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OVA AND DEVELOPMENTAL STAGES OF MAENA SMARIS (L.) AND MAENA CHRYSELIS (C. V.)

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OVA AND DEVELOPMENTAL STAGES OF *MAENA SMARIS* (L.) AND *MAENA CHRYSELIS* (C. V.)

by

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During my studies on the biology of *Maena smaris* (L.) — as the most important of non-migrating fish in the fisheries on the Adriatic shore — I happened to make some artificial fertilizations of the species in question. Since these fertilizations have been successful and the correspondent larval stages could be found in the early summer plankton I bring out the results as they may be of use to the planktologist interested in the fish larvae.

Before beginning to describe the larval stages of *Maena smaris* and *Maena chryselis,* I think it opportune to point out that during my former investigation into the morphology and taxonomy of the family of *Maenidae* only three of their representatives could be found in the Adriatic; all the three species were united with the same genus of *Maena* owing to their great similarity, i. e. *Maena maena* L., *Maena chryselis* (C. V.), and *Maena smaris* (L.). It was impossible to group the different Adriatic and probably Mediterranean species of the family of *Maenidae* into two genera as done hitherto, i. e. *Maena-Merolepis* and *Smaris-Spicara.*

Very little is comparatively known with regard to the eggs, larval and postlarval stages of the different species of *Maenidae.* The relating literature is very scanty and consists mainly of a few stray remarks which are imperfect and inadequante with as well as no illustrations. There are, however, to be mentioned Raffaele and Lo Bianco describing in a few lines the ova and larval stages of *Smaris alcedo* Risso and *Smaris Maurii* Risso which species correspond to *Maena chryselis* (C. V.) and *M. smaris* (L.) respectively.

Later on *Fage* in his »Report on the Danish Ocean. Expedition deals with one of the species of the genus *Maena* which very probably should be *Maena maena* L., being the only distinguished species of the ancient genus *Maena* in the Mediterranean.

Montalenti compiled all the data about the development of *Maenidae* up to 1933, unfortunately with a confusing synonymy of *Merolepis* and *Spicara* species. Just before the last war *Sanzo* published his »Uova e larve di *Smaris insidiator* C. V.« dealing with the developmental stages of this strange species that could not be found in the Adriatic, although its close allies *Maena maena, Maena chryselis* and *Maena smaris* are abundant. The absence of *Maena insidiator* in the Adriatic — so far as I have been able to find it out in the relating literature as well as during my own morphological and taxonomical research of *Maenidae* — is very interesting because on the Dalmatian Coast have been found, according to yet unpublished data by my colleague *Dr. Gamulin,* the typical eggs of *Smaris insidiator.* They are pelagic and not demersal as those of the other Mediterranean species of *Maenidae.*

Summing up all the available data we could collect to this very day it results what follows:

SPAWNING TIME

Maena maena L. . . . . June — according to *Lo Bianco* (Bay of Naples).

Maena chryselis (C. V.) . . . . . April-May — according to *Lo Bianco.* (Bay of Naples)

Maena smaris (L.) . . . . . March-May — according to *Lo Bianco* (Bay of Naples).

OVA

Maena chryselis et *smaris* . . . . . Diameter of egg 0.89 x 0.72 mm (acc. to *Lo Bianco* and *Raffaele)*
Diameter of oil globule 0.20 mm (according to *Montalenti).*

LARVAE

Maena chryselis et
M. smaris ..... length 10—14 mm: catching time May-June (*Lo Bianco* — Bay of Naples)
length 10—45 mm: catching time May-August (*Lo Bianco* — Bay of Naples)
Maena sp. ..... length 7—13 mm: catching time June-July (*Fage* — Mediterranean)
Pigmentation (*Fage, Lo Bianco*): one dark chromatophore on the top of the head and some spots along the dorsal and ventral sides of the body; the anus is situated in the first third of the body. The same characteristics are given by *Lo Bianco* for the other two species of *Maenidae*.

M A E N A S M A R I S (L.)

The examined species on the Dalmatian Coast has its spawning time mainly during May. Although the mean-spawning may start sometimes (conditioned to sea temperature) already in April, it finishes on the Dalmatian Coast, as far as I could find during my research, during June.

When the time of spawning approaches a change in the appearance of the fish — the assumption of a bridal dress- has been observed and then a gathering on the localised grounds takes place. The fish congregates on some particular and localised areas, »spawning banks«, known on the Yugoslav Coast as *kotilo*. These selected spots suitable for the deposition of the eggs — the eggs are demersal — consist mainly of sand and shells of Bryozoa, Corals, etc. On such spawning grounds the males gather near the bottom while the females stand above them (Lo Bianco 1909).

The eggs are usualy deposited in masses and fertilized when slowly descending through the under layers where the males are gathered. On the sea bottom the eggs adhere to foreign bodies as shells, rocks, algae or similar where the developement takes place up to the hatching stage (Lo Bianco 1909). Eggs fa-

stened to minute shells were found in the stomachs of the males which eat a great deal of them during spawning.

As there was very little probability of dredging out the deposited eggs from the sea bottom in an undamaged state, I tried to make artificial fertilization—whish easily succeeded. The ripe eggs were deposited on some glass plates where they firmly adhered both to each other and to the surface of the plate because of an adhesive coating with which each egg is furnished when mature. The glass plates with the sticking and fertilized eggs were put into small basins with aered sea water. The development of the eggs adhering to the plates could be easily examined with a binocular.

E g g

The spherical ripe eggs varying in diameter from 0.96 to 1.04 mm. are furnished with a double capsule coated with an adhesive substance which fixes them firmly to each other and to foreign surfaces. The immature eggs are somewhat smaller, 0.80 to 0.90 mm. in diameter, and not quite round; besides they are not provided with adhesive coating. When attached the eggs are somewhat flattened, thus forming an oval body. Each egg is provided with an oil globule of 0.20 mm. in diameter; occasionally two of them may be present. The yolk is homogeneous and yellowish.

The period of incubation is relatively short and lasts from 5 to 7 days in tanks where the temperature is about 5 degrees higher than on the spawning ground, at an approximative depth of 30 m. It is very probable therefore that on the sea bottom the process of segmentation is much slower.

After fertilization the germinal disc divides itself; within a few hours a number of blastomeres appear and soon the elongated shape of the embryo is formed. At a stage of 36 hours of development the embryo has advanced rapidly. The optic vesicles, the elliptical otocysts with the embryonic otoliths, and a quick beating heart on the ventral side between the optic vesicles and the otocysts are well formed. The notochord reaches forward to the otocysts.

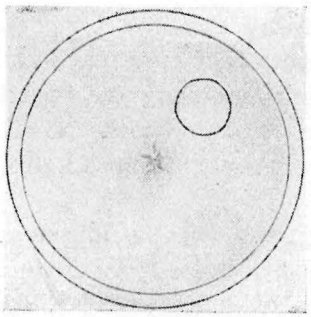

Fig. 1. — Ovum with the micropyle and oil globule.

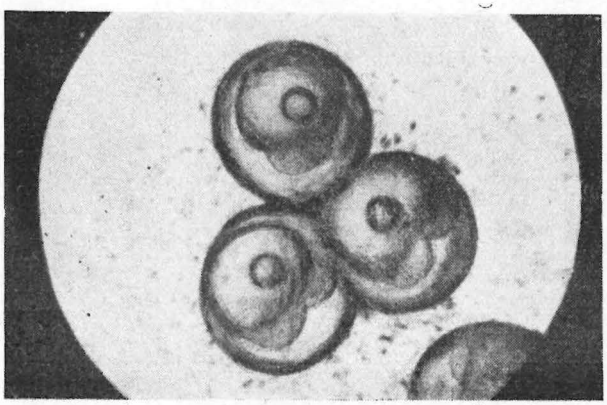

Fig. 2. — Three ova in the two-cells stage adhered firmly to each other. Diametar 1,02 mm.

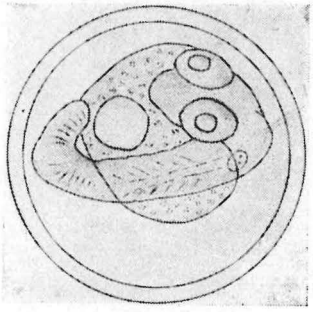

Fig. 3. — Ovum with the already elongated shape of the not yet pigmented embryo; 36 hours after fertilization.

After the third day the first pigmentation occurs. There are black pigment spots branching out in a stellate way on the posterior part of the eyes, along the ventral side of the trunk posterior to the anus, and under the oil-globule. The olfactory pits as well as the embryonic median fin are already distinguishable.

The violent wriggling of the embryos and the more regular pulsations of the heart indicate their advancement and the time for hatching, i. e. from the 5th to the 7th day of developement.

L a r v a

The minute larva measures on its extrusion about 2.30 mm. in length. A new hatched larva, illustrated on fig. 5. measures as follows:

Total length	2.33 mm.
Greatest diameter of the eye	0.28 mm.
Distance head — anus	1.08 mm.
Height behind the anus	
incl. prim. fin.	0.41 mm.
excl. prim. fin.	0.17 mm.
Length of pectoral fin	0.30 mm.

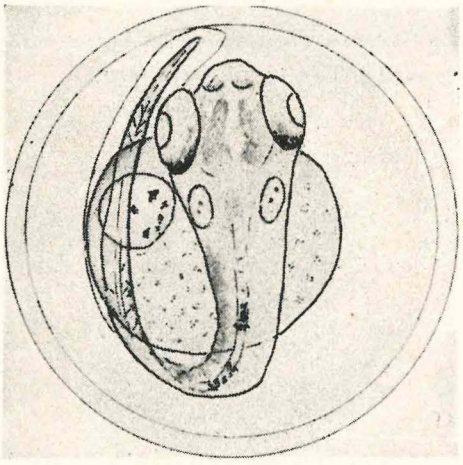

Fig. 4. — Ovum with the already pigmented embryo; 72 hours after fertilization.

The ellipsoidal yolk sac is relatively small, about 0.5 mm. in length and with an oil globule in its anterior part. The mouthless head is flexed downwards. The eyes are completely pigmented with a bright silver hue. The otocysts are situated above the eyes. The trunk is in its anterior part somewhat higher, tapering slightly off towards the tail; it consists of 23 segments already well defined. The primordial fin is well developed round the trunk from the head to the anus. The pectoral fins do not reach the anus. The intestine, which is developed only in its anterior part, opens behind the yolk sac at the first third of the total body length (incl. caudal fin).

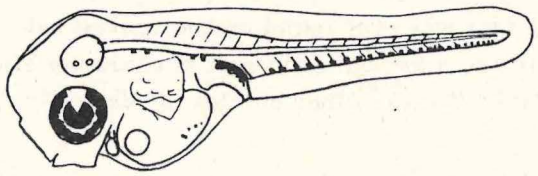

Fig. 5. — A new hatched larva of *Maena smaris*. Length 2.33 mm; without chromatophores on the top of the head.

The pigmentation corresponds with the one shown on fig. 5. All the new hatched larvae are distinguished by the presence of about 30 small chromatophores along the ventral side of the trunk posterior to the anus. The first pigment spots are bigger than the posterior ones disappearing slightly towards the tail. On the dorsal part of the intestine and on the yolk sac some large chromatophores branching in a stellate way are to be found. A black round chromatophore is well visible on the top of the head; occasionaly it is divided into two, very rarely absent. The black chromatophores on the yolk sac are usually surroundel with yellowish pigments.

D e v e l o p m e n t

Shortly after hatching, the larva shows some characteristic changes: the proportions of the body alter, the anus is situated more posteriorly, various cartilages of the skull are formed — the head thus becoming well shaped — the yolk sac diminishes

slowly and disappears during the fifth or seventh day, branchial clefts make their appearance behind the eyes, very fine fibrillar lines appear in the continuous median fin, the otocysts change their position and lie posterior to the eyes. The pigmentation becomes more visible. The number of chromatophores along the ventral side decreases from 30 to about 15. The later 2—5 pigment spots become separated from the others and are situated vetrally of the ural elements as soon as the final rays, formed in the lower region of the tail, push the notochord with the larval tail upwards.

One or two praeanal chromatophores are seldom present. No pigment spot was ever found on the ventral side of the intestine close to the anus, but such spot is characteristic, as it will be shown later, for the other species of *Maenidae*, i. e. *Maena chryselis*.

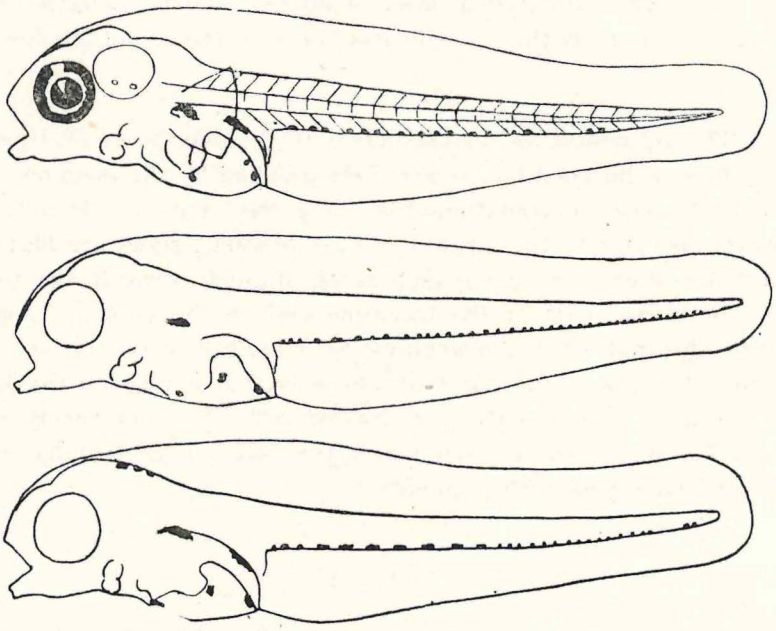

Fig. 6. — Slight variation in the pigmentation of the artificially bred larvae of *Maena smaris*. Length 4.20 mm. Note the position of the praeanal chromatophores.

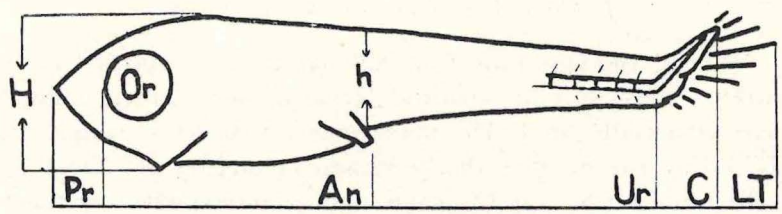

Fig. 7 — Shows the dimensional characteres with the abbreviations:

H . . . maximal height of body,
h . . . height of body behind the anus,
Pr . . . praeorbital space,
Or . . . diametar of eye,
An , . . distance snout-anus
Ur . . . length of body to the urostyl
C . . . length of body excl. caudal fin
Lt . . . length of body incl. caudal fin.

The dimensional characteristic features of the body change in the growing larvae as follows:

	2th day	5th day	6th day
Total length of the body . .	3.00 mm	3.63 mm	3.73 mm
Point of snout to anus . . .	1.15	1.24	1.45
Height of the body behind the anus (excl. fin) . . .	0.21	0.21	0.24
(incl. fin) . . .	0.51	0.51	0.51
Diameter of the eye	0.25	0.27	0.27
Greatest diameter of the otocyst	0.12	0.24	0.24
Length of the pectoral fin . .	0.33	0.42	0.42

After the fifth to the tenth day the larvae in the tanks perish attaining a maximal length of 4.20 mm. I failed, because of technical obstacles, to breed them beyond the point when the yolk sac disappeared.

P l a n k t o n i c s t a g e s

During the spawning time and later on, I captured in the plankton near Split the smallest larval stages corresponding to those artificially bred. The planktonic larvae were caught mainly during the night with the stramin plankton net about one to three miles far from the shore and examined when preserved in 2% formalin. Unfortunately the preserved larvae are of little use for dimensional measurements on account of their shrinkage when preserved or even dead. The artificially bred larvae suffered when dead a shrinkage to 25% (conditioned to their length). The dimensional characters of the preserved planktonic larvae were therefore different from the dimensional characters of non-preserved larvae artificially bred. The difference, however, is mainly due to their dissimilar growth.

The smallest larval stages caught in the plankton during May and June and preserved in formalin (1—2%) measure 3.60 mm. The anus is situated more backwards retaining thus its final position amidst the body, as is the case of the adults. The head becomes bigger, single jaw-bones being distinguished while on the gill cover three or four small spines make their appearance. The air bladder and the first fin rays in the caudal, dorsal, and anal fins are visible. Hippuralia are already well developed and the notochord is bent upwards.

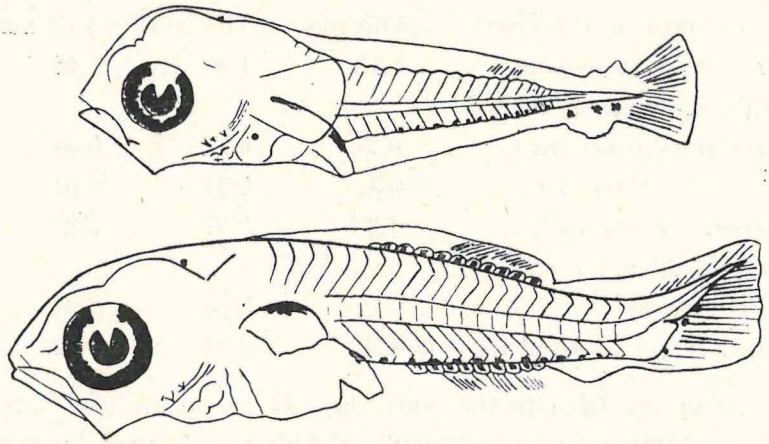

Fig. 8. — *Maena smaris*. Planktonic larva preserved in formol 2%. Length 4.75 mm (above) and 5.80 mm (below) respectively.

The following table shows some dimensional characters of the larvae caught during May and June, and preserved in 2% formol.

Tot. length of body in mm.	5.75	6.96	7.57	8.66	9.10	10.00
Pr	0.36	0.45	0.51	0.54	0.65	0.84
Or	0.90	1.06	1.18	1.30	1.42	1.63
An	2.50	2.87	3.25	3.63	3.81	4.18
Ur	4.84	5.75	6.06	6.81	7.32	8.18
C	5.33	6.36	6.51	7.27	7.90	8.70
H	1.30	1.30	1.60	1.66	1.75	1.87
h	1.03	1.15	1.30	1.45	1.60	1.60

Pigmentation in larval fishes is as a rule of specific value, but it is equally a rule that pigmentation, especially in preserved specimens, must be treated with caution. It seems, however, that pigmentation is a typical feature for the larvae of Maenidae as the only peculiar character to distinguish them among themselves.

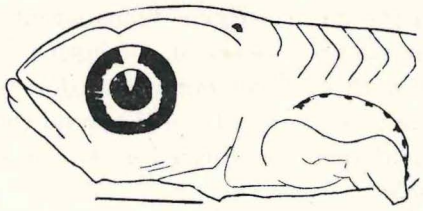

Fig. 9 — *Maena smaris*. Length 9.0 mm. Note the pigmentation dorsal from the air bladder.

Black chromatophores are arranged in a row between the anus and the tail in number of 11—18 (rarely more); the last 2—5 of them are situated ventrally of the hippuralia. As a specific character is to be considered a black chromatophore on the top of the head which is rarely divided into two, and very seldom absent. Two big pigment spots dorsal from the intestine, and the air bladder resp., remain as in the praelarva; often the chromatophores are splitted (Fig. 9). On the ventral side anterior to the anus one or two small pigment spots seldom occur. The ventral side close to the anus is never pigmented, as it is

(see later on) the case with *Maena chryselis*. Pigment is lacking on the dorsal part of the body in the region behind the dorsal fin (see below) although *Fage* reports a pigment spot in this region for *Maena* sp. (very probably *Maena maena* L.)

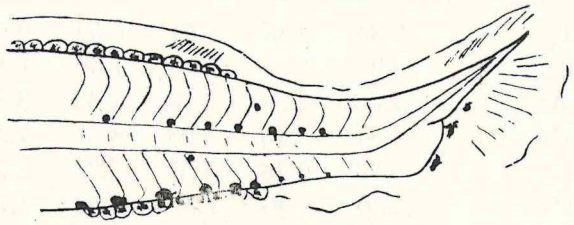

Fig. 10. — The trunk of *Maena smaris et chryselis* with the black chromatophores along the notochord; the covered pigment is visible when the larvae become transparent.

It is worth mentioning some black chromatophores along the dorsal part of the notochord, within the body, which are visible only when the larva becomes transparent (in xylol). This covered pigment which appears at a length over 6 mm is probably destined for the not yet pigmented dorsal part of the body; in sigle cases it is already formed behind the dorsal fin. The mentioned pigment spots are formed in *Maena smaris* as well as in *Maena chryselis*.

M A E N A C H R Y S E L I S (C. V.)

In the planktonic material taken during May-June-July I found together with the larvae of *Maena smaris* a great many specimens of very similar appearance differing slightly but in the pigmentation. Since *Maena chryselis* has the same spawning time as *Maena smaris*, and since there is but a slight morphological difference between them it is very probable that the specimens in question should belong to the former species. In order to separate both the species, and to give a diagnose for them I have made artificial fertilization also with *Maena chryselis*. The fertilized eggs were about to hatch when by accident all of them perished. As I could not obtain more ripe females of *M.*

chryselis I tried therefore a crossing between *Maena smaris* ♀ and *Maena chryselis* ♂. The crossing succeeded easily; about 50% of the fertilized eggs developed regularly while the other half of them perished after forming some blastomeres. The differences which show the artificially bred larvae (*M. smaris* ♀ × *M. chryselis* ♂) in comparison with the pure larvae of *Maena smaris* may be considered as diagnostic features for larvae of *Maena chryselis*.

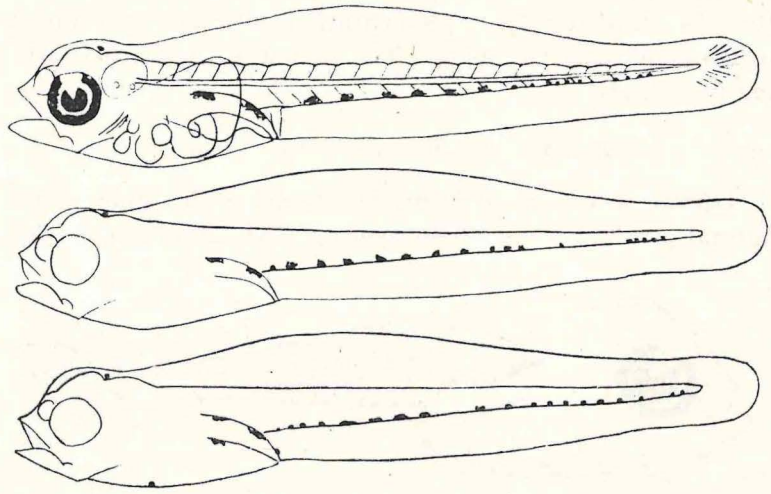

Fig. 11. — Larvae of artificially crossed *Maena smaris* ♀ *M. chryselis* ♂. Note praeanal chromatophores.

The new hatched bastard-larvae although of the same proportions as those of *Maena smaris* are characterized by a different pigmentation. As seen on fig. 11 there are some praeanal chromatophores, the most characteristic of which is the one close to the anus; it is not found in *Maena smaris*. The chromatophore on the top of the head is sometimes present or sometimes absent, and rarely multiplied (three of them were observed). The other arrangement of the pigment agrees with the pigmentation as in *Maena smaris*. All the planktonic larval stages, however, which show the same or very similar features concerning the arrangement of chromatophores, especially the praeanal ones, may be therefore identified as *Maena chryselis*.

Although crossing between *Maena smaris* and *Maena chryselis* may occur in the sea, it is absurd to consider the prevalent mass of larvae with the characteristic praeanal pigmentation as bastards and not as pure *Maena chryselis*.

E g g

Maena chryselis has eggs which resemble in all features *Maena smaris,* viz. the same diameter, oil globule and colour. Development of the embryos is the same as in *Maena smaris:* after the third day first pigmentation, olfactory pits and the median embryonic fin appear. The period of incubation lasts in tank 5—7 days.

P l a n k t o n i c l a r v a e

Larvae of *Maena chryselis* were found in the same plankton material as the former allied species. The larval stages captu-

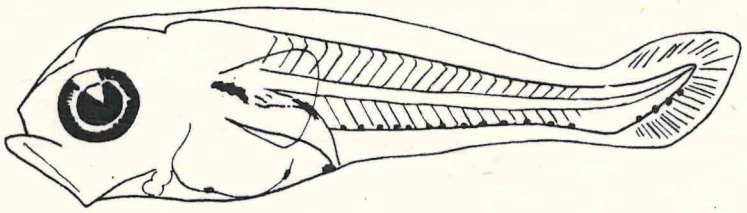

Fig. 12. — *Maena chryselis*. Planktonic larva preserved in formol 2%. Length 3.80 mm.

red in the plankton during May and June measured from 4.80 mm to 9.90 mm. Some dimensional characters taken from this material preserved in formalin (2%) are shown in the following table.

Total length of the body	6.1	6.5	7.6	8.6	9.1	9.8
Pr	0.5	0.6	0.6	0.6	0.7	0.6
Or	1.1	1.1	1.4	1.4	1.5	1.4
An	2.7	3.0	3.6	3.9	4.2	4.4
Ur	4.7	5.3	6.1	6.7	7.3	7.8
C	5.4	5.7	6.5	7.3	7.8	8.3
H	1.3	1.7	1.9	1.9	1.8	1.9
h	1.2	1.3	1.6	1.6	1.5	1.7

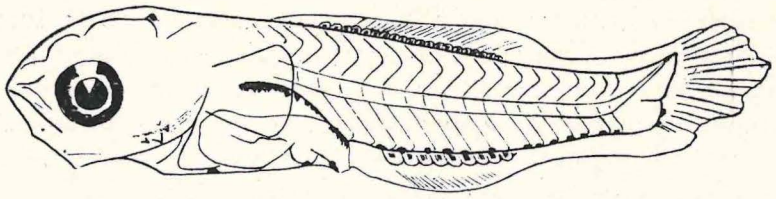

Fig. 13. — *Maena chryselis*. Planktonic larva preserved in formol 2%. Length 7.40 mm.

In comparison with *Maena smaris* there is a somewhat more posterior position of the anus, and a greater height of the body as follows:

Total length	dimensional characters	*Maena smaris*	*Maena chryselis*
	An	3.2	3.6
7.6 mm	H	1.6	1.8
	h	1.3	1.5
8.6 mm	An	3.6	3.9
	H	1.6	1.9
	h	1.4	1.6
9.1 mm	An	3.8	4.2
	H	1.7	1.8
	h	1.6	1.5

The pigmentation as already mentioned is much similar to the one of *Maena smaris:* pigment spots posterior from the anus as well as on the dorsal side of the intestine and air bladder, and on the top of the head. Most important for separating both the species in question is the arrangement of the praeanal pigment spots. From one to four — prevailingly three in number — chromatophores were observed; one of them is always situated close to the anus, which is not the case in *Maena smaris*. On the top of the head is one black chromatophore which may be often absent or sometimes splitted into two or three smaller spots. The number of the postanal chromatophores is not important, varying from 11 to 18. No chromatophores behind the dorsal fin were observed (see above *M. smaris)*.

Summing up the above mentioned characteristic features we may give a practical scheme for a quick diagnosis of both the species in question. It must be pointed out, however, that this scheme cannot be generalized for all the cases being valid only for the majority of larvae of *Maenidae*. We always found a low percentage of cases taking an intermediate position and this makes a diagnosis difficult.

The scheme is valid for specimens up to 10 mm in length and preserved in formalin.

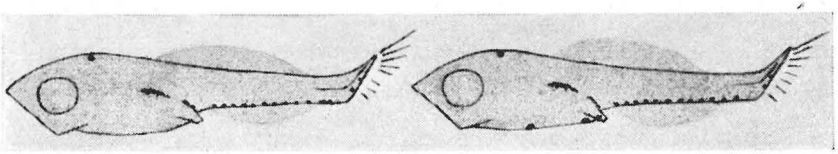

Fig. 14. — Scheme for a quick diagnosis of *Maena smaris* (L.) — left and *Maena chryselis* (C. V.) — right.

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JAJAŠCA I RAZVOJNI STADIJI GIRE OBLICE [*Maena smaris* (L.)] I GIRE OŠTRULJE [*Maena chryselis* (C. V.)

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Kratak sadržaj

U cilju upoznavanja planktonskih larvi gira — naših najvažnijih riba neselica — izvršena je u Institutu za oceanografiju i ribarstvo umjetna oplodnja zrelih jajašaca gire oblice i oštrulje. Oplođenje lako uspijeva, a isto tako i uzgoj novo izvaljenih ličinaka sve do stanja resorpcije žumanjkaste kesice. Razvoj oštrulje bio je, međutim, nesretnim slučajem poremećen, tako da sam bio primoran u pomanjkanju zrelih ženki oštrulja učiniti bastardiranje između zrelih ženki oblice i mužjaka oštrulje. Umjetno dobivene larve ukrštavanjem obih vrsti razlikovale su se bitno od čiste ličinke oblice; na tim razlikama oslanja se uglavnom određivanje planktonskih ličinaka oblice i oštrulje.

Jajašca, larvalni i postlarvalni stadiji gira bili su dosad malo poznati. Nekoliko podataka po tom predmetu koje su nam dali Lo Bianco, Raffaele i Fage sabrao je Montalenti pod nesretnom sinonimijom *Merolepis-Maena i Smaris-Spicara* rod. Sanzo je opisao detaljnije vrstu *Smaris insidiator* koja, izuzevši jednog jedinog nesigurnog podatka, dosada još nije primijećena u Jadranu.

Oblica — *Maena smaris* (L.).

U laboratoriju je dobijanje, oplođivanje i promatranje razvoja oplođenog jajašca oblice vrlo olakšano time što su jajašca demerzna. Prethodno oplođena jajašca pustio sam, da se prilijepe na unutrašnju površinu Petrijevih posuda, koje sam nakon toga metnuo u veće bazene. U pomanjkanju tekuće morske vode, sadržaj bazena sam mijenjao svaki dan. Izvaljene ličinke stavljao sam pomoću pipete svakog dana u svježu morsku vodu koju sam zračio komprimiranim zrakom. Na taj sam način uzgajao

larve sve do resopcije žumanjkaste kesice. Daljnje stadije lovio sam straminskom planktonskom mrežom tokom maja i juna u obalnoj zoni. Naročito podesno vrijeme za lov je noć.

Kratka karakteristika jajašca i ličanaka je slijedeća:

Jajašce varira u promjeru ako je zrelo od 0.96 do 1.04 mm te ima dvostruku membranu sa ljepljivom površinom. Prilijepljeno jaje je nešto ovalno dok je prije toga okruglo. Redovito sadrži po jednu uljnu kapljicu od 0.20 mm promjera; rjeđe ima tih kapljica više. Žumance je homogeno te nešto žućkasto.

Vrijeme inkubacije traje pet do sedam dana u bazenu gdje je bila temperatura za pet stupnjeva viša nego u prirodi. Poslije 36 sati razvića, embrijo je već dobro formiran. Prva prigmentacija pojavljuje se nakon trećeg dana razvića: male zvjezdaste hromatofore uzduž ventralne strane tijela i crni pigmenat u stražnjem dijelu očiju. U to doba se pojavljuju olfaktorične jamice te embrionalna peraja.

Izležene larve mjere oko 2.30 mm. Proporcije tijela date su na str. 8. Karakteristična je pigmentacija. Sve larve posjeduju do oko 30 malih crnih postanalnih hromatofora. Prve od tih su nešto veće od zadnjih. Dorzalno od crijeva i žumanjkaste kesice nalazi se nekoliko većih zvijezdica tamnog pigmenta. Na dorzalnoj strani glave smješten je mali crni hromatofor; rijetko je podijeljen u dva ili izostaje. Ponekad se pojavljuju manji hromatofori na samoj žumanjkastoj kesici.

Tokom razvoja sve do nestanka žumankaste vrećice kao i kasnije mijenjaju se tjelesne proporcije i poredaj hromatofora. Glava zadobije normalnu formu, otociste se smjeste iza očiju, polako se formiraju usta i škržni otvori. Broj postanalnih hromatofora se smanji otprilike na polovicu; posljednjih 2—5 se izdvoji i smjesti ispod hipuralnih elemenata čim se ovi formiraju.Predanalni hromatofori, jedan do dva po broju, se vrlo rijetko pojavljuju i to nikad sasma uz crijevo. Mijenjanje tjelesnih proporcija pokazuje nam tabela na str. . . .

Planktonske larve gire oblice prepoznajemo po tipičnoj pigmentaciji praelarve: oko 15 postanalnih, jedna dorzokranialna i nekoliko hromatofora dorzalno od crijeva i zračnog mjehura. Glede predanalnih hromatofora važi isto što i za praelarvu; u većini slučajeva je ventralna strana od anusa do njuške nepig-

mentovana. Posljednjih nekoliko postanalnih hromatofora leži izdvojeno ispod hipuralnih kostiju.

Najmanji planktonski stadiji mjerili su 3.60 mm, najveći 10.00 mm. Važan je omjer između tjelesne dužine te udaljenosti anusa od glave: Udaljenost *An* iznosi prosječno 48% tjelesne dužine bez repne peraje.

Oštrulja — *Maena chryselis* (C. V.).

Jajašce je sasma slično po obliku i veličini jajašcu oblice. Razvoj embrija i pigmentacija se u mnogočemu podudaraju sa prvom vrstom. Križanci, kako je već u početku spomenuto, razlikuju se bitno od čiste oblice po pigmentaciji. Na slici 11 je prikazan tipičan raspored hromatofora kod križanaca. Tipični su predanalni hromatofori, naročito pigment uz sam anus sa ventralne strane crijeva. Taj pigment nije se nikad pojavio kod oblice, pa je stoga izveden zaključak, da kod ukrštavanja potječe od oštrulje. U planktonu, međutim, bilo je stvarno ulovljeno mnoštvo ličinaka, koje su jako sličile oblici sa razlikom, da su posjedovale tipičnu predanalnu pigmentaciju značajnu za križance oblica ♀ × oštrulja ♂. Osim tipične predanalne pigmentacije vidimo, da se kod oštrulje ne pojavljuje uvijek dorzokranialni hromatofor već u mnogo slučajeva izostaju. I za križance je to svojstvo tipično. Anus je kod oštrulje smješten nešto više unatrag, nego je to slučaj za oblicu; ta udaljenost iznosi prosječno preko 50% tjelesne dužine.

Spomenuti moram još nekoliko crnih hromatofora uzduž same kičme, koje postanu vidljive kad učinimo larvu prozirnom (u xylolu, vidi sliku 10). Spomenuti pigment, koji je prekriven mišićima pojavljuje se tek, kad larva naraste bar preko 6 mm; vjerojatno je namijenjen dorzalnoj strani tijela kad larva naraste. Ta pigmentacija se pojavljuje i kod oblice.

Na kraju dodajem praktičnu shemu za brzo razlikovanje oblice od oštrulje. Napomenuti moram, da se ta shema ne može generalizirati za sve slučajeve već važi samo za pretežnu većinu larva iz naših vrsta gira. Vjerojatno je da ima i u prirodi križanje između oblice i oštrulje, što će razlikovanje larvi gira jako oteščati.

Tisak: Gradsko štamparsko poduzeće „Ante Jonić" — Split