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An Assessment of the Grand Bank Yellowtail Flounder Stock in NAFO Divisions 3LNO

by

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TAC regulation

The stock has been under TAC regulation since 1973, when a precautionary level of 50,000 t was established. In 1976, the TAC was set at 9000 t, following a series of high catches (Fig.1; Table 1) and a reduction in stock size. From 1977 to 1988, the TAC varied between 12,000 t and 23,000 t and was unchanged at 15,000 t for the last 4 years of that period. The TAC was set at 5000 t in 1989 and maintained at that level for 1990, following sharp declines in stock size after the large catches in 1985 and 1986. For 1991-1993, the TAC of 7000 t was set because there appeared to be a slight improvement in recruitment to the fishable stock. In 1994, the TAC of 7000 t was maintained, but the NAFO Fisheries Commission decided that no directed fisheries would be permitted for this stock and the 2 other flatfish fisheries on the Grand Bank (American plaice and witch flounder). Since 1995, the TAC has been set at zero and a fishery moratorium is presently in place.

Catch trends

The nominal catch increased from negligible levels in the early 1960's to a peak of over 39,000 t in 1972 (Fig. 1). With the exception of 1985 and 1986, when the catch was around 30,000 t, catches have been in the range of 10,000 to 18,000 t from 1976-93. Canada and the USSR were the major participants in the fishery up to 1975, with Canada taking virtually all the catch from 1976-81 (Table 1). Canadian catches were consistently around the TAC in the mid to late 1970's, but were under the TAC's in the early 1980's as much of the fishery for flounders was directed toward American plaice in Div. 3L. Catches by other nations began to increase in 1982 as freezer trawlers started to fish in the NAFO Regulatory Area on the Tail of the Bank (Tables 1&2) (see also Walsh et al 1995a). In 1985 and 1986, as well as in the period of 1989-1994, catches for all other nations combined exceeded those of Canada. Canadian catches were stable around 6700 t from 1991-93, but declined to "0" in 1994. USA catches declined steadily from 3,800 t in 1985 to zero in 1991 and 1992 (Table 2) and increased to 700 t from 1993-94.

Catches by Spain and Portugal have also decreased to relatively low levels during the period of 1992-96. South Korea, which has been involved in this fishery since 1982, and caught between 3500 and 5900 t per year from 1989 to 1992, has had no vessels in this fishery since early 1993. It should be noted that the catches for S. Korea in many years include a substantial amount of yellowtail flounder determined from breakdowns of catches reported as unspecified flounder.

Overall, the catches from this stock exceeded the TAC in each year from 1985-93, often by a factor of two (Fig. 1). However, there is still considerable doubt about the precise catch levels from this stock in the recent years before the moratorium, with up to one-third of the catch in some years (almost two-thirds in 1994) being determined from Canadian surveillance reports and estimates of the proportion of yellowtail flounder in catches of unspecified flounder by S. Korea (Brodie et al. 1994). Since the moratorium, the nominal catch of yellowtail flounder in 1995 was 67 t, of which EU-Spain took 65 t in the Regulatory Area, and in 1996, the catch was 287 tons of which EU-Spain took 232 t in the Regulatory Area, mainly Div 3N, (Tables 1 and 2). In 1996, Canada reported a catch of 55 t in a cooperative Department of Fisheries and Oceans (DFO) and fishing industry exploratory survey. In the 1996 the Statlant 21A statistics, EU-Spain reported a catch of 27 t on the Flemish Cap, NAFO Div 3M. STACFIS noted that this catch was probably an error in reporting or identification since the yellowtail flounder distribution doesn't extend to the Flemish Cap.

Commercial fishery data

There were no available length frequencies, age samples or catch data from the 1995 or 1996 by-catch fisheries. Noteworthy is that the catch rate analysis of Canadian data from 1965 to 1993, presented in 1994 showed that the CPUE in 1991 was the lowest in the series (Brodie et al 1994). Although there was a slight increase in the 2 subsequent years, the values in 1992 and 93 were the second and third lowest CPUE values in the time series. Catch rate analysis of data from the 1996-97 cooperative DFO/fishing industry surveys in Div. 3NO showed that catch rates were higher in the spring and summers surveys relative to the spring-summer Canadian CPUEs in the fisheries of the mid-1980s while the winter survey catch rates were much lower than the winter catch rates in the fishery (see Brodie et al 1997).

Canadian research vessel surveys

Canadian survey gears (see Table 3): From 1971 to 1982 the surveys of the Grand Bank were conducted by the FRV *A. T. Cameron* (ATC) using a two bridle Yankee 41.5 otter trawl rigged with rubber disk footgear. In 1983, this trawl was replaced by the three bridle Engel 145 Hi-Lift otter trawl rigged with large steel bobbin footgear and the *A.T. Cameron* was replaced by the *FRV Wilfred Templeman* (WT). Occasionally the *W. Templeman's* sister ship, the *FRV Alfred Needler* (AN) takes part in the surveys. In 1995, the old standard Engel trawl was replaced by a three bridle Campelen 1800 shrimp trawl rigged with rockhopper footgear (see Figs. 3-5; Table 3). The Yankee and the Engel trawls were both towed at 3.5 kt and the Campelen is towed at 3.0 kts (see McCallum and Walsh 1996 for details). Campelen trawl surveys of the Grand Bank began in the fall of 1995 aboard the W. Templeman. The Campelen trawl also replaced the Yankee 41 shrimp trawl used in the fall juvenile groundfish surveys from 1986-94. To date comparative fishing between the Campelen and the Yankee shrimp trawl have not been completed.

A) Spring groundfish surveys

Yankee and Engel otter trawl series, 1971-95

Annual stratified-random trawl surveys have been conducted by Canada in Div. 3LNO since 1971 with the exception of 1983 when the survey was cancelled due to vessel problems Stratification is based on depth and the survey strata out to the 731m contour are presented in Fig. 2. Strata deeper than 731 m were fished for the first time in this time series in 1994, however, mechanical problems with the survey vessel did not permit these strata to be fished in 1995. However, in virtually all years, few yellowtail flounder were ever caught deeper than 100 m on the Grand Bank.

Tables 4 to 6 give the survey catch rates in the form of stratified mean weight per tow by stratum and Tables 7-9 show biomass per stratum, along with confidence limits, in Div. 3L, 3N, and 3O respectively for the time period 1971 to 1995 (see also Figs. 6 & 7).

Biomass trends: Div. 3L, the biomass index has declined steadily from about 15,000 t in 1984-85 to less than 300 t in 1992-94 and to A 0" t in 1995 (Table 7;Fig. 6). The majority of the biomass occurs in depth strata in the range of 56-91 m. Div. 3N , most of the biomass for this stock occured in this division and was located mainly in depth strata in and around the Southeast Shoal, in a depth range of 42 m to 91 m. The biomass index has declined from 65,000 t in 1986 to around 30,000 tons between 1992 and 1995 (Table 8; Fig. 6). The survey estimate from the 1995 survey showed a 17% increase to 36,000 t. Analysis of the 1995 data showed that approximately 49% of the biomass estimate in Div. 3N came from stratum 361, the area west of the Southeast Shoal. Div. 3O, the biomass index fluctuated widely from 1992-95, after a period of relative stability from 1988 to 1991 at around 15,000 t (Table 9; Fig 6). The survey estimate from the 1995 survey was 8,000 t . Of concern are the estimates for 1992, 1994 and 1995 of less than 8,500 t, which are the lowest in the time series (Table 9). Div. 3LNO, Figure 7 shows the cumulative biomass of the 3LNO stock for the time period 1971 to 1995. Although the overall stock has been steadily declining since the 1984, especially in Div 3L and to a lesser extent in Div. 3O, it has remained fairly stable in Div. 3N in recent years. The overall stock size in the mid-1980's averaged around 100,000 t and since that period there has been a 45% reduction to an average level of 45,000 t for the period 1990-95.

Abundance trends: Figs. 8-10 show the abundance trends by Division up to 1995, with approximate 95% confidence intervals. There has been a continuous decline in Div. 3L to A0" abundance. Abundance in Div. 3N was stable from 1992 tp 1994 and showed an increase in 1995. The high degree of variability around the 1993 estimate in Div. 3O was generated by the high catch rates in stratum 352, however there was an increase in abundance from 1994 to 1995. The spring survey abundance at age index for all three divisions combined is presented in Table 13, and total abundance of the mature stock, at ages 5+ and ages 7+, are shown in Fig. 11.

Age composition: The spring surveys are usually dominated by yellowtail flounder of ages 5-8 years, but in recent years it is dominated by ages 6 - 7 (Table 10). Abundance of ages 1+ in 1995 was the third lowest in the time series at 97 million fish, up from the 1994 estimate of 81 million fish, the lowest in the time series (Table 10). In 1995 the survey abundance was dominated by the 1988 and 1989 year classes. All year-class strengths observed from surveys in the most recent period are considerably lower than those observed during the 1970's and early 1980's. Some caution must also be used in interpreting the population sizes at ages 6 and 7 in 1993, as about 50% of the totals at these ages came from Div. 3O, where the 1993 estimate of abundance was shown to have a very wide confidence interval (Fig. 10). Nevertheless, the recruitment index as measured as population numbers at age 4 has shown a steady decline from the high 1989 value (1985 cohort) to the low 1994-1995 estimates which are 5th and 6th lowest in the 20 year time series. Ages 5 and 6 estimates are average at best when compared with the whole time series.

Table 11 shows the proportion of biomass for individual cohorts which is estimated by applying average weight at age against population numbers at age for the period 1990-95 from indivdual fish weights taken at sea. There is close agreement in many cases between the estimated biomass and the derived biomass estimated from the swept area model. Most of the biomass is contributed by ages 7 and 8. Table 10 and Fig. 11 shows that the abundance of the 7+ age group has declined steadily during the 1980's but appears to have stablized somewhat since 1991.

Campelen shrimp trawl spring series, 1996-97

Beginning in the spring of 1996, the survey coverage of Divs. 3L, 3N and 3O was completed using the Campelen 1800 shrimp trawl. Although comparative fishing experiments between the Engel 145 otter trawl and the Campelen shrimp trawl were completed in 1996, conversion factors needed to convert the Engel equivalent indices, from 1971-95 to the Campelen indices have not been derived (see Warren et al. 1997). ***Therefore, it must be noted that all estimates of the Campelen trawl can not be directly compared with the Engel time series.***

Tables 12 to 14 present the biomass indices by stratum, with associated confidence limits for each division in the spring of 1996 (see also Figs. 6 and 7). Indices of abundance are presented in Table 10 and Figs. 8-11.

Div 3L, both the biomass and abundance for the portion of the stock is low even when compared to the unconverted indices in Figs. 6 and 8. Div 3N, the 1996 survey with the Campelen trawl yielded a biomass of 102,800 t with most of the biomass occuring in strata 376, 360 and 361 which are located in and around the Southeast Shoal (see Table 13 and Fig. 6). The preliminary 1997 spring survey biomass estimate puts the stock at around 123,000 tons and the stock is appears more widespread than in 1996 being found mainly on the Southeast Shoal and the area west of the shoal in stratum 360 in the Regulatory Area, and west and north in strata 361 and 362 (Table 13). Div. 3O, in 1996, the Campelen trawl survey estimated a trawlable biomass of 70,500 t of which 66% was found in stratum 352, inside the Regulatory Area (Table 14 and Fig.6). In the the preliminary estimates for 1997 the proportion of the stock estimated in this division showed an 18% decrease from 1996. Some of this differences in biomass between 1996 and 1997 in both Div 3N and 3O may simply reflect movement since the overall cumulative biomass estimate for Div. 3NO differs only slightly between spring 1996 (173.6 t) and spring 1997 (181.0t) (see Fig 7).

Abundance estimates for the 1996 catch for both Div. 3N and 3O are shown in Figs. 9 and 10. Although the are not directly comparable to the unconverted Engel trawl indices from 1984-95, one thing is noteworthy is that when the conversion is applied to Div. 3L Engel data the 1996 abundance estimate is will still be well below long term average.

Age composition 1996: The catch was dominated by ages 4-7 (Table 13), however a major portion of the biomass at age was spread across ages 5 to 8 (Table 15).

B) Fall groundfish surveys

Stratified-random bottom trawl surveys using an Engel 145 otter trawl have been conducted by Canada during the fall in Div. 3L since 1981. In 1990, this Engel survey was extended to cover Div. 3N and 3O. In the fall of 1995 and in the fall of 1996, the survey was conducted using the Campelen 1800 shrimp trawl.

Engel otter trawl series, 1990-94

Tables 16-18 gives a breakdown of the biomass and associated confidence intervals by division from 1990 to 1994. Div. 3L the biomass index in Table 16 has declined to "0" tons in 1994 similar to the decline seen in the spring survey for this time period (see Table 7). Div. 3N,where the majority of the stock is found, most of the biomass was generally found in stratum 361, northwest of the Southeast Shoal, and on the shoal itself in stratum 376, which extends in the Regulatory Area (Table 17). There was a stable trend in biomass with a mean of 48,000 t from 1990-1992 and then the biomass increase to to an average level of 58,000 t in the 1993-94 period. This pattern was not evident in the spring time series when the biomass for 1990-94 varied little around a mean value of 35,000 t for the same time period (Table 8). It should be noted that the low value in 1992 may be explained by the omission of stratum 375 and part of stratum 362 from the survey coverage due to time constraints. Div. 3O, most of the biomass was found in stratum 352 , similar to the spring time series . The trawlable biomass index, in Table 18, showed no obvious trend and has declined by 42% from 1993 to 1994. Some of the ups and downs in the biomass indices of Div. 3N and 30 may simply reflect movement of the stock over time. Fig. 12 shows the cumulative biomass for both divisions 3NO was fairly stable from 1990-92 at an average stock size of 42, 000 t and stablized at a higher level average level of 67,000 t for the 1993-1994 period. A similar upward trend was evident in the autumn juvenile groundfish survey series, which ended in 1994 (see Walsh et al. 1996). However, the spring time series shows a gradual long term decreasing trend.

Age Composition: Table 19 shows a breakdown of abundance at age of yellowtail flounder for the 1990-94 fall surveys in Div. 3LNO. In all years the population was dominated by ages 6 and 7 and table 20 shows that most of the biomass was contributed by ages 7 and 8 (Table 20). In the 1996 assessment of this stock it was noted that some caution should be exercised in evaluating these age compositions given the problems with the 1992 survey (Walsh et al. 1996). Age 5+ and age 7+ have shown a general increasing trend and the age 7+ abundance in 1994 was considerably higher than the estimates from 1990-93. Noteworthy, here, is the severe decline in abundance and the diasppearance of yellowtail flounder in Div. 3L (Fig. 13) which was shown in recent assessments to be related to range contraction of the stock due to decreasing stock size (Walsh et al 1995b; Walsh et al. 1996).

Recruitment, as measured by population numbers of age 4 yellowtail flounder have been average around 5 million fish with the exception of the 1993 estimate which shot up to 22 million (the 1989 cohort). This large cohort was not evident in the springtime series and this year class was below average in the juvenile groundfish survey time series of 1986-94 (Walsh et al. 1996).

Campelen trawl time series 1995-96

In 1995 and 1996, Canada conducted two fall surveys with the new Campelen shrimp trawl. Since conversion factors have not been developed to convert Engels units (1990-94) into Campelen units ,***it must be noted that the estimates of the Campelen trawl can not be directly compared with the Engel time series.***

Tables 12-14 give the breakdown in biomass by stratum with accompanying confidence intervals. Div. 3L, the stock almost double in size, but it is still relatively at low levels as seen in the unconverted 1990-94 survey indices (Table 10). Div 3N, the biomass estimates ranged from 102.8 to 113.2 t with most of the biomass was found in strata 376, 360 and 361 similar to other surveys (Table 13). Div. 3O, the biomass decreased by 27% from 25.7 t to 18.9 t and was mainly found in strata 252 (Table 14).

Table 19 shows that the overall abundance of yellowtail flounder remained stabled from 1995-96 at an average of 586 million fish. Table 15 shows that in 1995, ages 6 to 8 contributed most of the biomass and ages 5 to 8 in the 1996 survey

C) Campelen surveys -1995-97 spring and fall series.

Since the introduction of the new standard trawl in the fall of 1995, there have been two spring and two fall surveys for which we have biomass by stratum population numbers at age and distributional plots of standard numbers per tow. For the 1997 recently completed spring survey of Divs. 3N and 3O we have only preliminary biomass estimates . Given the absence of conversion factors to scale the Engel catches to the Campelen units a closer examination of these recent surveys may give us a ACampelen picture of the health of the stock.

Tables 12-14 and Fig. 14 gives the side by side comparison of the distribution of biomass in each division by season. The biomass is relatively stable in Div 3L and Div 3N across all surveys. In Div. 3O the biomass is low in each fall and higher in each spring. As mentioned earlier this may be related to movements back and forth between Div 3N and Div 3O. Figs 15 and 16 present distributional plot of the standardized weights and numbers per tow and it is evident that the distribution of the portion of the stock biomass in Div. 3O is less in the fall 1995 and 1996 surveys when compared to the spring 1996 survey. Similar data for 1997 is not available. Table 15 presents the population abundance and converted biomass at age for each survey. Ages 5+ contribute most of the biomass. Recruitment of age 4 yellowtail flounder is larger than in the 1995 spring survey (1992 cohort) than in either the spring or fall of 1996. Without the conversion factors it is difficult to extend any preception about recruitment in this stock

D) Cooperative surveys with the Canadian DFO and fishing industry 1996-97 (SCR Doc. 97/31).

The Department of Fisheries and Oceans (DFO) in St. John's, Newfoundland, and Fishery Products International Limited (FPI), a Canadian company also based in St. John's, are conducting cooperative trawl surveys directed at yellowtail flounder on the Grand Bank, NAFO Divisions 3NO. The primary objective of the surveys is to provide commercial indices of catch rate and distribution data for yellowtail flounder in this area. These grid surveys are designed to cover an area of approximately 9500 square nautical miles, corresponding to the area where the yellowtail flounder stock is mainly distributed, and where the Canadian commercial (FPI) fishery operated in most years prior to the current NAFO-imposed moratorium on fishing. Surveys have been carried out in July, 1996, and March and May, 1997 (see Brodie et al. 1997a).

High catch rates (average weight per tow) of yellowtail flounder, were taken in the July 1996 survey and the May 1997 survey but were much lower during the winter survey in March of 1997. The July survey CPUE for yellowtail flounder was similar to the maximum July CPUE of the commercial fleet, which occurred in the 1985 fishery. However, the March survey CPUE was much lower than any March CPUE value observed in the fishery, although a drop in catch rates during winter fisheries has occassionally occurred.

Spanish Spring groundfish surveys (SCR Doc. 97/25)

Beginning in 1995 EU-Spain has conducted stratified-random surveys for groundfish in the NAFO Regulatory Area of Div. 3NOusing a Pedreria bottom trawl with a swept area of 0.0075m^2. Most of the biomass was found in stratum 376 (Southeast Shoals) and stratum 360 (southwest of the Southeast shoals). The biomass increased almost 5 times from 1995 (27,704 t) to 1996 (129,642 t) and in 1997, the biomass decreased by 11% to 115,728 t. Similar trends in abundance estimates were noted (see Paz and Duran 1996). Modal length of the 1995-97 catches was 24 cm.

Distribution analysis

Yellowtail flounder inhabits the continental shelf of the Northwestern Atlantic Ocean from Labrador to Chesapeake Bay at depths of 10-100 m, (Bigelow and Schroeder 1953). This species has reached its northern limit in commercial concentrations on the Grand Bank off the coast of Newfoundland. Brodie et al. (1997b) showed that the area occupied by the yellowtail flounder stock in Divs. 3LNO was positively correlated with stock abundance from surveys, but not with bottom water temperatures from these same surveys. During the years of highest abundance in the late 1970's and early 1980's, the stock was distributed widely over the Grand Bank within the 100 meter depth contour. However, as the stock declined from mid 1980's onward, the remaining fish appear to aggregate in the area of the Southeast Shoal and area west of the shoal. They concluded that the contraction in the area of distribution for this stock to the preferred habitat around the Southeast Shoal was primarily a function of low stock size, which resulted from increased fishing activity in the mid to late 1980's. Most of this analyses has been presented in various SCR Docs. and reviewed at recent STACFIS meetings from 1994-96. The authors also note that examination of data from surveys conducted in 1995 and spring 1996 suggest that some expansion of the range may have occurred since spring 1994.

Figure 17a illustrates the range contraction of yellowtail flounder from the northern areas using biomass data from the 1975-95 spring time Engel series and the 1995-97 spring and fall Campelen trawl series. From 1977-87 the proportion of the stock in the northern area, i.e. north of 45^0 was relatively constant, but starting in 1988 there was a downward trend to 1995 in the proportion of the biomass distributed northward. In the Campelen series there is evidence of an increase in the northward distribution of the biomass in recent years. Figures 17b - 19 presents the distribution of juveniles (immature) ages 0 to 4 and the adults ages 5+ in the spring and fall surveys. In both surveys, juveniles are more abundant in the nursery area in and around the Southeast Shoal in Div. 3N straddling the 200 mile limit and extending into the Regulatory Area confirming earlier descriptions of juvenile distibution (see Walsh 1992; Walsh et al. 1995b). The adults in the spring surveys generally show more dispersion to the north and northwest into Div. 3O and appear more aggregated in Div. 3N in the fall survey.

Biological Studies

A) Mean weights-at-age from surveys

From 1990 onward, when yellowtail flounder sampled for otoliths during the Canadian surveys they were also weighed at sea. The unweighted mean weights at age from the spring and fall surveys in Div. 3N and 3O are shown in Fig. 20. Overall, there do not appear to be any significant trends in the average weights at age during the period 1990-96 for ages 4 to 7 yrs, however, ages 8 and 9yrs showed an upward trend in recent years Similar conclusions about the mean weight-at-age of yellowtail flounder were drawn from the juvenile groundfish surveys from 1986-94 surveys (Walsh et al. 1996).

B) Maturity at length and age (SCR Doc. 97/71)

Length at 50% maturity (L_{50}) and age at 50% maturity (A_50) were calculated for males and females separately from each division and for Div. 3LNO combined for the time period 1975-95 using the Canadian spring groundfish surveys (see Morgan and Walsh 1997). Males mature at a smaller size and younger age than females. Both age and length at 50 % maturity declined in males in recent years. A similar decline in age but not length was evident in females. Since 1992, the age at 50% maturity in males is approximatey 4.4 yrs and length at 50% maturity is approximately 25 cm. During the same time period, females reached age at 50% maturity at age 6.3 yrs and a 50% length of approximately 34 cm.

In the regulated fishery in the NAFO area for groundfish, the minimum mesh size is 130 mm. An L_{50} of 30.5 cm for yellowtail has been derived from experimental studies of 133 mm mesh size (Somolwitz 1983). The reported selection range was 29 to 34 cm and the selection factor was 2.3. The 50% selection length is close to the 50% maturation length of yellowtail flounders in recent years.

Relative Cohort Strength

A multiplicative model combining the spring, fall and juvenile Canadian survey abundances at age into a single estimate of relative cohort strength was examined. The model took the form:

$$\log(N_{ijkt})=\tau + \alpha_i+\beta_j+\delta_k+\varepsilon$$

where: N_{ijkt} = number at age i from survey j belonging to cohort k in year t

τ = intercept

α_i = age effect for i=2....5

β_j = survey effect for j=1...3

δ_k = cohort effect

ε = residuals from the fitted model

To evaluate the fit of the model the residuals were plotted against the predicted values (Fig. 21). This revealed a curved pattern, with the residuals from each survey forming a separate cluster.

It was decided to use the spring survey series only and to incorporate the data from 1975 to 1995. To do this the following model was applied:

$$\log(N_{ikt})=\tau + \alpha_i+\delta_k+\varepsilon$$

where: N_{ikt} = number at age i belonging to cohort k in year t and the other variables are as defined above.

This model showed no obvious pattern in the residuals and a significant fit to the data.

R^2=0.85, n=68

Source	DF	Type III SS	F Value	Pr > F
AGE	3	146.5	56.38	0.0001
COHORT	21	38.34	1.83	0.0191

The estimated cohort strengths were then exponentiated following bias correction and are shown in Fig. 22. Relative cohort strengths for cohorts from 1973-80 appeared to be fairly stable. This was followed by a decline from the 1980-83 cohorts, with the estimates again increasing to 1986. There was a decline in cohort strength from 1986 to 1991 with the relative cohort strength estimates for 1990 and 1991 being among the lowest in the time series. This declining trend in cohort strength coincided with the increase in fishing mortality of juvenile yellowtail flounder in the Regulatory Area during the same time period as discussed in many previous assessments (see also Walsh et al. 1995b).

D) Stock recruitment

The relative cohort strengths described above were plotted against female spawning stock biomass (SSB) calculated from the Canadian spring groundfish surveys from 1975-95 (adapted from Morgan and Walsh 1997). Similar to American plaice stock on the Grand Bank, the highest recruitment from SSB in the middle range (Morgan et al. 1997). The SSB index is low from 1988 to 1995 and to reinterate STACFIS=s comment in 1996 assessment, the probability of obtaining good year classes from spawning during this period is low (NAFO Redbook 1996).

E) Total Mortality (Z-values)

Values of total mortality calculated from survey data for similar cohorts between ages 6 and 7; 7 and 8; and 8 and 9 are shown in Fig. 24. Although the estimates are highly varible over time there is little in the way of discernable trends except that for ages 7-8 the values for the early 1990's are generally higher than in previous years consistent with very high levels of unregulated fishing effort. The negative values for ages 6-7 probably indicate the lack of full recruitment to the survey gear prior to age 7. The very high values between ages 8 and 9, on the other hand, are probably more related to a higher natural mortality as yellowtail flounder near the end of their life span and this would also mask attempts to extract estimates of fishing mortality.

F) Yield-per-Recruit

A yield per recruit analysis has been reproduced from Brodie and Pitt (1983) and is illustrated in Fig. 25 with the associated parameters presented in Table 20. The curve is typically flat-topped generating an unrealistic value of F max with an $F_{0.1}$ value of 0.52. Provided that there has been no change in growth parameters the yield per recruit analysis is likely representative of the Canadian otter trawl fishery prior to the closure since the Canadian fishery for this stock has been entirely by otter trawlers since the fishery began many years ago.

Assessment

Sequential population analysis (SPA) has been employed in the past to assess this stock but has not been used since 1984 as the basis of advice. Since then, it was concluded that the very high values of mortality at the older ages could not be fully explained and that the SPA models attempted were not appropriate. In 1990, the previously noted difficulties with the catch at age were raised, with the conclusion being that catch-at-age based models, such as SPA, were not suitable for this stock. Confidence in the catch and catch-at-age data for this stock remains at a low level, especially with the lack of sampling from fisheries in the Regulatory Area from 1992-95. Thus, evaluation of stock status continues to rely heavily on the interpretation of fishery-independent indices of abundance, i.e. research vessel surveys.

In the recent assessments, there were 5 indices used to evaluate this stock (Canadian spring and fall groundfish surveys, USSR/Russian groundfish surveys, Canadian juvenile groundfish surveys, and CPUE from the Canadian commercial fleet) and most indicated that the stock was still at a low level compared to historic values. In the current assessment, there are no new data for 3 of these indices (Russian surveys [discontinued], Canadian juvenile groundfish surveys [discontinued] and the Canadian CPUE series). New data are available on stock size in the Regulatory Area of Div. 3NO from the 1995-97 Spainish surveys which indicate that the stock biomass in 1996 and 1997 has stablized at around 123, 000 tons. New data on catch rate and distribution data are also available from a co-operative DFO/fishing industry cooperative surveys from 1996-97 which indicate that catch rates inside the Regulatory Area of Divs. 3NO are high during spring and summer but not in the March survey.

The decline in stock size in the mid- to late-1980's was caused by poor recruitment from the year-classes of the early 1980's as evident in the plot of cohort strength (Fig. 22) and a rapid increase in catches to about 30,000 t in 1985-86 from 10,000-15,000 t in 1980-83. The year-classes of 1984-86 were stronger than their immediate predecessors and likely were responsible for the increased catches from 1989 to 1991. Cohort strength declined during the late 80's early 90's coincidental with the increase in fishing mortality on juvenile yellowtail flounder in the Regulatory Area of Divs. 3NO (Walsh et al. 1995a) The recent levels of SSB from the spring time series are very low and the probability of obtaining good year classes is expected to be low. Interpretation of a S/R relationship may be confounded by temporal trends in the data and high fishing mortality in juveniles in the late 1980's and early 1990's.

Given the continuing inadequacies with the catch and sampling data, and still-unresolved questions about the natural mortality at age for this stock, it remains impossible to estimate the level of fishing mortality in the recent years before the moratorium. However, available data suggests that there has likely been increased fishing mortality at ages 5 and younger in the late 1980's and early 1990's than in earlier years (Myers 1994). Also as shown here, for ages 7-8 the Z-values for the early 1990's are generally higher than in previous years consistent with very high levels of unregulated fishing effort. Examination of the catch to spring RV biomass ratio (Fig. 26), which is assumed to reflect the exploitation rate on the stock, shows some interesting patterns. During the two periods of highest catches from this stock (early 1970's and mid 1980's), the catch/biomass ratio was above 0.25. In the years between these periods, when the catches were stable at a lower level, the catch/biomass ratio was usually below 0.12 when the stock of biomass was at its highest levels. A similar index based on the juvenile groundfish surveys and presented at the 1995 assessment (Walsh et al. 1995b) showed that, during the same period, catch/biomass ratio remained stable as biomass increased up to 1993. A decline in the 1994 ratio was difficult to interpret due to the uncertainty about the high 1994 biomass estimate from the juvenile groundfish survey. *STACFIS* expressed caution about the inclusion of juvenile age classes in the calculation of the catch/biomass ratios to reflect what is really happening in this stock, since the size composition of the commercial catch has changed several times over the history of the fishery (NAFO 1995).

Noteworthy is the near total absent of catches in NAFO Div. 3L which is consistent with the range contraction hypothesis (Walsh et al. 1995b, Brodie et al. 1997). In the recent assessment of this stock *STACFIS* noted that contraction of the stock in recent years could strongly influence surveys catch rates and contributed to the high variances seen in recent surveys. Such a contaction in the stock could also make it vulnerable to over-exploitation, should a fishery re-open. However, there is evidence from surveys in *1996 and 1997 to suggest some* expansion of the stock range but, nevertheless the biomass in Div. 3L remains at an extreme low level.

Summary

- *Spring surveys*: the biomass index for 1990-95 has shown the stock has declined by 45% from the average stock size in the mid-1980's of 100,000 t. Most of the trawlable biomass remains in Div. 3N and was somewhat stable compared to Div. 30. The stock size in Div. 3L is extremely low. The survey catches were usually dominated by ages 5-8, however, in 1994 and 1995 the catches were dominated by ages 6-7 and the strength of these cohorts were average at best in the historical time series.

- *Fall surveys:* The fall time series, which began in 1990, with the old standard Engel trawl also showed a disappearance of yellowtail flounder from Div 3L. The fall 1993 and 1994 estimates are higher than the corresponding spring estimates, although this is not a consistent pattern in the fall time series. The biomass index increased from an average 1990-92 value of 42,000 t to an average 1993-94 level of 65,000 t. A similar increasing trend was seen in the juvenile groundfish surveys for the same period.The overall abundance and that of the mature stock at age 5 + has generally increased since the start of the surveys in 1990. These surveys do not mirror the spring time series for the same time period.

- *Campelen surveys*: The combined biomass estimate for Divs. 3NO for fall 1995 and fall 1996 was stable at an average value of 130,000 tons while the spring 1995 and the spring 1996 estimate has stablized at an average value of 177,000 tons. In the 1996 survey with the Campelen trawl recruitment at age 4 (1992 cohort) dominated the catches of juveniles and the 1989 cohort at age 7. Without the conversion factors for survey trawls it is difficult to say much more about recruitment. Together, these surveys suggest an average stock size of 155,000 t of which ages 7+ contributed 54% of the biomass.

- *Spanish survey series:* Stock size was estimated at an average size of 123,000 t in the Regulatory Area, Div. 3NO, for the 1996-97 period. This is a 4 -fold increase over the 1995 estimate and such an increase cannot be explained by recent increases in growth and recruitment.

- *Co-operative DFO/industry series*: Since they began in July 1996, there have been 3 surveys completed in an expectedseasonal time series. High catch rates and a wide distribution were reported in the survey grid area that covers the traditional high areas of abundance mainly inside the Regulatory Area of Div. 3NO in the spring and summer surveys but very low in the winter survey. This seasonal difference may reflects changes in catchability, i.e. either trawl efficiency or availability, however, it is too early to tell if there is a seasonal change in catchability or some anomalous point. Noteworthy is that the spring-summer catch rates are higher that the Canadian commercial CPUE during the 1980's when the stock size was higher in the grid area.

- *Juvenile groundfish surveys* from 1985 to 1994, using the Yankee shrimp trawl, had also shown the systematic decline in Div. 3L as seen in the other surveys. The biomass in Div. 3O had remained relatively stable over the time series, showing a small increase from during 1992 and 1993 corresponding to a decrease in Div. 3N. Overall the stock has shown a systematic increase in size during recent years, however, the large increase in stock size in Div 3N in 1994 is probably an anomalously high estimate. The 1993 juvenile survey indicated that the 1989 to 1992 year-classes may be average to well below average.

- *SSB index*: Low SSB in recent years lowers the probability of producing good year classes.

Conclusions: surveys in 1996-97 have shown the stock is more widely distributed than the early 1990's but not extensive as in earlier years. The age structure has remained stable in all of the surveys for which age data are available and many age classes are contributing to the biomass index in *1996. The SSB has been at lower levels in recent years* relative to the 1980's and the relative cohort strength in recent years is below average as measured in the 1975-95 spring surveys. The mean weights at age have also remained stable. Based on 6 additional surveys since the 1996 assessment, the current view is that the stock size has increased since 1994 although the stock is perceived to be lower than the levels of the 1980's.

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Table 1. Nominal catches by country and TACs (tons) of yellowtail in NAFO Divisions 3LNO.

Year		Canada	France	USSR/ Russia	South Korea	Other		Total	TAC	
1960		7	-	-	-	-		7		
1961		100	-	-	-	-		100		
1962		67	-	-	-	-		67		
1963		138	-	380	-	-		518		
1964		126	-	21	-	-		147		
1965		3,075	-	55	-	-		3,130		
1966		4,185	-	2,834	-	7		7,026		
1967		2,122	-	6,736	-	20		8,878		
1968		4,180	14	9,146	-	-		13,340		
1969		10,494	1	5,207	-	6		15,708		
1970		22,814	17	3,426	-	169		26,426		
1971		24,206	49	13,087	-	-		37,342		
1972		26,939	358	11,929	-	33		39,259		
1973		28,492	368	3,545	-	410		32,815	50,000	
1974		17,053	60	6,952	-	248		24,313	40,000	
1975		18,458	15	4,076	-	345		22,894	35,000	
1976		7,910	31	57	-	59		8,057	9,000	
1977		11,295	245	97	-	1		11,638	12,000	
1978		15,091	375	-	-	-		15,466	15,000	
1979		18,116	202	-	-	33		18,351	18,000	
1980		12,011	366	-	-	-		12,377	18,000	
1981		14,122	558	-	-	-		14,680	21,000	
1982		11,479	110	-	1,073	657		13,319	23,000	
1983		9,085	165	-	1,223	-		10,473	19,000	
1984		12,437	89	-	2,373	1,836	b	16,735	17,000	
1985		13,440	-	-	4,278	11,245	b	28,963	15,000	
1986		14,168	77	-	2,049	13,882	b	30,176	15,000	
1987		13,420	51	-	125	2,718		16,314	15,000	
1988		10,607	-	-	1,383	4,166b	b	16,158	15,000	
1989		5,009	139	-	3,508	1,551		10,207	5,000	
1990		4,966	-	-	5,903	3,117		13,986	5,000	
1991		6,589	-	-	4,156	5,458		16,203	7,000	
1992		6,814	-	-	3,825	123		10,762	7,000	
1993		6,697	-	-	-	6,868		13,565	7,000	
1994	c	-	-	-	-	2069		2069	7,000	d
1995	c	2	-	-	-	65		67	0	
1996	c	55	-	-	-	232		287	0	
1997		-	-	-	-	-		-	0	

[a] see text fro explanation of South Korean catches
[b] includes catches estimated from Canadian surveliance reports
[c] provisional
[d] no directed fishery permitted

Table 2. Breakdown of 1984-95 catches from Table 1 listed as "other."

Year	Spain	Portugal	Panamaa	USA		Cayman Is	Misc.		Total
1984	25	-	1,800	-		-	11		1,836
1985	2,425	-	4,208	3,797		803	12		11,245
1986	366	5,521	4,044	2,221		1,728	2		13,882
1987	1,183	-	-	1,535		-	-		2,718
1988	3,205	-	-	863		-	100b	b	4,163
1989	1,126	5	-	319		-	101b	b	1,551
1990	119	11	-	6		-	2,981b	b	3,117
1991	246	-	-	-		-	5,212b	b	5,458
1992	122	1	-	-		-	-		123
1993	-	-	-	68		-	6,800	a	6,868
1994	719	-	-	700a	a	-	650	a	2,069
1995	65	-	-	-		-	-		65
1996	232	-	-	-		-	-		232

[a] Not reported to NAFO.Catches estimated from surveillance reports.
[b] Includes some estimated catches.

Table 3. Comparison of riggings and average trawl geometry of various trawls used in the Grand Bank surveys of yellowtail flounder from 1971-1997

Parameter	**Yankee 41.5 Otter trawl**	**Engel 145 Hi-Lift Otter trawl**	**Campelen 1800 Shrimp trawl**
	A.T. Cameron	**Wilfred Templeman**	**Wilfred Templeman**
Doors	4.5m^2/590kg	3.8m^2/1250kg	4.3m^2/1400kg
Sweeps (m)	40.2	15.2	6.1
Bridles (m)	2.1	50	40
Bouyancy (kg)	105	283.5	226.5
Headline (m)	24.1	29.2	29.5
Fishing Line (m)	unknown	31.2	19.5
Footgear Length (m)	30.5	44.2	35.6
Material	12 Rubber Rollers & 8 Rubber Bunts	25 Steel Bobbins & 4 Rubber Rollers	102 Rubber Disks (Rockhopper)
Weight Air (kg)	unknown	2349.7	501.3
Size (dia./cm)	53/46/36	53/46/36	35
Mesh Size (mm) Wings/Square	130	180	80/60
Bellies	130/92	150/130	60/44
Codend	92	130	44
Liner	30	30	12.7
Material	Polyethylene	Polyethelyene Nylon Codend	Polyethylene
Doorspread (m)	unknown	60-75	45-55
Wing Spread (m)	13*	17-22	15-17
Opening (m)	2.4-3.3*	4-6	4-5
Tow Speed (kts)	3.5	3.5	3.0

* Data taken from commercially used trawl (Carrothers, 1974).

Table 4 Mean weight of yellowtail per 30 minute tow, by stratum, from research vessel surveys in Division 3L. Numbers in parentheses are the number of sucessful sets.

Depth (m)	Stratum	No. of trawlable units	1971 ATC 187	1972 ATC 199	1973 ATC 207-9	1974 ATC 222	1975 ATC 233	1976 ATC 245-6	1977 ATC 262-3	1978 ATC 276-7	1979 ATC 289-91	1980 ATC 303-5	1981 ATC 317-9	1982 ATC 327-9
91-183	328	114,023	-	-	-	-	-		0.0(3)	-	0.0(5)	-	0.0(2)	0.0(3)
93-183	341	118,151	-	-	0.0(3)	-	-	-	0.1(4)	0.1(4)	0.0(6)	0.0(6)	0.0(2)	0.0(5)
93-183	342	43,913	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(4)	0.0(4)	-	0.0(3)
93-183	343	39,409	-	-	-	-	-	-	0.0(2)	0.0(3)	0.0(4)	0.0(4)	0.0(2)	0.0(4)
184-274	344	112,146	-	-	-	-	-	0.0(4)	0.0(4)	0.0(4)	0.0(2)	0.0(3)	0.0(5)	0.0(4)
275-366	345	107,492	-	-	-	-	-	0.0(4)	0.0(4)	0.0(2)	0.0(4)	0.0(5)	0.0(4)	0.0(4)
275-366	346	64,931	-	-	-	-	0.0(2)	0.0(2)	0.0(3)	-	0.0(4)	0.0(3)	0.0(3)	0.0(3)
184-274	347	73,788	0.0(2) -	-	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(4)	0.0(4)	0.0(5)	0.0(4)	0.0(2)	
93-183	348	159,136	0.0(3)	0.0(3)	-	0.0(6)	0.0(4)	0.0(6)	0.0(6)	0.0(6)	0.0(6)	0.0(7)	0.0(7)	0.0(4)
93-183	349	158,686	4.8(3)	0.0(4)	-	0.0(4)	0.0(2)	0.2(3)	0.0(6)	0.0(6)	0.0(7)	0.0(9)	0.0(4)	0.0(6)
57-91	350	155,458	32.2(3)	2.3(2)	0.0(4)	0.2(3)	0.0(3)	0.2(4)	3.8(4)	1.5(6)	1.1(9)	1.1(10)	0.3(3)	0.6(7)
57-91	363	133,614	119.8(3)	21.3(3)	12.5(4)	0.5(4)	1.0(3)	2.5(4)	27.4(5)	6.3(5)	22.3(8)	39.3(5)	3.0(3)	30.4(5)
93-183	364	211,456	13.7(4)	0.0(3)	-	0.0(4)	0.0(2)	0.0(3)	0.2(7)	0.1(6)	0.1(8)	0.4(6)	0.0(3)	0.0(6)
93-183	365	78,142	0.0(3)	0.0(2)	-	0.0(3)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	0.0(4)	0.0(4)	0.0(2)	0.0(3)
184-274	366	104,639	0.0(3)	-	-	0.0(3)	0.0(4)	0.0(4)	0.0(4)	-	0.0(4)	0.0(4)	0.0(3)	0.0(5)
275-366	368	25,071	0.0(2)	-	-	0.0(2)	0.0(2)	0.0(3)	0.0(3)	-	0.0(4)	0.0(2)	0.0(2)	0.0(2)
184-274	369	72,137	0.0(3)	-	-	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(2)	0.0(4)	0.0(3)	0.0(2)	0.0(2)
93-183	370	99,085	1.4(2)	0.3(3)	-	0.0(3)	0.0(3)	0.0(3)	0.5(3)	0.2(3)	0.0(4)	0.0(3)	0.0(2)	0.0(2)
57-91	371	84,147	88.5(3)	6.4(2)	-	0.0(3)	-	-	1.4(3)	0.3(3)	0.5(3)	0.5(3)	0.0(2)	1.1(4)
57-91	372	184,658	135.3(4)	28.1(3)	39.6(3)	7.1(3)	7.6(3)	44.2(3)	32.1(6)	20.5(7)	24.3(9)	25.0(6)	13.3(4)	19.8(6)
57-91	384	84,072	86.0(3)	3.0(2)	2.3(3)	0.6(3)	-	-	7.0(2)	0.0(3)	1.5(4)	0.0(2)	0.4(2)	10.3(2)
93-183	385	176,851	0.0(4)	0.0(4)	0.2(3)	0.0(2)	0.0(4)	0.0(2)	0.0(6)	0.0(6)	0.0(7)	0.0(4)	0.0(3)	0.0(3)
184-274	386	73,788	0.0(2)	-	-	0.0(3)	0.0(3)	0.0(2)	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(2)	0.0(3)
275-366	387	53,896	0.0(3)	-	-	0.0(3)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(4)	0.0(2)	0.0(2)	0.0(3)
275-366	388	27,098	0.0(2)	-	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)
184-274	389	61,628	0.0(3)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(2)	0.0(2)
93-183	390	111,170	0.3(3)	0.0(3)	0.0(3)	0.0(3)	0.0(3)	-	0.0(2)	0.0(4)	0.0(5)	0.3(3)	0.0(2)	0.8(4)
184-274	391	21,168	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	-	0.0(2)	0.0(2)	0.0(4)	0.0(2)	0.0(2)	0.0(2)
275-366	392	10,884	-	-	0.0(3)	0.0(4)	0.0(2)	-	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	729	13,962	-	-	-	-	-	-	-	-	-	-	-	-
550-731	730	12,761	-	-	-	-	-	-	-	-	-	-	-	-
367-549	731	16,214	-	-	-	-	-	-	-	-	-	-	-	-
550-731	732	17,340	-	-	-	-	-	-	-	-	-	-	-	-
367-549	733	35,130	-	-	-	-	-	-	-	-	-	-	-	-
550-731	734	17,115	-	-	-	-	-	-	-	-	-	-	-	-
367-549	735	20,417	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
550-731	736	13,136	-	-	-	-	-	-	-	-	-	-	-	-
732-914	737	17,040	-	-	-	-	-	-	-	-	-	-	-	-
732-914	741	16,789	-	-	-	-	-	-	-	-	-	-	-	-
732-914	745	26,122	-	-	-	-	-	-	-	-	-	-	-	-
732-914	748	11,935	-	-	-	-	-	-	-	-	-	-	-	-
Mean Wt (#sets)			**30.3(58)**	**5.4(38)**	**8.5(32)**	**0.7(70)**	**0.7(55)**	**4.0(64)**	**4.0(102)**	**2.1(94)**	**2.8(140)**	**3.8(115)**	**1.1(80)**	**3.2(103)**
Biomass ('000 t)			**64.5**	**9.2**	**9.2**	**1.4**	**1.5**	**8.5**	**11**	**4.9**	**7.8**	**10.2**	**2.9**	**8.8**

Table 4. (Cont'd.)

Depth		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
		AN	AN 43	WT	WT	WT	WT	WT	WT	WT	WT	WT	WT
(m)	Stratum	27-28	WT 28-30	48	59,60	70,71	82,83	95-96	106,107	120-122	136-138	152-154	168-170
93-183	328	0.0(2)	0.0(4)	0.0(9)	0.0(7)	0.0(2)	0.0(8)	0.1(7)	0.2(6)	0.0(4)	0.0(6)	0.0(4)	0.0(6)
93-183	341	0.0(4)	0.01(9)	0.0(9)	0.1(6)	0.0(6)	0.0(8)	0.0(4)	0.0(6)	0.0(8)	0.0(6)	0.0(5)	0.0(6)
93-183	342	0.0(4)	0.0(3)	0.0(3)	0.2(2)	0.0(2)	0.1(3)	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(3)	0.0(2)
93-183	343	-	0.0(3)	0.0(4)	0.0(3)	0.0(3)	0.0(3)	0.2(3)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)
184-274	344	-	0.0(5)	0.0(8)	0.0(4)	0.0(6)	0.0(7)	0.0(6)	0.0(5)	0.0(6)	0.0(6)	0.0(5)	0.0(5)
275-366	345	-	0.0(5)	0.0(7)	0.0(4)	0.0(8)	0.0(9)	0.0(4)	0.0(3)	0.0(6)	0.0(6)	0.0(5)	0.0(5)
275-366	346	-	0.0(2)	0.0(5)	0.0(5)	0.0(4)	0.0(4)	0.0(4)	-	0.0(4)	0.0(4)	0.0(3)	0.0(3)
184-274	347	-	0.0(5)	0.0(5)	0.0(3)	0.0(5)	0.0(6)	0.0(4)	0.0(4)	0.0(4)	0.0(4)	0.0(4)	0.0(4)
93-183	348	-	0.0(18)	0.0(12)	0.1(8)	0.0(11)	0.0(9)	0.0(11)	0.0(8)	0.0(9)	0.0(8)	0.2(8)	0.0(8)
93-183	349	0.1(6)	0.1(14)	1.3(14)	0.1(11)	0.1(8)	0.0(11)	0.0(9)	0.0(9)	0.0(9)	0.0(9)	0.5(8)	0.0(2)
57-91	350	1.5(6)	3.7(12)	2.3(11)	0.6(11)	1.6(8)	0.6(11)	0.2(7)	1.0(8)	0.1(11)	0.0(9)	0.0(7)	0.0(5)
57-91	363	28.2(5)	15.2(8)	8.3(10)	7.6(9)	4.9(7)	1.5(9)	3.4(7)	0.6(7)	0.1(9)	0.0(8)	0.0(6)	0.0(7)
93-183	364	0.6(5)	0.0(17)	0.0(17)	0.0(15)	0.0(10)	0.0(16)	0.0(12)	0.0(11)	0.0(12)	0.0(12)	0.0(10)	0.0(8)
93-183	365	-	0.0(7)	0.0(5)	0.0(5)	0.0(4)	0.0(6)	0.0(4)	0.0(4)	0.0(4)	0.0(5)	0.0(4)	0.0(4)
184-274	366	-	0.0(6)	0.0(8)	0.0(7)	0.0(6)	0.0(8)	0.0(6)	-	0.0(6)	0.0(7)	0.0(5)	0.0(5)
275-366	368	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(2)	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)
184-274	369	-	0.0(5)	0.0(6)	0.0(5)	0.0(4)	0.0(6)	0.0(5)	0.0(2)	0.0(4)	0.0(5)	0.0(3)	0.0(3)
93-183	370	-	0.0(8)	0.0(8)	0.0(7)	0.0(5)	0.0(8)	0.0(7)	0.0(6)	0.0(6)	0.0(6)	0.0(5)	0.0(5)
57-91	371	-	0.4(7)	0.3(6)	0.0(7)	0.1(5)	0.1(6)	0.0(6)	0.1(5)	0.0(5)	0.0(5)	0.0(4)	0.0(5)
57-91	372	59.4(5)	56.5(12)	36.3(14)	13.9(13)	7.0(11)	12.7(13)	4.7(7)	2.2(10)	0.3(10)	0.4(11)	0.5(8)	0.0(10)
57-91	384	-	4.6(6)	1.6(6)	1.1(7)	0.2(5)	0.1(6)	0.0(4)	0.0(4)	0.0(5)	0.0(5)	0.0(4)	0.0(5)
93-183	385	-	0.0(15)	0.0(13)	0.0(11)	0.0(10)	0.0(12)	0.0(11)	0.0(8)	0.0(10)	0.0(11)	0.0(8)	0.0(9)
184-274	386	-	0.0(5)	0.0(6)	0.0(5)	0.0(4)	0.0(6)	0.0(5)	0.0(3)	0.0(4)	0.0(5)	0.0(4)	0.0(4)
275-366	387	-	0.0(6)	0.0(4)	0.0(4)	0.0(4)	0.0(5)	0.0(4)	0.0(3)	0.0(3)	0.0(3)	0.0(3)	0.0(3)
275-366	388	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
184-274	389	-	0.0(5)	0.0(5)	0.0(6)	0.0(3)	0.0(5)	0.0(4)	0.0(3)	0.0(3)	0.0(4)	0.0(3)	0.0(4)
93-183	390	-	0.3(9)	0.0(8)	0.0(7)	0.0(5)	0.0(8)	0.0(5)	0.0(5)	0.0(6)	0.0(6)	0.0(5)	0.0(7)
184-274	391	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
275-366	392	-	0.0(2)	0.0(2)	0.2(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	729	-	0.0(2)	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
550-731	730	-	0.0(2)	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	731	-	0.0(2)	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
550-731	732	-	0.0(2)	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	733	-	0.0(3)	-	-	-	-	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)
550-731	734	-	0.0(2)	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	735	-	0.0(2)	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)
550-731	736	-	0.0(2)	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	-
732-914	737	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
732-914	741	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
732-914	745	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
732-914	748	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
Mean Wt. (#sets)		13.5(37)	4.7(221)	3.1(211)	1.4(181)	0.8(154)	1.0(205)	0.5(156)	0.3(143)	0.0(178)	0.0(181)	0.0(160)	0.0(151)
Biomass ('000 t)		15.1	13.5	8.5	3.8	2.2	2.7	1.4	0.7	0.1	0.1	0.3	0.00

Table 5. Mean weight of yellowtail per 30 minute tow, by stratum, from research vessel surveys in Division 3N. Numbers in parentheses are the number of sucessful sets.

Depth (m)	Stratum	No. of trawlable units	1971 ATC 187	1972 ATC 199	1973 ATC 207-9	1974 ATC 222	1975 ATC 233	1976 ATC 245-6	1977 ATC 262-3	1978 ATC 276-7	1979 ATC 289-91	1980 ATC 303-5	1981 ATC 317-9	1982 ATC 327-9
275-366	357	12,311	-	-	0.0(2)	-	-	-	0.0(2)	-	0.0(3)	0.0(3)	0.0(2)	0.0(2)
185-274	358	16,889	-	0.0(4)	0.0(3)	-	-	-	0.0(2)	-	0.0(2)	0.0(3)	0.3(3)	0.0(3)
93-183	359	31,602	-	0.0(3)	0.0(3)	-	-	0.0(3)	0.0(2)	-	0.0(4)	0.0(4)	0.0(3)	0.0(3)
57-91	360	224,592	-	58.3(4)	-	-	12.1(4)	128.6(4)	55.9(4)	43.5(4)	27.6(9)	83.8(11)	78.4(6)	36.7(7)
57-91	361	139,094	45.8(2)	115.8(3)	93.4(4)	151.5(4)	105.3(4)	113.0(5)	141.5(3)	122.8(4)	92.3(8)	128.4(7)	-	118.9(6)
57-91	362	189,162	140.2(2)	132.8(4)	22.1(5)	38.9(4)	33.3(3)	44.1(5)	62.4(5)	28.8(4)	40.3(12)	53.6(11)	104.2(5)	47.2(8)
57-91	373	189,162	73.6(4)	135.1(4)	26.7(4)	24.2(4)	-	23.3(5)	74.5(4)	50.5(5)	22.1(11)	48.1(8)	58.4(5)	23.7(5)
57-91	374	69,885	67.8(2)	42.4(2)	115.4(4)	16.1(2)	62.1(2)	-	22.4(3)	22.0(3)	24.8(4)	39.0(3)	71.7(3)	19.1(4)
<56	375	119,577	60.0(3)	69.0(3)	121.9(3)	94.5(3)	80.3(3)	-	62.7(4)	30.6(5)	66.1(5)	57.8(4)	69.3(4)	61.1(5)
<56	376	112,521	-	45.4(2)	10.3(3)	-	82.1(2)	126.4(3)	78.3(3)	4.6(2)	86.4(4)	125.3(3)	74.3(4)	63.0(7)
93-183	377	7,506	-	0.0(2)	0.0(2)	0.0(3)	0.0(2)	-	0.0(2)	0.0(2)	0.0(3)	0.0(4)	0.0(3)	0.0(2)
185-274	378	10,434	0.0(2)	0.0(2)	0.0(2)	0.2(3)	-	-	0.0(2)	1.4(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)
275-366	379	7,957	-	-	0.0(2)	0.0(3)	-	-	0.0(2)	0.3(2)	0.0(3)	0.0(3)	0.0(3)	0.0(2)
275-366	380	8,707	-	0.0(2)	0.0(3)	0.0(2)	-	-	0.0(2)	-	0.0(2)	0.0(3)	0.0(3)	-
185-274	381	13,662	0.0(4)	0.5(4)	0.0(3)	0.0(4)	0.0(2)	-	0.0(2)	0.0(3)	0.0(3)	0.5(4)	0.0(3)	0.0(2)
93-183	382	48,567	0.0(3)	0.0(4)	0.0(3)	0.0(3)	-	0.0(2)	0.0(3)	0.0(3)	0.0(3)	0.0(4)	0.0(2)	0.0(2)
57-91	383	50,593	18.6(2)	7.3(2)	0.1(2)	0.0(2)	-	0.0(3)	2.7(3)	0.0(2)	0.0(3)	0.5(4)	1.3(3)	10.0(2)
367-549	723	11,635	-	-	-	-	-	-	-	-	-	-	-	-
350-731	724	9,308	-	-	-	-	-	-	-	-	-	-	-	-
367-549	725	7,882	-	-	-	-	-	-	-	-	-	-	-	-
550-731	726	5,405	-	-	-	-	-	-	-	-	-	-	-	-
367-549	727	12,010	-	-	-	-	-	-	-	-	-	-	-	-
550-731	728	11,710	-	-	-	-	-	-	-	-	-	-	-	-
732-914	752	10,059	-	-	-	-	-	-	-	-	-	-	-	-
732-914	756	7,957	-	-	-	-	-	-	-	-	-	-	-	-
732-914	760	11,560	-	-	-	-	-	-	-	-	-	-	-	-
Mean (no. sets)			**71.9(24)**	**78.4(45)**	**44.8(48)**	**53.2(37)**	**53.5(22)**	**72.7(30)**	**60.8(48)**	**40.2(41)**	**40.1(82)**	**63.6(81)**	**63.0(54)**	**43.8(60)**
Biomass ('000 t)			**59.7**	**96.6**	**46**	**45.4**	**46.8**	**71.6**	**76.2**	**47.6**	**50.2**	**79.7**	**70.1**	**54.4**

Table 5. - (Cont'd.)

Depth (m)	Stratum	1984 AN 27-28	1985 AN 43 WT 29	1986 WT 47	1987 WT 58-60	1988 WT 70	1989 WT 82	1990 WT 95-96	1991 WT 106	1992 WT 119-120	1993 WT 136-137	1994 WT 152-154	1995 WT 168-170
275-366	357	0.0(2)	0.0(2)	0.0(2)	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
185-274	358	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
93-183	359	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.4(2)	0.0(2)	0.0(2)
57-91	360	142.1(7)	54.0(16)	14.1(13)	9.2(15)	2.4(12)	30.9(15)	6.6(15)	10.4(12)	19.6(14)	7.5(11)	2.6(8)	42.2(12)
57-91	361	139.9(5)	67.1(7)	44.1(10)	73.8(8)	88.7(7)	48.6(10)	125.2(9)	92.3(8)	38.9(8)	95.1(8)	197.8(5)	129.3(7)
57-91	362	95.1(7)	36.6(11)	73.2(14)	47.8(13)	43.8(10)	30.5(13)	35.3(10)	30.5(10)	3.0(12)	52.5(9)	1.5(6)	0.3(10)
57-91	373	63.5(7)	32.0(9)	17.9(4)	23.1(13)	23.8(10)	14.8(13)	0.9(10)	8.9(11)	0.1(10)	0.1(9)	0.8(7)	0.0(10)
57-91	374	35.5(3)	25.3(4)	11.6(6)	5.7(5)	2.3(5)	0.1(5)	0.9(5)	0.2(5)	0.8(5)	0.0(3)	0.0(3)	1.1(4)
<56	375	176.1(5)	97.8(8)	231.7(8)	142.8(8)	68.1(6)	23.2(8)	102.7(8)	14.9(6)	141.1(6)	60.0(6)	13.9(4)	72.8(6)
<56	376	32.5(4)	78.5(7)	88.2(9)	59.4(8)	4.3(6)	72.6(8)	40.3(7)	113.8(7)	11.2(7)	3.3(6)	2.2(4)	2.5(6)
93-183	377	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.5(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
185-274	378	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
275-366	379	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
275-366	380	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
185-274	381	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
93-183	382	0.0(3)	0.0(4)	0.0(4)	0.0(3)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)
57-91	383	1.8(3)	0.0(3)	0.0(4)	0.1(3)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(2)	0.0(3)	0.0(2)	0.0(2)
367-549	723	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
350-731	724	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	725	-	-	-	-	-	-	-	0.0(2)	0.0(1)	0.0(2)	0.0(2)	0.0(2)
550-731	726	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	727	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
550-731	728	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)
732-914	752	-	-	-	-	-	-	-	-	-	-	-	0.0(2)
732-914	756	-	-	-	-	-	-	-	-	-	-	-	0.0(2)
732-914	760	-	-	-	-	-	-	-	-	-	-	-	0.0(2)
Mean (No. sets)		**83.5(60)**	**45.3(85)**	**51.9(101)**	**40.2(91)**	**27.5(77)**	**26.5(94)**	**34.1(85)**	**28.4(93)**	**22.0(94)**	**24.7(85)**	**22.6(76)**	**27.9(89)**
Biomass ('000 t)		**104.6**	**56.7**	**65**	**49.9**	**34.4**	**33.3**	**42.6**	**37.2**	**28.6**	**32.4**	**30.3**	**36.6**

Table 6. Mean weight of yellowtail per 30-minute tow, by stratum, from research vessel surveys in Division 3Ø. Numbers in parentheses are the number of sucessful sets.

Depth (m)	Stratum	No. of trawlable units	1973 ATC 207, 208, 209	1975 ATC 233	1976 ATC 245, 246	1977 ATC 262, 263	1978 ATC 276, 277	1979 ATC 289, 290, 191	1980 ATC 303, 304, 305	1981 ATC 317, 318, 319	1982 ATC 327, 328, 329
93-183	329	129,185	0.0(2)	-	0.0(2)	0.0(3)	0.2(5)	0.0(6)	0.0(2)	0.0(2)	0.0(6)
57-91	330	156,809	0.1(6)	1.1(3)	0.2(3)	2.0(3)	5.6(6)	10.0(7)	0.0(2)	0.1(4)	1.9(7)
57-91	331	34,229	33.6(2)	0.4(2)	9.2(2)	-	7.3(2)	6.0(3)	3.5(2)	-	4.0(4)
93-183	332	78,592	-	3.2(2)	2.0(3)	11.5(3)	2.6(3)	2.0(4)	0.0(2)	-	0.3(4)
185-274	333	11,335	-	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	-	0.0(4)
275-366	334	6,906	-	-	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	-	0.0(4)
275-366	335	4,354	0.0(2)	-	0.0(3)	-	0.0(2)	0.0(2)	0.0(3)	-	0.0(2)
185-274	336	9,083	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(4)	0.0(2)	-	0.0(2)
93-183	337	71,161	0.2(3)	1.3(3)	4.5(2)	6.6(2)	0.0(2)	0.6(4)	0.0(3)	-	0.3(3)
57-91	338	142,472	33.7(5)	7.5(2)	9.1(3)	23.8(4)	2.3(5)	54.1(7)	23.0(5)	-	1.0(5)
93-183	339	43,913	1.4(2)	0.0(2)	-	-	0.7(2)	0.4(3)	-	0.0(2)	0.1(4)
57-91	340	128,810	-	0.6(3)	2.4(6)	22.2(3)	10.2(3)	32.8(7)	1.3(2)	15.0(3)	3.9(6)
57-91	351	189,162	31.2(5)	29.3(4)	15.7(4)	80.6(5)	26.4(6)	78.5(11)	68.2(10)	51.0(4)	34.2(9)
57-91	352	193,666	47.5(5)	55.5(4)	62.0(4)	76.6(5)	92.2(4)	79.7(12)	67.3(11)	-	40.3(7)
57-91	353	96,232	0.5(3)	43.9(3)	9.1(2)	41.7(3)	8.5(3)	68.6(5)	0.4(4)	-	4.5(3)
93-183	354	35,580	0.0(3)	-	4.8(3)	3.6(2)	-	0.0(4)	0.0(3)	0.0(2)	0.0(2)
185-274	355	7,732	0.0(2)	0.0(2)	0.0(2)	-	-	0.0(4)	0.0(2)	0.0(2)	0.0(2)
275-366	356	4,579	0.0(2)	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	717	6,981	-	-	-	-	-	-	-	-	-
350-731	718	8,332	-	-	-	-	-	-	-	-	-
367-549	719	5,705	-	-	-	-	-	-	-	-	-
550-731	720	7,882	-	-	-	-	-	-	-	-	-
367-549	721	5,705	-	-	-	-	-	-	-	-	-
550-731	722	6,981	-	-	-	-	-	-	-	-	-
732-914	764	-	-	-	-	-	-	-	-	-	-
732-914	772	-	-	-	-	-	-	-	-	-	-
Mean Wt.(#sets)			**19.0(45)**	**19.1(34)**	**14.2(45)**	**33.8(39)**	**20.6(51)**	**37.8(90)**	**22.7(59)**	**16.7(21)**	**11.8(74)**
Biomass ('000 t)			**21.2**	**22.2**	**18.4**	**42.1**	**26.7**	**50.8**	**29.5**	**11.6**	**15.8**

Table 6 (Cont'd.)

Depth (m)	Stratum	1984 AN 27, 28	1985 AN 43	1986 WT 47	1987 WT 58-60	1988 WT 70	1989 WT 82	1990 WT 94-95	1991 WT 105, 106	1992 WT 119, 120	1993 WT 136-138	1994 WT 152-154	1995 WT 168-170
93-183	329	0.0(5)	0.0(8)	0.0(8)	0.0(9)	0.0(7)	0.0(9)	0.0(7)	0.2(9)	0.0(8)	0.1(6)	0.0(5)	0.0(5)
57-91	330	0.5(4)	7.8(10)	3.3(9)	0.7(11)	0.7(9)	1.2(11)	0.6(10)	4.8(11)	0.0(10)	0.1(7)	0.0(5)	0.0(7)
57-91	331	23.8(3)	36.7(3)	3.6(4)	16.0(2)	6.0(2)	18.7(2)	-	0.7(2)	0.0(2)	1.3(2)	2.8(2)	0.3(2)
93-183	332	0.0(2)	0.3(5)	9.8(6)	5.9(5)	0.1(4)	12.7(5)	0.8(5)	0.8(6)	0.5(5)	6.6(4)	0.2(4)	0.9(4)
185-274	333	0.0(2)	0.0(2)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
275-366	334	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.2(2)	0.0(2)	0.0(2)	0.8(2)
275-366	335	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(3)	0.0(3)	0.0(2)	0.0(2)	0.2(2)
185-274	336	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.4(2)	0.0(2)
93-183	337	0.0(2)	0.0(5)	0.6(5)	0.7(6)	1.3(4)	1.7(5)	0.0(2)	0.0(5)	0.4(4)	4.8(2)	0.2(3)	0.2(4)
57-91	338	15.8(5)	11.1(9)	6.8(9)	2.4(9)	23.0(8)	7.2(10)	6.1(8)	5.4(10)	9.6(6)	5.7(6)	3.2(6)	5.3(6)
93-183	339	0.4(2)	0.1(3)	0.1(3)	0.1(3)	0.0(3)	0.0(3)	0.4(3)	0.0(3)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
57-91	340	3.0(4)	7.2(9)	8.3(7)	21.4(9)	5.8(7)	3.4(9)	9.7(9)	2.7(9)	1.8(5)	1.5(6)	0.0(2)	0.0(5)
57-91	351	40.5(6)	42.3(9)	39.1(14)	19.3(13)	36.5(10)	21.9(13)	27.3(12)	13.2(12)	3.3(10)	2.2(9)	0.1(7)	0.3(8)
57-91	352	30.5(7)	29.7(11)	34.9(14)	51.4(13)	24.8(11)	27.0(13)	36.0(13)	49.4(14)	22.8(8)	109.4(7)	26.9(8)	17.5(10)
57-91	353	1.0(2)	56.3(6)	21.8(7)	106.3(6)	2.2(5)	6.0(7)	12.0(6)	17.6(7)	5.6(4)	36.4(4)	1.1(4)	40.5(5)
93-183	354	0.0(2)	0.5(3)	0.0(3)	0.0(2)	0.0(2)	0.1(2)	0.0(2)	1.8(3)	0.0(2)	0.0(2)	0.0(2)	0.2(3)
185-274	355	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.2(2)
275-366	356	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.3(2)
367-549	717	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
350-731	718	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	719	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
550-731	720	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
367-549	721	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
550-731	722	-	-	-	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	4.5(2)
732-914	764	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
732-914	772	-	-	-	-	-	-	-	-	-	-	0.0(2)	-
													-
Mean (No. sets)		**12.8(56)**	**18.0(93)**	**14.7(102)**	**20.9(100)**	**12.2(84)**	**9.9(101)**	**11.9(93)**	**11.4(116)**	**5.2(91)**	**19.5(81)**	**4.2(81)**	**17.4(85)**
Biomass ('000 t)		**17.2**	**24.2**	**19.7**	**28.1**	**16.3**	**13.4**	**15.6**	**15.8**	**7.3**	**27**	**5.9**	**8.2**

Table 7 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from SPRING surveys using the ENGEL trawl, for Div. 3L, 1971-1982.

Stratum	Depth (m)	Area (sq.mi)	Units	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
784	<56	268	20	-	-	-	-	-	-	-	-	-	-	-	-
350	56-91	2071	155	5	0.4	0	0	0	0	0.6	0.2	0.2	0.2	0.1	0.1
363		1780	134	16	2.8	1.7	0.1	0.1	0.3	3.7	0.8	3	5.3	0.4	4.1
371		1121	84	7.4	0.5	-	0	-	-	0.1	0	0	0	0	0.1
372		2460	185	25	5.2	7.3	1.3	1.4	8.2	5.9	3.8	4.5	4.6	3.4	3.8
384		1120	84	7.2	0.2	0.2	0.1	-	-	-	0	0.1	0	0	0.9
TOTAL				**60.6**	**9.1**	**9.2**	**1.5**	**1.5**	**8.5**	**10.3**	**4.8**	**7.8**	**10.1**	**3.9**	**8.8**
328	92-183	1519	114	-	-	-	-	-	-	0	-	0	-	0	0
341		1574	118	-	-	0	-	-	-	0	0	0	0	0	0
342		585	44	-	-	-	-	-	-	0	0	0	0	-	0
343		525	39	-	-	-	-	-	-	0	0	0	0	0	0
348		2120	159	0	0	-	0	0	0	0	0	0	0	0	0
349		2114	159	0.8	0	-	0	0	0	0	0	0	0	0	0
364		2817	211	2.9	2.8	-	0	0	0	0	0	0	0.1	0	0
365		1041	78	0	2.8	-	0	0	0	0	0	0	0	0	0
370		1320	99	0.1	0	-	0	0	0	0.1	0	0	0	0	0
385		2356	177	0	0.2	0	0	0	0	0	0	0	0	0	0
390		1481	111	0	0.2	0	0	0	-	0	0	0	0	0	0.1
TOTAL				**3.8**	**6**	**0**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0.1**	**0**	**0.1**
344	184-274	1582	119	-	-	-	-	-	0	0	0	0	0	0	0
347		983	74	0	-	-	0	0	0	0	0	0	0	0	0
366		1394	105	0	-	-	0	0	0	0	-	0	0	0	0
369		961	72	0	-	-	0	0	0	0	0	0	0	0	0
386		983	74	0	-	-	0	0	0	0	0	0	0	0	0
389		821	62	0	0.2	0	0	0	0	0	0	0	0	0	0
391		282	21	-	0	0	0	0	-	0	0	0	0	0	0
TOTAL				**0**	**0.2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
345	275-366	1432	107	-	-	-	-	-	0	0	0	0	0	0	0
346		865	65	-	-	-	-	0	0	0	-	0	0	0	0
368		334	25	0	-	-	0	0	0	0	-	0	0	0	0
387		718	54	0	-	-	0	0	0	0	0	0	0	0	0
388		361	27	0	-	0	0	0	0	0	0	0	0	0	0
392		145	11	-	-	0	0	0	-	0	0	0	0	0	0
TOTAL				**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
729	367-549	186	14	-	-	-	-	-	-	-	-	-	-	-	-
731		216	16	-	-	-	-	-	-	-	-	-	-	-	-
733		468	35	-	-	-	-	-	-	-	-	-	-	-	-
735		272	20	-	-	-	-	-	-	-	-	-	-	0	-
TOTAL														**0**	
730	550-731	170	13	-	-	-	-	-	-	-	-	-	-	-	-
732		231	17	-	-	-	-	-	-	-	-	-	-	-	-
734		228	17	-	-	-	-	-	-	-	-	-	-	-	-
736		175	13	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL															
BIOMASS				**64.4**	**15.3**	**9.2**	**1.5**	**1.5**	**8.5**	**10.4**	**4.8**	**7.8**	**10.2**	**3.9**	**8.9**
95 UPPER				**92.1**	**31.2**	**14.9**	**3.8**	**4.8**	**22**	**19.4**	**9.8**	**12.6**	**16.1**	**9.3**	**16**
95 LOWER				**36.7**	**-0.6**	**3.5**	**-0.8**	**-1.8**	**-5**	**1.4**	**-0.2**	**3**	**4.3**	**-1.5**	**2.8**

Table 7 cont'd

STRATUM	DEPTH (m.)	AREA (mi.)	UNITS (000)	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
784	<56	268	20	-	-	-	-	-	-	-	-	-	-	-	0
350	56-91	2071	155	0.2	0.6	0.4	0.1	0.3	0.1	0	0.2	0	0	0	0
363		1780	134	3.8	2	1.1	1	0.7	0.2	0.5	0.1	0	0	0	-
371		1121	84	-	0	0	0	0	0	0	0	0	0	0	-
372		2460	185	11	10.4	6.7	2.6	1.3	2.3	0.9	0.4	0.1	0.1	0	-
384		1120	84	-	0.4	0.1	0.1	0	0	0	0	0	0	0	-
TOTAL				**15**	**13.4**	**8.3**	**3.8**	**2.3**	**2.6**	**1.4**	**0.7**	**0.1**	**0.1**	**0**	**0**
328	92-183	1519	114	0	0	0	0	0	0	0	0	0	0	0	0
341		1574	118	0	0	0	0	0	0	0	0	0	0	0	-
342		585	44	0	0	0	0	0	0	0	0	0	0	0	-
343		525	39	-	0	0	0	0	0	0	0	0	0	0	-
348		2120	159	-	0	0	0	0	0	0	0	0	0	0	-
349		2114	159	0	0	0.2	0	0	0	0	0	0	0	0	-
364		2817	211	0.1	0	0	0	0	0	0	0	0	0	0	-
365		1041	78	-	0	0	0	0	0	0	0	0	0	0	-
370		1320	99	-	0	0	0	0	0	-	0	0	0	0	-
385		2356	177	-	0	0	0	0	0	0	0	0	0	0	-
390		1481	111	-	0	0	0	0	0	0	0	0	0	0	-
TOTAL				**0.1**	**0**	**0.2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
344	164-274	1582	119	-	0	0	0	0	0	0	0	0	0	0	0
347		983	74	-	0	0	0	0	0	0	0	0	0	0	-
366		1394	105	-	0	0	0	0	0	0	-	0	0	0	-
369		961	72	-	0	0	0	0	0	0	0	0	0	0	-
386		983	74	-	0	0	0	0	0	0	0	0	0	0	-
389		821	62	-	0	0	0	0	0	0	0	0	0	0	-
391		282	21	-	0	0	0	0	0	0	0	0	0	0	-
TOTAL					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
345	275-366	1432	107	-	0	0	0	0	0	0	0	0	0	0	0
346		865	65	-	0	0	0	0	0	0	-	0	0	0	-
368		334	25	-	0	0	0	0	0	0	-	0	0	0	-
387		718	54	-	0	0	0	0	0	0	0	0	0	0	-
388		361	27	-	0	0	0	0	0	0	0	0	0	0	-
392		145	11	-	0	0	0	0	0	0	0	0	0	0	-
TOTAL					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
729	367-549	186	14	-	0	-	-	-	-	-	0	0	0	0	0
731		216	16	-	0	-	-	-	-	-	0	0	0	0	-
733	-	468	35	-	0	-	-	-	-	-	0	0	0	0	-
735		272	20	-	0	-	-	-	-	-	-	0	0	0	-
TOTAL					**0**						**0**	**0**	**0**	**0**	**0**
730	550-731	170	13	-	0	-	-	-	-	-	0	0	0	0	0
732		231	17	-	0	-	-	-	-	-	0	0	0	0	-
734		228	17	-	0	-	-	-	-	-	0	0	0	0	-
736		175	13	-	0	-	-	-	-	-	-	0	0	0	-
TOTAL					**0**						**0**	**0**	**0**	**0**	**0**
BIOMASS				**15.1**	**13.4**	**8.5**	**3.8**	**2.3**	**2.6**	**1.4**	**0.7**	**0.1**	**0.1**	**0**	**0**
95 UPPER				**26.3**	**20.4**	**12.5**	**5.7**	**3.4**	**4.7**	**2.6**	**1.2**	**0.2**	**0.3**	**0**	**0**
95 LOWER				**3.9**	**6.4**	**4.5**	**1.9**	**1.2**	**0.5**	**0.2**	**0.2**	**0**	**-0.1**	**0**	**0**

Table 8 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from SPRING surveys using the ENGEL trawl, for Div. 3N, 1971-1982.

STRATUM	DEPTH (M.)	AREA (mi.)	UNITS (000)	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
375	<56	1593	120	7.2	8.2	14.6	11.3	9.6	-	7.5	3.7	7.9	6.9	8.3	7.3
376		1499	113	-	5.1	1.2	-	9.2	14.2	8.8	0.5	9.7	14.1	8.4	7.1
TOTAL				**7.2**	**13.3**	**15.8**	**11.3**	**18.8**	**14.2**	**16.3**	**4.2**	**17.6**	**21**	**16.7**	**14.4**
360	56-91	2992	225	-	13.1	-	-	2.7	28.9	12.6	9.8	6.2	18.8	17.6	8.2
361		1853	139	6.4	16.1	13	21.1	14.6	15.7	19.7	17.1	12.8	17.9	-	16.5
362		2520	189	26.5	25.1	4.2	7.4	6.3	8.3	11.8	5.4	7.6	10.1	19.7	8.9
373		2520	189	13.9	25.5	5	4.6	-	4.4	14.1	9.5	4.2	9.1	11	4.5
374		931	70	4.7	3	8.1	1.1	4.3	-	1.6	1.5	1.7	2.7	5	1.3
383		674	51	0.9	0.4	0	0	-	0	0.1	0	0	0	0.1	0.5
TOTAL				**52.4**	**83.2**	**30.3**	**34.2**	**27.9**	**57.3**	**59.9**	**43.3**	**32.5**	**58.6**	**53.4**	**39.9**
359	92-183	421	32	-	0	0	-	-	0	0	-	0	0	0	0
377		100	8	-	0	0	0	0	-	0	0	0	0	0	0
382		647	49	0	0	0	0	-	0	0	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
358	184-274	225	17	-	0	0	-	-	-	0	-	0	0	0	0
378		139	10	0	0	0	0	-	-	0	0	0	0	0	0
381		182	14	0	0	0	0	0	-	0	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
357	275-366	164	12	-	-	0	-	-	-	0	-	0	0	0	0
379		106	8	-	-	0	0	-	-	0	0	0	0	0	0
380		116	9	-	0	0	0	-	-	0	-	0	0	0	-
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
723	367-549	155	12	-	-	-	-	-	-	-	-	-	-	-	0
725		105	8	-	-	-	-	-	-	-	-	-	-	-	-
727		160	12	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
724	550-731	124	9	-	-	-	-	-	-	-	-	-	-	-	0
726		72	5	-	-	-	-	-	-	-	-	-	-	-	-
728		156	12	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BIOMASS				**59.6**	**96.5**	**46.1**	**45.5**	**46.7**	**71.5**	**76.2**	**47.5**	**50.1**	**79.6**	**70.1**	**54.3**
95 UPPER				**73.9**	**133.2**	**66.8**	**62.3**	**143.8**	**90.1**	**105.2**	**70.3**	**68.6**	**99.5**	**101.6**	**66.8**
95 LOWER				**45.3**	**59.8**	**25.4**	**28.7**	**-50.4**	**52.9**	**47.2**	**24.7**	**31.6**	**59.7**	**38.6**	**41.8**

Table 8 cont'd

STRATUM	DEPTH (m)	AREA (mi.)	UNITS (000)	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
375	<56	1593	120	21.1	11.7	27.7	17.1	8.1	2.8	13.3	1.8	16.9	7.2	1.7	8.7
376		1499	113	3.7	8.8	9.9	6.7	0.5	8.2	4.5	12.8	1.3	0.4	0.1	0.3
TOTAL				**24.8**	**20.5**	**37.6**	**23.8**	**8.6**	**11**	**17.8**	**14.6**	**18.2**	**7.6**	**1.8**	**9**
360	56-91	2992	225	27.9	12.1	3.2	2.1	0.5	6.9	1.5	2.3	4.4	1.7	0.6	9.5
361		1853	139	19.5	9.3	6.1	10.3	12.3	4	17.4	12.8	5.4	13.2	27.5	18
362		2520	189	18	6.9	13.8	9	8.3	5.8	8.7	5.8	0.6	9.9	0.3	0.1
373		2520	189	12	6	3.4	4.4	4.5	2.8	0.2	1.7	0	0	0.2	0
374		931	70	2.5	1.8	0.8	0.4	0.2	0	0.1	0	0.1	0	0	0
383		674	51	-	0	0	0	0	0	0	0	0	0	0	0
TOTAL				**79.9**	**36.1**	**27.3**	**26.2**	**25.8**	**19.5**	**27.9**	**22.6**	**10.5**	**24.8**	**28.6**	**27.6**
359	92-183	421	32	0	0	0	0	0	0	0	0	0	0	0	0
377		100	8	0	0	0	0	0	0	0	0	0	0	0	0
382		647	49	0.1	0	0	0	0	0	0	0	0	0	0	0
TOTAL				**0.1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
358	184-274	225	17	0	0	0	0	0	0	0	0	0	0	0	0
378		139	10	0	0	0	0	0	0	0	0	0	0	0	0
381		182	14	0	0	0	0	0	0	0	0	0	0	-	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
357	275-366	164	12	0	0	0	-	0	0	0	0	0	0	0	0
379		106	8	0	0	0	0	0	0	0	0	0	0	0	0
380		116	9	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
723	367-549	155	12	-	-	-	-	-	-	-	0	0	0	0	0
725		105	8	-	-	-	-	-	-	-	0	-	0	0	0
727		160	12	-	-	-	-	-	-	-	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
724	550-731	124	9	-	-	-	-	-	-	-	0	0	0	0	0
726		72	5	-	-	-	-	-	-	-	0	0	0	0	0
728		156	12	-	-	-	-	-	-	-	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BIOMASS				**104.8**	**56.6**	**64.9**	**50**	**34.4**	**30.5**	**45.7**	**37.2**	**28.7**	**32.4**	**30.4**	**36.6**
95 UPPER				**142.5**	**71.9**	**92.8**	**71**	**48.8**	**42.1**	**67.2**	**51.7**	**47.9**	**55.7**	**59.6**	**55.3**
95 LOWER				**67.1**	**41.3**	**37**	**29**	**20**	**18.9**	**24.2**	**22.7**	**9.5**	**9.1**	**1.2**	**17.9**

Table 9 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from SPRING surveys using the ENGEL trawl, for Div. 3O, 1973-1986.

STRATUM	DEPTH (m.)	AREA (mi.)	UNITS (000)	1973	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986
330	56-91	2089	157	0	0.2	0	0.3	0.9	1.6	0	0	0.3	0	1.2	0.5
331		456	34	1.1	0	0.3	-	0.2	0.2	0.1	-	0.1	0	1.3	0.1
338		1898	142	4.8	1.1	1.3	3.4	0.3	7.7	3.3	-	0.1	2.3	1.6	1
340		1716	129	-	0.1	0.3	2.9	1.3	4.2	0.2	1.9	0.5	0.4	0.9	1.1
351		2520	189	5.9	5.5	3	15.2	5	14.9	12.9	9.6	6.5	7.7	8	7.4
352		2580	194	9.2	10.7	12	14.8	17.8	15.4	13	-	7.8	5.9	5.8	6.8
353		1282	96	0	4.2	0.9	4	0.8	6.6	0	-	0.4	0.1	5.4	2.1
TOTAL				**21.0**	**21.8**	**17.8**	**40.6**	**26.3**	**50.6**	**29.5**	**11.5**	**15.7**	**16.4**	**24.2**	**19**
329	92-183	1721	129	0	-	0	0	0	0	0	0	0	0	0	0
332		1047	79	-	0.3	0.2	0.9	0.2	0.2	0	-	0	0	0	0.8
337		948	71	0	0.1	0.3	0.5	0	0	0	-	0	0	0	0
339		585	44	0.1	0	-	-	0	0	-	0	0	0	0	0
354		474	36	0	-	0.2	0.1	-	0	0	0	0	0	0	0
TOTAL				**0.1**	**0.4**	**0.7**	**1.5**	**0.2**	**0.2**	**0**	**0**	**0**	**0**	**0**	**0.8**
333	184-274	147	11	-	0	0	0	0	0	0	-	0	0	0	0
336		121	9	0	0	0	0	0	0	0	-	0	0	0	0
355		103	8	0	0	0	-	-	0	0	0	0	0	0	0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
334	275-366	96	7	-	-	0	0	0	0	0	-	0	0	0	0
335		58	4	0	-	0	-	0	0	0	-	0	0	0	0
356		61	5	0	-	-	-	-	0	0	0	-	0	0	0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
717	367-549	166	12	-	-	-	-	-	-	-	-	-	-	-	0
719		76	6	-	-	-	-	-	-	-	-	-	-	-	-
721		76	6	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL															**0**
718	550-731	134	10	-	-	-	-	-	-	-	-	-	-	-	0
720		105	8	-	-	-	-	-	-	-	-	-	-	-	-
722		93	7	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL															**0**
BIOMASS				**21.1**	**22.2**	**18.5**	**42.1**	**26.5**	**50.8**	**29.5**	**11.5**	**15.7**	**16.4**	**24.2**	**19.8**
95 UPPER				**32.3**	**34.2**	**25**	**53.5**	**63.1**	**66.5**	**39.8**	**35.3**	**21.2**	**27.1**	**33.2**	**26.9**
95 LOWER				**9.9**	**10.2**	**12**	**30.7**	**-10.1**	**35.1**	**19.2**	**-12.3**	**10.2**	**5.7**	**15.2**	**12.7**

Table 9 cont'd

STRATUM	DEPTH (m.)	AREA (mi.)	UNITS (000)	1987	1988	1989	1990	1991	1992	1993	1994	1995
330	56-91	2089	157	0.1	0.1	0.2	0.1	0.8	0	0	0	0
331		456	34	0.5	0.2	0.6	-	0	0	0	0.1	0
338		1898	142	0.3	3.3	1	0.9	0.8	1.4	0.8	0.5	0.8
340		1716	129	2.8	0.7	0.4	1.2	0.3	0.2	0.2	0	0
351		2520	189	3.7	6.9	4.1	5.2	2.5	0.6	0.4	0	0.1
352		2580	194	10	4.8	5.2	7	9.6	4.4	0.2	5.2	3.4
353		1282	96	10.2	0.2	0.6	1.2	1.7	0.5	0.5	0.1	3.9
TOTAL				**27.6**	**16.2**	**12.1**	**15.6**	**15.7**	**7.1**	**2.1**	**5.9**	**8.2**
329	92-183	1721	129	0	0	0	0	0	0	0	0	0
332		1047	79	0.5	0	1	0.1	0.1	0	0.5	0	0.1
337		948	71	0	0.1	0.1	0	0	0	0.3	0	0
339		585	44	0	0	0	0	0	0	0	0	0
354		474	36	0	0	0	0	0.1	0	0	0	0
TOTAL				**0.5**	**0.1**	**1.1**	**0.1**	**0.2**	**0**	**0.8**	**0**	**0.1**
333	184-274	147	11	0	0	0	0	0	0	0	0	0
336		121	9	0	0	0	0	0	0	0	0	0
355		103	8	0	0	0	0	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
334	275-366	96	7	0	0	0	0	0	0	0	0	0
335		58	4	0	0	0	0	0	0	0	0	0
356		61	5	0	0	0	0	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
717	367-549	166	12	-	-	-	-	0	0	0	0	0
719		76	6	-	-	-	-	0	0	0	0	0
721		76	6	-	-	-	-	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
718	550-731	134	10	-	-	-	-	0	0	0	0	0
720		105	8	-	-	-	-	0	0	0	0	0
722		93	7	-	-	-	-	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BIOMASS				**28.1**	**16.3**	**13.2**	**15.7**	**15.9**	**7.1**	**2.9**	**5.9**	**8.3**
95 UPPER				**40.7**	**22.8**	**17.6**	**23.9**	**25.6**	**11.9**	**5.7**	**10.5**	**14.9**
95 LOWER				**15.5**	**9.8**	**8.8**	**7.5**	**6.2**	**2.3**	**0.1**	**1.3**	**1.7**

Table 13. Abundance index (millions) of yellowtail from Canadian spring groundfish surveys in Div. 3LNO based on Engel 145 high lift trawl units and 1996 based on Campelen 1800 shrimp trawl units.

Age	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	
1	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.1	0.00	0.00	
2	0.0	0.0	0.0	0.2	0.1	0.1	0.0	1.4	0.00	0.00	
3	0.8	3.9	0.2	2.9	0.9	5.0	1.1	5.5	0.3	0.7	
4	12.7	16.5	3.1	9.9	6.0	11.1	2.0	18.8	3.5	2.5	
5	63.8	73.8	18.6	38.2	12.6	37.9	8.8	38.6	26.4	12.9	
6	92.1	100.7	45.5	70.4	50.3	97.7	37.9	56.1	94.0	52.8	
7	106.8	92.5	121.7	73.1	129.2	140	97.3	87.4	131	90.9	
8	26.0	18.7	99.5	38.2	61.8	45.4	101.8	56.7	56.5	42.1	
9	2.9	0.4	27.7	4	7.2	3.1	19.6	13.9	4.4	3.3	
10	0.2	0.00	4.2	0.1	0.9	0.1	5.3	2.0	0.1	0.3	
11	0.0	0.1	0.3	0.00	0.00	0.0	0.0	0.3	0.0	0.0	
Total											
1+	305.3	306.6	320.8	237	269	340.4	273.8	280.8	316.2	205.5	
5+	291.8	286.2	317.5	224	262	324.2	270.7	255	312.4	202.3	
7+	135.9	111.7	253.4	115.4	199.1	188.6	224	160.3	192	136.6	
Age	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	1.0
2	0.00	0.00	0.1	0.2	0.00	0.1	0.1	0.00	0.0	0.0	29.1
3	0.1	0.1	0.1	2.4	0.8	0.4	1.0	0.5	0.3	0.1	88.2
4	1.8	0.5	1.2	23.8	7.9	5.6	5.2	7.6	2.0	2.8	120.3
5	11.8	6.4	1.6	25.9	22.1	27.0	11.0	18.4	9.2	3.3	97.3
6	30.3	20.2	9.5	27.3	29.3	39.3	26.3	39.2	24.0	32.4	96.7
7	93.7	56.5	31.8	33.5	45.6	39.3	26.1	41.7	30.5	38.8	126.6
8	45.7	76.3	45.8	17.2	38.6	19.6	12.0	15.0	14.1	19.1	62.9
9	6.6	7.6	9.1	1.7	4.9	2.8	2.7	1.5	1.0	0.1	1.2
10	0.5	0.6	0.4	0.1	0.4	0.00	0.0	0.0	0.0	0.0	0.0
11	0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Total											
1+	190.5	168.2	99.6	132.1	149.6	134.1	84.4	123.9	81.1	96.6	623.3
5+	188.6	167.6	98.2	105.7	140.9	128.0	78.1	115.8	78.8	93.7	384.7
7+	146.5	141	87.1	52.5	89.5	61.7	40.8	58.2	45.6	58.0	190.7

Table 11. Biomass at age of yellowtail flounder from Canadian spring surveys in Div. 3LNO from 1990-95 estimated by taking average weights from Div. 3N in each year and multiplying by population numbers at age.

Age	1990	Av. Wt	Biomass	1991	Av. Wt	Biomass	1992	Av. wt	Biomass	1993	Av. wt	Biomass	1994	Av. wt	Biomass	1995	Av. wt	Biomass
1	0.0			0.0			0.0			0.0			0.0			0.0		
2	0			0.1			0.1			0.0			0.0			0.0		
3	0.8			0.4			1.0			0.5			0.3			0.1	0.04	**0.004**
4	7.9	0.07	**0.553**	5.6	0.09	**0.504**	5.2	0.1	**0.52**	7.6	0.11	**0.836**	2.0	0.11	**0.22**	2.8	0.11	**0.308**
5	22.1	0.14	**3.094**	27	0.17	**4.59**	11	0.19	**2.09**	18.4	0.19	**3.496**	9.2	0.2	**1.84**	3.3	0.19	**0.627**
6	29.3	0.26	**7.618**	39.3	0.34	**13.362**	26.3	0.32	**8.416**	39.2	0.32	**12.544**	24	0.32	**7.68**	32.4	0.31	**10.044**
7	45.6	0.45	**20.52**	39.3	0.51	**20.043**	26.1	0.49	**12.789**	41.7	0.5	**20.85**	30.5	0.46	**14.03**	38.8	0.49	**19.012**
8	38.6	0.69	**26.634**	19.6	0.77	**15.092**	12	0.75	**9**	15	0.78	**11.7**	14.1	0.75	**10.575**	19.1	0.79	**15.089**
9	4.9	1.09	**5.341**	2.8	1.08	**3.024**	2.7	1.12	**3.024**	1.5	1.24	**1.86**	1.0	1.18	**1.18**	0.1	1.23	**0.123**
10	0.4			0.0			0.0			0.0			0.0			0.0		
11	0.00			0.0			0.0			0.0			0.0			0.0		
Estimated Biomass ('000t)			**63.76**			**56.615**			**35.839**			**51.286**			**35.525**			**45.207**
Derived Biomass ("000t)			**59.8**			**53.7**			**36.0**			**59.5**			**36.5**			**44.8**

Table 12 Biomass estimates ('000t) of YELLOWTAIL FLOUNDER by depth and stratum from the Campelen shrimp trawl surveys in Div. 3L from 1995-97

STRATUM	DEPTH (m.)	AREA (mi.)	UNITS (000)	1995 Fall	1996 Spring	1996 Fall	1997 Spring
350	56-91	2071	284.9	0.0(8)	0.2(9)	0.0(2)	No data
363		1780	244.9	0.6(7)	0.5(8)	0.4(6)	
371		1121	154.2	0.0(5)	0.0(5)	0.0(4)	
372		2460	338.4	0.6(5)	0.4(11)	1.8(9)	
384		1120	154.1	0.0(5)	0.0(5)	0.0(4)	
TOTAL				**1.2**	**1.1**	**2.2**	
328	92-183	1519	209	0.0(6)	0.0(7)	0.0(5)	
341		1574	216.5	0.0(6)	0.0(7)	0.0(6)	
342		585	80.5	0.0(2)	0.0(3)	0.0(2)	
343		525	72.2	0.0(2)	0.0(2)	0.0(2)	
348		2120	291.6	0.0(7)	0.0(10)	0.0(7)	
349		2114	290.8	0.0(9)	0.0(9)	0.0(7)	
364		2817	387.6	0.0(9)	0.0(13)	0.0(10)	
365		1041	143.2	0.0(4)	0.0(5)	0.0(4)	
370		1320	181.6	0.0(5)	0.0(6)	0.0(4)	
385		2356	324.1	0.0(9)	0.0(11)	0.0(9)	
390		1481	203.7	0.0(6)	0.0(7)	0.0(5)	
TOTAL				**0.0**	**0.0**	**0.0**	
344	184-274	1582	217.6	0.0(5)	0.0(7)	0.0(6)	
347		983	135.2	0.0(4)	0.0(4)	0.0(3)	
366		1394	191.8	0.0(5)	0.0(5)	0.0(5)	
369		961	132.2	0.0(3)	0.0(4)	0.0(2)	
386		983	135.2	0.0(4)	0.0(4)	0.0(3)	
389		821	112.9	0.0(3)	0.0(4)	0.0(3)	
391		282	38.8	0.0(2)	0.0(2)	0.0(2)	
TOTAL				**0.0**	**0.0**	**0.0**	
345	275-366	1432	197	0.0(7)	0.0(6)	0.0(5)	
346		865	119	0.0(3)	0.0(4)	0.0(3)	
368		334	46	0.0(2)	0.0(3)	0.0(3)	
387		718	98.8	0.0(3)	0.0(3)	0.0(2)	
388		361	49.7	0.0(2)	0.0(3)	0.0(2)	
392		145	20	0.0(2)	0.0(2)	0.0(2)	
TOTAL				**0.0**	**0.0**	**0.0**	
729	367-549	186	25.6	0.0(2)	0.0(2)	0.0(2)	
731		216	29.7	0.0(2)	0.0(3)	-	
733		468	64.4	0.0(3)	0.0(3)	0.0(3)	
735		272	37.5	0.0(2)	0.0(3)	0.0(2)	
TOTAL				**0.0**	**0.0**	**0.0**	
730	550-731	170	23.4	0.0(2)	0.0(2)	0.0(2)	
732		231	31.8	0.0(2)	0.0(2)	0.0(2)	
734		228	31.4	0.0(2)	0.0(2)	0.0(2)	
736		175	24.1	0.0(2)	0.0(2)	0.0(2)	
TOTAL				**0.0**	**0.0**	**0.0**	
Mean Wt(#sets)				**0.7(166)**	**0.2(188)**	**0.4(211)**	
BIOMASS('000t)				**1.2**	**1.1**	**2.2**	
95 UPPER				**0.3**	**1.7**	**5.3**	
95 LOWER				**2.2**	**0.5**	**-0.8**	

Table 13 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from Campelen shrimp trawl surveys in Div. 3N from 1995-97.

STRATUM	DEPTH (M.)	AREA (mi.)	UNITS (000)	1995 Fall	1996 Spring	1996 Fall	1997* Spring
375	<56	1593	219.1	14.8(9)	17.3(6)	12.0(6)	19.1
376		1499	206.2	24.5(9)	1.1(5)	24.2(8)	25.5
TOTAL				**39.3**	**18.4**	**36.2**	**44.6**
360	56-91	2992	411.6	16.3(17)	28.2(11)	36.8(10)	17.4
361		1853	254.9	34.1(11)	26.1(17)	31.2(10)	26.3
362		2520	346.7	12.1(5)	28.9(9)	8.0(6)	33.9
373		2520	346.7	1.0(5)	0.7(9)	0.0(7)	0.3
374		931	128.1	0.0(2)	0.9(3)	1.0(2)	0.4
383		674	92.7	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**63.5**	**84.8**	**77.0**	**78.3**
359	92-183	421	57.9	0.0(2)	0.0(2)	0.0(2)	0.0
377		100	13.8	0.0(2)	0.0(2)	0.0(2)	0.0
382		647	89	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
358	184-274	225	30.9	0.0(2)	0.0(2)	0.0(2)	0.0
378		139	19.1	0.0(2)	0.0(2)	0.0(2)	0.0
381		182	25	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
357	275-366	164	22.6	0.0(2)	0.0(2)	0.0(2)	0.0
379		106	14.6	0.0(2)	0.0(2)	0.0(2)	0.0
380		116	16	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
723	367-549	155	21.3	0.0(2)	0.0(2)	0.0(2)	0.0
725		105	14.4	0.0(2)	0.0(2)	0.0(2)	0.0
727		160	22	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
724	550-731	124	17.1	0.0(2)	0.0(2)	0.0(2)	0.0
726		72	9.9	0.0(2)	0.0(2)	0.0(2)	0.0
728		156	21.6	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
Mean Wt.(#sets)				42.8(90)	43.3(82)	47.1(82)	
BIOMASS('000t)				102.8	103.1	113.2	123.1
95 UPPER				135.7	129.7	156.1	
95 LOWER				69.9	78.1	70.3	

*Preliminary estimate

Table 14 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from Campelen shrimp trawl surveys of Div. 3O from 1995-97

STRATUM	DEPTH (m.)	AREA (mi.)	UNITS (000)	1995 Fall	1996 Spring	1996 Fall	1997* Spring
330	56-91	2089	287.4	1.1(5)	0.3(8)	0.0(6)	0.1
331		456	62.7	0.0(2)	0.0(2)	0.0(2)	0.1
338		1898	261.1	7.2(5)	8.0(7)	0.0(2)	7.1
340		1716	236.1	0.5(4)	0.0(6)	0.0(5)	0.8
351		2520	346.7	2.2(7)	4.7(8)	1.3(6)	10.0
352		2580	354.9	13.7(17)	46.0(9)	15.2(7)	28.0
353		1282	176.4	0.8(3)	10.7(5)	0.7(2)	11.1
TOTAL				**25.5**	**69.8**	**17.2**	**57.2**
329	92-183	1721	236.7	0.0(5)	0.0(6)	0.0(5)	0.0
332		1047	144	0.1(3)	0.5(4)	0.2(2)	0.0
337		948	130.4	0.0(2)	0.0(2)	1.3(2)	0.9
339		585	80.5	0.0(2)	0.0(2)	0.0(3)	0.0
354		474	65.2	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.1**	**0.5**	**1.5**	**0.9**
333	184-274	147	20.2	0.0(2)	0.0(2)	-	0.00
336		121	16.7	0.0(2)	0.0(2)	0.0(2)	0.00
355		103	14.2	0.0(2)	0.0(2)	0.0(2)	0.00
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
334	275-366	96	13.2	0.0(2)	0.0(2)	-	0.0
335		58	8	0.0(2)	0.0(2)	0.0(2)	0.0
356		61	8.4	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
717	367-549	166	22.8	0.0(2)	0.0(2)	-	0.0
719		76	10.5	0.0(2)	0.0(2)	0.0(2)	0.0
721		76	10.5	0.0(2)	0.0(2)	0.0(2)	0.0
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
718	550-731	134	18.4	0.0(2)	0.0(2)	-	0.00
720		105	14.4	0.0(2)	0.0(2)	0.0(2)	0.00
722		93	12.8	0.0(2)	0.0(2)	0.0(2)	0.00
TOTAL				**0.0**	**0.0**	**0.0**	**0.0**
Mean Wt(#sets)				10.1(81)	27.6(86)	7.6(60)	
BIOMASS('000t)				25.7	70.5	18.9	57.9
95 UPPER				38.4	96.3	31.5	
95 LOWER				13.1	44.9	6.2	

*Preliminary estimate

Table 15. Biomass at age of yellowtail flounder from Div. 3LNO derived from multiplying population numbers at age by average weights at age from Div. 3N samples from each spring and fall survey using the Campelen Trawl, 1996-97

	Age	1995 Fall	Wt-age	Biomass	1996 Spring	Wt-age	Biomass	1996 Fall	Wt-age	Biomass
	1	8.8	0.01	0.088	1.0	0.01	0.01	0.9	0.01	0.009
	2	83.9	0.02	1.678	29.1	0.01	0.291	17.4	0.01	0.174
	3	122.4	0.04	4.896	88.2	0.03	2.646	63.7	0.04	2.548
	4	89.7	0.1	8.97	120.3	0.09	10.827	132.2	0.09	11.898
	5	71.2	0.19	13.528	97.3	0.18	17.514	144.2	0.16	23.072
	6	88.2	0.31	27.342	96.7	0.29	28.043	98.6	0.29	28.594
	7	83.7	0.47	39.339	126.6	0.49	62.034	82.7	0.48	39.696
	8	43.3	0.77	33.341	62.9	0.83	52.207	36.9	0.73	26.937
	9	1.0	1.18	1.18	1.2	1.37	1.644	0.7	1.3	0.91
	10	0.0			0.0			0.0		
Estimated Biomass (000't) for Ages 7+				**73.8**			**115.8**			**67.5**
Estimated Biomass ('000t) for Ages 4+				**130.4**			**175.2**			**133.8**
Derived Biomass ('000t) for Ages 1+				**129.7**			**175.3**			**137.4**

Table 16 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from FALL surveys using the ENGEL trawl, for Div. 3L, 1990-1994.

STRATUM	DEPTH (m)	AREA (mi.)	UNITS (000	1990	1991	1992	1993	1994
784	<56	268	20	0	0	0	0	0
350	56-91	2071	155	0.5	0	0	0	0
363		1780	134	0.5	0.1	0.2	0	0
371		1121	84	0	0	0	-	0
372		2460	185	0.4	0.5	0.3	0.7	0
384		1120	84	0	0	0	0	0
TOTAL				**1.4**	**0.6**	**0.5**	**0.7**	**0**
328	92-183	1519	114	0	0	0	0	0
341		1574	118	0	0	0	0	0
342		585	44	0	0	0	0	0
343		525	39	0	0	0	0	0
348		2120	159	0	0	0	-	0
349		2114	159	0	0	0	0	0
364		2817	211	0	0	0	0	0
365		1041	78	0	0	0	0	0
370		1320	99	0	0	0	0	0
385		2356	177	0	0	0.4	0	0
390		1481	111	0	0	0	0	0
TOTAL				**0**	**0**	**0.4**	**0**	**0**
344	184-274	1582	119	0	0	0	0	0
347		983	74	0	0	0	0	0
366		1394	105	0	0	0	0	0
369		961	72	0	0	0	0	0
386		983	74	0	0	0	0	0
389		821	62	0	0	0	0	0
389		821	62	0	0	0	0	0
391		282	21	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
345	275-366	1432	107	0	0	0	0	0
346		865	65	0	0	0	0	0
368		334	25	0	0	0	0	0
387		718	54	0	0	0	0	0
388		361	27	0	0	-	0	0
392		145	11	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
729	367-549	186	14	0	0	0	0	0
731		216	16	0	0	0	0	0
733		468	35	0	0	0	0	0
735		272	20	-	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
730	550-731	170	13	-	0	0	0	0
732		231	17	0	0	0	0	0
734		228	17	0	0	0	0	0
736		175	13	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
BIOMASS				**1.4**	**0.6**	**0.9**	**0.7**	**0**
95 UPPER				**2.8**	**1**	**1.4**	**1.7**	**0**
95 LOWER				**0**	**0.2**	**0.4**	**-0.3**	**0**

Table 17 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from Fall surveys using the ENGEL trawl, for Div. 3N, 1990-1994.

STRATUM	DEPTH (m.)	AREA (mi.)	units (000)	1990	1991	1992	1993	1994
375	<56	1593	120	1.7	3.3	-	5.4	21
376		1499	113	12.5	4.5	4.1	15.7	5.2
TOTAL				**14.2**	**7.8**	**4.1**	**21.1**	**26.2**
360	56-91	2992	225	2.9	4.3	5.3	14	6.6
361		1853	139	6.4	11.1	15.6	19.3	26.6
362		2520	189	4.4	4.1	0.6	0.2	0.6
373		2520	189	0.1	0.3	0	0	0.5
374		931	70	0	0.1	-	0	-
383		674	51	0	0	-	0	0
TOTAL				**13.8**	**19.9**	**21.5**	**33.5**	**34.3**
359	92-183	421	32	0	0	0	0	0
377		100	8	0	-	0	0	0
382		647	49	0	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
358	184-274	225	17	0	0	0	0	0
378		139	10	0	0	0	0	0
381		182	14	-	0	-	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
357	275-366	164	12	0	0	0	0	0
379		106	8	0	-	0	0	0
380		116	9	-	0	-	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
723	367-549	155	12	-	0	-	0	0
725		105	8	-	-	0	0	0
727		160	12	-	-	-	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
724	550-731	124	9	-	0	-	0	0
726		72	5	-	-	-	0	0
728		156	12	-	-	-	-	0
TOTAL				**0**	**0**	**0**	**0**	**0**
BIOMASS				**28**	**27.7**	**25.6**	**54.6**	**60.5**
95 UPPER				**51.2**	**46.3**	**46.6**	**85.7**	**102.9**
95 LOWER				**4.8**	**9.1**	**4.6**	**23.5**	**18.2**

Table 18 Biomass estimates (000t) of YELLOWTAIL FLOUNDER by depth and stratum from Fall surveys using the ENGEL trawl, for Div. 3O, 1991-1994.

STRATUM	DEPTH (m)	AREA (mi.)	UNITS (000	1990	1991	1992	1993	1994
330	56-91	2089	157	0.1	0	0.1	0.3	0
331		456	34	0.1	0.6	0.2	0.3	0
338		1898	142	0.6	1.3	0.2	0.7	0
340		1716	129	0.4	2.6	0	0.2	0.1
351		2520	189	3.5	1.4	0.1	3.2	0.5
352		2580	194	4.6	13.3	10.9	5.5	5.7
353		1282	96	1.6	0	0	0.4	0
TOTAL				**10.9**	**19.2**	**11.5**	**10.6**	**6.3**
329	92-183	1721	129	0.1	0	0	0	0
332		1047	79	0	0	0.1	0.6	0.2
337		948	71	0	0	0	0	0
339		585	44	0	0.1	0	0	0
354		474	36	0	0	0	0	0
TOTAL				**0.1**	**0.1**	**0.1**	**0.6**	**0.2**
333	184-284	147	11	0	0	0	0	0
336		121	9	0	0	0	0	0
355		103	8	-	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
334	285-366	96	7	0	0	0	0	0
335		58	4	0	0	0	0	0
356		61	5	-	0	0	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
717	367-549	166	12	0	-	-	0	0
719		76	6	0	0	-	0	0
721		76	6	-	0	-	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
718	550-731	134	10	-	-	-	0	0
720		105	8	-	-	-	0	0
722		93	7	-	0	-	0	0
TOTAL				**0**	**0**	**0**	**0**	**0**
BIOMASS				**11**	**19.3**	**11.6**	**11.2**	**6.5**
95 UPPER				**16.7**	**28.4**	**26**	**18.5**	**12.7**
95 LOWER				**5.3**	**10.2**	**-2.8**	**3.9**	**0.3**

Table 19. Abundance index (millions) of yellowtail from Canadian fall groundfish surveys in Div. 3LNO using the Engel 145 otter trawl from 1990-94and 1995 and 1996 using the Campelen 1800 shrimp trawl

Age	1990	1991	1992	1993	1994		1995	1996	
0	-	-	-	-	-	-	-	2.3	
1	0.0	0.0	0.0	0.0	0.0		8.8	0.9	
2	0.1	0.1	0.1	0.0	0.1		83.9	17.4	
3	2.2	2.4	1.2	0.7	0.4		122.4	63.7	
4	5.9	6.6	5.9	22.3	4.6		89.7	132.2	
5	16.9	15.1	10.0	35.6	15.4		71.2	144.2	
6	22.9	33.8	18.5	46.2	39.8		88.2	98.6	
7	30.3	36	31.1	40.6	48.2		83.7	82.7	
8	13.4	20.9	17.6	13.8	35.5		43.3	36.9	
9	1.4	2.2	2.8	0.8	1.0		1.0	0.7	
10	0.00	0.00	0.00	0.00	0.00		0.0	0.0	
Total									
1+	93.1	117.1	87.2	160.0	145.0		592.1	579.5	
5+	84.9	108.0	80.0	137.0	139.9		287.4	363.1	
7+	45.1	59.1	51.5	55.2	84.7		128.0	120.3	

Table [illegible]. Biomass at age of yellowtail flounder from Div. 3LNO estimated by taking average weights from Div. 3N in each year and multiplying by population numbers at age from the fall surveys in 1990-94.

Age	1990	Wt-age	Biomass	1991	Wt-Age	Biomass	1992	Wt-age	Biomass	1993	Wt at age	Biomass	1994	Wt-age	Biomass
1	0.0			0.0			0.0			0.0			0.0		
2	0.1			0.1			0.1			0.0			0.1		
3	2.2			2.4			1.2			0.7			0.4		
4	5.9	0.15	**0.885**	6.6	0.1	**0.66**	5.9	0.11	**0.649**	22.3	0.1	**2.23**	4.6	0.11	**0.506**
5	16.9	0.23	**3.887**	15.1	0.18	**2.718**	10.0	0.19	**1.9**	35.6	0.2	**7.12**	15.4	0.2	**3.08**
6	22.9	0.41	**9.389**	33.8	0.31	**10.478**	18.5	0.31	**5.735**	46.2	0.32	**14.784**	39.8	0.33	**13.134**
7	30.3	0.65	**19.695**	36	0.47	**16.92**	31.1	0.47	**14.617**	40.6	0.48	**19.488**	48.2	0.49	**23.618**
8	13.4	0.87	**11.658**	20.9	0.69	**14.421**	17.6	0.7	**12.32**	-13.8	0.72	**9.936**	35.5	0.74	**26.27**
9	1.4	1.17	**1.638**	2.2	0.98	**2.156**	2.8	0.97	**2.716**	0.8	1.16	**0.928**	1.0	1.08	**1.08**
10	0.00			0.00			0.00			0.00			0.00		
9	1.4			2.2			2.8			0.8			1.0		
10	0.00			0.00			0.00			0.00			0.00		
Estimated Biomass ('000t)			**47.152**			**47.353**			**37.937**			**54.486**			**67.688**
Derived Biomass ('000t)			**40.4**			**47.6**			**38.1**			**66.5**			**67.0**

Table 21 Summary of yield per recruit (M=0.3) calculations for yellowtail flounder in Divisions 3LNO (reprinted from Brodie and Pitt 1983)

		age	**wt-at-age**	**partial rec.**		
		4	0.247	0.01		
		5	0.305	0.13		
		6	0.456	0.46		
		7	0.610	1.00		
		8	0.725	1.00		
		9	0.842	1.00		
		10	1.030	1.00		
		11	1.103	1.00		
	F	**Catch**	**Yield**	**Av. Wt.**	**Y/effort**	
	0.1000	0.1130	0.0760	0.670	2.1100	
	0.2000	0.1910	0.1230	0.6420	1.7090	
	0.3000	0.2470	0.1520	0.6160	1.4150	
	0.4000	0.2890	0.1710	0.5930	1.1940	
	0.5000	0.3210	0.1840	0.5740	1.0260	
$F_{0.1}$	0.5176	0.3250	0.1860	0.5710	1.0000	
	0.6000	0.3460	0.1920	0.5560	0.8940	
	0.7000	0.3660	0.1980	0.5410	0.7900	
	0.8000	0.3840	0.2030	0.5280	0.70600	
	0.9000	0.3980	0.2060	0.5160	0.63700	
	1.0000	0.4110	0.2080	0.5060	0.57900	
	1.1000	0.4230	0.2100	0.4960	0.53100	
	1.2000	0.4330	0.2110	0.4880	0.4900	
	1.3000	0.4420	0.2120	0.4800	0.4550	
	1.4000	0.4500	0.2130	0.4730	0.4240	
	1.5000	0.4580	0.2130	0.4660	0.3970	
F_{max}	2.6164	0.5160	0.2160	0.4180	0.2300	

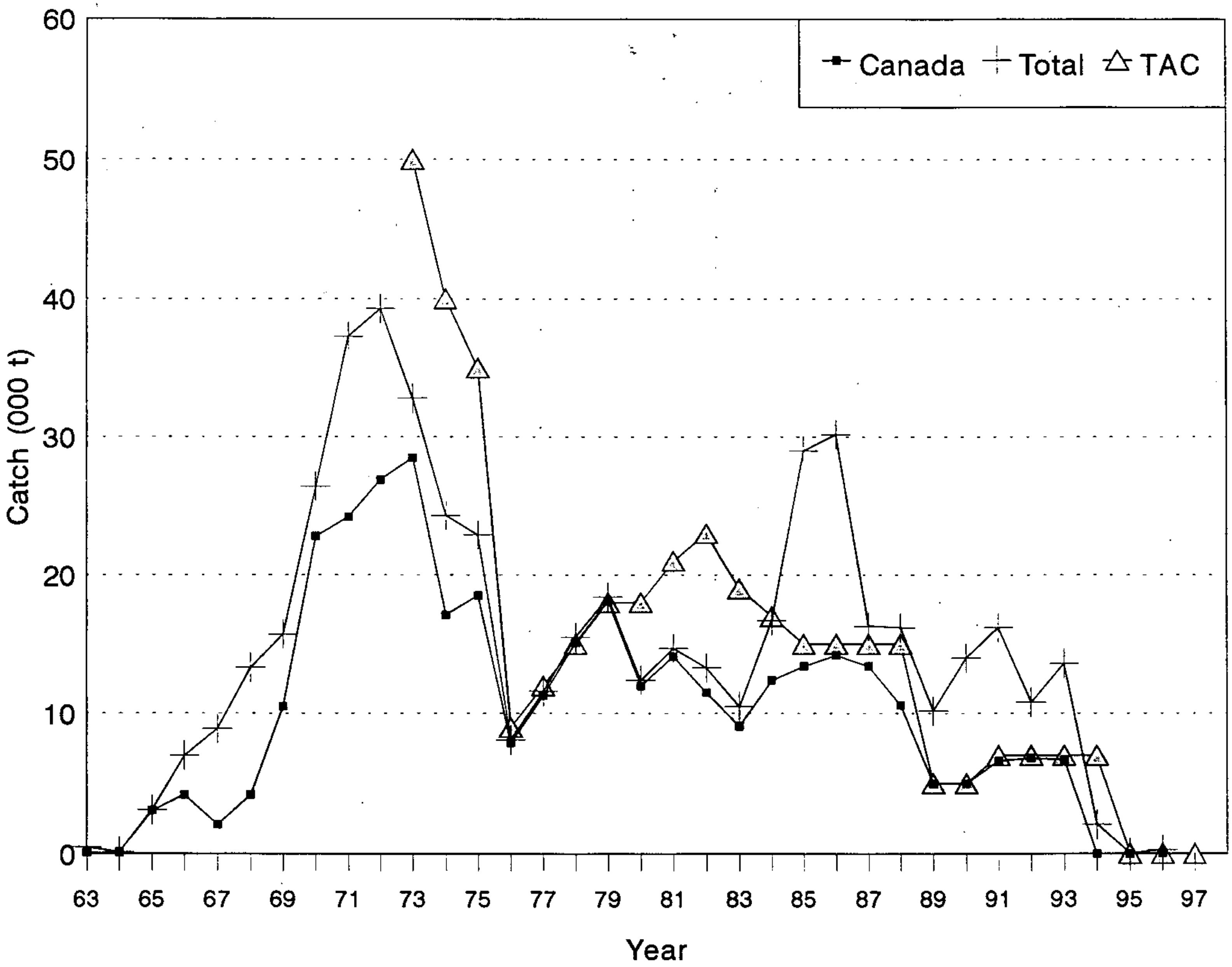


Fig. 1. Catches and TAC's of yellowtail in Div. 3LNO.

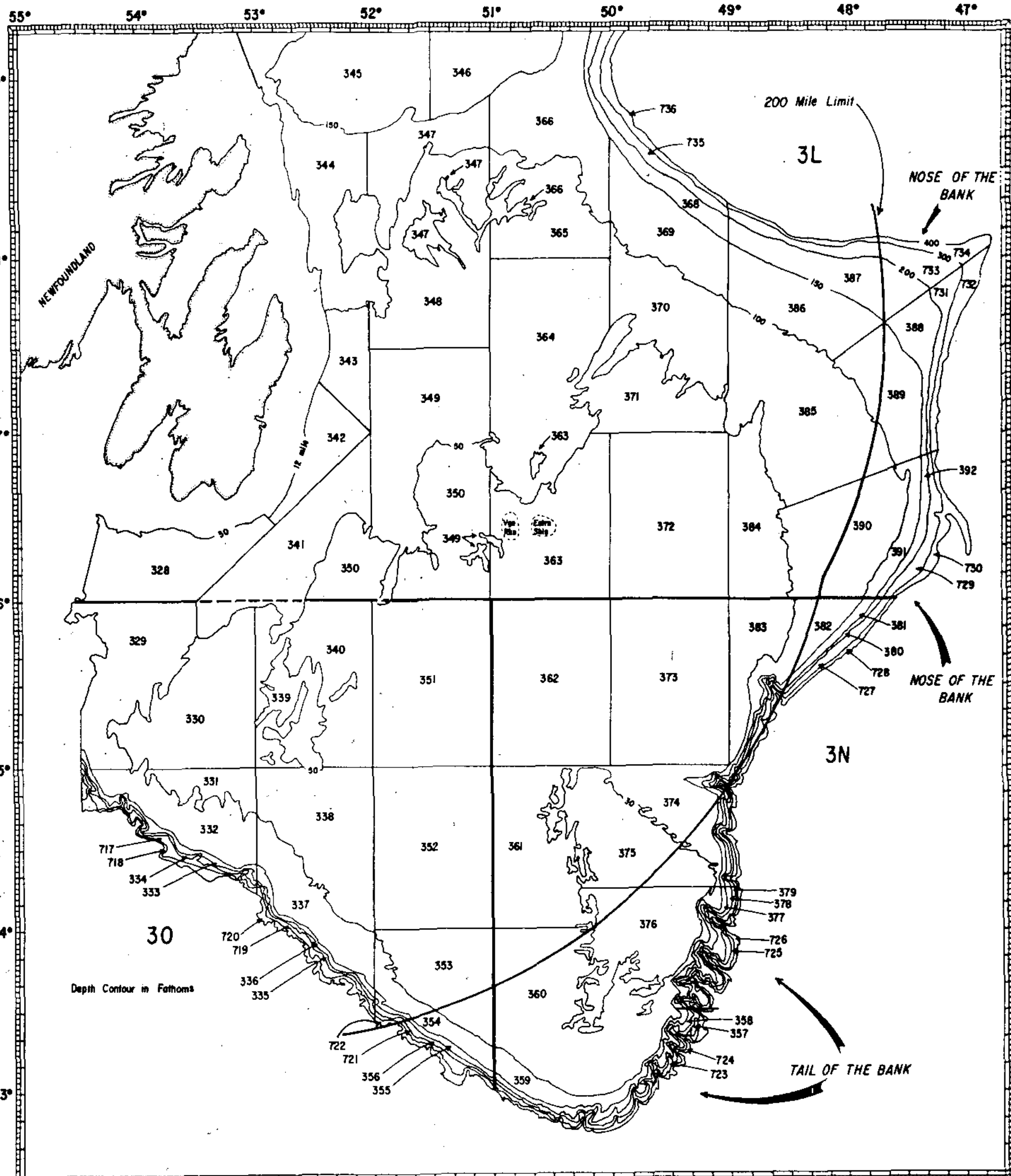


Fig. 2. Depth stratification chart (max. 731m) of the Grand Bank, NAFO Div. 3LNO used in the annual spring and fall groundfish surveys.

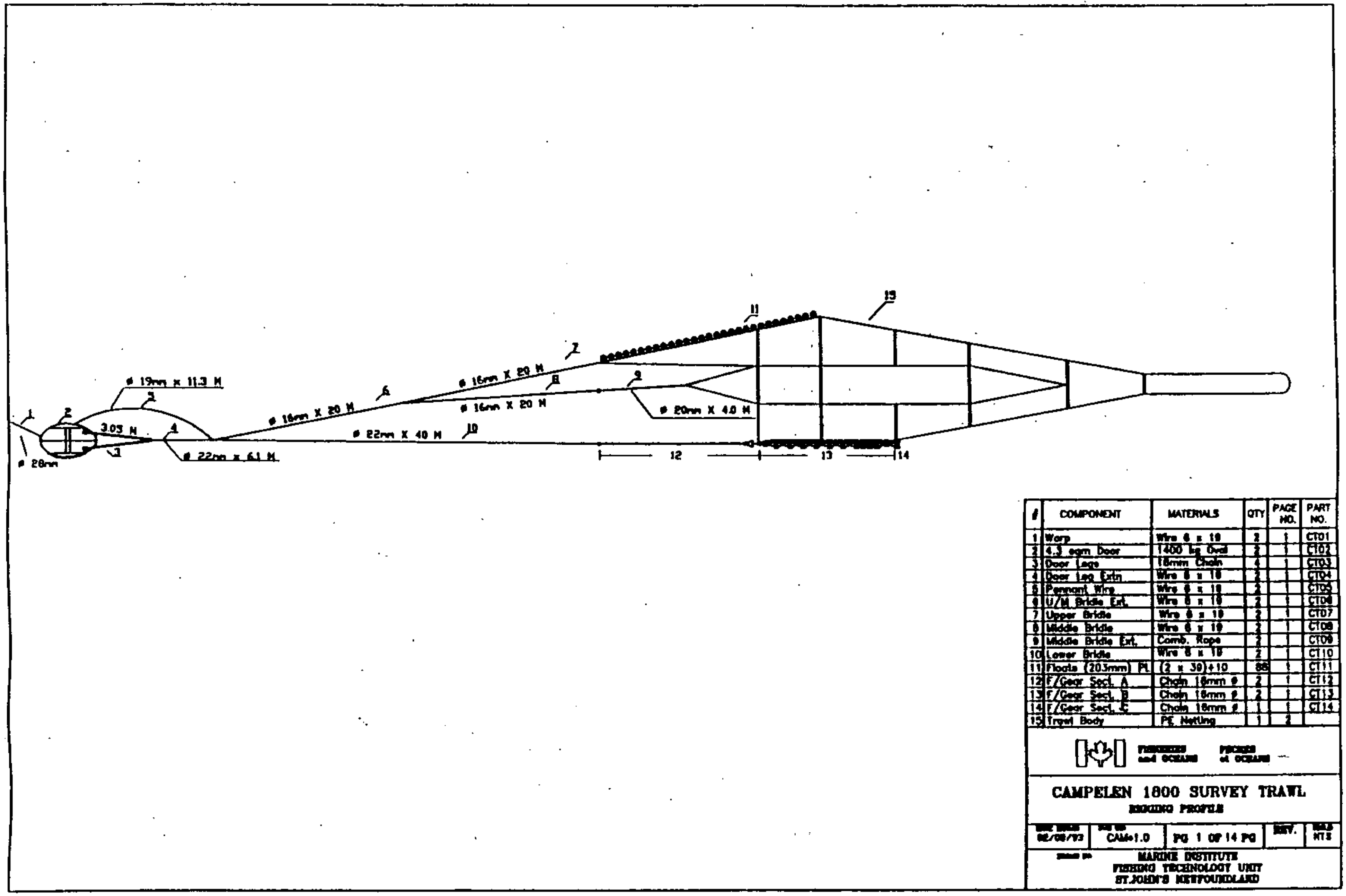


Figure [illegible]. Rigging diagram of the Campelen 1800 Shrimp trawl as used on the FRV's Wilfred Templeman and Teleost.

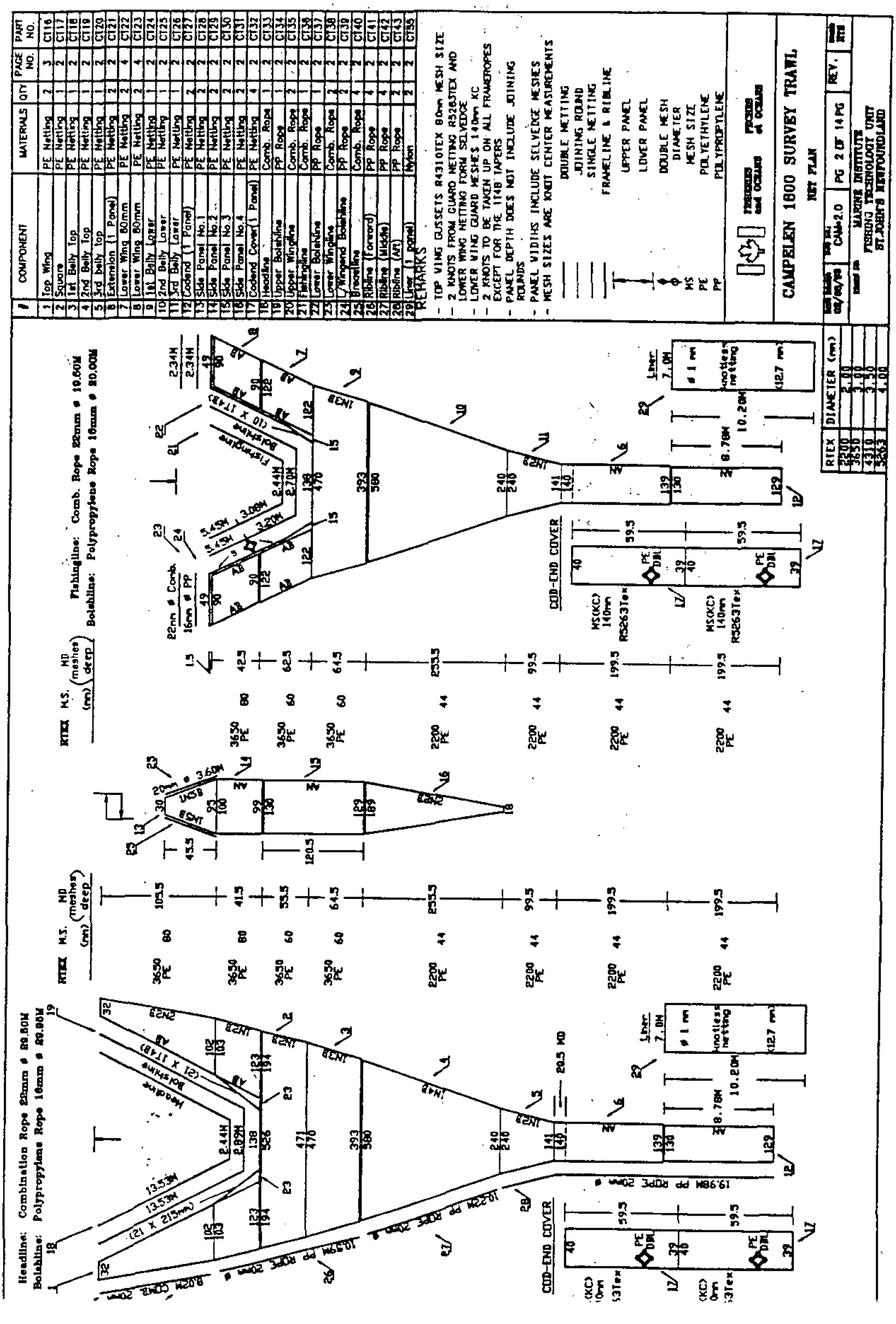
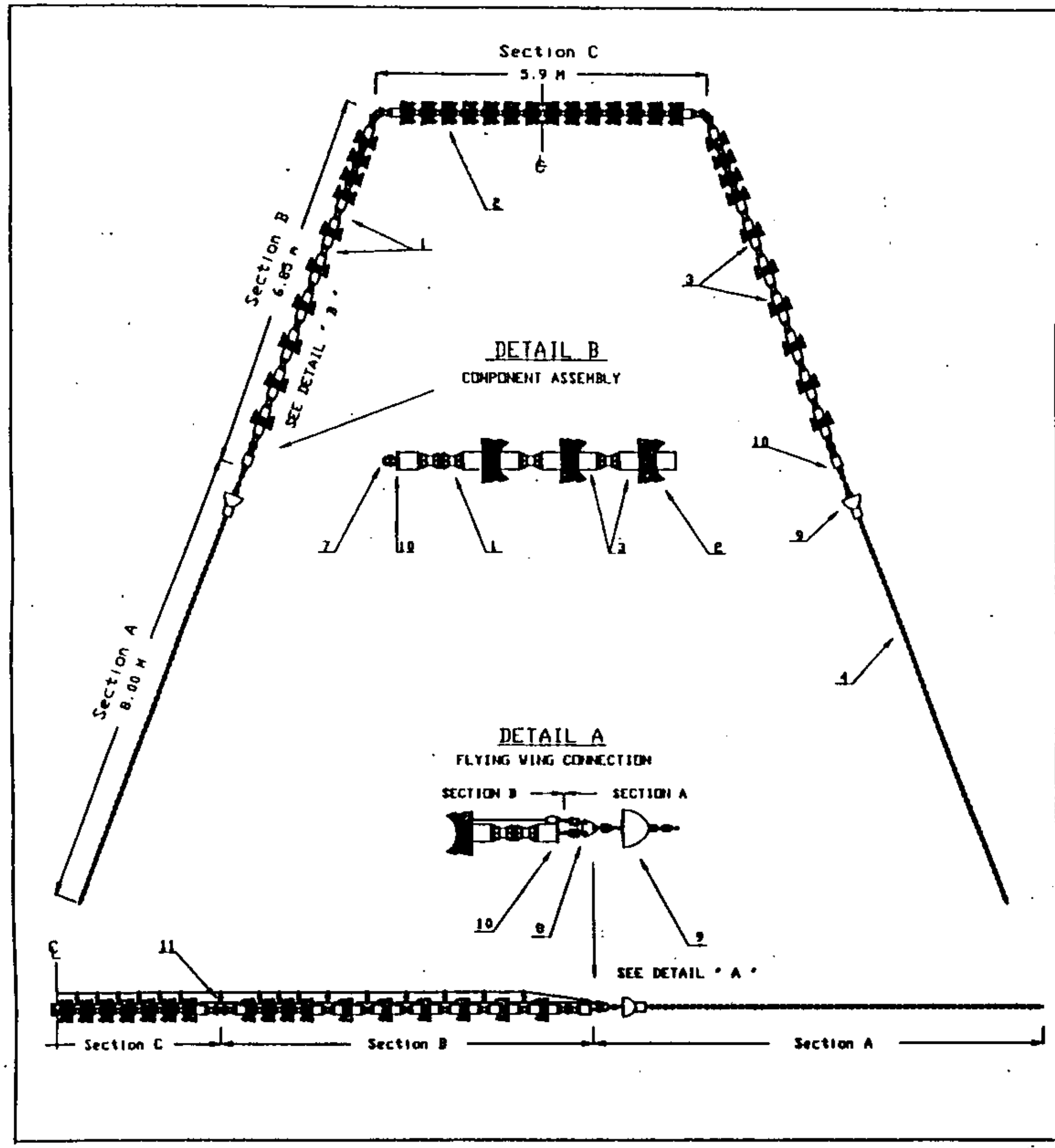


Figure [illegible]. Trawl plan of the Campelen 1800 Shrimp trawl as used on the FRV's Wilfred Templeman and Teleost.



DRAWING NOTES:

- GROUND GEAR IS SYMMETRICAL ABOUT CENTERLINE.
- LENGTHS FOR SECTION B & C ARE MEASURED FROM CENTRE HAMMERLOCK TO CENTRE HAMMERLOCK.
- LENGTH OF SECTION A IS MEASURED FROM CENTRE HAMMERLOCK TO END OF CHAIN (SEE DETAIL A).

#	COMPONENT	WEIGHT (KGS) (IN SEAWATER)		NUMBERS				Page NO.	PART NO
		UNIT	TOTAL	TOTAL	SECT. A	SECT. B	SECT. C		
1	8" (200mm) Iron Spacer	5.29	206.31	39	0	2x12	1x15	8	CT44
2	14" Rockhopper Sets of 3 Disk	0.55	56.1	34X3	0	2x10	1x14	9	CT45
3	7" (178MM) Rubber Spacer	0.43	14.62	34	2X1	2x15	1x2	10	CT46
4	5/8" (16mm) Mid Link Chain	4.96/M	74.30	14.98	2x7.49m				CT12
5	5/8" (16mm) Mid Link Chain	4.96/M	66.96	13.5m		2x6.75m			CT13
6	5/8" (16mm) Mid Link Chain	4.96/M	28.76	5.80m			1X5.80m		CT14
7	5/8" (16mm) Hammerlock	1.0	12	10	2x4	2x2	0		CT48
8	Delta Plate (362mm)	4.76	9.52	2	2	0	0	11	CT49
9	14"(356mm) Rubber Bunt Bobbin	4.98	9.96	2	2	0	0	12	CT50
10	6" (152mm) Washer	0.42	3.36	8	2x1	2x2	1x2	13	CT51
11	15.5" (393mm) Bobbin Chain	0.58	19.14	33.	0	2x10	1x13	14	CT52
	TOTAL WEIGHT		501.03						

FISHERIES and OCEANS PÊCHES et OCÉANS

CAMPELEN 1800 SURVEY TRAWL

GROUND GEAR

DATE	DWG		REV.	SCALE
92/08/93	CAM-3.0	PG 7 OF 14 PG		NTS

DRAWN BY: MARINE INSTITUTE, FISHING TECHNOLOGY UNIT, ST.JOHN'S NEWFOUNDLAND

Figure 5. Footgear diagram of the Campelen 1800 Shrimp trawl as used on the FRV's Wilfred Templeman and Teleost.

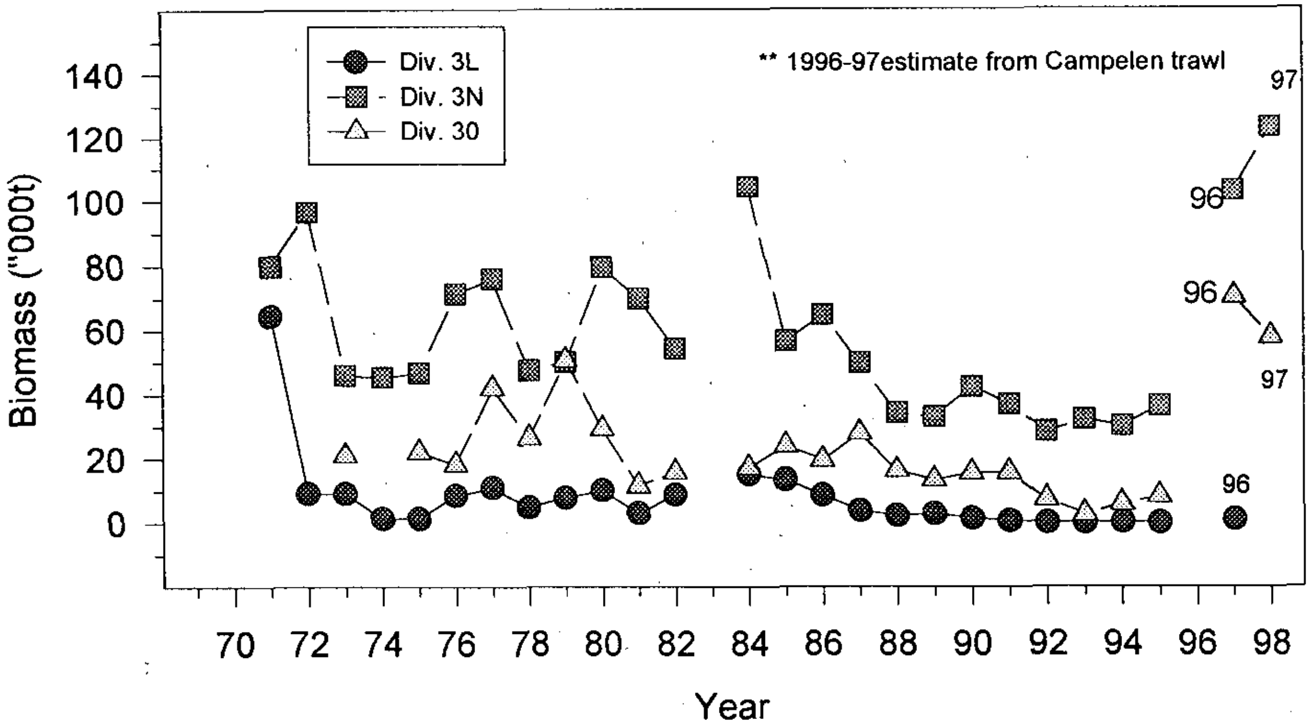


Fig. 6. Biomass estimates of yellowtail by NAFO Division from the Canadain spring surveys using the Engel 145 otter trawl from 1971-95 and the Campelen 1800 shrimp trawl in 1996 & 97. The 1996 estimate is not directly comparable to previous years.

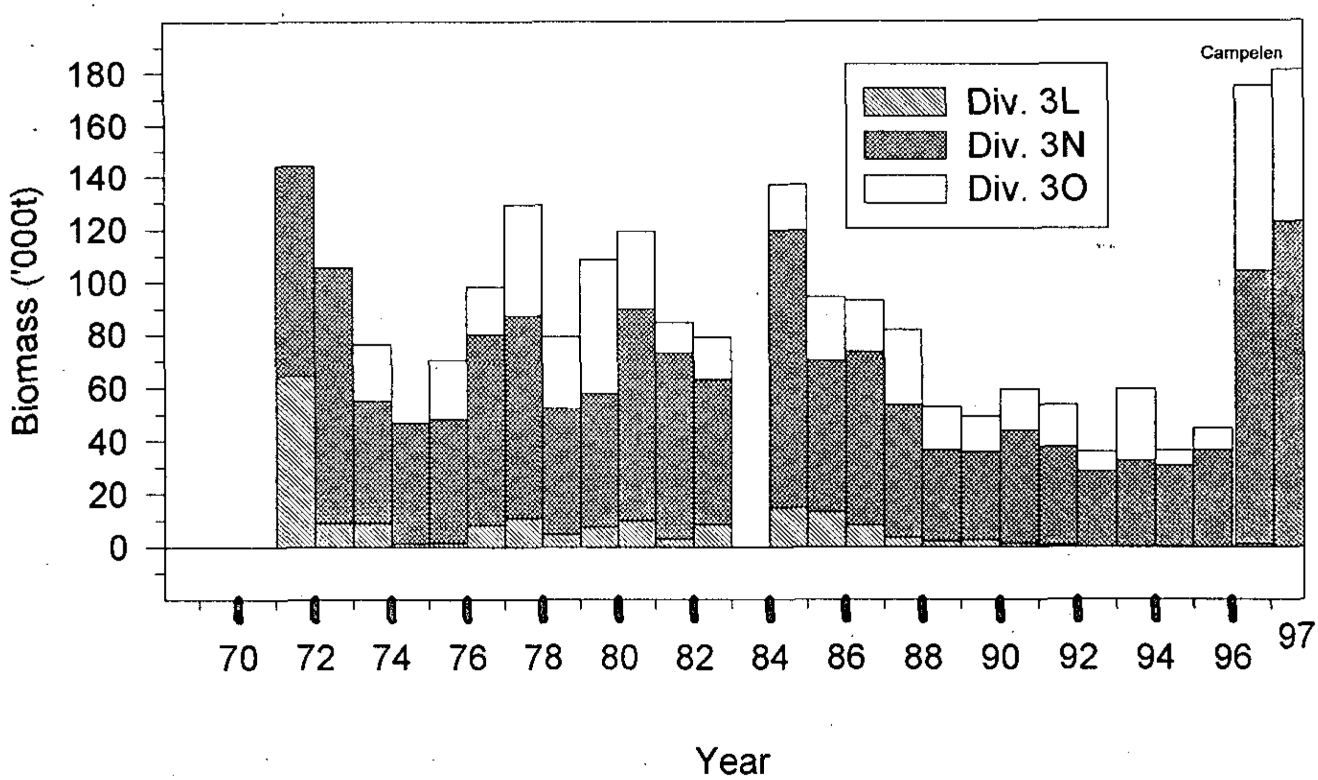


Fig. 7. Cumulative biomass estimates of yellowtail from Divisions 3L, 3N, & 3O from the Canadian spring surveys with the Engel 145 otter trawl. The 1996 & 1997 estimates are from the Campelen 1800 shrimp trawl (no data for Div. 3L in 1997

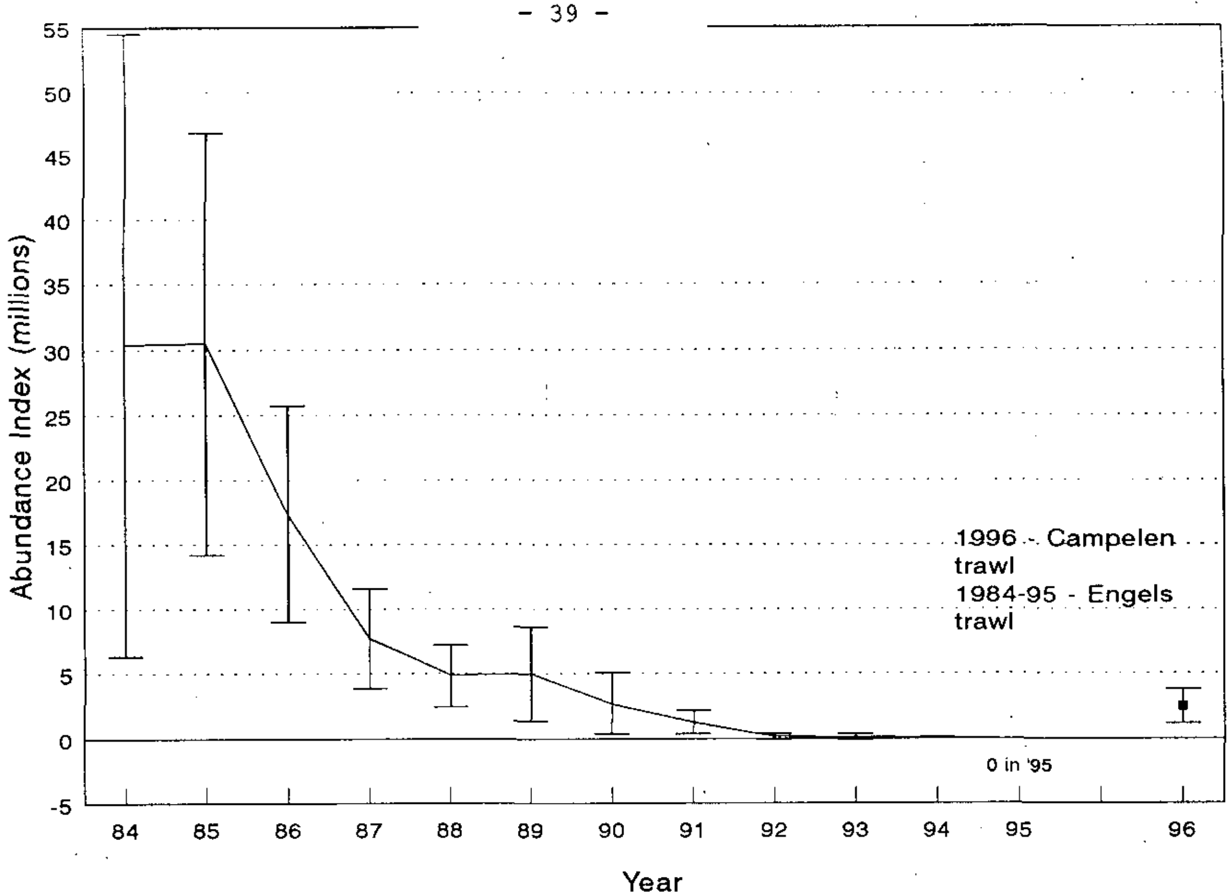


Fig. 8 . Abundance estimates of yellowtail (with approx. 95% C.I) from Canadian spring surveys in Div.3L.

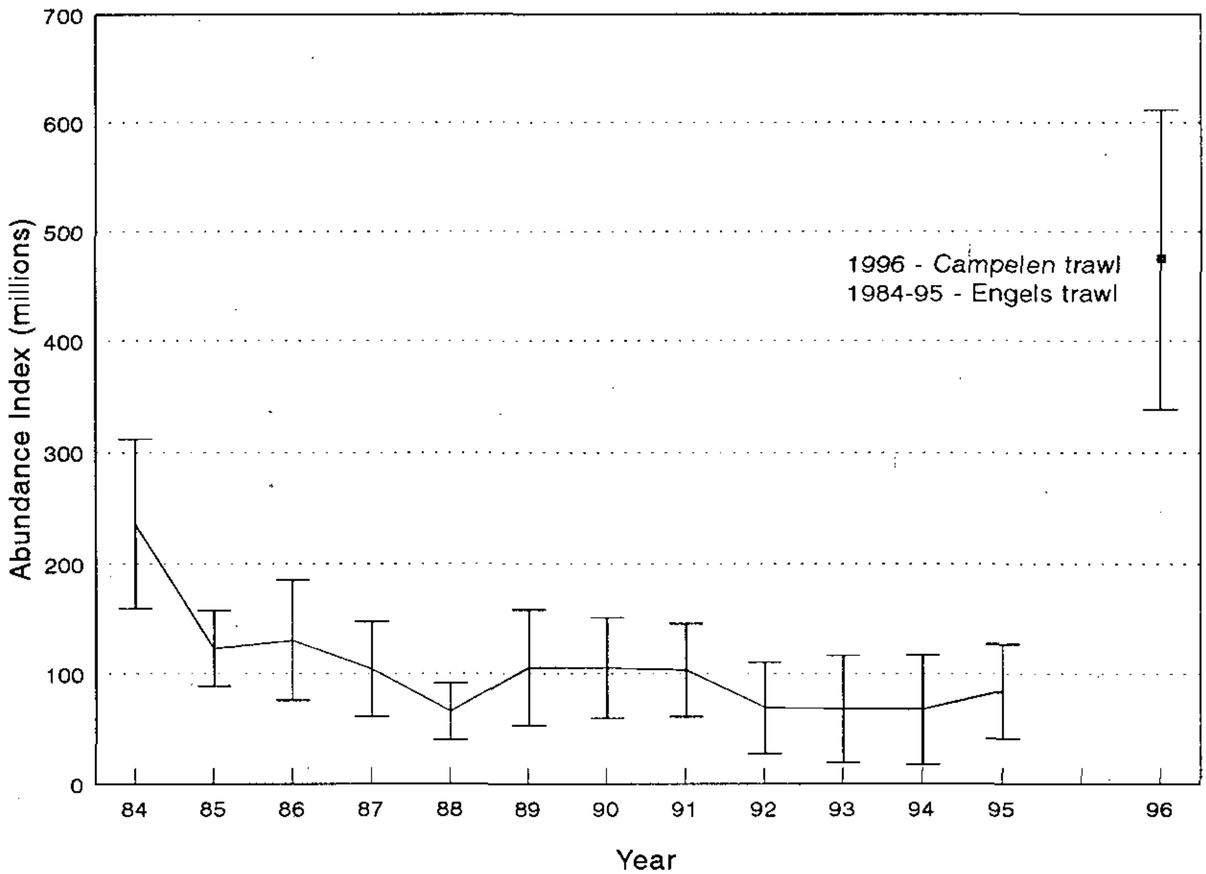


Fig. 9 . Abundance estimates of yellowtail (with approx. 95% C.I.) from Canadian spring surveys in Div.3N.

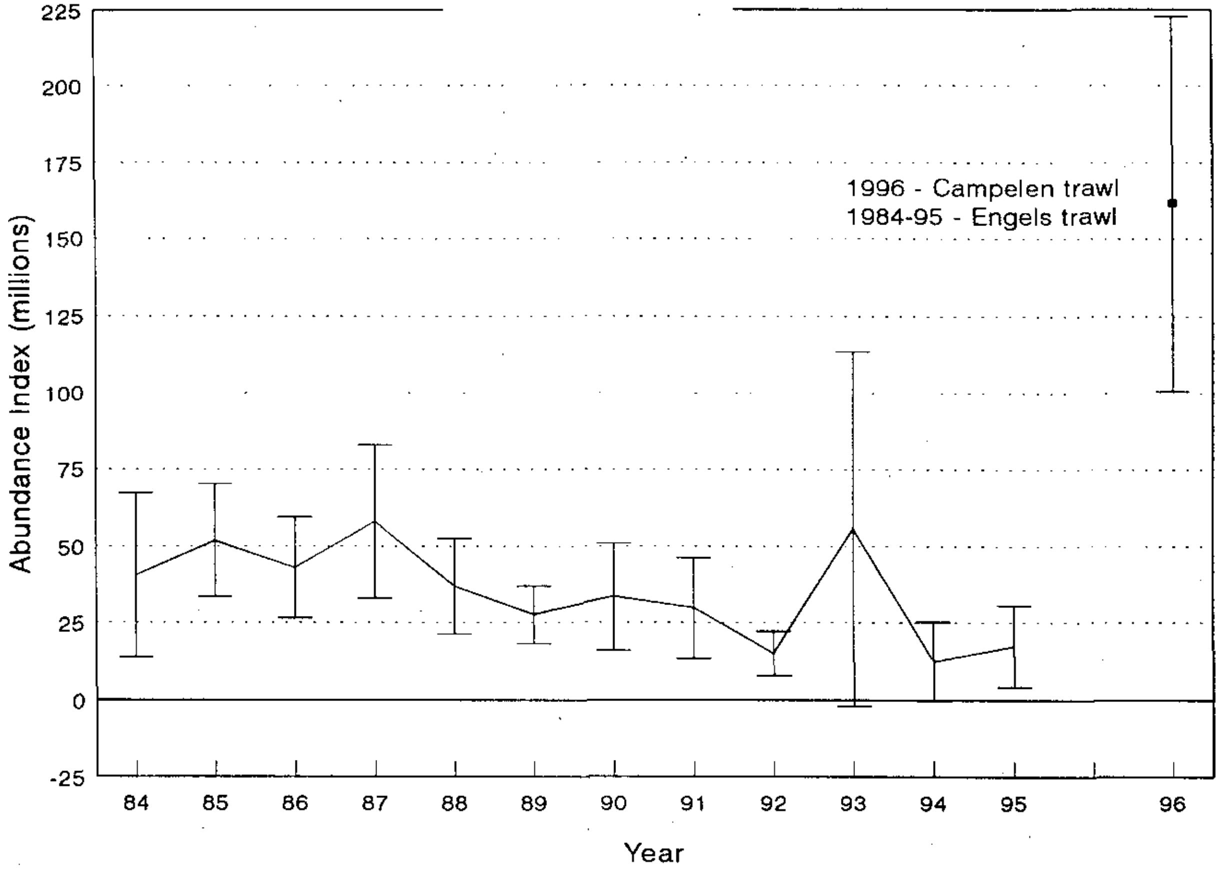


Fig. /o. . Abundance estimates of yellowtail (with approx. 95% C.I.) from Canadian spring surveys in Div.3O.

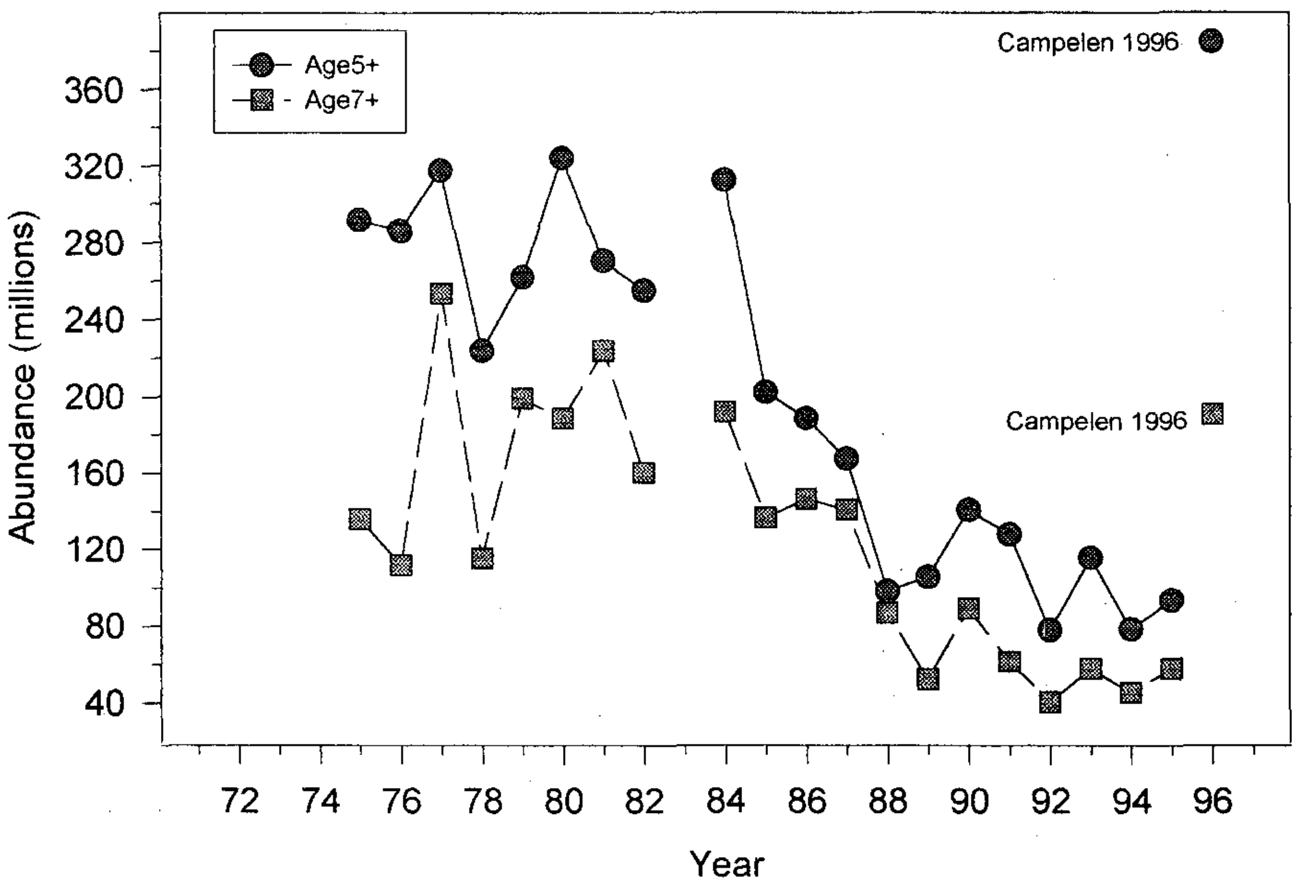


Fig. 11. Index of abundance of adult yellowtail flounder from the Canadian spring surveys, 1975-95, using the Engel 145 otter trawl, 1975-95 and the Campelen 1800 shrimp trawl in 1996

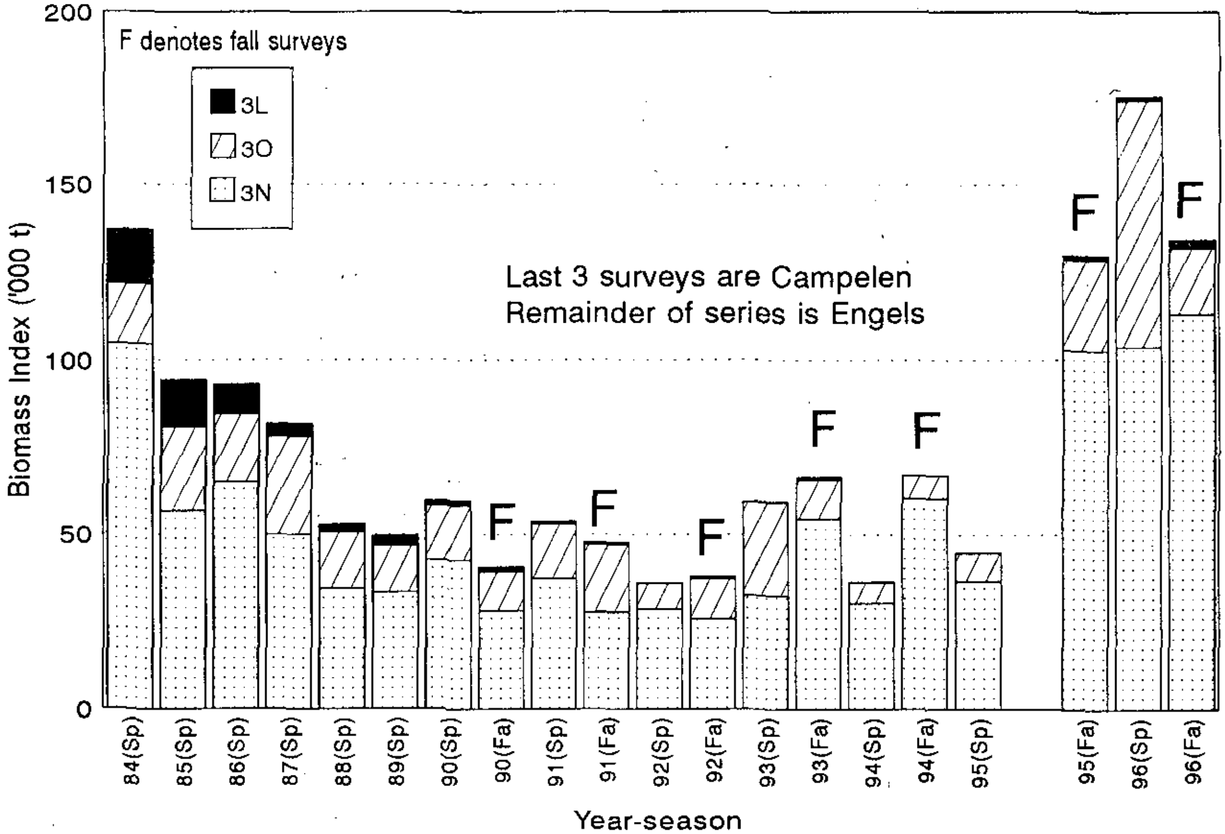


Fig. 12 . Biomass of yellowtail flounder from Canadian RV surveys conducted in spring and fall in Div. 3LNO.

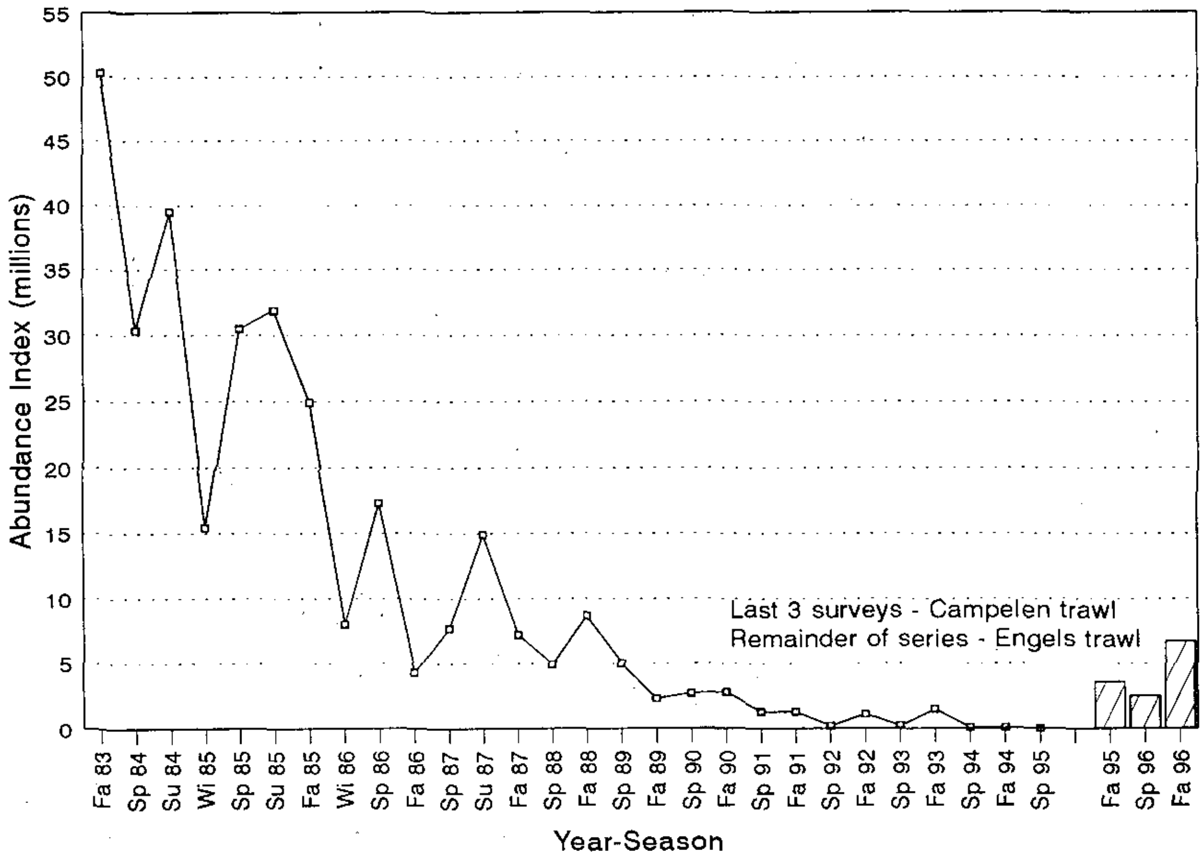


Fig. 13 . Abundance of Yellowtail from surveys conducted at various times in Div. 3L.

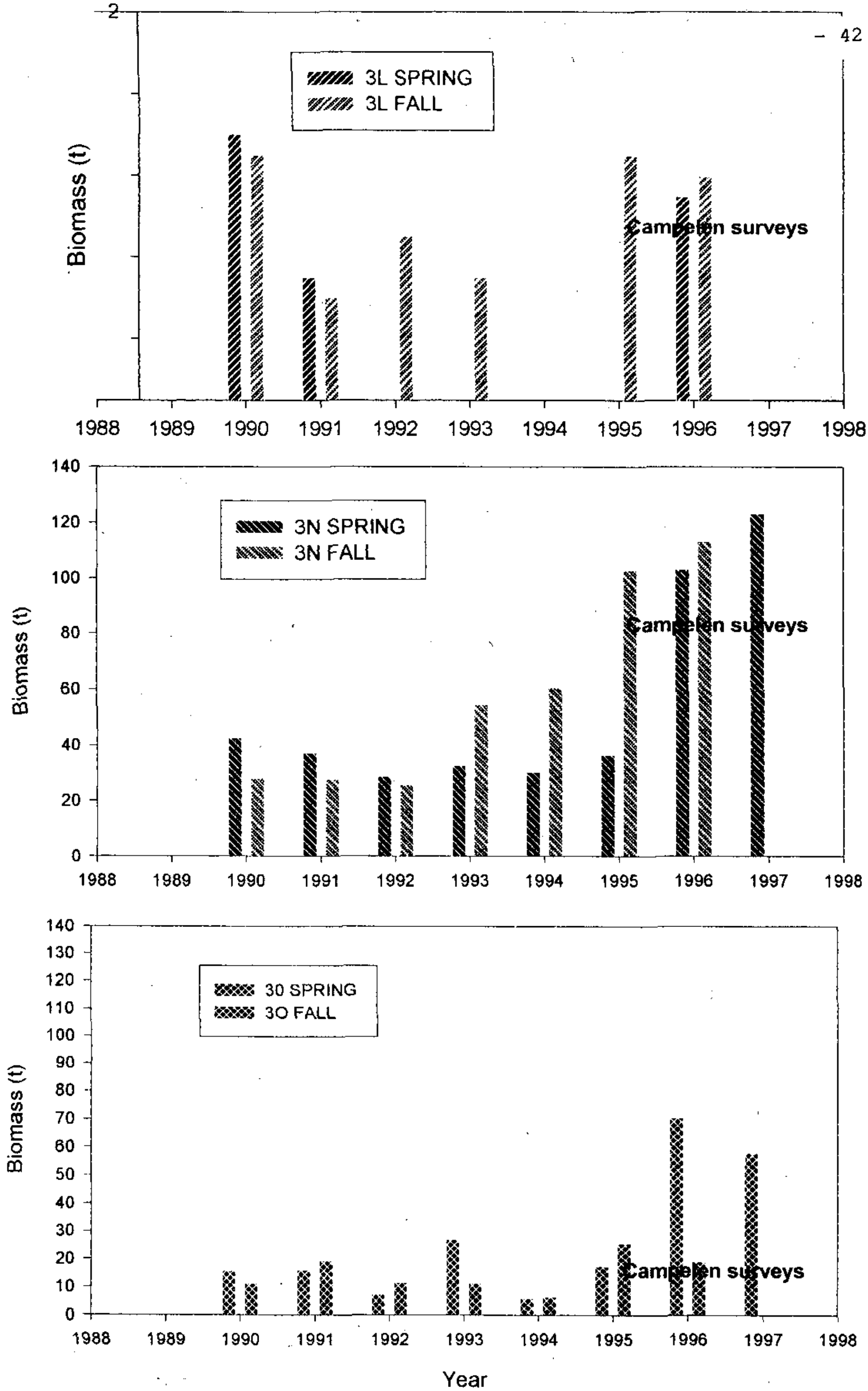


Fig.14 Comparison of yellowtail biomass from spring and fall surveys with the Engel 145 otter trawl from 1990-95 in spring and 1990-94 in fall. The 1996-97 spring and 1995 fall estimates are derived from catches with the Campelen 1800 shrimp trawl

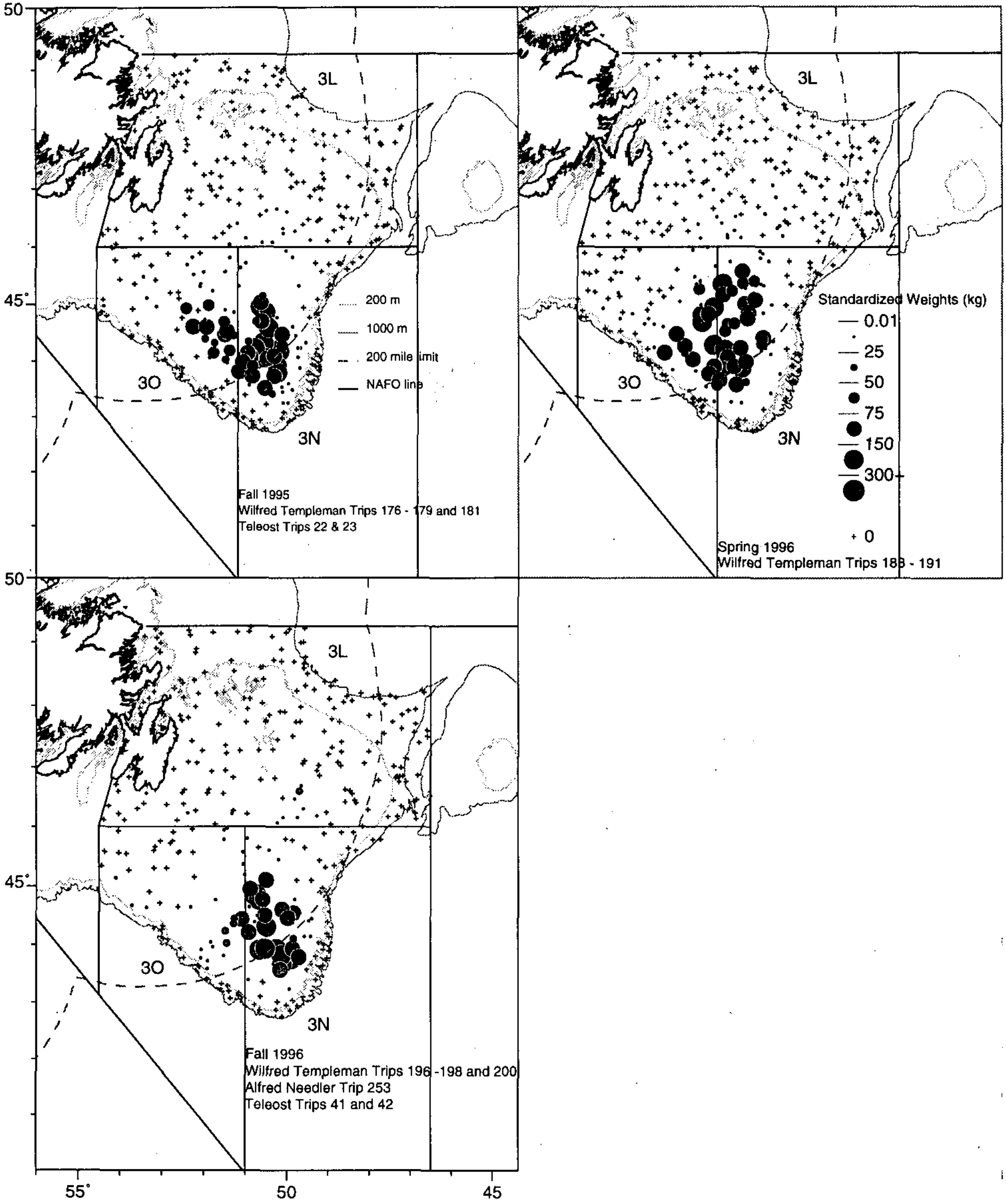


Fig. 15. Distribution of standard weights per tow (kg) of yellowtail flounder during fall 1995, spring and fall 1996 surveys of the Grand Bank using the Campelen survey trawl.

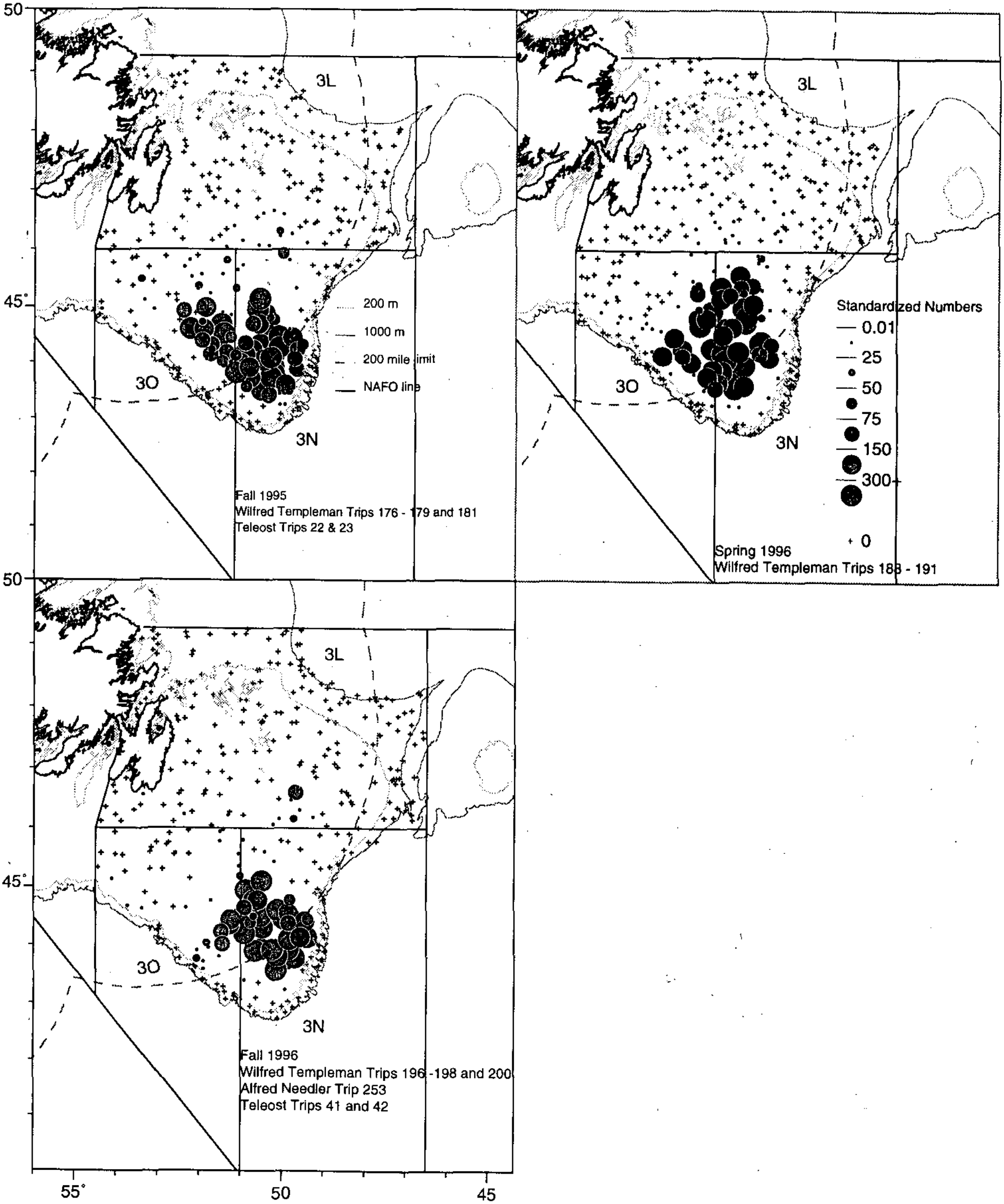


Fig. 16. Distribution of standard numbers per tow of yellowtail flounder during fall 1995, spring and fall 1996 surveys of the Grand Bank using the Campelen survey trawl.

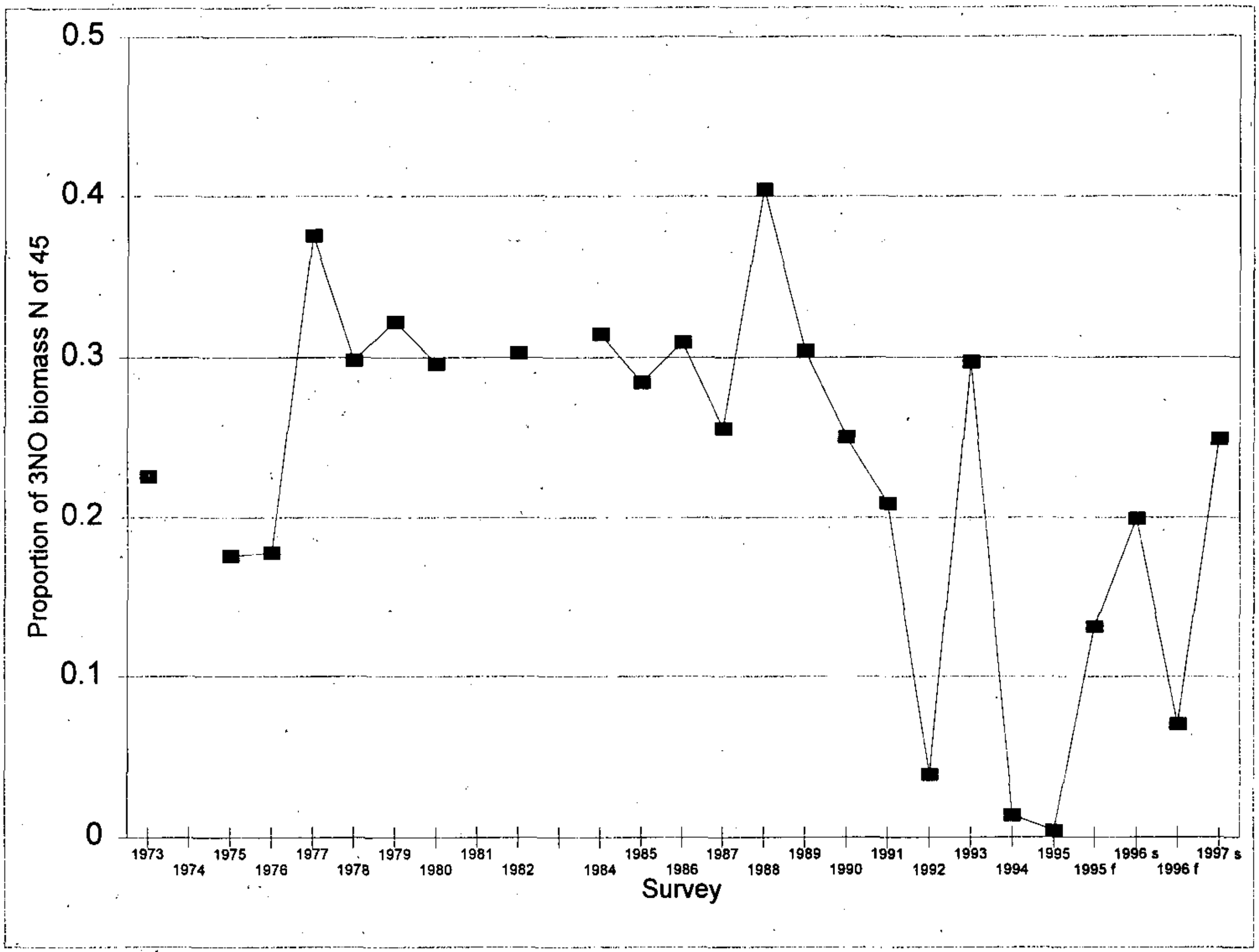


Fig. 17a. The proportion of yellowtail biomass distributed north of 45° N derived from the 1975-95 Engel trawl spring surveys and the 1995-97 Campelen spring and fall surveys.

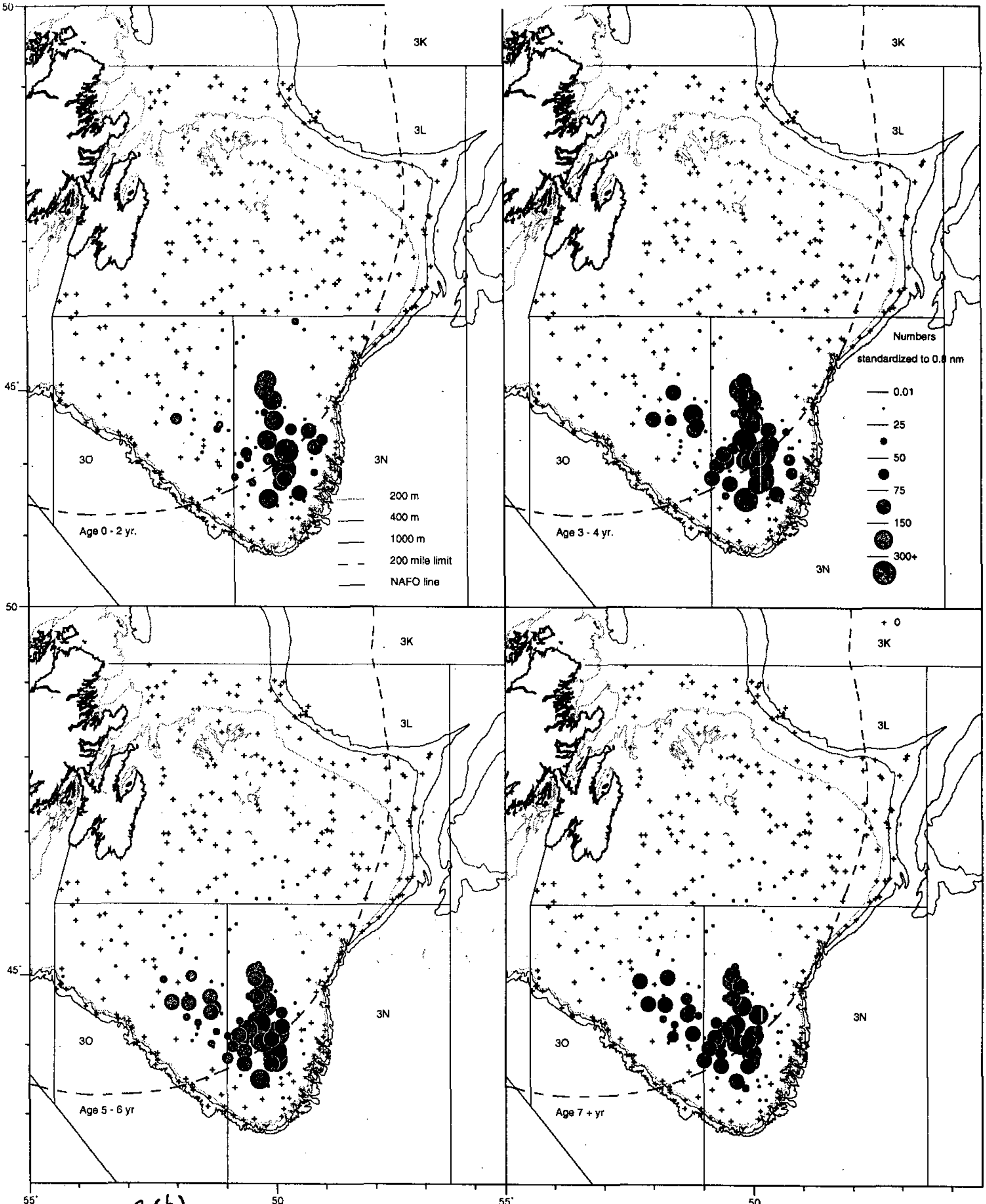


Fig. 17 (b) Distribution of Yellowtail Flounder at age caught by Canadian research surveys during the fall of 1995, using a Campelen 1800 shrimp trawl.

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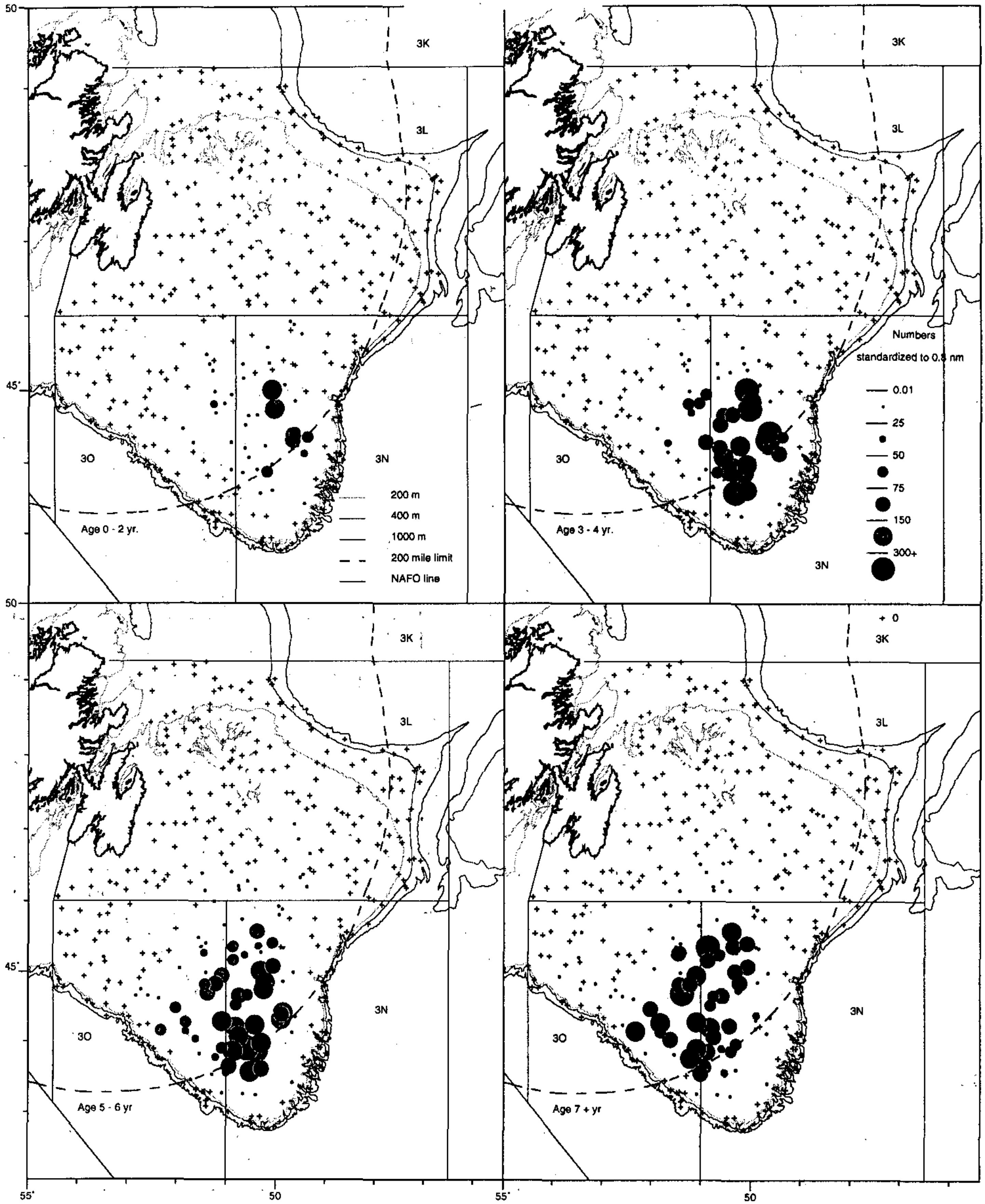

Fig. 18 Distribution of Yellowtail Flounder at age caught by Canadian research surveys during the spring of 1996, using a Campelen 1800 shrimp trawl.

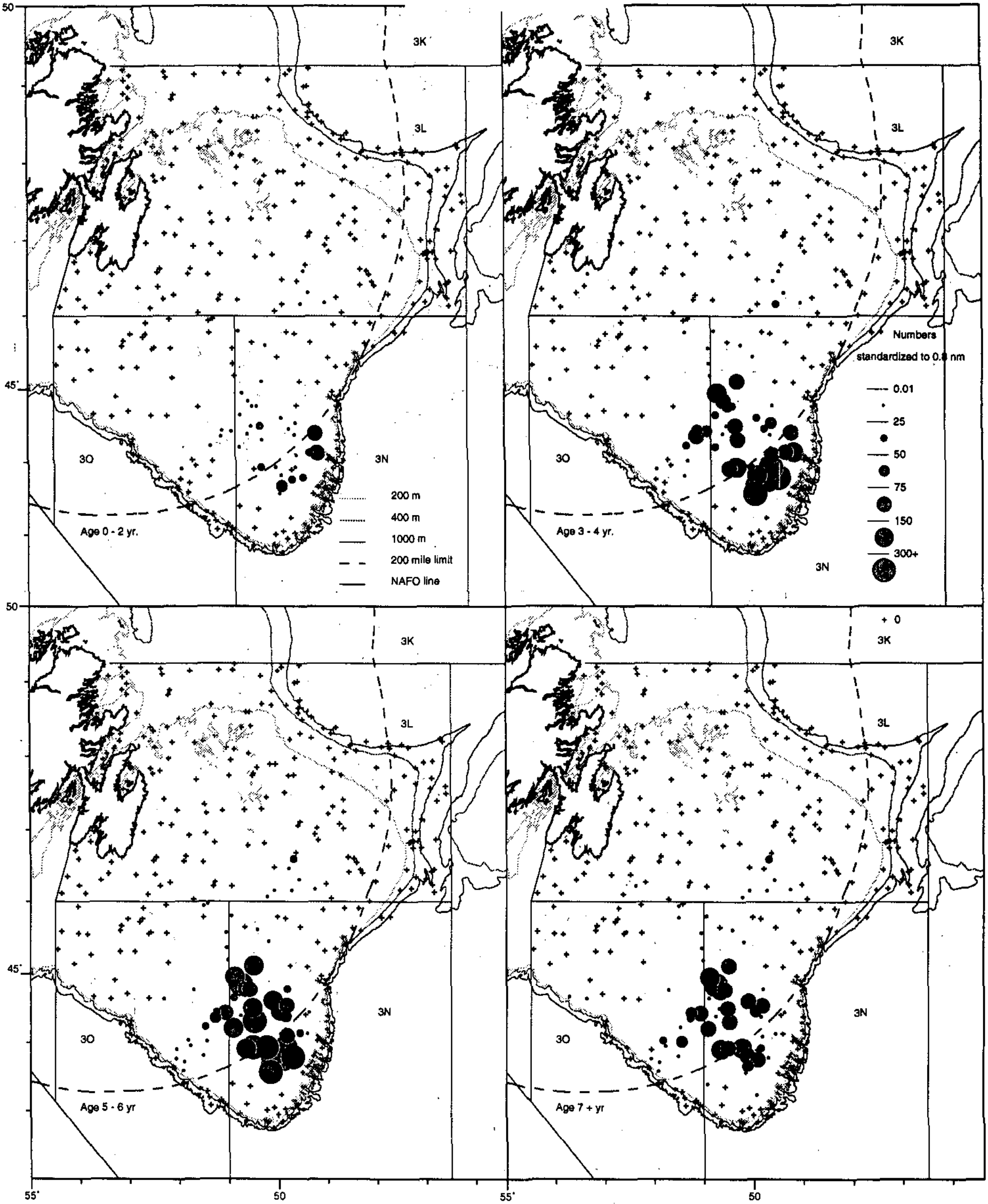

Fig. 19 Distribution of Yellowtail Flounder at age caught by Canadian research surveys during the fall of 1996, using a Campelen 1800 shrimp trawl.

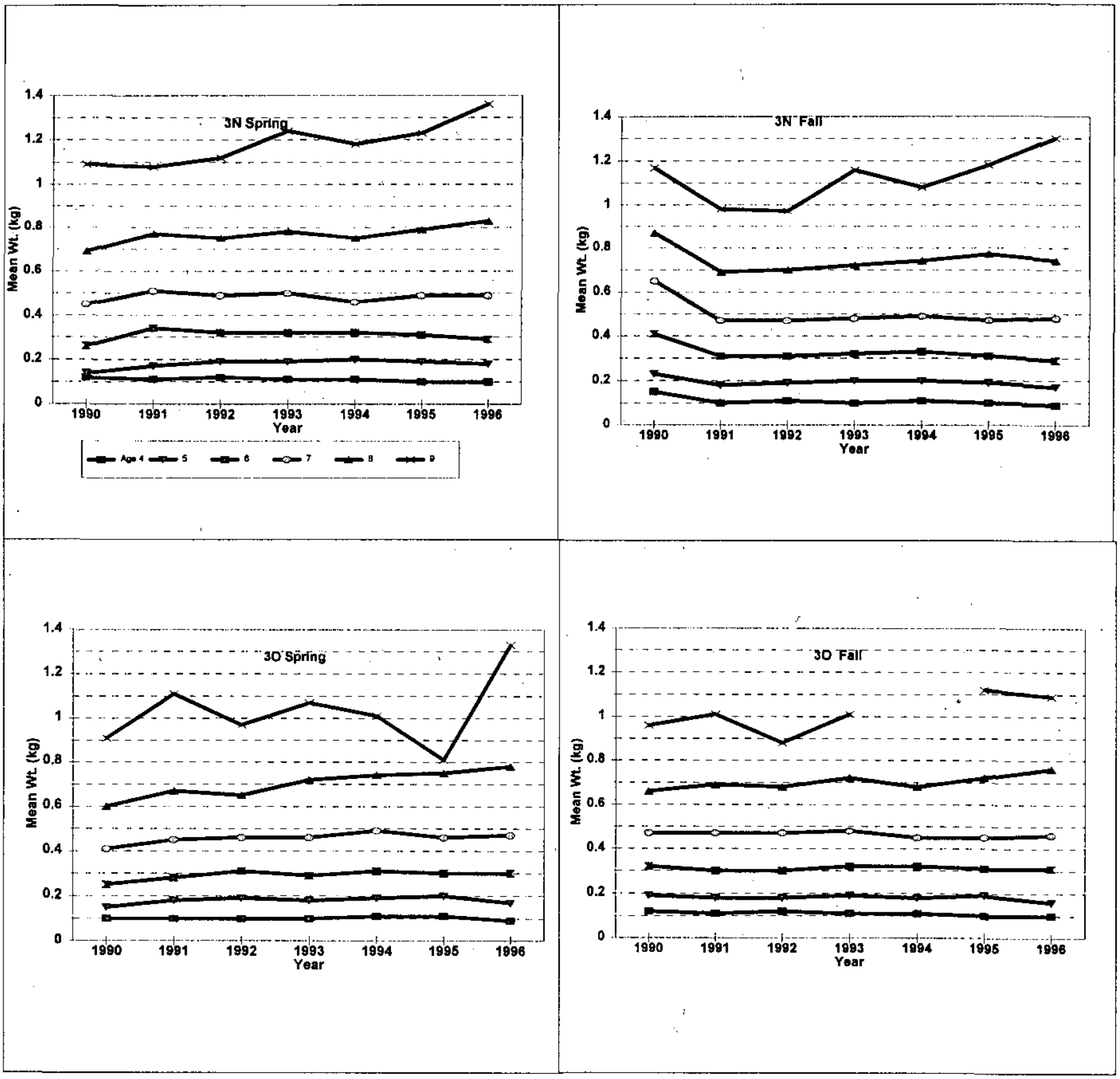

Fig. 20. Trends in mean weight at age from the spring and fall groundfish surveys.
The Engel trawl was used from 1990 to 1995 (spring), and the Campelen trawl was used from 1995 (fall) onward.

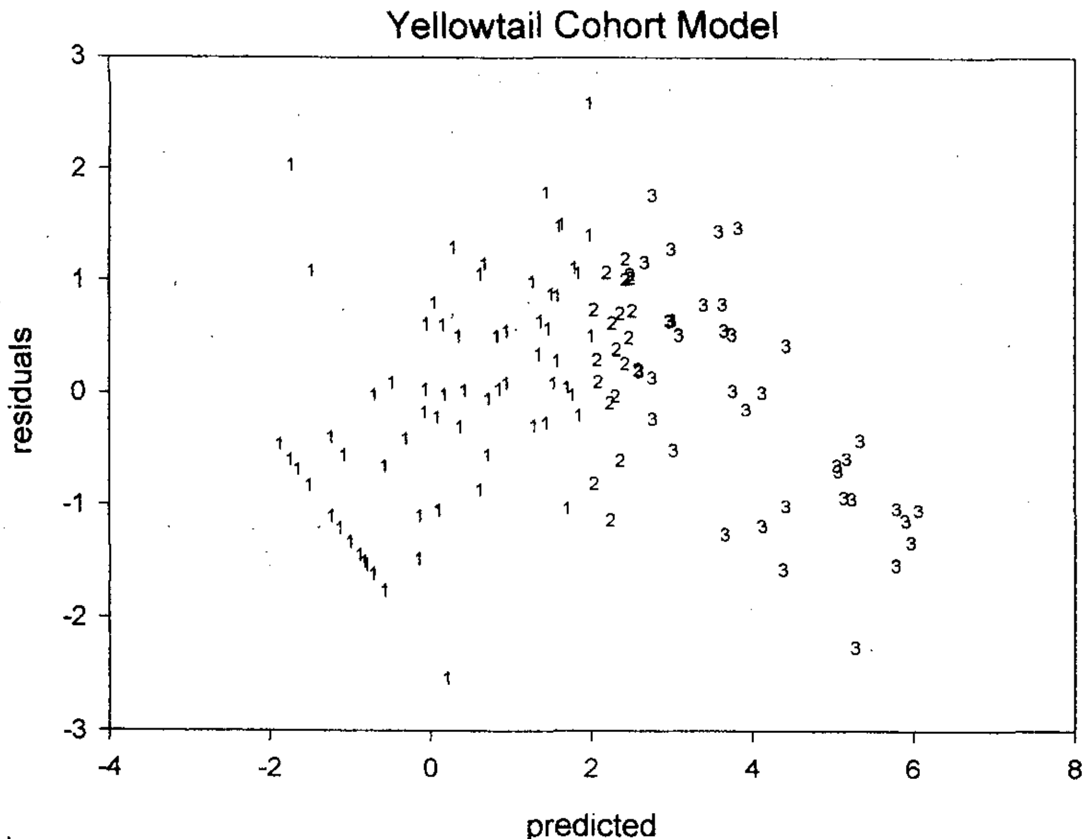

Fig. 21 Residual pattern from cohort strength multiplicative model based on spring groundfish surveys from 1975-95 (code =1), fall surveys from 1990-94 (code=2) and juvenile surveys 1986-94 (code=3).

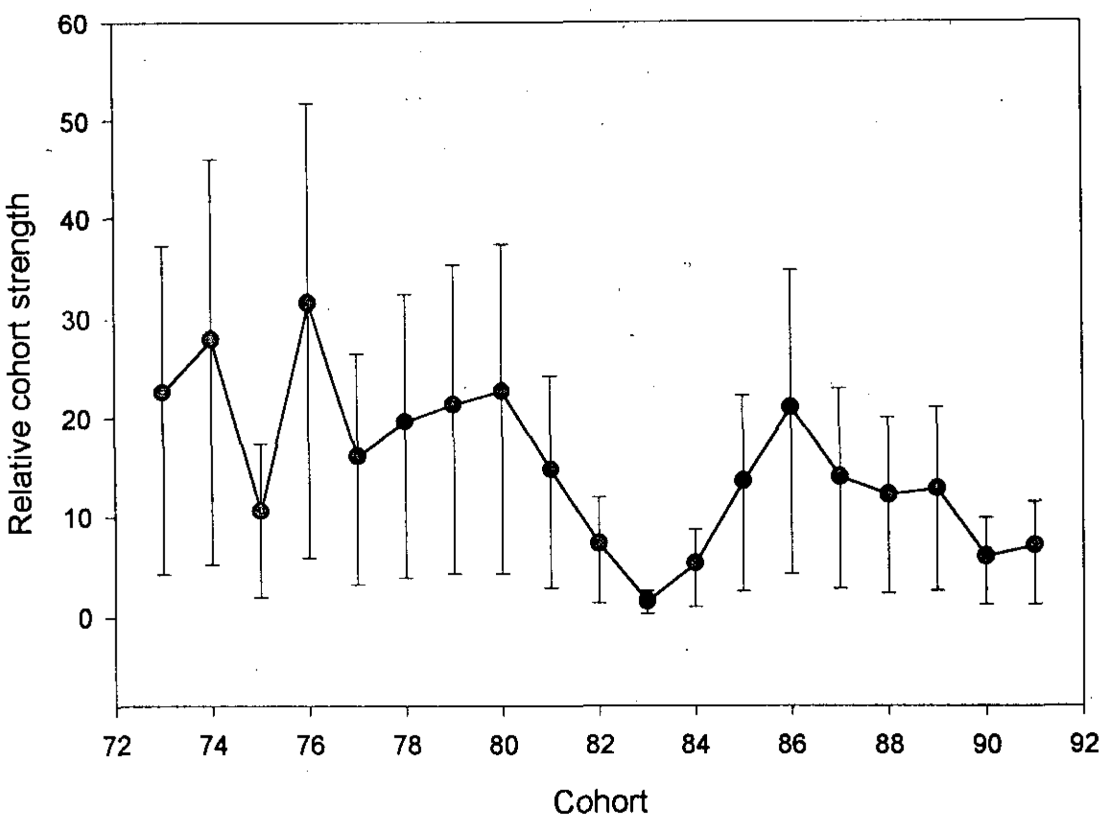

Fig. 22 Relative cohort strength for 3LNO yellowtail flounder using Canadian spring survey data from 1975-95.

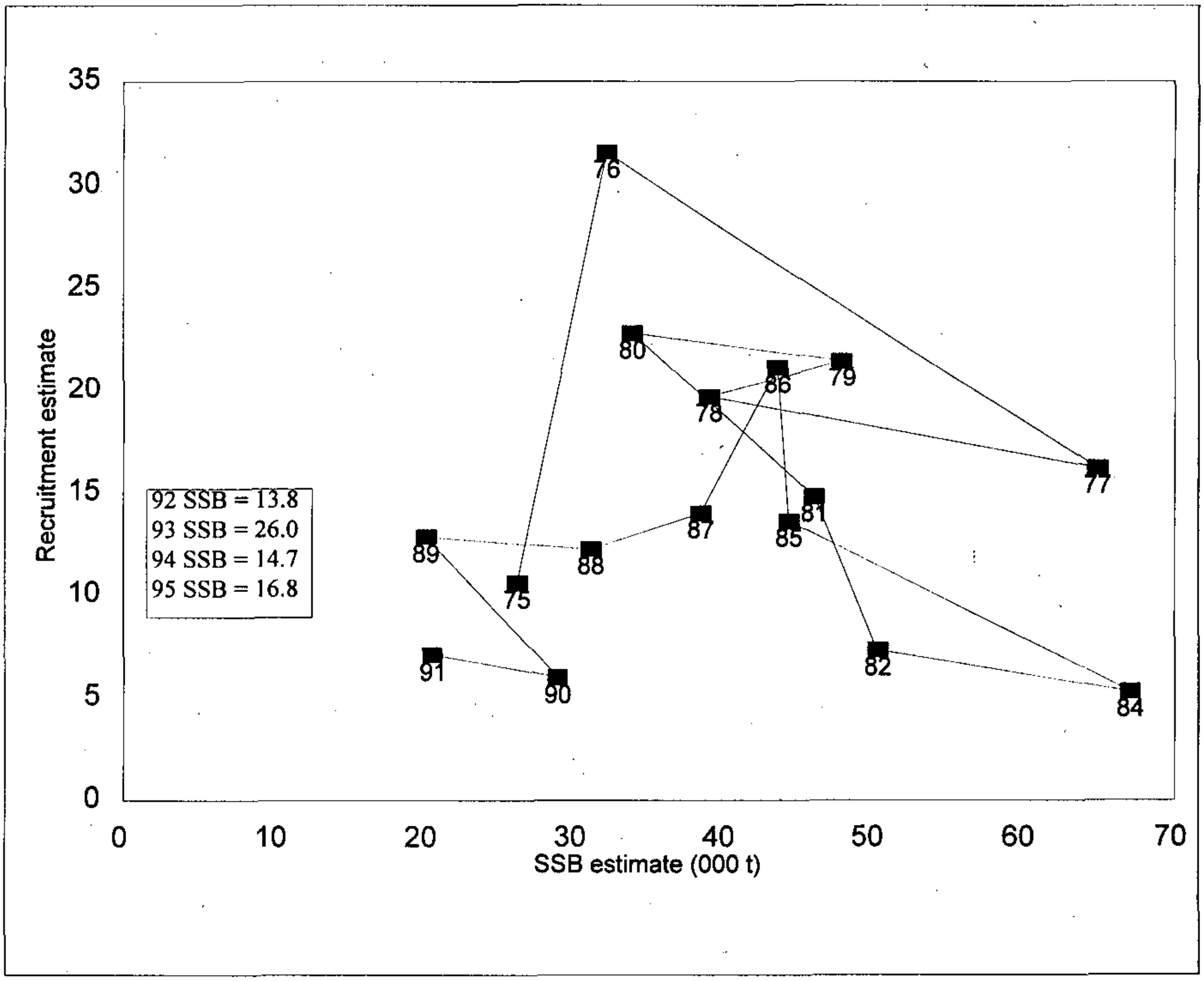

Fig. 23. Stock recruitment plot for yellowtail flounder in Div. 3LNO.

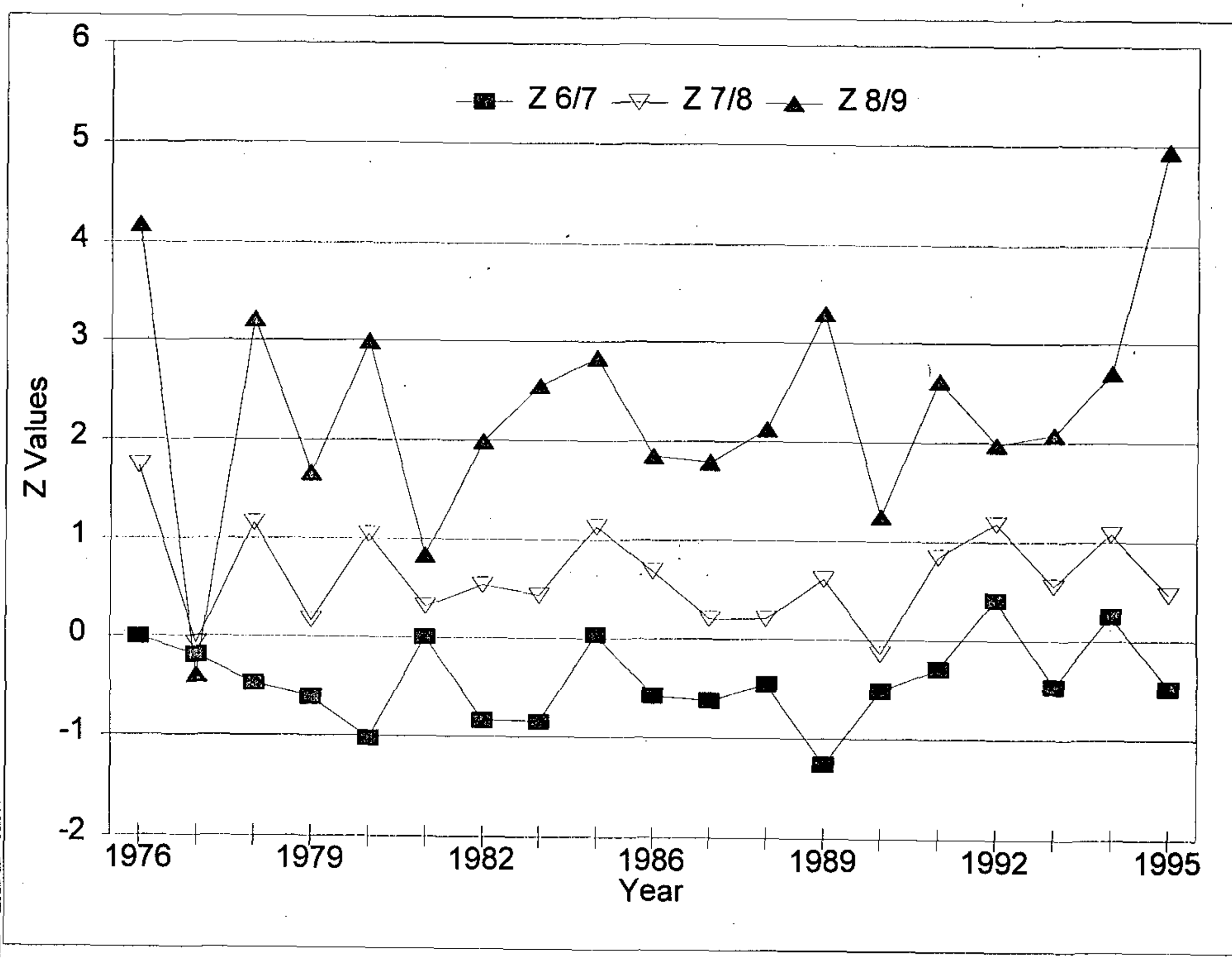

Fig. 24 Trends in total mortality (Z-values) for adult yellowtail flounder derived using data from the 1975-95 spring surveys.

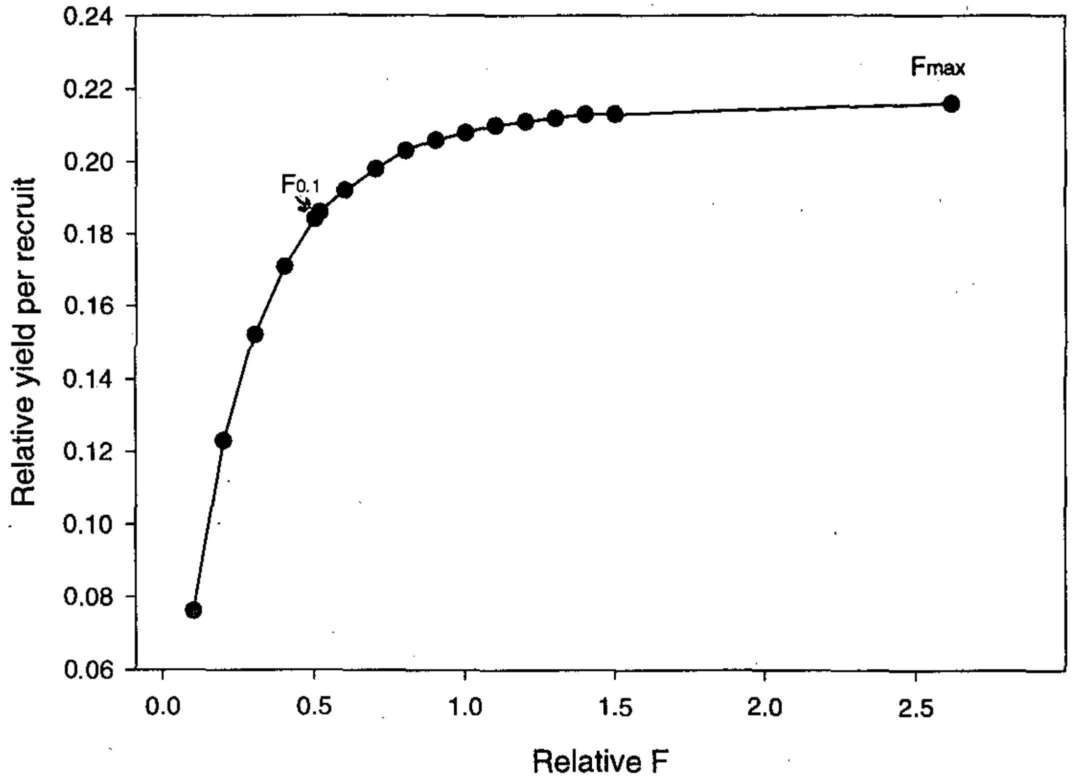

Fig. 25 Relative yield per recruit for yellowtail flounder stock in NAFO Divisions 3LNO (adopted from Brodie and Pitt 1983). Data from average partial recruitment were calculated from average F's (1968-76) from cohort analysis and average weights (1968-74) were used to estimate yield per recruit.

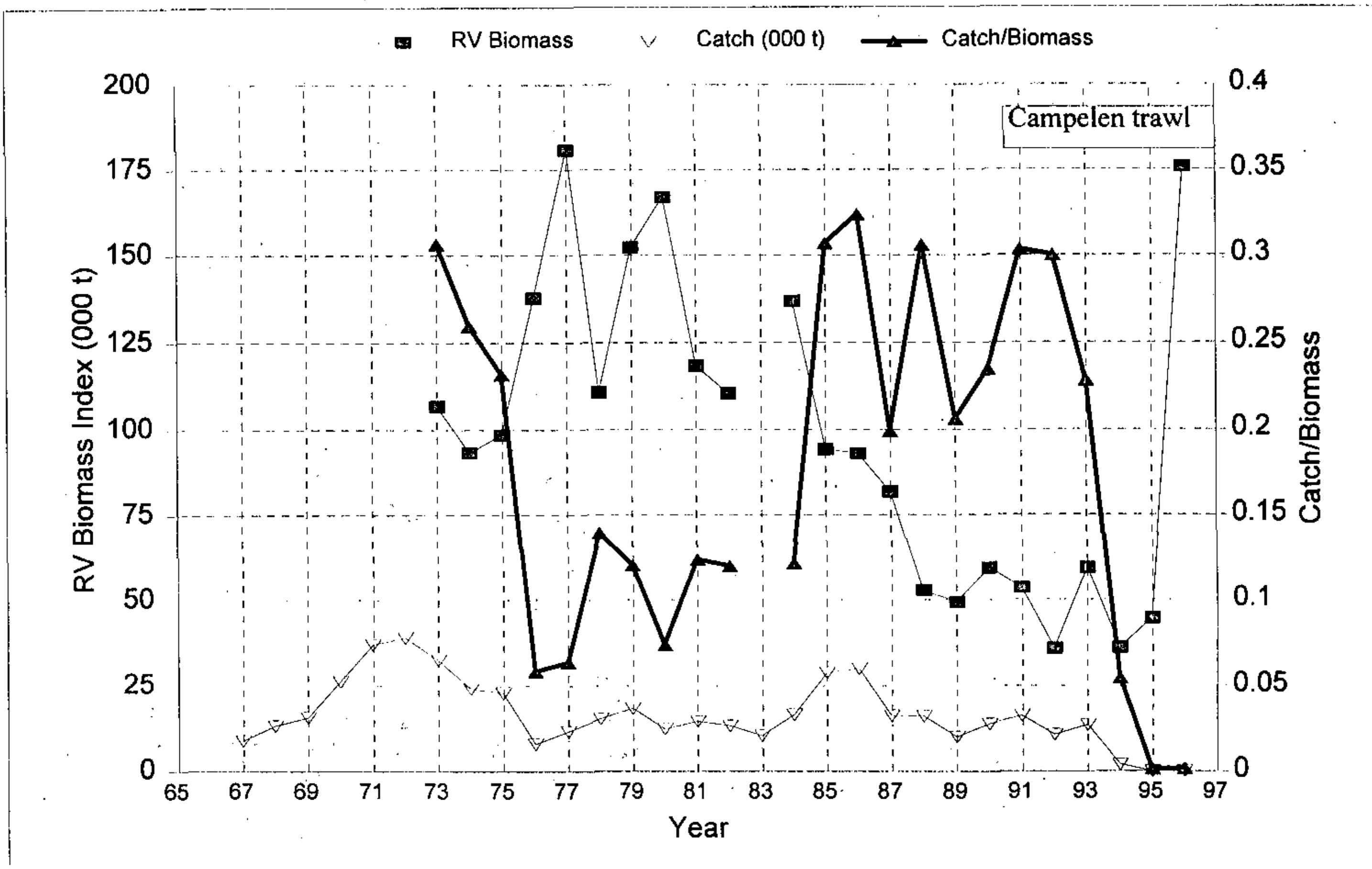

Fig. 26. Comparison of catch and research vessel biomass indices of yellowtail flounder from spring surveys of Div 3LNO. Catch/biomass ratio is used as a proxy for exploitation rate.