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GILBERTO GANDOLFI, ROBERTO GANDOLFI, FRANCESCO
LE MOLI

**Short-term individual recognition in *Padogobius
martensi* (Teleostei, Gobiidae)**

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Zoologia. — *Short-term individual recognition in Padogobius martensi* (Teleostei, Gobiidae) (*). Nota di GILBERTO GANDOLFI, ROBERTO GANDOLFI e FRANCESCO LE MOLI, presentata (**) dal Socio S. RANZI.

RIASSUNTO. — I combattimenti per la conquista di un territorio tra paia di maschi *Padogobius martensi* (Günther) di uguali dimensioni, sembrano essere influenzati, oltre che dalle recenti esperienze di vittoria e di sconfitta, anche dal fatto che i contendenti, se hanno già combattuto tra loro, si riconoscono. È possibile affermare questo se il secondo combattimento avviene a 1 ora di distanza dal primo, mentre il riconoscimento individuale reciproco è da escludere a 24 ore di distanza.

In many species of fish, social dominance situations of the sort first described for hens [1] are established. This type of social structure tends, as has been widely demonstrated, to be very stable with a consequent decrease of the conflicts within the group and it has as its basis, reciprocal individual recognition [2]. While the possibility that this may occur in partial dominance situations seems to be excluded [3].

From the research done on Pecilids [4, 5, 6, 7, 8], Centrarchids [9, 10, 11] and Anabantoids [12, 13, 14] it is quite clear that, among other things, dimensions, sex and recent social conditionings are factors which play a part in the establishment of hierarchies. The same factors, as has been shown in a recent paper [15] influence the outcome of the encounters between individuals of the Gobiid fish *Padogobius martensi* (Günther). This fresh-water goby is characterized by individual territorialism which is typical of both sexes and related to the necessity of subdividing food supplies and at the same time to regulating population density in a certain area and to providing a suitable place for the preparation of a nest, for reproduction and for the exercise of parental care by the male.

The aim of this further investigation is to establish whether, even in situations of individual territorialism, there is interindividual recognition between two adversaries who had previously competed for the possession of a territory, and whether this recognition could influence the outcome of a second encounter or could interfere with the effect already demonstrated of recent social experiences with adversaries of the same sex and similar dimensions.

In the experiments 144 adult male *P. martensi* were used; these were part of some catches made in the hill stream Stirone at Scipione (Parma). The total length of the fish ranged from 55 to 78 mm. After a brief period

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spent in communal tanks, the fish were transferred to individual containers, after the length of each individual had been measured and marking had been done under anaesthesia with Sandoz MS 222 at a concentration of 1:15,000. Marking was done by making clips in the fins. This did not cause any modifications in aggressive behaviour.

The experiments in series I and I' were each carried out with 20 pairs of males of almost the same length, allowing differences under 1 mm. The individuals of each pair were placed at the same time in containers 20×35×20 cm., with a sandy bottom, filter, aerator, and water at approximately 18°C.

After periods of time that varied from 20 or 30 seconds to 30 minutes, the two *P. martensi* began to fight showing the typical threatening postures followed by a fight which was usually resolved in a short time with the escape of the defeated fish (TB) to the walls of the container in a submission posture; i.e. fins lowered and very pale body colour. The winning fish (TA) remained on the bottom with dark pigmentation and fins fully extended, ready to attack again should the defeated fish try to abandon the walls. At this stage the fish were put into isolation for a few minutes and then the winner was transferred to a container occupied by a male at least 5 mm. longer (fish A), where in a short time it had an experience of defeat without being physically damaged and with the possibility of escaping to a shelter that had been conveniently put there beforehand. At the same time the defeated fish was put into a container occupied by a male at least 5 mm. shorter than itself (fish B) where it experienced a victory.

After these experiences, an hour (series I) or 24 hours (series I') was allowed to pass and then the fish were again put in the container in which they had fought previously in order to observe the outcome of a second encounter for possession of the territory (Table I).

TABLE I
Experimental procedure in Series I and I'.

1st encounter	Experiences	2nd encounter
TA → TB	A → TA TB → B	TA — TB

The experiments in series II and II' were each carried out with 8 groups of 4 males of similar dimensions, allowing differences under 1 mm. When they were made to fight in pairs, two were winners (fish TA₁ and TA₂) and two were losers (fish TB₁ and TB₂). After the experiences which were carried out in the same way as has been described above, they were made to compete TA₁ against TB₂ and TA₂ against TB₁ so that, unlike the previous experiments, fish could meet which had not already competed against each other for the

same territory (Table II). In this case also, an hour (series II) or 24 hours (series II') was allowed to elapse from the end of the first fight to the encounter following the experiences.

TABLE II
Experimental procedure in Series II and II'.

1st encounter	Experiences	2nd encounter
TA ₁ → TB ₁	A ₁ → TA ₁ TB ₁ → B ₁	TA ₁ — TB ₂
TA ₂ → TB ₂	A ₂ → TA ₂ TB ₂ → B ₂	TA ₂ — TB ₁

From the results of the four series of experiments (Table III) it appears as a general condition that fish TA overcomes fish TB far more often than the reverse. This is obviously related to the fact that, since the winners of the first encounter were indicated TA, in this way the more aggressive were selected.

TABLE III
Results of the four experimental series.

2nd encounter	No. of wins in the respective series			
	I	I'	II (*)	II' (*)
TA → TB	16	18	7	13
TB → TA	4	2	9	3

(*) The wins of TA₁ and TA₂ have been taken together, similarly those of TB₁ and TB₂.

Two by two comparisons of experimental series done with Fisher's method [16], formulating a hypothesis of equality of results, allow the following conclusions to be drawn.

i) *Series I and I'.*

The hypothesis of equality of results cannot be rejected ($p = 0.331$). Moreover, since fish TA wins 16 times out of 20 in series I and 18 times out of 20 in series I', it seems that the effect of the experiences is almost completely eliminated in the two experiments. This would conflict with the data provided by Gandolfi and Notarbartolo [15], although a direct statistical comparison is impossible owing to the different experimental situations.

It is however strange that TB's victory over B and TA's defeat by A have no obvious effects when TA and TB fight for the second time whether this encounter takes place an hour (series I) or 24 hours (series I') after the first.

ii) *Series II and II'*.

The results are significantly different ($p = 0.028$). While 24 hours after the first fight (series II') TA wins 13 times out of 16, with exactly the same result as that described in section i), one hour (series II) later TA's wins are only 7 out of 16. In this last case and only in this case, does it seem that the experiences have an effect determining a higher number of wins for TB.

iii) *Series I and II*.

The results are significantly different ($p = 0.036$). And this is the comparison which makes it possible to put forward the hypothesis that an hour after the first fight, reciprocal individual recognition does occur between adversaries and does influence the outcome of the second fight. In fact in series II, when the second fight takes place between individuals who do not know each other, the effect of the experiences makes it possible for TB to gain a higher number of wins inspite of its lower aggressiveness. This does not happen in series I when the second fight takes place between fish that know each other. In this case fish TA who has overcome TB in the first fight succeeds more often in winning again, inspite of the negative experience it has undergone, and this is probably because TB recognizes it.

iv) *Series I' and II'*.

The equality hypothesis cannot be rejected ($p = 0.390$). After 24 hours, the result described in section iii) is no longer valid. It is possible therefore to consider a probable effect of reciprocal individual recognition only within restricted time limits.

A certain reluctance to fight on the part of the fish TB in the second encounter of series I which although it cannot be evaluated in quantitative terms, given the strong variations of situations, does seem to confirm what has been said above.

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