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VARIATION OF RECRUITMENT IN FLATFISHES ON A NURSERY GROUND OF THE NORTHERN BAY OF BISCAY, FROM 1981 TO 1990

by

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ABSTRACT

A stratified sampling scheme of the Bay of Vilaine (332 km^2) provided a ten years index of abundance series for the O-group and the I-group of the Dover sole *Solea solea*, the plaice *Pleuronectes platessa*, the dab *Limanda limanda* and of the wedge Sole *Dicologoglossa cuneata*. Variation of distribution and abundance of these species are compared according to their life-cycles, their biogeographic preferences and their estuarine dependence.

RESUME

Un plan d'échantillonnage stratifié de la Baie de Vilaine (332 km^2) fournit une série d'indices d'abondance sur 10 années pour les groupes O et I de la sole *Solea solea*, la plie *Pleuronectes platessa*, la limande *Limanda limanda* et le céteau *Dicologoglossa cuneata*. La distribution et l'abondance de ces espèces sont présentées et commentées en fonction des cycles biologiques, des préférences biogéographiques et de la dépendance des estuaires.

INTRODUCTION

Since 1980, a survey of the nursery ground of the Bay of Vilaine (Northern Bay of Biscay) was carried out to get an annual estimate of the local recruitment of sole *Solea solea* (L.) (DESAUNAY et al., 1987). An other study, from 1986 to 1989, was devoted to the distribution and abundance of the larval stages of sole and indicated an overall stability of these stages in this region, within a variation by a factor x 2 (KOUTSIKOPOULOS et al., 1991). Moreover, the survey of the exploited stock in the Bay of Biscay (ICES areas VIII A1-B1) confirmed the low range of variation in sole recruitment (ANON., 1990). From the same estimates of the seasonal

abundance for other flatfish species in the Bay of Vilaine nursery ground, we try now a comparison of the local recruitment on a 10 years period for the plaice *Pleuronectes platessa*, the dab *Limanda limanda*, and the wedge sole *Dicologoglossa cuneata* in addition to the Dover sole.

MATERIALS AND METHODS

The bay of Vilaine nursery ground, on an area of 332 km^2 (fig.1), was studied on every early summer (June or July) and in autumn (late September to the end of October), for a 10 years period (1981-1990). A small 3 m. beam-trawl, with 20 mm mesh size in the cod end (stretched mesh), was used according to a stratified sampling scheme (Fig.1, table 1). The studied area fits with the summer distribution of sole juveniles.

Date	Hauls number
3-5/VI/81	26
23-26/XI/81	24
2-6/VII/82	43
20-23/X/82	28
23-28/VI/83	37
3-10/XI/83	45
27/VI-4/VII/84	50
30/X-5/XI/84	36
18-22/VI/85	40
18-26/IX/85	40
3-10/VII/86	39
18-26/IX/86	47
4-10/VII/87	46
4-13/IX/87	72
28/VI-7/VII/88	58
20-23/IX/88	49
20-23/VII/89	45
19-22/IX/89	46
21-25/VII/90	37
15-18/IX/90	51
Total	859

Table 1: Dates of cruises and number of hauls

For technical reasons, the internal part of the estuary was not sampled, neither the very soft muddy grounds nor the rocky area where trawling was too difficult. The population index, also called. density of fishes (nb individuals/1000 m^2) was calculated from raw catches without any correction for selectivity or catchability. The results will be given only for O-group and I-group, the separation into age groups resulting from the length frequency distributions.

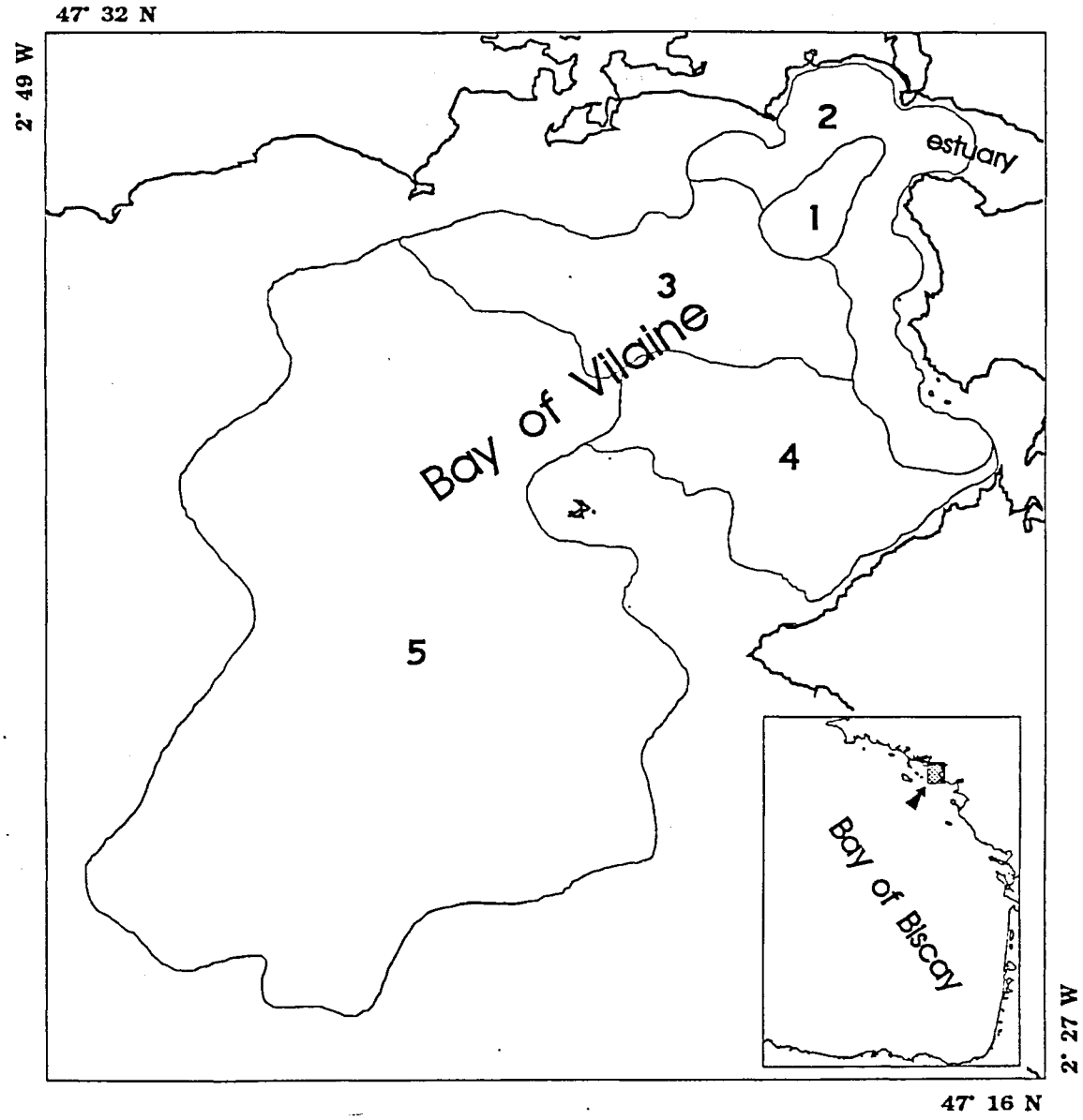


Fig. 1. Map of the studied area with the location of the five strata

RESULTS

- AGE DISTRIBUTION

Fig. 2 shows the length distributions of the cumulated samples in summer and in autumn. The Bay of Vilaine is obviously a nursery ground for these four species, which are entirely represented by fishes smaller than 25 cm and by O-group and I-group. The Dover sole, which spawns around the beginning of March (KOUTSIKOPOULOS et al., 1991), is represented by the three first age groups in summer, with modal lengths around 6, 15 and 23 cm. In autumn, the O-group (10 cm) is dominating in number and the I-group reaches a modal length of 20 cm.

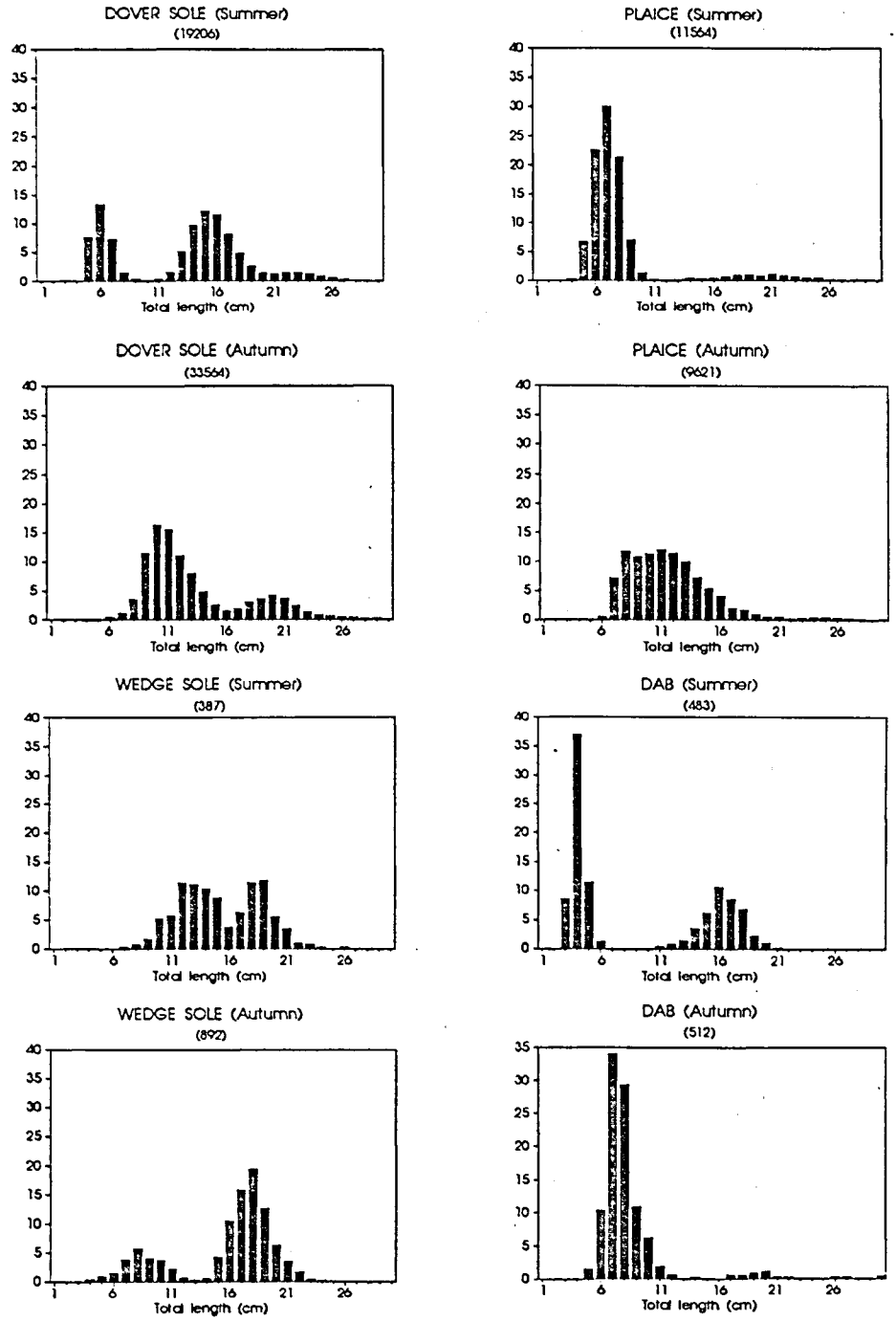


Fig. 2. Summer an autumn length distribution of the four studied species: the frequencies are expressed in percentage of the total number.

Although we got no data on the spawning period for the plaice in the Bay of Biscay, we can deduce from DENIEL'S (1981) observations in the Bay of Douarnenez (48°10'N) that this species spawns from December to February. As early as the middle of June, the bay of Vilaine shelters many O-group young plaice about 7 cm long, whereas the I-group already reaches from 16 to 25 cm. In September and October, only O-group is caught with a maximum length about 20 cm, the main part ranging from 7 to 15 cm, thus in accordance with DENIEL'S conclusions on the high growth rate of plaice in this Atlantic coast.

The Dab is not abundant in the bay of Biscay and our catches were never high nor constant. Summer catches consisted in O-group (modal length 4 cm) and I-group (16 cm). In Autumn like for plaice, the O-group is greatly dominating, with fishes ranging from 6 to 10 cm.

These observations are in agreement with DENIEL (1981) and confirm also higher growth rate in the Bay of Biscay than in more northern waters.

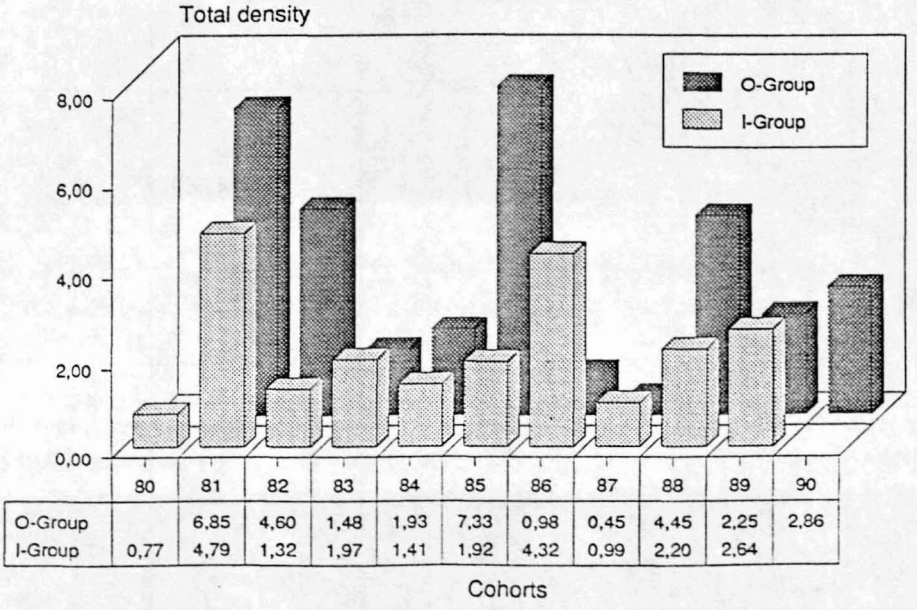
An exhaustive work on the wedge sole, which is abundant only in the south of the Bay of Biscay, has been made by LAGARDERE (1982). This species is a summer spawner, which explains a later apparition of O-group juveniles in the inshore waters. Both I-group and II-group are caught only in small numbers and occasionally in the Bay of Vilaine in June. The I-group is more abundant in Autumn than the O-group, with respective modal lengths of 18 cm and 8 cm.

- EVOLUTION OF SEASONAL AND YEARLY ABUNDANCE

Figures 3 to 6 give the estimated densities resulting from the stratified sampling scheme. Comparisons are sometimes tricky because of bias of catchability and selectivity according to species and ages. In a general way, sole, plaice and dab exhibit increasing densities of their O-group from the summer O-group (with an under estimate due to selectivity) to the autumn O-group. On the next year, these densities are decreasing from summer to autumn with a likely decrease of catchability for the longest fishes. In order to get rid of these bias, we will restrict our propose to the comparison between the autumn O-group and the following summer I-group.

The case of Dover sole appears to be rather complicated (fig.3) the mean densities vary, on the 10 years period, by a factor x 16 for the O-group and by a factor x 6 for the I-group. Two features can be hardly explained :

1) the no keeping of highest abundances over the first winter, namely for cohorts 1982, 1985 and 1988
2) the apparent increase of estimated numbers for cohorts 1986 and 1987.



	80	81	82	83	84	85	86	87	88	89	90
O-Group		6,85	4,60	1,48	1,93	7,33	0,98	0,45	4,45	2,25	2,86
I-Group	0,77	4,79	1,32	1,97	1,41	1,92	4,32	0,99	2,20	2,64	

Fig. 3. Dover sole: total density (nb/1000 m^2) for autumn O-group and following summer I-group

In the plaice (fig.4), a highest abundance period can be noticed, from 1984 to 1987, which is preceded then followed by very weak years. The order of magnitude of interannual variations, with the exception of weakest years, is x 20 for the O-group and x 7 for the I-group.

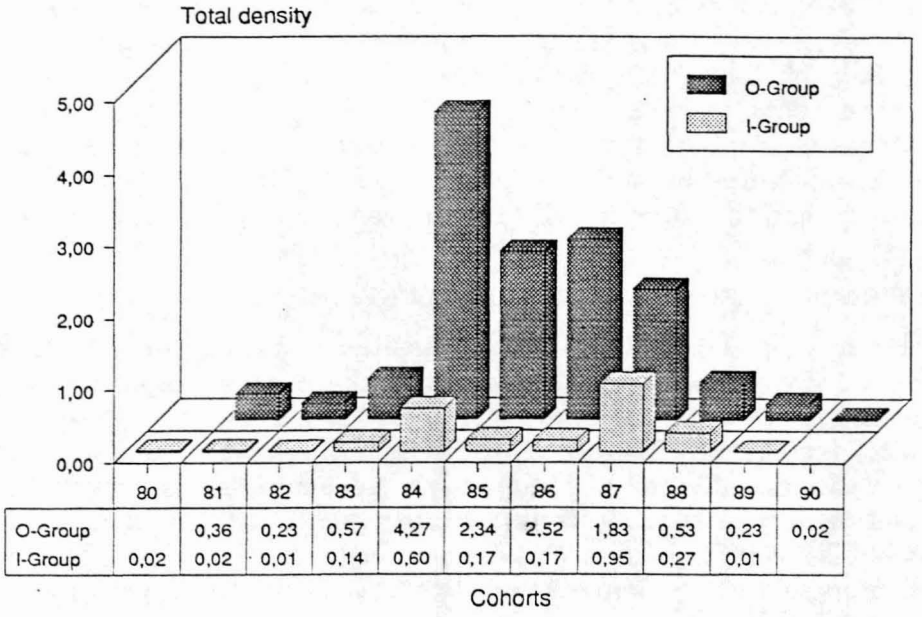


Fig. 4. Plaice: total density (nb/1000 m^2) for autumn O-group and following summer I-group

The dab (fig.5) gave significant catches only in 1986, 1987 and 1988 for the O-group, and later for the I-group. This period is not synchronised with the evolution of plaice, but starts two years later. Interannual fluctuations about 10 folds are observed from 1986 to 1989.

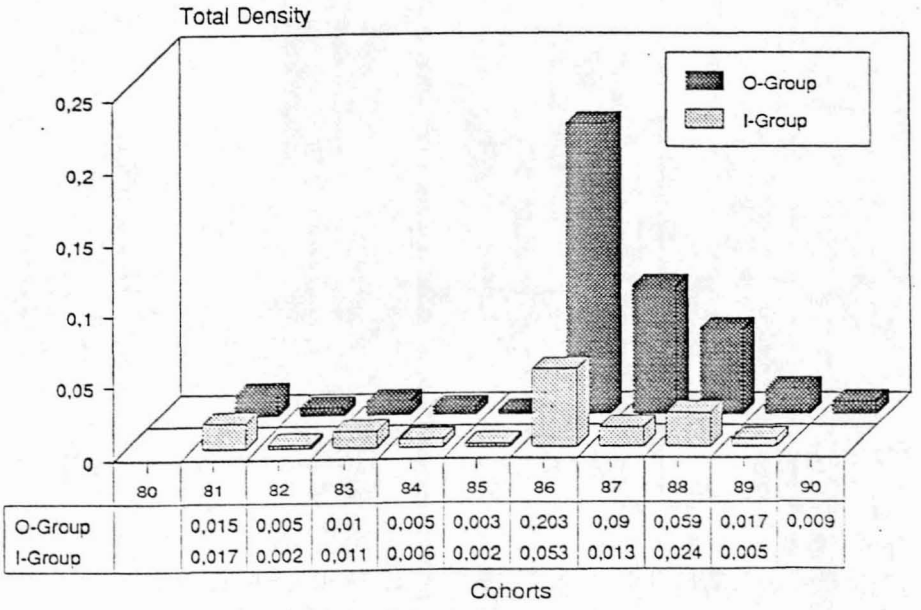


Fig. 5. Dab: total density (nb/1000 m^2) for autumn O-group and following I-group

The figure is different for the Wedge Sole (fig.6). This species was scarce, or even absent (1986) from 1985 onwards and was more regularly caught from 1981 to the summer 1985. During this period and probably in relation with the summer spawning, the yearly fluctuation was rather high, by a factor x 17 (O-group) and x 26 (I-group).

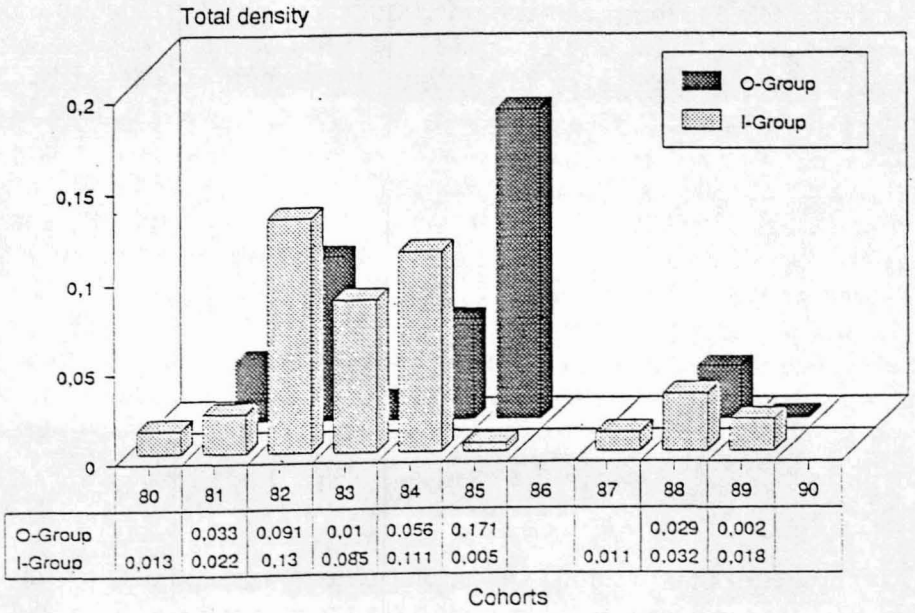


Fig. 6. Wedge sole: total density (nb/1000 m^2) for autumn O-group and following summer I-group

DISCUSSION

This series of estimates of juvenile populations shows a wide range of year to year fluctuations in abundance. For plaice, dab and wedge sole, unfavourable periods may lead to a very weak or even null recruitment, alternating with more favourable years. On the contrary, Dover sole juveniles are always significantly present on this nursery ground, even if a wide interannual fluctuation in number is observed. Accordingly, the Dover sole is the only permanent and major target for the bottom trawl and gill net fisheries in the Northern Bay of Biscay.

But this statement on an isolated sector cannot be extrapolated to the whole stock, if we consider the case of Dover sole. For this species, highest interannual fluctuations are registered on the nursery ground of the Bay of Vilaine than on a wide range like the off-shore spawning areas (eggs and larvae abundance constancy, KOUTSIKIPOULOS et al., 1991) or the whole Biscay stock (VPA estimates, Anon, 1990).

The specific preferences of the four studied flatfishes have probably induced no additional bias to our survey, since the whole area offer different suitable environments in term of depth, salinity and sediments, the role of which parameters has been indicated by RILEY et al. (1981). Extreme cases would have happened with flounder *Platichtys flesus* whose juveniles are numerous only in the estuarine part of the Vilaine (MARCHAND) or, with *Microchirus variegatus* which can be found only out of our surveyed area.

But specific estuarine-dependence are supposed to define the level of sensitivity of a given species to the coastal climate during the pré-recruitment stages as proposed by RILEY et al. (1984). In our case, the most sensitive species would be the plaice, then the Dover sole, the dab and finally the wedge sole.

Differences in the spawning period and in biogeographic preferences can explain the specific variations of recruitment. The Dover Sole and at a lesser level, the plaice, are common flatfishes in the Northern Bay of Biscay where they spawn in winter.

But the dab, as a northern winter spawner and overall, the wedge sole, which is more common south of 47°N are there in an extreme position and, consequently are directly affected by climatic variations. An other species, which is too scarce in the Bay of Vilaine to allow any estimate, the Senegal sole *Solea senegalensis*, could lead to the same comments. This point was already discussed by LAGARDERE (1982), who proposed the southern Bay of Biscay to be a link for the adaptation of "cold" species or "warm" species. According to LAGARDERE, patterns of distribution are characterized by a double need : a trophic migration and a spawning migration. This fits well with both the dab and the wedge sole, if we consider the mild period up to 1984, in favour of the wedge sole and the cold period, from 1985 onwards, in favour of the dab. For *Dicologoglossa cuneata*, an extent of the trophic area during the warmer period allows the I-group to enter Northern zones, where the species don't spawn. For *Limanda limanda*, on the contrary, and in comparison with *P.platessa* a delay of about 2 years is needed after the beginning of a cold period, probably to extend the spawning area to southern zones.

CONCLUSION

The impact of environment and climatic factors is one of the aim of a long term study of the recruitment in Solea solea. The first results show a weak influence of winter temperature on larval stages (KOUTSIKOPOULOS et al., 1991) and the relatively high variations of juveniles numbers is not easily connected with climate. An other way to make appear the effective relationship between pre-recruitment processes and local climatic features would be to identify a set a species which are present in the studied zone but on the border of their preferred biogeographic area. For the Northern part of the Bay of Biscay, between 47°N and 48°N, the dab and the Wedge Sole may be suitable "experimental species", among the flatfishes.

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