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Haddock on the Eastern Scotian Shelf

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by

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Abstract

The nominal catch of 4TVW haddock totalled 7,000 t in 1990 representing 117% of the advised tac of 6,000 t. The fishery on this resource has been restricted to by-catches since 1987. By-catch rates were set at 5% in 1987 but were increased to 15% in 1988. This rate remained in effect throughout 1990. Longline landings in 1990 were the highest observed since 1960 and were taken mainly in Division 4W in and around the closed area. Trawler landings represented less than 50% of the total and were caught mainly in 4Vs. Maximum age in the commercial catch was 9 with contributions of age 7+ fish less than 1%. This restricted age range coupled with a low mean weight of fish in the catch is indicative of a continued high level of exploitation probably in excess of F_{max}. Research vessel surveys indicate a potentially large 1988 year-class. These fish (age 2 in 1990) have also been evident in the catches of the small mesh gear silver hake fishery for the past two years. These fish are most abundant in and around the closed areas. The distributional characteristics of the 1988 year-class are similar to those of other large year-classes observed in the early 1980s. These fish may begin recruiting to the fishery in significant numbers in 1991.

Résumé

Les prises nominales d'aiglefin dans les divisions 4TVW se sont élevées à 7 000 t en 1990, représentant 117 % du TPA conseillé de 6 000 t. La pêche de cette ressource est limitée aux prises accidentelles depuis 1987. Le taux de prises accidentelles, qui avait été fixé à 5 % en 1987, est de 15 % depuis 1988. En 1990, les débarquements d'aiglefin capturé à la palangre ont été les plus élevés depuis 1960. Ils provenaient essentiellement de la division 4W, plus précisément de la zone fermée et des alentours de celle-ci. Les prises au chalut représentaient moins de 50 % du total et provenaient surtout de la division 4Vs. L'âge maximal du poisson capturé était de 9 ans. Il faut cependant préciser que le poisson de 7 ans et plus représentait moins de 1 % des prises. Cette étroite fourchette d'âges, associée à un faible poids moyen de l'aiglefin capturé, est révélatrice du maintien d'un taux d'exploitation élevé, probablement supérieur à F_{max}. Les résultats des campagnes d'évaluation des navires scientifiques révèlent que la classe d'âge de 1988 pourrait être abondante. Les poissons de cette classe d'âge (de 2 ans en 1990) étaient aussi présents dans les prises de merlu argenté au chalut à petite maille au cours des deux dernières années. Ils sont plus abondants dans les zones fermées à la pêche et aux alentours de celles-ci. Les caractéristiques de distribution de la classe d'âge de 1988 sont semblables à celles des autres fortes classes d'âge observées au début des années 1980. Les poissons de cette classe d'âge pourraient commencer à être recrutés en nombre important en 1991.

Description of the Fishery to 1991

Catches from this resource have averaged 26,500 t per year from 1950 to 1969, 5,000 t from 1970 to 1979 and ranged between 8,000 and 20,000 t until 1987 (Table 1). The nominal catches for 1987 through 1990 have been taken exclusively as by-catch in other groundfish fisheries operating in divisions 4T, 4V and 4W, and totalled approximately 7,000 t in 1990. This represents a 17% overrun of the advised 1990 TAC of 6,000 t.

In 1987, the combination of smaller recruiting year-classes (1983-1985) relative to the early 1980's year-classes, low levels of spawning stock biomass, and the concentration of the fishery on the only two remaining year-classes of any appreciable size (1981, 1982), resulted in the restriction of the fishery to a 5% by-catch. In 1988 this was increased to 15% which remained in effect through 1990. Management also imposed a year-round ban on mobile gear fisheries in areas identified as nursery grounds (mainly Western and Emerald banks). The year-round nursery ground closure imposed in 1987 remains in effect to the present.

Until 1984, most of the catch from this stock was taken from Division 4W by large OTBs (TC4 and TC5) fishing in the spring. From 1984 to 1986 Subdivision 4Vs accounted for 40-60% of the total catch. Since the restriction of the fishery to by-catches in 1987, landings in both 4Vs and 4W have increased (Table 2). Landings from 4W have increased approximately four-fold from that recorded in 1987. Landings in 4Vs doubled from 1987 to 1989, but declined 20% in 1990. Landings in 4T and 4Vn are presently negligible. From 1987 to 1990 the proportion of landings contributed by OTBs has decreased from approximately 60% to 45% of annual landings while the by longliners portion has increased from 21% to 47% (Table 3). Longline landings in 1990 are the highest observed since 1960. Seine landings presently represent about 6% of the annual total. The largest proportion of the annual landings are presently recorded during the second and third quarters (Table 4), although in 1990 first quarter landings of OTBs and longliners were higher than for the previous three years from both Subdivision 4Vs and Division 4W (Table 5).

As was the case in 1989, there were some indications that haddock reported as caught in 4W may actually have been caught in 4X. Early in 1990 there were also reports of haddock caught in Subdivision 4Vs being reported from Subarea 3. None of these reports indicate the quantities of fish involved and could therefore not be incorporated in the present population assessment.

Age Composition and Weight-at-Age of the Catch

The age composition of the 1990 small mesh gear catch in the foreign fishery was estimated in a manner consistent with recent practices, by applying the July RV age-length key to the length frequency distribution of the haddock by-catch. The age composition of Canadian landings in 1990 was based on age-length keys for quarterly catches by Division, and Subdivision where sampling was adequate. Sampling in 1990 was inadequate to reconstruct the 1990 catch at age for longline landings. Reports from Scotia-Fundy Port Technicians indicate that these landings were comprised of many small landings (less than 1,000 lbs in many cases) by small

fixed gear vessels, making them difficult to sample. In addition, a proportion of the fixed gear haddock landings which were available had been graded at sea mainly by preferential discarding of smaller, and some by processing the larger fish in the catch and landing these as fillets. Landings which had been altered in this manner were not sampled because they represent a biased view of the catch length/age frequency distribution. In the absence of longline samples, landings from this gear sector were included in the mobile gear landings for purposes of reconstructing the catch at age. The components of the 1990 catch at age are given in Tables 6 and 7.

The catch at age in 1990 was composed primarily of the 1985 and 1986 year-classes (53% and 24% by numbers respectively) which made up 74% of the total numbers caught. By weight these year-classes accounted for 77% of the total catch (1984 = 60% and 1985 = 17%). In 1989 and 1990 the catches of fish at age 2 were larger than has been observed since 1977 the last year of small mesh fisheries on the shelf outside of the small mesh gear box. These fish were caught as by-catch in the small mesh gear fishery for silver hake, which is restricted to a 1% aggregate by-catch of haddock. Since the fishery is closed once this limit has been reached, haddock catches are generally avoided. This would indicate that these catches were unavoidable and the result of the overall abundance of these year-classes. The 1988 year class accounted for 9% of the 1990 catch by numbers and 2% of the catch by weight. In 1990 the small mesh gear catch at age represented 16.8% of the total catch by numbers and 100% of these landings at ages 0 through 2. In 1989 the small mesh gear catch represented 31% of the total catch by numbers and 100% of the landings at ages 0 through 3.

Since 1984 the maximum age in the catch has diminished to the point where in 1990 the oldest fish in the catch was 9 years old. An examination of Table 8 shows some catch at age 10 in 1990, but these translate into fewer than 500 fish in the total catch at age and are therefore set to 0 in the overall catch at age matrix (Table 9). Mean weights at age estimated from commercial landings have been relatively stable since 1970 for ages 1 through 5. However, since 1982 there has been an increase in the mean weights of 6 and 7 year old fish in the catch, these increases being particularly abrupt from 1988 to 1990 (Table 11). This most recent abrupt increase in weight at age is also evident at age 8 although there are very few fish caught at age 8. The proportional catch at age matrix (Table 10) shows that the contribution of fish aged 7 or older has been less than 1% since 1986.

Commercial Catch Rates

The by-catch nature of this fishery since 1987 does not allow for a comparison of present catch rates to those of earlier years from directed fisheries. By-catch catch rates are not considered to be representative of the abundance of this stock.

Research Vessel Index

The research survey catch rates at age from 1970 to 1990 show a decline in overall abundance from 1983 to 1987 with a subsequent increase (Figure 2). Since 1987 the catch rate

has shown a modest increase. Estimates of the 1988 year-class at ages 1 and 2 indicate that this is one of the largest year-classes to enter the population since 1970 (Table 12). The associated CVs of between 27 and 37% of the mean catch per tow of the 1988 year-class at ages 0 through 2 show that this is a relatively reliable estimate (Table 13).

The only year-class previously observed at age 0 in Subdivision 4Vs was the very large 1981 year-class. The 1990 year-class is also present in the area (Table 14). Even though this is suggestive of a large year-class it is not possible to draw firm conclusions as to the size of the latter year-class because the abundance of age 0 haddock is poorly estimated by the surveys. Age 1 fish have been observed in 4VS in 17 of the past 21 years. Overall catch rates increased rapidly in 1982 as a result of the incursion of fish belonging mainly to the 1981 year-class (Figure 3). These high catch rates declined to pre-1982 values by 1989. Since 1987 catch rates at ages 4+ have declined rapidly to the present. Some increase in catch rates at ages 0-3 is evident in 1990 due mainly to the presence of the 1988 year-class.

The age composition in Subdivision 4Vn is primarily from ages 4+ (Figure 4). Age 0 fish have never been observed in the survey of this area, while fish at ages 1-3 have occurred in less than 50% of the surveys. Catch rates show clearly the influx and subsequent decline of the 1981 and 1982 year-classes beginning in 1984. Since these two large year-classes, there has been no significant recruitment to this part of the population (Table 15).

Division 4W has traditionally been the centre of distribution of this resource as evidenced by the significantly higher catch rates observed there (Figure 5). Age 0 fish have been observed in 17 of the past 21 years while age 1 fish are present in all years. Catches of fish aged 0-3 increased after 1977, following the exclusion of the foreign fleet. The peak in recent catch rates occurred in 1983 due to the presence of the large 1981 and 1982 year-classes. Catch rates at these younger ages declined from 1983 to 1987 as these two large year-classes aged and were followed by smaller year-classes. The post-1987 catch rates at ages 0-3 increased due to the 1988 year-class. Catch rates at ages 4+, which peaked in 1984, continue to decline to the present to a point where they now equal catch rates of the late 1970s and early 1980s (Table 16).

The maximum age observed in the survey has been declining since the early 1980s. In 1990 the oldest fish in the survey was 8 (in 4Vn) while in the early 1980s fish at ages 10 and 11 were observed with some as old as age 15.

The view of the resource derived from the groundfish surveys is consistent with that put forth by much of the industry prosecuting this resource. Catches of haddock in 4T and 4Vn are presently negligible, while catches in 4Vs are low and are generally difficult to find. Catches have increased significantly in 4W since 1987 to the point where they are classified as good. Reports from fixed gear fishermen fishing inside the closed area indicate that fish there are relatively plentiful and that during the mid-year fishery in 1990, catch rates of haddock often exceeded those of cod.

In addition to the age based analysis of the survey data, catch rates at length were also

examined. Figure 6 shows the mean catch per tow at length for all 21 years of survey data available. Two points are noteworthy; the first is the clarity of the modes for ages 0 through 3+ at 8.5 cm, 20.5 cm, 32.5 cm, and 40.5 cm respectively, and the second is the relative size of the 1988 year-class at a modal length of 30.5 cm. This year-class is evident as an above average mode in both 4Vs (Figure 7) and 4W (Figure 8) but not in 4Vn (Figure 9). The progression of the 1988 year-class through the population is shown in Figure 10. This shows that its catch rate in the surveys has been above average at both ages 1 and 2.

Estimation of Stock Parameters

As was the case in previous assessments we were not able to estimate fishing mortality in the current year. This year, the results of a number of formulations of the adaptive framework were examined. Each of these resulted in retrospective estimates of F far in excess of what had been estimated in that year. These results led us to question the validity of the estimates of F in the current year. In the absence of a satisfactory explanation for the increase in retrospective F, the results of the adaptive framework were considered to be unreliable.

Assessment Results

Fishing Mortality and Stock Abundance

Total mortalities estimated from survey catch rates at age indicate that F in recent years is well above $F_{0.1} = 0.25$ and has been increasing since the early to mid-1980s (Table 17). Given the variability in survey catch rates these estimates, while indicating the overall trend in F, should be viewed as approximate. The mean weight of a fish in the catch in 1990 also points to an exploitation rate well in excess of F_{max} (Figure 11).

Recruitment

Results of the 1990 July RV survey indicate that the 1988 year-class appears to be relatively large and is associated with relatively low CVs. Its distribution over the stock area is consistent with that of previously observed large year-classes. Figure 12 shows the spatial distribution of three poor year-classes (1973, 1978 and 1983) relative to two year-classes which are known to have been abundant. The spatial characteristics of the 1988 year-class at age 2 is more characteristic of an abundant year-class than a poor year-class.

Prognosis

Although we are unable to estimate F precisely in 1990 there are a number of indicators which show that this stock has experienced heavy exploitation in the recent past and probably continues to be exploited at high rates even under present by-catch restrictions. Research vessel catch rates at age indicate that Fs are presently on the order of 1.0 or above. The reduction in the overall age span of the stock to the point where fish older than age 7 are relatively rare also indicates heavy exploitation over a long period. This is consistent with the relatively small

average weight of a fish in the catch which indicates an exploitation rate well in excess of F_{max}. The increases in allowable by-catch rates for 1988 through 1990 to 15%, and the subsequent increase 1991 to 30% will not result in a reduction of this heavy exploitation. To reduce exploitation by-catch rates should be reduced to 5%.

The relatively large 1988 year-class is a positive sign. This is most evident in Division 4W, particularly in and around the closed area. Although the connection between the establishment of the closed area and subsequent increases in haddock abundance, have not been proven, the observations presented on Figures 5 and 6 are highly suggestive of this being the case. Given that fishing mortalities remain high even with the imposition of present by-catch rates, the closed area should remain in effect to afford some protection to incoming year-classes, particularly the strong 1988 year-class which will be entering the fishery in 1991 at a modal length of approximately 40 cm which is under the present minimum size limit. Fixed gear catches inside the closed area now represent the largest proportion of the catch. To ensure that the efficacy of the closed area is maintained, that is to protect incoming year-classes from fishing related mortality, catches of young fish by this fleet should be minimized by the establishment of a minimum hook size requirement for the closed area. Reports from industry in this area indicate that by-catches of small fish with the present No. 10 hooks can be significant. Finally, it is notable that the large catches of small fish by the small mesh gear fishery are presently the greatest reported source of fishing mortality on these age classes (0 through 3). This is inconsistent with the objective of protecting young fish.

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

	4T					4Vn'					4Vs					4W						
Year	Can.	USA	USSR	Spain	Other	Can.	USA	USSR	Spain	Other	Can.	USA	USSR	Spain	Other	Can.	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				5869	120		747	9						19960	1533		132		30111	
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	10	13318	
1969	167				3	245				112	726			631	66	8270		235	864	1	11320	
1970	160					395	2		75	1	620		34	830	16	4754	574	636	1332		9429	
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	1868	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				2	2339		104		73	3433	2000

Table 1. (Continued)

	4T					4Vn+					4Vs					4W						
Year	Can.	USA	USSR	Spain	Other	Can.	USA	USSR	Spain	Other	Can.	USA	USSR	Spain	Other	Can.	USA	USSR	Spain	Other	Total	TAC
1980	81					188				42	1841					12448		209		31	14840	15000
1981	177					119				25	1796					17684		187		21	20009	23000
1982	47					183				23	2373					12498		53		49	15226	23000
1983	30					206				17	1542					7302		149		166	9412	15000
1984	120					299				11	3195		2		1	3992		168		233	8021	15000
1985	498					598				59	7291				2	2862		275		79	11664	15000
1986	531					904				17	8798				4	6277		312		78	16921	17000
1987	438					484				13	1587					994		207		154	3877	0
1988	369					507					2057					1176		332		99	4540	0
*1989	87					423					3104					3497		**683			7794	6700
*1990	30					111					2430					4049		**407			7027	6000

+ -- Between 1954 and 1958 catches for 4Vn and 4Vs were combined as 4V.
* -- Provisional data
** -- From Observer data (USSR and CUBA combined)

Table 2. 4TVW haddock landings (t) by division and subdivision (Canadian catches only from inter-regional data).

Area	1986	1987	1988	1989	1990
4T	553	453	383	79	30
4Vn	899	491	506	421	111
4Vs	8719	1547	2041	3114	2430
4W	6170	991	1150	3580	4049
TOTAL	16341	3481	4080	7194	6620

Table 3. Canadian nominal catches (t) of eastern Scotian Shelf haddock (4TVW) by gear. (From IS files for 86-88.)

Year	Otter Trawler	Longliner	Danish/Scottish Seiner	Misc.	Total
1960	20835	1077	23	696	22631
1961	22060	448	52	1377	23937
1962	16453	665	76	705	17899
1963	11943	511	147	526	13127
1964	10679	70	62	874	11685
1965	8033	352	66	160	8611
1966	10222	233	19	130	10604
1967	7855	126	25	573	8579
1968	8819	296	16	364	9495
1969	8603	289	30	341	9263
1970	5056	479	20	262	5817
1971	8709	538	77	179	9503
1972	2141	528	76	138	2883
1973	2459	628	28	232	3347
1974	543	493	17	162	1215
1975	593	873	10	82	1558
1976	383	657	10	75	1125
1977	2198	729	26	170	3123
1978	4009	1069	67	340	5485
1979	1745	1232	66	147	3190
1980	13063	933	229	270	14495
1981	17859	1253	464	113	19689
1982	12346	1567	890	249	15052
1983	6969	1254	541	235	8997
1984	6188	908	451	112	7659
1985	9548	822	830	50	11249
1986	13952	1105	1179	106	16341
1987	2077	736	585	83	3481
1988	2341	1134	424	180	4080
1989*	4333	2322	475	64	7194
1990*	2967	3139	409	106	6620

* - Provisional Statistics

Table 4. 4TVW haddock landings by quarter and major gear type 1986-1989 (Canadian landings only). (From IS files)

	1986					1987				
	Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL
OTB	3072	4158	3661	3060	13952	356	680	608	433	2077
LL	86	203	535	281	1105	34	135	377	190	736
SNU	121	483	349	226	1179	5	370	175	34	585
Other	1	14	65	26	106	0	19	40	24	83
TOTAL	3280	4858	4611	3592	16341	396	1203	1200	682	3481

	1988					1989				
	Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL
OTB	266	852	777	447	2341	763	2022	1062	487	4332
LL	33	177	721	204	1134	285	522	858	657	2322
SNU	11	199	197	17	424	14	283	150	28	475
Other	7	63	53	57	180	0	16	34	14	64
TOTAL	317	1291	1747	725	4080	1062	2842	2104	1186	7194

Table 4. (Continued)

	1990				
	Q1	Q2	Q3	Q4	TOTAL
OTB	1074	972	663	258	2967
LL	833	474	1341	491	3139
SNU	15	168	216	11	409
Other	0	7	64	35	106
TOTAL	1921	1621	2284	795	6620

Table 5. 4TVW haddock landings by area, quarter and gear type (Canadian landings only).

4T						
Year	**Gear**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
1986	OTB	9	71	85	4	169
	LL	0	2	6	5	12
	SNU	0	261	83	16	359
	Other	0	1	10	1	13
	TOTAL	9	336	184	25	554
1987	OTB	4	78	43	9	134
	LL	0	2	6	4	13
	SNU	0	208	75	5	289
	Other	0	11	6	0	17
	TOTAL	4	300	130	19	453
1988	OTB	1	18	199	5	224
	LL	0	1	2	4	8
	SNU	0	57	69	7	132
	Other	0	9	9	2	20
	TOTAL	1	85	279	18	383
1989	OTB	0	9	2	0	11
	LL	0	0	1	2	3
	SNU	0	39	20	1	60
	Other	0	4	1	0	6
	TOTAL	0	52	24	3	79
1990	OTB	1	2	0	1	5
	LL	0	0	1	0	1
	SNU	0	19	3	0	22
	Other	0	1	1	0	2
	TOTAL	1	22	5	2	30

Table 5. (Continued)

4Vn						
Year	**Gear**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
1986	OTB	67	139	180	18	405
	LL	0	27	87	47	161
	SNU	0	190	134	4	328
	Other	0	1	3	1	6
	TOTAL	67	356	405	71	899
1987	OTB	28	84	32	20	164
	LL	7	28	54	26	115
	SNU	0	142	47	18	207
	Other	0	1	2	3	5
	TOTAL	35	254	135	66	491
1988	OTB	26	113	14	11	164
	LL	0	21	113	52	186
	SNU	0	102	48	3	153
	Other	0	0	2	0	2
	TOTAL	26	236	177	66	506
1989	OTB	24	178	46	1	249
	LL	0	13	32	8	53
	SNU	0	96	17	1	114
	Other	0	1	2	1	4
	TOTAL	25	287	97	12	424
1990	OTB	17	35	12	6	70
	LL	0	6	14	1	21
	SNU	0	15	5	0	20
	Other	0	0	0	0	1
	TOTAL	17	56	31	7	111

Table 5. (Continued)

4Vs						
Year	**Gear**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
1986	OTB	810	3666	3093	917	8485
	LL	4	93	115	0	212
	SNU	0	17	3	0	19
	Other	0	0	2	0	2
	TOTAL	814	3775	3212	917	8719
1987	OTB	252	398	412	291	1353
	LL	2	58	98	16	174
	SNU	0	11	7	1	19
	Other	0	0	0	0	0
	TOTAL	254	468	517	308	1547
1988	OTB	188	596	448	385	1617
	LL	14	67	211	27	319
	SNU	0	24	16	0	40
	Other	7	45	11	2	65
	TOTAL	209	732	685	414	2041
1989	OTB	592	1255	538	209	2594
	LL	11	100	193	95	399
	SNU	5	76	34	2	118
	Other	0	3	0	0	4
	TOTAL	608	1434	765	307	3112
1990	OTB	819	651	370	184	2025
	LL	132	84	54	6	276
	SNU	0	64	62	0	126
	Other	0	3	0	0	3
	TOTAL	951	802	487	190	2430

Table 5. (Continued)

4W						
Year	**Gear**	**Q1**	**Q2**	**Q3**	**Q4**	**Total**
1986	OTB	2186	282	302	2122	4893
	LL	82	81	328	229	719
	SNU	121	16	130	206	472
	Other	1	12	50	23	86
	TOTAL	2391	391	810	2579	6170
1987	OTB	72	120	121	113	427
	LL	26	45	219	144	434
	SNU	5	8	47	10	70
	Other	0	7	32	21	60
	TOTAL	103	181	419	288	991
1988	OTB	51	125	116	45	336
	LL	19	88	394	121	622
	SNU	11	16	64	8	99
	Other	0	9	31	53	93
	TOTAL	81	238	605	226	1150
1989	OTB	146	581	478	276	1479
	LL	274	409	633	551	1867
	SNU	9	72	79	24	184
	Other	0	8	31	12	51
	TOTAL	429	1070	1218	863	3580
1990	OTB	236	283	282	66	868
	LL	701	384	1272	484	2840
	SNU	15	70	145	11	241
	Other	0	3	62	34	100
	TOTAL	952	741	1761	596	4049

Table 6. Composition of age-length keys for 1990.

		1st QTR	2nd QTR	1st Half	3rd QTR	4th QTR	2nd Half
4TV	# Samples	18	15		4	10	
	# Measured	3626	3151		1073	1831	
	# Aged	329	327		90	234	
	Catch	969.1	880.6		522.9	199	
4W	# Samples			8			9
	# Measured			1645			1716
	# Aged			192			132
	Catch			1692.9			2356.5

Table 7. Composition of 1990 4TVW haddock catch at age (000's of fish). (Numbers in brackets are numbers of otoliths in the key.)

Age	4TV				4W			Total
	Q1 (329)	Q2 (327)	Q3 (90)	Q4 (234)	Q1/2 (192)	Q3/4 (132)	SMG (226)	
0	0	0	0	0	0	0	4	4
1	0	0	0	0	0	0	126	126
2	0	0	0	0	0	0	527	527
3	0	7	52	16	8	79	210	372
4	71	127	66	17	184	707	79	1251
5	421	474	187	76	739	1254	69	3220
6	145	52	80	22	215	12	7	533
7	18	3	1	1	17	0	1	41
8	1	0	0	0	1	0	0	2
9	0	0	0	0	3	0	0	3
Σ	656	663	386	132	1167	2052	1023	6079

Table 8. Weights (kg) at age for 1990 commercial catch.

	4TV				4W			
Age	Q1	Q2	Q3	Q4	Q1/2	Q3/4	SMG	Total
0	0	0	0	0	0	0	0.064	0.06
1	0	0	0	0	0	0	0.137	0.14
2	0	0	0.49	0	0	0	0.261	0.25
3	0.59	0.68	0.79	0.81	0.77	0.72	0.486	0.60
4	1.02	0.96	1.09	1.15	1.00	0.94	0.916	0.96
5	1.33	1.35	1.42	1.52	1.37	1.29	1.241	1.33
6	1.93	2.05	1.79	2.09	1.97	1.99	1.766	1.94
7	3.02	3.53	3.28	2.56	3.01	0	2.514	3.04
8	3.37	0	0	4.73	3.68	0	3.859	3.53
9	0	0	0	0	4.06	0	-	4.06
10	0	0	0	5.53	0	0	-	5.53

Table 9.Commercial catch at age 4TVW haddock (000's of fish)

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
1	0	0	0	50	0	0	0	0	0	0	0	0
2	0	10	0	0	6	3	12	0	213	0	63	8
3	177	855	83	765	449	349	211	504	1926	647	2115	2938
4	2194	1126	2389	4967	1915	2324	2881	1021	11209	3634	3817	6803
5	3269	4330	2823	6056	6626	4113	10071	2592	2400	13199	2504	5559
6	1297	3090	5018	2216	4654	4445	2159	5132	2539	2045	8128	3388
7	1412	483	3227	1794	1831	1407	2466	1765	2866	1538	1076	7071
8	1088	357	293	1306	1079	457	1318	1642	963	1233	777	809
9	556	303	575	98	405	247	431	620	1334	341	788	528
10	433	228	230	66	96	25	265	313	340	244	276	534
11	253	142	358	79	65	18	68	51	89	92	164	213

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	0	2	205	1287	2591	53595	2127	89	5	31	306	268
2	0	31	436	924	3073	32161	9696	181	13	42	129	667
3	455	409	1491	511	4074	24140	9638	1006	398	438	679	888
4	6408	4901	2039	3471	2368	15192	8887	2622	1806	1408	1743	2189
5	7580	8501	7794	3673	6023	7775	4645	2836	2926	2039	1400	2740
6	3339	4298	6190	6594	2069	4057	1217	1113	2494	1955	1365	1208
7	2164	1362	1957	3190	2906	1282	1637	441	793	939	1163	944
8	1964	1062	839	1243	1562	1234	499	597	379	279	389	1177
9	372	727	317	287	403	402	272	212	406	131	88	277
10	157	193	223	126	81	72	89	174	116	118	38	39
11	161	61	59	113	45	54	12	55	78	39	19	21

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	306	487	59	279	431	213	714	1	332	870	530	497	10
2	288	1178	233	61	676	283	433	268	376	318	433	470	360
3	671	646	975	470	157	965	811	423	2372	262	1520	1084	1514
4	751	1467	254	805	249	335	2412	1120	4334	5072	764	3207	4158
5	924	811	464	282	323	513	436	675	3238	5081	5629	2040	2225
6	668	723	298	185	189	283	715	159	1702	3010	1957	1677	821
7	345	342	114	63	132	117	203	149	249	1178	1220	530	410
8	191	159	47	30	36	80	61	16	129	139	214	235	90
9	159	60	8	8	8	19	23	5	39	105	48	29	30
10	9	99	17	4	10	15	8	6	9	30	28	18	5
11	18	2	16	1	3	6	2	2	7	10	5	19	2

	1985	1986	1987	1988	1989	1990
1	133	12	30	56	1590	126
2	69	50	76	68	774	527
3	411	1289	160	129	519	372
4	8006	10064	983	1584	2220	1251
5	4162	5954	1686	1726	2949	3220
6	881	767	377	390	699	533
7	232	100	24	39	63	41
8	47	13	6	4	2	2
9	14	1	1	4	1	3
10	2	1	0	1	0	0
11	1	1	1	0	0	0

Table 10 Percent commercial catch at age 4TVW haddock

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
2	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.02
3	.02	.08	.01	.04	.03	.03	.01	.04	.08	.03	.11	.11	.02	.02	.07
4	.21	.10	.16	.29	.11	.17	.14	.07	.47	.16	.19	.24	.28	.23	.09
5	.31	.40	.19	.35	.39	.31	.51	.19	.10	.57	.13	.20	.34	.39	.36
6	.12	.28	.33	.13	.27	.33	.11	.38	.11	.09	.41	.12	.15	.20	.29
7	.13	.04	.22	.10	.11	.11	.12	.13	.12	.07	.05	.25	.10	.06	.09
8	.10	.03	.02	.08	.06	.03	.07	.12	.04	.05	.04	.03	.09	.05	.04
9	.05	.03	.04	.01	.02	.02	.02	.05	.06	.01	.04	.02	.02	.03	.01
10	.04	.02	.02	.00	.01	.00	.01	.02	.01	.01	.01	.02	.01	.01	.01
11	.02	.01	.02	.00	.00	.00	.00	.00	.00	.00	.01	.01	.01	.00	.00

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	.06	.10	.38	.05	.01	.00	.00	.04	.03	.07	.08	.02	.13	.19	.08
2	.04	.12	.23	.25	.02	.00	.01	.02	.06	.07	.20	.09	.03	.31	.10
3	.02	.16	.17	.25	.11	.04	.06	.09	.09	.16	.11	.39	.21	.07	.34
4	.16	.09	.11	.23	.28	.19	.19	.24	.21	.17	.25	.10	.37	.11	.12
5	.17	.24	.06	.12	.30	.31	.27	.19	.26	.21	.14	.19	.13	.15	.18
6	.31	.08	.03	.03	.12	.26	.26	.19	.12	.15	.12	.12	.08	.09	.10
7	.15	.12	.01	.04	.05	.08	.13	.16	.09	.08	.06	.05	.03	.06	.04
8	.06	.06	.01	.01	.06	.04	.04	.05	.11	.04	.03	.02	.01	.02	.03
9	.01	.02	.00	.01	.02	.04	.02	.01	.03	.04	.01	.00	.00	.00	.01
10	.01	.00	.00	.00	.02	.01	.02	.01	.00	.00	.02	.01	.00	.00	.01
11	.01	.00	.00	.00	.01	.01	.01	.00	.00	.00	.00	.01	.00	.00	.00

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	.12	.00	.03	.05	.04	.05	.00	.01	.00	.01	.01	.18	.02
2	.07	.09	.03	.02	.04	.05	.04	.00	.00	.02	.02	.09	.09
3	.14	.15	.19	.02	.12	.11	.16	.03	.07	.05	.03	.06	.06
4	.41	.40	.34	.32	.06	.33	.43	.57	.55	.29	.40	.25	.21
5	.07	.24	.25	.32	.46	.21	.23	.30	.33	.50	.43	.33	.53
6	.12	.06	.13	.19	.16	.17	.09	.06	.04	.11	.10	.08	.09
7	.03	.05	.02	.07	.10	.05	.04	.02	.01	.01	.01	.01	.01
8	.01	.01	.01	.01	.02	.02	.01	.00	.00	.00	.00	.00	.00
9	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00
10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 11 Commercial weights at age 4TVW haddock

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
1	.08	.08	.08	.68	.08	.08	.08	.08	.08	.08	.08	.08
2	.31	.68	.31	.31	.68	.58	.68	.31	.50	.31	.53	.80
3	1.13	.84	.82	1.00	.89	.95	.87	.79	.75	.76	.70	.68
4	1.19	1.19	1.03	1.07	1.09	1.13	1.08	1.04	.89	.99	.98	.89
5	1.61	1.39	1.38	1.29	1.35	1.52	1.14	1.30	1.25	1.19	1.26	1.17
6	2.25	1.82	1.86	1.63	1.66	1.82	1.57	1.48	1.53	1.56	1.47	1.48
7	2.69	2.47	2.17	2.08	2.11	2.25	1.95	1.81	1.72	1.82	1.75	1.79
8	3.02	2.93	2.63	2.33	2.62	2.76	2.13	2.15	2.13	2.07	2.10	2.17
9	3.10	2.99	2.56	1.61	2.99	3.18	2.44	2.39	2.23	2.37	2.09	2.41
10	3.38	3.16	2.84	1.39	2.51	3.87	2.69	2.60	2.28	2.39	2.46	2.74
11	3.49	3.32	3.59	2.32	2.46	3.54	3.06	2.78	2.81	2.79	2.41	2.95

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	.08	.06	.05	.10	.10	.10	.09	.12	.11	.10	.11	.12
2	.31	.19	.20	.14	.28	.25	.27	.38	.17	.22	.33	.34
3	.67	.79	.45	.36	.45	.42	.36	.53	.43	.65	.64	.63
4	.91	.90	.83	.94	.71	.71	.70	.78	.80	.88	.91	.92
5	1.10	1.15	1.02	1.15	1.10	1.11	1.03	1.15	1.12	1.26	1.29	1.30
6	1.41	1.53	1.35	1.36	1.35	1.30	1.33	1.48	1.59	1.62	1.56	1.63
7	1.83	1.87	1.74	1.75	1.64	1.93	1.55	1.77	2.16	2.28	2.07	1.93
8	2.19	2.22	2.18	2.01	1.92	2.23	2.18	2.17	2.19	2.77	2.59	2.30
9	2.46	2.41	2.73	2.36	2.34	2.42	2.30	2.55	2.57	3.31	3.14	2.87
10	2.70	2.76	2.60	2.55	2.72	2.79	2.67	2.82	3.10	3.32	4.04	3.43
11	2.68	3.30	3.45	2.44	2.39	3.12	3.04	3.06	3.34	3.21	3.55	3.75

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	.10	.12	.12	.16	.09	.14	.08	.09	.08	.08	.06	.07
2	.28	.35	.41	.25	.37	.51	.35	.33	.23	.38	.26	.19
3	.59	.65	.64	.85	.53	.93	.67	.71	.72	.69	.63	.53
4	.96	.98	1.12	1.20	1.22	1.23	1.07	1.17	1.03	.95	.96	.82
5	1.34	1.37	1.66	1.57	1.61	1.51	1.51	1.55	1.36	1.27	1.20	1.16
6	1.83	1.87	1.98	2.14	2.03	1.90	1.97	2.02	1.85	1.68	1.61	1.43
7	2.19	2.22	2.47	2.45	2.27	2.35	2.58	2.44	2.32	2.19	2.15	1.72
8	2.41	2.59	2.79	2.80	2.33	2.51	2.69	2.96	2.66	2.71	2.78	1.90
9	2.97	3.25	2.84	3.04	3.19	2.81	3.28	3.27	3.13	3.08	3.14	2.80
10	3.86	3.17	3.43	3.13	2.61	3.33	3.50	3.44	3.40	3.41	3.51	2.06
11	3.83	3.63	3.40	4.12	3.10	3.20	3.85	4.21	3.65	3.66	4.50	1.82

	1984	1985	1986	1987	1988	1989	1990
1	.09	.12	.10	.10	.11	.08	.14
2	.26	.20	.27	.21	.30	.28	.25
3	.58	.46	.63	.51	.65	.66	.60
4	.74	.70	.82	.93	.91	.95	.96
5	1.04	.99	1.05	1.22	1.21	1.25	1.33
6	1.46	1.43	1.57	1.67	1.59	1.66	1.94
7	1.79	1.93	2.41	2.25	2.19	2.36	3.04
8	2.15	2.35	2.28	2.52	2.31	3.11	3.53
9	2.66	2.96	2.58	2.74	2.57	4.70	4.06
10	3.24	2.20	3.76	3.07	2.69	2.99	2.99
11	3.18	5.59	4.47	4.73	4.61	4.52	4.51

TABLE 12 RV MEAN CATCH RATES AT AGE 4TVW HADDOCK

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
0	.10	.06	.00	.00	.23	.07	.30	.20	.00	1.49	1.44
1	2.74	1.72	1.32	.53	.37	5.07	2.76	6.07	9.90	.09	3.51
2	1.00	3.63	.89	1.73	2.15	.72	3.13	11.38	11.07	9.13	.28
3	1.84	1.20	1.30	.54	2.90	1.94	.48	8.97	14.81	9.94	14.88
4	2.04	1.58	.59	.47	.53	1.73	.95	1.22	8.32	10.33	13.92
5	.99	.63	.49	.17	.54	.46	.93	1.94	.51	2.90	8.65
6	.62	.36	.37	.35	.27	.83	.21	.72	.49	.37	2.09
7	.70	.16	.15	.07	.20	.22	.23	.20	.12	.29	.33
8	.35	.25	.07	.10	.09	.09	.05	.11	.02	.10	.12
9	.14	.01	.04	.02	.05	.05	.02	.00	.00	.00	.02
10	.04	.00	.02	.05	.03	.05	.02	.05	.01	.04	.00
11	.04	.00	.00	.00	.04	.00	.02	.01	.01	.02	.00
12	.03	.00	.00	.00	.00	.02	.06	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00	.00
14	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
0	22.35	.77	.15	.28	.00	.14	.08	1.04	.10	.05
1	15.61	18.19	21.80	.30	4.22	.60	1.93	4.70	13.86	1.21
2	9.38	15.75	14.49	10.84	1.04	2.25	1.73	13.43	7.07	17.02
3	.99	14.21	30.22	16.89	11.08	7.78	4.67	10.20	3.21	11.80
4	7.37	2.05	11.63	29.11	21.68	26.06	15.57	16.16	10.79	7.35
5	4.68	7.21	3.08	5.25	4.73	11.88	6.17	9.26	6.01	4.53
6	2.01	3.05	2.74	2.57	1.26	1.30	.55	1.13	.46	.42
7	.31	.97	.95	1.36	.30	.40	.09	.11	.03	.02
8	.09	.23	.24	.30	.06	.07	.00	.03	.00	.00
9	.10	.02	.07	.11	.00	.00	.05	.00	.00	.00
10	.03	.02	.06	.02	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00
12	.00	.00	.04	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.02	.00	.00	.00	.00	.00	.00	.00
15	.00	.02	.00	.00	.00	.00	.00	.00	.00	.00

Table 13 CVs for RV mean catch rates at age 4TVW haddock

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
0	.65	.72	.00	.00	.00	.51	.67	.46	.00	.39	.63	.51	.24	.61	.45
1	.47	.36	.34	.28	.24	.56	.42	.33	.28	.82	.22	.24	.26	.32	.44
2	.32	.39	.48	.50	.01	.51	.32	.38	.49	.30	.32	.46	.23	.25	.26
3	.30	.33	.35	.35	.01	.40	.37	.36	.46	.41	.31	.31	.14	.49	.21
4	.18	.30	.24	.33	.04	.42	.49	.32	.40	.34	.40	.24	.19	.32	.21
5	.20	.25	.23	.39	.02	.31	.40	.27	.28	.28	.38	.24	.21	.15	.17
6	.23	.26	.29	.50	.00	.35	.34	.26	.23	.26	.27	.21	.20	.20	.15
7	.31	.26	.29	.46	.05	.35	.31	.33	.43	.33	.27	.24	.18	.22	.20
8	.20	.40	.49	.53	.24	.35	.34	.33	.35	.50	.30	.32	.12	.21	.37
9	.24	.56	.49	1.00	.00	.38	.52	.00	.00	.00	.40	.35	.92	.18	.54
10	.80	.00	.71	.80	.33	.34	.45	.78	1.00	.71	.00	.66	.38	.74	.69
11	.24	.00	.00	.00	.13	.00	.52	1.00	1.00	.74	.00	.00	.00	.00	1.00
12	.32	.00	.00	.00	.00	.86	.00	.00	.00	.00	.00	.00	.00	.83	.00
13	.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	1.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.00	.00	.00

	1985	1986	1987	1988	1989	1990
0	.00	.63	.56	.27	.38	.47
1	.57	.36	.38	.34	.30	.28
2	.35	.27	.37	.91	.48	.37
3	.24	.21	.20	.69	.28	.28
4	.14	.20	.21	.38	.18	.18
5	.18	.15	.24	.20	.14	.19
6	.25	.21	.19	.20	.27	.22
7	.28	.23	.28	.30	.60	.33
8	.53	.36	.00	1.00	.00	.00
9	.00	.00	.56	.00	.00	.00
10	1.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00

Table 14. RV mean catch rates at age 4Vs haddock.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.11
1	.05	.33	.21	.05	.23	.14	.03	.06	.00	.03	2.31	1.59	24.85
2	.09	.01	1.81	.01	.07	.14	1.96	.10	.00	.33	.17	.21	2.47
3	.08	.05	1.60	.18	.08	.04	.26	1.13	.01	.21	.15	.03	13.80
4	1.80	.02	.35	.13	.06	.02	.00	.56	.00	.08	.22	.07	.81
5	.84	.06	.16	.00	.03	.08	.04	.55	.00	.04	.20	.07	3.07
6	.49	.10	.38	.00	.00	.22	.00	.10	.00	.00	.08	.15	.83
7	.24	.07	.07	.05	.03	.04	.00	.06	.00	.02	.03	.14	.27
8	.52	.07	.00	.00	.06	.00	.00	.00	.00	.00	.07	.00	.35
9	.16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
10	.03	.00	.00	.03	.04	.04	.00	.00	.00	.00	.00	.00	.00
11	.05	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00
12	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00	.00	.00	.00
14	.03	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

	1983	1984	1985	1986	1987	1988	1989	1990
0	.00	.00	.00	.00	.00	.00	.00	.05
1	3.09	.00	.00	.02	.00	.16	.32	.97
2	9.85	3.88	.00	.03	.41	.01	.70	2.55
3	4.85	13.47	1.65	1.22	1.47	.49	.04	.59
4	3.99	8.03	13.19	8.89	6.11	2.66	.18	.15
5	1.92	1.26	2.99	4.12	6.30	4.45	.44	.47
6	.48	.29	.39	1.01	.47	.77	.23	.21
7	.19	.35	.37	.15	.06	.00	.02	.01
8	.05	.03	.00	.07	.00	.09	.00	.00
9	.10	.00	.00	.00	.13	.00	.00	.00
10	.00	.00	.01	.00	.00	.00	.00	.00
11	.00	.02	.00	.00	.00	.00	.00	.00
12	.01	.00	.00	.00	.00	.00	.00	.00
13	.00	.01	.00	.00	.00	.00	.00	.00
14	.07	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00

Table 15. RV mean catch rates at age 4Vn haddock.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	.00	.21	.00	.00	.39	.12	.00	.00	.00	.00	.43	.00	.73	.00
2	.00	.00	.00	.00	.00	.88	.00	.00	.00	.26	.00	.27	.00	.00
3	.00	.00	.00	.00	.00	.11	.00	.00	.00	.00	.12	.00	.34	.10
4	.33	.00	.00	.12	.00	.11	.00	.00	.26	.00	.00	.32	.55	.45
5	.67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.37	.26	.29	.00
6	.00	.00	.00	.00	.00	.00	.00	.00	.13	.00	.00	1.06	.50	.23
7	.09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.10	.93	.23
8	.00	.00	.00	.00	.00	.00	.00	.18	.00	.00	.00	.21	.00	.19
9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.10
10	.33	.00	.00	.00	.00	.00	.00	.35	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00	.00	.00	.13	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.56	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

	1984	1985	1986	1987	1988	1989	1990
0	.00	.00	.00	.00	.00	.00	.00
1	.13	.00	.31	.00	.00	.00	.00
2	.27	.00	.09	.00	.00	.07	.00
3	.56	.00	1.35	.00	.00	.00	.11
4	3.00	3.90	1.72	.57	.06	.14	.10
5	.81	3.46	6.20	1.57	.85	1.25	.20
6	.30	1.38	1.10	.42	1.33	.22	.44
7	.66	.10	.06	.07	.38	.22	.00
8	.00	.00	.06	.00	.00	.00	.05
9	.00	.00	.00	.07	.00	.00	.00
10	.00	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00

TABLE 16 RV MEAN CATCH RATES AT AGE 4W HADDOCK

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
0	.19	.11	.00	.00	.42	.13	.54	.36	.00	2.71	2.63
1	4.95	2.90	2.27	.93	.46	9.13	5.01	11.03	18.04	.14	4.87
2	1.78	6.61	.48	3.15	3.87	1.06	4.48	20.67	20.17	16.38	.39
3	3.30	2.15	1.36	.87	5.24	3.49	.71	15.63	26.97	17.97	27.00
4	2.53	2.86	.85	.75	.92	3.13	1.73	1.86	15.11	18.77	25.23
5	1.15	1.10	.79	.31	.97	.79	1.67	3.19	.93	5.25	15.56
6	.83	.58	.43	.64	.49	1.38	.38	1.25	.86	.68	3.76
7	1.10	.25	.23	.10	.35	.38	.42	.33	.23	.51	.59
8	.31	.42	.13	.17	.11	.16	.09	.16	.03	.18	.17
9	.16	.02	.08	.04	.08	.09	.03	.00	.00	.00	.03
10	.00	.00	.03	.06	.03	.07	.03	.02	.02	.07	.00
11	.04	.00	.00	.00	.06	.00	.03	.02	.00	.03	.00
12	.04	.00	.00	.00	.00	.03	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
0	40.73	1.34	.27	.50	.00	.25	.15	1.90	.18	.07
1	27.45	17.40	37.79	.53	7.70	1.03	3.51	8.45	25.06	1.60
2	16.90	27.15	20.22	17.26	1.89	4.06	2.90	24.47	12.43	29.42
3	1.79	17.17	52.01	23.22	19.16	13.14	7.59	18.28	5.82	21.11
4	13.33	3.12	18.60	47.62	30.48	41.57	24.42	27.77	19.52	13.29
5	8.43	11.16	4.40	8.61	6.07	17.85	6.99	13.91	10.43	7.92
6	3.37	4.95	4.65	4.44	1.78	1.52	.63	1.31	.65	.56
7	.45	1.41	1.56	2.13	.30	.63	.12	.12	.00	.04
8	.12	.19	.36	.53	.11	.07	.00	.00	.00	.00
9	.17	.03	.05	.20	.00	.00	.00	.00	.00	.00
10	.05	.03	.11	.05	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.08	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.04	.00	.00	.00	.00	.00	.00	.00	.00

Table 17. RV F MATRIX

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
2	.00	.47	.00	.00	.00	.28	.00	.00	-.12	.00	.00	.00
3	.00	.83	.30	.00	-.10	.21	.00	.00	-.09	.00	.00	.00
4	-.05	.52	.81	-.18	.32	.51	.00	-.12	.16	.00	.50	.00
5	.98	.97	1.04	.00	-.07	.42	.00	.66	.86	-.02	.89	-.18
6	.83	.34	.14	.00	.00	.60	.05	1.18	.12	.13	1.26	.23
7	1.14	.66	1.41	.35	.01	1.09	-.19	1.56	.32	-.09	1.71	.54
8	.80	.63	.25	.00	.62	1.24	.55	2.41	.03	.68	1.13	.11
9	3.20	1.59	.92	.55	.33	1.52	.00	.00	.00	1.44	.02	1.29
10	.00	.00	.00	.00	.00	.92	.00	.00	.00	.00	.00	1.55
11	.00	.00	.00	-.04	.00	1.03	.35	1.08	.00	.00	.00	.00
12	.00	.00	.00	.00	.56	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.84	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

	1983	1984	1985	1986	1987	1988	1989	1990
1	.00	.00	.00	.00	.00	.00	.00	.00
2	.03	.50	.00	.43	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	1.23	.00
4	.00	-.16	.00	.00	.00	.00	.00	.00
5	.00	.60	1.62	.40	1.24	.32	.79	.67
6	.77	-.02	1.22	1.09	2.87	1.50	2.80	2.45
7	.97	.50	1.93	.95	2.44	1.45	3.43	2.76
8	1.20	.94	2.89	1.31	.00	.86	.00	1.61
9	.98	.59	.00	.00	.03	.00	.00	.00
10	.00	.83	3.60	.00	.00	.00	.00	.00
11	.00	2.15	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	2.66	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00

Figure 1. Commercial mean weights at age 4TVW Haddock

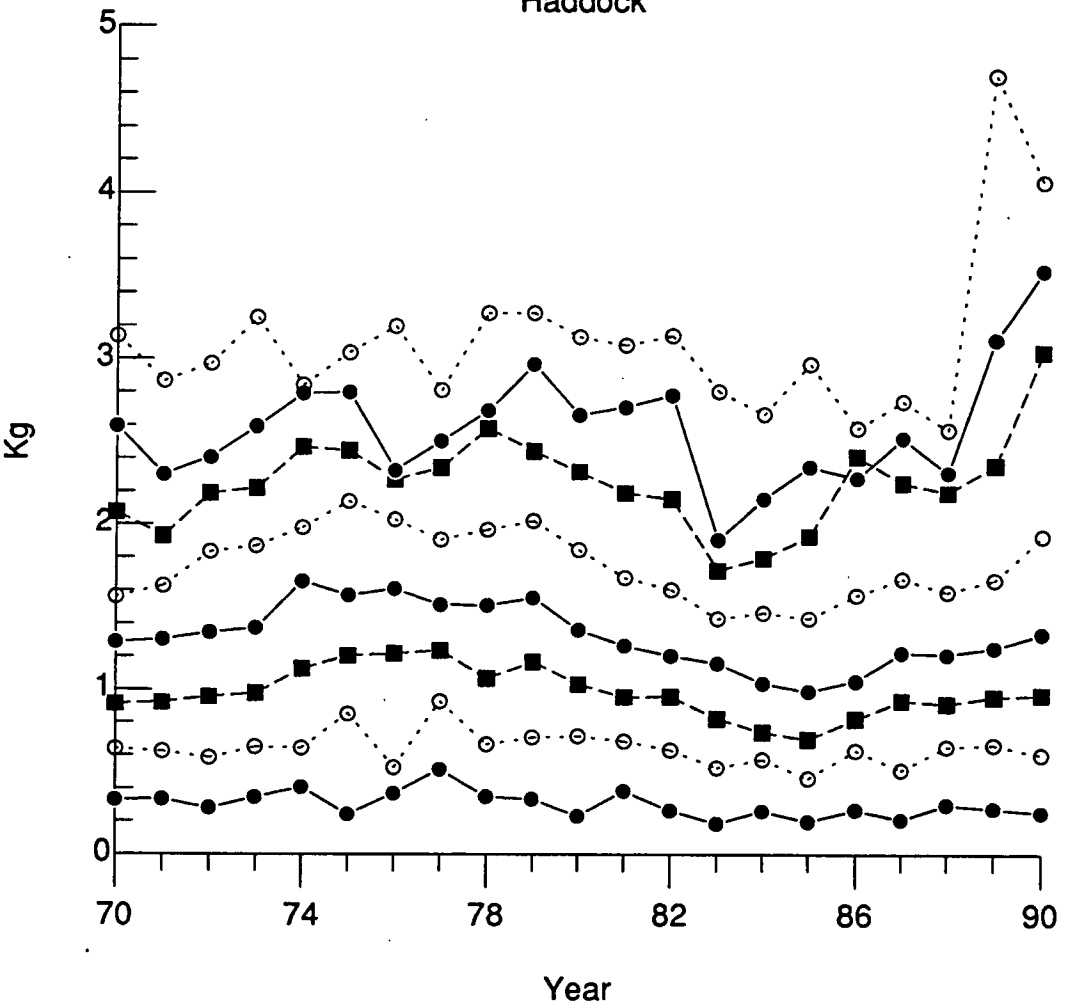


Figure 2. Mean haddock catch per tow in 4VW (All ages)

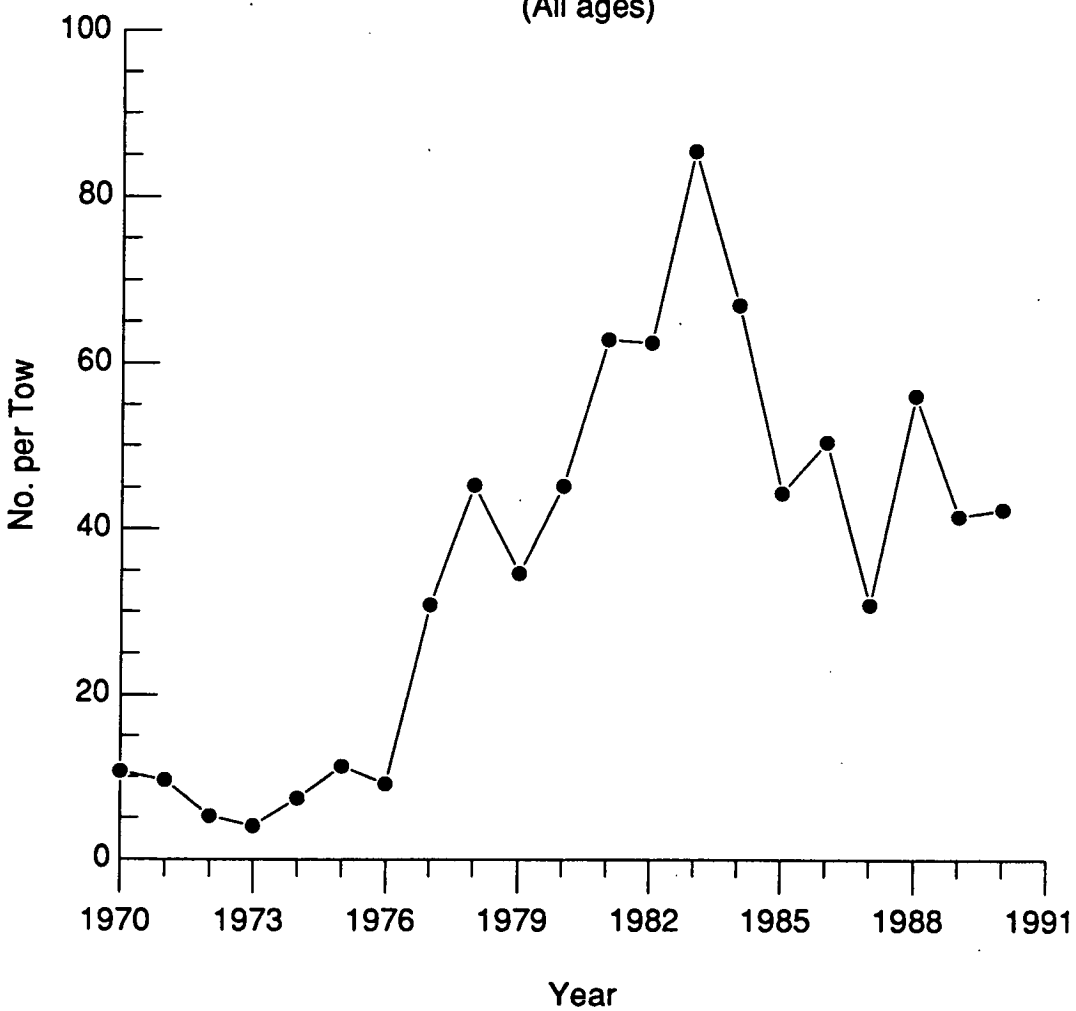


Figure 3. Mean haddock catch per tow in 4Vs

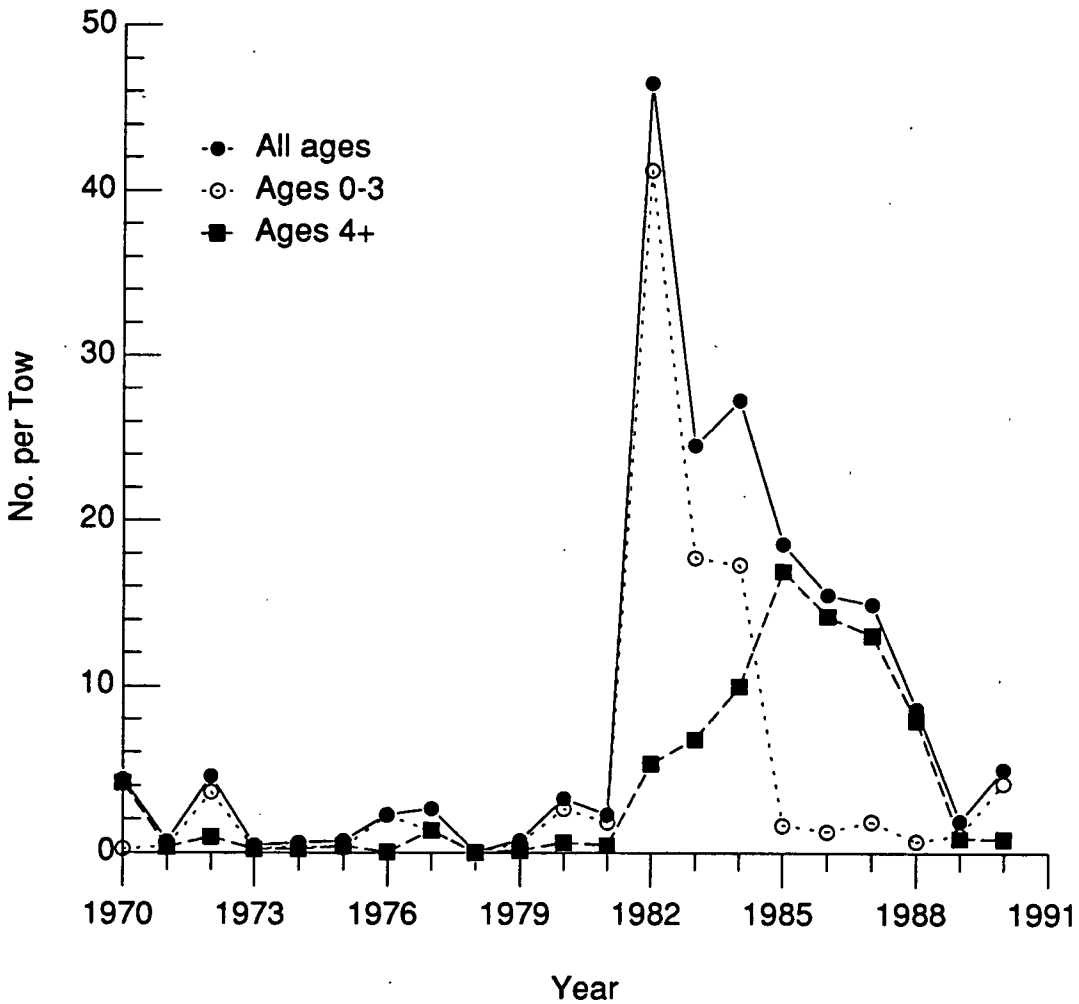


Figure 4. Mean haddck catch per tow in 4Vn

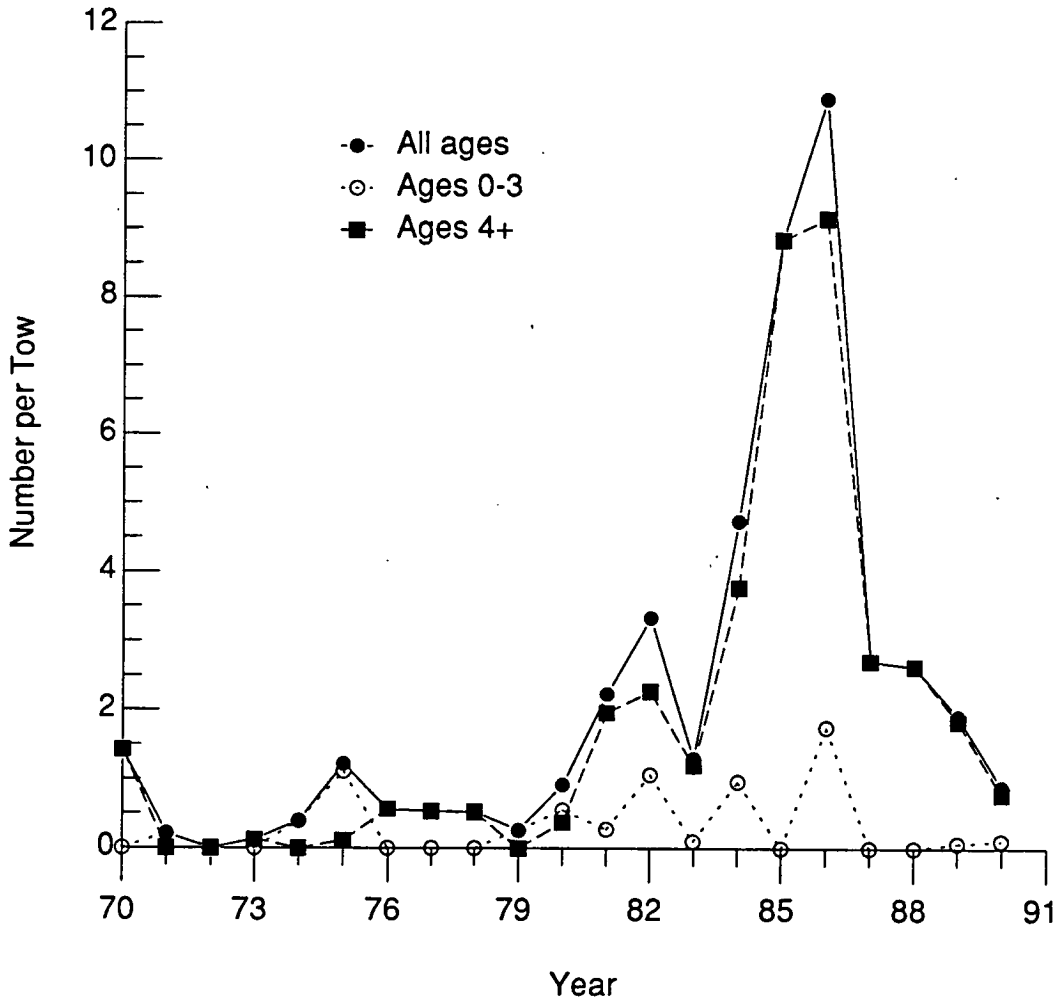


Figure 5. Mean haddock catch per tow in 4W

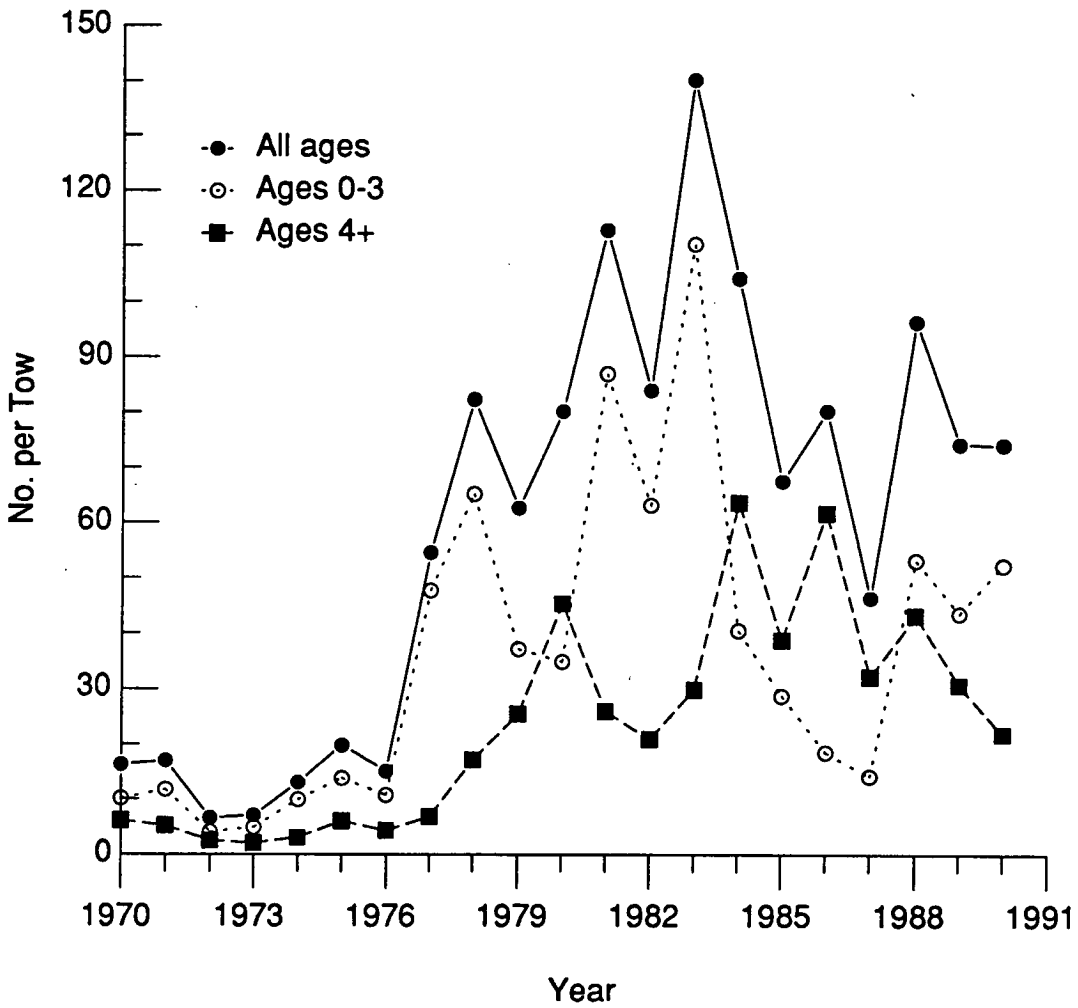


Figure 6. Mean catch per tow at length 4TVW haddock

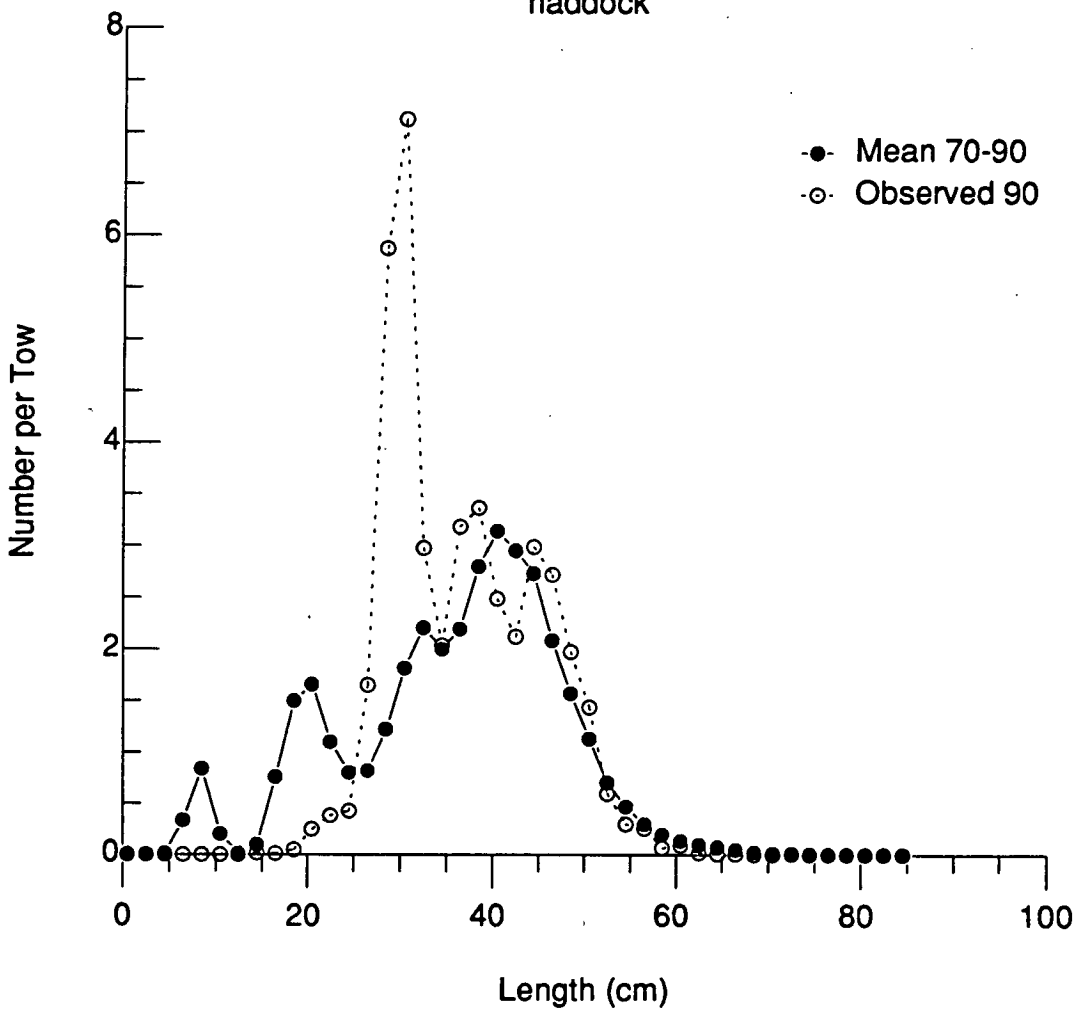


Figure 7. Mean catch per tow at length
4Vs haddock

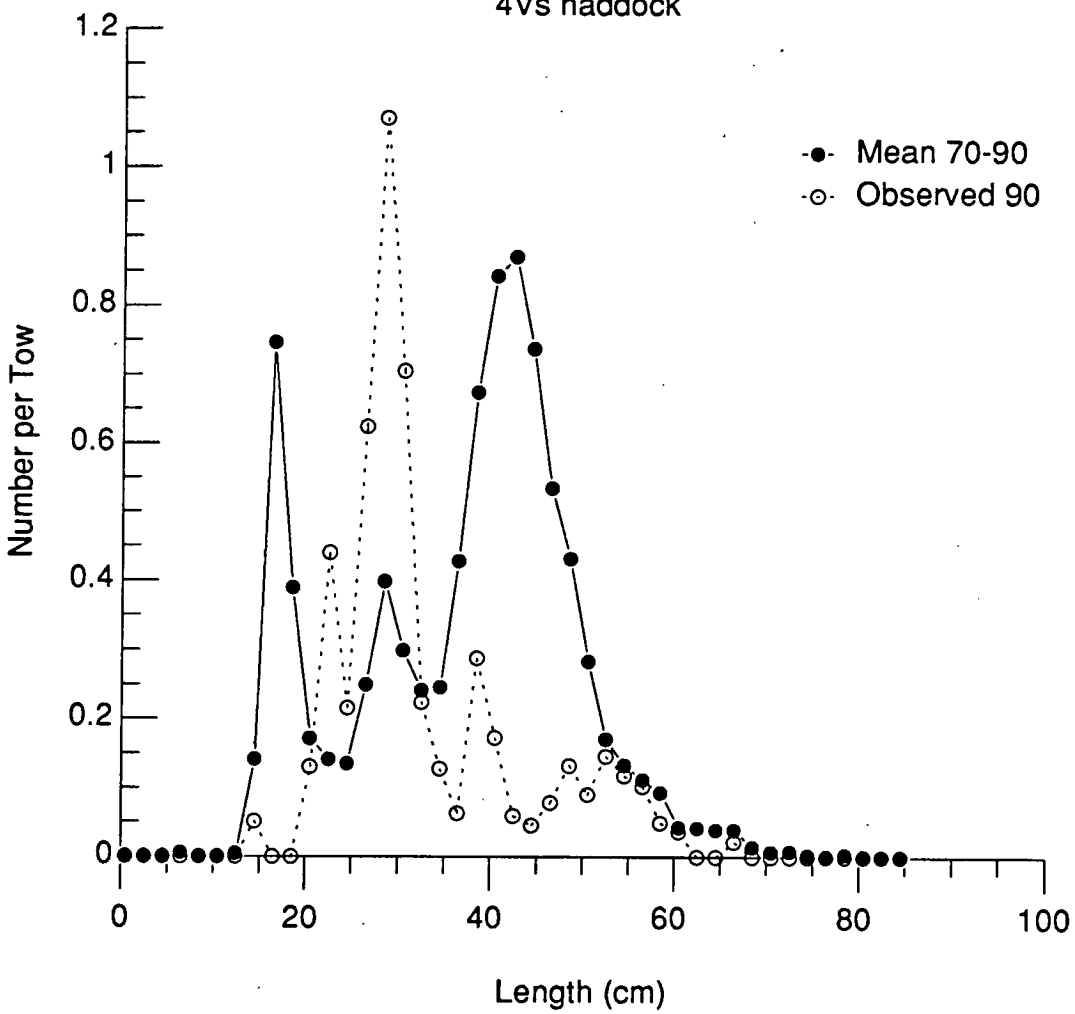


Figure 8. Mean catch per tow at length
4W haddock

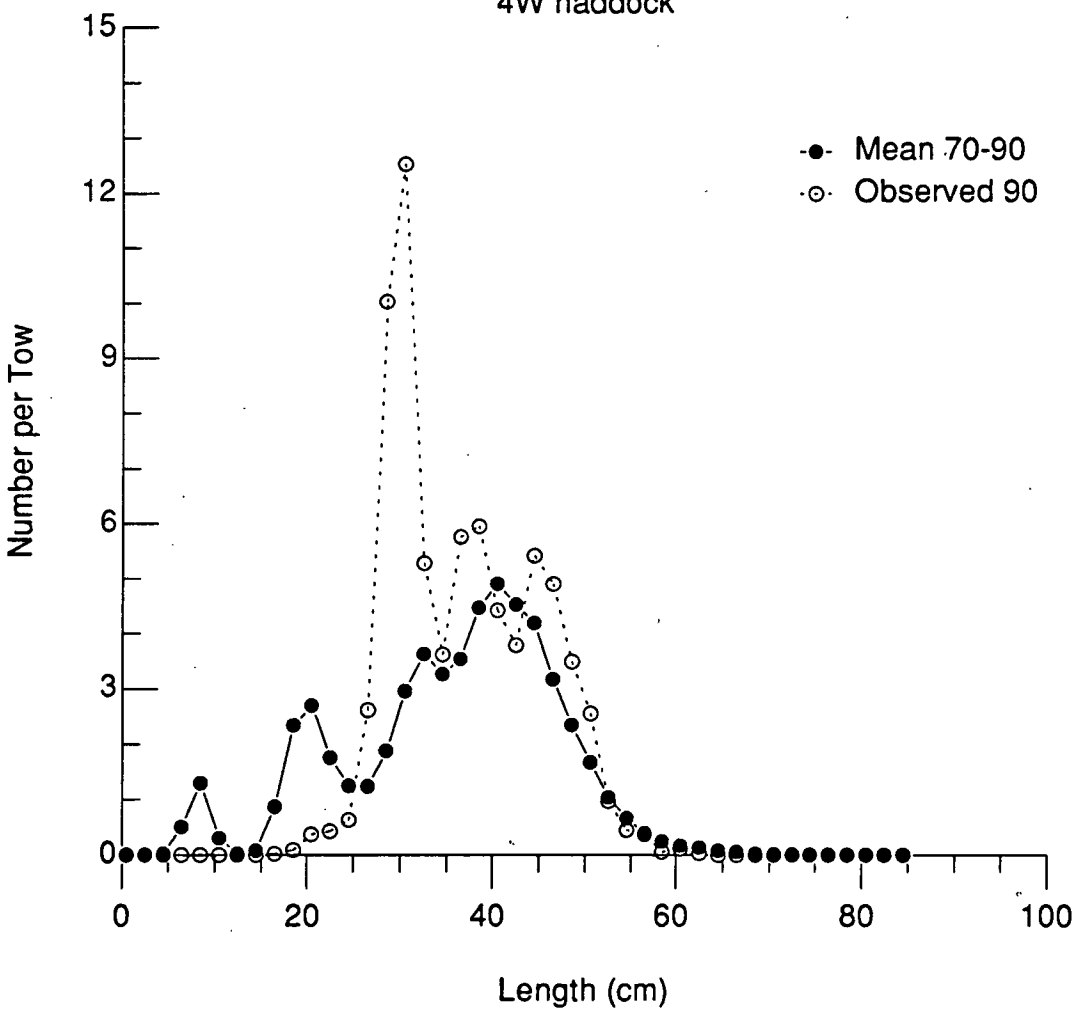


Figure 9. Mean catch per tow at length
4Vn haddock

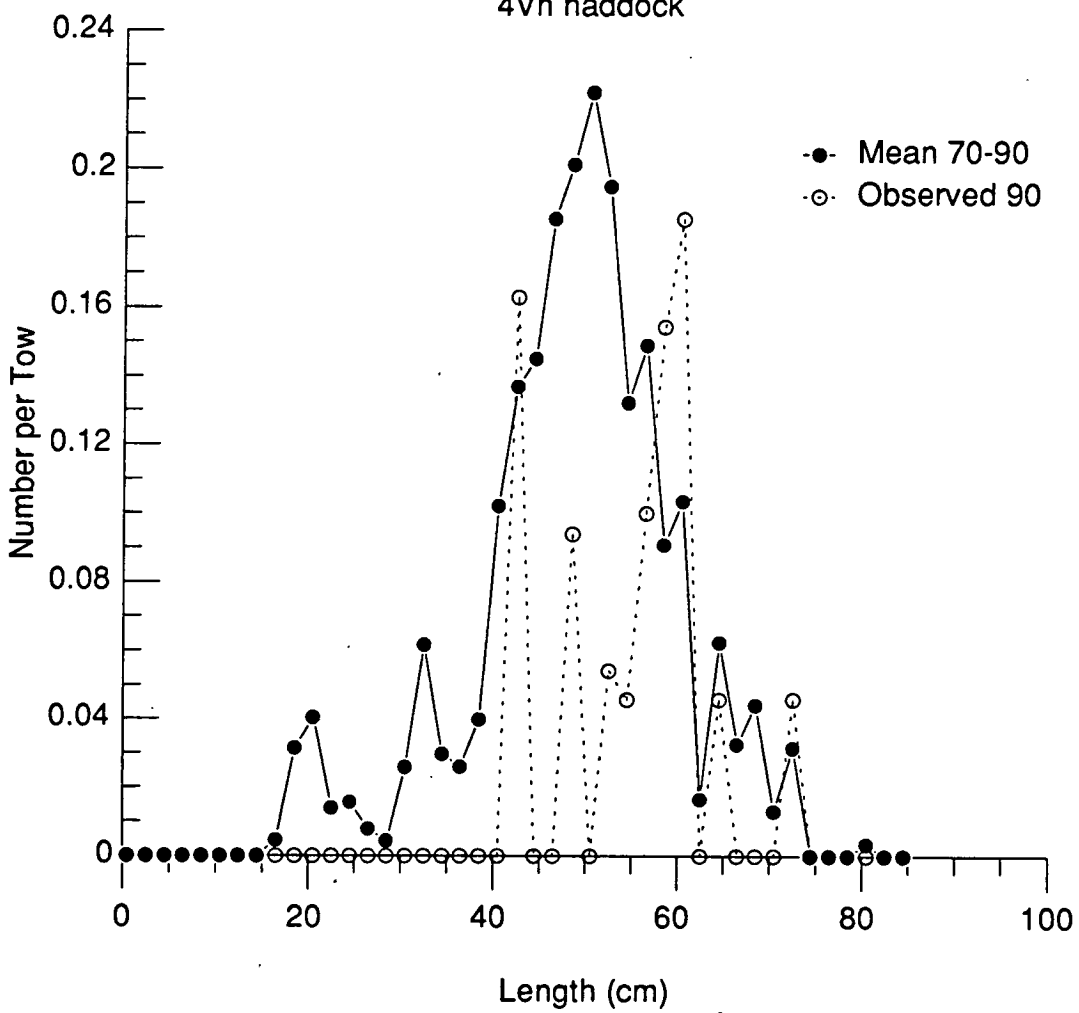
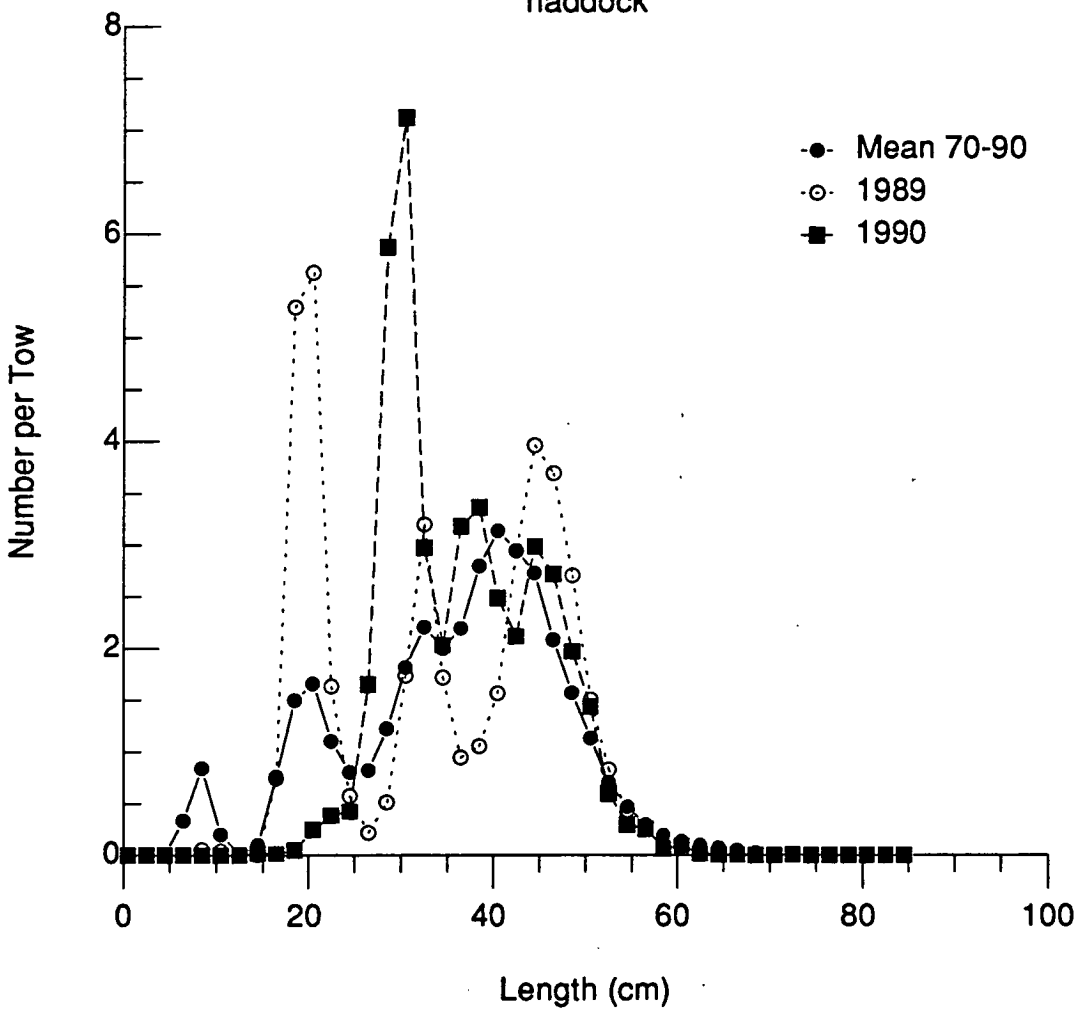


Figure 10. Mean catch per tow at length 4TVW haddock



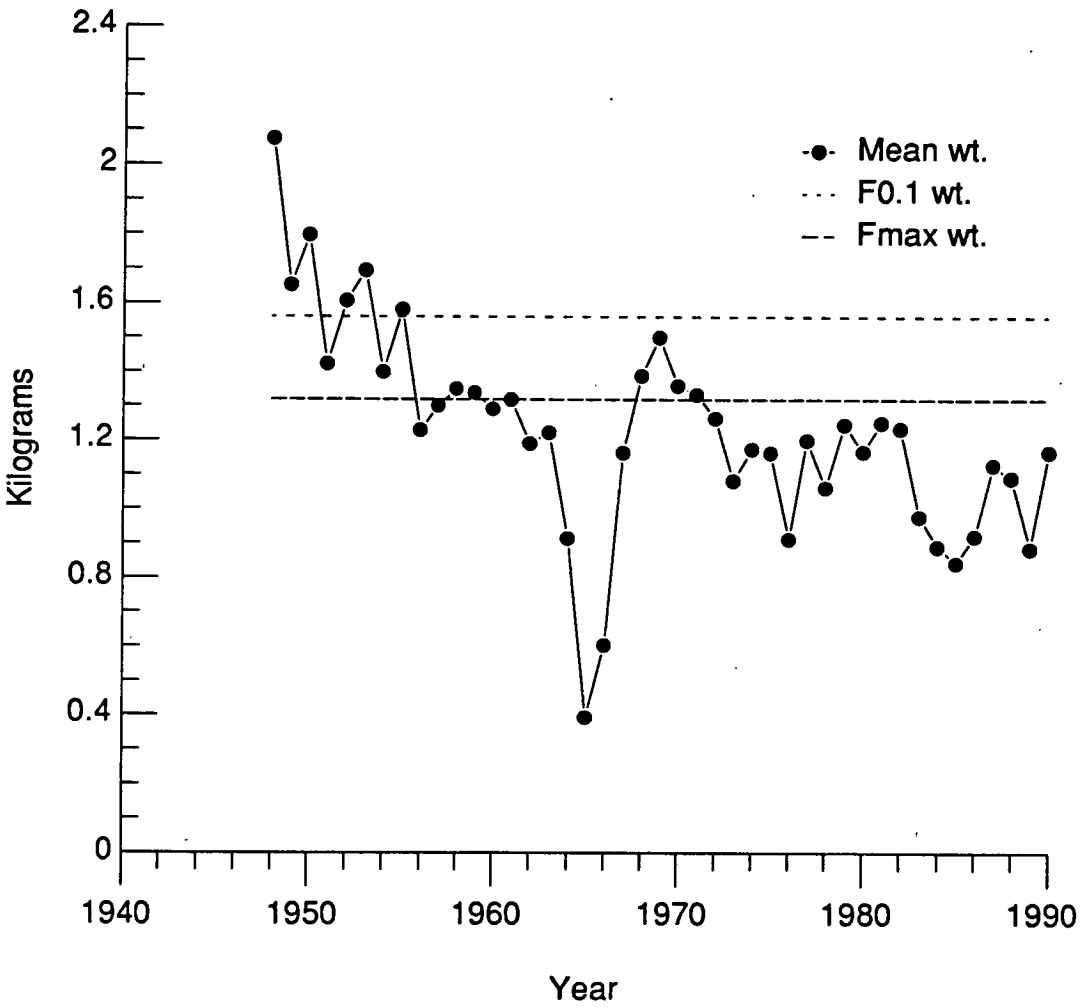
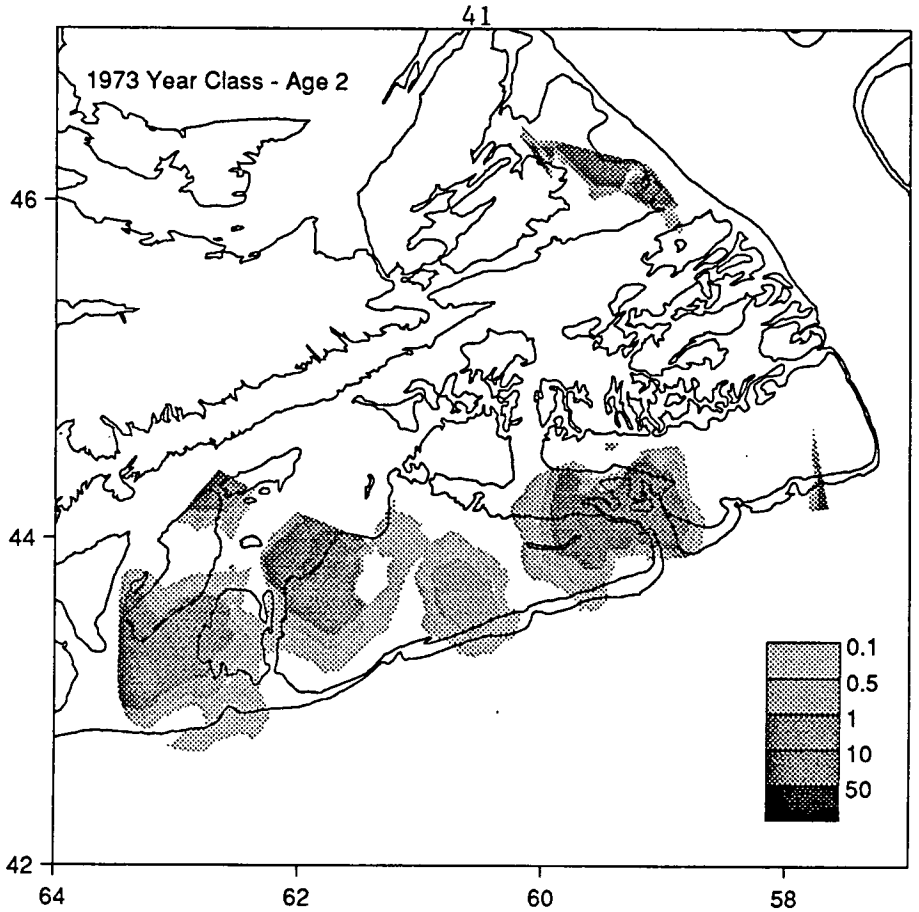


Figure 11. Mean weight of a fish in the catch of 4TVW haddock.


1973 Year Class - Age 2
46
44
42
64
62
60
58
0.1
0.5
1
10
50

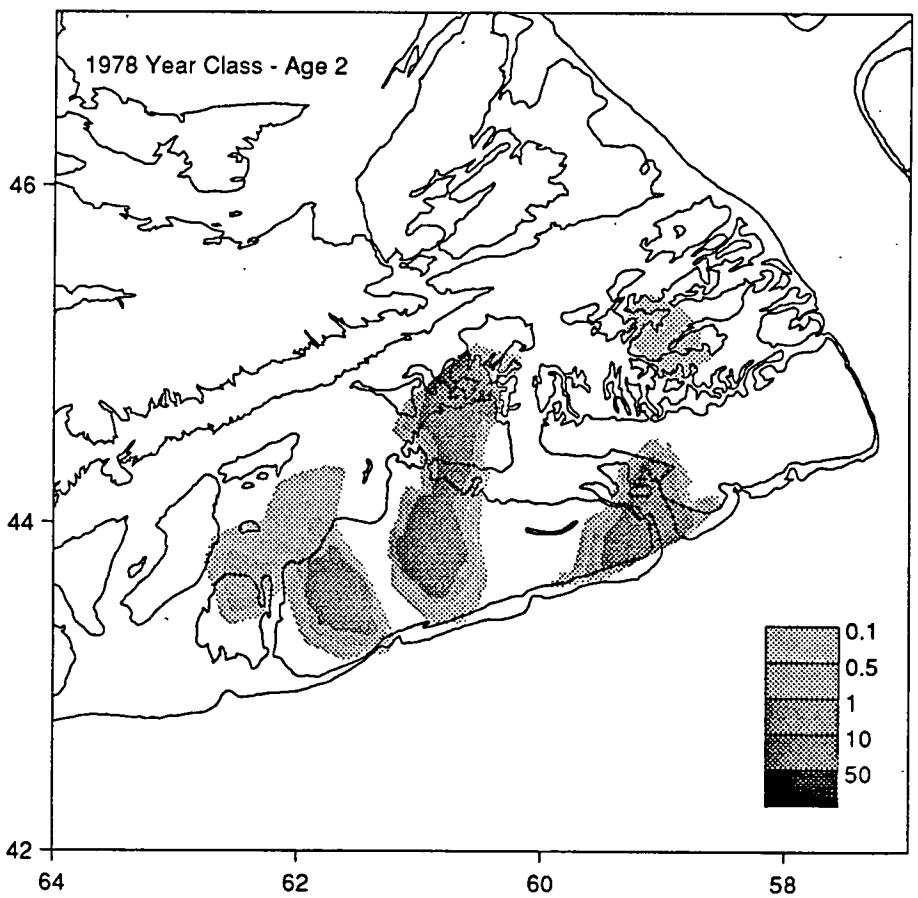
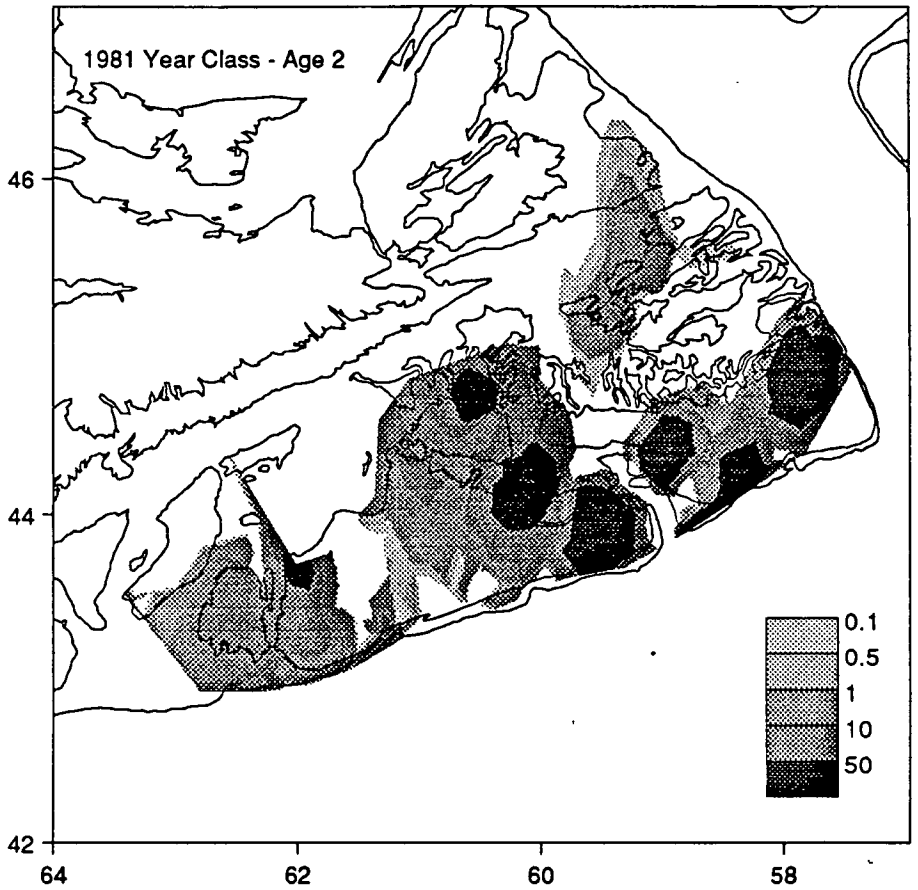

1978 Year Class - Age 2
46
44
42
64
62
60
58
0.1
0.5
1
10
50

Figure 12.



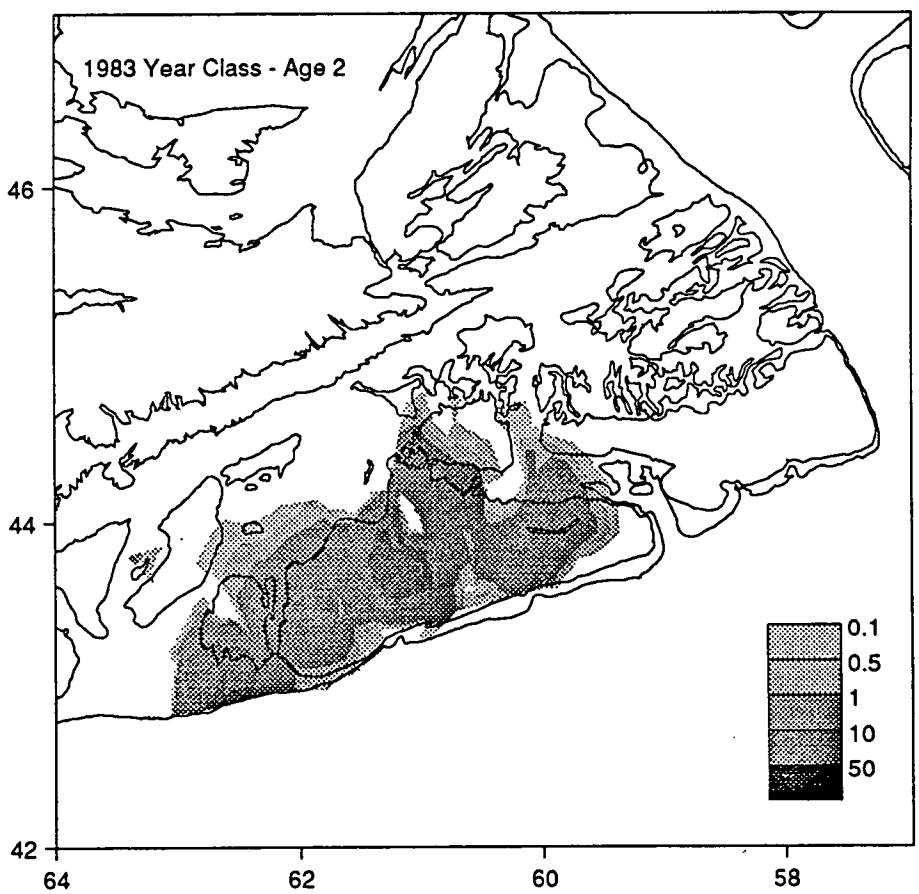
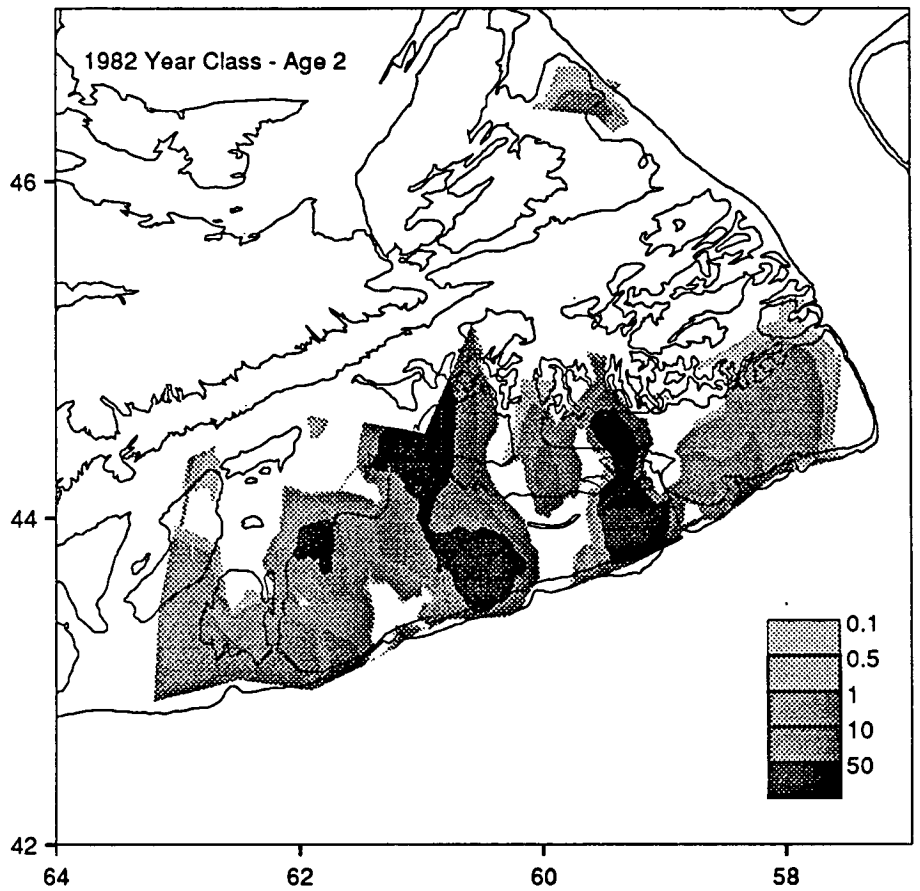


Figure 12. (Continued)



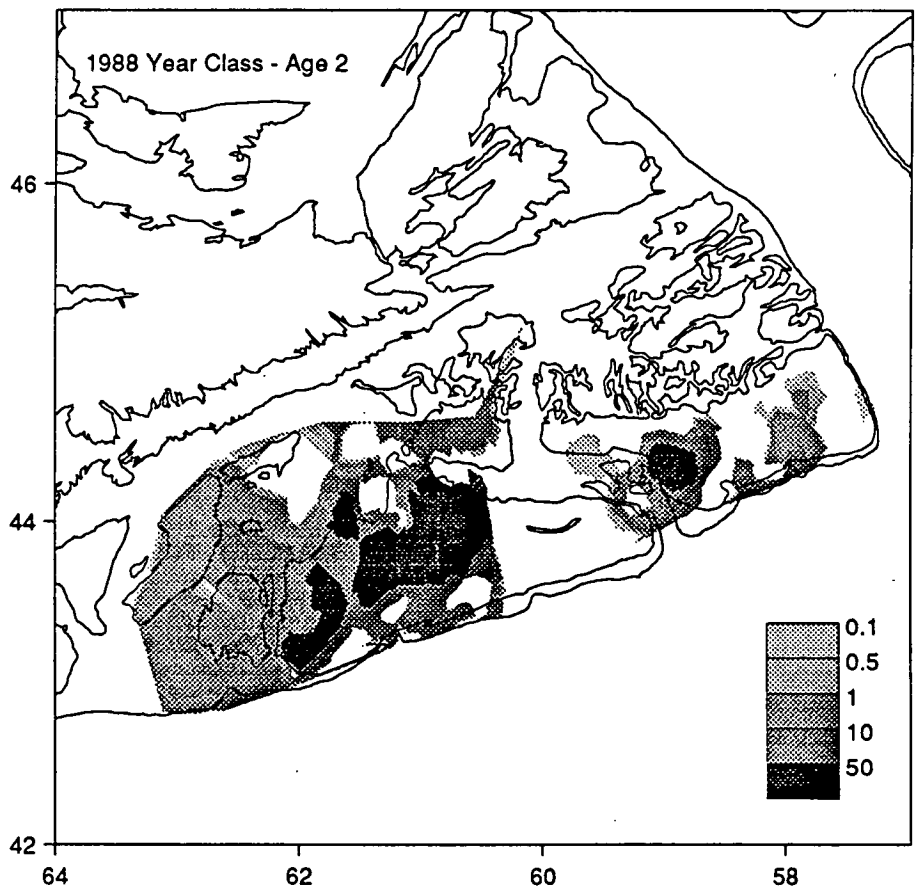


Figure 12. (Continued)