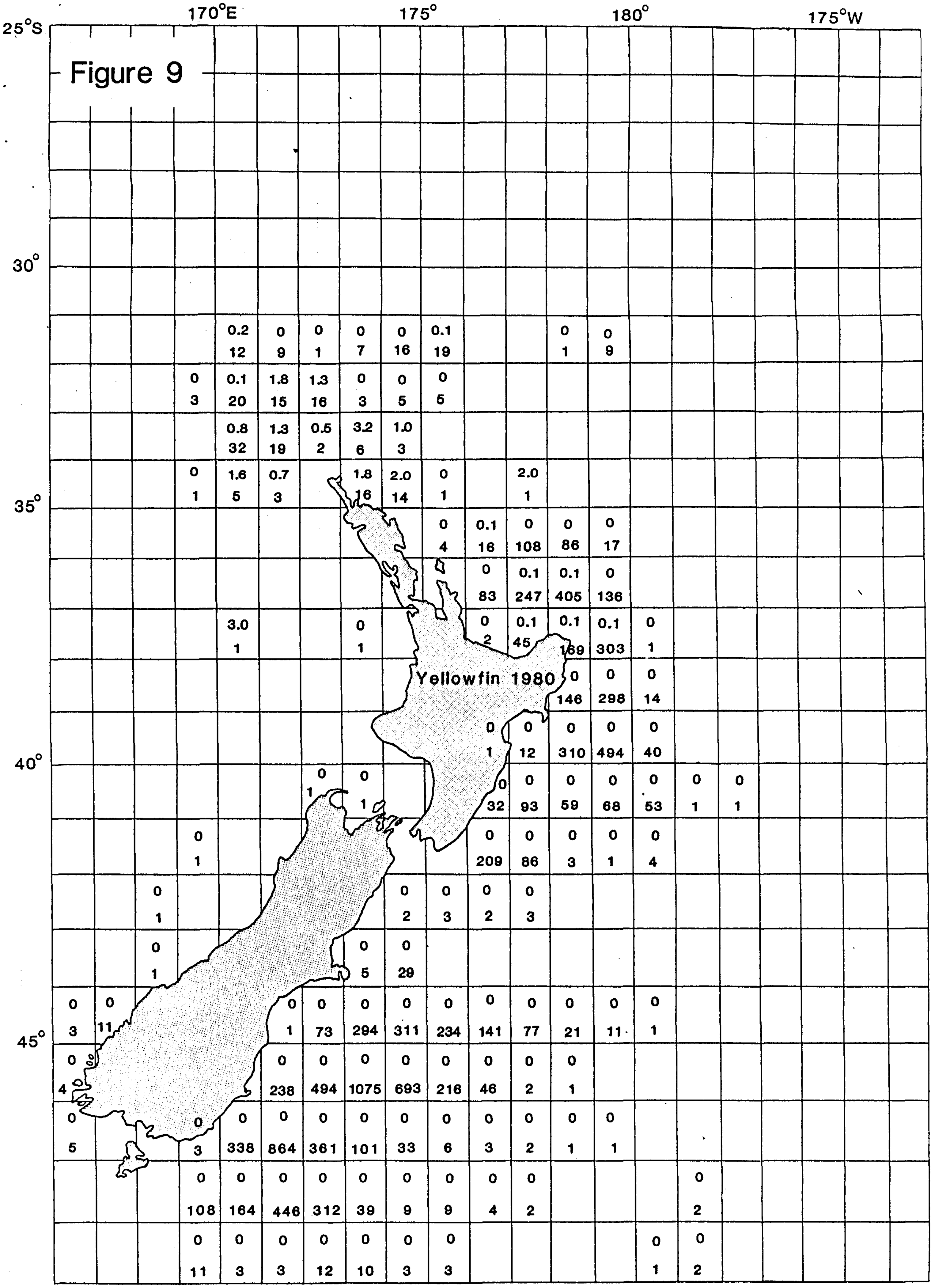

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Yellowfin 1980
0.2 12
0 9
0 1
0 7
0 16
0.1 19
0 1
0 9
0 3
0.1 20
1.8 15
1.3 16
0 3
0 5
0 5
0.8 32
1.3 19
0.5 2
3.2 6
1.0 3
0 1
1.6 5
0.7 3
1.8 16
2.0 14
0 1
2.0 1
0 4
0.1 16
0 108
0 86
0 17
0 83
0.1 247
0.1 405
0 136
3.0 1
0 1
0 2
0.1 45
0.1 169
0.1 303
0 1
0 146
0 298
0 14
0 1
0 12
0 310
0 494
0 40
0 1
0 1
0 32
0 93
0 59
0 68
0 53
0 1
0 1
0 1
0 209
0 86
0 3
0 1
0 4
0 1
0 2
0 3
0 2
0 3
0 1
0 5
0 29
0 3
0 11
0 1
0 73
0 294
0 311
0 234
0 141
0 77
0 21
0 11
0 1
0 4
0 238
0 494
0 1075
0 693
0 216
0 46
0 2
0 1
0 5
0 3
0 338
0 864
0 361
0 101
0 33
0 6
0 3
0 2
0 1
0 1
0 108
0 164
0 446
0 312
0 39
0 9
0 9
0 4
0 2
0 2
0 11
0 3
0 3
0 12
0 10
0 3
0 3
0 1
0 2

Figure 9

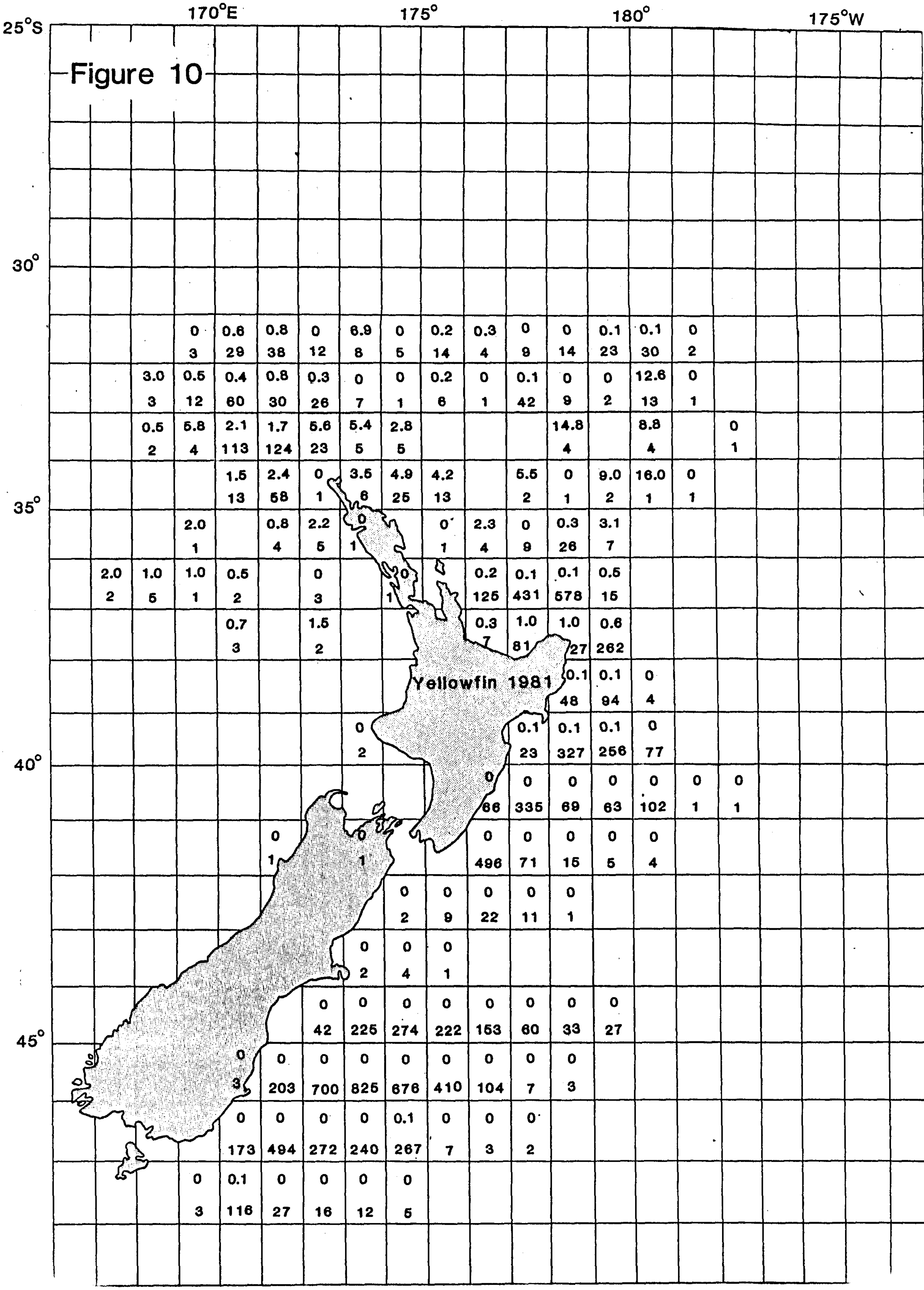


Figure 10
Yellowfin 1981
25°S
30°
35°
40°
45°
170°E
175°
180°
175°W
0 3 | 0.6 29 | 0.8 38 | 0 12 | 6.9 8 | 0 5 | 0.2 14 | 0.3 4 | 0 9 | 0 14 | 0.1 23 | 0.1 30 | 0 2
3.0 3 | 0.5 12 | 0.4 60 | 0.8 30 | 0.3 26 | 0 7 | 0 1 | 0.2 6 | 0 1 | 0.1 42 | 0 9 | 0 2 | 12.6 13 | 0 1
0.5 2 | 5.8 4 | 2.1 113 | 1.7 124 | 5.6 23 | 5.4 5 | 2.8 5 | 14.8 4 | 8.8 4 | 0 1
1.5 13 | 2.4 58 | 0 1 | 3.5 6 | 4.9 25 | 4.2 13 | 5.5 2 | 0 1 | 9.0 2 | 16.0 1 | 0 1
2.0 1 | 0.8 4 | 2.2 5 | 0 1 | 0 1 | 2.3 4 | 0 9 | 0.3 26 | 3.1 7
2.0 2 | 1.0 5 | 1.0 1 | 0.5 2 | 0 3 | 0 1 | 0.2 125 | 0.1 431 | 0.1 578 | 0.5 15
0.7 3 | 1.5 2 | 0.3 7 | 1.0 81 | 1.0 27 | 0.6 262
0.1 48 | 0.1 94 | 0 4
0 2 | 0.1 23 | 0.1 327 | 0.1 256 | 0 77
0 66 | 0 335 | 0 69 | 0 63 | 0 102 | 0 1 | 0 1
0 1 | 0 1 | 0 496 | 0 71 | 0 15 | 0 5 | 0 4
0 2 | 0 9 | 0 22 | 0 11 | 0 1
0 2 | 0 4 | 0 1
0 42 | 0 225 | 0 274 | 0 222 | 0 153 | 0 60 | 0 33 | 0 27
0 3 | 0 203 | 0 700 | 0 825 | 0 676 | 0 410 | 0 104 | 0 7 | 0 3
0 173 | 0 494 | 0 272 | 0 240 | 0.1 267 | 0 7 | 0 3 | 0 2
0 3 | 0.1 116 | 0 27 | 0 16 | 0 12 | 0 5

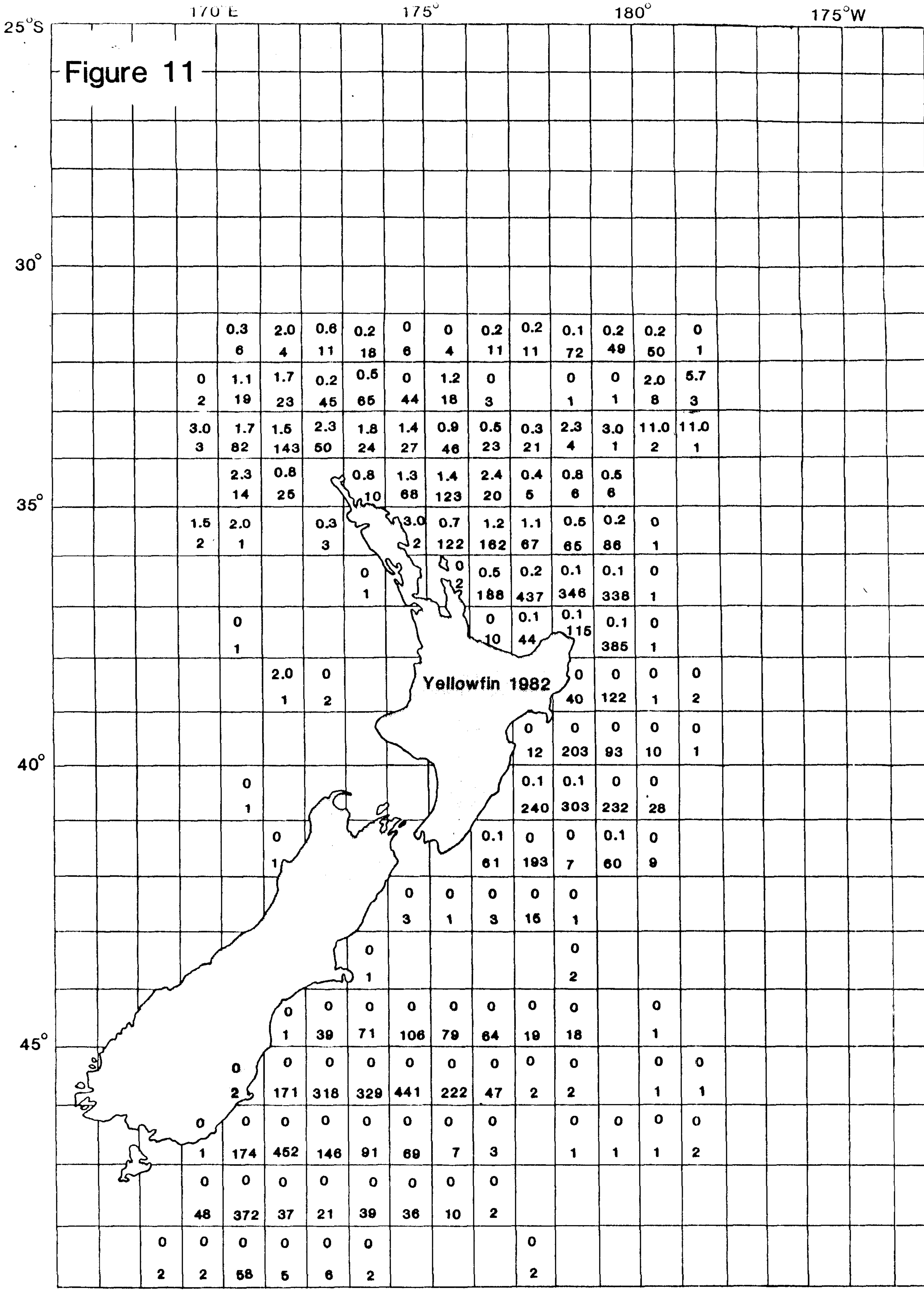
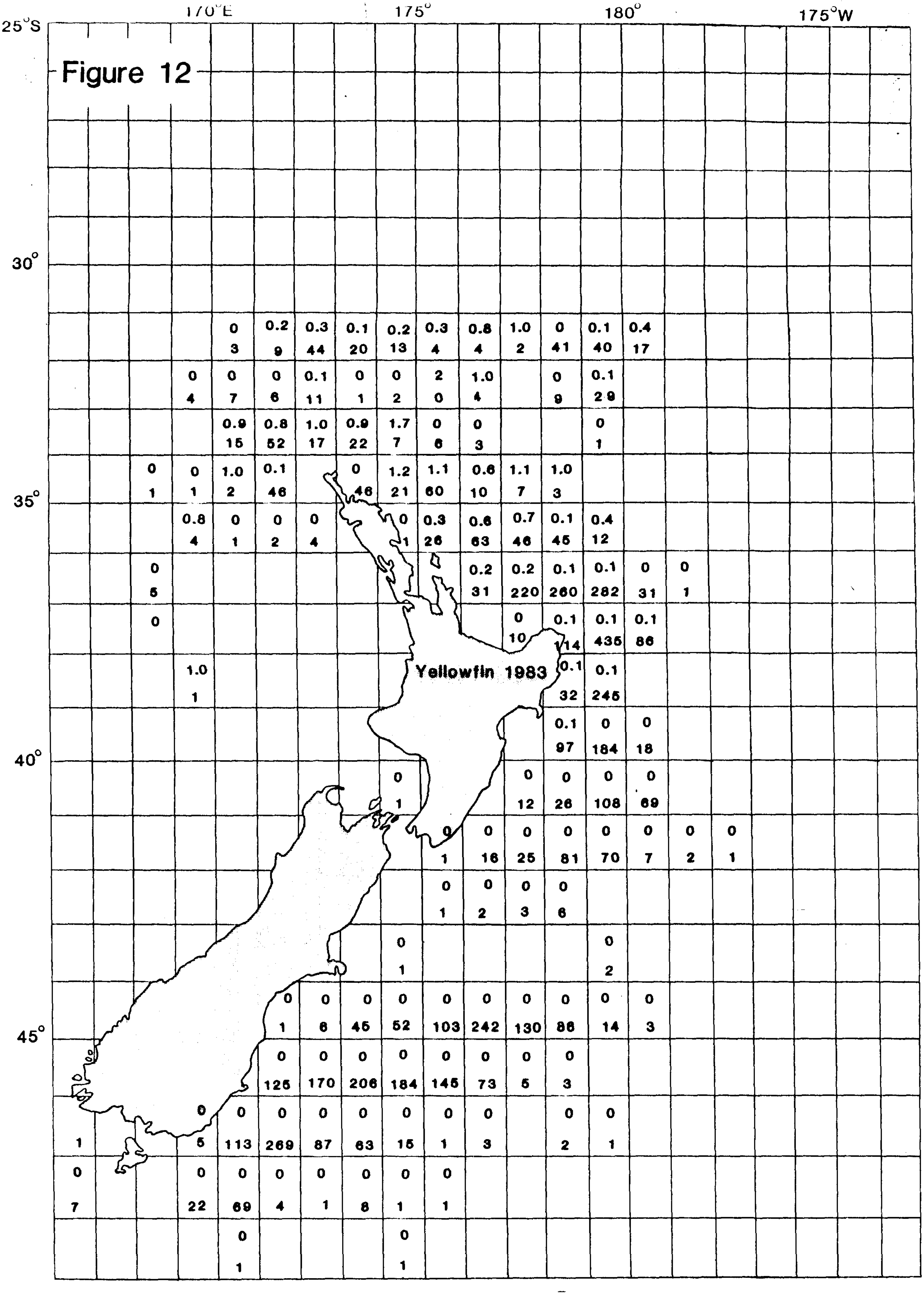


Figure 11
Yellowfin 1982
25°S
30°
35°
40°
45°
170°E
175°
180°
175°W
0.3 6 | 2.0 4 | 0.6 11 | 0.2 18 | 0 6 | 0 4 | 0.2 11 | 0.2 11 | 0.1 72 | 0.2 49 | 0.2 50 | 0 1
0 2 | 1.1 19 | 1.7 23 | 0.2 45 | 0.5 65 | 0 44 | 1.2 18 | 0 3 | 0 1 | 0 1 | 2.0 8 | 5.7 3
3.0 3 | 1.7 82 | 1.5 143 | 2.3 50 | 1.8 24 | 1.4 27 | 0.9 46 | 0.5 23 | 0.3 21 | 2.3 4 | 3.0 1 | 11.0 2 | 11.0 1
2.3 14 | 0.8 25 | 0.8 10 | 1.3 68 | 1.4 123 | 2.4 20 | 0.4 5 | 0.8 6 | 0.5 6
1.5 2 | 2.0 1 | 0.3 3 | 3.0 2 | 0.7 122 | 1.2 162 | 1.1 67 | 0.5 65 | 0.2 86 | 0 1
0 1 | 0 2 | 0.5 188 | 0.2 437 | 0.1 346 | 0.1 338 | 0 1
0 1 | 0 10 | 0.1 44 | 0.1 115 | 0.1 385 | 0 1
2.0 1 | 0 2 | 0 40 | 0 122 | 0 1 | 0 2
0 12 | 0 203 | 0 93 | 0 10 | 0 1
0 1 | 0.1 240 | 0.1 303 | 0 232 | 0 28
0 1 | 0.1 61 | 0 193 | 0 7 | 0.1 60 | 0 9
0 3 | 0 1 | 0 3 | 0 15 | 0 1
0 1 | 0 2
0 1 | 0 39 | 0 71 | 0 106 | 0 79 | 0 64 | 0 19 | 0 18 | 0 1
0 2 | 0 171 | 0 318 | 0 329 | 0 441 | 0 222 | 0 47 | 0 2 | 0 2 | 0 1 | 0 1
0 1 | 0 174 | 0 452 | 0 146 | 0 91 | 0 69 | 0 7 | 0 3 | 0 1 | 0 1 | 0 1 | 0 2
0 48 | 0 372 | 0 37 | 0 21 | 0 39 | 0 36 | 0 10 | 0 2
0 2 | 0 2 | 0 58 | 0 5 | 0 6 | 0 2 | 0 2


170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Yellowfin 1983
0 3 | 0.2 9 | 0.3 44 | 0.1 20 | 0.2 13 | 0.3 4 | 0.8 4 | 1.0 2 | 0 41 | 0.1 40 | 0.4 17
0 4 | 0 7 | 0 6 | 0.1 11 | 0 1 | 0 2 | 2 0 | 1.0 4 | 0 9 | 0.1 29
0.9 15 | 0.8 52 | 1.0 17 | 0.9 22 | 1.7 7 | 0 6 | 0 3 | 0 1
0 1 | 0 1 | 1.0 2 | 0.1 46 | 0 46 | 1.2 21 | 1.1 60 | 0.6 10 | 1.1 7 | 1.0 3
0.8 4 | 0 1 | 0 2 | 0 4 | 0 1 | 0.3 26 | 0.6 63 | 0.7 46 | 0.1 45 | 0.4 12
0 5 | 0.2 31 | 0.2 220 | 0.1 260 | 0.1 282 | 0 31 | 0 1
0 | 0 10 | 0.1 114 | 0.1 435 | 0.1 86
1.0 1 | 0.1 32 | 0.1 245
0.1 97 | 0 184 | 0 18
0 1 | 0 12 | 0 26 | 0 108 | 0 69
0 1 | 0 16 | 0 25 | 0 81 | 0 70 | 0 7 | 0 2 | 0 1
0 1 | 0 2 | 0 3 | 0 6
0 1 | 0 2
0 1 | 0 6 | 0 45 | 0 52 | 0 103 | 0 242 | 0 130 | 0 86 | 0 14 | 0 3
0 125 | 0 170 | 0 206 | 0 184 | 0 145 | 0 73 | 0 5 | 0 3
1 | 0 5 | 0 113 | 0 269 | 0 87 | 0 63 | 0 15 | 0 1 | 0 3 | 0 2 | 0 1
0 7 | 0 22 | 0 69 | 0 4 | 0 1 | 0 8 | 0 1 | 0 1
0 1 | 0 1
Figure 12

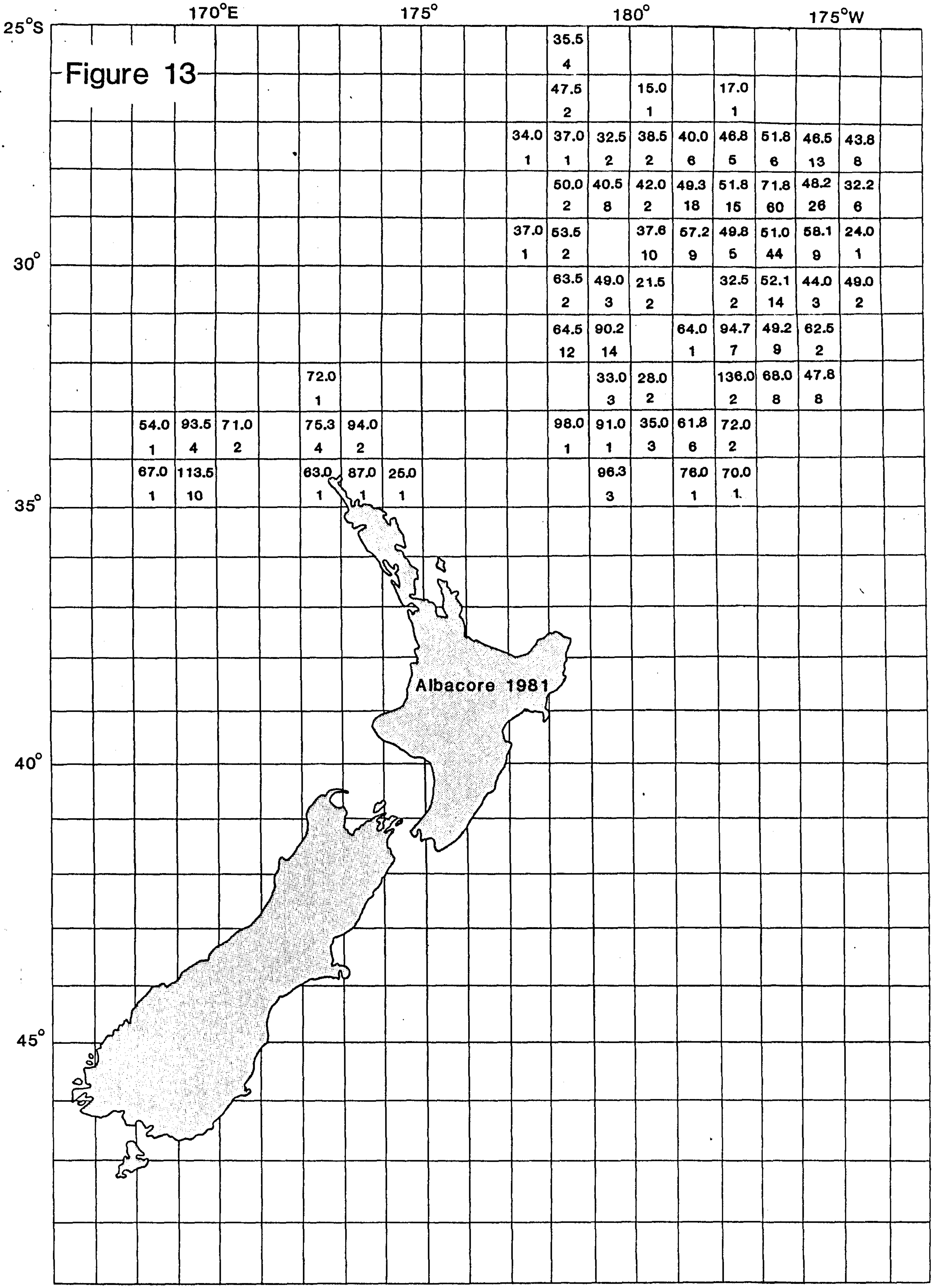

25°S
170°E
175°
180°
175°W
30°
35°
40°
45°
35.5 4
47.5 2
15.0 1
17.0 1
34.0 1
37.0 1
32.5 2
38.5 2
40.0 6
46.8 5
51.8 6
46.5 13
43.8 8
50.0 2
40.5 8
42.0 2
49.3 18
51.8 15
71.8 60
48.2 26
32.2 6
37.0 1
53.5 2
37.6 10
57.2 9
49.8 5
51.0 44
58.1 9
24.0 1
63.5 2
49.0 3
21.5 2
32.5 2
52.1 14
44.0 3
49.0 2
64.5 12
90.2 14
64.0 1
94.7 7
49.2 9
62.5 2
72.0 1
33.0 3
28.0 2
136.0 2
68.0 8
47.8 8
54.0 1
93.5 4
71.0 2
75.3 4
94.0 2
98.0 1
91.0 1
35.0 3
61.8 6
72.0 2
67.0 1
113.5 10
63.0 1
87.0 1
25.0 1
96.3 3
76.0 1
70.0 1
Albacore 1981

Figure 13

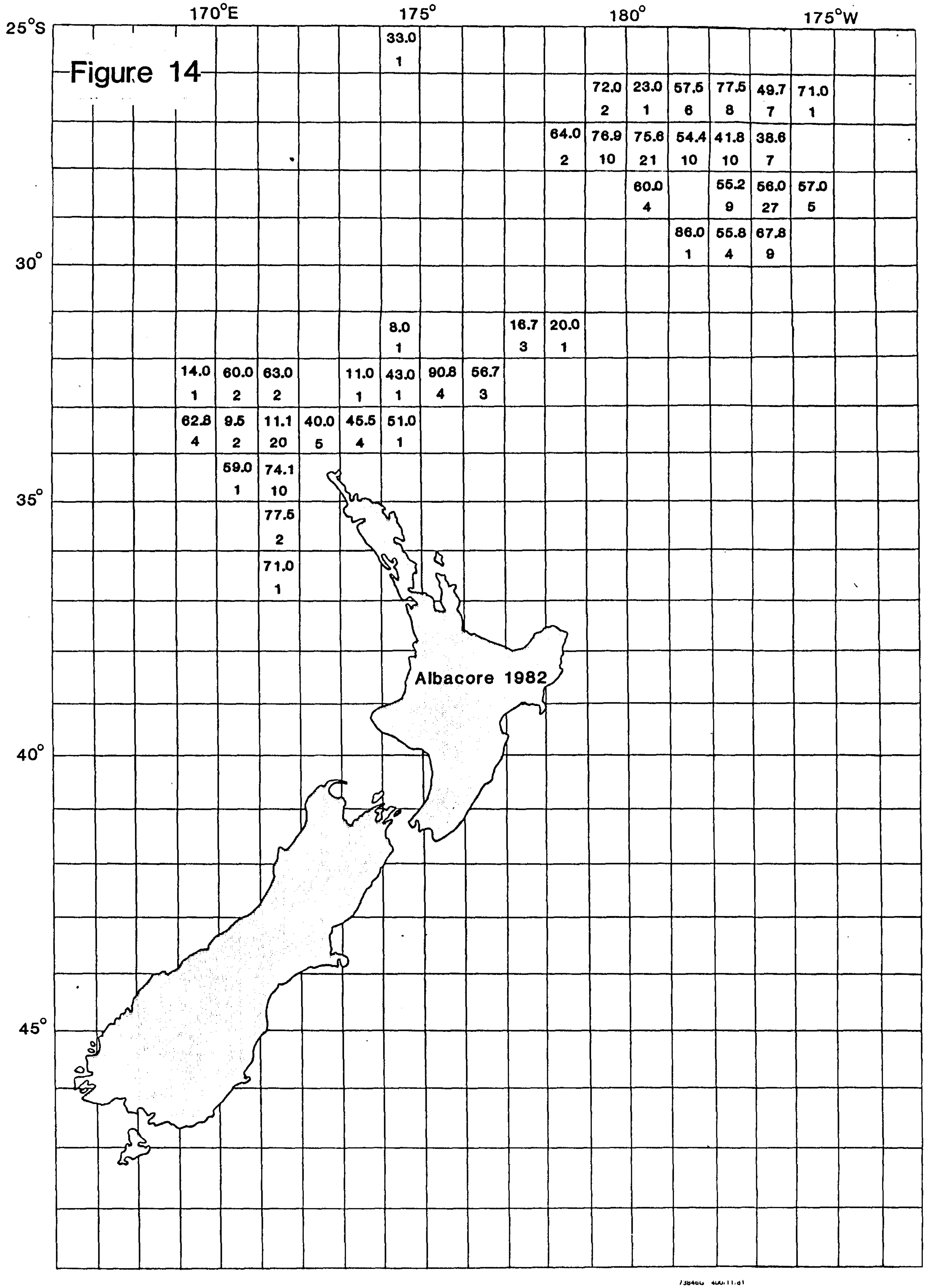


Figure 14
170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
33.0
1
72.0
2
23.0
1
57.5
6
77.5
8
49.7
7
71.0
1
64.0
2
76.9
10
75.6
21
54.4
10
41.8
10
38.6
7
60.0
4
55.2
9
56.0
27
57.0
5
86.0
1
55.8
4
67.8
9
8.0
1
16.7
3
20.0
1
14.0
1
60.0
2
63.0
2
11.0
1
43.0
1
90.8
4
56.7
3
62.8
4
9.5
2
11.1
20
40.0
5
45.5
4
51.0
1
59.0
1
74.1
10
77.5
2
71.0
1
Albacore 1982

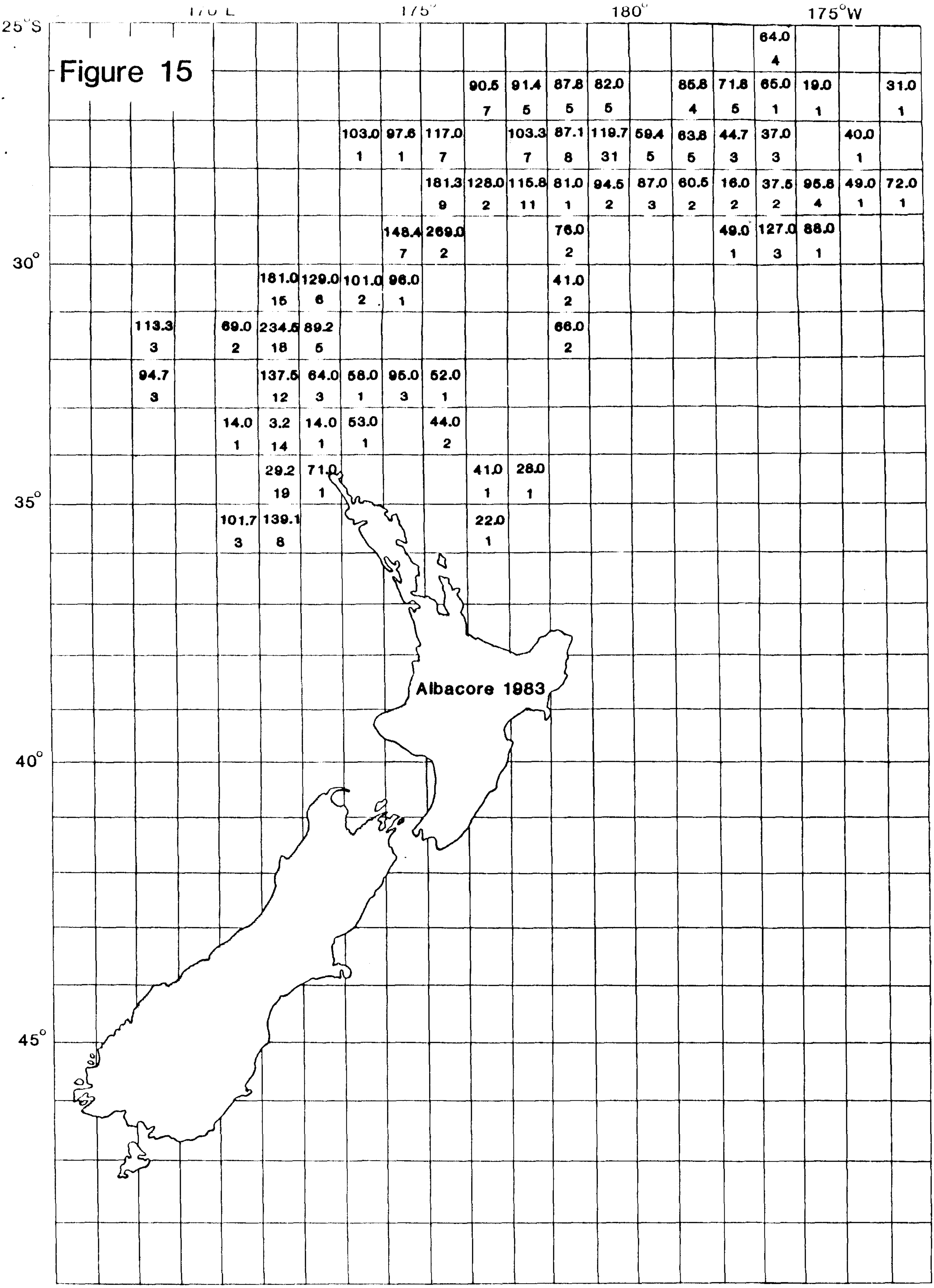

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Albacore 1983
64.0 4
90.5 7
91.4 5
87.8 5
82.0 5
85.8 4
71.8 5
65.0 1
19.0 1
31.0 1
103.0 1
97.6 1
117.0 7
103.3 7
87.1 8
119.7 31
59.4 5
63.8 5
44.7 3
37.0 3
40.0 1
181.3 9
128.0 2
115.8 11
81.0 1
94.5 2
87.0 3
60.5 2
16.0 2
37.5 2
95.8 4
49.0 1
72.0 1
148.4 7
269.0 2
76.0 2
49.0 1
127.0 3
88.0 1
181.0 15
129.0 6
101.0 2
96.0 1
41.0 2
113.3 3
69.0 2
234.5 18
89.2 5
66.0 2
94.7 3
137.5 12
64.0 3
58.0 1
95.0 3
52.0 1
14.0 1
3.2 14
14.0 1
53.0 1
44.0 2
29.2 19
71.0 1
41.0 1
28.0 1
101.7 3
139.1 8
22.0 1

Figure 15

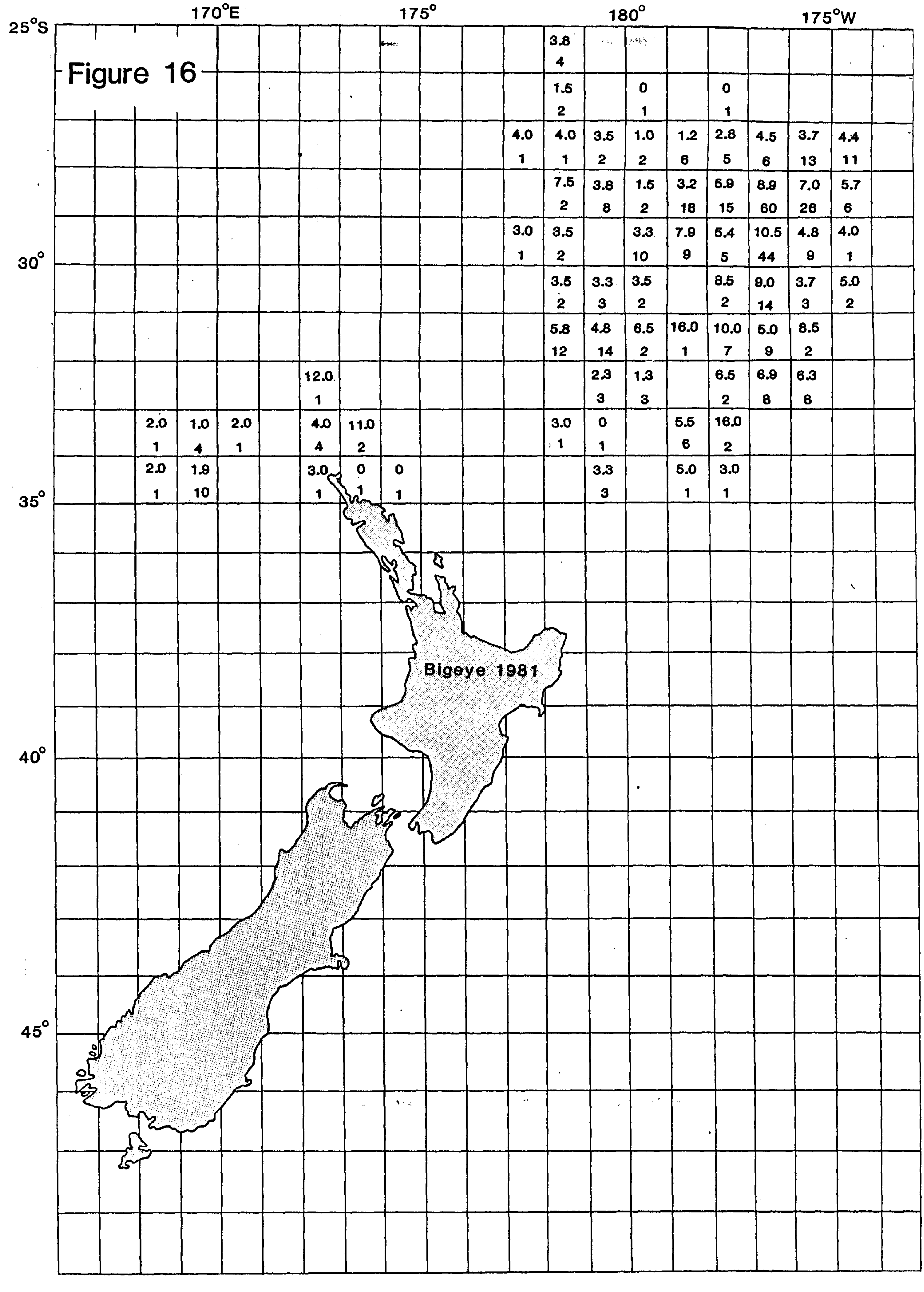
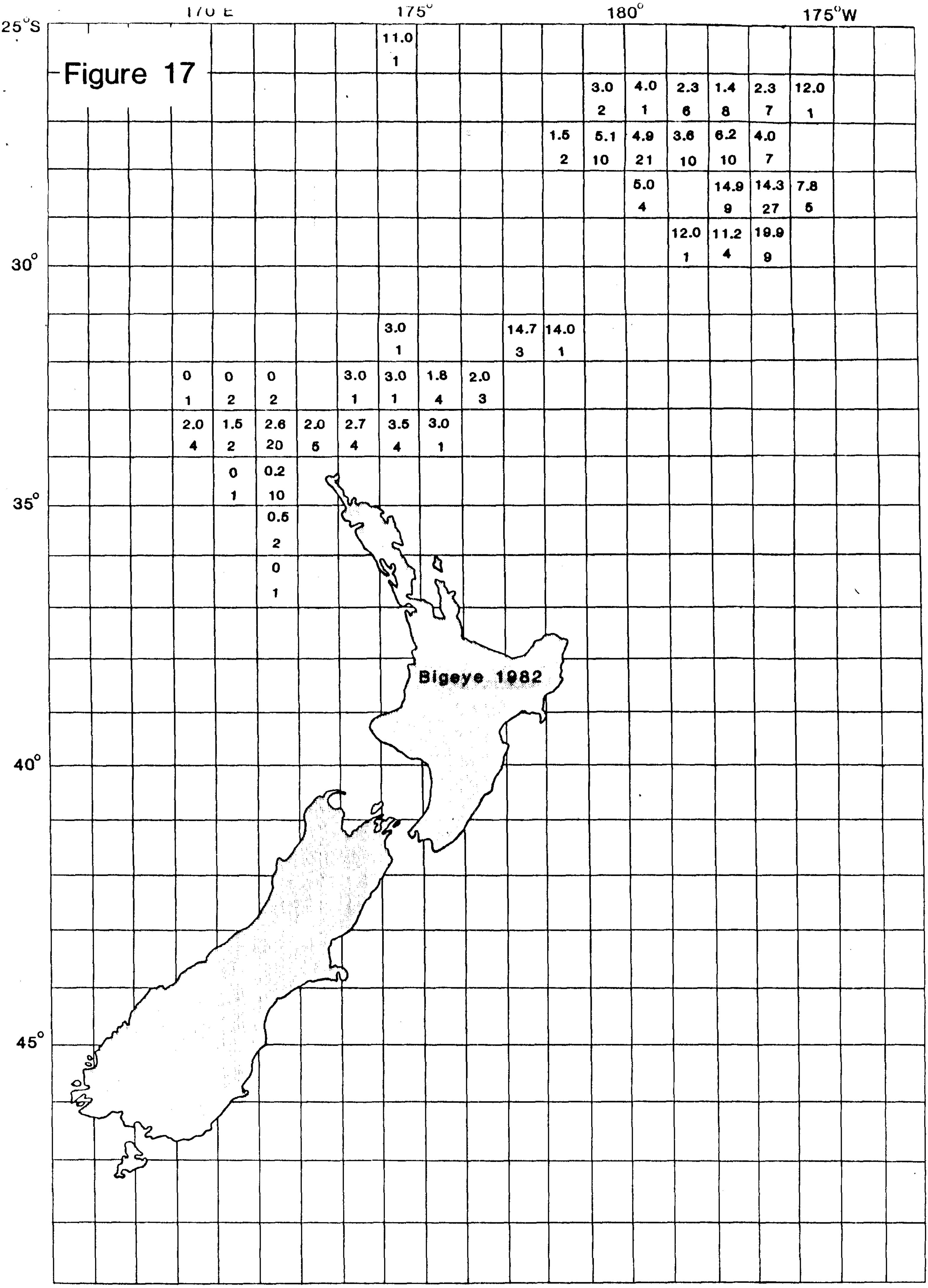
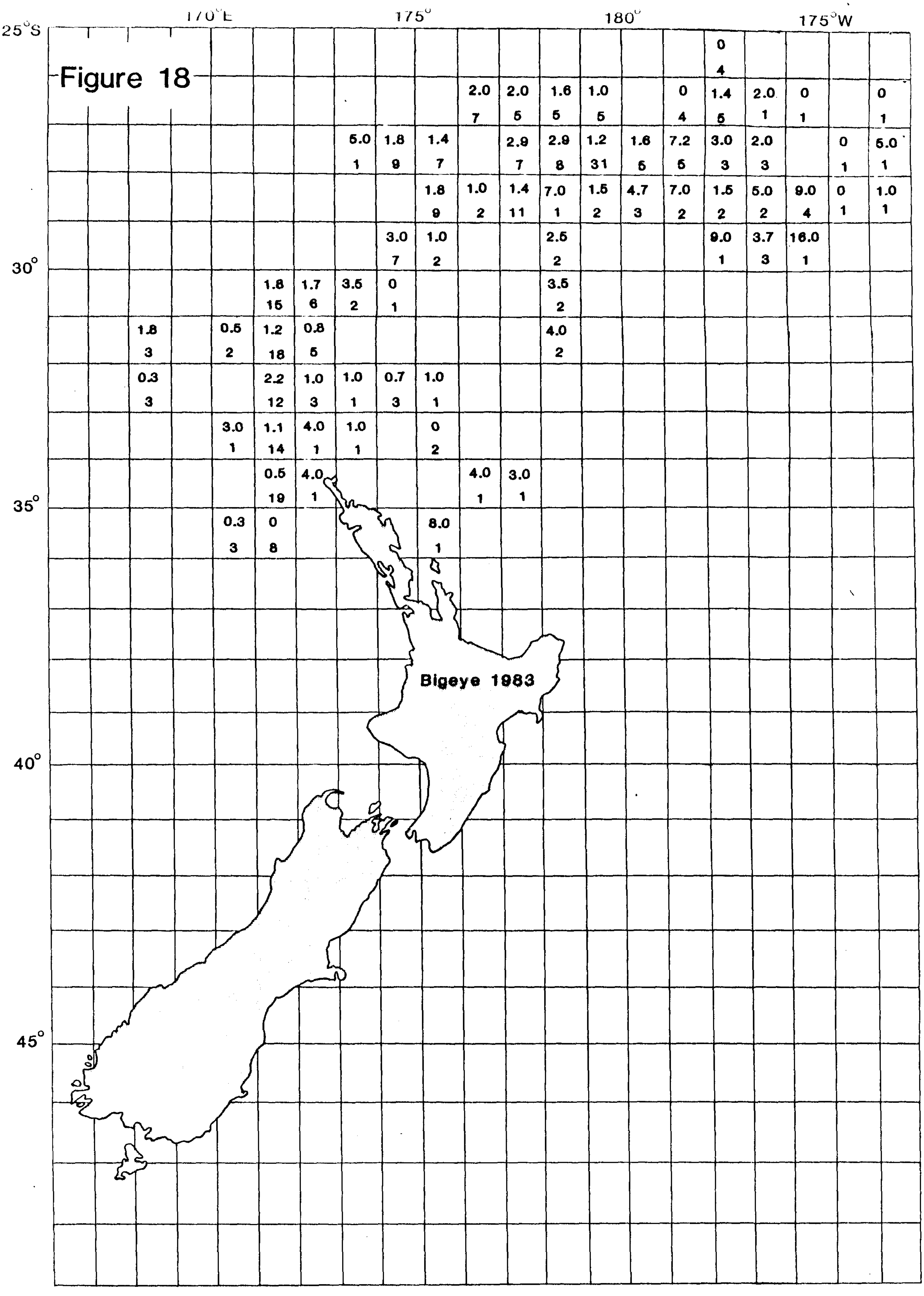

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
Bigeye 1981
3.8 4
1.5 2 | 0 1 | 0 1
4.0 1 | 4.0 1 | 3.5 2 | 1.0 2 | 1.2 6 | 2.8 5 | 4.5 6 | 3.7 13 | 4.4 11
7.5 2 | 3.8 8 | 1.5 2 | 3.2 18 | 5.9 15 | 8.9 60 | 7.0 26 | 5.7 6
3.0 1 | 3.5 2 | 3.3 10 | 7.9 9 | 5.4 5 | 10.5 44 | 4.8 9 | 4.0 1
3.5 2 | 3.3 3 | 3.5 2 | 8.5 2 | 9.0 14 | 3.7 3 | 5.0 2
5.8 12 | 4.8 14 | 6.5 2 | 16.0 1 | 10.0 7 | 5.0 9 | 8.5 2
12.0 1 | 2.3 3 | 1.3 3 | 6.5 2 | 6.9 8 | 6.3 8
2.0 1 | 1.0 4 | 2.0 1 | 4.0 4 | 11.0 2 | 3.0 1 | 0 1 | 5.5 6 | 16.0 2
2.0 1 | 1.9 10 | 3.0 1 | 0 1 | 0 1 | 3.3 3 | 5.0 1 | 3.0 1

Figure 16



170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
11.0
1
3.0
2
4.0
1
2.3
6
1.4
8
2.3
7
12.0
1
1.5
2
5.1
10
4.9
21
3.6
10
6.2
10
4.0
7
5.0
4
14.9
9
14.3
27
7.8
5
12.0
1
11.2
4
19.9
9
3.0
1
14.7
3
14.0
1
0
1
0
2
0
2
3.0
1
3.0
1
1.8
4
2.0
3
2.0
4
1.5
2
2.6
20
2.0
5
2.7
4
3.5
4
3.0
1
0
1
0.2
10
0.5
2
0
1
Bigeye 1982

Figure 17



170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
0 4
2.0 7
2.0 5
1.6 5
1.0 5
0 4
1.4 5
2.0 1
0 1
0 1
5.0 1
1.8 9
1.4 7
2.9 7
2.9 8
1.2 31
1.6 5
7.2 5
3.0 3
2.0 3
0 1
5.0 1
1.8 9
1.0 2
1.4 11
7.0 1
1.5 2
4.7 3
7.0 2
1.5 2
5.0 2
9.0 4
0 1
1.0 1
3.0 7
1.0 2
2.5 2
9.0 1
3.7 3
16.0 1
1.8 15
1.7 6
3.5 2
0 1
3.5 2
1.8 3
0.5 2
1.2 18
0.8 5
4.0 2
0.3 3
2.2 12
1.0 3
1.0 1
0.7 3
1.0 1
3.0 1
1.1 14
4.0 1
1.0 1
0 2
0.5 19
4.0 1
4.0 1
3.0 1
0.3 3
0 8
8.0 1
Bigeye 1983

Figure 18

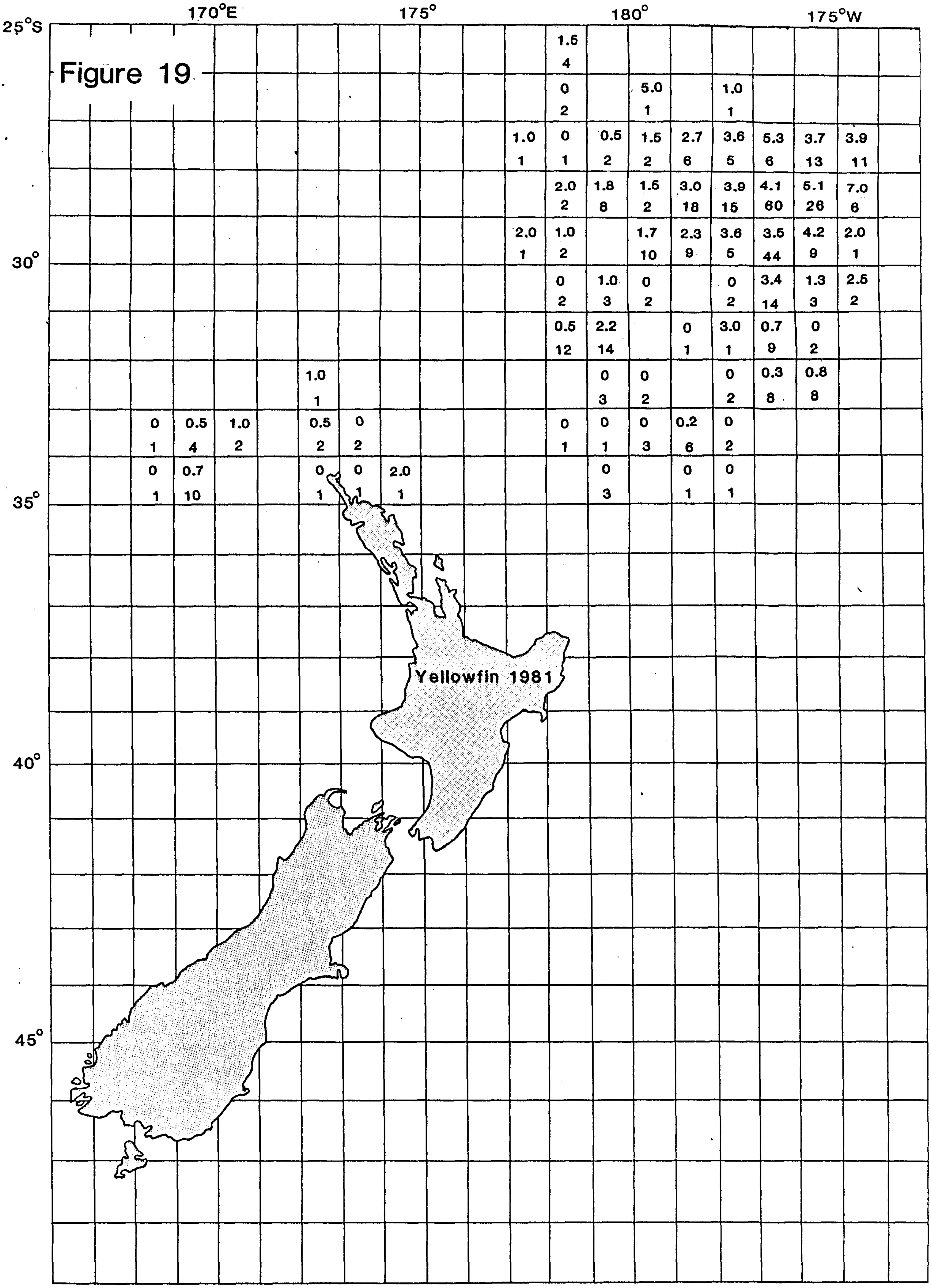


Figure 19
Yellowfin 1981
25°S
30°
35°
40°
45°
170°E
175°
180°
175°W
1.5
4
0
2
5.0
1
1.0
1
1.0
1
0
1
0.5
2
1.5
2
2.7
6
3.6
5
5.3
6
3.7
13
3.9
11
2.0
2
1.8
8
1.5
2
3.0
18
3.9
15
4.1
60
5.1
26
7.0
6
2.0
1
1.0
2
1.7
10
2.3
9
3.6
5
3.5
44
4.2
9
2.0
1
0
2
1.0
3
0
2
0
2
3.4
14
1.3
3
2.5
2
0.5
12
2.2
14
0
1
3.0
1
0.7
9
0
2
1.0
1
0
3
0
2
0
2
0.3
8
0.8
8
0
1
0.5
4
1.0
2
0.5
2
0
2
0
1
0
1
0
3
0.2
6
0
2
0
1
0.7
10
0
1
0
1
2.0
1
0
3
0
1
0
1

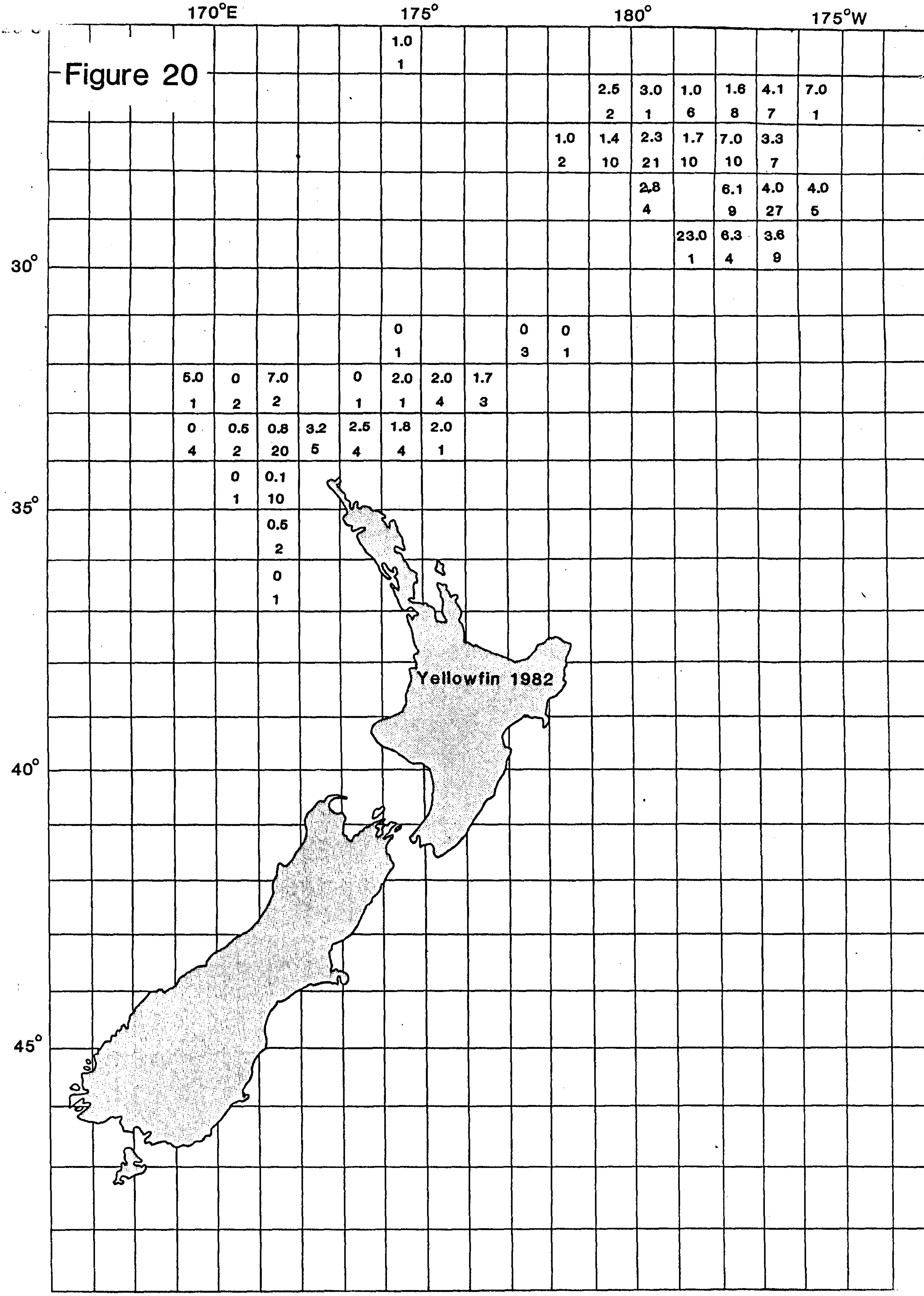

170°E
175°
180°
175°W
30°
35°
40°
45°
Yellowfin 1982
1.0 1
2.5 2
3.0 1
1.0 6
1.6 8
4.1 7
7.0 1
1.0 2
1.4 10
2.3 21
1.7 10
7.0 10
3.3 7
2.8 4
6.1 9
4.0 27
4.0 5
23.0 1
6.3 4
3.6 9
0 1
0 3
0 1
5.0 1
0 2
7.0 2
0 1
2.0 1
2.0 4
1.7 3
0 4
0.5 2
0.8 20
3.2 5
2.5 4
1.8 4
2.0 1
0 1
0.1 10
0.5 2
0 1

Figure 20

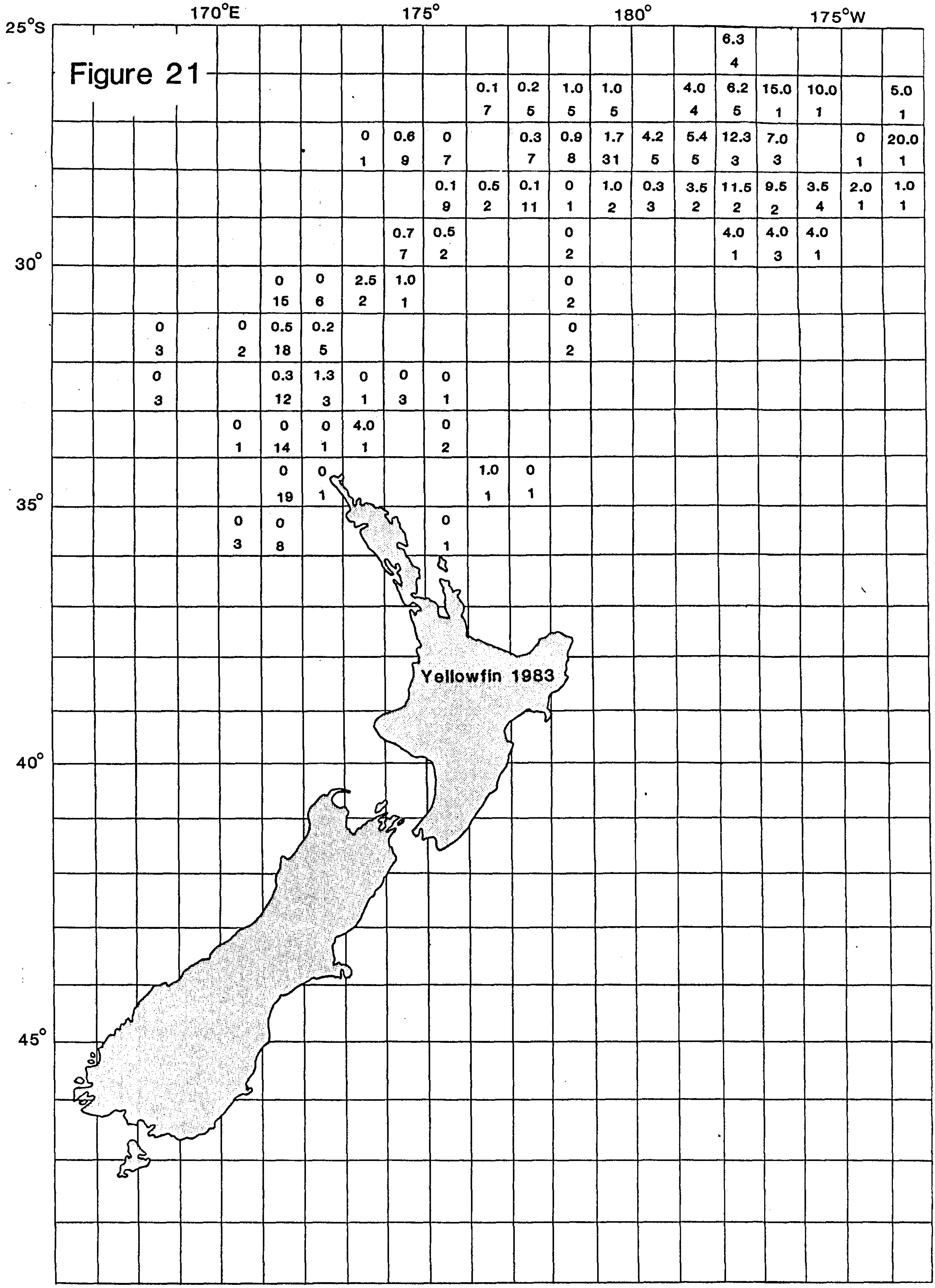

170°E
175°
180°
175°W
25°S
30°
35°
40°
45°
6.3 4
0.1 7
0.2 5
1.0 5
1.0 5
4.0 4
6.2 5
15.0 1
10.0 1
5.0 1
0 1
0.6 9
0 7
0.3 7
0.9 8
1.7 31
4.2 5
5.4 5
12.3 3
7.0 3
0 1
20.0 1
0.1 9
0.5 2
0.1 11
0 1
1.0 2
0.3 3
3.5 2
11.5 2
9.5 2
3.5 4
2.0 1
1.0 1
0.7 7
0.5 2
0 2
4.0 1
4.0 3
4.0 1
0 15
0 6
2.5 2
1.0 1
0 2
0 3
0 2
0.5 18
0.2 5
0 2
0 3
0.3 12
1.3 3
0 1
0 3
0 1
0 1
0 14
0 1
4.0 1
0 2
0 19
0 1
1.0 1
0 1
0 3
0 8
0 1
Yellowfin 1983

Figure 21

errata (page 1): the statement "and occasionally northern bluefin T. tonggol (Bleeker, 1851) are made incidental to the main fisheries." should read "and occasionally northern bluefin T. thynnus (Linne, 1758) are made incidental to the main fisheries, the longtail tuna T. tonggol (Bleeker, 1851) may also be caught in northern waters."