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# Gemfish

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# GEMFISH

(*Rexea solandri*)

## INTRODUCTION

The gemfish fishery is relatively small, with a TAC set at 5750 t. Catches increased up until the introduction of the ITQ system, reaching a maximum of 8253 t in 1985-86. There has never been a specific research programme on gemfish, although some biomass data have been collected on mixed species research surveys.

## BIOLOGY

Information on the biology of gemfish was summarised by Hurst and Patchell (1985) and Holton (1987).

Little is known of the biology of New Zealand gemfish, but some data are available on the same species in Australian waters. The following is a summary of a literature review by Holton (1987).

Australian gemfish occur on the continental shelf and slope, from about 150 - 550m depth, similar to the distribution in New Zealand. They undertake spawning migrations, moving northward in about May and spawning in late winter/early spring (July - September), in slope waters of 330-500m depth.

Ageing of Australian gemfish has not been validated, but suggests that the fish are relatively fast growing, reaching 23-35cm, 35-45cm, and 45-55cm in the first 1, 2, and 3 years, respectively. Females appear to live longer and to grow to a larger size than males, reaching a maximum of about 16 years old, and 115cm long. Males appear to reach about 11 years old and 105cm long. Most fish mature between 60-65cm (about 4-5 years).

In New Zealand, gemfish appear to have a similar depth distribution, and to make northward migrations in autumn to winter/early spring spawning grounds. They are widely distributed around New Zealand on the continental shelf and slope down to 500m, although they are not common on the Sub-Antarctic shelf or around the Chatham Islands. Spawning areas are not well defined, but are thought to be on the west coast of the South Island and perhaps around the Bay of Plenty/North cape area.

## STOCK BOUNDARIES

Hurst (1987) described the seasonality of gemfish fisheries and suggested that there appeared to be at least 2 stocks (see also the seasonal data given below):

1. A larger southern/west coast stock, caught in the southern area in spring, summer and autumn, which presumably migrates to the west coast to spawn and is caught there mainly in August-September. The exact timing of the spawning is unknown, but data from surveys on the west coast by the W.J.Scott suggest it could begin in May/June.

2. A smaller northern/east coast stock, caught mainly on the east coast in spring and summer, which presumably migrates to the Bay of Plenty - North Cape area in May - June, also to spawn.

There are no data on the inter-relationship of these 'stocks' and therefore no new stock management areas were proposed. If the gemfish in Fishstock areas 1 and 2 are part of the same migrating stock then perhaps the two management areas could be combined. Similarly, for the southern and west coast management areas. However, it can be difficult to distinguish possible seasonal movements of fish from the seasonal movements of the vessels (e.g. most deepwater vessels tend to concentrate on hoki and orange roughy in June/July and would not be in Area F), and such analyses need to be treated with caution.

Therefore, it would be unwise to recommend area amalgamations at this time - any such recommendation should be based on more substantive evidence on the relationship of these fisheries, which could be obtained from tagging experiments, seasonal trawl surveys, genetic analyses etc. Also, the times and locations of spawning have not been well described and require verification.

In order to prevent over-exploitation of any one of these fisheries, the 4 separate management areas should be retained, i.e. Auckland, Central (east), South-East + Southland + Sub-Antarctic, and Challenger + Central (west) east coast.

FISHERY

1. Annual catch by nation (Table 1, Fig. 1)

Figure 1 gives annual catches of domestic vessels back to 1944 (from Holton 1987). Table 1 lists annual catches by all vessels from 1978. Although some gemfish would almost certainly have been caught, they were presumably not in significant enough quantities to have been recorded by species in the data summaries provided by foreign nations prior to 1978.

The domestic catch of gemfish appeared to increase steadily through the late 1960's, and then decline to less than 200 t in 1975. Holton (1987) suggests that most of this apparent increase is probably due to the combining of northern and southern (gemfish) kingfish catch records from 1966 -72. Gemfish catches increased during the late 1970's, but only exceeded 1000 t per annum from 1980. The peak domestic catch occurred in 1983-84, at almost 2000 t.

The deepwater (New Zealand chartered and foreign licensed) catch also increased during the 1980's, reaching a peak of 6557 t in 1985-86, the

year before the fishery came under quotas. Quota monitoring reports for 1986-87 suggest a catch in the order of 4455 t, which is less than the 5750 t TAC for that year.

2. Catch by area (Tables 2 & 3, Fig. 2 & 3)

Domestic catches from 1944-85, by port of landing (Holton (1987), show that the 1970 peak in domestic catches came mainly from landings at ports on the east coast of the North Island; Tauranga, Napier and Gisborne (Fig. 2), Again, Holton (1987) suggested that this apparent increase was due to the confusion of northern and southern kingfish in the catch records.

Domestic catch by domestic fishery areas is given in Fig. 3. for the 3 fishing years from 1983-84 to 1985-86 (1986-87 data are not available). There is considerable variation between years in some areas but no consistent trends for all areas.

Deepwater catches by EEZ area from 1978-79 to 1985-86 are given in Table 2. New Zealand chartered vessels catch the majority of their gemfish in areas F and G and these are by far the largest gemfish fisheries in recent years.

Catches for all vessels have been combined by gemfish fishstock area, from 1983-84 to 1986-87, in Table 3. This has been done by combining domestic and deepwater data described above as follows:

| Gemfish Fishstock | Domestic areas | EEZ areas |
|---|---|---|
| 1 | 1 - 10, 42 - 48 | N.A. |
| 2 | 11 - 16 | N.A. |
| 3 | 18 - 32, 49 - 52 | C,D,E & F |
| 7 | 17, 33 - 41 | G & H |

The data from 1983-84 to 1985-86 are only estimates, as some of the catches are not recorded by area. Therefore the totals in Table 3 will not add up to the annual totals in Table 1. 1986-87 data are from the Quota Monitoring System and represent the first year of fishing under quotas for this species. They should be used as a guide to the total as not all of the licensed catch may have been included. The corresponding area TAC's are also given in Table 3. All area catches for 1986-87 appear to be below the TAC's except in area 2, where the TAC was exceeded by 4%.

Prior to the introduction of the ITQ system, the catch levels exceeded the recommended TAC's in quite a few areas. Of particular note were large increases in areas 1 and 3 in 1985-86, the last year of uncontrolled fishing. (N.B. some of the area 3 catch may have been misreported barracouta).

3. Catch by area by month (Figs. 4 - 6).

Hurst (1988) gave a summary of the seasonal patterns of gemfish fisheries, by major fishery area. The following description presents more detail of these seasonal patterns.

To enable domestic and deepwater catch data to be added together, both sets of data have been presented by EEZ area. Domestic data for the North Island has also been given by QMA areas 1 and 2 (because these two domestic fisheries are managed separately).

The domestic fisheries (Fig. 4) in QMA areas 1 and 2 show almost the reverse seasonal pattern of each other. Area 1 shows distinct seasonal peaks in gemfish catch in May - June in all three years. There is also a correspondingly distinct decline in catch from May to at least September in area 2 catches. These data suggest that fish from area 2 migrate to area 1 for a short spawning season and then return to area 2 for the more extensive non-spawning fishery.

Like the domestic catch in area 2, the pattern in QMA area 3 (EEZ area C only, domestic catch in D,E & F is insignificant) appears to be of an extended season through spring, summer and autumn, with a decline in winter. The overall reported catch has declined significantly from 1983-84 to 1985-86.

The domestic catch in QMA area 7 (EEZ area G only, as the area H catch is part of the area 1 fishery) is relatively small, but shows peaks in August and January - March.

Deepwater catches by area and month are given in Fig 5, back to 1978-79, with the exception of 1980-81 data which are not available. The catches in areas C, D and E were insignificant and the monthly data are not included here.

The seasonal pattern of catch in areas E(A), F(E) & F(W) is confused by the changing of the area E(A) - F boundary in 1983. However, most of the E(A) catch prior to the change came from the new area F and therefore the area F(E) & F(W) are probably the best data to use to determine seasonal trends. In area F(E), peaks in catches have occurred from October through to May, with the season having become more extended in the last two fishing years. There is always a consistent fall in catches from July - September. In area F(W), a similar pattern can be observed, although the October -November peak is larger than in area F(E).

In area G the season is much more pronounced than for the domestic catch, being almost exclusively August -September since 1979-80. These fish are possibly spawning in this area at this time.

By combining the domestic and deepwater monthly data in areas where there is a significant level of catch (i.e. excluding areas D & E), results in few changes to the patterns described above. The major effect is for the deepwater catch to swamp most of the seasonal pattern of the

domestic catch, so that in area G, for example, the early spring peak is more pronounced than for the domestic data alone.

4. C.P.U.E.

Analysis of domestic C.P.U.E. is not feasible, as it requires details of the target species on a tow by tow basis, neither of which are recorded in the domestic statistics.

Analysis of deepwater C.P.U.E. was not appropriate before 1983 as the total catch was comparatively small, and to a large extent probably bycatch of other fisheries. With the adaptation of the new masterfiles to allow existing extract programmes to be run, it should be possible, in the near future, to analyse some C.P.U.E. data.

5. Recreational fishery.

The amount caught by amateurs is unknown, but is probably insignificant compared with commercial catches.

BIOMASS AND YIELD ESTIMATES

There are no new data on stock size estimation and no age data which would enable us to revise the productivity value (15%) which has been used to derive yields from trawl survey data. For a review of the existing biomass data for gemfish, see Hurst (1987). The review of yield estimates in this paper is based on the new approach of estimating MCY.

TAC's were originally based on 1983 catch levels (adjusted to the 1984 level for Fishstock 1), which were the highest reported levels of catch by area at that time. The Fishstock 3 TAC was increased above the 1983 catch level based on the highest relevant biomass estimate.

Estimation of MCY for 1988-89 has been done by two methods: firstly, by averaging of an annual catch history = cY, where c = 1.0 (N.B. catches have fluctuated but effort has probably been variable, possibly increasing in areas 1 and 3 and decreasing in area 2) and the years = 1983-84 to 1985-86 (1986-87 data were not used as the newly introduced TAC's appeared to impose a limit on catches), and secondly, by averaging recruited biomass estimates, where the biomass is the average of the wingtip and doorspread estimates and MCY = 0.5MB (B is assumed to be less than virgin biomass). Natural mortality is assumed to be 0.3 (Australian data suggests values of 0.4 and 0.6 for females and males respectively, but age data were not validated).

FISHSTOCK 1. Auckland

MCY = 1.0 x Y = 565t.
This is the average of catches for the fishing years 1983-84 to 1985-86, and assumes that the effort has been relatively constant over this time.

FISHSTOCK 2. Central - Central-East

MCY = 1.0 x Y = 465t.
This is the average of catches for the fishing years 1983-84 to 1985-86. The amount of effort may have decreased over the time period used, and the average is less than the longer term average for the area, (estimated at about 550t for the years 1980 to 1985 for Napier + Gisborne + Wellington landings). However, it may not be appropriate to use different years for the catch history than used for area 1, as there is some evidence that the two fisheries are related.

Note: The industry calculated a biomass of 1500t, which is a an average biomass estimate calculated from three years commercial catch data on target fishery areas. Before the suitability of these data can be assessed FRC requires more detail on how the data were analysed and the raw data. The c.v.'s of the individual estimates were high (ranging from 45 to 166%) and thus the estimates are probably unsuitable for estimating MCY. Also, assuming that Fishstocks 1 and 2 are inter-related, any such estimate would need to apply to both areas.

FISHSTOCK 3. South-East, Southland, and Sub-Antarctic.

MCY = 0.5MB = 1590t.
This is the average (1590t) of the yields of 5 trawl survey biomass estimates from the Stewart/Snares shelf (omitting the low Oct-Nov 1983 estimate which did not survey the western side of the shelf), plus the average (36t) of the 2 complete Chatham Rise surveys, plus the average (70t) of 9 Canterbury Bight surveys. This includes most but not all of the gemfish distribution area in Fishstock 3. The suggested yield takes no account of possible seasonal migrations of fish out of the area.

The use of commercial catch history data to estimate MCY was not valid as the effort and catch increased significantly after the introduction of the deepwater policy in 1983 and before the introduction of ITQ's, reaching a maximum a 5446t in 1985-86.

FISHSTOCK 7. Challenger and Central - Central-West

MCY = 1.0 x Y = 1570t
This is the average of the catch of fishing years 1983-84 to 1985-86 and assumes relatively constant effort during this time.

MCY = 0.5MB = 1300t
This is the average of 2 years continuous surveys by the W.J Scott in the northern part of area C, which is the main gemfish fishery area. It does not include the entire gemfish distribution in this Fishstock area. Other biomass data either overlap this survey area and/or did not sample deep enough.

REFERENCES

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Hurst R.J. & Patchell, G.J. 1985: Gemfish. In TAC background papers for 1985 pp. 79-81.

Holton, A.L. 1987: Project proposal and literature review of the biology of gemfish and history of the New Zealand fishery. (Unpub. FMD report.)

Table 1. Reported annual catch (t) of gemfish, by nation, from 1978-79.

| Year* | New Zealand | | Foreign licensed | | | | Total |
|---|---|---|---|---|---|---|---|
| | Domestic | Chartered | Japan | Korea | USSR | Total | |
| 1978-79 | 352 | 53 | 1509 | 1079 | 0 | 2588 | 2993 |
| 1979-80 | 423 | 1174 | 1036 | 78 | 60 | 1174 | 2771 |
| 1980-81 | 1050 | ? | ? | ? | ? | ? | 1050+ |
| 1981-82 | 1223 | 1845 | 391 | 16 | 0 | 407 | 3475 |
| 1982-83 | 822 | 1368 | 274 | 567 | 0 | 841 | 3031 |
| 1983-83 | 1617 | 1799 | 57 | 37 | 0 | 94 | 3510 |
| 1983-84 | 1982 | 3532 | 819 | 305 | 0 | 1124 | 6638 |
| 1984-85 | 1360 | 2993 | 470 | 223 | 0 | 693 | 5046 |
| 1985-86 | 1696 | 4056 | 2059 | 442 | 0 | 2501 | 8253 |
| 1986-87^ | ? | ? | ? | ? | ? | ? | 4455 |

* Fishing years are: 1978-79 to 1982-83 (1 April to 31 March); 1983-83 (changeover = 1 April to 30 September); 1983-84 (1 October - 30 September)

^ Data for 1986-87 are from the Quota Monitoring Reports and provide only an indication of total catch.

? Data not available.

Table 2. Gemfish catch (t) by deepwater vessels (N.Z. chartered and foreign licensed), by EEZ area, 1978-1986.

| Fishing Year* | EEZ AREA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | C | D | EA | E-E(A) | FE | FW | G | H | TOTAL |
| 1978-79 | 87 | 638 | 0 | 342 | 0 | 263 | 65 | 1093 | 154 | 2642 |
| 1979-80 | 84 | 369 | 29 | 944 | 18 | 352 | 214 | 303 | 34 | 2347 |
| 1980-81 | 0 | ? | ? | ? | ? | ? | ? | ? | ? | ? |
| 1981-82 | 0 | 112 | 6 | 321 | 0 | 223 | 361 | 1063 | 167 | 2252 |
| 1982-83 | 0 | 13 | 3 | 883 | 0 | 135 | 310 | 458 | 408 | 2209 |
| 1983-83 | 0 | 92 | 2 | 44 | 0 | 100 | 16 | 1125 | 11 | 1391 |
| 1983-84 | 0 | 59 | 2 | 298 | 0 | 582 | 2234 | 1395 | 86 | 4657 |
| 1984-85 | 0 | 29 | 1 | 262 | 3 | 758 | 1204 | 1317 | 37 | 3686^ |
| 1985-86 | 0 | 293 | 7 | 403 | 32 | 2213 | 2315 | 1268 | 28 | 6558 |

* Fishing years as in Table 1.

? Data not available

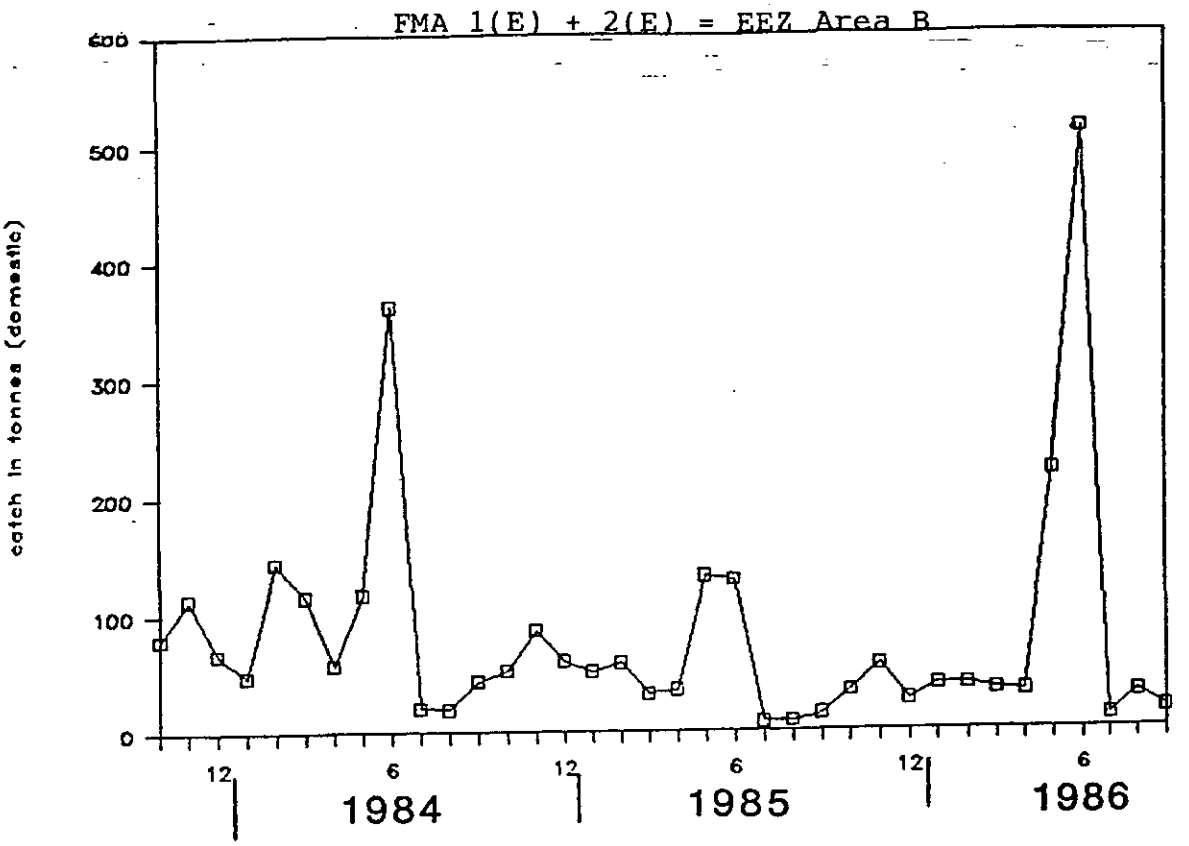
^ 75t undefined by area

Table 3. Estimated domestic and deepwater catch of gemfish, by gemfish fishstock area, for the fishing years 1983-84 to 1986-87.

| Fishstock code | Catch (t)* 1983-84 | 1984-85 | 1985-86 | 1986-87 | TAC 1986-87 |
|---|---|---|---|---|---|
| 1 | 588 | 388 | 716 | 449 | 550 |
| 2 | 632 | 381 | 381 | 892 | 860 |
| 3 | 3481 | 2533 | 5446 | 2045 | 2840 |
| 7 | 1741 | 1491 | 1468 | 1069 | 1490 |

* Data for 1984-84 to 1985-86 are from the FSU, data for 1986-87 are from the quota monitoring reports and may not include all catches, particularly those of the foreign licensed fleet.

Figure 3A. Gemfish domestic catch by FMA and EEZ areas.



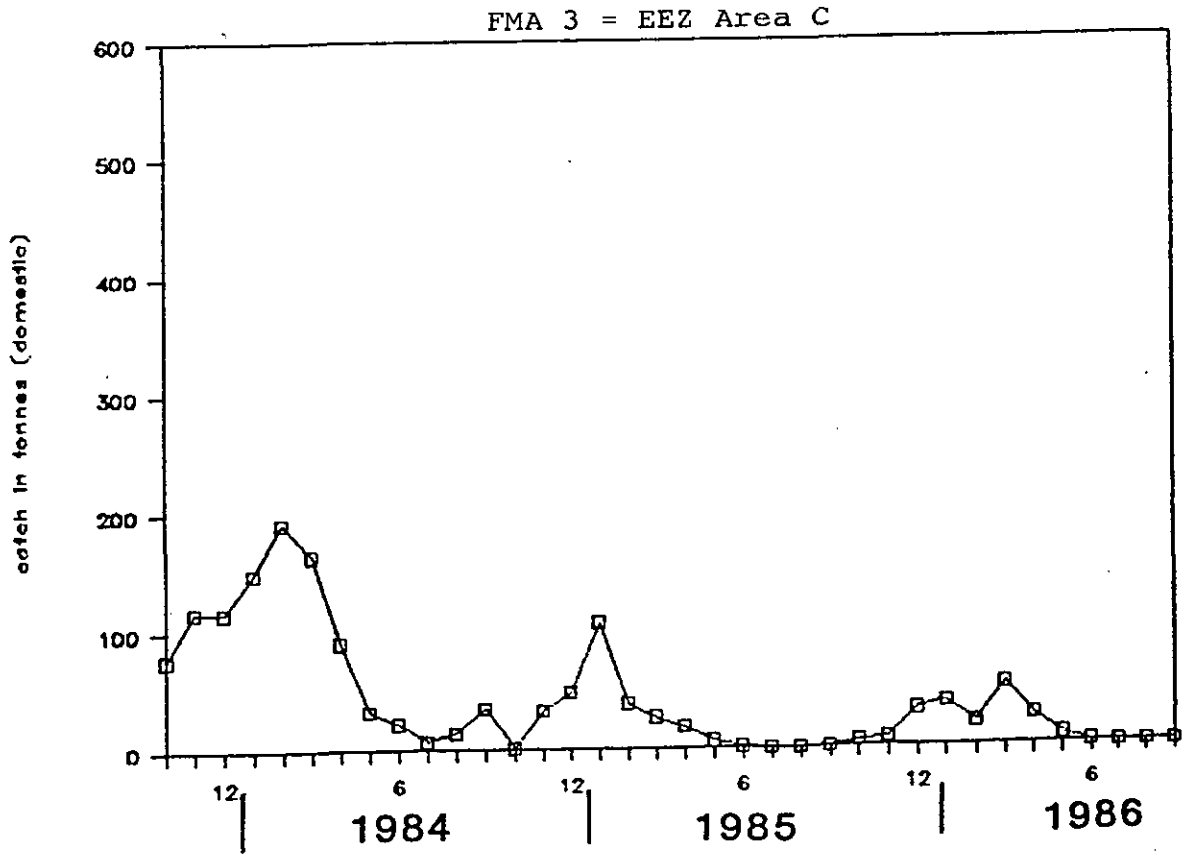
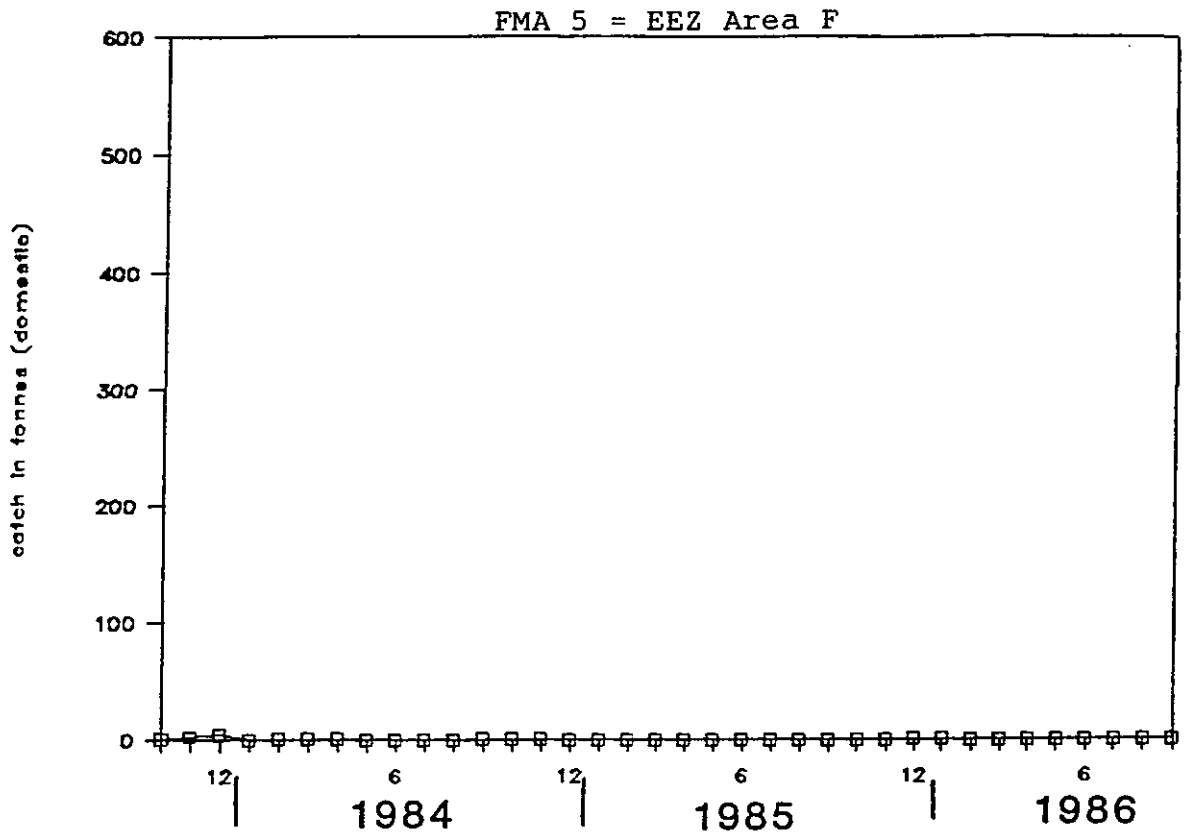



Figure 3A (ctd). Domestic catch



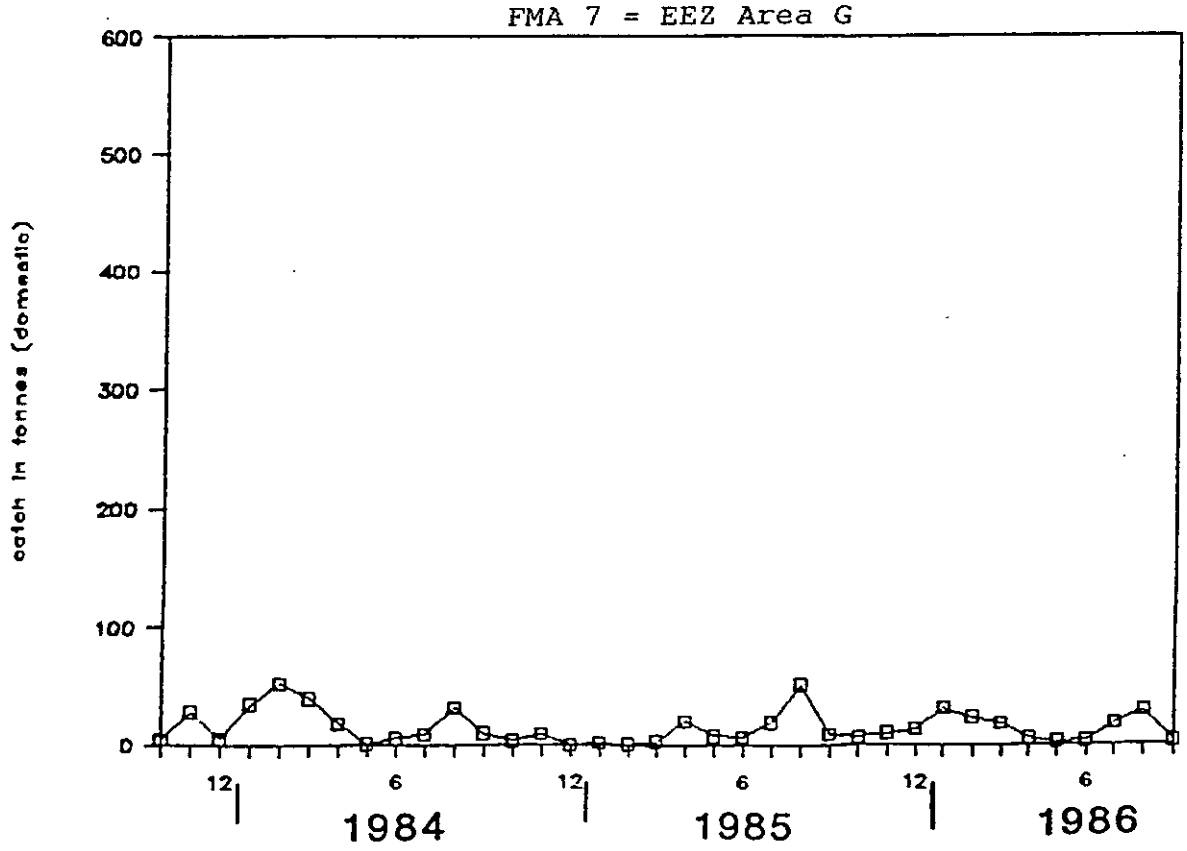



Figure 3A (ctd). Domestic Catch

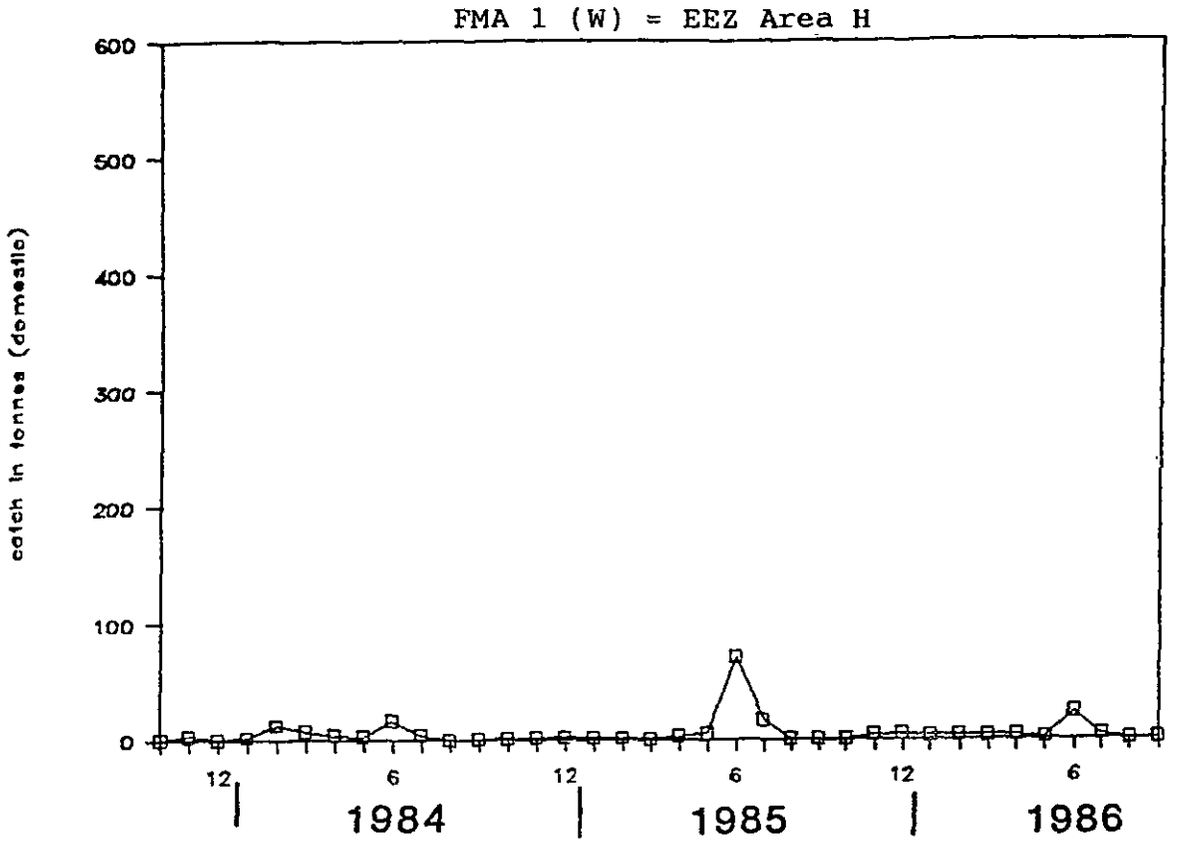
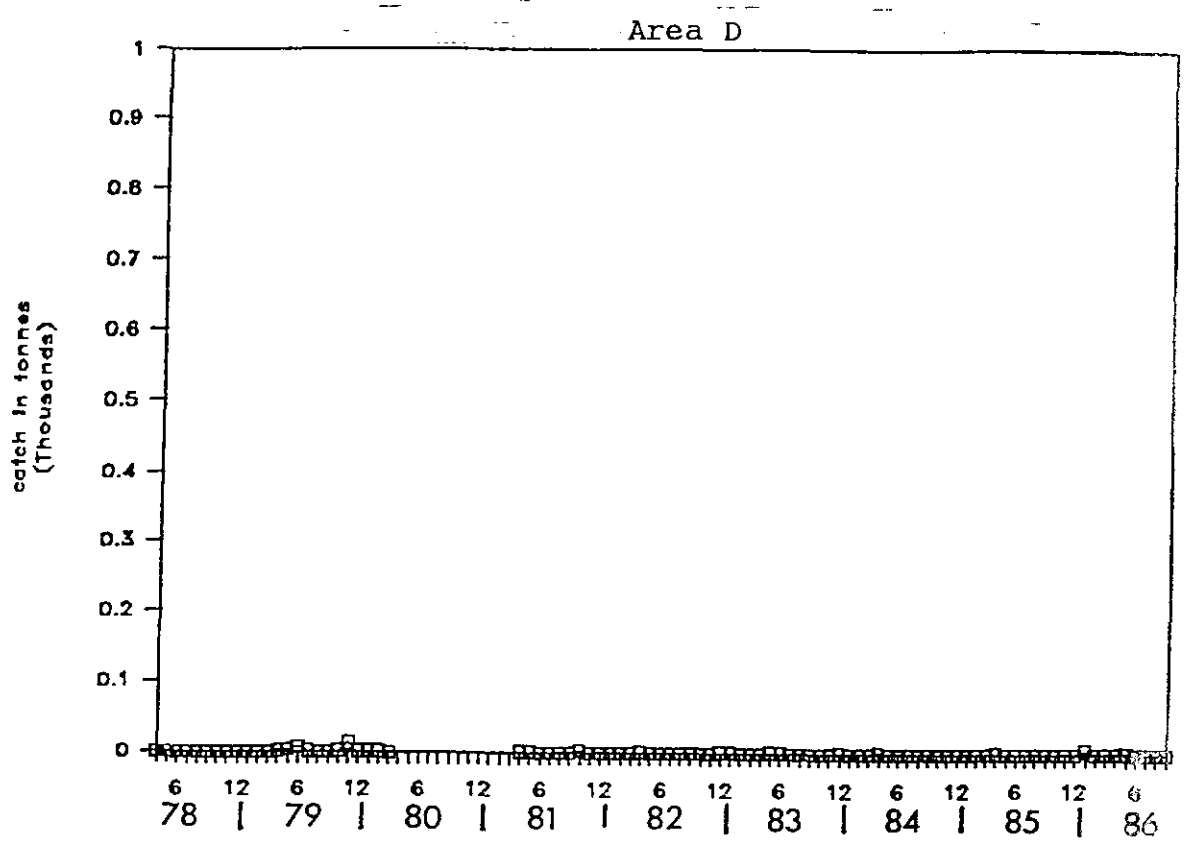


Figure 3B. Gemfish deepwater catch by EEZ area.



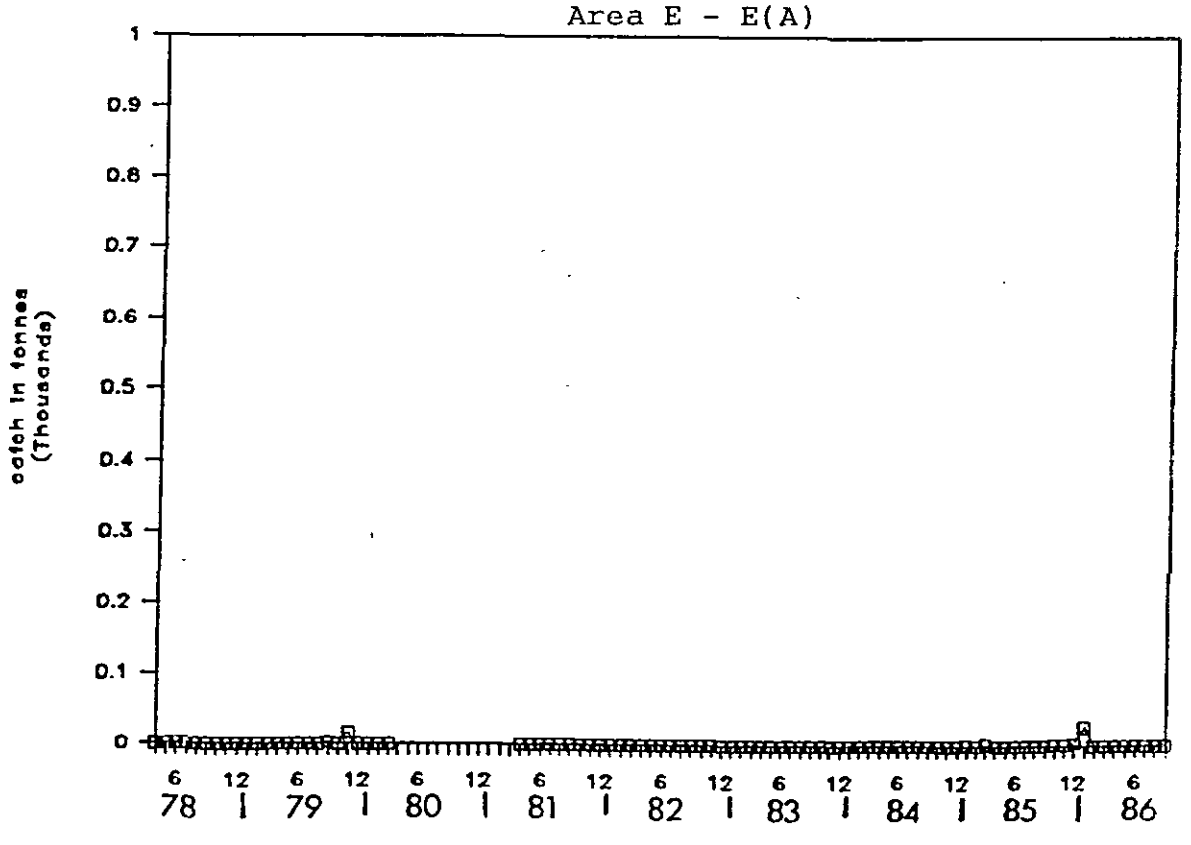
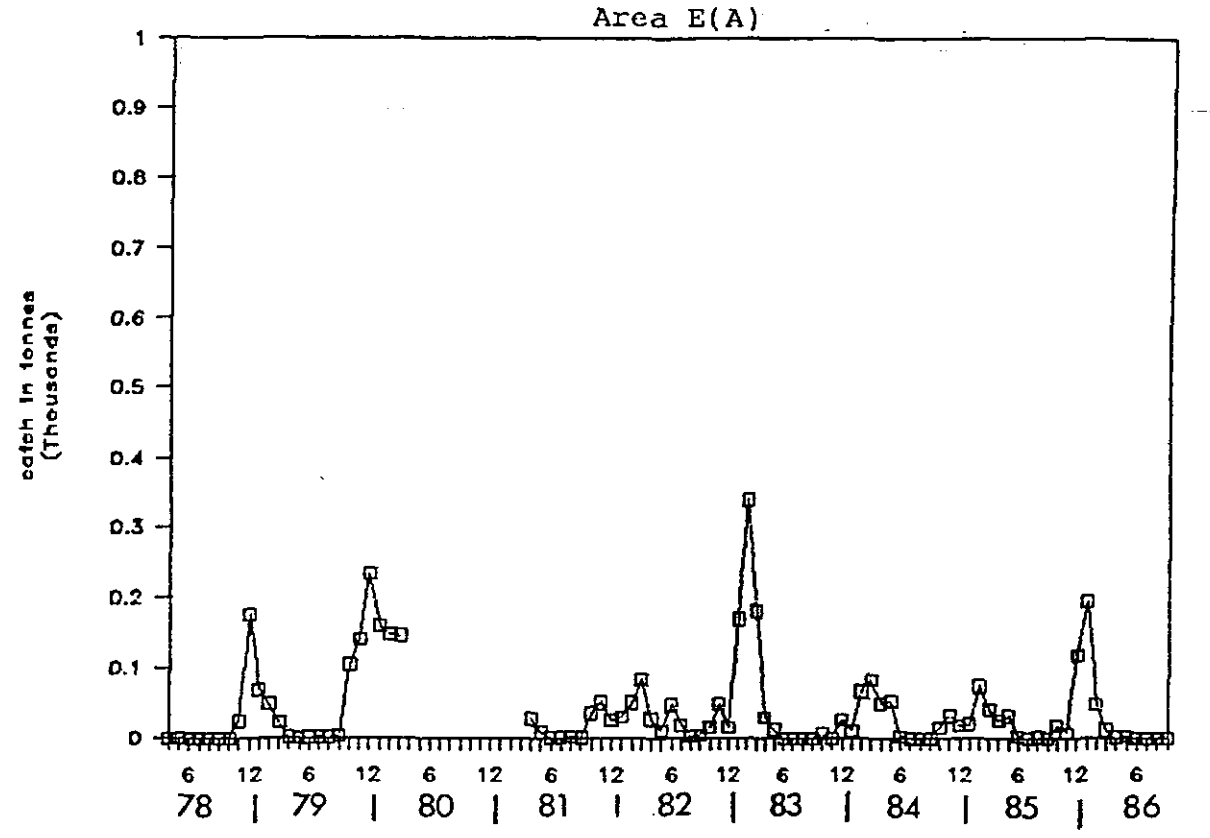



Figure 3B (ctd). Deepwater Catch



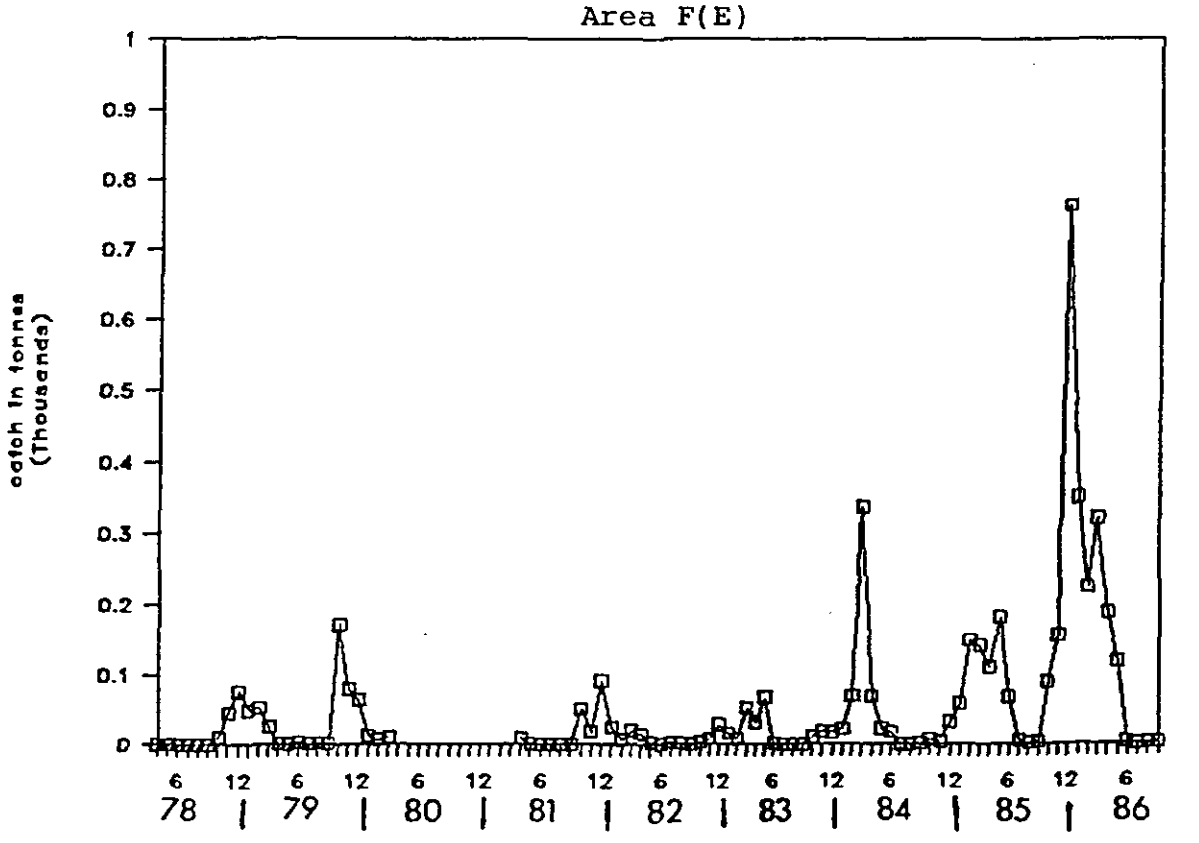
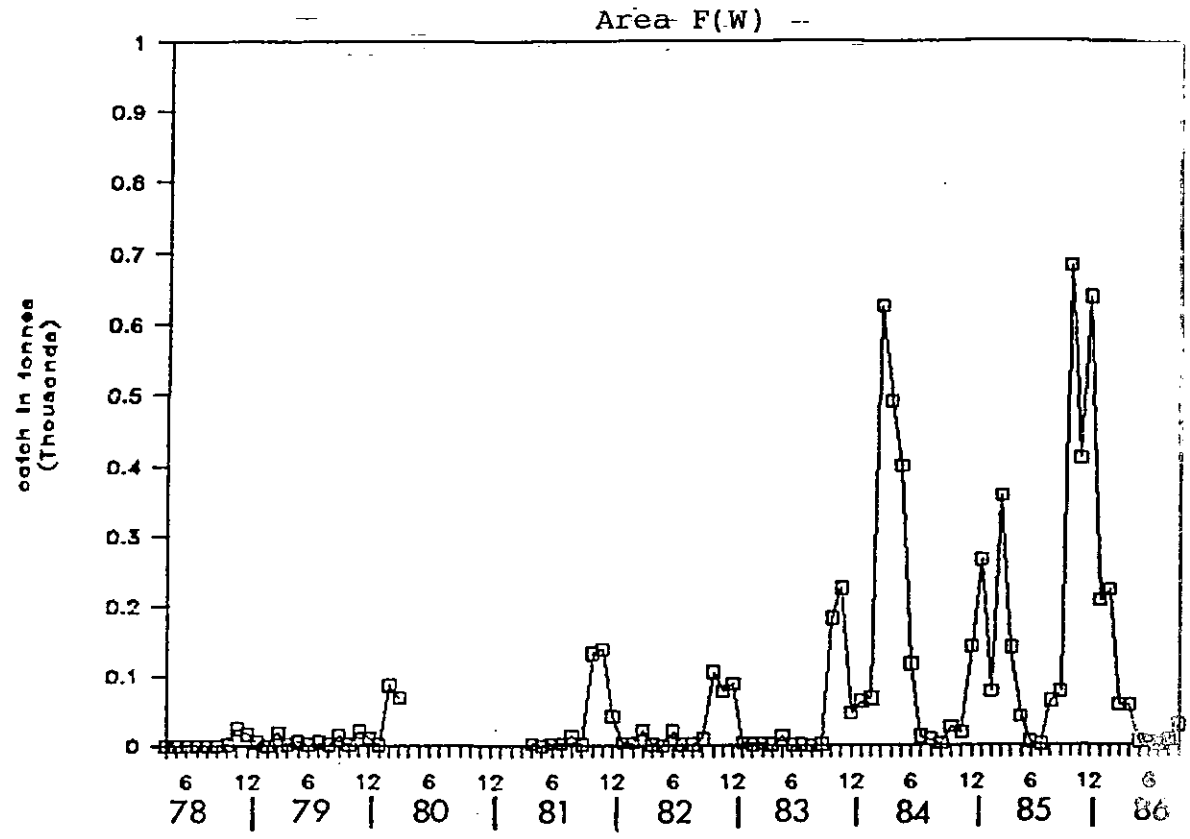



Figure 3B (ctd). Deepwater Catch



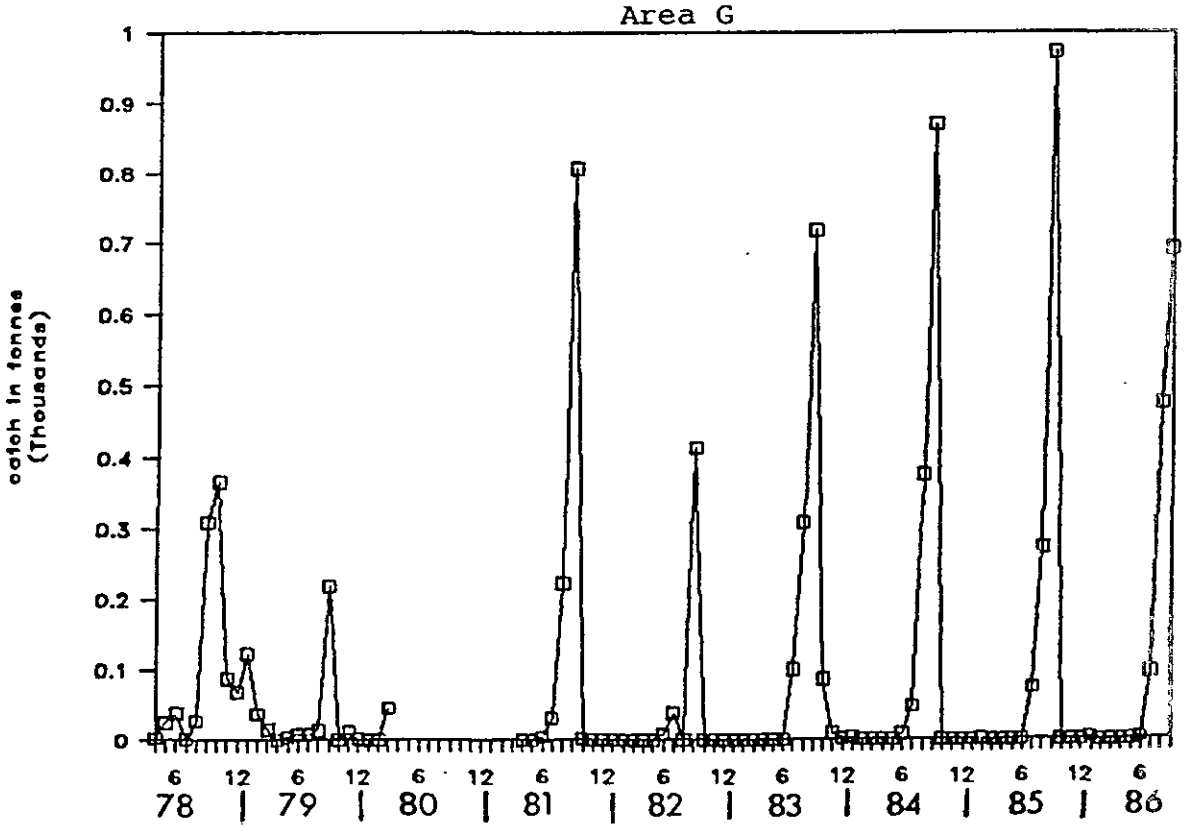



Figure 3B (Ctd). Deepwater Catch

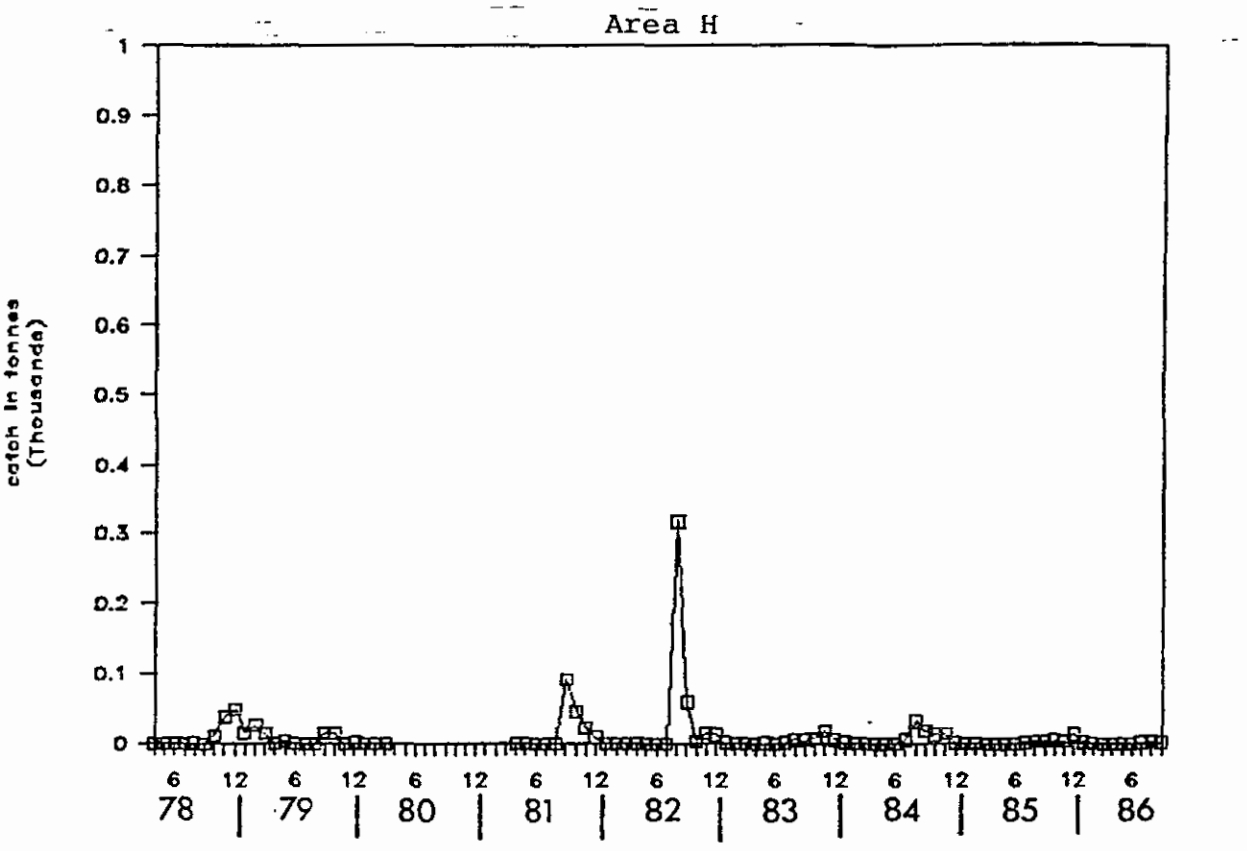
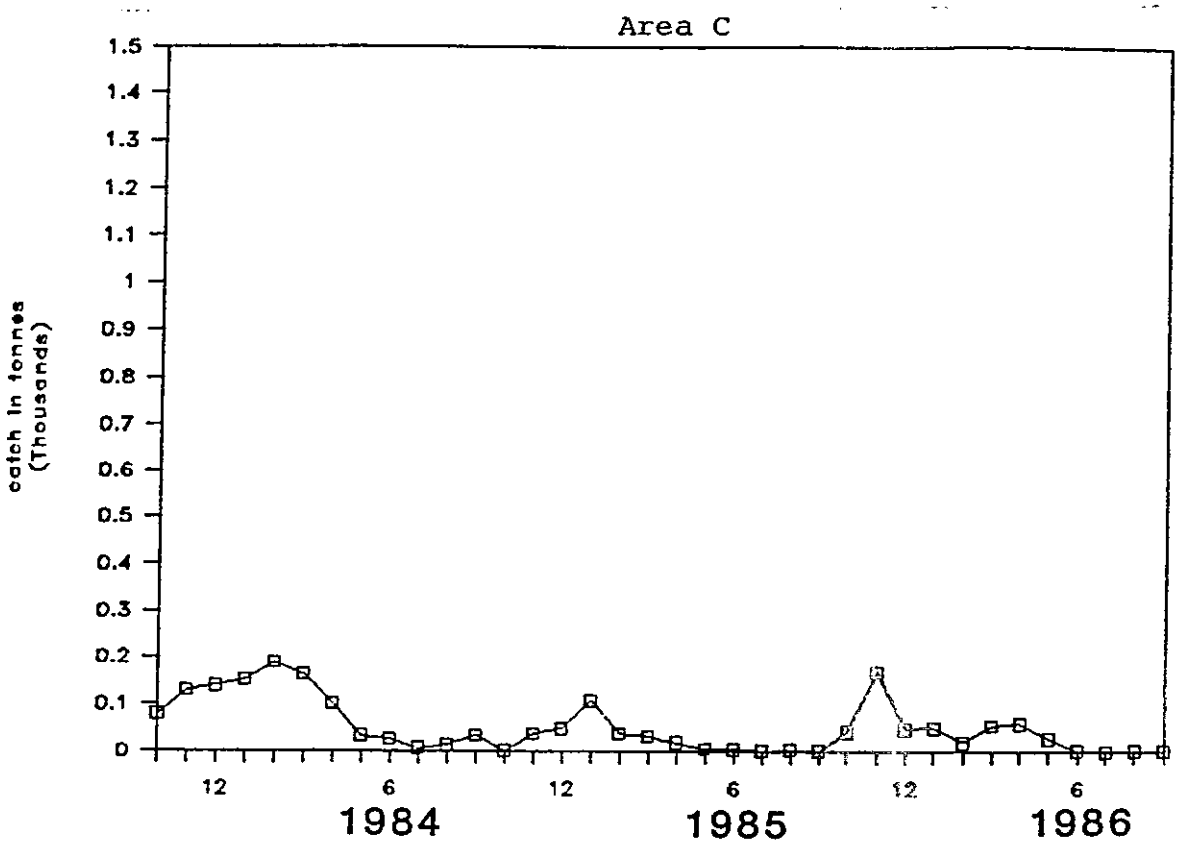


Figure 3C. Gemfish total catch by EEZ Area.



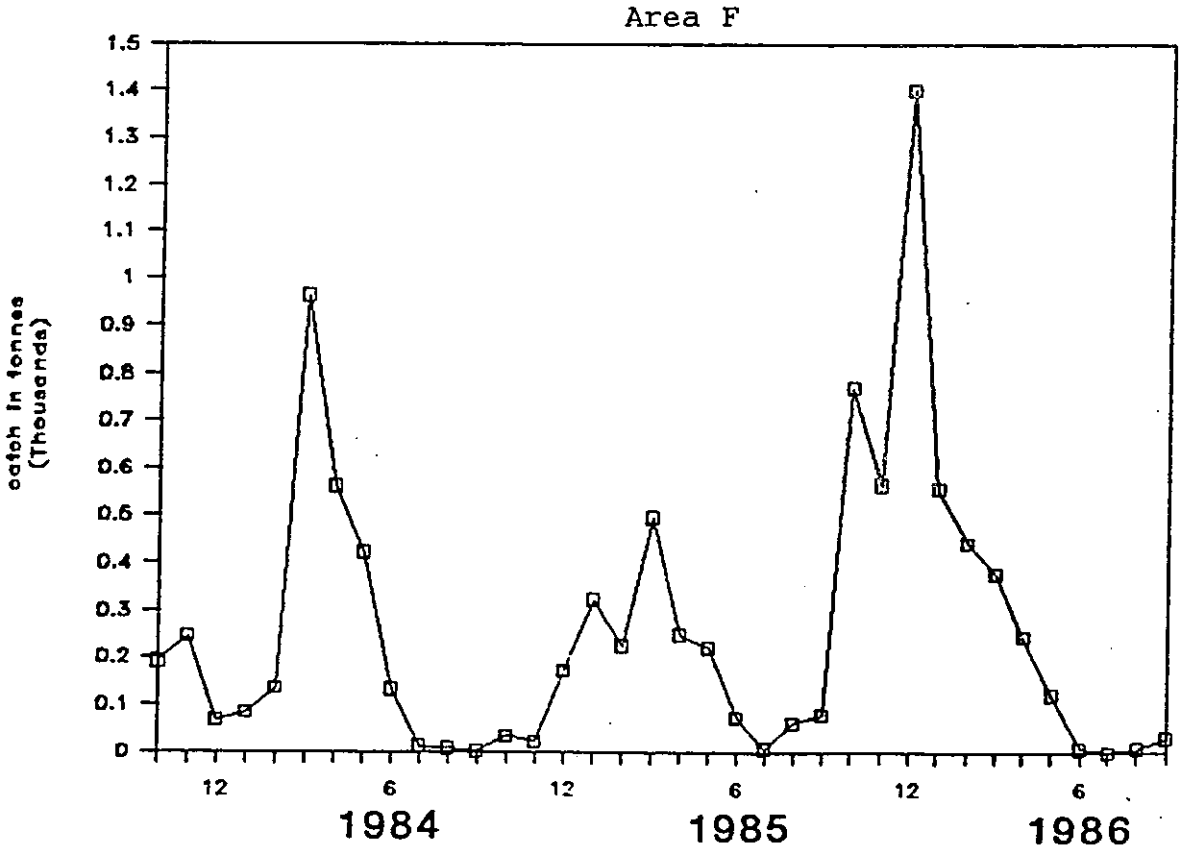



Figure 3C (ctd). Total catch.