Particularities of the reproductive cycle in two species of deep-water sharks, *Centrophorus squamosus* and *Centroscymnus coelolepis*.

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Centrophorus squamosus and *Centroscymnus coelolepis* are two squaloid sharks inhabiting the continental slope in the Northeast Atlantic, exploited since few years by french bottom trawlers. Their reproductive biology has been studied from 1018 *Centrophorus squamosus* and 2025 *Centroscymnus coelolepis*. Biological parameters such as size at first maturity, fecundity and size at birth are mentionned. Biological particularities of the exploited population are reviewed. For both species, mean size at first maturity in females is greater than for males. Analysis of catches shows that youngest miss and a part of adult population lacking ; for both species, the ratio male/female is umbalanced in favour of females and in *C. squamosus*, a high percentage of immatures and absence of pregnant specimens are also noticed. A depth segregation according to maturity stages occur in *C. coelolepis*. In *C. squamosus* this behaviour is less obvious as greater part of the population is out of reach of actual sampling area. Lack of observation in early life stages makes difficult the study of reproductive cycle even if analysis of the proportion in each maturity stage throughout the year tends to pointed out that those two species are asynchronous.

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In France, the most abundant species of deep-water sharks landed as "siki" are *Centrophorus squamosus* (Leafscale gulper shark) and *Centroscymnus coelolepis* (Portuguese dogfish).

For a long time they have been exploited only by portuguese longliners but during the eight last years, commercial catches of "siki" from french bottom trawlers increased widely to 2940 tons (eviscerated).

In order to improve data on the reproductive biology 1018 *C. squamosus* and 2025 *C. coelolepis* have been collected at several periods of the year, between 600 to 1500 meters in depth, during 11 surveys performed on board of commercial trawlers off west and north of British Isles.

Biological parameters.

C. squamosus and *C. coelolepis* are both aplacental viviparous species. Biological parameters are indicated in table 1. Females reach a greater size at first maturity than males. The ovarian fecundity has been determined counting ripe ova in C stages specimens ; it is twice more important for *C. coelolepis* than for *C. squamosus*. In *C. squamosus*, uterin fecundity and size at birth could not have been estimated as none pregnant females are recorded.

Table 1 : Biological parameters in *C. squamosus* and *C. coelolepis*. Mean size at first maturity and size at birth in cm.

Species	Mean size at first maturity. Males	Mean size at first maturity. Females	Ovarian fecundity (ova / female)	Uterin fecundity (embryos/litter)
Centrophorus squamosus	98 cm	124 cm	9 ova	No data
Centroscymnus coelolepis	86 cm	102 cm	17 ova	14 embryos 30 cm

Size frequency distribution

The distribution of these two species of sharks, *C. coelolepis* and *C. squamosus*, in NE Atlantic is caracterized by the absence of specimens after the birth and down to 63 cm in *C. coelolepis* or 84 cm TL in *C. squamosus*. This lack of young cannot be explained by the fishing gear involved for sampling. The ratio male/female is imbalanced in favour of females (about twice numerous than males). Those informations indicated that a part of the real population is lacking (smallest and some males) in catches.

Moreover, in females *C. squamosus*, a high percentage of immature (70 %) and absence of pregnant specimens are noticed. Females have an irregular size distribution compared to that observed in *C. coelolepis*.

Segregation by maturity stages.

In *C. coelolepis* the depth segregation is obvious. Pregnant specimens of *C. coelolepis* preferentially distribute in deepless strata (between 700 to 1000 meters). Frequency of immature increases with depth ; 85 % of males and 50 % of females are immature specimens at 1400 meters.

Reproductive cycle.

The proportion of each maturity stage has been established for males and females throughout the year . In *C. coelolepis*, all stages were recorded regardless of the season, but no cycle is evident. Globally, a 70 % of males are adult (stage C and D). In females, 40 % of adults are pregnant, and there is the same proportion (about 20 %) of mature specimens ready to ovulate (C stage) and in post-natal stage (G stage). Gravid females which were collected during a survey contained embryos in all stages of development *i.e.* from recent fertilized ova to near-term embryos.

In *C. squamosus* in which pregnant females are missing, no seasonal variations are noticed and a cycle can not be pointed out. Globally, 60 % of males are mature. In females, whenever the sampling period is, immature are dominant in catches (71 %).

First results point out :

Sexual dimorphism. Females reach a greater size than males.

Difference of ovarian fecundity between *C. coelolepis* (17 ova/ female) and *C. squamosus* (9 ova / female)

Segregation

Depth segregation by maturity stages, obvious in *C. coelolepis*, less noticeable in *C. squamosus*.

Sexual segregation : umbalanced sex ratio male/female in favour of females, twice more numerous than males in catches.

Geographical segregation : inaccessibility of youngest in both species and pregnant females of Leafscale gulper shark in the fishing area-

Asynchronous reproductive cycle. Sampling is biaised as a greater part of the real population is out of reach (smallest specimens, males, and in *C. squamosus*, pregnant females).
Such patterns could precluded actual fluctuations of the entire population.

Several interrogations are still unsolved.

How long cycle is and particulary the pregnancy ?

How many cycle occur in the life ?

The answering to those questions is fondamental for the estimation of turn-over in the exploited population and essential in a long-term management context.