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Canadian Atlantic Fisheries Scientific Advisory Committee

CAFSAC Research Document 85/47

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Comité scientifique consultatif des pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 85/47

The Eastern Scotian Shelf (4VW) Haddock Stock and Fishery in 1984, With an Historical Perspective on Stock and Recruitment Back to 1948

by

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Abstract

The catch of 4VW haddock in 1984 was 8,229 t, thus the TAC was again undercaught by about half. This was attributed to the presence of numerous small, unmarketable haddock in the usual area of fishing in 4W. As a consequence a higher than usual proportion of catch was taken in 4Vs in the latter part of the year. The survey and commercial catch rate indices are showing different trends for this stock. The latter are suspect in view of the recent disruption of the usual fishing pattern. The 1978 year-class previously estimated to be very small is contributing a surprising amount of the catch and is an outlier in the tuning relationships. The trends in the residuals for the calibration relationships which were a problem in the previous assessment are still there but much less pronounced than in previous years, possibly owing to data transformation in calculating the RV survey index. The COHORT analysis was extended back to 1948. The longer time series enables a better perspective on the history of this stock. However, the trend in fishing mortality to fully recruited ages does not reveal the extremely high fishing mortalities on young fish in 1965 and 1966 which may have resulted in recruitment failure for about 8 years thereafter. Recent large year-classes are big even in comparison to those of the earlier years when stock biomass was about double what it now is. On the basis of RV surveys terminal F was estimated to be 0.2. If the TAC (15,000 t) is taken in 1985 the $F_{0.1}$ catch in 1986 would be 16,600 t, whereas if the $F_{0.1}$ catch of 13,800 t is taken in 1985 the $F_{0.1}$ catch in 1986 increases slightly to 16,900 t.

Résumé

En 1984, les prises d'aiglefins dans des div. 4VW se sont chiffrées à 8 229 t, ce qui signifie que cette fois encore on n'a atteint qu'à peu près la moitié du TPA. Ce résultat serait dû à la présence dans la zone de pêche habituelle de la div. 4W d'un grand nombre d'aiglefins de trop petite taille pour être envoyés sur le marché. La proportion de poissons pêchés dans la subdivision 4Vs a été plus élevée que d'habitude durant les derniers mois de l'année. Les indices déterminés d'après les relevés dénotent pour ce stock une tendance différente de celle qui se dégage des indices établis d'après les prises de pêche commerciale. On peut douter de la valeur de ces derniers, car la pêche n'a pas suivi son cours habituel ces derniers temps. Les poissons de la classe de 1978, classe qu'on estimait très petite, représentent une proportion étonnante des prises; cette classe est à l'écart des relations concordantes. Les groupes qui s'écartaient des relations d'étalonnage et posaient des problèmes lors de la dernière évaluation présentent toujours la même tendance, mais elle est moins prononcée que les années précédentes, ce qui est peut-être dû au fait que les données sont transformées lors du calcul de l'indice des relevés par navires de recherche. On a étendu la période de l'analyse de cohorte pour remonter jusqu'en 1984. En étudiant une période plus longue, on aura une meilleure idée de l'évolution du stock. La tendance de la mortalité dans les classes d'âge à recrutement complet ne fait cependant pas ressortir les taux de mortalité par pêche fort élevés qu'on a obtenus pour les jeunes poissons en 1965 et en 1966 qui sont peut-être la cause du manque de recrutement observé au cours des quelque huit années suivantes. Les grandes classes d'âge des dernières années sont importantes par comparaison à celles des années passées, alors que la biomasse du stock représentait à peu près le double de ce qu'elle est maintenant. D'après les relevés par navires de recherche, on a estimé le F de dernière année à 0,2. Si le TPA (15 000 t) est atteint en 1985, les prises à $F_{0,1}$ seront de 16 600 t en 1986; par contre, si les prises à $F_{0,1}$ de 13 800 t sont capturées en 1985, la prise à $F_{0,1}$ en 1986 augmentera légèrement pour se chiffrer à 16 900 t.

Introduction

Through the 1950s and early 1960s catches of 4VW haddock averaged around 25,000 t a year. With the exception of the 1965 catch of about 55,500 t, primarily by Soviet small mesh gear, catches have declined steadily as the stock collapsed and reached a minimum in 1976 (Figure 1). Recent TACs and catches are as follows ('000 t):

	1978	1979	1980	1981	1982	1983	1984	1985
TAC	2	2	15	23	23	15	15	15
Nominal catch	6	3	15	20	15	9[1]	8[1]	-

[1] Preliminary Level

TACs increased from 2,000 in 1979 to 23,000 t in 1981 based primarily on the results of an SPA calibrated with a research vessel (RV) survey abundance index. Since 1981 the fleet has been unable to take the quota, in spite of good markets for haddock in recent years. In 1982 an anomalously cold winter was blamed for displacing haddock from their usual location. In 1983 and 1984 avoidance of young unmarketable fish of the 1980 and 1981 year-classes are the likely reasons for low catches. There is also good reason to believe that appreciable but unknown quantities of small fish were discarded at sea in these years.

Previously, most of the catch has been taken in 4W (Table 1) by large otter trawlers (Tables 2 and 3), in the spring (Table 4). Longliner catches typically represent 15-20% of the total and are more evenly distributed through the year (Table 5).

Although large trawlers continued to dominate the fishery in 1984, the spatial and temporal distribution of catches was different. A higher than usual proportion of catch was taken in 4Vs (mainly as by-catch in the cod fishery) and the catches were spread much more evenly through the year. The significance of the change in timing of the catch is that it affects the partial recruitment pattern.

In recent years the assessment of this stock has suffered from three main problems which were highlighted in the previous assessment as follows (Mahon et al., 1984):

- partial recruitment is important for projections, but the inability to predict catch composition in 1983 suggests either an unstable partial recruitment or substantial errors in ageing in 1982 or 1983;
- there are severe problems in the tuning relationships; and
- there is little idea of a 'typical' year-class size due to the short time series.

Some progress has been made as regards the last two of these problems. In particular, catch at age has been developed back to 1948. This exercise

will be dealt with first in a separate section. Then follows the 1984 update of the post 1969 time series for survey and fishery data. After calibrating the SPA for the 1970-1984 period, the 1948-1969 data are included for an SPA run to provide an historical perspective on stock and recruitment.

Age Composition of the Landings 1948-1969

Landings

From 1954 on, ICNAF Statistical Bulletins provide a breakdown of landings by gear, country, month, area, etc.. Between 1948 and 1954 landings as compiled by Beverton and Hodder (1962, p. 30) were used. During the 1961-1969 period there were substantial catches of haddock by the USSR (Tables 1, 6). Although recent information from the Scotia-Fundy International Observer Program (IOP) suggests that some of the ratios of haddock to silver hake catch in that period were improbably low (compare Table 6c with Table 11), we have not adjusted the reported landings of haddock in the 1961-1969 period as we have done from 1970 onwards. For a start, we do not know what by-catch ratio to apply. Since 1970 the Soviets have purportedly been directing for silver hake and attempting to minimize haddock by-catch. In the 1960s they were fishing for 'biomass' and the main species sought is listed as 'mixed' or 'groundfish'.

Small Mesh Gear

The age composition of removals by Soviet small mesh gear are estimated in a similar fashion to that suggested by Halliday (1971) and adopted by Waldron (1980). Firstly, on the basis of Halliday's analysis we assume that all the haddock reported caught by Soviet vessels was taken with small mesh gear (Table 6a).

The size and age composition of these small mesh removals are assumed to be similar to that observed in catches by research surveys using trawls with 1¼" codend liners (Halliday, 1971). Although there are appropriate length-frequency data from surveys in the 4W area in each year, samples were not aged in every year. Consequently, it was necessary to apply age-length keys from one year to length-frequency data in another to derive catch at age. The sources of these data are presented in Table 7. The choice of key for each year was made with reference to changes in growth presented by Mahon and White (1983).

The estimated age composition of the catch is shown in Table 12.

Non Small Mesh Gear

Landings of 4VW haddock were well sampled for size and age composition in this period (Table 8). One major sector was not sampled at all: the Spanish vessels, mainly pair trawlers. As did Halliday (1971), we have assumed that the Spanish catches were similar in age composition to the Canadian otter trawl catches.

Whenever there was adequate sampling we broke the catch into three components. Table 9 shows this breakdown and the sampling intensity associated with each group. Tables 13 to 16 show the catch at age by each grouping.

Weight-Length Relationships

Mahon et al. (1984) demonstrated that seasonal differences in weight at length (condition) were greater than interannual differences. This analysis was based on research vessel survey data from 1970-1972. Prior to 1970 there was no systematic measurement of individual fish weights, either on surveys or from the commercial fishery. Consequently, average weight-length relationships for trimesters (January-April, May-August, September-December) were used in estimating catch at age for the 1948-1969 period. These averages were calculated by fitting a least squares regression of log weight on log length to three random samples of about 5,000 fish from each trimester over the 1970-1982 period. The following estimates of slope and intercept resulted:

Trimester	a	b	n
1. January-April	0.00592	3.1340	5119
	0.00598	3.1370	4921
	0.00621	3.1213	5014
2. May-August	0.00773	3.0771	5295
	0.00745	3.0865	5257
	0.00713	3.0947	5258
3. September-December	0.00737	3.0835	5366
	0.00766	3.0847	5594
	0.00753	3.0906	5437

Differences in the parameters within trimesters are small and the underlined parameters were used in estimating the age composition of the catch. The weight-length parameters from the first trimester were used for catch in the January to June period; those from the third trimester for the July to December catch and those from the second trimester were used when the catch for the entire year was treated together. The parameters for the second trimester were also used for the Soviet small-mesh catch.

Age Composition of the Removals for 1984

Small Mesh Gear

Small mesh gear removals in 1984 were all by-catch, primarily in the USSR silver hake fishery (Table 10). Since 1977 observers of the IOP have been recording by-catch levels and size composition of haddock on these vessels.

From 1977 to the present the observed by-catch ratios have been applied to the reported silver hake catch to estimate the haddock by-catch (Table 11). From 1970 to 1977 the average of the 1977-1979 by-catch ratios was used. The estimated by-catch is substantially higher than reported catch (Table 11), and has increased considerably in the past two years.

The catch for small mesh removals from 1970-1976 was assumed to be similar in age structure to the research vessel summer survey catch in those years. From 1977 on, length-frequencies of haddock by-catch in the USSR small mesh fishery were available from the IOP. Summer research vessel age-length keys were applied to these length-frequencies to estimate the age composition of the catch (Table 12). In 1984 length-frequencies for May, June, and July were combined, as most of the catch was taken in these months. Weight-length relationships from these surveys (all lengths included) were used.

Gear Other Than Small Mesh

The catch at age for non-small mesh gear in 1984 was calculated in three parts (Table 9) and is presented in Tables 13 to 16. Following previous practice (Mahon et al., 1984) season specific weight-length relationships for fish greater than 30 cm were used. Catch at age from small mesh and other gears was combined (Tables 17, 18).

Comparison of the observed catch at age for 1984 with that projected by the 1983 assessment (Mahon et al., 1984) shows a relatively high proportion of ages 3 and 4 in the observed catch (Figure 2). This suggests an increase in the partial recruitment at these ages in 1984 from that used in the catch projections in the previous year, possibly due to the shift in the time at which the catch was taken.

The nominal catch at age and the percent contribution by age are shown in Tables 19 and 20.

Weights At Age

Mean weights at age in the RV surveys are in Table 21. The weights at age for the commercial catch are a weighted mean of each of the four parts contributing to the catch at age; weighted by numbers at age (Table 22). The trend of declining mean weights at age observed over the past 5 years continued in 1984 but the drop was relatively small.

Abundance Indices

The summer RV survey series (Halliday and Koeller, 1981) has been the main index used to calibrate the cohort analysis. In 1981 the 12 year A.T. Cameron series ended. In 1982 the survey was carried out by the Lady Hammond. A conversion factor of 1.20 was used to bring the A.T. Cameron estimates into line with the Lady Hammond. In 1983 and 1984 the Alfred Needler was used. Comparative fishing experiments suggest no difference between the Lady Hammond and the Alfred Needler.

Research survey data are highly variable. This has made it difficult to determine changing trends in abundance. Consequently, we decided to explore the value of transformation in reducing the variability of these data. The following procedure was employed. Means within strata were calculated using the catch per tow at age after adding 1 to each value and taking logs. The within stratum means were then antilogged and 1 subtracted from them. Finally overall means were taken, weighted by stratum area.

In performing this analysis some data selection took place. Since a standard tow is 1.75 nautical miles, achieved by towing for 30 minutes at 3.5 knots, only the following were included: tows of 20-40 minutes duration; speeds of 2-5 knots; and tow distances of greater than 1 nautical mile. For comparative purposes, these data were also used to calculate the arithmetic mean catch at age per tow as in previous years. These and the retransformed geometric means are in Tables 23 and 24. It should also be noted that during the past year an error was found in the 1973 survey data (Cruise A, Stratum 58, Set 7) the towed distance was previously in error miles, but has been corrected. A comparison of the age 5+ numbers for the two indices in Tables 23 and 24, is in Figure 3.

There is some doubt as to the precise methodology which should be applied in transforming the RV survey data. A slightly different approach was adopted for 4X haddock. Some guidelines on this topic are expected from CAFSAC in the coming year.

The trends in mean catch per tow for all RV surveys (spring, summer, fall, and comparative) suggest that the recent increase in abundance (1977-1981) continues, but at a slower rate than in the 1978-1981 period (Table 26, Figure 4).

Catch rates by Canada Maritimes otter trawlers show a substantial decline in 1983 and remain low in 1984 (Table 27). A multiplicative catch rate standardization (Gavaris, 1980) was carried out by Mahon et al. (1984) (Figure 5). The regression was weighted by catch. This series shows an increasing trend from 1972 through 1982 with a sharp decline to similar levels in 1983 and 1984. This decline in commecial catch rates in the last two years is not reflected in the survey catch per tow in kg. This is likely due to the relatively high abundance of partially recruited (to the commercial fishery) age classes.

Estimation of Stock Abundance

The following 3 relationships were used to calibrate the cohort analysis.

a) SPA numbers, age 5 vs RV mean catch-per-standard-tow, age 5
b) SPA fishable biomass vs RV fishable biomass beginning of year
c) SPA fishable biomass vs standardized catch rate

All calculations were performed using the COHORT program of Rivard (1982). Natural mortality was assumed to equal 0.2. Assuming full recruitment at age 6, partial recruitment of younger fish in each year was estimated as F-at-age divided by fully recruited F. Partial recruitment was assumed to be 1 for all fully recruited ages.

Owing to the apparent change in partial recruitment in 1984, partial recruitment values at ages 2-4 were recalculated as follows. The cohort analysis was calibrated using age 5 of the RV survey. Using the fully recruited terminal F (0.15) estimated by the above calibration procedure, the terminal Fs of ages 4-2 were reset successively so as to maximize the correlation coefficient (last point included) for the age specific relationships of SPA vs RV numbers (Figures 6 to 9). The resulting partial recruitment pattern can be found in Table 31.

The choice of age 5 alone in estimating fully recruited F was based on two considerations. Firstly, age 6 is the 1978 year-class for which there appear to be problems which remain to be solved. Secondly, there is very little catch at ages 7+ on which to base an estimate of F_t. It is important to note that the projections depend a great deal on abundance and partial recruitment at ages 2-4. Using the above method, these values are not significantly affected by the fully recruited terminal F used.

For relationships i and ii the RV values were averaged within cohorts between summer surveys (Table 25) and compared to the beginning of year SPA values. The purpose of averaging in this way was to reduce the variability inherent in the survey data, and to use a closer temporal match between the SPA and surveys than is afforded by the past practice of comparing SPA midyear estimates obtained by log linear interpolation, with RV summer estimates.

The r^2 values and intercepts for the calibration relationships above are in Table 28. For the survey indices both r^2 and intercept indicate on F_t of about 0.15. As would be expected the commercial catch rates point to a substantially higher F_t; about 0.55.

Plots of these relationships at a terminal F of 0.20 are in Figures 10 to 12. The SPA estimate of numbers, fishing mortalities, and partial recruitment values are in Tables 29, 30, and 31.

Yield-Per-Recruit

A Thompson and Bell yield-per-recruit analysis (Rivard, 1982) using the 1984 weights at age, with age 14 interpolated, gave an $F_{0.1}$ of 0.21 and a F_{max} of 0.42. The $F_{0.1}$ value estimated in previous years is 0.22. The yield-per-recruit at $F_{0.1}$ is 0.39. The average weight of fish in the catch at $F_{0.1}$ is 1.4 kg. In recent years the average weights in the catch have been about 1 kg.

Recruitment

In recent years about 50% of the nominal catch has come from partially recruited age classes. Consequently, the problem of estimating abundance of age classes 1-4 is particularly critical to the catch projections of this stock.

Some recent year-classes 1980-1982 appear to be large relative to the weak year-classes of the 1970s. With the development of an SPA back to 1948 (Table 29), it is now possible to put these year-classes in the context of recruitment levels in the 1950s and early 1960s when the stock was at higher levels.

Mature female spawning biomass for 1948-1983 was estimated from the SPA numbers-at-age times weights-at-age (Table 22) times percent maturity-at-age (Tables 32 and 33), assuming a 1:1 sex ratio. The percent mature females at ages 1-7+ was determined from RV survey cruises from 1958 to 1983 then smoothed within ages using a three year running average (Figure 13). The 1948-1957 period was assumed to be equal to 1958.

The trends in recruitment (SPA age 1 numbers) and mature female biomass in the preceeding year (Figure 14) show that recent estimates of recruitment are similar to previous large year-classes in the 1950s and 1960s. However, the recent high levels of recruitment are being produced by much lower levels of mature female biomass than was present in the earlier years. This observation is only meaningful if there is some relationship between recruitment and parent biomass.

The plot of recruitment versus mature female biomass (Figure 15) shows an obvious association between the two. Pending a more thorough analysis, the most appropriate approach to interpreting this association is to divide the stock and recruitment axes, (Figure 15), into three classes, each corresponding to low, medium, and high values, and to examine the relative frequency of recruitment classes in each of the stock classes.

With one exception, low stock has always resulted in low recruitment. High stock has usually resulted in medium recruitment with occasional high and low (but no very low) values. Recruitment resulting from medium stock has been evenly distributed among the classes (i.e., is most variable) though it may on average be higher than recruitment from high stock levels. It should be noted that the most recent recruitment estmates, those about which we are least certain result from medium levels of stock.

As regards projections, this recruitment time series allows a more reasonable mean recruitment value to be used as input.

The numbers of recruits at ages 1 and 2 in 1984 were estimated from the age-specific relationships between survey and SPA numbers. For age 1, the 1982 point was an obvious outlier and was excluded from the relationship (Figure 16).

Catch Projections

The following input parameters were used for catch projections the results of which appear in Tables 34 and 35.

Age	Population Numbers 1984 (000)	Catch 1984 (000)	Weights (kg)	PR
1	13,400	10	0.09	0.004
2	62,316	360	0.26	0.032
3	47,217	1.514	0.58	0.18
4	45,536	4,158	0.74	0.53
5	13,496	2,225	1.04	1
6	4,979	821	1.46	1
7	2,484	410	1.79	1
8	546	90	2.15	1
9	180	30	2.66	1
10	29	5	3.24	1
11	14	2	3.18	1

Discussion

The current assessment indicates that the stock biomass was over-estimated during the period of rapid recovery at the turn of the decade. The surveys continue to show a steady increase in biomass, primarily due to good recruitment from the 1980-82 year-classes. Present indications are that the 1983 year-class is relatively poor. Although there is good reason to question the validity of the recent decline in commercial catch rates, they should caution against continuing to accept the survey trends too readily.

Even accepting the survey results at face value, there are problems with calibration of the SPA. The first of these concerns the 1978 year-class. At ages 1-3 this year-class appeared to be very poor in both survey and commercial catch. In 1983 and 1984 its relative strength (ages 5 and 6) increased to an unexpected degree. The effect of this is to substantially increase our estimates of this year-class at younger ages, contrary to the indications of the survey. The point for this year-class becomes an outlier in each of the age by age relationships used for determining partial recruitment. There are several possible explanations for this observation.

i) The year-class is really much larger than previously thought, and the early survey estimates are in error.

ii) The year-class is really as small as early survey estimates but shifting fishing patterns resulted in the direction of an unusually high proportion of fishing effort on this age class. If so, then F at age six in 1984 should be set independently of other ages. This

is not in keeping with the accepted practice of using the same terminal F on all fully recruited ages.

iii) The year-class is really as small as previous estimates suggest but that ageing errors have artificially increased its apparent size. In 1984 a new person began reading the ages of haddock. There were some initial difficulties with fish of ages 4-6. These were largely corrected but may persist to some extent. It is also noteworthy that when there is a very small age-class bracketed by two large ones, a constant percentage of ageing errors across ages will tend to fill in the small age-class. For example, with three age classes in the ratios of 3:1:3, a 10% error rate will change the observed ratios to 1.8:1:1.8. If, as might be expected, ageing errors are higher at older ages, the filling in effect might account for the unexpected increase in size of the 1978 year-class in 1983 and 1984. Of the three possibilities listed this seems the most likely.

Further in regard to calibration of the SPA, there are still patterns in the residuals of the relationships. Use of a transformation has, in general, reduced the scatter in the relationships. This makes the patterns in some of the residual plots even more apparent than in previous assessments. Figure 9, the relationship for age 2, shows a pronounced linear trend in the residuals for 1971-82, with the 1983 and 1984 points far off the trend. At age 4 the points for 1980-82 all have large positive residuals (Figure 7). The commercial catch rate residuals have a parabolic pattern in which the 1984 observation, while twice the size of the largest residual in the early part of the series, could be predicted from the pattern established in the previous years.

Taking a longer term perspective, the historical information presented in Figures 13 and 14 provides a better view of management options then has previously been available. Firstly, Figure 14 indicates that at levels of mature female biomass below 20,000 t one can expect consistently low recruitment (geometric mean = 12 million, $F_{0.1}$ yield = 4,700 t). At intermediate levels of stock biomass there may be a trade off between slightly higher levels of recruitment and substantially decreased stability. The geometric mean levels of recruitment over the medium and high stock ranges are 57 and 52 million corresponding to $F_{0.1}$ yields of 22,200 t and 20,300 t respectively. Previous assessments have pointed out other fishery characteristics associated with high stock biomass levels: high catch rates and large fish (Mahon 1983).

In this context it is interesting to note that estimated fishing mortality has been higher than F_{max} throughout the known history of this stock (Figure 17). With the exception of the war years, catches from 1931 and 1948 appear to have averaged in the upper 20,000 t area. The resulting Fs were also probably close to F_{max}.

Finally, growth of 4VW haddock appears to be at or near an historical low. This may be due to the presence of several large year-classes or to the fact that the stock now occupies only a portion of its historical range. If growth in biomass is accompanied by range expansion, growth may

improve and $F_{0.1}$ yield levels may be slightly higher than those calculated above.

Summary

The survey and commercial catch rate indices are showing different trends for this stock. The latter are suspect in view of recent disruption of the usual fishing pattern.

The 1978 year-class previously estimated to be very small is contributing a surprising amount of the catch and is an outlier in the tuning relationships.

The trends in the residuals for the calibration relationships are still there but much less pronounced than in previous years.

The longer time series enables a better perspective on the history of this stock (Figure 17). However, the trend in fishing mortality to fully recruited ages does not reveal the extremely high fishing mortalities on young fish in 1965 and 1966 (Table 30) which may have resulted in recruitment failure for about 8 years thereafter (Figure 14).

Recent large year-classes are big even in comparison to those of the earlier years when stock biomass was about double what it now is.

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Table 1. Nominal catches (t) of eastern Scotian Shelf haddock (4TVW) by NAFO Division and country as reported to NAFO.

	4T					4Vn*					4Vs					4W						
Year	Canada	USA	USSR	Spain	Other	Canada	USA	USSR	Spain	Other	Canada	USA	USSR	Spain	Other	Canada	USA	USSR	Spain	Other	Total	TAC
1954	5918	1044			40	5549	405		1058	24						12323	1956		17		28334	
1955	3101	31				3339	450		1183	13						12777	1217				22111	
1956	2861					4899	147		1350	12						18273	1661		354		29557	
1957	1740	1				5769	120		747	9						19960	1533		132		30011	
1958	2599			151		3166	71		1343	6						17572	427		1593		26928	
1959	2996	1		64		1594	159		69		3456	111		2870		21156	4804		640		37920	
1960	2041					1317	6		97		1187	18		3926	1	20093	127		1024		29837	
1961	1297			273	2	1055	1		47	1	846			1526	7	22277	23	151	1441	16	28963	
1962	1132			10		1097	1		5	2	1235			1076		15566	51	2567	3224		25966	
1963	1019			46		1213	1	6	64		1061	1		2828	195	11002	60	3295	4915	866	26572	
1964	461			1		958			59	52	677	11		2057	2	9810	42	4391	2884	1889	23294	
1965	432			3	3	402			53	84	1201			1806	47	7007	8	42876	1500	96	55518	
1966	149			1		311		516	30		1494			940	9	8259	19	9985	1885	51	23649	
1967	112			9		203		95	26	31	898			839	9	7180	5	459	1046		10912	
1968	144				4	127			70	6	1128		59	1702	23	8392		195	1458	12	13320	
1969	167				3	245				112	726			631	69	8270		235	864	1	11323	
1970	160					395	2		75	1	620		34	830	20	4754	574	636	1332		9436	
1971	151					466			215	1	1133		11	1114		7940	497	464	1477		13469	
1972	60					362	3		136	19	421		3	599	37	2096	70	103	737	102	4748	
1973	21				2	286			76	164	233			431	9	2830	173	76	95	18	4414	
1974	17				14	161			3	1	147		30	174	196	907	6	102	521	78	2357	(0)
1975	35				2	67			15	4	107	1		48	3	1393	20	52	63	59	1869	(0)
1976	12					40				1	52	1	9		1	1198	31	15			1360	(2000)
1977	8					189				8	144				1	2845	1	14		38	3248	(2000)
1978	18					119				3	441		3		38	4949	82	139		109	5901	(2000)
1979	59					194				11	650				3	2339		104		73	3433	(2000)
1980	81					188				42	1841					12448		209		31	14840	(15000)
1981	177					119				25	1796					17684		187		21	20009	(23000)
1982	25					181					2365					12485		51		49	15156	(23000)
1983	36					200				22	1532				12	7265		169		157	9393	(15000)
1984	110					301				10	3256				4	3991		298		259	8229	(15000)
1985																						(15000)

* Catches for 1954-58 are for 4Vn and 4Vs combined.

Table 2. Recent Canadian fishery allocations and the respective reported catch (t) of 4VW haddock. Information from Canadian Atlantic Quota Reports.

Year	Fleet	Allocation	Reported Catch	%	Closure Date
1977	All Vessels	1700	2086	123	
1978	All Vessels	1700	5040	296	
1979	All Vessels	1700	2650	156	
1980	All <125'	3400	3302	97	
	All >125'	11500	11175	97	Apr. 2/80
1981	All <125'	4550	4352	96	
	All >125'	18300	15233	83	May 6/81
1982	All >100'	16600	9365	56	
	MG 65'-100'	750	583	78	Jul. 23/82
	MG <65'	4000	3097	77	Aug. 28/82
	FG <65'	1650	1410	85	
1983	All >100'	11650	5906	51	
	MG 65'-100'	500	395	79	
	MG <65'	1450	1318	91	
	FG <65'	1400	1418	101	
1984	All >100'	11850	5290	45	
	MG 65'-100'	330	256	76	
	MG <65'	1920	1168	60	
	FG <65'	900	924	103	
1985	All >100'	11850	1736*		Apr. 3/85
	MG 65'-100'	330	86*		
	MG <65'	1920	90*		
	FG <65'	900	28*		

* Landings to date: 1985/04/05

Table 3. Canadian (M, Q, & Nfld.) nominal catches (t) of eastern Scotian Shelf haddock in 4V and 4W (4TVW) by gear.

Year	Otter Trawler	Danish/Scottish Longliner	Danish/Scottish Seiner	Miscellaneous	Total
1960	20835	1077	23	696	22631
61	22060	448	52	1377	23937
62	16453	665	76	705	17899
63	11943	511	147	526	13127
64	10679	70	62	874	11685
1965	8033	352	66	160	8611
66	10222	233	19	130	10604
67	7855	126	25	573	8579
68	8819	296	16	364	9495
69	8603	289	30	341	9263
1970	5056	479	20	262	5817
71	8709	538	77	179	9503
72	2141	528	76	138	2883
73	2459	628	28	232	3347
74	543	493	17	162	1215
1975	593	873	10	82	1558
76	383	657	10	75	1125
77	2198	729	26	170	3123
78	4009	1069	67	340	5485
79	1745	1232	66	147	3190
1980	13063	933	229	270	14495
81	17859	1253	464	113	19689
82	12346	1567	890	249	15052
83	6969	1254	541	235	8997
84	6188	908	451	112	7659

Table 4. Nominal catches (t) of eastern Scotian Shelf haddock in 4V and 4W by month by Canadian (MQ) otter trawlers.

YEAR	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
1960	578	3372	4827	1328	1177	597	1427	1678	1543	1199	1665	1442	20833
1961	1387	2761	5029	6605	1389	324	508	489	859	927	1022	488	21788
1962	626	1863	4749	2401	1164	615	954	1079	1015	739	654	449	16308
1963	664	236	388	4444	1357	645	844	1079	1004	434	659	237	11991
1964	406	1531	1473	1557	1155	378	688	1082	804	359	342	638	10413
1965	347	819	1005	1114	986	350	1563	644	109	206	338	363	7844
1966	369	463	3301	1821	2151	264	247	138	136	63	262	101	9316
1967	198	294	4038	800	258	85	263	237	100	526	661	187	7647
1968	254	546	3302	782	730	901	602	114	317	391	650	408	8997
1969	888	1183	3108	1472	852	183	132	106	61	117	81	349	8532
1970	425	480	1436	1459	141	86	398	110	74	78	115	227	5029
1971	408	772	4740	1946	147	225	47	39	16	20	32	200	8592
1972	103	90	1022	280	105	221	19	56	26	18	49	128	2117
1973	93	155	1218	313	150	282	4	2	23	16	32	107	2395
1974	45	78	58	20	24	103	18	43	35	28	30	40	522
1975	25	71	68	124	65	20	85	9	40	34	20	27	588
1976	15	1	18	39	76	102	4	32	17	22	13	42	381
1977	44	90	79	57	217	37	49	114	184	180	297	796	2144
1978	118	151	669	1121	193	25	124	113	58	62	226	66	2926
1979	26	76	157	43	357	136	120	112	45	110	193	268	1643
1980	107	1165	2391	1099	316	486	744	676	411	1108	1444	1466	11413
1981	426	752	3099	3308	1990	606	509	209	105	589	346	290	12229
1982	176	305	4207	2737	1778	1076	680	288	135	196	220	102	11900
1983	72	191	1400	2078	1386	737	272	209	160	100	143	31	6779
1984	93	104	492	942	815	1018	1097	270	343	328	149	323	5974

Table 5. Nominal catches (t) of eastern Scotian Shelf haddock in 4V and 4W by month by Canadian (MQ) longliners.

YEAR	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
1960	50	122	76	66	18	-	133	80	172	25	190	145	1077
1961	3	36	23	35	6	1	8	13	63	64	159	81	492
1962	13	1	74	2	7	6	25	33	67	145	206	86	665
1963	25	3	4	49	9	17	26	30	49	85	68	52	417
1964	3	-	3	5	3	-	-	-	-	23	12	22	71
1965	17	41	27	65	23	10	5	23	28	39	53	21	352
1966	-	24	71	11	-	-	7	12	9	52	30	17	233
1967	3	1	19	10	-	3	7	5	15	29	25	9	126
1968	10	19	17	42	10	10	12	42	42	49	38	6	297
1969	1	1	8	8	4	9	25	56	39	68	53	17	289
1970	19	4	43	22	12	12	25	57	120	110	40	15	479
1971	-	14	12	33	18	26	94	61	106	107	38	29	538
1972	-	-	3	9	17	26	102	88	73	111	81	18	528
1973	1	6	115	149	47	40	39	62	56	78	59	17	669
1974	10	4	16	20	27	44	74	78	59	71	63	27	493
1975	31	37	69	78	93	81	74	138	88	105	57	24	875
1976	20	36	93	113	71	56	106	85	72	70	57	17	796
1977	15	33	55	36	42	86	65	92	72	116	100	34	746
1978	31	63	78	104	121	116	175	166	105	53	49	8	1069
1979	5	18	123	109	129	110	148	215	142	94	109	30	1232
1980	4	2	36	98	103	111	125	189	98	89	32	12	899
1981	4	28	152	37	82	69	142	168	173	196	189	82	1322
1982	5	16	231	126	82	124	141	194	298	254	73	27	1569
1983	17	12	50	91	70	142	142	139	157	181	174	95	1269
1984	62	38	44	38	48	70	118	87	125	163	64	51	908

(a) Monthly catches of 4VW haddock reported to NAFO by USSR. 27/ 4/85

	1961	1962	1963	1964	1965	1966	1967	1968	1969
1	0	0	9	16	0	0	0	0	26
2	0	63	0	7	0	0	0	0	5
3	0	1575	0	177	0	0	164	17	76
4	0	102	0	0	0	109	117	58	7
5	0	289	294	99	148	2369	12	67	5
6	0	0	0	10	74	2064	251	0	0
7	0	0	0	434	14529	4254	0	1	51
8	0	0	248	3521	16145	906	0	76	15
9	0	0	493	101	3793	655	0	0	45
10	120	0	1655	22	4275	153	10	0	0
11	31	306	602	4	3747	127	0	35	5
12	0	232	0	0	165	0	0	0	0

(b) Monthly catches of 4VW silver hake reported to NAFO by USSR. 27/ 4/85

	1961	1962	1963	1964	1965	1966	1967	1968	1969
1	0	0	7858	154	0	0	0	0	459
2	0	0	4087	135	0	0	0	0	860
3	0	51	5861	1100	18	0	0	0	1363
4	0	720	6741	3	0	0	0	0	9079
5	0	0	38713	28003	15593	1719	58	626	5035
6	0	0	20877	629	511	704	1746	104	0
7	0	0	2	13065	16760	569	20	0	5235
8	0	0	12999	19557	12195	83	10	46	12299
9	0	0	12522	0	2818	324	0	36	7006
10	0	0	1744	194	403	230	0	972	1686
11	0	3952	2396	74	692	271	0	881	1747
12	0	4101	2755	23	650	0	0	720	0

(c) By-Catch ratio of haddock per ton of silver hake. 27/ 4/85

	1961	1962	1963	1964	1965	1966	1967	1968	1969
1			0.11•	10.39					5.66
2			0.00•	5.19					0.58•
3		3088.17	0.00•	16.09	0.00•				5.58
4		14.17	0.00•	0.00•					0.08•
5			0.76•	0.35•	0.95	137.81	20.69	10.70	0.10•
6			0.00•	1.59	14.48	293.18	14.38	0.00•	
7			0.00•	3.32	86.69	747.63	0.00•		0.97
8			1.91	18.00	132.39	1091.55	0.00•	165.21	0.12•
9			3.94		134.60	202.16		0.00•	0.64•
10			94.90	11.34	1060.79	66.52		0.00•	0.00•
11		7.74	25.13	5.41	541.47	46.86		3.97	0.29•
12		5.66	0.00•	0.00•	25.38			0.00•	

Table 6. Catches of haddock and silver hake by the USSR (1961-1969). In (c) unexpectedly low by-catch ratios are indicated by a period

Table 7. Sources of Research Vessel survey age-length keys and length-frequencies used in estimating catch-at-age for USSR removals in 1961-1969.

Year	Length Frequency (number samples)	Age Length Key (number sampled)
1961	A037 April-May 1961 (22,789)	(809)
1962	A052-53 March-April 1962 (32,406)	(1233)
1963	H051 Sept. 1963 (8,160)	H024 July 1960 (653)
1964	A088 July 1964 (10,369)	P008 July 1967 (913)
1965	L002 July-Aug. 1965 (1,860)	P008 July 1967 (913)
1966	J001-2, H007 June-July 1966 (6,019)	P008 July 1967 (913)
1967	P008 July 1967 (1,290)	(913)
1968	P26- P36 May & October 1968 (650)	(199)
1969	A155-156, P42, P49 Jan. March, July (2,870)	(1,170)

A = A.T. Cameron

H = Harengus

P = Prince

L = Louise

J = P.J. Lawrence

Table 8. Summary of samples of commercial catch by year, quarter, and gear type for 4VW haddock.

Year	Gear	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec
1948	Otter trawlers	6	3	2	6
	Longliners	0	0	2	2
	Dory	7	3	0	0
	Traps	0	1	1	0
1949	Otter trawlers	11	9	3	6
	Longliners	0	2	0	0
	Dory	7	1	0	2
1950	Otter trawlers	6	4	0	0
	Longliners	2	0	0	2
	Dory	1	1	0	0
	Traps	0	2	0	0
1951	Otter trawlers	7	3	0	2
	Longliners	0	1	0	1
	Dory	0	0	0	0
1952	Otter trawlers	8	3	2	1
	Longliners	0	1	0	5
	Dory	0	1	0	1
	Traps	0	1	0	0
1953	Otter trawlers	9	3	7	3
	Longliners	2	2	0	5
	Dory	0	0	0	0
1954	Otter trawlers	1	11	1	1
	Longliners	0	0	2	2
	Dory	1	0	0	0
1955	Otter trawlers	9	6	10	4
	Longliners	0	2	2	0
1956	Otter trawlers	9	19	10	7
	Longliners	1	2	1	1
1957	Otter trawlers	16	18	4	2
	Longliners	0	0	3	5
1958	Otter trawlers	8	12	12	8
	Longliners	2	2	5	6
1959	Otter trawlers	19	8	9	4
	Longliners	0	0	7	1
1960	Otter trawlers	12	5	6	1
	Longliners	0	0	5	1

Table 8. Continued

Year	Gear	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec
1961	Otter trawlers	6	10	3	3
	Longliners	0	0	1	1
1962	Otter trawlers	17	6	8	4
	Longliners	0	0	1	0
	Traps	0	1	0	0
1963	Otter trawlers	3	14	7	5
	Longliners	0	1	0	0
	Traps	0	1	0	0
1964	Otter trawlers	7	21	2	2
	Longliners	0	0	0	0
1965	Otter trawlers	3	11	1	1
	Longliners	0	0	1	0
1966	Otter trawlers	4	3	1	1
	Longliners	0	0	0	0
1967	Otter trawlers	7	2	1	3
	Longliners	0	0	0	0
	Traps	0	0	1	0
1968	Otter trawlers	6	9	2	3
	Longliners	0	0	0	1
1969	Otter trawlers	5	2	1	1
	Longliners	0	0	1	3
1970	Otter trawlers	5	5	0	1
	Longliners	0	0	2	1
1971	Otter trawlers	16	7	0	1
	Longliners	0	0	1	4
1972	Otter trawlers	5	1	0	1
	Longliners	0	0	0	1
1973	Otter trawlers	6	1	1	0
	Longliners	0	2	0	1
1974	Otter trawlers	1	0	0	0
	Longliners	0	0	1	1
1975	Otter trawlers	1	2	0	1
	Longliners	0	0	0	1

Table 8. Continued

Year	Gear	Jan-Mar	Apr-Jun	Jul-Sept	Oct-Dec
1976	Otter trawlers	0	1	1	1
	Longliners	1	0	1	1
1977	Otter trawlers	1	2	4	7
	Longliners	1	2	0	0
	Danish seine	0	1	0	0
1978	Otter trawlers	11	7	1	1
	Longliners	1	4	0	0
1979	Otter trawlers	1	2	4	3
	Longliners	1	3	5	3
1980	Otter trawlers	18	8	9	14
	Longliners	0	0	4	0
	Danish seine	0	2	0	0
1981	Otter trawlers	21	13	8	6
	Longliners	2	0	6	4
	Danish seine	0	0	2	0
	Gillnet	0	0	1	0
1982	Otter trawlers	19	29	6	7
	Longliners	4	3	7	1
	Danish seine	0	2	1	0
1983	Otter trawlers	12	34	13	3
	Pair trawlers	0	1	1	1
	Longliners	0	5	3	0
	Danish seine	0	3	0	1
	Gillnet	0	3	0	0
1984	Otter trawlers	8	25	12	18
	Pair trawlers	0	0	2	1
	Longliners	0	3	1	0
	Danish seine	2	0	3	1
	Gillnet	0	1	0	0

Table 9. Grouping of catch by gears and time period for estimation of removals-at-age. Trawlers are primarily stern and side bottom trawls but also pair trawls, other is primarily longline, Danish seine, and Scottish seine but prior to 1959 includes a high proportion of Dory Schooner catches.

Year	Period	Gears	No. of Samples	Number Aged	Number Measured	Catch (t)	Weight-Length Relationship a	b	Cruise
1948	Jan - Dec	Trawlers	17	678	3400	15216		Summer	[Spring, summer, and fall weight-length relationships are overall for the periods January-April, May-August, and September-December respective for the years 1970-1981; see text.]
	Jan - Dec	Other	16	560	2808	7828		Summer	
1949	Jan - Dec	Trawlers	29	1151	5800	13258		Summer	
	Jan - Dec	Other	12	457	2084	5564		Summer	
1950	Jan - Dec	Trawlers	10	400	2000	22452		Summer	
	Jan - Dec	Other	8	232	1356	6149		Summer	
1951	Jan - Dec	Trawlers	12	484	2425	18618		Summer	
	Jan - Dec	Other	2	60	300	6708		Summer	
1952	Jan - Dec	Trawlers	14	559	3974	23517		Summer	
	Jan - Dec	Other	9	349	1751	4693		Summer	
1953	Jan - Dec	Trawlers	22	917	4200	18350		Summer	
	Jan - Dec	Other	9	357	1477	4586		Summer	
1954	Jan - June	Trawlers	12	745	3882	15942		Spring	
	July - Dec	Trawlers	2	106	530	7146		Fall	
	Jan - Dec	Other	5	199	984	5246		Summer	
1955	Jan - June	Trawlers	15	679	3411	13213		Spring	
	July - Dec	Trawlers	14	489	2619	4708		Fall	
	Jan - Dec	Other	4	160	800	4090		Summer	
1956	Jan - June	Trawlers	28	1119	5601	14236		Spring	
	July - Dec	Trawlers	17	677	3380	10316		Fall	
	Jan - Dec	Other	5	199	1008	5004		Summer	
1957	Jan - June	Trawlers	34	1540	7803	17336		Spring	
	July - Dec	Trawlers	6	289	1430	8979		Fall	
	Jan - Dec	Other	8	319	1600	3696		Summer	
1958	Jan - June	Trawlers	20	1085	4891	16956		Spring	
	July - Dec	Trawlers	20	1039	5206	7435		Fall	
	Jan - Dec	Other	15	680	3354	2537		Summer	
1959	Jan - June	Trawlers	27	1163	6225	24452		Spring	
	July - Dec	Trawlers	12	479	2410	10841		Fall	
	Jan - Dec	Other	8	310	1537	2627		Summer	
1960	Jan - June	Trawlers	17	680	3399	14824		Spring	
	July - Dec	Trawlers	7	302	1452	13018		Fall	
	Jan - Dec	Other	6	240	1150	1995		Summer	
1961	Jan - June	Trawlers	16	757	5806	19983		Spring	
	July - Dec	Trawlers	6	277	1474	6888		Fall	
	Jan - Dec	Other	2	60	277	1938		Summer	

Table 9. Continued

Year	Period	Gears	No. of Samples	Number Aged	Number Measured	Catch (t)	Weight-Length Relationship a	b	Cruise
1962	Jan - June	Trawlers	23	1219	7550	13256		Spring	
	July - Dec	Trawlers	12	543	3231	8515		Fall	
	Jan - Dec	Other	2	95	477	1628		Summer	
1963	Jan - June	Trawlers	17	720	5189	13712		Spring	
	July - Dec	Trawlers	12	567	3225	8100		Fall	
	Jan - Dec	Other	2	34	585	1459		Summer	
1964*	Jan - June	All	28	1246	8237	13106		Spring	
	July - Dec	All	4	238	1372	5797		Fall	
1965	Jan - Dec	Trawlers	16	625	4199	12017		Summer	
	Jan - Dec	Other	1	40	203	625		Summer	
1966*	Jan - Dec	All	9	417	3102	13148		Summer	
1967	Jan - June	Trawlers	9	575	3353	7337		Spring	
	July - Dec	Trawlers	4	142	958	2586		Fall	
	Jan - Dec	Other	1	40	198	435		Summer	
1968	Jan - June	Trawlers	15	584	3788	9387		Spring	
	July - Dec	Trawlers	5	186	1203	2945		Fall	
	Jan - Dec	Other	1	33	199	732		Summer	
1969	Jan - Dec	Trawlers	9	318	2065	10353		Summer	
	Jan - Dec	Other	4	181	801	732		Summer	
1970	Jan - Dec	Trawlers	11	405	2172	7986	0.0062	3.136	Cameron #170 March 1970
	Jan - Dec	Other	3	107	602	779	0.0112	2.989	Cameron #175/176 July 1970
1971	Jan - Dec	Trawlers	24	966	5930	12174	0.0052	3.168	Cameron #184 March 1971
	Jan - Dec	Other	5	197	966	820	0.0088	3.035	Cameron #188/189 July 1971
1972	Jan - Dec	Trawlers	7	255	1661	3802	0.0036	3.261	Cameron #196 March 1972
	Jan - Dec	Other	1	29	200	817	0.0133	2.943	Cameron #200/201 July 1972
1973	Jan - Dec	Trawlers	8	299	1831	3407	0.0036	3.261	Cameron #196 March 1972
	Jan - Dec	Other	3	100	652	927	0.0096	3.017	Cameron #212/213 July 1973
1974	Jan - Dec	Trawlers	1	37	364	1545	0.0089	3.035	Cameron #225/226 July 1974
	Jan - Dec	Other	2	70	459	680	0.0089	3.035	Cameron #225/226 July 1974
1975	Jan - Dec	Trawlers	4	136	1048	778	0.0045	3.204	Cameron #219 March 1974
	Jan - Dec	Other	1	30	200	982	0.0094	3.023	Cameron #236/237 July 1975
1976	Jan - Dec	Trawlers	3	106	850	424	0.0191	2.837	Cameron #250/251 July 1976
	Jan - Dec	Other	3	89	478	912	0.0191	2.837	Cameron #250/251 July 1976
1977	Jan - June	Trawlers	3	105	616	548	0.0103	2.983	Cameron #259 March 1977
	July - Dec	Trawlers	11	319	2419	1684	0.0108	2.996	Cameron #265/266 July 1977
	Jan - Dec	Other	4	133	885	982	0.0108	2.996	Cameron #265/266 July 1977

* No commercial samples collected for other gears in 1964 or 1966. The catch for other gears for these years has been added to the trawler catch by season for 1984 and to the overall trawler catch for 1966.

Table 9. Continued

Year	Period	Gears	No. of Samples	Number Aged	Number Measured	Catch (t)	Weight-Length Relationship a	b	Cruise
1978	Jan - June	Trawlers	18	582	5776	3453	0.0019	3.425	Cameron #274 March 1978
	July - Dec	Trawlers	2	55	507	649	0.0103	3.000	Cameron #279/280 July 1978
	Jan - Dec	Other	5	164	1068	1536	0.0103	3.000	Cameron #279/280 July 1978
1979	Jan - June	Trawlers	3	80	650	847	0.0063	3.117	Hammond #13/14 March 1979
	July - Dec	Trawlers	6	189	1324	878	0.0050	3.187	Hammond #26/27 Oct-Nov 1979
	Jan - Dec	Other	12	347	2675	1528	0.0057	3.155	Cameron #292/293 July 1979
1980	Jan - June	Trawlers	24	759	5527	7077	0.0069	3.091	Hammond #33/34 March 1980
	July - Dec	Trawlers	22	619	5021	6122	0.0049	3.197	Hammond #42/43 October 1980
	Jan - Dec	Other	6	180	1421	1412	0.0117	2.970	Cameron #306/307 July 1980
1981	Jan - June	Trawlers	29	642	7450	15709	0.0070	3.102	Hammond #48/49 March 1981
	July - Dec	Trawlers	14	374	3062	2067	0.0087	3.049	Hammond #64/65 October 1981
	Jan - Dec	Other	15	407	2793	2025	0.0093	3.037	Cameron #321/322 July 1981
1982	Jan - June	Trawlers	48	1339	11563	10702	0.0059	3.143	Hammond #71/72 March 1982
	July - Dec	Trawlers	13	379	2682	1657	0.0068	3.100	Needler #2/3 October 1982
	Jan - Dec	Other	18	472	3337	2676	0.0123	2.954	Hammond #80/81 July 1982
1983	Jan - June	Trawlers	39	694	9253	6068	0.0086	3.026	Hammond #94/95 March 1983
	July - Dec	Trawlers	17	133	3642	936	0.0085	3.045	Needler #17/18 October 1983
	Jan - Dec	Other	15	131	2676	2060	0.0116	2.961	Needler #12/13 July 1983
1984	Jan - June	Trawlers	33	535	7716	3546	0.0079	3.052	Needler #24/25 March 1984
	July - Dec	Trawlers	33	315	7279	2655	0.0085	3.045	Needler #17/18 October 1983
	Jan - Dec	Other	11	256	2329	1471	0.0097	3.005	Needler #31/32 July 1984

Table 10. Foreign removals of 4VW haddock in 1984 as reported by FLASH (silver hake fishery is with small mesh gear).

County	Fishery	Area	Catch
Cuba	silver hake	4W	223.6
France	cod	4Vn	10.3
GDR	silver hake	4W	1.7
Japan	silver hake	4Vs	0.3
		4W	4.0
Portugal	cod	4Vs	3.9
	silver hake	4W	29.7
USSR	silver hake	4W	298.3

Table 11. Estimation of small mesh removals of haddock in 4VW in silver hake directed fisheries by Cuba, Bulgaria, Romania, Japan, Portugal, and the USSR 1970 to 1983. In 1984 The GDR also carried out directed fisheries for silver hake.

Year	Nominal Catch of Silver Hake (t)	IOP By-Catch Ratio (%)	Reported Catch of Haddock (t)	Estimated By-Catch Of Haddock (t)
1970	164,013	0.82*	670	1345
1971	122,616	0.82*	475	1005
1972	108,828	0.82*	106	892
1973	269,420	0.82*	76	2209
1974	87,497	0.82*	132	717
1975	98,994	0.82*	109	812
1976	90,483	0.82*	24	742
1977	30,019	0.64	33	192
1978	45,966	1.25	229	575
1979	50,374	0.51	176	257
1980	37,709	0.75	229	283
1981	37,554	0.80	201	300
1982	58,132	0.40	94	233
1983	34,259	1.64	326**	562
1984	72,297	1.33	557**	959

* Mean of 1977-1979 weighted by-catch observed.

** FLASH

TABLE 12, CATCH AT AGE (THOUSANDS) OF 4VW HADDOCK BY SMALL MESH GEAR, ALL YEAR 4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	205	1287	2591	53595	2127	89
2	0	0	0	0	0	0	0	0	0	0	0	0	0	29	436	924	2986	32157	9467	55
3	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1181	396	3381	23582	8403	100
4	0	0	0	0	0	0	0	0	0	0	0	0	0	54	411	429	1405	13292	3297	133
5	0	0	0	0	0	0	0	0	0	0	0	0	0	53	719	528	615	6003	1489	122
6	0	0	0	0	0	0	0	0	0	0	0	0	0	17	436	330	132	1286	319	33
7	0	0	0	0	0	0	0	0	0	0	0	0	0	9	154	198	44	429	106	11
8	0	0	0	0	0	0	0	0	0	0	0	0	0	5	51	297	44	429	106	28
9	0	0	0	0	0	0	0	0	0	0	0	0	0	2	26	66	0	0	0	6
10	0	0	0	0	0	0	0	0	0	0	0	0	0	2	26	66	0	0	0	11
11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	33	0	0	0	6
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	5	31	306	268	306	487	59	279	431	213	714	1	332	870	530	497	10
2	13	42	127	636	280	1134	233	61	407	197	426	258	374	241	413	462	326
3	28	56	245	216	352	418	318	223	64	49	219	97	137	22	74	305	147
4	18	52	307	247	148	378	65	206	120	9	122	54	59	59	7	82	383
5	23	31	138	102	116	109	64	48	128	13	19	28	26	32	18	52	184
6	38	35	87	60	75	239	30	72	29	7	17	7	9	18	9	77	130
7	15	16	77	28	35	60	24	18	30	3	3	6	2	3	3	30	75
8	5	5	52	43	21	60	11	7	6	1	1	1	0	1	0	10	11
9	13	2	18	2	9	10	5	4	2	0	0	0	0	1	0	2	3
10	3	2	5	0	3	20	7	4	2	0	0	0	0	0	0	1	1
11	5	0	5	0	0	0	8	0	2	0	1	0	0	0	0	0	0
12	3	0	4	0	0	0	0	1	4	0	0	0	0	0	0	0	0
13	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 13, CATCH AT AGE (THOUSANDS) OF 4VW HADDOCK BY TRAWLERS IN JAN -JUNE 4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	43	27	189	153	223	178	52	67	50	9	61	0	0
4	0	0	0	0	0	0	1655	491	4586	1370	1875	2658	1502	2790	821	1016	552	0	0
5	0	0	0	0	0	0	5811	1501	1301	7657	1608	3796	3607	5857	4053	1640	3747	0	0
6	0	0	0	0	0	0	1462	3221	1545	1618	5803	2696	1949	3092	3453	4316	1494	0	0
7	0	0	0	0	0	0	1518	1030	1860	1186	843	5541	1522	1177	1064	2184	2262	0	0
8	0	0	0	0	0	0	769	1053	577	845	584	685	1338	807	552	695	1231	0	0
9	0	0	0	0	0	0	292	473	853	219	572	376	327	636	228	159	308	0	0
10	0	0	0	0	0	0	90	146	195	183	214	406	134	175	148	40	67	0	0
11	0	0	0	0	0	0	32	10	74	63	131	170	146	55	31	10	44	0	0
12	0	0	0	0	0	0	18	33	21	20	50	100	92	78	24	5	11	0	0
13	0	0	0	0	0	0	14	23	6	5	23	12	45	52	9	0	4	0	0
14	0	0	0	0	0	0	5	0	2	17	14	17	19	9	1	7	0	0	0
15	0	0	0	0	0	0	5	0	0	0	0	0	0	7	3	0	0	0	0
16	0	0	0	0	0	0	9	0	0	0	0	0	9	0	0	0	0	0	0

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	47	0	0	0	0	0	0	0	0	0	0	0	0	0	8	3	8	0
3	522	318	0	0	0	0	0	0	0	0	25	462	87	296	63	1019	627	172
4	1454	1306	0	0	0	0	0	0	0	0	22	1542	325	1697	3814	433	2476	2146
5	1938	2159	0	0	0	0	0	0	0	0	96	288	191	1905	4446	4463	1338	1285
6	896	1811	0	0	0	0	0	0	0	0	97	361	36	1210	2526	1441	1066	289
7	343	567	0	0	0	0	0	0	0	0	29	134	33	201	1016	818	297	137
8	518	264	0	0	0	0	0	0	0	0	37	21	6	97	105	138	163	40
9	186	360	0	0	0	0	0	0	0	0	8	13	0	26	74	19	16	5
10	157	79	0	0	0	0	0	0	0	0	10	7	4	5	22	19	5	2
11	45	42	0	0	0	0	0	0	0	0	1	2	0	4	5	2	10	1
12	3	30	0	0	0	0	0	0	0	0	5	0	0	0	1	7	2	0
13	6	16	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	0
14	0	3	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 14. CATCH AT AGE (THOUSANDS) OF 4VW HADDOCK BY TRAWLERS IN JULY-DECEMBER 4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	12	0	213	0	63	0	0	3	0	0	87	0	0	78
3	0	0	0	0	0	0	134	423	1716	463	1856	2721	392	253	259	106	632	0	0	381
4	0	0	0	0	0	0	848	508	6158	1988	1763	4022	4712	1694	774	2021	411	0	0	776
5	0	0	0	0	0	0	3666	831	877	4470	697	1526	3670	2246	2850	1465	1661	0	0	677
6	0	0	0	0	0	0	242	1207	461	181	1664	491	1105	858	2077	1659	443	0	0	163
7	0	0	0	0	0	0	297	285	362	154	138	1092	533	151	565	664	600	0	0	80
8	0	0	0	0	0	0	232	173	76	228	92	58	461	175	136	92	287	0	0	47
9	0	0	0	0	0	0	22	30	114	69	121	54	22	81	22	25	95	0	0	15
10	0	0	0	0	0	0	21	20	18	43	10	69	0	0	7	7	15	0	0	6
11	0	0	0	0	0	0	23	6	6	14	6	4	9	0	11	3	1	0	0	4
12	0	0	0	0	0	0	0	4	1	0	0	0	7	5	3	1	0	0	0	0
13	0	0	0	0	0	0	0	0	14	0	0	0	30	0	1	1	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	84	0	3	2	62	15	0	34
3	52	0	0	0	0	0	0	0	0	779	57	113	1897	143	319	142	1181
4	471	0	0	0	0	0	0	0	0	284	405	308	2390	783	142	382	1312
5	580	0	0	0	0	0	0	0	0	204	20	158	925	295	496	133	360
6	538	0	0	0	0	0	0	0	0	54	9	31	263	168	169	113	165
7	139	0	0	0	0	0	0	0	0	12	4	19	21	51	86	12	38
8	100	0	0	0	0	0	0	0	0	8	0	1	9	10	18	11	14
9	30	0	0	0	0	0	0	0	0	2	0	2	4	11	4	6	16
10	32	0	0	0	0	0	0	0	0	0	0	1	1	1	5	7	2
11	27	0	0	0	0	0	0	0	0	1	0	1	3	3	0	7	1
12	7	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0
13	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

TABLE 15. CATCH AT AGE (THOUSANDS) OF 4VW HADDOCK BY TRAWLERS IN JAN-DECEMEBER 4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	10	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	229	0
3	177	810	36	661	235	279	0	0	0	0	0	0	0	0	0	0	0	541	1234	0
4	1927	976	2179	4636	1481	1954	0	0	0	0	0	0	0	0	0	0	0	1887	5589	0
5	2774	3419	2281	4837	5758	3415	0	0	0	0	0	0	0	0	0	0	0	1735	3156	0
6	864	2215	4122	1214	4135	3768	0	0	0	0	0	0	0	0	0	0	0	2674	898	0
7	829	326	2396	1228	1575	1097	0	0	0	0	0	0	0	0	0	0	0	791	1531	0
8	587	180	210	627	914	314	0	0	0	0	0	0	0	0	0	0	0	774	393	0
9	268	157	459	67	301	205	0	0	0	0	0	0	0	0	0	0	0	366	272	0
10	244	117	122	35	76	12	0	0	0	0	0	0	0	0	0	0	0	71	89	0
11	110	59	297	49	45	0	0	0	0	0	0	0	0	0	0	0	0	42	12	0
12	38	77	183	69	56	0	0	0	0	0	0	0	0	0	0	0	0	11	7	0
13	16	23	5	19	15	0	0	0	0	0	0	0	0	0	0	0	0	4	7	0
14	20	8	56	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	17	3	126	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	11	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	31	8	44	0	0	268	0	0	0	0	0	0	0	0
3	0	380	428	664	315	223	647	106	89	0	0	0	0	0	0	0	0
4	0	1331	1381	1884	544	973	89	261	25	0	0	0	0	0	0	0	0
5	0	1957	1178	2553	737	654	297	146	70	0	0	0	0	0	0	0	0
6	0	1779	1220	1089	528	322	214	78	22	0	0	0	0	0	0	0	0
7	0	867	985	823	217	184	41	28	23	0	0	0	0	0	0	0	0
8	0	257	310	1065	150	76	14	13	3	0	0	0	0	0	0	0	0
9	0	119	66	265	83	38	0	4	2	0	0	0	0	0	0	0	0
10	0	104	28	32	4	42	5	0	1	0	0	0	0	0	0	0	0
11	0	32	11	19	18	0	3	1	1	0	0	0	0	0	0	0	0
12	0	21	9	20	0	2	0	0	1	0	0	0	0	0	0	0	0
13	0	9	4	4	0	3	0	1	0	0	0	0	0	0	0	0	0
14	0	0	4	1	0	1	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 16, CATCH AT AGE (THOUSANDS) OF 4VW HADDOCK BY OTHER GEAR (LL,SDN,SSC) IN JANUARY-DECEMBER 4/ 5 /85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	6	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0
3	0	45	47	104	214	71	34	54	21	30	36	39	12	81	0	0	0	17	0	3	0
4	267	150	210	332	433	369	378	22	466	277	179	123	194	363	33	5	0	13	0	259	11
5	494	911	542	1219	868	698	594	260	222	1072	199	237	303	346	173	39	0	37	0	99	164
6	433	875	895	1002	518	676	455	704	533	246	660	201	285	331	224	288	0	96	0	21	107
7	582	156	831	567	256	310	651	450	645	199	95	438	109	25	175	143	0	62	0	7	72
8	502	177	84	679	165	143	317	416	310	159	102	66	165	75	100	159	0	31	0	4	10
9	288	146	116	30	104	42	117	117	367	53	95	98	24	7	41	37	0	36	0	5	3
10	189	111	108	30	20	13	153	147	127	19	52	59	22	16	42	12	0	1	0	0	2
11	143	83	61	30	20	18	14	35	9	16	27	40	6	5	17	67	0	12	0	0	4
12	52	59	46	30	18	7	26	35	3	5	15	19	6	9	11	18	0	1	0	0	0
13	37	25	43	30	20	3	26	10	0	0	6	10	0	0	3	0	0	2	0	0	4
14	10	10	12	11	20	3	41	22	0	0	0	4	0	0	0	0	0	0	0	0	0
15	7	2	4	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	7	6	0	0	46	19	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	2	0	0	0	0	0	1	1	7	7	0	7	2	0	0
3	2	6	8	4	5	10	142	4	113	73	128	42	35	108	10	14
4	25	55	56	59	116	99	338	104	20	343	432	188	416	181	266	317
5	51	84	84	71	48	102	88	125	200	108	299	382	309	651	517	396
6	141	58	59	65	162	54	35	139	125	328	85	221	299	338	422	237
7	56	101	93	94	99	49	17	79	73	63	90	26	108	313	191	159
8	18	27	69	20	23	22	9	28	35	39	8	23	23	58	51	26
9	9	4	10	68	13	3	0	5	9	10	3	9	20	24	6	6
10	13	5	7	2	37	5	0	6	4	0	1	3	6	4	6	1
11	7	3	2	0	2	5	0	0	5	0	1	0	2	3	2	1
12	7	1	4	0	2	0	0	1	2	0	0	1	1	0	1	0
13	1	2	1	0	0	0	0	1	1	1	0	0	0	0	0	0
14	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 17. TOTAL CATCH AT AGE (THOUSANDS) OF 4VW HADDOCK BY ALL GEARS 4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
1	0	0	0	50	0	0	0	0	0	0	0	0	0	2	205	1287	2591	53595	2127	89
2	0	10	0	0	6	3	12	0	213	0	63	8	0	31	436	924	3073	32161	9696	181
3	177	855	83	765	449	349	211	504	1926	647	2115	2938	455	409	1491	511	4074	24140	9638	1006
4	2194	1126	2389	4967	1915	2324	2881	1021	11209	3634	3817	6803	6408	4901	2039	3471	2368	15192	8887	2622
5	3269	4330	2823	6056	6626	4113	10071	2592	2400	13199	2504	5559	7580	8501	7794	3673	6023	7775	4645	2836
6	1297	3090	5018	2216	4654	4445	2159	5132	2539	2045	8128	3388	3339	4298	6190	6594	2069	4057	1217	1113
7	1412	483	3227	1794	1831	1407	2466	1765	2866	1538	1076	7071	2164	1362	1957	3190	2906	1282	1637	441
8	1088	357	293	1306	1079	457	1318	1642	963	1233	777	809	1964	1062	839	1243	1562	1234	499	597
9	556	303	575	98	405	247	431	620	1334	341	788	528	372	727	317	287	403	402	272	212
10	433	228	230	66	96	25	265	313	340	244	276	534	157	193	223	126	81	72	89	174
11	253	142	358	79	65	18	68	51	89	92	164	213	161	61	59	113	45	54	12	55
12	90	136	230	99	74	7	44	72	26	25	66	119	105	93	38	24	11	11	7	3
13	52	48	48	49	34	3	40	33	20	5	29	22	75	52	13	1	4	7	7	6
14	31	18	68	11	36	3	45	22	2	17	14	21	20	9	1	7	0	0	0	0
15	24	4	130	0	4	11	5	0	0	0	0	0	0	7	3	0	0	0	0	0
16	18	15	0	0	46	19	9	0	4	0	0	0	9	0	0	0	0	0	0	0

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	5	31	306	268	306	487	59	279	431	213	714	1	332	870	530	497	10
2	13	42	129	667	288	1178	233	61	676	283	433	268	376	318	433	470	360
3	398	438	679	888	671	646	975	470	157	965	811	423	2372	262	1520	1084	1514
4	1806	1408	1743	2188	751	1467	254	805	249	335	2412	1120	4334	5072	764	3207	4158
5	2926	2039	1400	2740	924	811	464	282	323	513	436	675	3238	5081	5629	2040	2225
6	2494	1955	1365	1208	668	723	298	185	189	283	715	159	1702	3010	1957	1677	821
7	793	939	1163	944	345	342	114	63	132	117	203	149	249	1178	1220	530	410
8	379	279	389	1177	191	159	47	30	36	80	61	16	129	139	214	235	90
9	406	131	88	277	159	60	8	8	8	19	23	5	39	105	48	29	30
10	116	118	38	39	9	99	17	4	10	15	8	6	9	30	28	18	5
11	78	39	19	21	18	2	16	1	3	6	2	2	7	10	5	19	2
12	39	28	14	25	0	4	0	1	7	7	0	0	2	5	7	6	1
13	22	10	6	5	0	3	0	1	1	3	1	0	1	4	0	0	0
14	3	0	6	2	0	1	0	0	0	1	1	1	1	4	0	0	0
15	0	0	0	2	0	0	0	0	0	0	0	1	1	0	1	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

TABLE 18, PERCENT OF TOTAL CATCH AT AGE (NUMBERS) FOR 4VW HADDOCK 4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
1	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.0	10.3	38.3	5.5	0.9	0.1
2	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.9	0.0	0.3	0.0	0.0	0.1	2.0	4.3	12.2	23.0	25.0	1.9	0.1
3	1.6	7.7	0.5	4.4	2.6	2.6	1.1	3.7	8.0	2.8	10.7	10.5	2.0	1.9	6.9	2.4	16.2	17.2	24.9	10.8	4.2
4	20.1	10.1	15.4	28.3	11.1	17.3	14.4	7.4	46.8	15.8	19.3	24.3	28.1	22.6	9.4	16.2	9.4	10.9	22.9	28.1	19.1
5	30.0	38.8	18.2	34.5	38.3	30.6	50.3	18.8	10.0	57.3	12.6	19.8	33.2	39.2	36.1	17.1	23.9	5.6	12.0	30.4	30.9
6	11.9	27.7	32.4	12.6	26.9	33.1	10.8	37.3	10.6	8.9	41.0	12.1	14.6	19.8	28.7	30.7	8.2	2.9	3.1	11.9	26.3
7	13.0	4.3	20.9	10.2	10.6	10.5	12.3	12.8	12.0	6.7	5.4	25.2	9.5	6.3	9.1	14.9	11.5	0.9	4.2	4.7	8.4
8	10.0	3.2	1.9	7.4	6.2	3.4	6.6	11.9	4.0	5.4	3.9	2.9	8.6	4.9	3.9	5.8	6.2	0.9	1.3	6.4	4.0
9	5.1	2.7	3.7	0.6	2.3	1.8	2.2	4.5	5.6	1.5	4.0	1.9	1.6	3.3	1.5	1.3	1.6	0.3	0.7	2.3	4.3
10	4.0	2.0	1.5	0.4	0.6	0.2	1.3	2.3	1.4	1.1	1.4	1.9	0.7	0.9	1.0	0.6	0.3	0.1	0.2	1.9	1.2
11	2.3	1.3	2.3	0.5	0.4	0.1	0.3	0.4	0.4	0.4	0.8	0.8	0.7	0.3	0.3	0.5	0.2	0.0	0.0	0.6	0.8
12	0.8	1.2	1.5	0.6	0.4	0.1	0.2	0.5	0.1	0.1	0.3	0.4	0.5	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.4
13	0.5	0.4	0.3	0.3	0.2	0.0	0.2	0.2	0.1	0.0	0.1	0.1	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.2
14	0.3	0.2	0.4	0.1	0.2	0.0	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.2	0.0	0.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.2	0.1	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.4	4.2	2.6	7.1	8.1	2.4	12.7	19.4	7.5	12.3	0.1	2.6	5.4	4.3	5.1	0.1
2	0.6	1.8	6.4	6.6	19.7	9.4	2.8	30.4	10.0	7.4	9.5	2.9	2.0	3.5	4.8	3.7
3	5.9	9.2	8.5	15.5	10.8	39.2	21.5	7.1	34.0	13.9	15.0	18.5	1.6	12.3	11.0	15.7
4	18.9	23.7	20.9	17.3	24.5	10.2	36.8	11.2	11.8	41.4	39.6	33.9	31.5	6.2	32.7	43.2
5	27.3	19.1	26.2	21.3	13.6	18.7	12.9	14.5	18.1	7.5	23.9	25.3	31.6	45.6	20.8	23.1
6	26.2	18.6	11.6	15.4	12.1	12.0	8.5	8.5	10.0	12.3	5.6	13.3	18.7	15.8	17.1	8.5
7	12.6	15.8	9.0	8.0	5.7	4.6	2.9	5.9	4.1	3.5	5.3	1.9	7.3	9.9	5.4	4.3
8	3.7	5.3	11.3	4.4	2.7	1.9	1.4	1.6	2.8	1.1	0.6	1.0	0.9	1.7	2.4	0.9
9	1.8	1.2	2.7	3.7	1.0	0.3	0.4	0.4	0.7	0.4	0.2	0.3	0.7	0.4	0.3	0.3
10	1.6	0.5	0.4	0.2	1.7	0.7	0.2	0.4	0.5	0.1	0.2	0.1	0.2	0.2	0.2	0.0
11	0.5	0.3	0.2	0.4	0.0	0.6	0.0	0.1	0.2	0.0	0.1	0.1	0.1	0.0	0.2	0.0
12	0.4	0.2	0.2	0.0	0.1	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.0
13	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 19. NOMINAL CATCH AT AGE (T) FOR 4VW HADDOCK

5/ 5/85

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	33	32	30	56	7	44	40	30	57	0	27	70	32	35	1
2	43	224	81	409	95	15	249	146	151	90	87	122	115	88	95
3	434	555	393	420	627	401	83	895	540	300	1699	180	959	570	873
4	1591	2015	717	1433	285	968	303	413	2574	1307	4468	4838	731	2638	3069
5	1802	3567	1241	1114	768	443	519	777	659	1049	4406	6433	6772	2367	2305
6	2136	1965	1224	1350	588	396	384	540	1407	321	3142	5048	3144	2394	1200
7	2410	1821	755	759	282	155	300	273	525	363	578	2580	2629	912	735
8	1010	2711	459	411	132	83	84	202	165	47	345	376	596	447	194
9	275	795	472	196	24	24	26	52	74	16	123	324	150	81	79
10	153	135	35	314	60	14	25	50	29	20	32	101	98	38	15
11	68	77	70	6	53	4	10	19	9	8	26	36	20	34	7
12	58	92	0	16	0	4	25	19	0	0	7	10	29	20	1
13	25	16	0	12	0	3	5	5	4	2	3	19	0	0	1
14	30	11	0	7	0	0	0	0	3	2	0	5	0	0	0
15	0	10	0	0	0	0	0	0	0	4	2	3	3	0	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
1+	10069	14027	5477	6504	2922	2553	2054	3420	6196	3528	14943	20143	15277	9623	8581

TABLE 20. PERCENT NOMINAL CATCH AT AGE FOR 4VW HADDOCK

5/ 5/85

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.3	0.2	0.5	0.9	0.2	1.7	1.9	0.9	0.9	0.0	0.2	0.3	0.2	0.4	0.0
2	0.4	1.6	1.5	6.3	3.2	0.6	12.1	4.3	2.4	2.5	0.6	0.6	0.8	0.9	1.1
3	4.3	4.0	7.2	6.5	21.5	15.7	4.0	26.2	8.7	8.5	11.4	0.9	6.3	5.9	10.2
4	15.8	14.4	13.1	22.0	9.8	37.9	14.8	12.1	41.5	37.0	29.9	24.0	4.8	27.4	35.8
5	17.9	25.4	22.7	17.1	26.3	17.4	25.3	22.7	10.6	29.7	29.5	31.9	44.3	24.6	26.9
6	21.2	14.0	22.3	20.8	20.1	15.5	18.7	15.8	22.7	9.1	21.0	25.1	20.6	24.9	14.0
7	23.9	13.0	13.8	11.7	9.7	6.1	14.6	8.0	8.5	10.3	3.9	12.8	17.2	9.5	8.6
8	10.0	19.3	8.4	6.3	4.5	3.2	4.1	5.9	2.7	1.3	2.3	1.9	3.9	4.6	2.3
9	2.7	5.7	8.6	3.0	0.8	0.9	1.3	1.5	1.2	0.4	0.8	1.6	1.0	0.8	0.9
10	1.5	1.0	0.6	4.8	2.0	0.5	1.2	1.5	0.5	0.6	0.2	0.5	0.6	0.4	0.2
11	0.7	0.6	1.3	0.1	1.8	0.1	0.5	0.6	0.1	0.2	0.2	0.2	0.1	0.3	0.1
12	0.6	0.7	0.0	0.3	0.0	0.2	1.2	0.5	0.0	0.0	0.0	0.0	0.2	0.2	0.0
13	0.2	0.1	0.0	0.2	0.0	0.1	0.2	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
14	0.3	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
15	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

TABLE 21, WEIGHTS AT AGE IN THE RV SURVEYS FOR 4VW HADDOCK 4/ 5/85

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.108	0.119	0.098	0.115	0.122	0.159	0.092	0.140	0.080	0.090	0.080	0.080	0.060	0.070	0.090
2	0.326	0.328	0.281	0.340	0.407	0.245	0.328	0.390	0.350	0.330	0.230	0.330	0.260	0.180	0.250
3	0.664	0.634	0.499	0.678	0.725	0.837	0.564	0.800	0.670	0.630	0.610	0.580	0.640	0.470	0.430
4	0.988	0.924	0.968	1.121	1.067	1.154	1.143	1.110	1.080	1.000	0.990	0.950	0.890	0.740	0.660
5	1.406	1.279	1.274	1.396	1.563	1.640	1.533	1.660	1.550	1.370	1.300	1.270	1.160	1.110	0.980
6	1.767	1.584	1.863	1.987	2.082	2.089	1.865	1.870	2.100	1.850	1.820	1.700	1.590	1.390	1.330
7	2.152	1.836	2.318	2.068	2.032	2.265	2.430	2.470	2.710	2.270	2.490	2.330	1.940	1.730	1.750
8	2.747	2.356	2.159	2.713	2.403	2.544	2.608	2.950	1.940	2.900	3.110	2.470	2.480	2.170	2.290
9	3.148	2.164	2.151	4.088	2.123	2.468	2.898	0.000	0.000	0.000	2.460	2.780	3.830	2.710	2.620
10	3.402	0.000	3.473	3.749	3.421	3.131	1.708	3.480	4.250	3.660	0.000	3.140	2.700	2.290	2.960
11	4.077	0.000	0.000	0.000	3.121	0.000	2.898	5.260	3.560	3.190	0.000	0.000	0.000	0.000	4.190
12	3.930	0.000	0.000	0.000	0.000	3.984	4.184	0.000	0.000	0.000	0.000	0.000	0.000	2.980	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.260	0.000	0.000	0.000	0.000	0.000	0.000	5.310
14	5.541	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.190	0.000	0.000	0.000	3.880	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.140	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

TABLE 22, WEIGHTS AT AGE (KG) IN THE COMMERCIAL CATCH OF 4VW HADDOCK

4/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1				0.680										0.060	0.049	0.099	0.102	0.103	0.090
2		0.680			0.680	0.580	0.680		0.500		0.530	0.800		0.190	0.200	0.142	0.281	0.254	0.267
3	1.130	0.838	0.821	0.997	0.885	0.954	0.869	0.786	0.750	0.762	0.704	0.680	0.667	0.794	0.453	0.364	0.445	0.421	0.356
4	1.189	1.189	1.026	1.073	1.095	1.133	1.084	1.038	0.888	0.986	0.976	0.892	0.912	0.899	0.825	0.939	0.710	0.715	0.698
5	1.611	1.393	1.385	1.292	1.353	1.517	1.144	1.298	1.252	1.185	1.264	1.168	1.096	1.147	1.022	1.146	1.096	1.114	1.034
6	2.250	1.821	1.861	1.626	1.662	1.822	1.574	1.476	1.527	1.557	1.472	1.477	1.414	1.526	1.350	1.356	1.350	1.297	1.332
7	2.692	2.465	2.165	2.081	2.113	2.253	1.953	1.813	1.722	1.816	1.749	1.788	1.829	1.867	1.735	1.748	1.644	1.928	1.551
8	3.022	2.925	2.634	2.332	2.615	2.761	2.127	2.151	2.127	2.074	2.102	2.173	2.191	2.225	2.182	2.007	1.925	2.232	2.177
9	3.097	2.986	2.562	1.612	2.986	3.175	2.438	2.392	2.227	2.370	2.089	2.405	2.461	2.406	2.730	2.356	2.345	2.418	2.300
10	3.383	3.162	2.838	1.391	2.514	3.868	2.691	2.597	2.283	2.388	2.460	2.740	2.703	2.762	2.597	2.547	2.724	2.791	2.670
11	3.490	3.315	3.593	2.316	2.463	3.540	3.063	2.780	2.815	2.791	2.407	2.946	2.678	3.298	3.455	2.443	2.393	3.119	3.040
12	3.808	3.641	4.069	1.809	4.164	4.110	1.453	3.117	2.074	2.419	2.743	2.976	3.377	3.452	3.339	3.211	2.354	3.554	2.600
13	4.161	3.265	2.929	1.572	2.411		1.391	3.756	2.552	2.090	4.831	2.743	2.964	3.720	3.813	3.780	3.090	4.258	3.770
14	4.233	3.262	4.099	5.260	2.002		4.066	3.590	5.690	2.150	3.340	3.559	3.712	4.500	5.690	2.760			
15	5.232	2.281	3.962		5.260	4.958								4.630	3.250				
16	4.817	4.782			4.090	4.810	4.260		5.680				4.100						

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.122	0.108	0.099	0.108	0.119	0.098	0.115	0.122	0.159	0.092	0.140	0.080	0.090	0.080	0.080	0.060	0.070	0.090
2	0.384	0.174	0.218	0.332	0.335	0.280	0.347	0.407	0.245	0.369	0.515	0.349	0.335	0.231	0.383	0.265	0.186	0.263
3	0.534	0.434	0.652	0.638	0.625	0.586	0.651	0.643	0.852	0.526	0.927	0.666	0.708	0.716	0.686	0.631	0.526	0.577
4	0.784	0.800	0.883	0.913	0.921	0.955	0.976	1.123	1.203	1.217	1.234	1.067	1.167	1.031	0.954	0.957	0.822	0.738
5	1.149	1.118	1.260	1.288	1.302	1.344	1.374	1.656	1.572	1.607	1.514	1.511	1.554	1.361	1.266	1.203	1.160	1.036
6	1.485	1.593	1.616	1.565	1.627	1.832	1.866	1.978	2.137	2.027	1.905	1.967	2.020	1.846	1.677	1.606	1.428	1.462
7	1.767	2.159	2.277	2.072	1.930	2.187	2.218	2.468	2.447	2.271	2.345	2.582	2.444	2.319	2.190	2.154	1.721	1.794
8	2.167	2.188	2.774	2.595	2.303	2.407	2.593	2.789	2.800	2.327	2.505	2.687	2.965	2.662	2.708	2.779	1.905	2.154
9	2.548	2.572	3.313	3.137	2.867	2.971	3.248	2.841	3.036	3.194	2.811	3.276	3.273	3.128	3.082	3.138	2.802	2.664
10	2.816	3.103	3.324	4.044	3.435	3.861	3.174	3.435	3.131	2.611	3.328	3.497	3.435	3.402	3.409	3.513	2.065	3.240
11	3.065	3.343	3.210	3.553	3.752	3.830	3.630	3.395	4.120	3.102	3.196	3.846	4.208	3.654	3.664	4.496	1.816	3.182
12	3.800	4.053	4.016	4.104	3.738		4.089		3.984	3.890	2.592			4.112	2.024	4.270	3.502	2.162
13	3.380	3.397	5.001	4.477	3.041		4.390		3.760	3.620	1.875	4.610	4.652	2.708	4.177			4.100
14		3.130	5.260	5.196	4.881		6.410					4.910	4.241		1.126		3.880	
15					6.120								3.970	4.230	5.620	4.870		4.270
16																		3.610

TABLE 23, ARITHMETIC MEAN-CATCH-PER-TOW OF 4VW HADDOCK IN RV SURVEYS 4/ 5/85

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
0	0.10	0.06	0.05	0.00	0.23	0.07	0.62	0.31	0.00	1.49	1.48	22.23	0.76	0.15	0.28
1	2.72	1.72	1.32	0.63	0.37	4.62	3.28	6.02	8.07	0.09	3.68	16.22	18.17	21.79	0.30
2	1.02	3.65	0.90	1.95	2.15	0.65	3.62	11.39	10.49	9.24	0.34	9.19	15.95	14.45	10.87
3	1.84	1.12	1.30	0.51	2.89	1.92	0.51	8.97	14.11	10.05	15.37	0.96	14.05	30.11	16.88
4	2.04	1.62	0.58	0.44	0.54	1.71	1.01	1.23	7.85	10.48	14.98	7.16	2.34	11.41	29.25
5	0.98	0.63	0.49	0.15	0.55	0.45	0.95	1.94	0.47	2.95	9.34	4.51	7.23	2.95	5.26
6	0.63	0.36	0.37	0.24	0.25	0.82	0.22	0.72	0.46	0.38	2.00	1.95	3.07	2.53	2.58
7	0.70	0.15	0.15	0.06	0.22	0.21	0.22	0.20	0.12	0.29	0.30	0.29	1.00	0.87	1.36
8	0.35	0.26	0.07	0.06	0.08	0.09	0.06	0.12	0.01	0.10	0.11	0.10	0.22	0.23	0.30
9	0.15	0.01	0.04	0.03	0.04	0.04	0.02	0.00	0.00	0.00	0.02	0.11	0.02	0.06	0.11
10	0.03	0.00	0.02	0.05	0.03	0.05	0.02	0.07	0.01	0.04	0.00	0.01	0.02	0.06	0.02
11	0.04	0.00	0.00	0.00	0.03	0.00	0.02	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.01
12	0.03	0.00	0.00	0.00	0.00	0.02	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
16	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.01

TABLE 24, RETRANSFORMED GEOMETRIC MEAN CATCH-PER-TOW OF 4VW HADDOCK BY RV SURVEYS

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
0	0.07	0.04	0.02	0.00	0.07	0.05	0.13	0.15	0.00	0.53	0.41	3.06	0.50	0.07	0.13
1	1.27	0.81	0.65	0.51	0.17	1.44	1.40	1.64	2.36	0.04	2.01	6.20	8.09	9.00	0.18
2	0.55	1.12	0.36	0.94	1.03	0.30	1.22	2.84	2.09	2.84	0.25	2.54	5.27	5.87	4.39
3	0.93	0.58	0.63	0.32	1.21	1.04	0.25	2.61	3.23	2.35	3.12	0.57	5.69	10.11	6.66
4	0.95	0.81	0.40	0.33	0.30	0.83	0.40	0.60	2.49	3.47	3.18	4.25	1.25	5.40	12.51
5	0.52	0.42	0.36	0.13	0.33	0.30	0.43	1.02	0.32	1.36	2.65	2.33	3.67	1.84	3.12
6	0.37	0.26	0.26	0.20	0.17	0.48	0.15	0.48	0.34	0.28	0.99	1.12	1.85	1.78	1.77
7	0.43	0.13	0.12	0.05	0.16	0.16	0.16	0.16	0.09	0.22	0.21	0.22	0.72	0.65	0.94
8	0.18	0.18	0.05	0.05	0.06	0.07	0.06	0.10	0.01	0.07	0.08	0.09	0.17	0.19	0.23
9	0.11	0.01	0.04	0.02	0.04	0.04	0.02	0.00	0.00	0.00	0.01	0.09	0.01	0.05	0.08
10	0.02	0.00	0.01	0.03	0.03	0.04	0.01	0.05	0.01	0.03	0.00	0.01	0.02	0.03	0.02
11	0.03	0.00	0.00	0.00	0.03	0.00	0.02	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00
12	0.03	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
16	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.01

TABLE 25, MEAN CATCH-PER-TOW OF 4VW HADDOCK IN RV SURVEYS , AVERAGED WITHIN COHORTS BETWEEN YEARS

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.24	0.16	0.11	0.08	0.31	0.27	0.47	0.59	0.00	1.03	1.60	4.97	2.12	0.11
2	1.19	0.54	0.78	0.73	0.23	1.33	2.00	1.85	2.59	0.10	2.26	5.72	6.89	6.29
3	0.56	0.84	0.34	1.07	1.03	0.27	1.79	3.03	2.21	2.98	0.38	3.80	7.30	6.25
4	0.87	0.48	0.46	0.31	1.01	0.65	0.38	2.55	3.35	2.73	3.64	0.85	5.54	11.25
5	0.63	0.54	0.23	0.33	0.30	0.60	0.64	0.44	1.84	3.04	2.72	3.95	1.52	4.11
6	0.37	0.33	0.27	0.15	0.40	0.21	0.45	0.59	0.30	1.16	1.73	2.07	2.56	1.81
7	0.22	0.18	0.11	0.18	0.16	0.28	0.15	0.20	0.27	0.24	0.47	0.90	1.10	1.29
8	0.28	0.08	0.08	0.05	0.11	0.09	0.13	0.04	0.08	0.13	0.14	0.19	0.37	0.39
9	0.04	0.08	0.04	0.05	0.05	0.04	0.00	0.00	0.00	0.03	0.09	0.04	0.09	0.13
10	0.00	0.01	0.03	0.02	0.04	0.02	0.03	0.00	0.00	0.00	0.01	0.04	0.02	0.03
11	0.00	0.00	0.00	0.03	0.00	0.03	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.01
12	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 26. Catch-(kg)-per-standard-tow by summer groundfish survey in 4VW (A = A.T. Cameron, H = Lady Hammond, N = Alfred Needler).

Vessel (Season)	Year	Area (Strata) 4Vn 40-42	4Vs 43-46	4Vs 47-52	4V 40-52	4W 53-66	4VW 40-66
A(SU)	1970	2.38	-	15.13	5.11	10.59	8.03
A(SU)	1971	0.00	0.19	1.50	0.52	9.01	5.18
A(SU)	1972	0.00	1.92	2.63	1.67	4.16	3.04
A(SU)	1973	0.15	0.13	0.90	0.36	5.02	2.92
A(SU)	1974	0.00	-	1.54	0.44	9.09	5.19
A(SU)	1975	0.37	0.00	2.57	0.83	12.33	7.14
A(SU)	1976	1.64	-	2.57	1.13	8.07	4.94
A(SU)	1977	3.08	0.17	7.28	2.90	28.86	17.15
A(SU)	1978	0.87	-	0.03	0.21	40.38	22.26
*H(SP)	1979	-	0.02	10.55	3.97	22.00	15.05
A(SU)	1979	0.11	0.16	0.97	0.38	40.18	22.22
H(FA)	1979	5.44	0.38	3.12	2.37	38.14	22.00
*H(SP)	1980	-	3.00	3.20	3.09	17.51	12.47
A(SU)	1980	0.50	0.60	2.39	1.09	60.01	33.43
H(SU)	1980	2.26	2.48	8.41	4.14	54.25	31.64
H(FA)	1980	11.28	0.12	17.65	7.80	30.78	20.41
H(SP)	1981	0.50	1.30	2.26	1.39	228.97	126.28
A(SU)	1981	4.21	1.19	1.25	1.92	31.73	18.28
*H(SU)	1981	1.54	0.24	1.96	1.04	18.11	8.32
*H(FA)	1981	0.68	0.23	4.44	1.65	57.88	33.98
*H(SP)	1982	-	0.00	17.45	13.96	39.41	33.60
H(SU)	1982	4.09	0.52	45.57	13.74	38.73	27.46
*N(FA)	1982	4.78	-	-	4.78	49.18	44.66
*H(SU)	1983	1.61	1.85	8.77	2.35	60.07	33.60
N(SU)	1983	1.74	0.76	25.20	8.02	52.02	32.17
N(FA)	1983	18.61	0.56	48.43	18.60	48.61	35.07
N(SU)	1984	4.80	1.13	34.29	11.53	53.88	34.77

Note: Catch per standard tow values for Lady Hammond and Alfred Needler divided by 1.22 to be comparable with A.T. Cameron.

* Not all strata sampled.

Table 27. Catch rates for Canada Maritimes otter trawlers (t/hr) January - June inclusive, and longlines (t/1000 hooks) all year. Effort is given in parentheses. The mean standardized catch rate is weighted by effort.

Year	LL all TC		OTB - TC4		OTB - TC5		Mean OTB TC4, 5
1968	0.201	(184)	0.460	(4585)	0.616	(791)	1.16
1969	0.167	(6)	0.411	(5513)	0.569	(3577)	1.02
1970	0.235	(51)	0.268	(4168)	0.489	(1426)	0.72
1971	0.338	(68)	0.343	(598)	0.476	(5240)	0.81
1972	0.165	(79)	0.247	(1485)	0.299	(1485)	0.57
1973	0.322	(451)	0.241	(1912)	0.373	(970)	0.62
1974	0.158	(241)	0.180	(183)	0.231	(52)	0.45
1975	0.159	(1605)	0.178	(90)	0.378	(119)	0.56
1976	0.159	(1697)	0.282	(319)	0.167	(311)	0.51
1977	0.193	(1045)	0.226	(563)	0.273	(677)	0.52
1978	0.201	(2036)	0.629	(1134)	0.559	(1192)	1.27
1979	0.157	(1671)	0.300	(120)	0.482	(112)	0.79
1980	0.220	(513)	0.668	(2325)	1.494	(1590)	2.04
1981	0.176	(2168)	0.607	(5550)	0.991	(4045)	1.61
1982	0.209	(1919)	0.701	(3417)	1.211	(3512)	1.93
1983	0.153	(1579)	0.466	(2272)	0.755	(2467)	1.24
1984	0.172	(1043)	0.437	(286)	0.664	(1905)	1.12

Table 28. Intercept and r^2 values for various calibration relationships at various levels of F_t.

	r^2 / intercept		
F_t	SPA 5+ vs RV 5+	SPA vs RV fishable Biomass	SPA fishable biomass vs Standardized Catch Rate
0.40	-	-	0.568 -3386
0.35	-	-	0.551 -3541
0.30	0.799 1982	-	0.401 -636
0.25	0.857 1636	0.803 3802	0.363 -194
0.20	0.908 1116	0.872 2001	-
0.15	0.932* 249	0.910* -1039	-
0.10	0.896 -1489	0.901 -7229	-

Table 29. Population numbers (thousands) from COHORT analysis of 4VW haddock at F_t=0.20.

POPULATION NUMBERS

22/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
1	68737	39536	72174	34546	26476	122270	42817	44458	64396	79935	69600	29692	48545	33497	58715	84522	91812	91519
2	44193	56277	32370	59091	28239	21677	100106	35056	36399	52723	65445	56984	24310	39745	27423	47886	68036	72825
3	20883	36182	46066	26502	48380	23115	17744	81949	28701	29608	43166	53524	46648	19903	32512	22057	38370	52923
4	25126	16937	28850	37641	21006	39204	18609	14337	66638	21756	23656	33427	41163	37780	15925	25270	17597	27728
5	17578	18586	12848	21459	26323	15466	29995	12629	10814	44416	14524	15913	21212	27904	26497	11194	17548	12265
6	3177	11434	11299	7964	12089	15556	8941	15445	7995	6682	24423	9626	7999	10508	15153	14642	5842	8918
7	3475	1428	6565	4711	4516	5687	8715	5367	8002	4248	3620	12641	4815	3528	4715	6806	6021	2911
8	2400	1568	732	2455	2233	2041	3383	4904	2797	3958	2087	1990	3952	1985	1656	2089	2686	2301
9	2055	981	960	334	828	852	1257	1578	2529	1418	2125	1005	897	1459	664	596	586	785
10	1118	1180	529	266	185	311	474	639	730	864	853	1027	345	398	537	257	229	114
11	640	523	760	225	158	65	232	149	241	290	486	449	358	141	151	238	97	114
1+	189382	184631	213153	195194	170433	246243	232274	216510	229242	245899	249984	216279	200245	176847	183950	215557	248822	272403

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	15279	14779	10768	6701	8131	4439	8091	7795	4653	20061	27875	32785	42405	21032	39798	86306	71659	76661	13241
2	26435	10584	12020	8811	5459	6380	3392	6348	5941	3757	16172	22431	26649	34073	17219	32283	69873	58190	62316
3	30523	12870	8502	9829	7176	4352	4620	2517	4131	4653	3021	12629	18109	21427	27654	13757	26143	56816	47217
4	21487	16270	9627	6601	7651	5261	2759	3175	1477	2500	3384	2331	9466	14093	17160	20495	11027	20029	45536
5	8956	9551	10948	6247	4130	4687	2327	1580	1272	979	1318	2545	1605	5568	10525	10127	12191	8337	13496
6	3007	3130	5253	6316	3270	2115	1359	1070	559	622	547	787	1620	920	3948	5687	3694	4888	4979
7	3631	1361	1555	2044	3402	1442	638	508	221	189	341	276	388	679	609	1692	1933	1253	2484
8	1223	1491	715	556	824	1733	326	210	106	78	97	160	121	134	421	273	319	479	546
9	767	549	681	243	203	322	354	95	29	44	37	47	58	43	95	228	98	67	180
10	280	381	258	190	80	86	13	146	23	16	29	23	22	27	31	42	91	37	29
11	29	149	155	106	49	32	35	3	30	3	9	15	5	10	17	17	8	49	14
1+	111616	71115	60481	47645	40375	30849	23915	23445	18443	32902	52830	74029	100448	98005	117476	170907	197036	226806	190038

Table 30. Fishing mortality at age from COHORT analysis of 4VW haddock.

FISHING MORTALITY 22/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
1	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.017	0.032	1.042	0.167	0.007	0.001
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.001	0.000	0.000	0.001	0.018	0.022	0.051	0.670	0.520	0.019	0.001
3	0.009	0.026	0.002	0.032	0.010	0.017	0.013	0.007	0.077	0.024	0.056	0.063	0.011	0.023	0.052	0.026	0.125	0.701	0.429	0.090	0.053
4	0.101	0.076	0.096	0.158	0.106	0.068	0.188	0.082	0.206	0.204	0.196	0.255	0.189	0.155	0.153	0.165	0.161	0.930	0.611	0.196	0.232
5	0.230	0.298	0.278	0.374	0.326	0.348	0.464	0.257	0.281	0.398	0.211	0.488	0.502	0.411	0.393	0.450	0.477	1.206	0.851	0.398	0.350
6	0.600	0.355	0.675	0.367	0.554	0.379	0.310	0.458	0.432	0.413	0.459	0.493	0.619	0.602	0.600	0.689	0.497	0.699	0.593	0.499	0.744
7	0.596	0.468	0.784	0.546	0.594	0.319	0.375	0.452	0.504	0.511	0.398	0.963	0.686	0.556	0.614	0.730	0.762	0.667	0.690	0.443	0.828
8	0.695	0.290	0.584	0.887	0.764	0.284	0.563	0.462	0.479	0.422	0.530	0.597	0.797	0.895	0.821	1.072	1.029	0.899	0.600	0.584	0.880
9	0.355	0.417	1.084	0.391	0.779	0.386	0.476	0.570	0.874	0.309	0.527	0.870	0.613	0.800	0.749	0.759	1.432	0.832	0.498	0.557	1.074
10	0.560	0.240	0.656	0.318	0.848	0.093	0.960	0.777	0.724	0.375	0.442	0.854	0.697	0.766	0.614	0.776	0.500	1.186	0.430	0.702	0.687
11	0.567	0.353	0.722	0.486	0.596	0.353	0.389	0.470	0.516	0.428	0.460	0.731	0.676	0.640	0.550	0.730	0.703	0.730	0.618	0.520	0.792
1+	0.075	0.075	0.101	0.117	0.137	0.069	0.115	0.084	0.135	0.123	0.103	0.184	0.157	0.166	0.160	0.141	0.135	0.855	0.499	0.171	0.222

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.005	0.042	0.069	0.043	0.072	0.014	0.015	0.017	0.007	0.019	0.000	0.009	0.011	0.008	0.007	0.001
2	0.005	0.027	0.123	0.098	0.229	0.044	0.018	0.047	0.014	0.018	0.009	0.024	0.011	0.007	0.009	0.006
3	0.050	0.110	0.256	0.175	0.333	0.302	0.118	0.059	0.088	0.051	0.022	0.100	0.021	0.066	0.021	0.036
4	0.269	0.290	0.616	0.358	0.715	0.211	0.440	0.085	0.173	0.331	0.092	0.327	0.320	0.080	0.195	0.106
5	0.447	0.469	1.038	0.577	0.838	0.516	0.383	0.316	0.252	0.357	0.144	0.416	0.809	0.714	0.315	0.200
6	0.419	0.619	0.998	0.784	1.375	0.887	0.399	0.483	0.507	0.670	0.212	0.647	0.879	0.881	0.477	0.200
7	0.708	0.474	1.286	0.911	1.362	0.845	0.463	0.559	0.628	0.866	0.277	0.602	1.468	1.196	0.630	0.200
8	0.810	0.738	1.389	1.038	1.794	0.676	0.545	0.531	0.813	0.824	0.140	0.415	0.826	1.358	0.780	0.200
9	0.905	0.653	3.011	0.686	1.227	0.396	0.217	0.280	0.575	0.561	0.130	0.611	0.714	0.776	0.651	0.200
10	1.163	0.736	0.697	1.433	1.384	1.861	0.371	0.457	1.322	0.541	0.276	0.400	1.480	0.412	0.794	0.200
11	0.518	0.566	1.228	0.829	1.401	0.847	0.413	0.502	0.579	0.705	0.229	0.618	0.974	0.980	0.526	0.200
1+	0.214	0.245	0.575	0.255	0.397	0.183	0.085	0.050	0.047	0.074	0.034	0.142	0.142	0.094	0.055	0.059

Table 31. Partial recruitment values derived from COHORT analysis of 4VW haddock.

PARTIAL RECRUITMENT 22/ 5/85

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
1	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.023	0.043	1.420	0.269
2	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.002	0.000	0.000	0.001	0.028	0.029	0.070	0.912	0.838
3	0.016	0.075	0.003	0.065	0.017	0.048	0.033	0.014	0.147	0.057	0.121	0.083	0.016	0.036	0.083	0.035	0.171	0.956	0.692
4	0.177	0.216	0.132	0.314	0.177	0.191	0.475	0.174	0.392	0.476	0.427	0.338	0.279	0.240	0.245	0.224	0.221	1.267	0.985
5	0.402	0.841	0.383	0.745	0.544	0.983	1.173	0.546	0.537	0.929	0.459	0.646	0.742	0.637	0.631	0.612	0.654	1.643	1.373
6	1.048	1.003	0.930	0.733	0.925	1.072	0.785	0.972	0.824	0.963	0.996	0.653	0.914	0.933	0.963	0.936	0.681	0.952	0.956
7	1.041	1.321	1.079	1.089	0.992	0.902	0.949	0.959	0.961	1.192	0.865	1.276	1.014	0.863	0.985	0.992	1.045	0.909	1.112
8	1.215	0.819	0.805	1.768	1.275	0.803	1.424	0.981	0.913	0.984	1.152	0.791	1.177	1.387	1.317	1.457	1.411	1.225	0.968
9	0.620	1.179	1.493	0.780	1.300	1.090	1.204	1.211	1.667	0.721	1.144	1.152	0.906	1.240	1.201	1.032	1.964	1.134	0.804
10	0.978	0.680	0.903	0.634	1.417	0.262	2.428	1.650	1.381	0.875	0.960	1.131	1.029	1.188	0.985	1.055	0.685	1.617	0.694
11	0.990	0.996	0.994	0.969	0.995	0.997	0.984	0.997	0.983	0.999	1.000	0.969	0.998	0.993	0.882	0.993	0.964	0.995	0.996

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	0.013	0.001	0.009	0.075	0.053	0.051	0.051	0.016	0.037	0.034	0.012	0.026	0.000	0.015	0.011	0.008	0.014	0.004
2	0.036	0.001	0.010	0.047	0.095	0.118	0.163	0.051	0.044	0.094	0.024	0.026	0.038	0.039	0.011	0.007	0.017	0.032
3	0.173	0.067	0.095	0.194	0.197	0.210	0.237	0.351	0.285	0.118	0.150	0.072	0.096	0.160	0.021	0.067	0.040	0.180
4	0.376	0.292	0.505	0.508	0.474	0.429	0.507	0.245	1.060	0.168	0.294	0.467	0.400	0.527	0.319	0.080	0.367	0.530
5	0.762	0.440	0.840	0.823	0.800	0.692	0.595	0.599	0.922	0.626	0.429	0.504	0.626	0.669	0.807	0.717	0.595	1.000
6	0.956	0.935	0.786	1.085	0.768	0.939	0.976	1.030	0.962	0.958	0.863	0.945	0.921	1.043	0.878	0.884	0.899	1.000
7	0.849	1.041	1.329	0.832	0.990	1.091	0.967	0.982	1.116	1.109	1.068	1.223	1.204	0.970	1.466	1.200	1.188	1.000
8	1.118	1.106	1.520	1.294	1.069	1.244	1.273	0.785	1.313	1.053	1.383	1.162	0.607	0.669	0.825	1.363	1.471	1.000
9	1.066	1.350	1.699	1.144	2.319	0.822	0.871	0.460	0.522	0.556	0.978	0.792	0.567	0.984	0.713	0.779	1.226	1.000
10	1.344	0.864	2.182	1.290	0.537	1.717	0.983	2.161	0.894	0.906	2.250	0.764	1.198	0.645	1.477	0.414	1.497	1.000
11	0.996	0.995	0.973	0.993	0.946	0.993	0.994	0.983	0.995	0.997	0.985	0.995	0.996	0.996	0.972	0.984	0.992	1.000

TABLE 32. PERCENTAGE OF MATURE FEMALES AT AGE FROM RV SURVEYS FOR 4VW HADDOCK 4/ 5/85

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.4	0.0	0.0	0.0	0.0	1.6	0.0	0.0	6.1	1.8	20.0	0.0	3.0	4.1
3	14.5	4.4	0.7	1.4	8.3	0.0	46.2	1.3	38.1	5.7	92.3	9.2	22.6	39.3
4	34.4	37.5	23.2	25.5	41.9	16.8	58.3	28.6	40.6	48.3	66.7	27.8	56.6	80.4
5	90.9	77.2	68.6	78.3	77.7	66.0	95.7	63.4	90.0	91.6	90.0	78.1	90.7	88.1
6	93.9	84.7	88.9	87.1	98.5	92.1	100.0	76.7	100.0	97.4	53.3	95.6	98.6	97.7
7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
2	6.0	3.8	0.0	3.7	3.4	4.3	28.9	5.2	0.0	8.8	1.0	3.5
3	44.3	52.9	30.2	66.1	11.5	58.9	78.9	46.9	36.0	20.7	46.3	31.7
4	74.0	85.7	52.0	87.0	91.1	81.1	97.6	93.9	79.9	93.8	75.0	83.7
5	95.2	100.0	88.2	100.0	98.8	98.9	100.0	98.0	99.3	99.3	100.0	97.2
6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.1	100.0	100.0
7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 33. NUMBERS SAMPLED AT AGE FOR MATURITY OF FEMALE 4VW HADDOCK

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
1	51	32	34	9	8	28	0	4	3	34	0	64	96	34	71	22	12
2	73	212	27	129	68	63	0	53	49	56	5	84	66	145	67	52	44
3	55	271	142	72	156	29	13	76	63	88	13	120	106	61	106	17	63
4	32	152	164	102	86	95	24	49	69	116	12	90	129	92	50	21	25
5	11	127	105	69	130	53	23	41	30	95	10	73	54	67	63	3	34
6	33	72	72	31	130	63	6	43	11	38	15	113	71	44	27	12	12
7	38	245	118	130	135	86	1	81	65	64	19	135	195	149	42	12	32

	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	99	127	83	104	3	114	165	204	65
2	27	149	116	121	211	16	159	287	85
3	59	26	151	109	160	175	29	201	145
4	46	112	37	127	262	139	192	32	80
5	16	83	88	12	201	148	134	178	36
6	30	29	47	29	58	70	117	106	55
7	20	45	36	18	85	33	74	108	44

Table 34. Catch projections for 4VW haddock assuming the TAC is taken in 1985

POPULATION NUMBERS 85/08/03

	1984	1985	1986
1	13400	31252	31252
2	62316	10962	25563
3	47217	50694	8909
4	45536	37291	39821
5	13496	33532	27025
6	4979	9047	21809
7	2484	3338	5884
8	546	1665	2171
9	180	366	1083
10	29	120	238
11	14	19	78
1+	190197	178287	163834
2+	176797	147035	132582
3+	114481	136073	107019
4+	67264	85379	98109

POPULATION BIOMASS (AVERAGE)

	1984	1985	1986
1	1092.64	2548.11	2548.21
2	14821.06	2606.05	6078.98
3	24247.85	25965.95	4571.38
4	28953.70	23531.96	25255.85
5	11527.01	28239.96	22974.09
6	6000.92	10750.96	26161.68
7	3672.66	4865.65	8658.47
8	969.76	2914.59	3835.37
9	394.41	792.98	2367.26
10	76.64	317.00	633.06
11	35.81	49.75	204.41
1+	91792.44	102582.95	103288.75
2+	90699.81	100034.85	100740.55
3+	75878.75	97428.80	94661.57
4+	51630.90	71462.85	90090.18

CATCH NUMBERS

	1984	1985	1986
1	10	26	24
2	360	73	155
3	1514	1866	300
4	4158	3889	3809
5	2225	6272	4656
6	821	1692	3757
7	410	624	1014
8	90	311	374
9	30	69	187
10	5	23	41
11	2	4	13
1+	9624	14850	14329
2+	9614	14823	14305
3+	9254	14751	14150
4+	7740	12885	13850

CATCH BIOMASS

	1984	1985	1986
1	1	2	2
2	95	19	41
3	873	1076	173
4	3069	2871	2811
5	2305	6500	4825
6	1200	2475	5494
7	735	1120	1818
8	194	671	805
9	79	183	497
10	15	73	133
11	7	11	43
1+	8573	15000	16642
2+	8572	14998	16640
3+	8477	14978	16599
4+	7605	13903	16426

MEAN WEIGHT OF INDIVIDUALS IN CATCH

1984	1985	1986
0.9	1.0	1.2

FISHING MORTALITY

	1984	1985	1986
1	0.001	0.001	0.001
2	0.006	0.007	0.007
3	0.036	0.041	0.038
4	0.106	0.122	0.111
5	0.200	0.230	0.210
6	0.200	0.230	0.210
7	0.200	0.230	0.210
8	0.200	0.230	0.210
9	0.200	0.230	0.210
10	0.200	0.230	0.210
11	0.200	0.230	0.210
1+	0.059	0.100	0.105

Table 35. Catch projections for 4VW haddock assuming that $F=F_{0.1}$ in 1985.

POPULATION NUMBERS 85/08/03

	1984	1985	1986
1	13400	31252	31252
2	62316	10962	25565
3	47217	50694	8915
4	45536	37291	39965
5	13496	33532	27315
6	4979	9047	22254
7	2484	3338	6004
8	546	1665	2215
9	180	366	1105
10	29	120	243
11	14	19	80
1+	190197	178287	164914
2+	176797	147035	133662
3+	114481	136073	108097
4+	67264	85379	99181

POPULATION BIOMASS (AVERAGE)

	1984	1985	1986
1	1092.64	2548.21	2548.21
2	14821.06	2606.86	6079.47
3	24247.85	26011.24	4574.33
4	28953.70	23651.40	25347.69
5	11527.01	28506.08	23220.96
6	6000.92	10852.27	26694.62
7	3672.66	4911.50	8834.85
8	969.76	2942.05	3913.51
9	394.41	800.45	2415.48
10	76.64	319.99	645.95
11	35.81	50.22	208.57
1+	91792.44	103200.26	104483.64
2+	90699.81	100652.05	101935.43
3+	75878.75	98045.19	95855.96
4+	51630.90	72033.95	91281.63

CATCH NUMBERS

	1984	1985	1986
1	10	24	24
2	360	67	155
3	1514	1705	300
4	4158	3567	3822
5	2225	5777	4706
6	821	1559	3834
7	410	575	1034
8	90	287	382
9	30	63	190
10	5	21	42
11	2	3	14
1+	9624	13647	14503
2+	9614	13623	14479
3+	9254	13556	14324
4+	7740	11851	14024

CATCH BIOMASS

	1984	1985	1986
1	1	2	2
2	95	18	41
3	873	983	173
4	3069	2632	2821
5	2305	5986	4876
6	1200	2279	5606
7	735	1031	1855
8	194	618	822
9	79	168	507
10	15	67	136
11	7	11	44
1+	8573	13796	16883
2+	8572	13793	16881
3+	8477	13776	16840
4+	7605	12793	16667

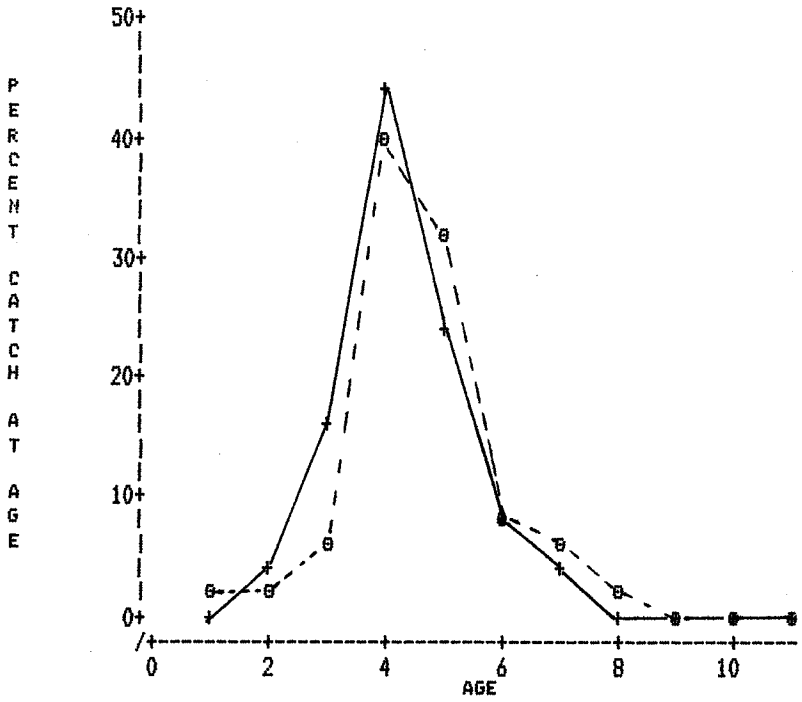
MEAN WEIGHT OF INDIVIDUALS IN CATCH

1984	1985	1986
0.9	1.0	1.2

FISHING MORTALITY

	1984	1985	1986
1	0.001	0.001	0.001
2	0.006	0.007	0.007
3	0.036	0.038	0.038
4	0.106	0.111	0.111
5	0.200	0.210	0.210
6	0.200	0.210	0.210
7	0.200	0.210	0.210
8	0.200	0.210	0.210
9	0.200	0.210	0.210
10	0.200	0.210	0.210
11	0.200	0.210	0.210
1+	0.059	0.091	0.106

Figure 1. Nominal catch of 4VW haddock



AGE	EST	OBS
1	1.2	0.1
2	1.5	3.7
3	6.8	15.7
4	40.7	43.2
5	32.9	23.1
6	7.4	8.5
7	6.4	4.3
8	2.1	0.9
9	0.9	0.3
10	0.1	0.0
11	0.0	0.0

θ PROJECTED

\+ OBSERVED

FIGURE 2. COMPARISON OF PROJECTED AND OBSERVED CATCH-AT-AGE IN NUMBERS FOR 4VW HADDOCK

Figure 3. Comparison of mean catch-per-tow at ages 5+ from Tables 22 and 23

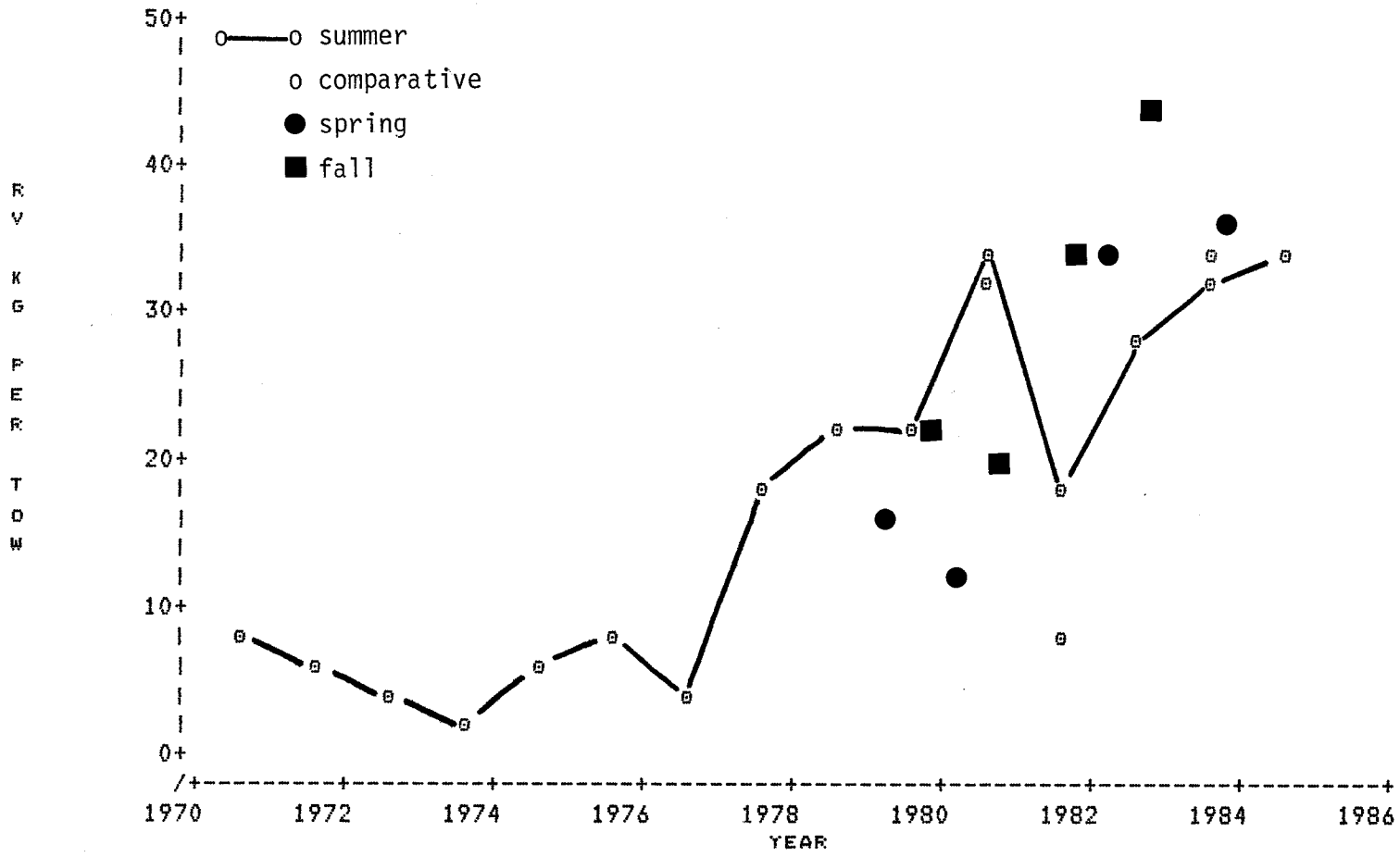
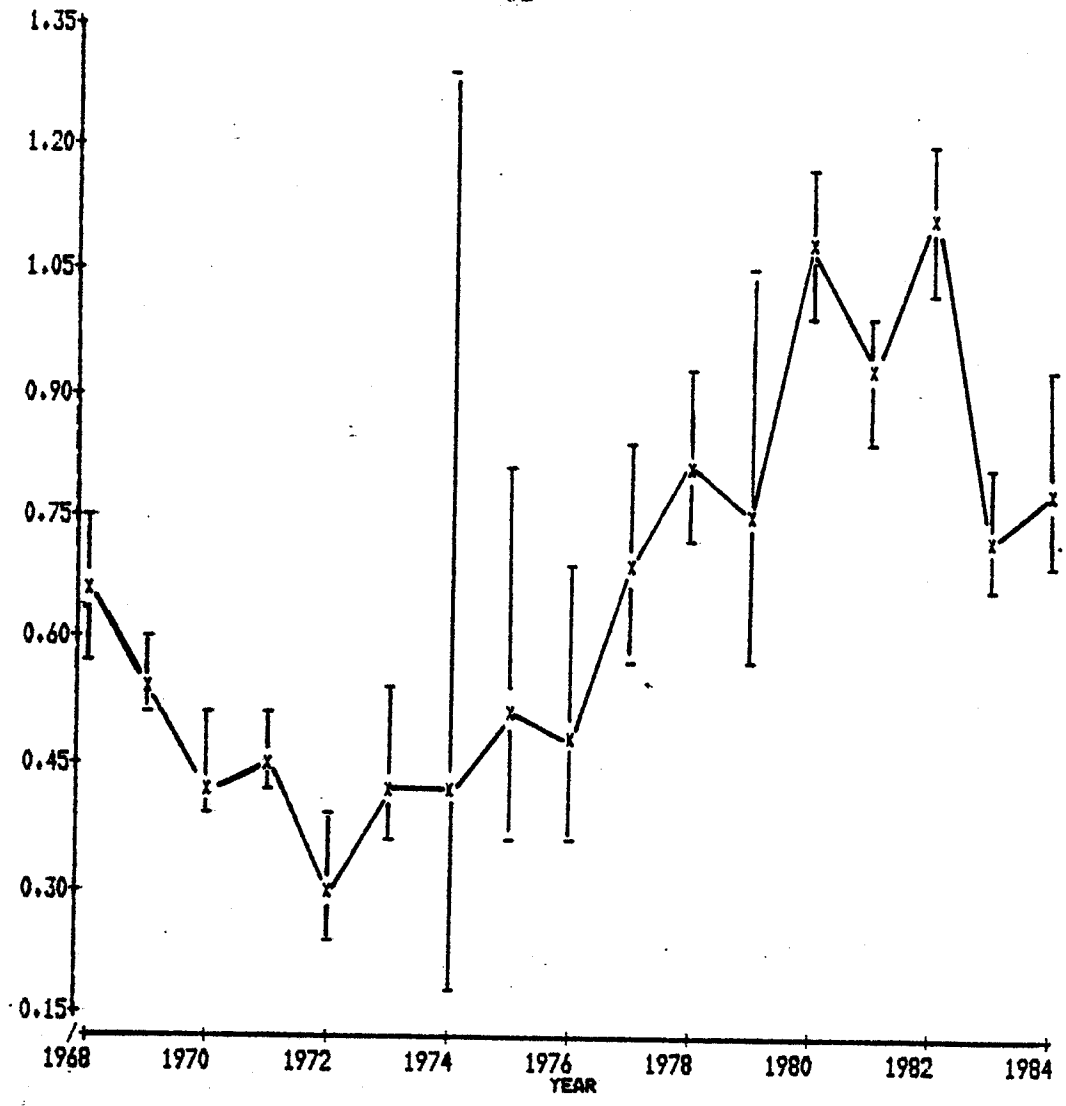


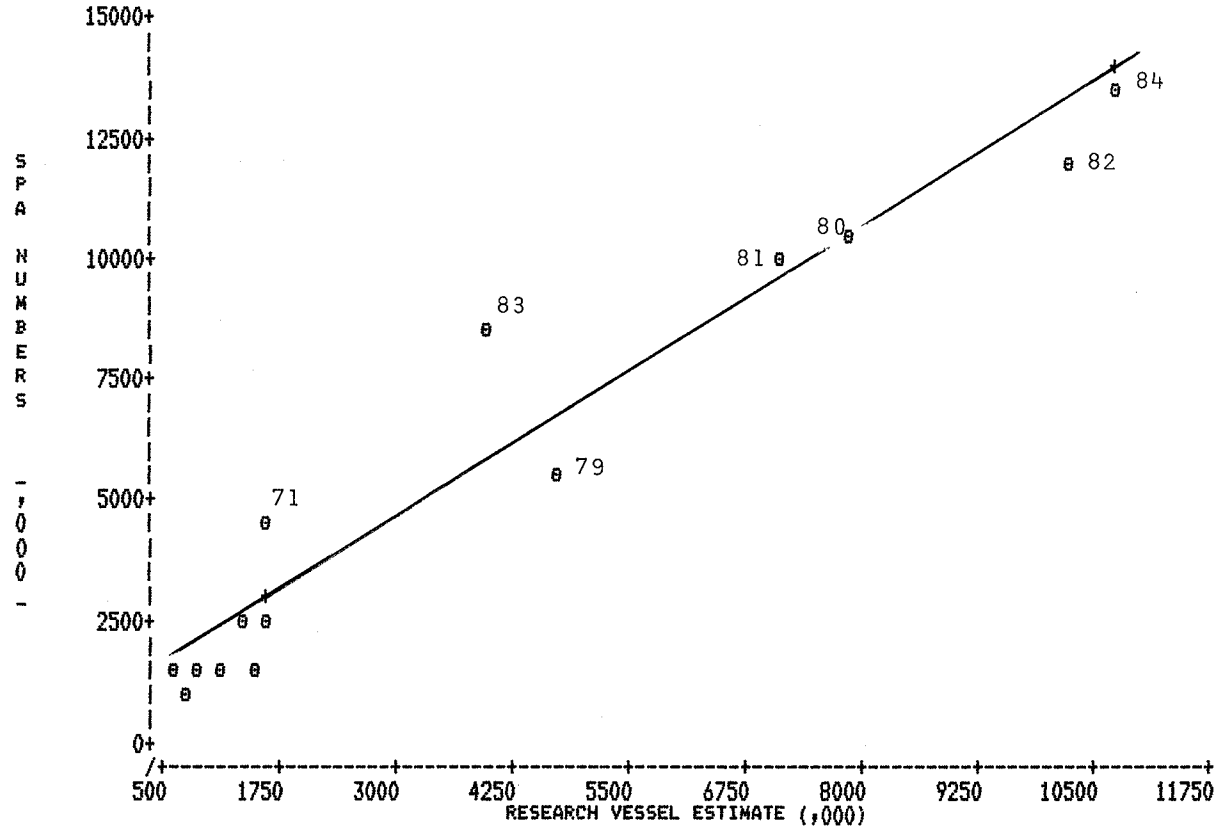
Figure 4. Mean catch-per-tow (kg) for 4VW haddock in all surveys



YEAR	TOTAL CATCH	PROP.	CATCH RATE MEAN	S.E.	EFFORT
1968	13332	0.283	0.660	0.050	20206
1969	11323	0.404	0.550	0.036	20585
1970	9436	0.234	0.434	0.037	21759
1971	13469	0.346	0.459	0.030	29347
1972	4748	0.170	0.314	0.042	15119
1973	4414	0.212	0.431	0.053	10247
1974	2357	0.016	0.407	0.224	5797
1975	1869	0.131	0.523	0.126	3571
1976	1360	0.232	0.479	0.100	2842
1977	3248	0.395	0.684	0.077	4750
1978	5901	0.344	0.811	0.070	7276
1979	3433	0.125	0.760	0.139	4514
1980	14840	0.551	1.076	0.061	13786
1981	20009	0.443	0.918	0.043	21802
1982	15166	0.591	1.111	0.052	13650
1983	9393	0.462	0.728	0.043	12910
1984	5299	0.328	0.791	0.071	6702

AVERAGE C.V. FOR THE MEAN:0.131

Figure 51. The standardized catch rate and effort for 4VW haddock (from Mahon et al 1984)



INTERCEPT = 759 ; SLOPE = 1.218 ; R SQUARED = 0.9360

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	4687	2327	1580	1272	979	1318	2545	1605	5568	10525	10127	12191	8337	13496
RESEARCH	1635	1414	606	864	779	1552	1663	1143	4798	7904	7082	10285	3959	10695
ESTIMATE	2751	2481	1497	1812	1707	2649	2784	2151	6601	10383	9382	13283	5580	13781
RESIDUALS	1937	-154	82	-540	-728	-1331	-239	-545	-1033	142	745	-1092	2757	-285

FULLY RECRUITED F (AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

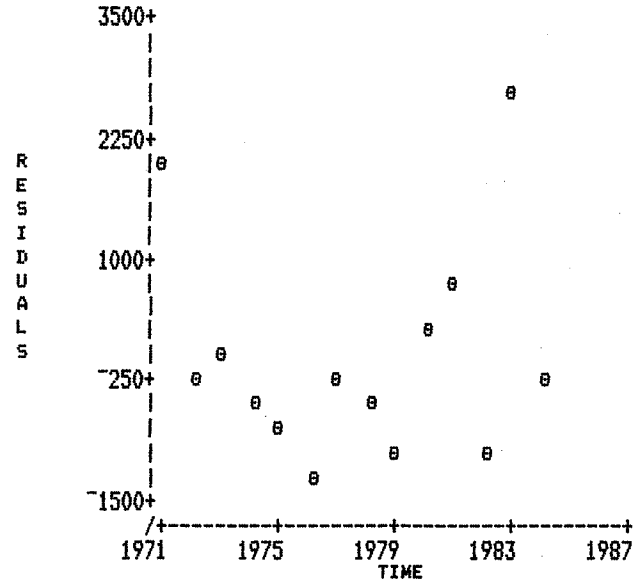
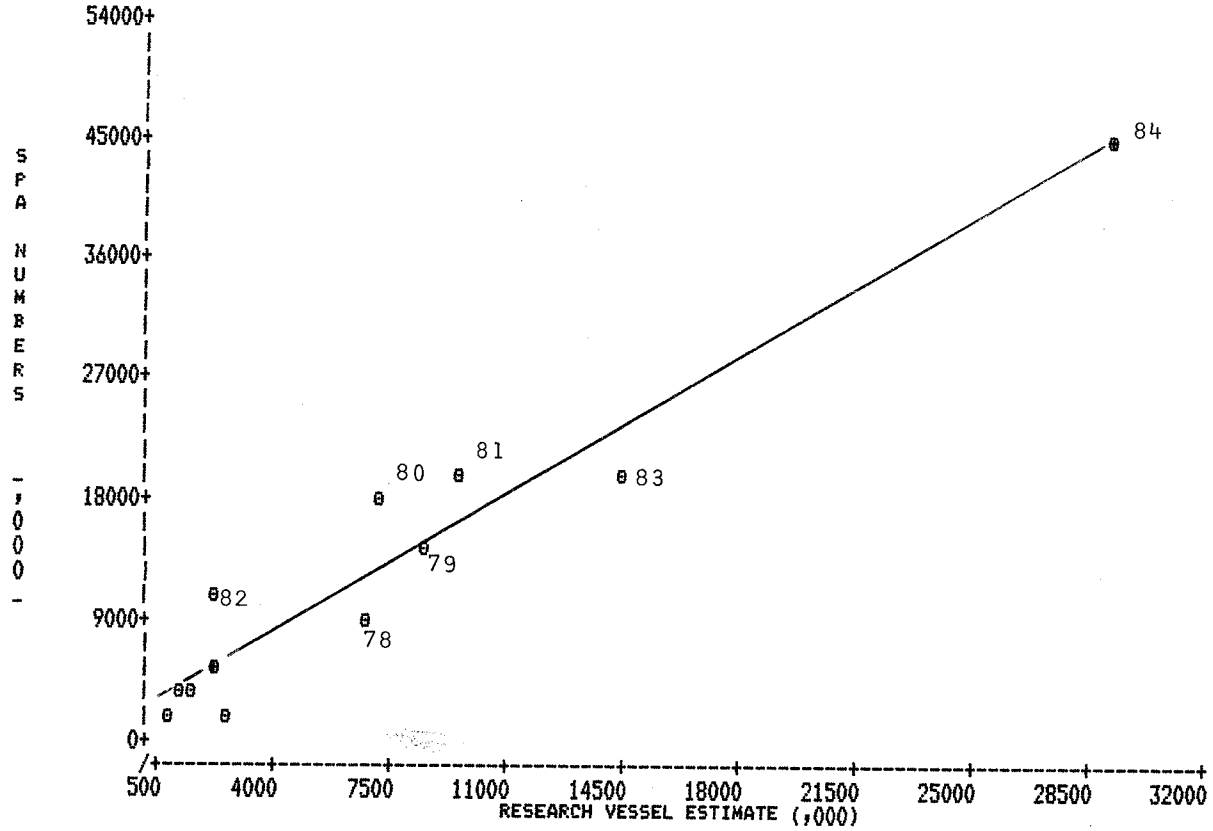


FIGURE 6 . SPA VS RV AGE 5 NUMBERS AT BEGINNING OF YEAR



INTERCEPT = 1833 ; SLOPE = 1.503 ; R SQUARED = 0.9411

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	5261	2759	3175	1477	2500	3384	2331	9466	14093	17160	20495	11027	20029	45536
RESEARCH	2256	1260	1192	816	2620	1682	999	6640	8717	7112	9480	2208	14433	29289
ESTIMATE	5225	3727	3625	3059	5772	4362	3334	11816	14938	12526	16085	5153	23532	45867
RESIDUALS	36	-968	-450	-1583	-3272	-977	-1004	-2350	-845	4634	4410	5874	-3504	-330

FULLY RECRUITED F (AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

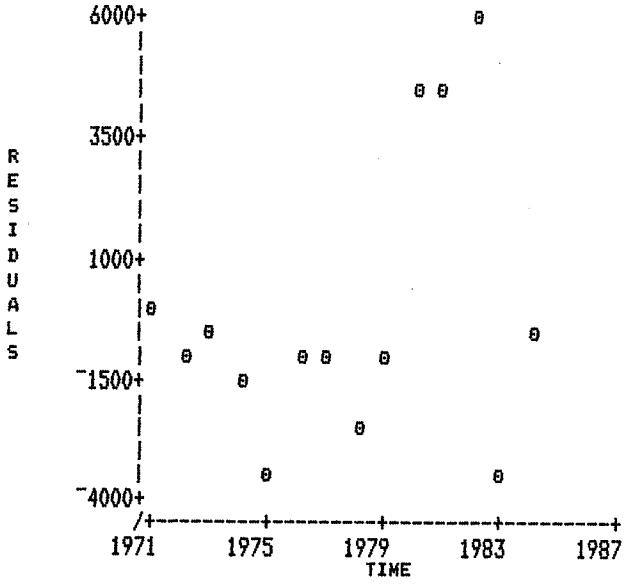
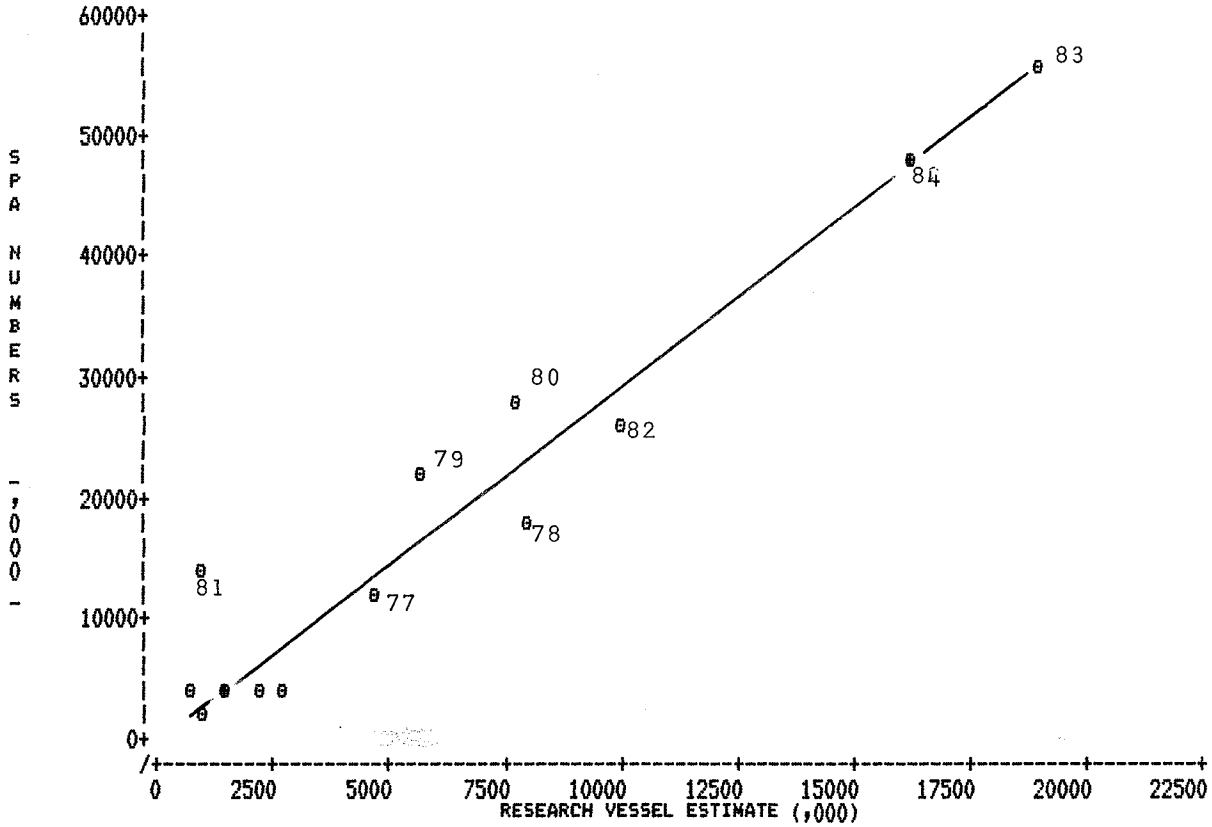


FIGURE 7 , SPA VS RV AGE 4 NUMBERS AT BEGINNING OF YEAR



INTERCEPT = 695 ; SLOPE = 2.861 ; R SQUARED = 0.9402

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	4352	4620	2517	4131	4653	3021	12629	18109	21427	27654	13757	26143	56816	47217
RESEARCH	1470	2184	889	2779	2694	710	4657	7891	5765	7755	990	9891	19014	16275
ESTIMATE	4902	6945	3240	8644	8401	2726	14018	23270	17190	22881	3528	28993	55093	47257
RESIDUALS	-550	-2325	-723	-4513	-3748	295	-1389	-5160	4237	4773	10229	-2850	1723	-40

FULLY RECRUITED F (AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

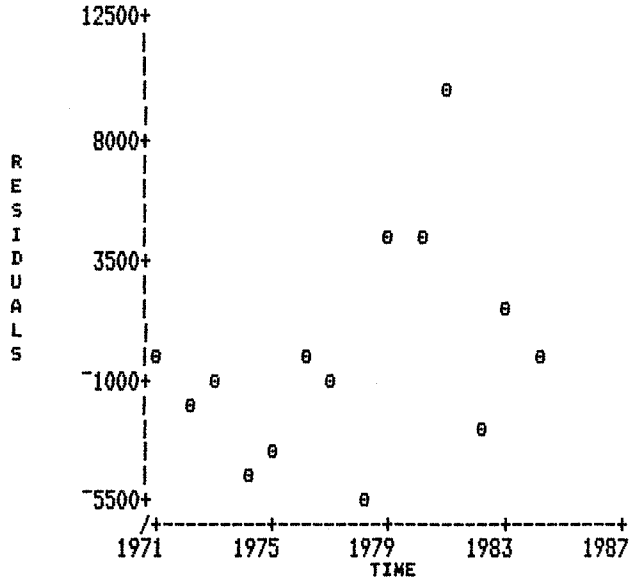
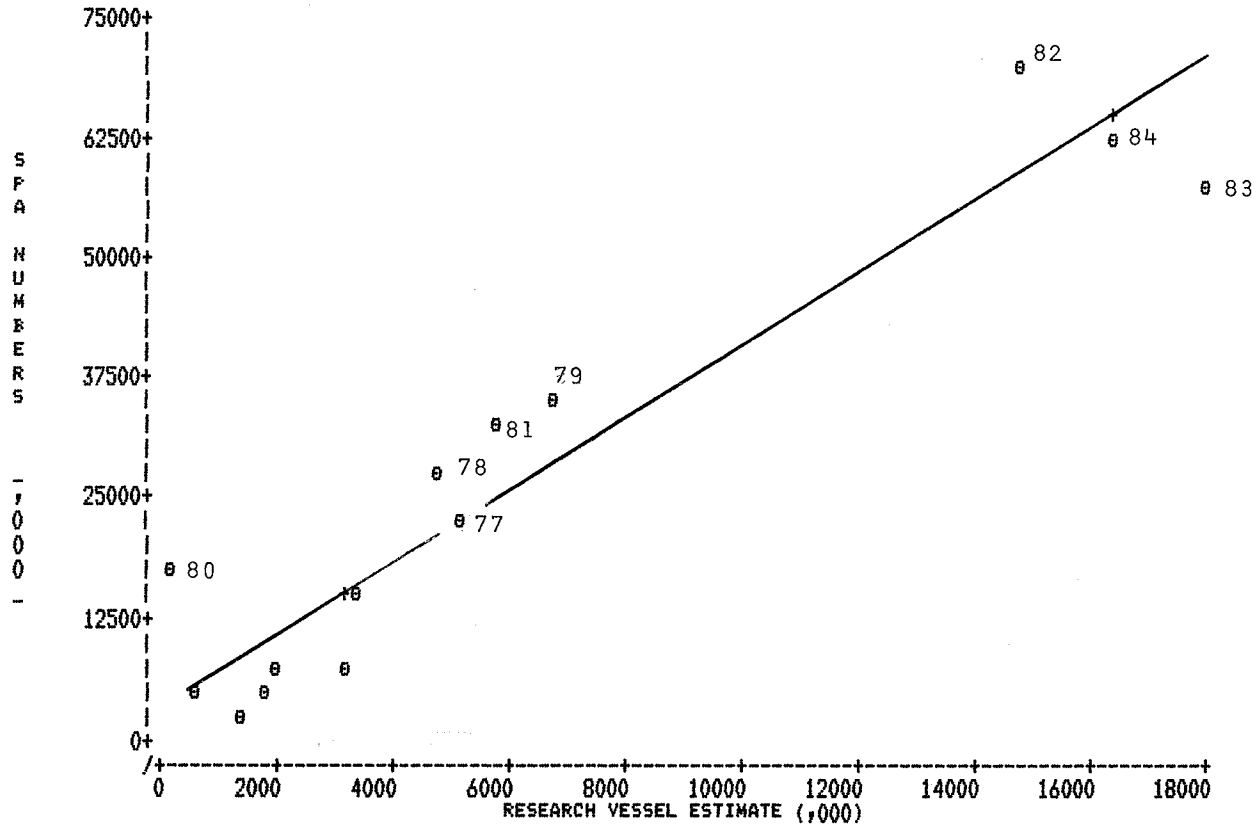


FIGURE 8. SPA VS RV AGE 3 NUMBERS AT BEGINNING OF YEAR



INTERCEPT = 4080 ; SLOPE = 3.660 ; R SQUARED = 0.8988

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	6380	3392	6348	5941	3757	16172	22431	26649	34073	17219	32283	69873	58190	62316
RESEARCH	3106	1403	2035	1891	588	3457	5195	4824	6741	271	5880	14891	17941	16371
ESTIMATE	15448	9215	11526	11000	6232	16732	23091	21734	28748	5072	25598	58575	69738	63994
RESIDUALS	-9068	-5823	-5178	-5058	-2476	-559	-659	4916	5325	12147	6685	11299	-11548	-1679

FULLY RECRUITED F (AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

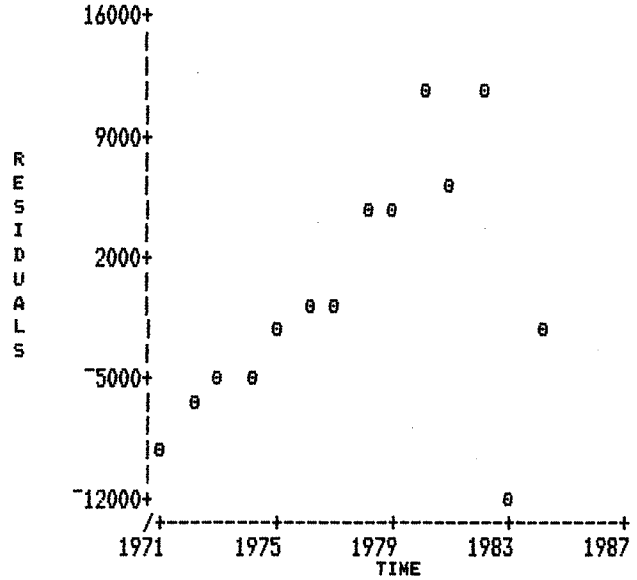
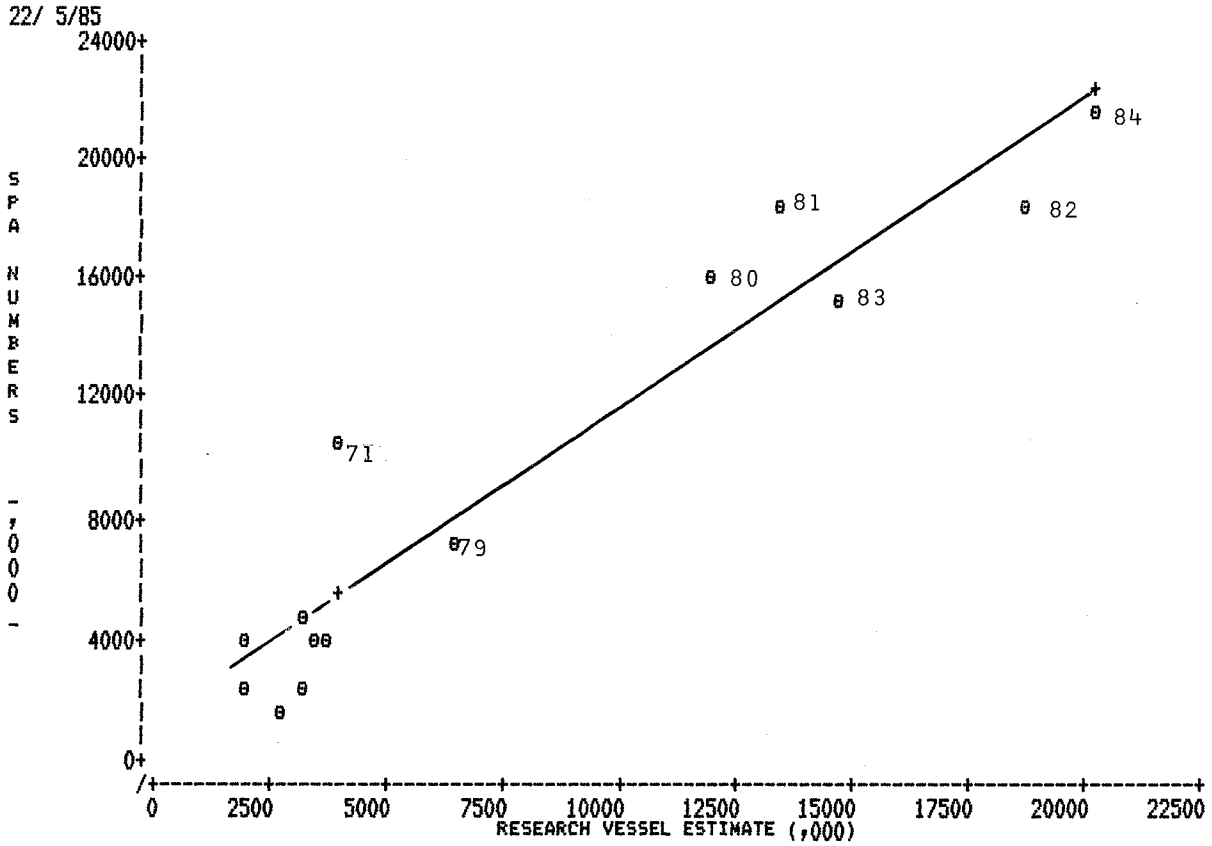


FIGURE 9. SPA VS RV AGE 2 NUMBERS AT BEGINNING OF YEAR



INTERCEPT = 1116 ; SLOPE = 1.034 ; R SQUARED = 0.9084

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	10417	5052	3610	2240	1930	2378	3853	3818	7381	15646	18067	18334	15110	21728
RESEARCH	4001	3195	1986	2125	2811	3300	3742	3388	6527	12005	13407	18725	14756	20239
ESTIMATE	5252	4419	3169	3313	4023	4527	4985	4619	7865	13528	14977	20475	16372	22041
RESIDUALS	5165	633	442	-1073	-2092	-2149	-1132	-801	-484	2118	3089	-2142	-1262	-312

FULLY RECRUITED F (AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

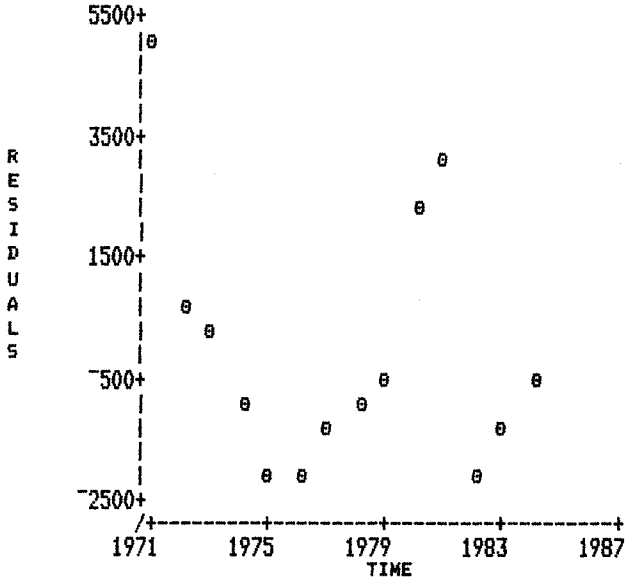
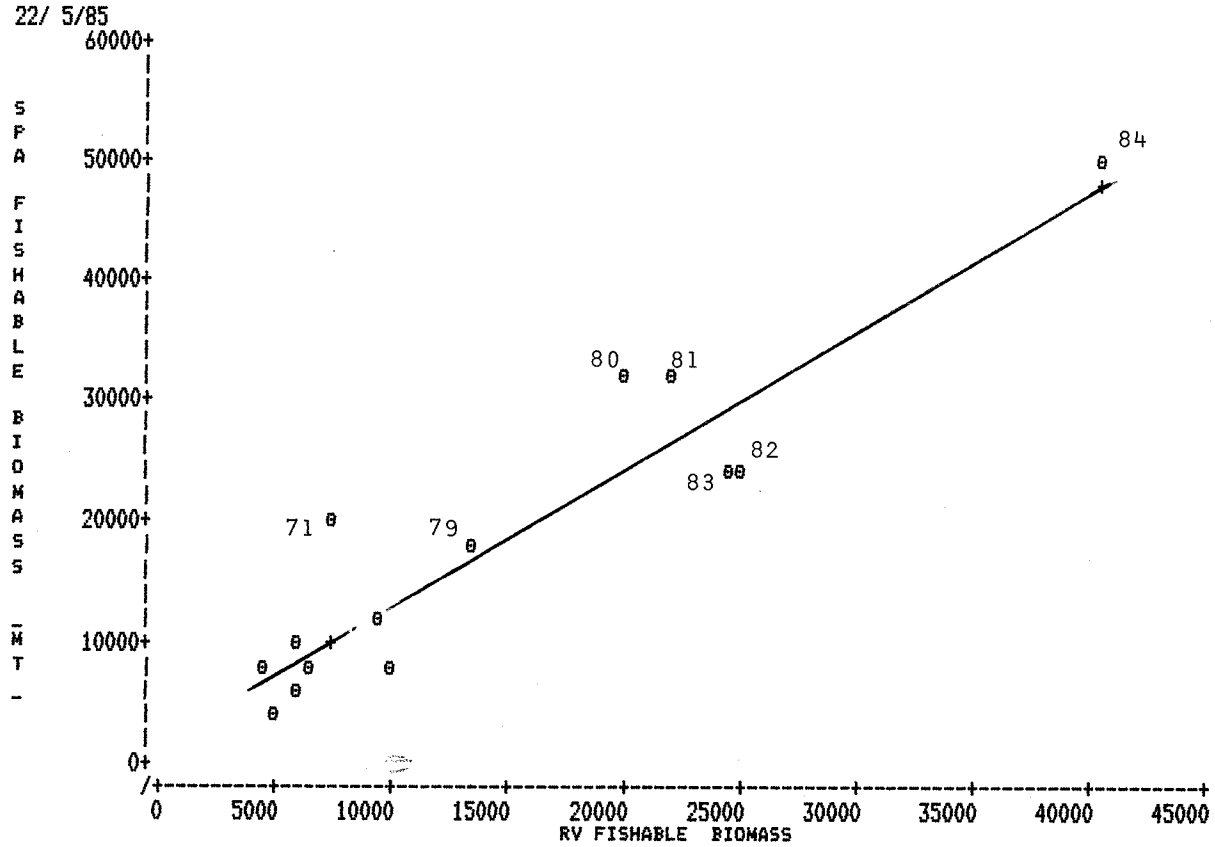


Figure 10. SPA beginning of year numbers vs RV numbers averaged across years (ages 5+).



INTERCEPT = 1688 ; SLOPE = 1.156 ; R SQUARED = 0.8690

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	19494	9920	8104	4944	8101	5186	7392	11925	18065	32583	31896	24264	23656	50757
FISHABLE B	7615	6003	4410	4889	9905	6089	6508	9539	13266	20230	22143	25248	24639	40717
ESTIMATE	10494	8630	6787	7341	13141	8729	9214	12718	17028	25081	27293	30883	30178	48770
RESIDUALS	9000	1290	1316	-2397	-5041	-3543	-1822	-794	1038	7502	4603	-6618	-6522	1986

FULLY RECRUITED F(AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

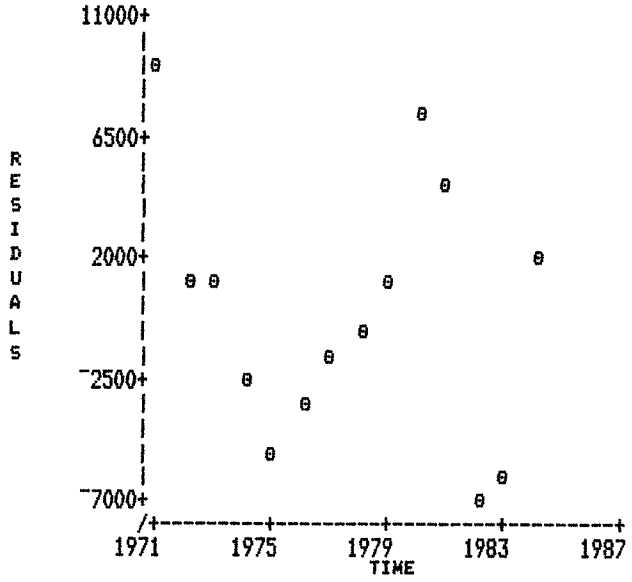
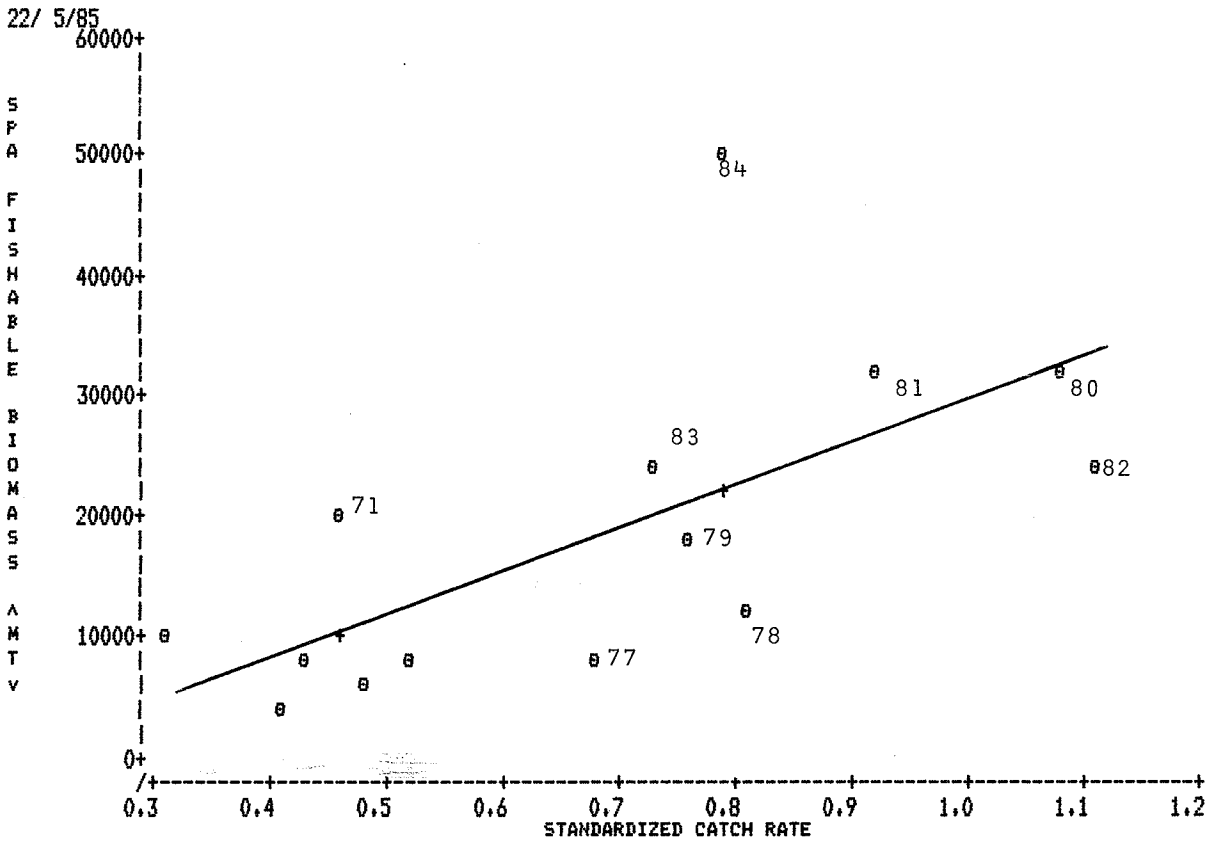


FIGURE 11, SPA BEGINNING OF YEAR FISHABLE BIOMASS VS RV FISHABLE BIOMASS AVERAGED BETWEEN YEARS



INTERCEPT = -4487.29 ; SLOPE = 33621.777 ; R SQUARED = 0.4049

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	19494	9920	8104	4944	8101	5186	7392	11925	18065	32583	31896	24264	23656	50757
CATCH RATE	0.46	0.31	0.43	0.41	0.52	0.48	0.68	0.81	0.76	1.08	0.92	1.11	0.73	0.79
ESTIMATE	10943	6072	9996	9184	13109	11602	18503	22782	21081	31704	26369	32869	19976	22094
RESIDUALS	8551	3848	-1892	-4240	-5008	-6416	-11111	-10858	-3016	879	5527	-8605	3680	28662

FULLY RECRUITED F(AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

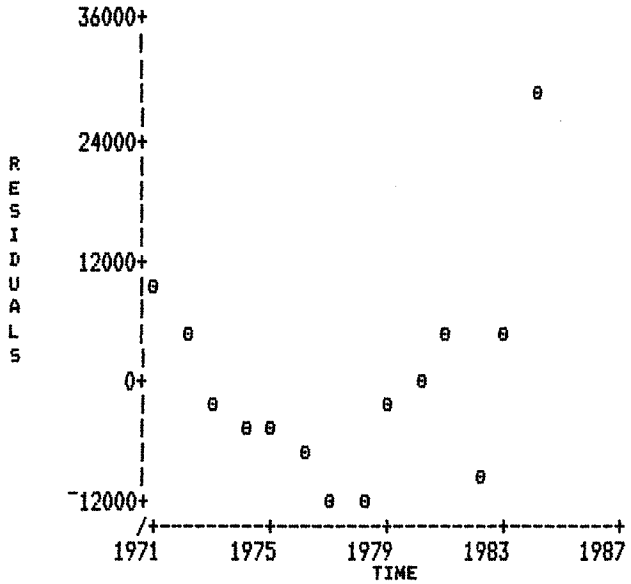


FIGURE 12. SPA FISHABLE BIOMASS VS STANDARDIZED COMMERCIAL CATCH RATE

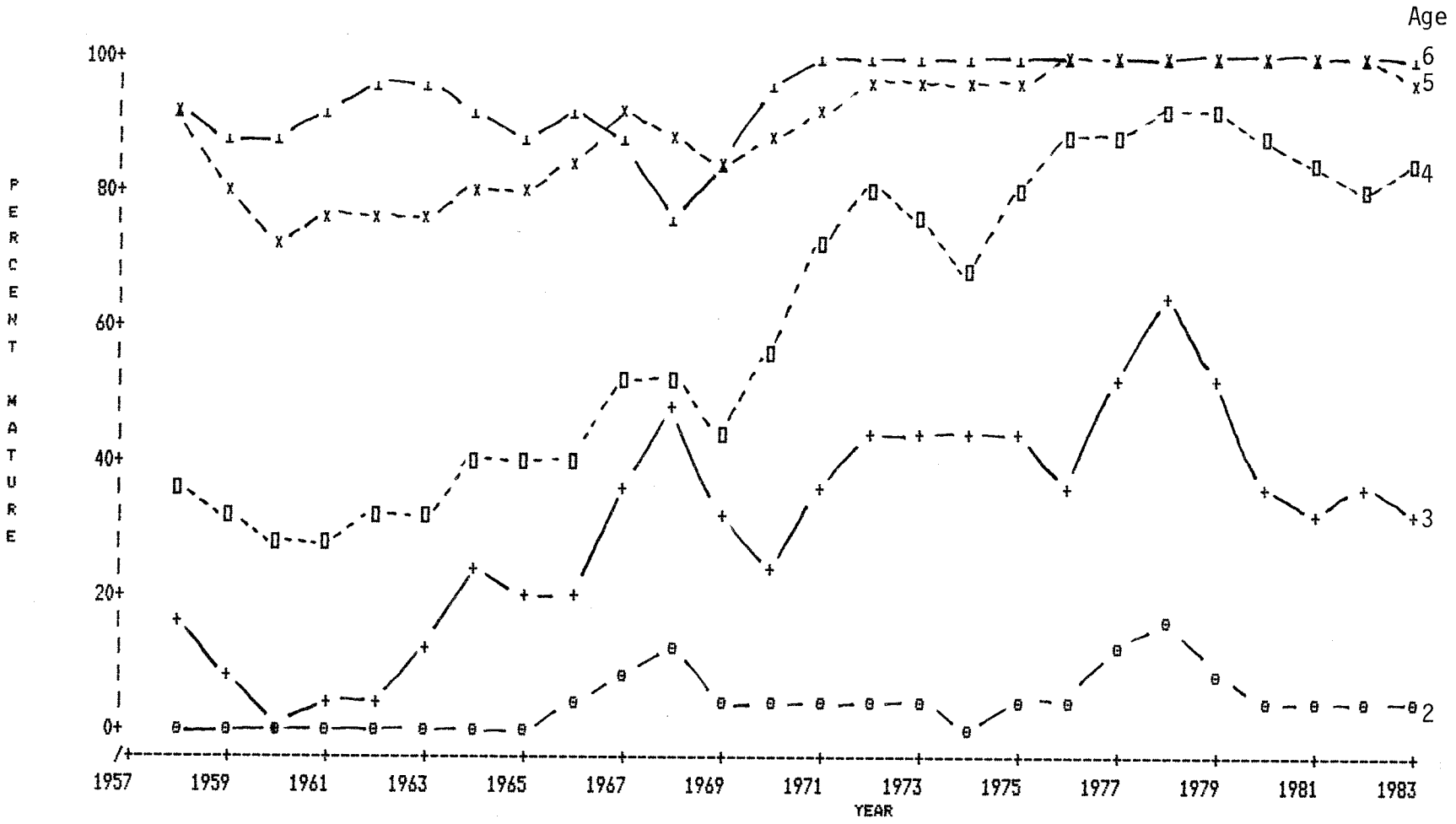


Figure 13. Percentage of mature females in the 4VW haddock stock from RV surveys (Jan-Sept). The plotted values are running averages of 3.

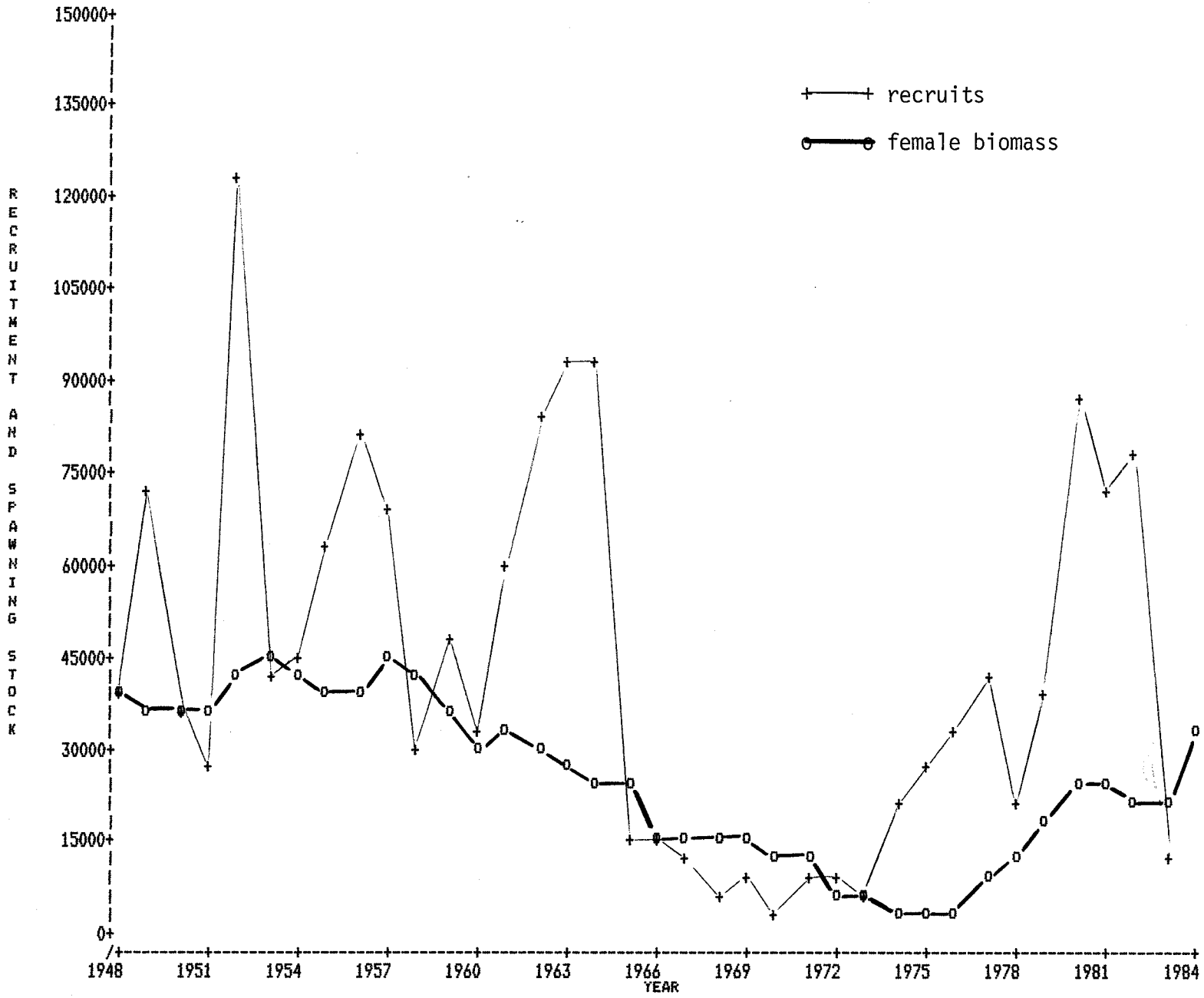


Figure 14. Trends in recruitment (SPA age 1 numbers) and mature female biomass (t) for 4VW haddock

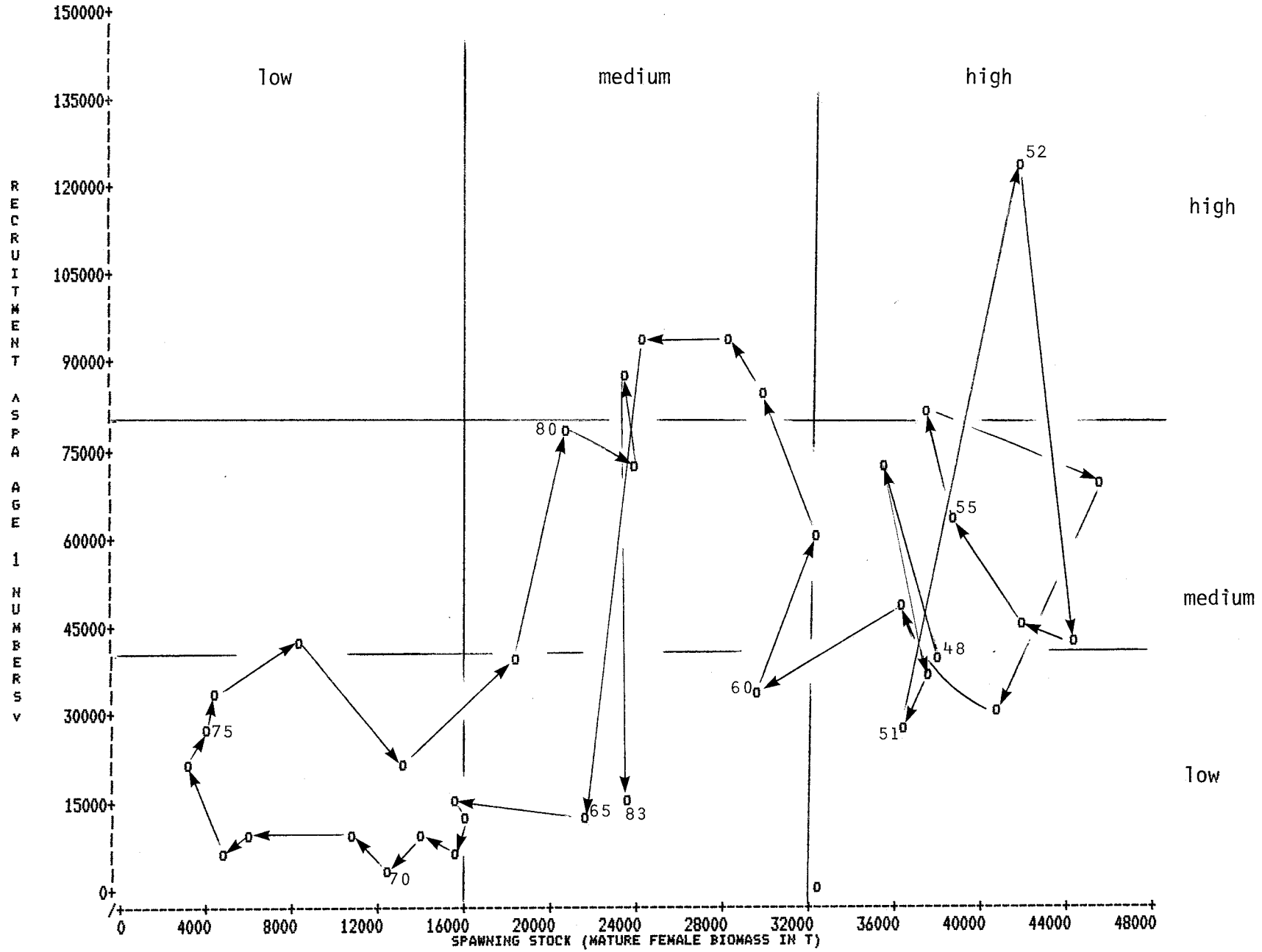
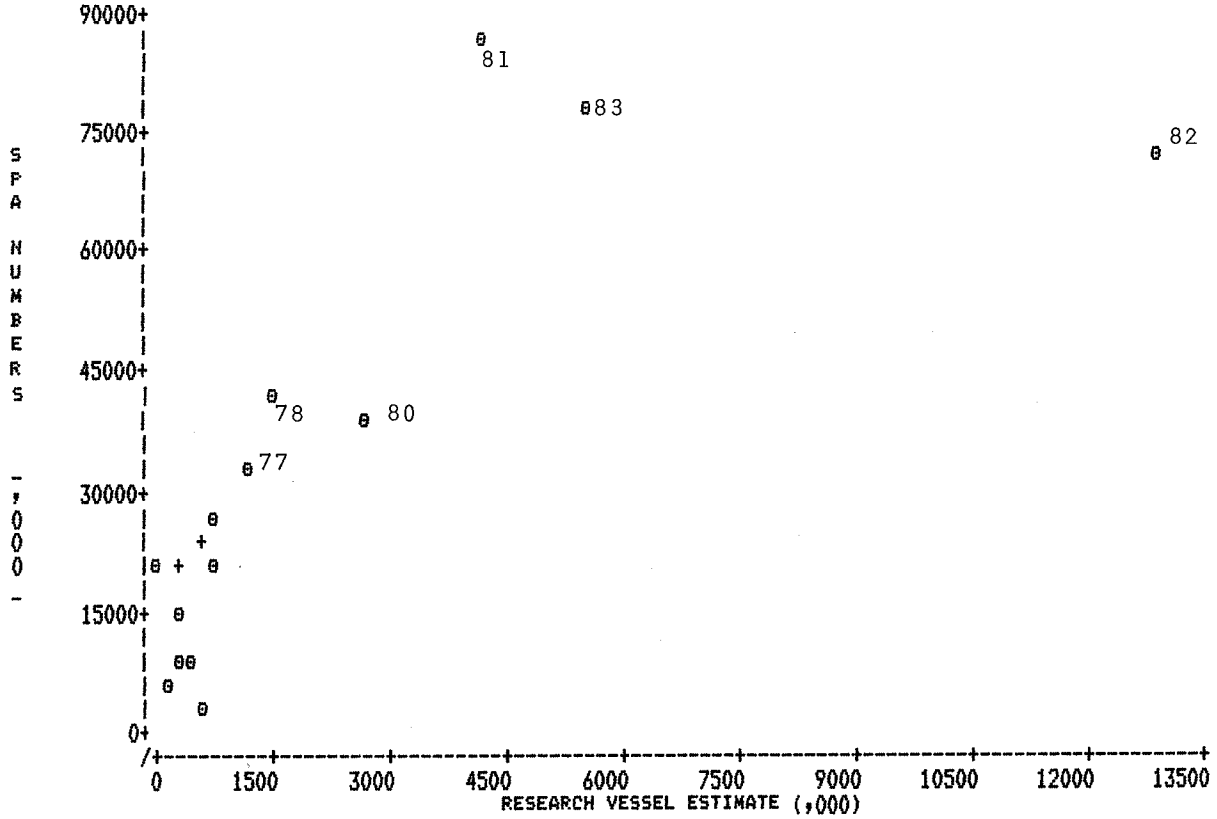


Figure 15. Recruitment versus spawning stock in the previous year for 4VW haddock



INTERCEPT = 19988 ; SLOPE = 5.893 ; R SQUARED = 0.5684

YEAR	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
SPA	4439	8091	7795	4653	20061	27875	32785	42405	21032	39798	86306	71659	76661	16049
RESEARCH	633	410	277	208	802	696	1217	1543	52	2693	4177	12950	5519	296
ESTIMATE	23717	22401	21620	21216	24717	24087	27161	29083	20295	35854	44602	96300	52509	21732
RESIDUALS	-19278	-14310	-13825	-16562	-4656	3788	5624	13322	737	3943	41704	-24641	24152	-5683

FULLY RECRUITED F (AGES 6 PLUS)

0.570 1.299 0.835 1.409 0.861 0.415 0.504 0.588 0.709 0.230 0.621 1.001 0.996 0.530 0.200

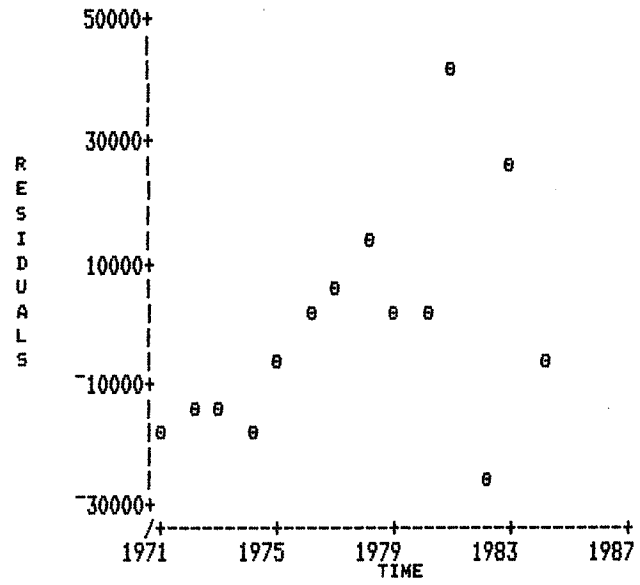


FIGURE 16, SPA VS RV AGE 1 NUMBERS AT BEGINNING OF YEAR

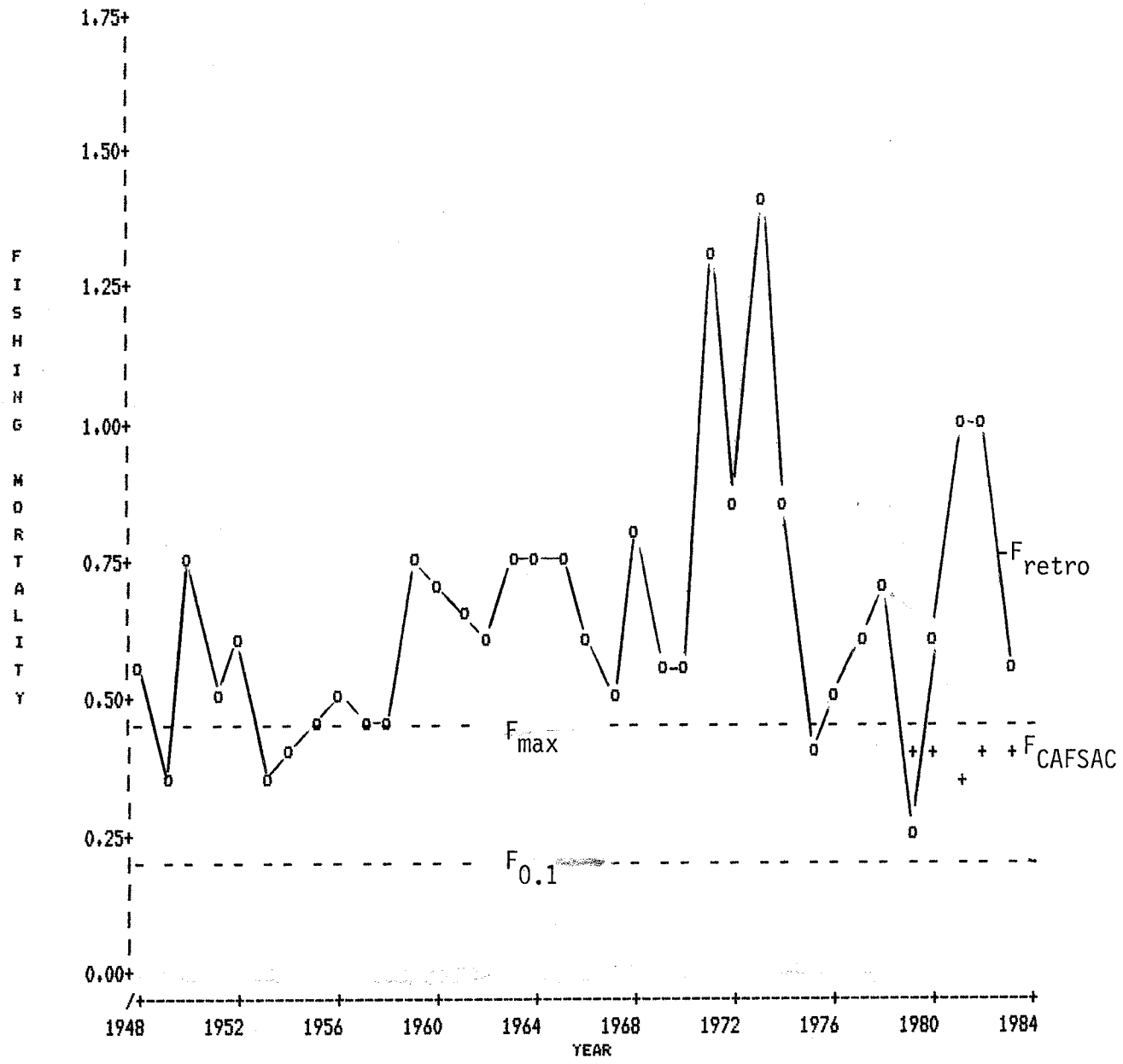


Figure 17. Fishing mortality to fully recruited ages (6+) compared to F_{max} $F_{0.1}$, and the terminal F estimated by CAFSAC (F_{CAFSAC})