*Acta Adriat., 21 (2): 137—150 (1980)*

YU ISSN: 0001 - 5113
AADRAY

# TEMPORAL DISTRIBUTION OF YOUNG MUGILIDS (MUGILIDAE) IN THE COASTAL WATERS OF THE CENTRAL EASTERN ADRIATIC

## VREMENSKA DISTRIBUCIJA CIPALA (MUGILIDAE) U PRIOBALJU ISTOČNE OBALE SREDNJEG JADRANA

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The occurrence of juvenile mullet species as well as their temporal distribution are observed at 3 stations along the eastern coast of the central Adriatic. Five species are identified: *M. cephalus cephalus, Liza (Liza) ramada, Liza (Liza) aurata, Chelon labrosus* and *Liza (Protomugil) saliens.*

Proportion of presence (in percentages) of each individual species, their distribution and length structure are primarily dependent on the time of spawning of each species and on the influence of environmental factors on these stages. Generally speaking, the time of occurrence of juvenile of the above mentioned species of Mugilidae along the eastern coast of the central Adriatic is similar to that reported for the waters of the eastern Mediterranean.

## INTRODUCTION

Whereas the investigations of the adult stages of the Adriatic mullet species have been carried out on some few occasions (Drecum, 1956; Morović, 1953, 1957, 1961; Šoljan, 1965), no work has embraced the ecology of their juveniles. However, with respect to the potential significance which the grey mullet may have in mariculture, the investigations into their juvenile stages should be given more and more attention. Thus, the initial step in sheltered coves and estuaries, their occurrence and seasonal distribution in establish the time of occurrence of their juveniles, their qualitative-quantitative composition as well as their seasonal distribution in the coastal waters. Since the investigations have so far been directed to the studies of juveniles in sheltered coves and estuaries, their occurrence and seasonal distribution in rivers, i. e. fresh waters should be studied.

As reported in the literature the Mugilidae family includes 75 species, of which only 6 are known in the Adriatic (Šoljan, 1965). After Morović (1961) their presence in percentages in the commercial catches is as follows: *Mugil cephalus cephalus* Linnaeus (Syn. *M. cephalus* Linnaeus) — 33,8%, *Chelon labrosus* (Risso) (Syn. *M. chelo* Cuvier) — 24,8%, *Liza (Liza)*

*ramada* (Risso) (Syn. *M. capito* Cuvier) — 14,3‰, *Liza (Liza) aurata* (Risso) (Syn. *M. auratus* Risso) — 13,6‰ *Liza (Protomugil) saliens* Risso (Syn. *M. saliens* Risso) — 12,8‰ and *Oedalechilus labeo* (Cuvier) (Syn. *M. labeo* Cuvier) with only 0,7‰.

The grey mullet are known to spawn in the sea. When they reach juvenile stage, immediatly upon the completion of metamporphosis, they commonly migrate to the coastal waters, including estuaries and rivers. The only exception is *Oedalechilus labeo* which the whole of their life cycle live further offshore (Bograd, 1961). This was proved by our studies, as well. Namely, no specimen of this species was recorded from our catches. Therefore, this species is not included in this paper. Individual species proved to be predominant in different seasons and in selected localities. This depends on the spawning period of each of the species as well as on their preference for different environmental conditions.

This paper is an attempt to establish for the first time the temporal distribution and the time of occurrence of juvenile Mugilidae in esturies and sheltered coves of the central Adriatic.

## 1. STUDY AREA

Juvenile mullet specimens were collected from three stations in the central Adriatic, each of them displaying different ecological properties (Fig. 1).

Station 1 is located in the mouth of the small river Pantan. Depth does not exceed 1 m, the bottom is muddy and covered by algae. Salinity varies from 3—15‰, and temperature from 13—20°C.

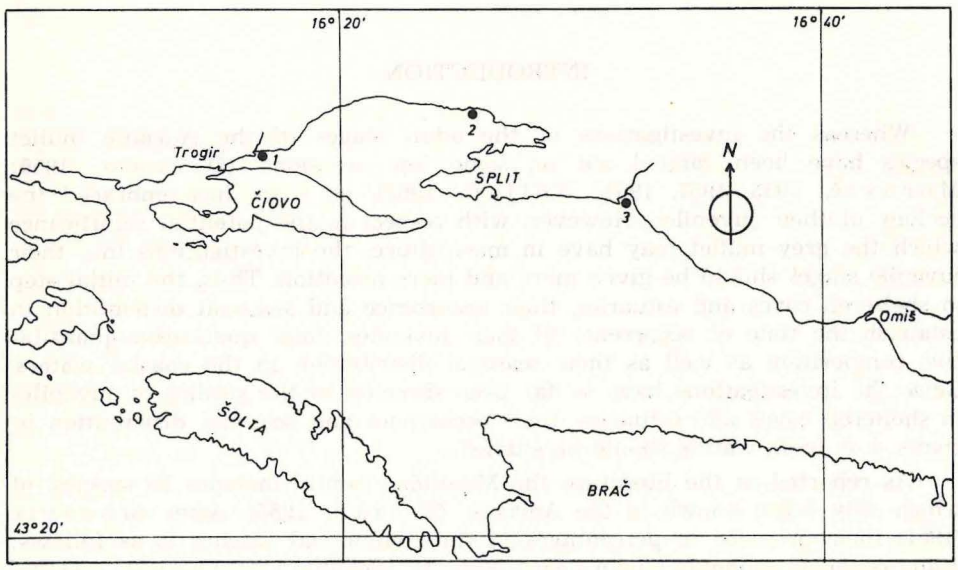



Fig. 1 Chart of the smapling stations

Station 2 is located in a sheltered cove of the Kaštela Bay, rather intensively polluted. The bottom is partly covered by the thick black mud. Depth is 30—80 cm. Owing to the submarine fresh water, springs salinity is somewhat lowen, ranging between 27 and 35‰. Temperatures are similar to the mean temperatures of the Kaštela Bay with maximum in August (25°C) and the temperature of 12,5°C was recorded in December.

Station 3 is located about 100 metres eastward from the mouth of Žrnovnica River. Hydrological properties of this station are most directly influenced by the tidal changes. Depth does not exceed 50 cm. Sandy bottom is on some places covered by marine phanerogams.

## 2. MATERIAL AND METHODS

Small coastal trawl net of 15 m in length was used for the catch of juveniles. It consists of two parts: outer wings of 8 mm mesh size, and the central sack of 5 mm mesh size. Samples were taken from each station twice in a month's period, between March 1978 and November 1979. Due to some difficulties no samplings were carried out in Jannuary and February 1979. Samples were preserved in 4% formalin. In the case of less than 50 specimens of each species, all the individuals were worked out. Length was measured to the nearest milimetre. Fish were placed in one centimetre length groups. Mean length was calculated for each of the length groups.

The net used proved to be unifit for the catch of fish exceeding 100 mm, capable of escaping it, as well as for the smallest fish (below 20 mm in total length) which easily pas through the meshes. The biggest fish caught by this net was of 245 mm total length, and the smallest specimen measured 16 mm.

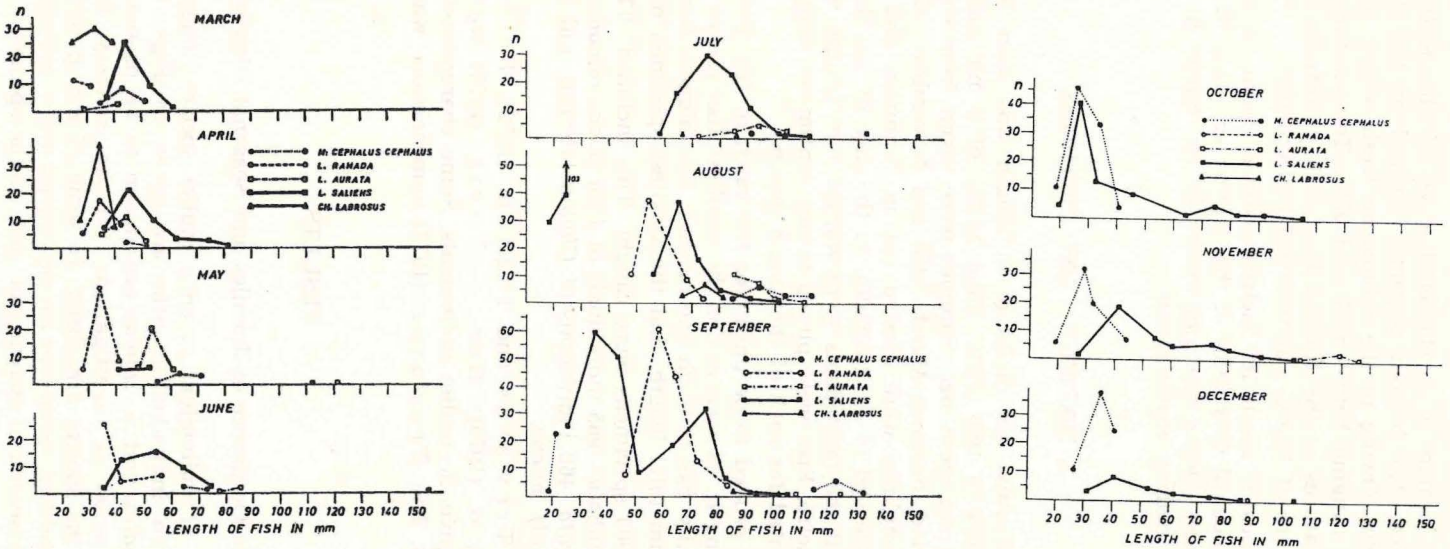
A total of 4,965 specimens were caught. This included: 935 individuals of *Mugil cephalus cephalus,* 965 individuals of *Liza (Liza) ramada,* 298 individuals of *Liza (Liza) aurata,* 468 individuals of *Chelon labrosus* and 2,324 individuals of *Liza (Protomugil) saliens.*

The keys of Trewavas and Ingham (1972); Perlmutter *et al.* (1957); Farrugio (1975); Ben — Tuvia (1975) were used for the identification of juvenile mullet individuals. Some characteristics we observed were also applied. The Trewavas (1973) nomenclature was used.

## 3. RESULTS

### 3.1. The Occurence of Jueniles and Seasonal Distribution

The presence of individiual juvenile mullet species, length structure and their occurrence in individual months are given in Figs. 2a, 2b, and 2c. *M. cephalus cephalus* and *L. saliens* are shown to be present in the catches throughout the period of investigations. On the contrary, even though not rare, the rest of the species are absent in some of the months. Frequency of occurrence of individual species in catches varies from one month to another. This is due to the season of spawing of each of the species.




Figs. 2a, 2b and 2c Length structure of juvenile mullet species given as the mean number for all the stitions

### 3.1.1. *Mugil cephalus cephalus* Linnaeus, 1758

This species accounts for the 18,7% in the total composition of juvenile mullet throughout the period of studies. The most significant proportion of this species, 78%, was recorded in December. The percentage values were somewhat lower in November (56,4%) and October (53%). The first occurrence of juveniles was noted in September with the size range between 18 and 26 mm. This, at the same time, represents the new generation. Individuals of the preceeding year class were present in the same catches. Teir size ranged from 113 to 133 mm (Fig. 2b). Individuals of 18 mm in length were also recorded in October and November. They are, in fact, the juveniles of the current spawning season. During the winter months, from December on, a continuous increase in minimum total body lengths was recorded; 33 mm in December and 46 mm in March. This is indicative of the end of the period of migration. Temporarily caught relatively greater individuals are not sufficinetly representative of the actual growth in the course of one year. Mean total length of the individuals of one year of age was 130 mm. This agrees with the length of fish during their first year of life measured in older individuals. Thus, Morović (1961) gave the male length of 127 mm, and female length of 148 mm for the first year of life, with a mean of 135 mm, or the area of the former fish pond »Pantan«.

During the spawning season the specimens of this species of 18 to 22 mm in length are very rare or are completely absent at P-2. However, they sometimes make up more than 90% of the cathes in the estuaries. Even though the presence of juveniles is significant from September to as late as December, maximum number seems to occur in October. Thus, we caught 450 specimens of 21—27 mm by only one haul in the vicinity of the mouth of Žrnovnica on 8 October 1979, and only 12 individuals 100 m off the mouth. No individual of this species was recorded from the hauls carried out at localities where salinity exceeded 30‰. However, juveniles of *L. saliens* were predominant there.

### 3.1.2. *Liza (Liza) ramada* (Risso, 1826)

This species made up 19,3% of the total composition of juveniles of mullet during the period of investigations. The largest number of individuals, with the mean total body length 30 mm, was caught at the mouth of Pantan in the spring months. Only single specimens were found at localities far from the fresh water origins. Since the catches from January and February are not available, we could not say the exact time of the first occurrence of this species juveniles. Namely, the mean total body length was 26 mm in March, with the range 23 to 32 mm (Fig. 2a).

In April and May, minimum total body lengths varied from 20 to 28 mm. During the summer months a continuous increase in the total body length was recorded. In September they reached 63 mm with the range 44 to 92 mm. Judging from the length structure of juveniles and minimum body length, the season of juvenile migrations to the coastal waters was concluded to extend over some few months, probably ending in April. The juveniles of this species keep at selected localities for the major part of the year. Thus, the largest number of individuals of *L. ramada,* of the mean length of about 60 mm, was recorded from the mouth of the small river Pantan and in the

vicinity of the mouth of Žrnovnica, just in August an September. On 18 August 1979 this species constituted more than 80% of the catches relized from the sheltered cove of the Kaštela Bay, close to Station 1 which is strongly affected by the fresh waters. Somewhat later, upon the high tide and the inflow of the sea water, *L. saliens* accounted for more than 90% of the collected juveniles.

### 3.1.3. *Liza (Liza) aurata* (Risso, 1980)

The earliest occurrence of juveniles of this species was not recorded, since in March the smallest individuals were already 29 mm in length. The mean total body length of individuals was 36 mm. This value slightly exceeds that recorder for the *L. ramada* species at that time. This species constituted only 5,9% of the total composition of juveniles of mullet. The largest number of individuals was caught in the sheltered cove P-2 what indicates the reduced tolerance of this species to the reduced salinity.

In April and May the minimum body lengths of individuals were 35 and 45 mm respectively, giving the respective means of 39 and 54 mm. In these months the juveniles of this species constitute 12,3 and 31,4% respectively of the total quantitative composition of juvenile mullet. This species occurs most frequently in catches together with *Ch. labrosus* and *L. saliens*. Later on, the total body length of the caught individuals was 67 mm in June, 86 mm in July, 91 mm in August and 118 mm in September, to reach 120 mm in November. These data are indicative of the relatively quick growth rate of this species under natural conditions.

### 3.1.4. *Chelon labrosus* (Risso, 1826)

Juveniles of this species are continuously present in catches during March and April. Only single individuals were found in the samples collected from July to September. This species makes up only 9,4% of the total composition of juvenile mullet. The largest number of individuals was recorded from P-2 in the spring months. In March, this species accounted for the 72,9% of the catch realized from this station. The mean total length was 25 mm, with the range 16—39 mm. In April, the proportion of presence of this species in the catch from the same station was reduced to 46% while the mean length increased to 31 mm. This species is very rare at P-3 and completely absent at P-1. These data are indicative of the prefence of this species for the waters of somewhat higer salinity. The mean total body length was 93 mm in September. From that time on, in October, November and December, there was not recorded any individual of this species (Figs. 2b, 2c).

### 3.1.5. *Liza (Protomugil) saliens* (Risso, 1810)

This species made up 46,7% of the total composition of juvenile mullet throughout the penied of investigations. First occurrence of juveniles of this species was recorded from the coastal area in the first half of August. Size of individuals varied from 18 to 26 mm in that period. Specimens of the preceeding year class were present in the same catches.

From November on, at the end of the period of migration, the continuous increase in the total body length of the youngest individuals was noted. Minimum lengths recorded in this period were: 32 mm in December, 35 mm

in March, 36 mm in April and 40 mm in May. Juveniles between 35 and 40 mm in the total body length found in late spring are likely to be the individuals of the lagged spawning from the preceeding year. They did not show any significant growth increment due to the unfavourabe environmental conditions during the winter months. As it is evident from the Fig. 2a, two completely separate populations of this species were present in August. The mean body length of new juveniles was 21 mm, while the mean length of the preseeding year class was 78 mm. From August on, it was observed that the smallest length groups of the both year classes were very close as their size, and later on they were completely mixed.

### 3.2. *The Time of Mugilidae Spawning*

The determination of the exact time of spawning of individual fish species is of interest not only for science but for the practice, as well. Firts of all, this is of importance for the protection of fish stock during the spawning season and for the collection of juveniles of commercially important species for the purpose of artificail rearing.

With respect to the time when juveniles of different mullet species enter the coastal waters and estuaries, it may be concluded that these different species spawn in different seasons. It may be assumed that the spawning of each individual species takes place a month or maximum two prior to the first occurrence of the smallest individuals. Thus, A n d e r s o n, (1958) assumes that under natural conditions *M. cephalus cephalus* reach the length of 20 mm in 3 or 4 weeks.

All the data available up to now refering to the spawning season of the Adriatic Mugilidae have been based upon the occurrence of sexually mature individuals and the analysis of their gonads. However, as far as these data are concerned there is a rather significant disagreement between different authors. We are going to try to determine the probable spawning period of individual Mugilidae species on the basis of the time of occurrence of the smallest individuals.

The first occurrence of juveniles of *M. cephalus cephalus* was recorded from P-3 at the beginning of September. The total body length of individuals ranged from 18 to 26 mm in that period (Table 1). This may be indicative of the fact that the spawning season of this species begins already in July or August. Specimens of 18 mm were, as a rule, recorded from the catches of October and November. Therefore, it is evident that the spawning season extends over 2 to 3 months.

The total body length of *L. ramada* varied from 23 to 32 mm in March. It may be assumed that juveniles of this species occurred considerably earlier, probably in February or even January, when sampling was not carried out. In March, the youngest specimens of *L. aurata* and *Ch. labrosus* occurred in the same catches. They showed similar length composition which indicates that the spawning of all these species probably takes place contemporaneously. However, to establish more precisely the spawning time of these species the catches from January and February will be indispensable.

The first occurrence of the smallest individuals of *L. saliens* was recorded at the beginning of August. Their size ranged from 18 to 26 mm (Tab. 1). Presence of this species individuals not exceeding 20 mm in the total body

Table 1 Mean total body length and length range of the mullet species caught from three stations along the eastern coast of the central Adriatic (Total length given in mm)

| Month / Species | I* | II* | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *M. cephalus cephalus* | | | 46(32—52) | 49(39—58) | 60(55—73) | 70(60—71) | 98(80—102) | 97(83—112) | 22(18—26)<br>113—133 | 23(18—36) | 25(18—39) | 33(24—42) |
| *L. ramada* | | | 26(23—32) | 28(20—42) | 35(28—43) | 41(34—57) | 0 | 57(48—68) | 63(44—92) | 0 | 0 | 88 |
| *L. aurata* | | | 36(39—41) | 39(35—53) | 54(46—63) | 67(65—73) | 86(73—105) | 91(82—111) | 0 | 0 | 0 | 0 |
| *Ch. labrosus* | | | 25(16—39) | 31(21—42) | 0 | 0 | 78(67—87) | 75(60—84) | 93(85—102) | 0 | 0 | 0 |
| *L. saliens* | | | 46(35—60) | 47(36—82) | 44(40—54) | 56(35—74)<br>150—245 | 79(59—136) | 21(18—26)<br>78(55—131) | 33(18—49)<br>77(60—105) | 36(19—51) | 49(26—60) | 40(32—85) |

* No samples were taken in January and February

length was observed until November. During the migration of juveniles of this species, the shallow sheltered coves and isolated small pools, where the temperatures exceed 30°C are almost exclusively inhabited by the species *L. saliens*. On the basis of everything that has been mentioned above, it may be assumed that the spawning of this species extends over 3 to 4 months, probably beginning in June.

## 4. DISCUSSION

Juvenile mullets collected from three stations in the central Adriatic form March 1978 to November 1979 show considerable differences in qualitative--quantitative composition from one month to another (Fig. 3). Therefore, it

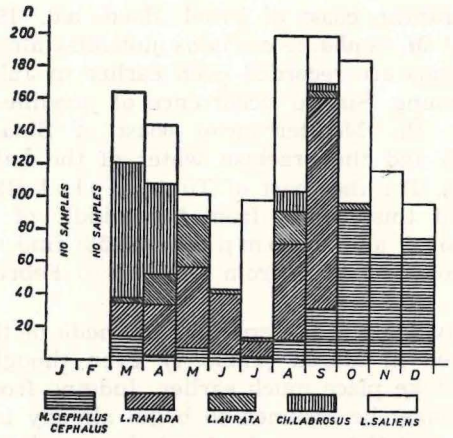



Fig. 3 Mean number of specimens per haul in the March 1978—November 1979 period (Total number is the mean for all the stations)

is sometimes rather difficult to distinguish the smallest individuals only on the basis of their morphological characteristics, particularly in the spring months when the mixed populations of several species of juvenile mullet of similar length structure occur in samples. The only exception is *M. cephalus cephalus* which is easily identifiable due to the markedly silver body colour and relatively big head in relation to the body, as well as to the adipose eye-lid in specimens exceeding 40 mm. An approximate knowledge of the season of spawning makes also easier the determination of species. Thus, for example, the specimens below 30 mm found in the spring months cannot belong either to the *L. saliens* which spawns in the summer month or to the *M. cephalus cephalus* which spawns somewhat later. However, the juveniles of the other three species *L. ramada*, *L. aurata* and *Ch. labrosus)* occur almost contemporaneously. *Ch. labrosus* is characterised by a rather marked pigmentation all over the body. When it is doubtful to which species some of the individuals belong they should be opened. Thus, on

the basis of the liver shape and the number and shape of piloric extensions it may be said with precison to which of the species the respective specimen belongs.

After Morović (1961) who worked in the area of Pantan, spawning of the *M. cephalus cephalus* starts in Juhy and reaches its maximum at the middle of August. However, Brunelli (1916) reports the September—December to be the period of spawning of this species in the Venetian Lagoon. We recorded the first occurrence of this species juveniles in the coastal waters in September Their mean body length was 22 mm. This proves that what Morović stated that this species most probably spawned in July and August. However, Graeffe (1888) finds this species to spawn in the Gulf of Triest as late as February. It was noted that the juveniles of this species of less than 20 mm in length occurred in the mouths of rivers up to December what shows that the spawning of this species lasts for several months.

For the Mediterranean coast of Israel Bograd, 1961, reports the first regular occurrence of *M. cephalus cephalus* juveniles already in August, even though some individuals are recorded even earlier in July, as a result of the unusually early spawning. Similar occurrence of juveniles is reported for the Bardawil Lagoon — the Mediterranean coast of Sinai (Zismann and Ben-Tuvia, 1974) and the brackish water of the Lake Edku UAR (El-Zarka *et al.*, 1970). For the coast of Tunis, Heldt (1948) records sexually mature individuals of this species from the middle of August till the end of September. Arnold and Thompson (1958) find this species to spawn along the Atlantic coast of USA from October to February with maximum in December.

The smallest individuals of the species *L. ramada* of the mean total length 26 mm were observed in March (Table 1), even though the occurrence of juveniles is likely to take place much earlier. Judging from the length ranges, the spawning season may be assumed to begin already in December and last through-out January and February. In April the length of this ssecies individuals ranges from 28 to 42 mm, and in May from 29 to 43 mm. This indicates that the population is on longer renewed with the new juveniles. On the basis of caught adult individuals Morović (1961) records the sexual maturity of this species in December. Bograd (1961) finds the first occurrence of this species juveniles in estuaries during January suggesting, at the same time, the spawning season to cover November and December. El Zarka *et al.* (1970) reports the first occurrence of juveniles from January to May, with maximum in March.

Juveniles of *L. aurata* reach the mean total length of 36 mm (range 29—41 mm) in March. This is indicative of that the spawning season takes place at time similar to that of the preceeding species, or even somewhat earlier. Spawning of this species begins in Tunis in September and lasts till the end of October (Heldt, 1948). Bograd (1961) records the first occurrence of juveniles of *L. aurata* at the end of January, i.e. at the same time or somewhat later than it was recorded for the species *L. ramada.*

Juveniles of *Ch. labrosus* were recorded from the catches of March. Their mean total length was 25 mm with the range 16—39 mm (Table 1). The spawning of this species takes place approximately at the time when *L. ramada* and *L. aurata* species spawn, or only somewhat later. Morović, (1963) finds

this species to be fully sexually mature in January and February. In Israel, this species spawns somewhat later, i.e. in February and March (B o g r a d, 1961) and in Tunis from December to the end of January (H e l d t, 1948).

The period in which the juveniles of *L. saliens* of 20 mm in length occur lasts for almost 4 months, with the beginning in July. The spawning time may, thus, also be held to be prolongated. On 15 June 1979 we caught two sexually mature individuals: a female (Lt = 245 mm, W = 110 g) and a male (Lt = 155 mm, W = 25 g) close to the mouth of the Žrnovnica River (P-3). They excreted milt or eggs by the slight pressure. Therefore, it may be assumed that the spawning season of *L. saliens* begins in June or perhaps in May, extending over the succeeding summer months. The data on the spawning period of this species in the Adriatic are very poor. B r u n e l l i (1916) shows that this period is rather long and that the exact time may not be established. B o g r a d (1961) records regular occurrence of juveniles in Israel from June on through the succeeding five months and assumes that the spawning of this species lasts from April to July.

With respect to the numerousness of the mullet juveniles at individual localities, it is obvious that different species prefer quite different habitats. Even though individual specimens of the species *M. cephalus cephalus* and *L. ramada* are found all along the coast, their preference for the localities under the stronger influence of fresh water is obvious. This is proved by thier successful rearing in the fresh water ponds of Israel (P e r l m u t t e r *et al.*, 1957). *L. saliens* occurs frequently in the catches with two preeceding species. However, the largest number of individuahs of this species was caught in the shallow sheltered coves with brackish water. Two other species, *L. aurata* and *Ch. labrosus* mainly keep at localities with the more marked maritime properties.

## CONCLUSIONS

In the March 1978 — November 1979 period (with the exception of January and February 1979) juvenile mullet species were sampled on monthly basis at three stations along the eastern Adriatic coast. Five species of juvenile mullet were fonud to enter the coastal area immediately upon their spawning: *M. cephalus cephalus, L. ramada, L. aurata, Ch. labrosus* and *L. saliens.*

The smallest individuals of *M. cephalus cephalus,* of 18—26 mm in length, occur at the mouths of rivers in the first half of September. Migration season extends to October and November. Afterwards the renewal of population by the new juveniles ceases. Juveniles of *L. ramada* and *L. aurata* are recorded in March, even though it may be concluded, owing to their length structure, that the first occurrence takes place even earlier. During March juveniles of *Ch. labrosus,* the minimum body length of which is only 16 mm, occur in the catches together with these two species. The first occurrence of juvenile *L. saliens* of less than 20 mm in length, is recorded in August when the shallow sheltered coves with relatively high temperature, are simply crowded with the individuals of this species. From August on to as late as November, a continuous renewal of population takes place.

With respect to the time of the first occurrence of juvenile stages in the coastal waters, the spawning season of these species may be concluded to

take place in different parts of the year, probably a month or two earlier than they are noted to occur as earliest specimens. Generally speaking, *L. ramada* and *L. aurata* spawn during the winter months, and their juveniles may be expected in early spring. Spawning of *Ch. labrosus* takes place approximately contemporaneously or somewhat later than does that of the two preceeding species. On the contrary, *L. saliens* spawns in the first summer months, while the spawning and the occurrence of *Mugil cephalus cephalus* are recorded at the end of summer and at the beginning of autumn. It was observed that the migration of juveniles extends most frequently over some few months. Therefore, the spawning season is very likely to extend over a longer period.

Having consideration to the qualitative-quantitative composition of juvenile mullet species at individual localities, it may be concluded that different species prefer quite different ecological conditions. *M. cephalus cephalus* and *L. ramada* are predominant in the mouths of rivers what proves their tolerance of freshened waters. *L. saliens* prefers shallow sheltered coves with brackish water, while *L. aurata* and *Ch. labrosus* are least tolerant to fresh water.

Proportion of presence (in percentages) of different juvenile mullet species in the catches is primarily dependent on the locality at which the respective catches were realized and on the spawning season of each individual species. In total, *L. saliens* was most numerous throughout the period of investigations making up 46.7%, *L. ramada* comes next with 19.4%, followed by *M. cephalus cephalus* with 18.7%, *Ch. labrosus* 9.4% and at last *L. aurata* with only 5.9%. It is very likely that the proportion of presence of these species would at other localities and under different environmental conditions, show another relations. Thus, their distribution in rivers, which are known to be the habitats of the juvenile stages of mullet, remains an open question. Samplings will be continued both on these and on other localities. It is to be expected that any new data will add much to the problems only touched here.

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Received: September 22, 1980.

# VREMENSKA DISTRIBUCIJA MLAĐI CIPALA (MUGILIDAE) U PRIOBALJU ISTOČNE OBALE SREDNJEG JADRANA

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## KRATAK SADRŽAJ

U radu se iznose rezultati istraživanja pojave mlađi cipla i njihove vremenske distribucije na tri postaje istočne obale srednjeg Jadrana. Istraživanja su obuhvatila period od marta 1978. do novembra 1979. s ciljem doprinosa boljem poznavanju ekologije mlađi mugilida.

Od ukupno šest vrsta poznatih za Jadran, pet predstavnika njihove mlađi zalazi u priobalne vode. Svrstani po procentualnom učešću u lovinama tokom cijelog perioda istraživanja *L. saliens* je na prvom mjestu, a zatim slijede *L. ramade, M. cephalus cephalus, Ch. labrosus* i na posljednjem mjestu *L. aurata.* Nijedan primjerak vrste *O. labeo* nije zabilježen u našim lovinama.

Na osnovu analize dužinskog sastava cipalske mlađi, te vremena prve pojave najmanjih primjeraka pokušala se utvrditi približna sezona mriješćenja svake od njih kao i moguća dužina njegovog trajanja. Uočeno je da na prostornu i vremensku raspodjelu mlađa utječe u prvom redu vrijeme mriješćenja kao i skup abiotskih faktora sredine. Pokazalo se da je mlađ najlakše dostupna izolovanju u prvim mjesecima njenog ulaska u priobalne vode. Rezultat ovih istraživanja i sakupljena iskustva daju solidnu osnovu za eventualni izlov ove mlađi u većim količinama, te njihovo naseljavanje u pogodne akvarije s ciljem umjetnog uzgoja.