V-IX2

Size and age at first maturity in Horse Mackerel (*Trachurus trachurus* L.) from the Adriatic Sea

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Size and age at first maturity are important characteristics for the assessment of a species under exploitation. The knowledge of these parameters makes possible a rather real evaluation of spawning biomass since they directly affect its reproductive potencial, defining the reproductive life span of individuals.

This paper present the result of studies of variations in mean length and mean age at first maturity in horse mackerel from the Adriatic Sea. This species make up a considerable part of the trawl catch at the eastern Adriatic coast.

The data used cover the 1986-1988 period. Total length (L,cm), weight and sex were recorded. Gonad maturity was determined by macroscopic examination using Macer scale of specific maturation (MACER, 1974). Age was estimated by otoliths reading. Mean age (A_o) and mean length (L_o) at onset of maturity and the reproductive life span (RLS) were calculated by the Lysack formula (TRIPPEL and HARVEY,1987). Length (L_{50}) and age (A_{50}) for 50 % maturity as well as length (L_{95}) and age (A_{95}) at 95 % maturity were taken directly from the maturation curves.

Variation in mean length and mean age (years) at first maturity of horse mackerel for the period 1986-1988 are as follow:

Year	Sex	N	L_o	L_{50}	L_{95}	N	A_o	A_{95}	A_{catch}	RSL
1986	Males	150	19.70	20.84	26.34	61	2.56	5.70	3.44	0.88
	Females	154	19.28	20.22	25.88	72	2.13	5.10	3.23	1.10
1987	Males	155	19.57	21.65	26.50	98	2.82	6.08	4.11	1.29
	Females	134	19.41	21.60	27.15	85	2.68	6.15	3.57	1.08
1988	Males	180	20.60	23.15	27.12	103	2.70	5.88	4.00	1.30
	Females	201	20.66	22.42	26.90	111	2.54	5.05	3.98	1.44

Onset of maturity in males tended to occur at larger sizes and older ages than in females. However, it may be stated that both males and females mature during the third year of age. The complete population reaches maturity not earlier than at five year of age. The transition from all inmature to 100 % mature condition occurred over a 10 cm interval of length and 3 to 4 years of age, for both males and females. The intervals tended also to increase.

When mean length at onset of maturity in males and females is compared to asymptotic length of this species, which was estimated to be 37.55 cm, for 1980-1981 period (ALEGRIA, 1984), it may be concluded that in both sexes the onset of maturity takes place when the specimens attain 52 % of the total length. This suggests that the reproduction strategy is rather late, probably due to the fact that most of energy is expended on the process of fast growth of adolescents.

The values obtained for each separate year of our study show a tendency to slight increase of mean length at first maturity, particularly in females. In relation to the age, however, the variations show no defined trend. The changes observed are probably related to changes of sea water temperature and favourable environmental conditions, which affect genetically defined length and age at onset of maturity. It is known that the increase in length and age at first maturity normally corresponds to years classes hatched at higher population biomass, since under those conditions reaching first maturity takes more time. This can mean that the horse mackerel stock is subexploited in the Adriatic Sea. However, it is uncertain if these were actual trends or due to sampling variability.

In the catch of horse mackerel in the eastern Adriatic, the adolescents up to 2.5 years of age make up 38 %, 41 % are individuals of 3-5 years and the rest are older individuals. On this basis the mean age of catches was estimated. If first maturity occurs when females attain, on average for 1986-1988 period, 2.45 years of age their reproductive life span lasts 1.25 spawning periods. Similar may be stated for males.

In summary, this study has indicated that there has been a trend of slight increase in mean length and age at first maturity of horse mackerel of the Adriatic Sea, resulting in a shorter reproductive life span. However, further data are necessary to determine if this will be continued.

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V-IX3

Oogenesis of *Saurida undosquamis* (Richardson) from the South-Eastern Mediterranean

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The present work deals with egg development in Saurida undosquamis as an example of Indo-Pacific species appeared in the Mediterranean on the fifteens of this century from the Red Sea crossing the Suez Canal and became one of the most important fisheries items. For histological analysis, one hundred ovaries collected during different periods of the year and egg diameter measured. Morphological study of oocytes in the fresh ovaries and relation between them at different phases of development is based on egg diameter measurements.

I was observed that process of oogenesis is divided into two phases, the first is the period of small growth (Protoplasmic) which could be subdivided into a Juvenile phase in which the ovules are represented by small oocytes with diameter 14.0 to 34.0 micron. The membrane is thin, cytoplasm is finely granulated, nucleus is relatively large occupying 60-80% of the egg cell. Eggs are transparent, chromosomes are not clear (phase B). b phase of egg cell with layered follicle in which the diameter of sexual cells ranges from 42-84 micron. The ovule consists of egg membrane and follicular membrane. The first is thin, while the second is double layered. Nucleus occupies about half the ovule diameter (Phase C).

The second period is that of intensive growth (Trophoplasmic), also this period can be subgrouped into three phases : a phase of primary yolk accumulation which is considered as the beginning of vitellogenesis and diameter of the egg cell fluctuates between 84 and 176 micron, yolk granules begin to appear at the periphery of the oocyte in vacuoles and gradually occupy its central part, they are of differnet sizes and have globe shaped form. The nucleus has nearly ovalshape, nucleoli are bigger than in the previous phase. The egg cell is not transparent having light yellow colour (Phase D). b phase of ovules filled with yolk. Diameter of the egg-cell ranges between 179 and 280 micron. The cell membrane is thicked (20-22 micron), cytoplasm is nearly full of yolk granules, nucleus is nearly oval occupying relatively smaller area. Micropyle begins formation at the end of this phase, the nucleus migrates to the animal pole at which there is a unique micropyle, chromosomes are not distinguished. Fresh ovule has bright yellow to orange colour (Phase E). c. Phase of ripe egg, diameter of eggs ranges from 280 to 360 micron, cell membrane becomes more thicker (28 micron). The micropyle is clear and a layer of fibers which may be produced by the follicular cells is found above zona radiate. In this stage, the deposition of yolk is accompanied by its hydration resulting in an increase in size of oocytes and eggs become transparent again. Nucleus is not distinguished. Based on diameter measurements, there are four peaks of diameter oocytes (Phase F). The smallest oocytes with diameter 50-200 micron, transparent and considered as reserve group. Second group of oocytes having diameter 200-450 micron, they are not transparent The third group of oocytes which are in the period of trophoplasmic growth with diameter 450-700 micron, oocytes are light yellow to orange. The fourth group is that of mature and ripe oocytes in which the yolk deposition takes place, having diameter 700-1300 micron, this group is divided into two subgroups, the first comprises eggs at the beginning of yolk deposition (diameter 700-1500 micron). As a result of this process, the eggs become semitransparent. The second subgroup has eggs with diameter 1100-1300 micron. This subgroup is characterized by the end of yolk deposition process and eggs are transparent.

Based on results obtained from histological and morphological studies of gonads and oocytes, the maturity scale for Sauride undosquamis is as follows :

Stage I : Ovaries and oocytes are thin and transparent, sexual cells cannot be visually differentiated, the oldest oocytes are in phase (B).

Stage II : Ovaries are slightly increased but still are colourless and transparent occupying about half the body cavity. The oldest generation of oocytes are in phase (C).

Stage III: Ovaries occupy more than half the body cavity. Oocytes are in the period of trophoplasmic growth having light-yellow to orange colour. The oldest oocytes belong to phases (D and E).

Stage IV : Ovaries occupy about two thirds of the body cavity cloudy translucent eggs of comparatively big diameters appeared. The oldest generations of oocytes are in phase (F).

Stage V : This characterizes the spawning fish in which ovaries attain the maximum size and occupy nearly all the body cavity. Ovaries contain perfectly transparent eggs discharged from follicles.

Stage VI : Fishes discharge eggs. Saurida undosquamis is a partial spawning, therefore the oocytes which will be discharged in the recurrent spawning season grow at different times.

The present study reveals that arsynchronous development of oocytes appears in stage III. After the discharge of the first egg portion, the ovary does not pass to stage VI as in the monocyclic spawning fisk but passes to a stage in which the oocytes are found in a stage similar to stage III, however, this special case of maturity differs from stage III in that the next egg portion has empty follicles and so this stage is considered as VI-III_2. If the fish discharges a second egg portion, so it will pass to stage VI-III_3 and then VI-IV_3. When the fish discharges all portions of eggs, the ovary enters into stage III

V