

Possibility of hybridization between *Dentex Dentex* and *Pagrus Major*, a transplanted fish species into the Adriatic Sea

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Owing to the factors of ecological and ethological isolation between species, the rate of natural hybridization in fish is very low. However in some cases the frequency of natural hybrids may increase considerably. HUBBS (1955) observed that hybridization is often a function of the integration of the habitat and that species that are segregated in breeding can tend to breed together where the environment is rendered intermediate either through natural causes or through modification by man. Thus, it may be that when there is gametic compatibility, such hybridization does occur between totally allopatric species artificially grouped in the same environment (CHEVASUS, 1979).

This paper reports on artificial hybridization between red sea bream *Pagrus major* and common dentex *Dentex dentex*, as an indication of possible natural hybridization. Red sea bream was transplanted into Adriatic fish farms, as species commercially very interesting and its breeding was successful. They even matured spontaneously in the Adriatic in April-May which confirms their good adaptation to this environment.

Most of the species common dentex and red sea bream parental stock matured spontaneously under ambient conditions in the middle of May, in the Hatchery of the Institute of Oceanography and Fisheries in Split, giving small quantities of ripe eggs and milt. Therefore they were stripped of gametes. Results of the trials on artificial reproduction and larval rearing of common dentex, red sea bream and their reciprocal hybrids are given in Table 1.

Table 1. Results of trials on artificial reproduction of *Dentex dentex*, and *Pagrus major* and their reciprocal hybrids.

	Fecundity (number of eggs)	Number of fertilized eggs	Fertilization (%)	Hatching (%)	Mean hatching time (hours)	Total length of larvae (mm) ± SD	Survival after 30 days (%)
						newly hatched	
						after yolk sac absorption	
<i>Dentex dentex</i>	45 000	20 000	83	62	60.15	2.28 ± 0.02	3.49 ± 0.02
<i>D. dentex</i> ♀ x <i>P. major</i> ♂		20 000	77	56	58.00	2.31 ± 0.03	3.55 ± 0.02
<i>Pagrus major</i>	161 000	20 000	90	40	53.30	2.19 ± 0.02	3.37 ± 0.02
<i>P. major</i> ♀ x <i>D. dentex</i> ♂		20 000	82	50	53.45	2.19 ± 0.08	3.51 ± 0.05

Percentage of fertilization and hatching in hybrids slightly disagree with that of the parental species and showed high gametic compatibility between studied species. The duration of the embryo development and the length of newly hatched larvae showed evident maternal effect in both hybrid combinations. After hatching four studied combinations were placed in two larval tanks each. The larval rearing method was described by JUG-DUJAKOVIC and GLAMUZINA (1988).

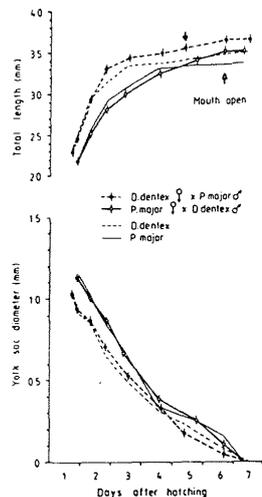


Fig. 1. Growth and yolk sac resorption of *Dentex dentex*, *Pagrus major* and their reciprocal hybrids at constant temperature (17.50, 5°C)

Distribution of total lengths with standard deviation and yolk-sac resorption for the yolk-sac larvae of common dentex, red sea bream and their reciprocal hybrids are shown in Figure 1. There was no significant difference between Hybrids and maternal species (T-test, $P < .05$; SOKAL and ROHLF, 1969).

There was no significant difference in survival from hatching to day 30 (G-test of independence; SOKAL and ROHLF, 1969) and growth (ANOVA, $P < 0.05$) between hybrid and maternal species (Table 1) in both hybridizations.

The results of this experiment confirm the possibilities of natural hybridization between common dentex and red sea bream, the species transplanted into the middle Adriatic where common dentex existed before. This calls for the control of natural spard population for detection of eventual natural hybrids and their viability and great prudence in future introducing an allopatric species into an environment already populated with the same family.

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Fishery-biology studies in the Bay Tarska Vala (Istrian Peninsula - Adriatic Sea)

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The bay Tarska Vala is situated on the Western coast of the Istrian Peninsula. As to the productivity, it is particularly rich habitat of many marine fishes. Traditionally, the bay has been fished twice a year, in spring and autumn, for more than 900 years (Fig.1).

Preliminary fishery-biology studies of Tarska Vala started in 1989. A total of 13 fish species and 2 cephalopod species were recorded (Table 1). Average catch was around 25,000 kg for the 1981-1991 period, ranging from 4,000 kg (1987) to 80,000 kg (1990).

Numerically best represented species in analyzed catches were: *Liza aurata* - 43.4%, *Lithognathus mormyrus* - 16.4%, *Dicentrarchus labrax* - 10.3% and *Liza ramada* - 9.4%. Weight of the catches showed the dominance of the following species: *Dicentrarchus labrax* - 26.1%, *Liza aurata* - 25.4%, *Liza ramada* - 13.0% and *Lithognathus mormyrus* - 10.5%.

Liza aurata (Fig. 2) were best represented in this and all the earlier catches; analyzed individuals of 22.3-36.6 cm length range and mean length $XL_t = 29.13$ cm belonged to the third, fourth and older age groups and for the most part (more than 85%) exceeded minimum length at first maturity (up to 26 cm) (MOROVIC, 1962). A comparison of the mean lengths of analyzed specimens of all the catches realized by now (Nov., 1989 - $XL_t = 27.85$; Dec., 1990 - $XL_t = 29.05$; May, 1991 - $XL_t = 29.81$; Dec., 1991 - $XL_t = 29.13$) showed very small departures and a slight increase trend confirming that this population is, for the time being, normally regenerated and recruited. Fish from autumn catches were already spawned which is in agreement with their rare records from the Mediterranean (HELDT, 1948).

Dicentrarchus labrax (Fig. 3) is a permanently present species in the catches with rather considerable variations in quantity; 68 analyzed specimens of 30.5-88.0 cm length range and mean total length $XL_t = 41.17$ cm belonged to the third to eleventh age groups. Minimum total lengths of males at first maturity range from 23 to 32 cm. Therefore, only a small proportion (4.5%) of specimens (taking upper length values as relevant) was below permissible limit. However, sexual maturity was established in the smallest specimens by milt stripping. So it may be stated that almost exclusively mature individuals were caught. A comparison of mean total lengths of specimens of all the catches realized by now (Nov., 1989 - $XL_t = 35.25$; Dec., 1990 - $XL_t = 47.58$; May, 1991 - $XL_t = 33.55$; Dec., 1991 - $XL_t = 41.17$) showed that they were rather low, particularly in some of the catches, but still within permissible limits.

Lithognathus mormyrus. Analyzed specimens of 15.7 to 32.7 cm length range and mean total length $XL_t = 25.89$ cm belonged to the 2+ age group and older. Sexual maturity in this protandic hermaphrodite species occurs at 20 cm length in males and at 25 cm in females. Analyzed sample, sex excluded, contained about 18% immature individuals. However, a comparison of mean lengths of the fish in the catches realized by now (Nov., 1989 - $XL_t = 24.52$; Dec., 1990 - $XL_t = 26.17$; May, 1991 - $XL_t = 27.56$; Dec., 1991 - $XL_t = 25.89$) showed their irregular oscillations within narrow limits, with no defined trend. This points to the fact that length frequency distribution of this species was more or less identical, with slight departures, throughout the period of our study.

Liza ramada occurred in larger numbers only from time to time; of 62 analyzed specimens of 29.0 to 62.0 cm length range and mean total length $XL_t = 37.70$ cm, 5% specimens were immature (after available data for the Adriatic they attain first maturity at 30 cm length).

There is no need to limit the fishing in Tarska Bay.

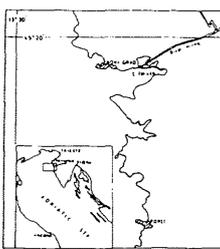


Fig. 3. Length frequency distribution of sea bass (*Dicentrarchus labrax*)

Species	Date	TL	Range	n	TL	Range	n
<i>Liza aurata</i>	11.1989	22.45	21.0-34.0	13,79	16.0-17.5	167,75	40,0-150,0
	12.1989	27,85	21,0-34,0	1,31	23,0-26,0	233,000	23,0-100
	11.1990	28,24	18,4-41,4	22,87	11,7-17,8	101,90	10,0-11,0
<i>Lithognathus mormyrus</i>	11.1989	26,32	18,3-31,3	35,38	13,0-20,0	190,44	10,0-20,0
	12.1989	25,37	21,0-27,0	22,00	20,0-22,0	241,513	20,0-22,0
	11.1990	26,37	18,0-35,0	10,31	11,0-15,0	216,76	10,0-13,0
<i>Dicentrarchus labrax</i>	11.1989	35,25	17,3-33,3	5	20,0-20,0	70,0-100,0	10
	12.1990	47,58	11,4-70,0	14,42	12,0-17,7	323,40	44,0-200,0
	11.1991	33,55	27,0-40,0	22,10	17,0-14,0	107,0	20,0-100,0
<i>Liza ramada</i>	11.1989	37,70	29,0-39,0	15,13	16,0-22,0	443,30	24,0-80,0
	12.1990	41,28	31,7-40,0	22,10	17,0-14,0	107,0	20,0-100,0
	11.1991	33,55	27,0-40,0	22,10	17,0-14,0	107,0	20,0-100,0
<i>Mugil cephalus</i>	11.1989	31,06	25,0-43,0	18,72	13,0-22,0	315,11	13,0-100,0
	12.1990	29,43	25,0-40,0	23,07	22,0-24,0	459,43	19,0-100,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
<i>Liza melanocephala</i>	11.1989	31,5	27,0-33,0	18,30	15,0-20,0	321,00	10,0-100,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
<i>Trachurus mediterraneus</i>	11.1989	31,06	25,0-43,0	18,72	13,0-22,0	315,11	13,0-100,0
	12.1990	29,43	25,0-40,0	23,07	22,0-24,0	459,43	19,0-100,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
<i>Alepa fallax melastota</i>	11.1989	31,5	27,0-33,0	18,30	15,0-20,0	321,00	10,0-100,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
<i>Umetus exilis</i>	11.1989	31,5	27,0-33,0	18,30	15,0-20,0	321,00	10,0-100,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0
	12.1990	30,8	28,0-32,0	17,43	11,0-17,0	276,5	10,0-150,0

Tab. 1. Catch structure from Tarska cove (1989, 1990).

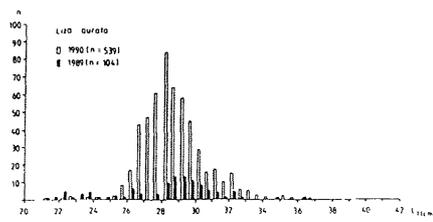


Fig. 2. Length frequency distribution of golden grey mullet (*Liza aurata*).

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