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The Sexual Maturity of Female Shrimp (*Pandalus borealis*) in the Denmark Strait in the Years 1985 - 1992 and a Comparison to the Nearest Icelandic Shrimp Stocks in 1992.

by

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Abstract

An account is given of the sexual maturity of *P. borealis* in the Denmark Strait in the years 1985 -1992 as calculated from the logistic curve. There is also a comparison of the L_{50} of shrimp in the Denmark Strait in the year 1992 with the various L_{50}s of the nearest shrimp grounds in the Icelandic waters. The L_{50}s of Denmark Strait are by far the largest.

Introduction

The Pandalids are generally protandreous hermaphrodites that reproduce first as males to later change to females that spawn as such for the rest of their life. Rasmussen (1953) has indicated that the time of sex change in *P. borealis* is related to the size of the individuals rather than age. The findings of Skuladottir *et al* (1991) where the variation of L_{50} of female *P. borealis* and age, studied in four areas within Icelandic waters, did not support this theory. The same authors also studied the variation of L_{50} more accurately for all shrimp grounds in Icelandic waters in the same years i.e. in 1988 and 1989.

In this study the L_{50} of shrimp in the Denmark Strait are shown by months and years with some referance to that of the nearest Icelandic stocks.

Material and Methods

Most of the samples of shrimp used here were obtained from commercial vessels and kept frozen untill measured. The shrimp was thawed and measured middorsally to the nearest half mm. All the shrimp of the July 1992 samples was however measured and sexed fresh.

The calculation of the maturity ogive was based on the proportions of mature females (females without sternal spines, the definition of McCrary 1971) against all specimens in the same length class. The method used for calculating the maturity ogive and L_{50} of mature females was the sigmoid, so called logistic curve used by Berkson (1944). Ashton (1972) has shown how to fit this curve by least squares. Here the maturity ogive is fitted to all the individual samples of a month in the same area and the overall L_{50} is the carapace length (CL) where the 0.5 proportion point lies as calculated by the logistic function.

Results

The main strata numbers of the area investigated of both the Dohrnbank area (the eastern part of the Denmark Strait) and the other Icelandic shrimp grounds are shown on fig 1. In spite of there being a short distance between the Dohrnbank area (strata no. 626 - 628 and 676 - 678) and the new offshore shrimp grounds called Hali (strata numbers 674 and 675) there is a deep trough between which could act as a barrier and in that manner prevent migration. The maturity ogives have been fitted to the samples of every month of the years 1985 through 1992, where there are samples available in the Denmark Strait. These are shown on figs. 2 - 4. On figure 4 there are maturity ogives of shrimp from the Dohrnbank area and other shrimp grounds in the Icelandic waters like the afore mentioned Hali, Nordurkantur (strata numbers 720 -724 and 770 -771) and the fjord Isafjardardjup (stratum no. 622). As there were only samples in April and May in the Dohrnbank area the maturity ogive of Nordurkantur is shown in May for comparison. Alas there were no May samples availabe for the Hali area but instead there were a few in July. To match these samples there is a maturity ogive shown for Nordurkantur also in July. At the moment only the November maturity ogive of Isafjardardjup is shown and this is compared to that of the same month of Nordurkantur. It is evident that the L_{50}s are of three size categories, namely the biggest one at the Dohrnbank area of over 27 mm, 23.5 - 25 mm at both the Hali and the Nordurkantur area and finally the 18.9 mm of Isafjardardjup. The L_{50}s of the Dohrnbank area by months and years are listed in table 1. and shown in fig. 5. There could be a vague trend in the size of L_{50} through the winter, e.g towards a lower L_{50} as the new batch of immature females change into mature females just before spawning. But more samples in all months are needed to see whether there is is any such trend.

Discussion

The maturity of females has been studied before in the Icelandic waters particularily in 1988 and 1989 (Skuladottir et. al. 1991) where L_{50} was found to be similar for Nordurkantur as here shown, namely 23.7 mm in June - July 1988 and 24.9 mm in July - August 1989. This is not so far from the July value of Nordurkantur in 1992 of 24.1 mm (fig. 4). Moreover the l_{50}s of Isafjardardjup were 19.1 mm in October 1988 and 16.4 mm in October 1989 as compared to the 18.9 mm of November in 1992. It is evident that there appears to be a certain consistency in the L_{50}s of the offshore areas, female maturing at about the same size every year. Although Isafjardardjup shows this variation, the afore mentioned 19.1 mm of 1988 is about the highest known for that area. The Dohrnbank area has a much higher L_{50} than any other area known so far at least in the Icelandic waters. The lower L_{50} of both Hali and Nordurkantur are also distinct and do not resemble that of the Dohrnbank area although the unusually low value for that area, 26.5 mm of September in 1990 could imply an execptional very minor mixing with the Icelandic offshore stocks.

The variation of L_{50} in the Icelandic waters seems to tie up with the great variation in near bottom temperatures observed in the Icelandic waters, namely the lower the average bottom temperature the larger the L_{50} (Skuladottir *et al.*). In general if there was a mixing of the two stocks i.e. the Denmark Strait one and the Nordurkantur - Hali stock it would have to take place early in life, namely in the male phase. The males seem to be living for considerable time where there are the conditions in the environment, temperature etc. which results in the males being so large (and probably old) when they change sex.

Conclusion

The maturity ogives for the Denmark Strait (Dohrnbank area) appear to be fairly consistent from the years 1985 through 1992, supporting the theory that the stock in the Denmark Strait is different from the nearest Icelandic offshore stock and vastly different to the fjord stocks of which Isafjardardjup is an example.

References

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Table 1. L_{50} per month and year in the Denmark Strait, calculated mostly from Icelandic samples.

Month	85	86	87	Y E A R 88	90	91	92	Mean
Apr							27.7	27.7
May						28.5	27.1	27.8
Jul	28.3				27.4			27.9
Aug	27.5			28.4				28.0
Sep			27.6	27.9	26.5			27.3
Okt		27.3	28.9					28.1
Nov	27.3		28.3					27.8
Dec	27.7	28.8	28.6					28.4

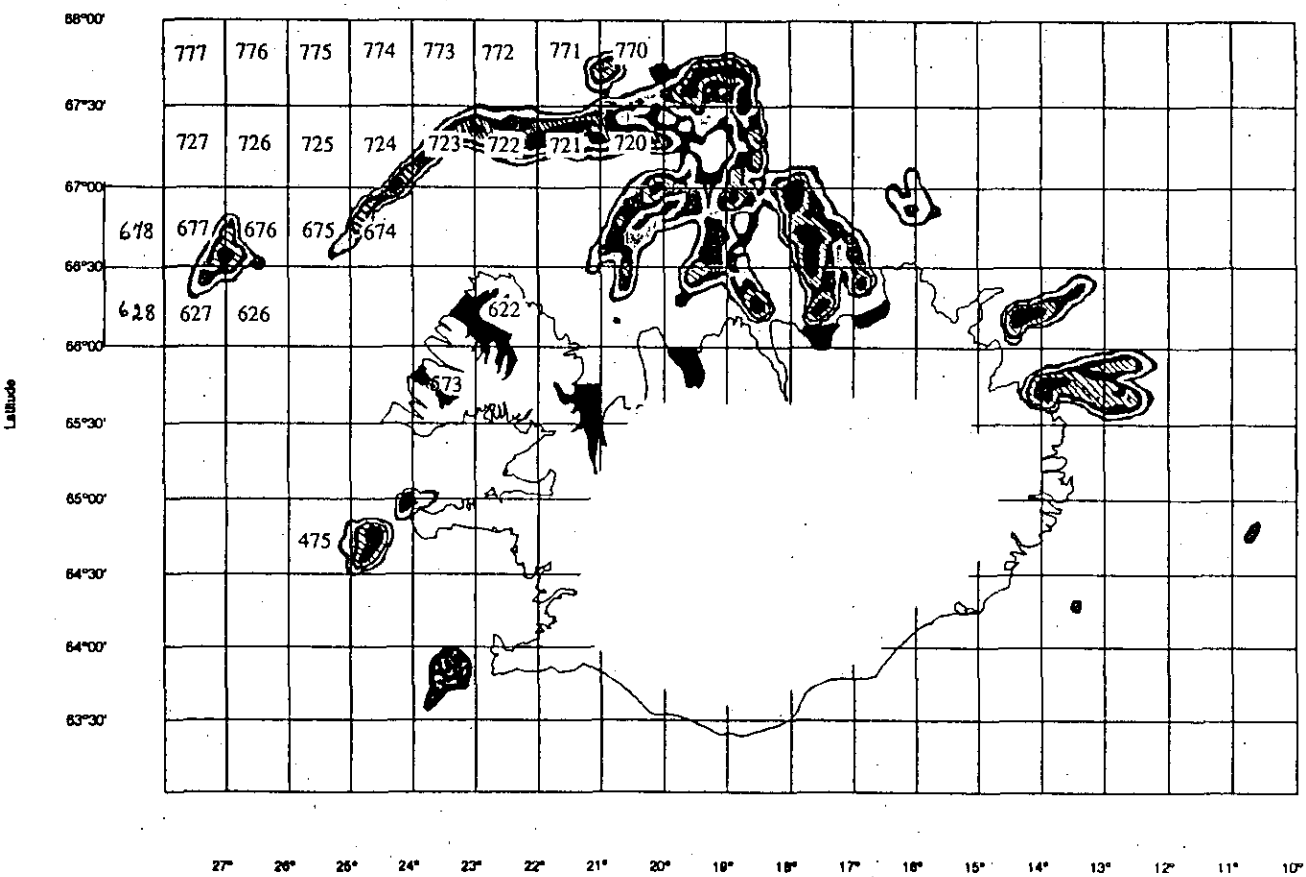

Figure 1. The shrimp grounds in Icelandic waters. Strata numbers used in the paper are shown on this map.

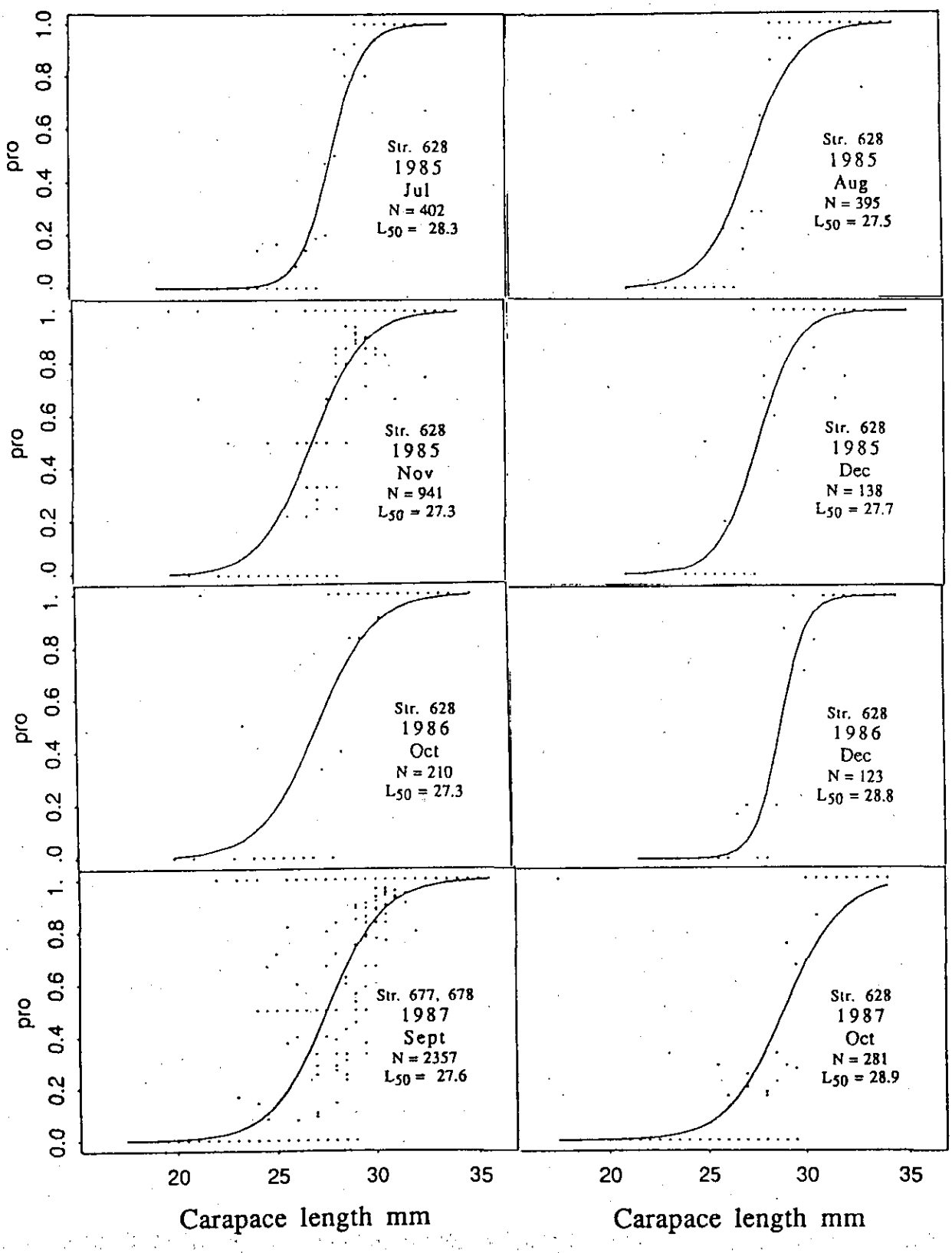

Figure 2. The female maturity ogives in the Denmark Strait in the years 1985-1987.

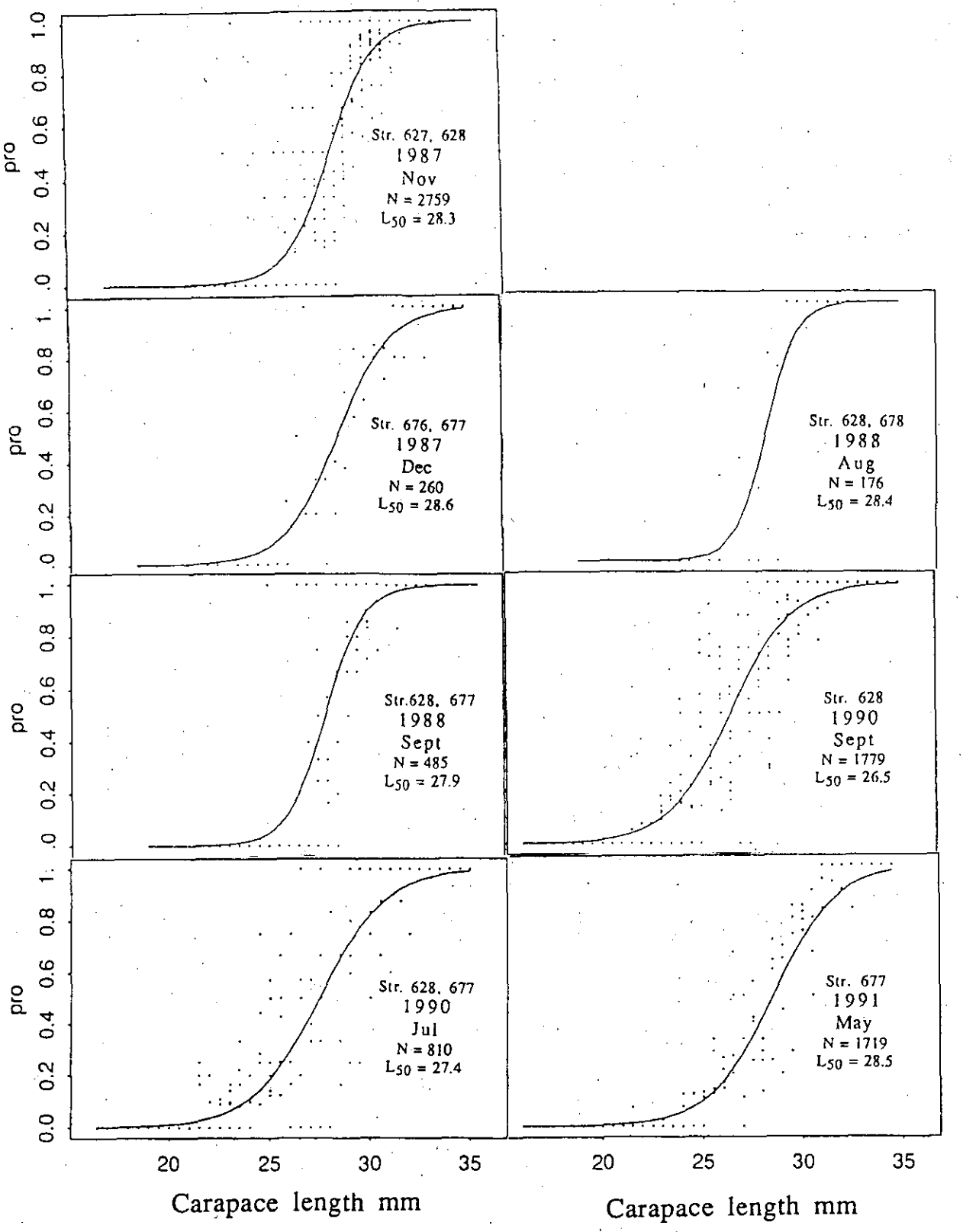

Figure 3. The female maturity ogives in the Denmark Strait in the years 1987 - 1991.

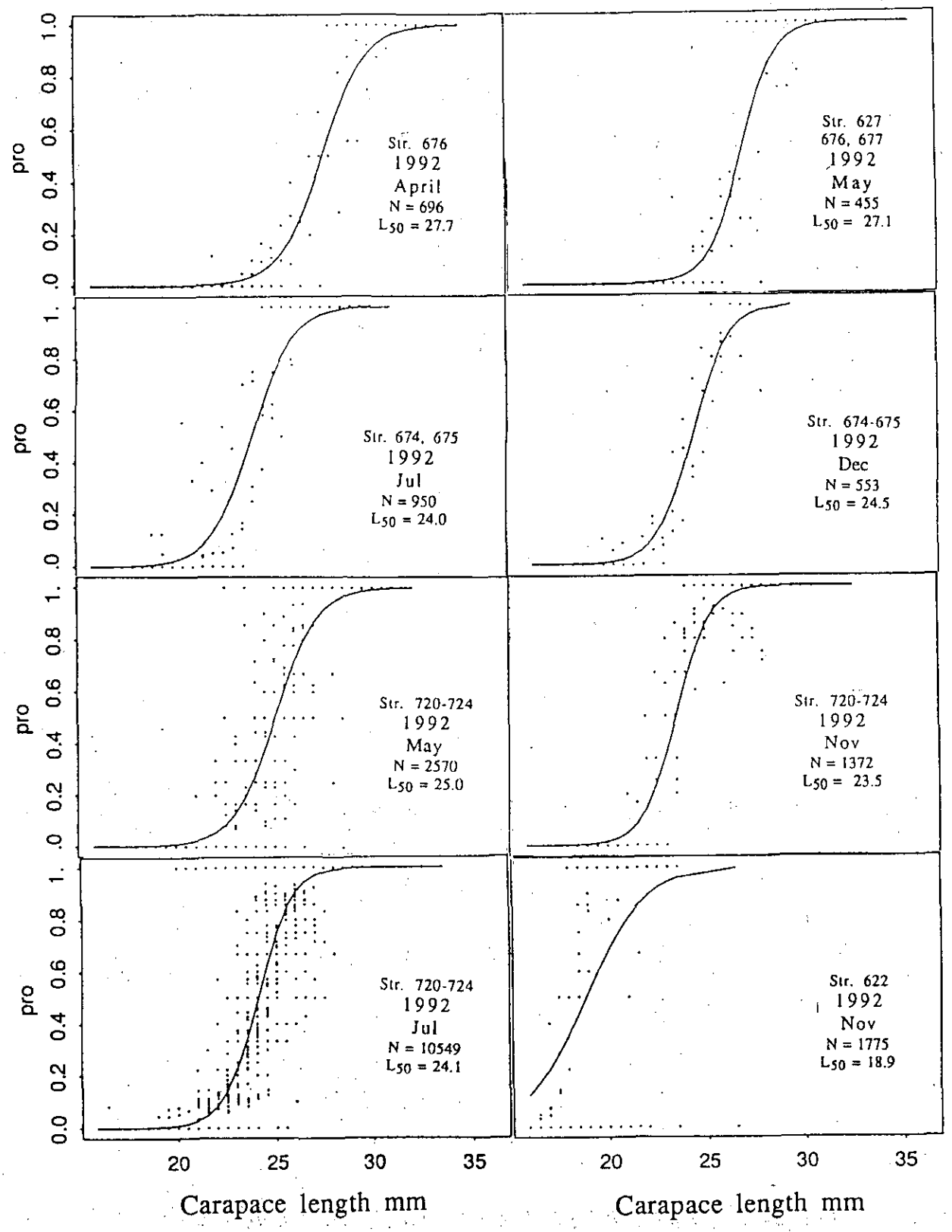

Figure 4. The female maturity ogives in the Denmark Strait as compared to the other most ajacent Icelandic shrimp grounds in 1992 .

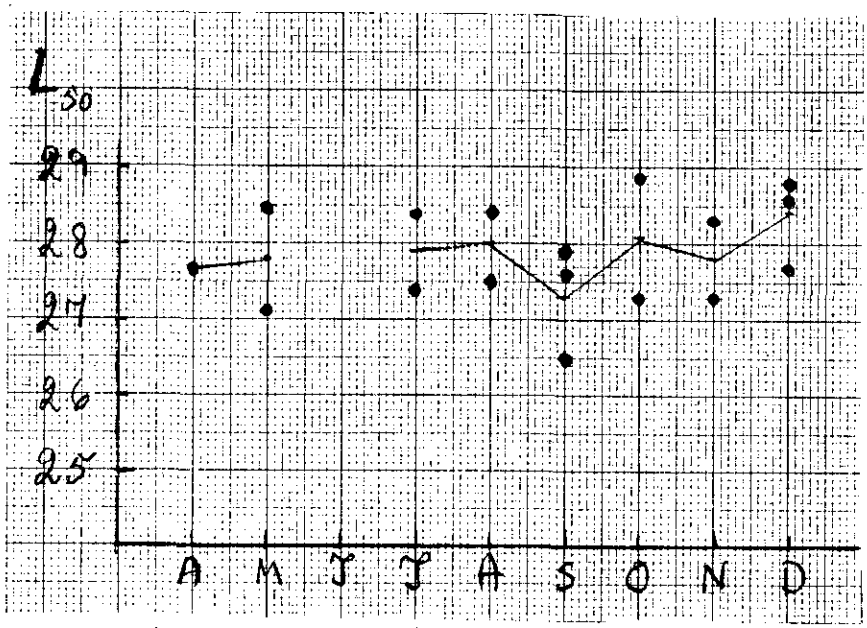

Figure 5. The L_{50}s of the Denmark Strait area by months irrespective of years. The solid line is that of the averages.