Capelin in NAFO Div. 2J3KL

by

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Abstract

The relationships between abundance indices derived from acoustic surveys and inshore catch rates in Div. 3L and Div. 2J3K were examined. Year-class abundances at age 2 derived from acoustic surveys in Div. 3L and Div. 2J3K were correlated. The mature biomass projected one year from the Div. 3L acoustic survey was significantly correlated with the Div. 3L trap catch rate but was not correlated with the Div. 3K catch rate. The mature biomass measured during the Div. 3L acoustic survey was significantly correlated with the Div. 3L trap catch rates in the same year. The 1991 catch rate was higher than would have been expected from this relationship. The same mature biomass from the survey was correlated with the Div. 3K same year trap catch rate but in this case the 1991 estimate was lower than the 1991 Div. 3L catch rate and consistent with the acoustic survey results. The trends in Div. 3L and Div. 3K trap catch rates were highly correlated as were year-class strengths from these two sources. The year-class strengths measured at age 2 in acoustic surveys were correlated with year-class strengths measured in inshore traps.

The relationship between mature biomass projected from the Canadian fall acoustic survey in Div. 2J3K and inshore trap catch rate the next year was not significant. The abundance of a year-class at age 2 in the fall acoustic survey was significantly correlated with the trap catch rates at ages 3 and 4. The maturing biomass measured during the Canadian Div. 2J3K acoustic survey was not correlated with the Div. 3K catch rate the following fishing season. The mature biomass projected from USSR fall acoustic estimates was correlated with inshore trap catch rates in Div. 3K the next year.

Résumé

On a étudié la corrélation entre les indices d'abondance provenant des études acoustiques et les taux de prises dans la division 3L et dans les divisions 2J3K. L'abondance des classes d'âge à deux ans établie d'après les études acoustiques réalisées dans ces divisions a été confirmée. Les projections sur un an de la biomasse de poisson adulte établies d'après l'étude acoustique dans la division 3L s'est trouvée à correspondre étroitement aux taux de prises au parc en filet dans cette division, mais non à ceux de la division 3K. On a constaté un rapport assez étroit entre la biomasse adulte mesurée lors de l'étude acoustique dans la division 3L et les taux de prises au parc en filet dans cette division au cours de l'année considérée. Le taux de prises de 1991 a été supérieur à ce que ce rapport permettait d'escompter. On a également comparé cette biomasse de poisson adulte aux taux de prises au parc en filet dans la division 3K au cours de la même année. Cette fois, les estimations pour 1991 se sont avérées inférieures aux taux de prises dans la division 3L en 1991 et correspondaient aux résultats de l'étude acoustique. Les tendances des taux de prises au parc en filet des divisions 3L et 3K ont été nettement confirmées, tout comme la force des classes d'âge de ces divisions. La force des classes d'âge à deux ans mesurée dans les études acoustiques correspondait aux résultats obtenus dans les parcs en filets des pêcheurs côtiers.

Il n'y a pas de rapport étroit entre les projections de la biomasse de poisson adulte établies dans le cadre de l'étude acoustique canadienne d'automne dans les divisions 2J3K et les prises de la pêche côtière au parc en filet de l'année suivante. L'abondance des classes d'âge à deux ans découlant de l'étude acoustique d'automne était en étroite corrélation avec le nombre de poissons de trois et quatre ans présents dans les prises au parc en filet. La biomasse des poissons atteignant la maturité, mesurée lors de l'étude acoustique dans les divisions 2J3K, ne correspondait pas aux prises de la saison suivante dans la division 3K. En revanche, les projections de biomasse de poisson adulte fondées sur les études acoustiques réalisées par l'U.R.S.S. en automne se sont trouvées confirmées dans les prises au parc en filet des pêcheurs côtiers dans la division 3K l'année suivante.

Introduction

Canadian acoustic surveys have been conducted during spring in Div. 3L and fall in Div. 2J3K with the aim of estimating the abundance of recruiting year-classes, especially age 2. These are offshore surveys and additional research, namely catch rate collections through logbooks from index fishermen, is also performed when capelin move inshore to spawn. Several relationships between these various indices were investigated in Carscadden et al. (1991) and this paper updates several of these relationships.

Year-class Abundance at Age 2

Estimates of year-class abundance at age 2 were available (Miller 1992, Miller and Carscadden 1991) for the 1981-89 year-classes (Table 1) from offshore acoustic surveys in Div. 3L and Div. 2J3K. The relationship (Fig. 1) is statistically significant ($r = 0.68^*$, $n = 9$). The Div. 3L surveys generally result in higher absolute estimates of each year-class. This is especially obvious for the 1988 year-class; this year-class was very abundant during the spring 1990 survey but has not appeared as strong in subsequent offshore surveys (Miller and Carscadden 1991).

Projected Biomass (Div. 3L) and Inshore Catch Rates

The relationship between the biomass in Div. 3L projected during NAFO meetings and the inshore trap catch rates (Nakashima and Harnum 1992a) in Div. 3L (Table 2) was examined (Fig. 2). This relationship was significant ($r = 0.80^{**}$, $n = 9$). As outlined in Carscadden et al. (1991), up to and including 1985, a combination of estimates of recruiting year-classes from USSR and Canadian surveys was used. Since 1986, Canadian survey estimates have been used. The 1991 trap catch rate is lower than would be expected from the high biomass estimate during the spring 1990 survey.

The relationship between the mature biomass projected from the Div. 3L survey and the trap catch rate (Nakashima and Harnum 1992b) in Div. 3K (Table 2) was not significant ($r = 0.50$, $n = 9$) (Fig. 3).

Mature Biomass During Div. 3L Surveys and Inshore Catch Rates

During the Canadian spring acoustic surveys in Div. 3L, both immature and maturing fish are taken. The maturing fish are ripening to spawn approximately 6-8 weeks later. Using the results from Canadian acoustic surveys from 1982 to 1991 (Table 2), the relationship (Fig. 4) between this mature biomass and Div. 3L trap catch rates a few months later is significant ($r = 0.64^*$, $n = 10$). The 1991 trap catch rate is clearly higher than would be expected from the 1991 survey estimate. The surveys during 1982, 1983 and 1984 were conducted during April and had problems with relatively small area surveyed and/or ice (as did the 1991 estimate); nevertheless, the inshore catch rates were consistent with these estimates and with the inshore aerial survey index (Nakashima 1992).

The relationship (Fig. 5) between the mature biomass detected during the Div. 3L spring survey and the trap catch rate in Div. 3K (Table 2) a few months later is also significant ($r = 0.77^*$, $n = 9$). In this case, the 1991 trap catch rate was low and consistent with the low mature biomass estimate from the acoustic survey.

The inshore trap catch rates in Div. 3L and 3K were highly correlated ($r = 0.83^{**}$, $n = 9$) (Fig. 6).

Relative Year-class Strengths

The trends in year-class strength from catch rate-at-age from traps have been calculated by Nakashima and Harnum (1992a, b). In this analysis, only three- and four-year-olds were used since these age-groups comprise the bulk of the spawning stock. The catch rates-at-age for each year-class were summed to take into account differing maturation rates.

The year-class strengths in the trap catch rates from Div. 3L and 3K (Table 3) were highly correlated ($r = 0.98^{**}$, $n = 7$) (Fig. 7). For Div. 3L, the year-class strength estimates from the Div. 3L acoustic surveys were highly correlated (Fig. 8) with year-class strengths measured at ages 3 and 4 in the traps inshore ($r = 0.91^{**}$, $n = 8$).

Div. 2J3K Fall Acoustic Surveys and Inshore Indices

Mature biomass was projected from Div. 2J3K Canadian acoustic surveys (Miller 1992) the previous year. Abundance estimates from the Canadian surveys were projected forward from 1 November to 1 July the following year assuming $M = 0.30$. It was assumed that fish observed in the acoustic survey could not be identified as immature or maturing. Consequently, on 1 July the following year, proportions mature at age (Table 4) from Carscadden et al. (1985) were applied to the total numbers to derive estimates of mature abundance. This estimate of mature numbers was then converted to weight using mean weights at age (Table 4). The relationship between mature biomass projected from the Canadian fall acoustic survey in Div. 2J3K and inshore trap catch rate (Table 2) the next year (Fig. 9) was not significant ($r = 0.45$, $n = 8$). However, the abundance of a year-class at age 2 in the fall acoustic survey (Table 1) is significantly correlated ($r = 0.89^{**}$, $n = 7$) with the abundance of that year-class as measured by catch rates at ages 3 and 4 (Table 3) in Div. 3K traps (Fig. 10).

Maturities are routinely assessed during the Canadian fall acoustic survey, although it is often difficult to discern immature and maturing fish. Nevertheless, it was possible to derive estimates of abundance of maturing fish from the survey estimates (Table 5). However, because of the difficulties in assessing maturities at this time of year, there is potentially large variance around this estimate. The relationship between the maturing biomass measured during the fall Div. 2J3K survey and the Div. 3K trap catch rate the following season (Fig. 11) was not significant.

The biomass projected (Table 5) from USSR acoustic estimates (Bakanev 1992) during the fall (using $M = 0.30$ and parameters in Table 4 is significantly correlated ($r = 0.83^{**}$, $n = 7$) with inshore catch rates in Div. 3K the next year (Table 2, Fig. 12).

References

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1992b. The 1991 inshore capelin fishery in NAFO Div. 3K. CAFSAC Res. Doc. 92/19. 19 p.

Table 1. Abundance (billions) of capelin at age 2 from Canadian Div. 3L and Div. 2J3K acoustic surveys.

Year-class	Abundance	
	Div. 3L	Div. 2J3K
1981	3.4	2.5
1982	21.0	34.7
1983	369.5	54.0
1984	59.4	6.6
1985	88.1	4.4
1986	380.4	96.0
1987	314.8	59.0
1988	353.2	2.6
1989	7.7	2.5

Table 2. Projected biomass (000's t) in Div. 3L calculated as in NAFO meetings, mature biomass (000's t) in Div. 3L derived directly from spring acoustic surveys and inshore catch rates (t/day) from Div. 3L and Div. 3K.

Year	Projected biomass	Mature biomass from surveys	Trap catch rates	
			Div. 3L	Div. 3K
1982		357	3.1	
1983	648	48	3.4	3.3
1984	384	216	2.9	4.1
1985	596	773	4.6	3.2
1986	1300	1572	4.6	5.8
1987	2830	1570	8.8	10.5
1988	900	2240	6.2	5.9
1989	3345	1254	6.7	5.8
1990	3500	3095	8.6	10.7
1991	4687	65	7.3	4.6

Table 3. Year-class strengths, ages 3+4, from trap catch rates in Div. 3L and Div. 3K and year-class strengths (billions) from Div. 3L spring acoustic surveys.

Year-class	Catch rates-at-age (3+4)		Abundance
	Div. 3L	Div. 3K	Age 2
1980	114.5		9.7
1981	75.7	70.2	3.4
1982	163.0	126.8	21.0
1983	279.4	300.1	369.5
1984	74.2	66.5	59.4
1985	165.2	149.9	88.1
1986	323.9	348.0	380.4
1987	215.3	188.4	314.8
1988			
1989			

Table 4. Proportions mature at age and mean weights (g) used in projections.

Age	Proportion mature	Mean weight (g) (inshore mean 1979, 1982-89)
3	.22	29.9
4	.64	37.3
5	.77	35.1
6	.89	36.7

Table 5. Projected mature biomass (000's t) from Canadian Div. 2J3K acoustic surveys, mature biomass (000's t) as measured during Canadian Div. 2J3K acoustic surveys and projected mature biomass (000's t) from USSR Div. 2J3K acoustic surveys.

Year	Projected mature biomass - Canadian	Measured mature biomasss - Canadian	Projected mature biomass - USSR
1982		1710	
1983		-	564
1984	43	101	553
1985	427	1176	215
1986	604	849	868
1987	302	537	1059
1988	49	124	535
1989	931	2158	-
1990	1076	2456	-
1991	61	123	399

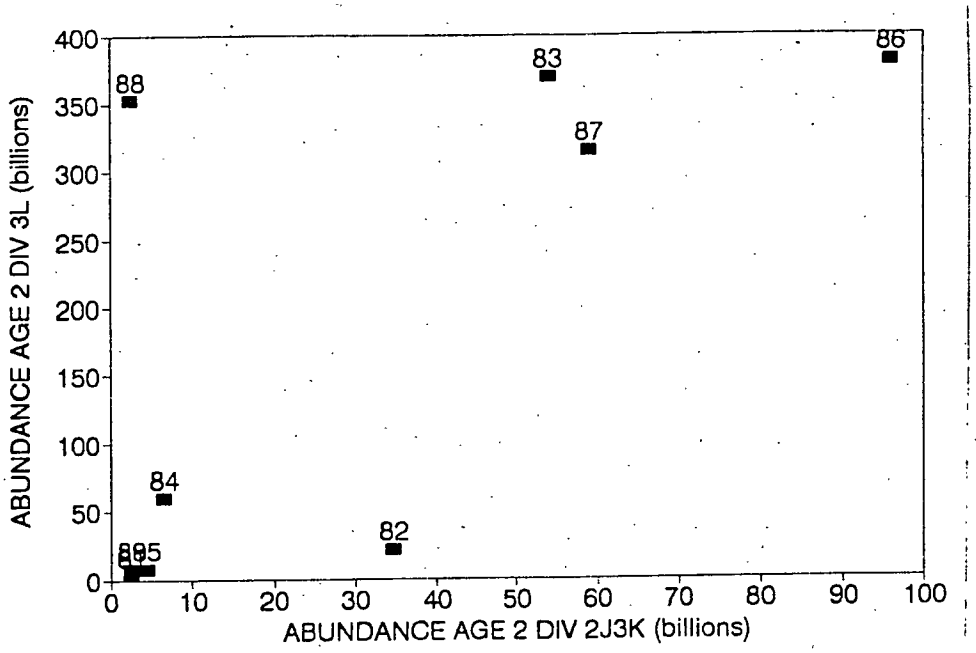

Fig. 1. Relationship between abundance of 1991-89 year-class at age 2 as measured by acoustic surveys in Div. 3L and Div. 3K.

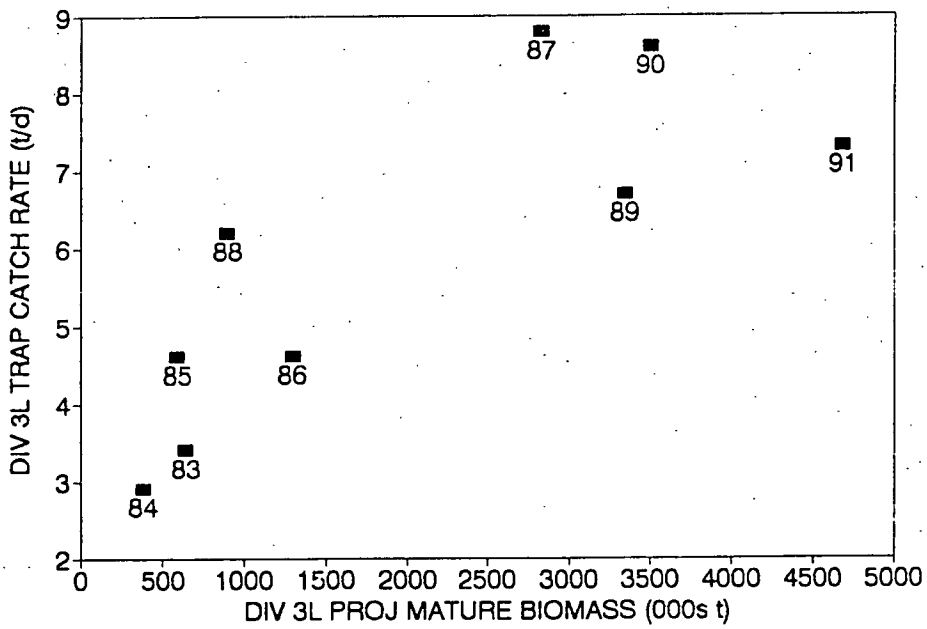

Fig. 2. Relationship between the mature biomass in Div. 3L projected during NAFO meetings and Div. 3L inshore trap catch rates.

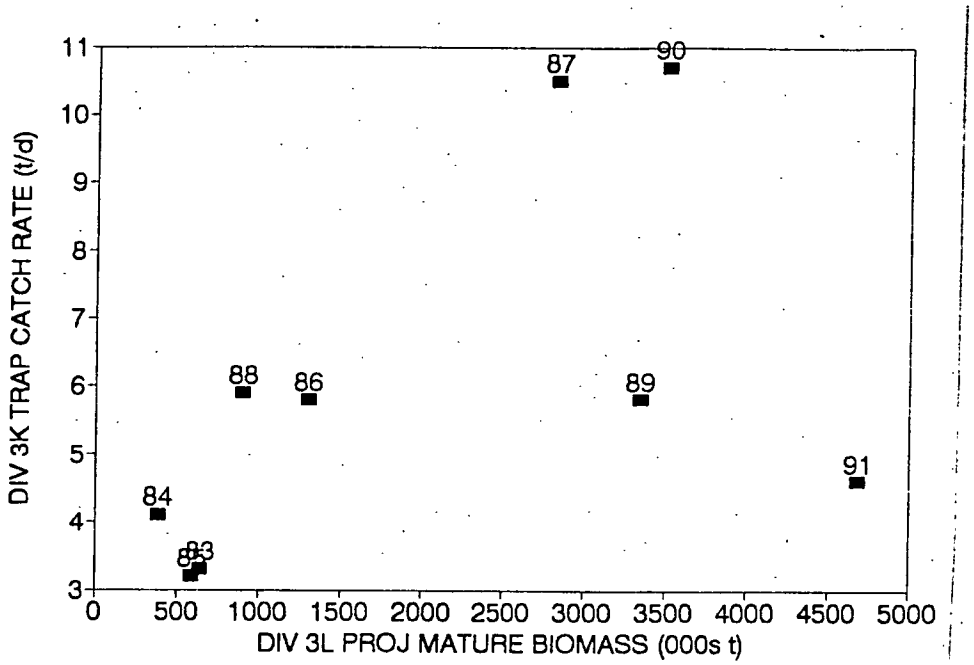

Fig. 3. Relationship between mature biomass projected from the Div. 3L acoustic survey and the Div. 3K inshore trap catch rate.

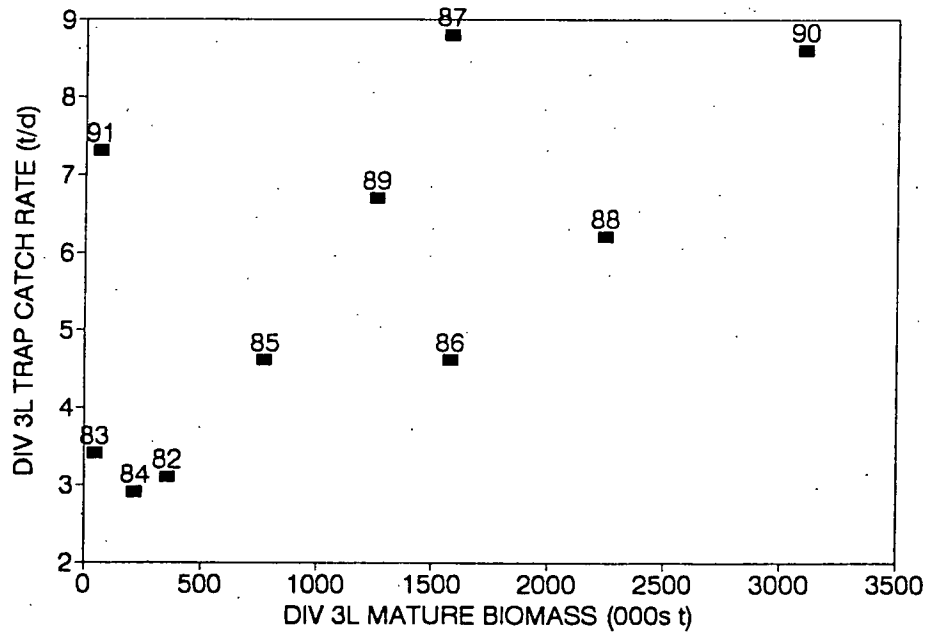

Fig. 4. Relationship between the mature biomass measured during the Div. 3L acoustic survey and inshore trap catch rate in Div. 3L later in the same year.

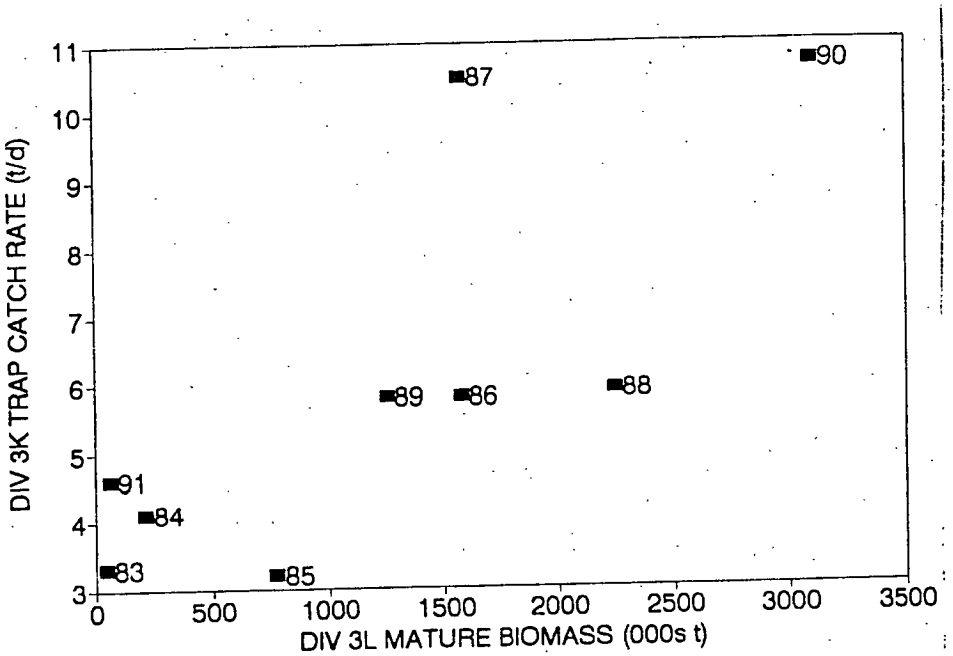

Fig. 5. Relationship between the mature biomass measured during the Div. 3L acoustic survey and inshore trap catch rate in Div. 3K later in the same year.

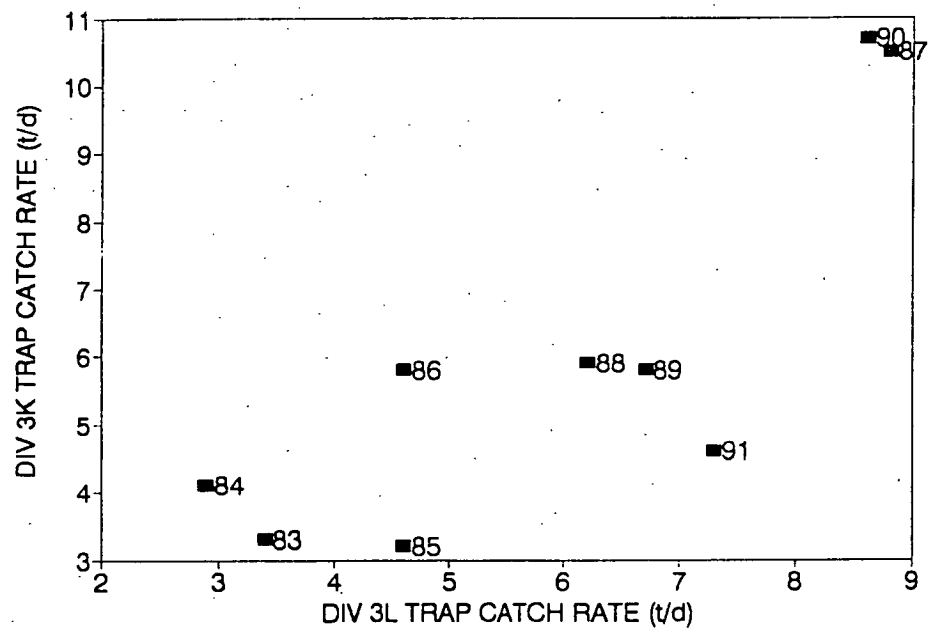

Fig. 6. Relationship between the inshore trap catch rates in Div. 3L and Div. 3K.

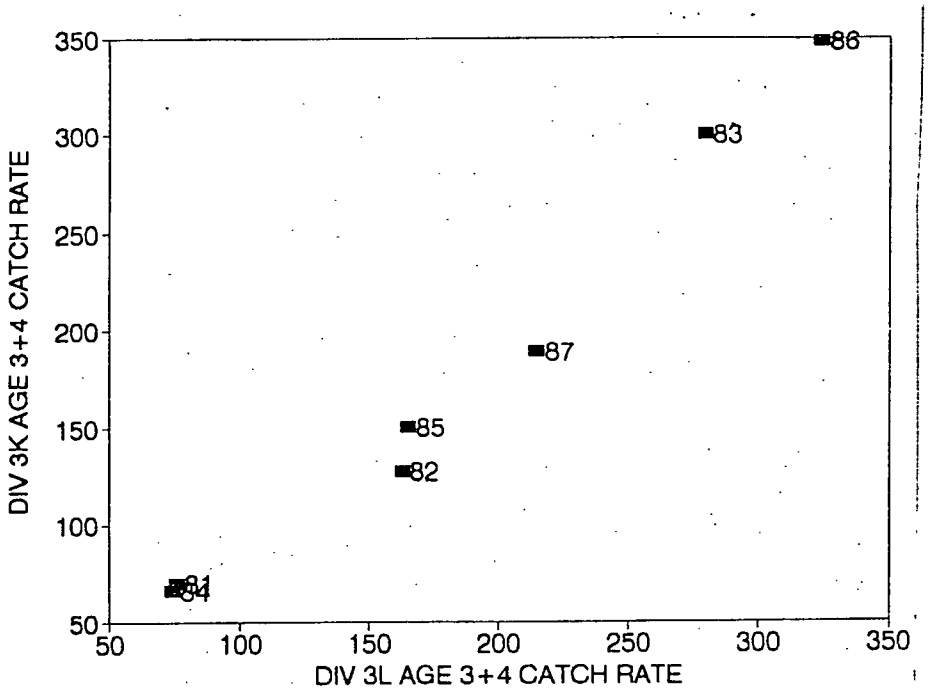

Fig. 7. Relationship between ages 3 + 4 trap catch rates in Div. 3L and Div. 3K.

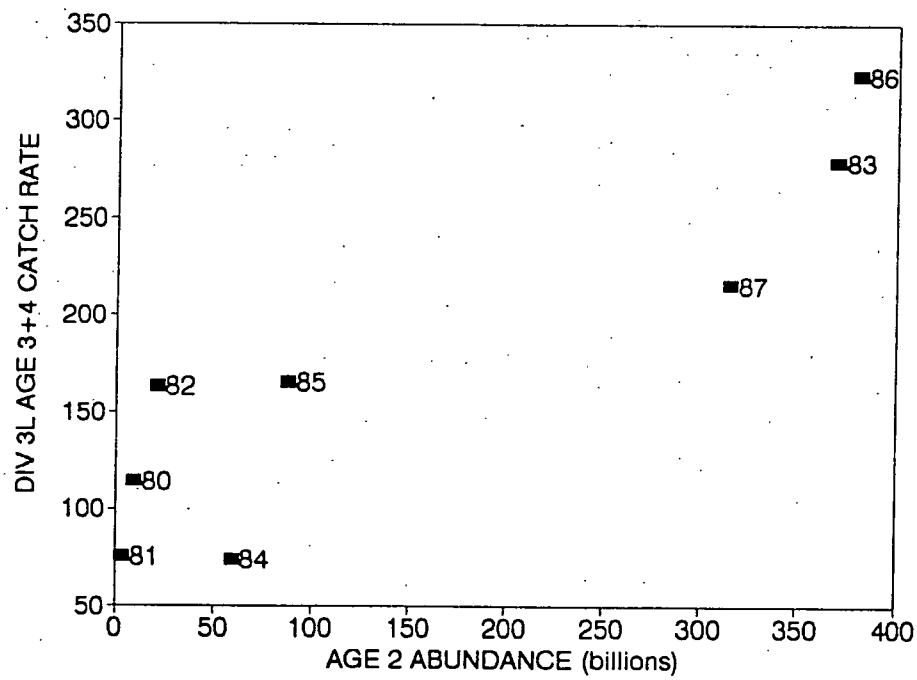

Fig. 8. Relationship between year-class abundance measured at age 2 during Div. 3L acoustic surveys and the same year-class abundance as measured by ages 3 + 4 inshore trap catch rates in Div. 3L.

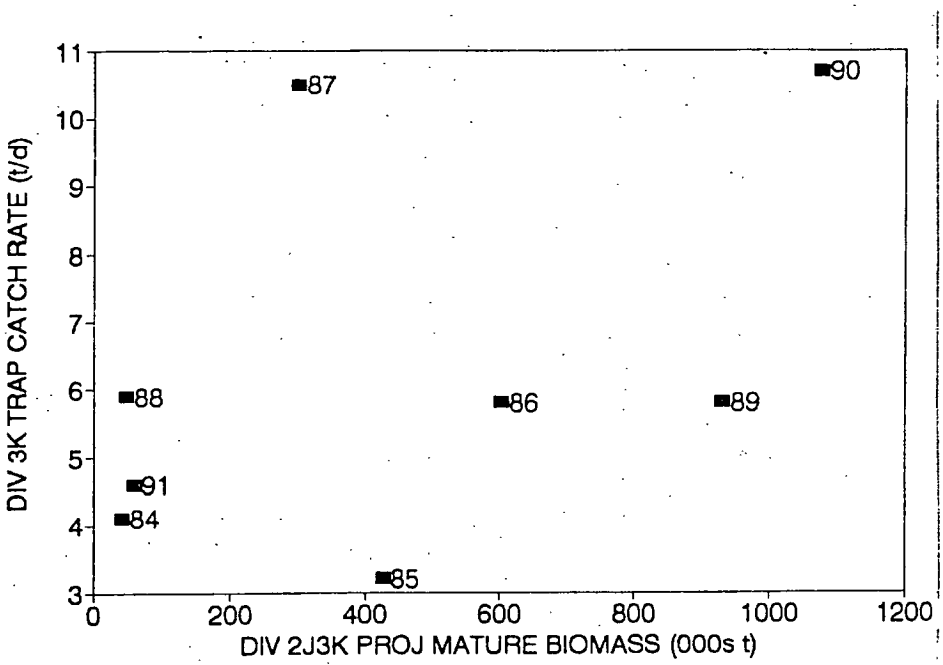

Fig. 9. Relationship between mature biomass projected from Div. 2J3K Canadian fall acoustic surveys and the inshore trap catch rate in Div. 3K.

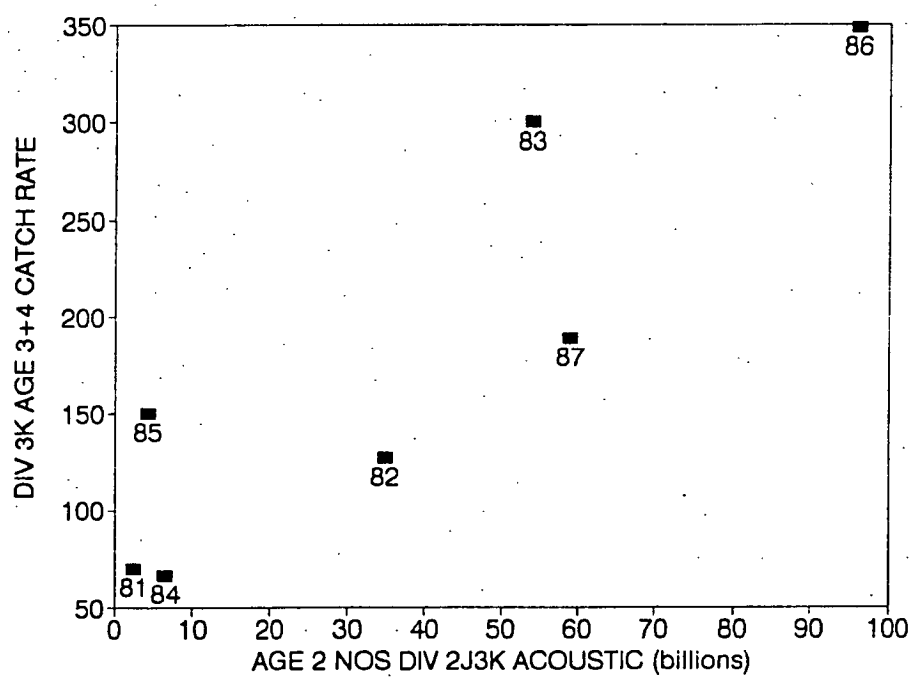

Fig. 10. Relationship between year-class abundance measured at age 2 in Div. 2J3K Canadian acoustic surveys and abundance of the same year-class measured as ages 3 + 4 catch rate in Div. 3K.

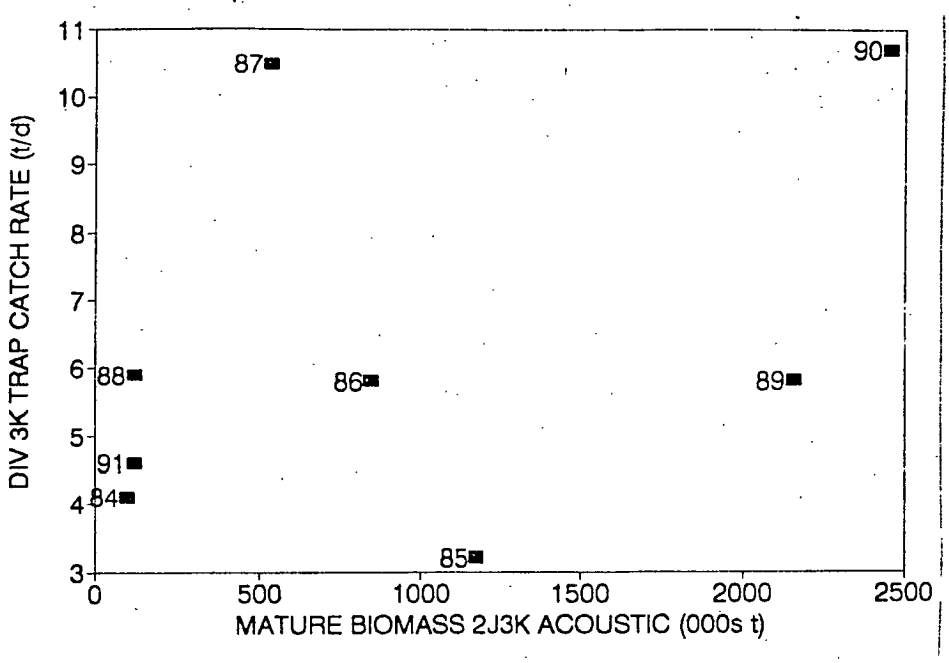

Fig. 11. Relationship between mature biomass measured during Div. 2J3K Canadian acoustic surveys and Div. 3K trap catch rates.

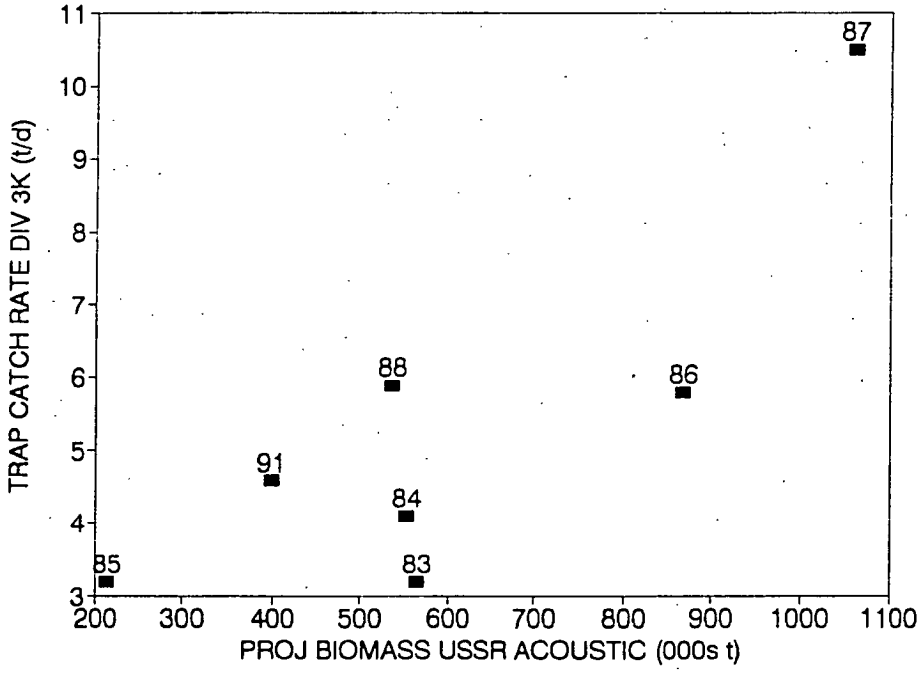

Fig. 12. Relationship between mature biomass projected from USSR acoustic surveys and Div. 3K trap catch rate.