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(Linnaeus, 1758) WITH EMPHASIS ON
DICHROMATISM AND SEX**

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NOTES ON THE LABRID FISH *CORIS JULIS*

(Linnaeus, 1758)

WITH EMPHASIS ON DICHROMATISM AND SEX

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ABSTRACT

The author has studied from a morphological and anatomical point of view the Mediterranean wrasse, *Coris julis*, from about 300 specimens belonging to the two colour forms, *C. julis* (bright turquoise) and *C. giofredi* (brown-white). The results confirm the histological conclusions of several authors: there is only one species, *C. julis*, which changes from *giofredi* to *julis* coloration during its life.

Julis individuals are either males or have no gonades at all, while *giofredi* are both males and females. Therefore, this species cannot be considered as absolutely protogynous, and the dichromatism is not only a sexual one.

INTRODUCTION

For centuries many, mostly confusing and contradictory articles concerning colour and sex of the "Girelle", a common mediterranean labrid fish, have been published. The striking differences in colour patterns between the smaller individuals and the larger, more brightly coloured specimens, were frequently discussed. The two colour phases often have received different scientific names:

Coris giofredi (Risso, 1810) (*Julis giofredi*): the smaller form, with rather unobscure colours: back and sides brown; abdo-

men white with a small, straight, golden stripe running from the snouth underneath the eye to the end of the body.

Coris julis (Linnaeus, 1758) (*Julis vulgaris*): the brightly coloured form, with turquoise on the back and sides, laterally intersected by a broad, dentated orange band, running from the snouth over the eye, above the base of the pectoral fin, to the end of the body (this strips is more dorsal than the small golden stripe of the other form). Just behind the operculum there is a longish black spot; the first three dorsal spines are elongated; the proximal portion of the dorsal fin is bright black and red, while the rest of the fin is light orange and lilac.

RISSE (1810, 1826), BONAPARTE (1831), CUVIER and VALENCIENNES (1839), MOREAU (1881), GOURRET (1893), CAPORACCO (1921) and ROSA DE STEFANI (1951), all separated the two colour phases into these two species. While most of the supporters of this separation mentioned only the differences in colour of the body and shape of the dorsal fin, some also wrote about smaller and more numerous scales for *C. giofredi* (MOREAU, 1881), differences in body dimensions (GÜNTHER, 1862; GOURRET, 1893; CAPORACCO, 1921) or the numbers of spines and rays (MOREAU, 1881; CAPORACCO, 1921).

Other ichthyologists considered these two very different colour patterns to be the result of a remarkable sexual dichromatism: the smaller brownish form being the females and the turquoise form the males. STEINDACHNER (1868) proposed that both these forms be named *C. julis*. GÜNTHER, in his Catalogues (1861, 1862), separated the forms as *C. julis* and *C. giofredi*, but in 1880 ended a description of the Rainbow Wrasse with: "It has been stated that they are respectively male and female of the same species of fish". Despite the strong arguments of e.g. MOREAU and GOURRET that the two colours forms represented two species, more and more investigators, TROIS (1904), FACCIOLA (1916), FOWLER (1936), LE GALL (1937), TORTONESA and TROTTI (1950) and DIEUZEIDE and NOVELLE (1953), accepted the idea of a sexual dichromatism.

Later, other rerearchers suggested it was not just a question of one or two species or of two different coloured sexes, but rather a far more intricate and complex situation. For instance, LO BIANCO (1909) had already identified both females and males in both "*giofredi*" and "*julis*" groups. However, not untill 1957, 1958 was there new attention given to this confusing but interesting phenomenon.

BACCI and RAZZANTI (1957, 1958) found that all specimens of the turquoise "*julis*" phase they examined were males, the majority of the brownish "*giofredi*" phase was female. But some individuals of the latter group contained real testes. (These researchers

were checking for hermaphroditism in Labrids. Labrids are related to the Serranidae and Sparidae, families, that are well known for hermaphroditism and sex reversal). BACCI and RAZZANTI decided to consider : "*C. giofredi* and *C. julis* as the younger and older individuals of a single protogynous hermaphrodite species, *C. julis*, with a sex change from female to male that runs roughly parallel to the change of the livery". Among 86 specimens of the "*giofredi*" phase examined, REINBOTH (1957) found 64 females, but also 22 males, while he counted 33 males in the "*julis*" phase group. Both types of these males had functional testes. With injections of testosterone, REINBOTH was successful in causing a change in colour from the "*giofredi*" phase into the "*julis*" phase (1).

Although the experiments of REINBOTH clarified the problem of "one or two" species, it was still a matter of interest and concern to see and discover if the same conclusion could be reached by using classical methods, checking the differences that has been distinguished.

I am grateful to Prof. G. PETIT, the former Director of the Laboratoire Arago, at Banyuls-sur-Mer, France, for his permission to use the laboratory and its facilities I wish to acknowledge the assistance of Ir. J. F. WOLTERSON (Wageningen, Holland) for his help with statistical treatment of the data. The investigations were carried out as part of the studies for the masters degree, under sponsorship of Prof. Dr. H. ENGEL and Drs. P. J. H. VAN BREE. This work was supported by a grant of the french government. I should like to express my gratitude to Prof. G. PETIT and his staff of the Laboratoire Arago for the help given and for the friendly way they received me, as well as for the mentioned grant.

MATERIALS

The wrasses used for this investigation were collected daily by fishermen of the laboratory. The traps used were round reed baskets with triangular meshes ("girelliers"). Bait (crushed sea urchins) was placed in the trap through a small conical opening at the top; the bottom of the trap consisted of a removable zinc disk. A long rope with a large cork at the free end was fasten to the basket.

For collecting, the traps were lowered into the sea for 45-60 minutes. Collecting could have be done along the coast, but a greater number of specimens was obtained by collecting in the open sea.

(1) Louise STOLL (1955) caused a colour changing from a yellow into a blue-green pattern in the wrasse *Thalassoma bifasciatum* by similar hormone experiments.

In the laboratory, the wrasses were maintained in a large container that had a layer of sand on its bottom. Fishes were removed daily and killed by placing them into water containing a lethal concentration of urethane.

Urethane causes a dispersion of melanin granules, thus dying fish have their darkest coloration. But, also when no anesthesia is used, the colours are changing as a fish is dying and is taken out of the water. For this reason both the appearance of the specimen when it was still alive and the habitus of the dead body were used for colour determination. Immediately after death, the numbers of spines, rays and scales were counted; several body dimensions measured and the sex determined by dissecting the animal. Gonadal condition was judged from 1 (= nearly-no-gonad) to 5 (= completely-mature, gonads-fill-up-whole-abdomen). Like this 292 specimens of *C. julis* have been studied, in the period of august and september 1960.

RESULTS

DISTRIBUTION-FREQUENCY

The Rainbow Wrasse is very common in the Mediterranean and can also be found along the atlantic sea coasts in the vicinity of the Straits of Gibraltar. Further north and south it becomes rare.

Differences between the distribution of the two colour phases have been reported. For instance, according to GOURRET (1893) both could be found in the waters at Marseille, Toulon, Nice and Napels. Moreover, *C. giofredi* were present in Messina and the Gulf of Biscay, while *C. julis* had been reported along the Adratic, the Balearics, Genua, Livorno, Rome, Sicily and Rhodes. GOURRET considered *C. julis* to be the more common species. Only in Marseille was *C. giofredi* more numerous. According to CAPORIACCO (1921) *C. giofredi* is rather rare.

The present author studied the distribution and frequency only in the neighbourhood of Banyuls-sur-Mer. Nevertheless she has reasons to believe that the above mentioned scientists appear inaccurate in their conclusions. While swimming and snorkeling many different groups were observed. Both colour phases were present in all groups. Moreover, it was striking that the brownish "*giofredi*" phase was much more numerous. Precise information concerning the relative numbers can be seen in the material used. (During

the collecting no selection of colour or size was made, so the sample was random). 270 specimens of the "*giofredi*" colour were collected, while only 22 specimens of the "*julis*" pattern were on hand.

During June 1959 the author collected 31 specimens of the "*giofredi*" colour and only 7 "*julis*" specimens in the waters at Banyuls-sur-Mer. At the fishmarket of Rosas (Spain) she also observed a higher number of the "*giofredi*" than the "*julis*" specimens. BACCI and RAZZANTI (1957, 1958) and REINBOTH (1957, 1962) also found a higher proportion of the "*giofredi*" phase. The preference of former days for putting large, remarkable individuals into museum collections apparently caused an extreme selection and hindered the proper conclusions about distribution and frequency. I assume that in all areas where the Girelles are found, both colour phases are present with the "*giofredi*" specimens at a higher proportion.

BEHAVIOUR

The Girelles frequent sandy spots among rocks and stones in the shallow waters along the coast, where *Posidonia* replaces the fields of *Zostera*. *C. julis* never forms real schools, but they usually stay together in groups. Particularly the smaller specimens, with the "*giofredi*" colours, cluster together, while the larger "*julis*" phase individuals seem to be less gregarious. Though these specimens frequently mix with others, they rest more on the bottom or swim some meters away from the group. Sometimes these more solitary specimens show a kind of territorial defence, chasing other Girelles that come near or close away from that area. At such moments of aggression the defender expands the dorsal fin displaying all of its bright colours. But such moments are rare.

The wrasses swim mostly in criss cross directions, picking at rocks, at the sandy bottom or moving up and down, back and forth with the movements of the water. They move in the typical, graceful way of the Labrids, using only their pectoral fins. The dorsal fin is mostly in a flat position; the caudal and ventral fins can be used for stabilisation. The body is very flexible enabling these fish to make very small and sharp turns.

NEU (1935) observed that *C. giofredi* shows more movements of the caudal part of its body. Nevertheless, he considered *C. julis* to be the more lively. But in my observations I found that the "*giofredi*" specimens seem more active in swimming and dancing

around, while the larger “*julis*” individuals move more stately and slowly.

Some time before sunset the wrasses disappear. They dig into the sand and stay there until after sunrise. Also, when they are frightened these fish quickly hide and disappear under rocks or in the sand. It was noted in the laboratory that not all the individuals reappeared every morning. Some remained in the sand for days. This was especially true for the “*julis*” phase specimens.

COLOUR

Detailed descriptions of the colour patterns of *C. julis* and *C. giofredi* are given by CUVIER and VALENCIENNES (1839) and GOURRET (1893). They and other authors have mentioned also differences between specimens of one colour phase (“species”). GOURRET even distinguished four chief colour patterns for both *C. julis* as *C. giofredi*. Studying these wrasses, I realised that it was important to distinguish clearly between temporary and lasting colour differences.

The Girelle can change colours rapidly and frequently. For instance, in the “*giofredi*” phase, the brown colours on its back and sides become more intense and the fish can become very dark. This brown can vanish and then only the longitudinal stripe underneath the lateral line remains brown, thus the fish appears more striped. In the “*julis*” phase the back can become extra brightly turquoise. These are temporary changes, elicited by excitement, fear, etc. In my opinion former authors may have referred to these temporary differences.

There are, however, striking and lasting colour differences, when the “*giofredi*” and “*julis*” specimens are compared. These differences in colour of the body and shape and colour of the dorsal fin are described in the introduction. Contrary to the findings of CUVIER and VALENCIENNES (1839) or GOURRET (1893), I could not find distinct differences in colour of the caudal fin or of the eye. I agree with those authors that there are differences in the colours of the anal fin, which is faint red-lilac-yellow in the “*giofredi*” phase and clear orange-lilac in the “*julis*” phase.

INTERMEDIATES

Among the 270 specimens of the "*giofredi*" colour phase studied I found seven specimens with deviating colours. Five specimens (standard length 8,2; 9,5; 11,0; 11,0; and 11,3 cm) showed a vague but noticeable indication of a broad dentated band on both sides from the snouth to the caudal fin. In the "*julis*" phase this band is very brightly coloured, but in these five specimens it was grey-brown instead of bright orange. The backs of the bodies and the fins had the normal "*giofredi*" colours. The dorsal fins did not show any red in their most frontal parts and the first spines were not longer than the spines following. One specimen (10,7 cm st. 1) showed a more definite orange in the visible dentated side band. There was a vague beginning of the black spot behind the operculum and there was some red and black in the dorsal fin. The first spine was almost 1 mm longer than the rest. But the total appearance of this specimen was still that of a "*giofredi*" individual.

Only one specimen (10,4 cm st. 1) was neither a "*giofredi*" nor a "*julis*" individual. Its back was rather grey instead of brown or turquoise; the dentated lateral band was present but very pale orange; there was no indication of black behind the operculum, the fins were more or less as in the "*giofredi*" phase, but there was some red and black in the beginning of the dorsal fin and the first spine was 1 mm longer than the rest.

SEX

Of the 262 specimens with definite "*giofredi*" colours studied, 164 proved to be females, 79 males, while 20 specimens could not be sexed, their gonads being too small or almost not present at all.

It is difficult to understand how so many ichthyologists have considered the "*giofredi*" phase as the female phase, while one third of this group are actually functional males. The numerical difference between females and males was significant ($p < 0,01$) (chi-square value = 28,6).

Of the 22 specimens with the "*julis*" colours, 13 were males and 9 could not be sexed. It was remarkable none of the "*julis*"

specimens had very large gonads as could be found in the smaller " *giofredi* " coloured males. While most of the " *giofredi* " males had active, functional testes, more fluctuations could be found among the females. The ovaries varied from well developed and mature, to average sized, to thin and loose, among females collected on the same day.

Of the seven specimens with intermediate colours, five had very thin gonads that could not be sexed microscopically; the specimen of 10,4 cm st. l. — the most completely intermediate specimen —, had thin gonads that looked like inactive ovaries. Only the 10,7 cm st. l. specimen, that had some black colour behind the operculum, had real active testes.

According to BACCI and RAZZANTI (1957, 1958) and REINBOTH (1957) *C. julis* can change both colour and sex. REINBOTH stated the morphological changes can start earlier than the sex reversal. The fact that, in this study, some individuals with intermediate colours with almost no gonads were found and the fact that half of the " *julis* " group did not have gonads, does not contradict that theory.

SPAWNING SEASON

Most of the Girelles had active gonads during August; the activity could be described as state 4 or even 5 (see under Material). The gonads of both females and males were progressively reduced during september and this was in particular marked during the last three weeks of the month. This reduction must have been due to the approaching cessation of the spawning season. ROSA DE STEFANI (1955) stated that there was a reduction of the gonads during August. GOURRET (1893) reported the peak of the spawning activities in July; TROIS (1904) believed that June and July were the active spawning months and LO BIANCO (1909) assigned the spawning activities from April to June.

The fishermen of the Laboratoire Arago informed me that the number of Girelles is reduced in October and that there are almost none present during the winter months. Starting with May the Girelles appear again and can be collected. GOURRET (1893) reported this seasonal habitation; REINBOTH (1962) mentioned it briefly. It would be most interesting to know if this Mediteranean Labrid fish migrate with the changing of the seasons. Though, this author is inclined to suppose they hibernate hidden in the sand.

MORPHOMETRY

The following measurements were made on 265 fish; the total length, standard length, head, snout, eye diameter, depth of the body (above the anus) and the abdominal length (distance from snout to the anus). All measurements were to within 0,01 cm. In addition, five morphometric relationships were calculated : the size of the head, snout, eye, depth and belly were divided by the standard length, and this value multiplied by 100, to give the respective percentages.

Statistical analyses of the data for both the females and males of the " *giofredi* " group and the " *julis* " group were carried out. Averages " m " and standard deviations " s " were calculated. For defining m and s linear transformations were used. The Student's *t*-test or the χ -test was used in testing for significant differences. The 0,01 level of significance was used in this and all following tests. The results are shown in Table 1. (The lower proportion of

TABEL 1
Results of morphological measurements
(m = average; s = standard deviation)

	"giofredi" females	"giofredi" males	"giofredi" females & males	"julis"
number of specimens	164	79	243	22
standard length	m = 8,86 cm s = 0,97 cm	m = 8,44 cm s = 1,07 cm	- -	m = 11,02 cm s = 0,70 cm
percentage head/st. l.	m = 30,5 % s = 0,86 %	m = 30,4 % s = 0,98 %	m = 30,5 % s = 0,90 %	m = 30,4 % s = 0,71 %
percentage snout/st. l.	m = 9,50 % s = 0,59 %	m = 9,35 % s = 0,59 %	m = 9,40 % s = 0,59 %	m = 9,39 % s = 0,62 %
percentage belly/st. l.	m = 55,76 % s = 1,29 %	m = 55,78 % s = 1,29 %	m = 55,77 % s = 1,26 %	m = 55,23 % s = 1,15 %
percentage depth/st. l.	m = 19,00 % s = 0,76 %	m = 19,20 % s = 0,71 %	m = 19,10 % s = 0,75 %	m = 19,70 % s = 0,59 %
percentage eye/st. l.	m = 5,73 % s = 0,41 %	m = 5,80 % s = 0,49 %	m = 5,75 % s = 0,44 %	m = 5,13 % s = 0,46 %

" *julis* " individuals posed some difficulties, but we have not tried to change this, in order to maintain the random nature of the sample).

The total length for all the three groups proved to be 118-120 % of the standard length. Because of the chance of damage to the caudal fin, the total length was not used for further calculations.

The only significant difference that was found between the females and males of the “*giofredi*” phase was the greater number of female individuals (see above) and a difference in the standard length (t value = 10,7) which was 0,42 cm more in the female group. It is interesting that the diagram for the females is bimodal, with peaks at 8,1 cm and 9,5 cm, while the number of the “*giofredi*” males decreases after one peak at 8,6 cm (see figure 1). But

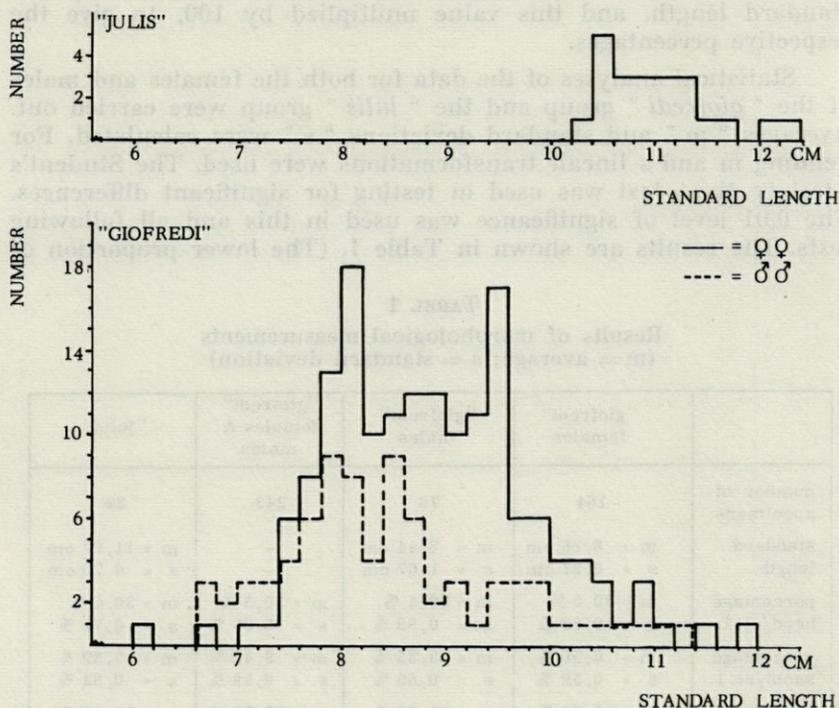


FIG. 1. — Number of specimens with a given standard length.

no significant differences in colour or in relative body dimensions were found for the male or female group. The number of the “*julis*” group is significantly lower than the “*giofredi*” group and the standard length significantly larger than in both sex groups of the “*giofredi*” phase.

According to GÜNTHER (1862) the head is more than 1/4 of the body length for *C. giofredi* and less than 1/4 for *C. julis*. CAPO-

RIACCO (1921) also noted differences for the head and body length relationship. But this author has found no significant difference between the two colour groups in this percentage. No significant differences were found either for the snout/standard length or belly/standard length relations.

According to GÜNTHER, GOURRET and CAPORIACCO the depth of the body is smaller for *C. giofredi*. STEINDACHNER described that during aging the body depth becomes deeper. But the author found the differences between the two colour groups were yet not significantly different ($F = 1,6$).

The only body dimension that was really significantly different for the "*giofredi*" and the "*julis*" group proved to be the eye/standard length relation. The standard deviations were not different, but the average of the percentage of the "*julis*" group is significant different from the average of the "*giofredi*" group. The eye-body length relation is not linear but changes during growth. But it is not unusual that such allometric changes occur during growth.

SCALES

The head of *C. julis* is nude; the rest of the body is covered with rather small cycloid scales. The number of scales on the lateral line (which is not interrupted but makes a s-turn at the end of the body) and the number of transverse scales were counted in 265 specimens. The formulae proved to be 75-79 on the lateral line and 4/19-21 transverse.

TABEL 2
Number of specimens with a given number of spines and rays

	"giofredi" group			"julis" group		
	IX-11	IX-12	IX-13	IX-11	IX-12	IX-13
dorsal fin D	2x	261x	7x	0x	21x	1x
anal fin A	III-11 5x	III-12 260x	III-13 5x	III-11 0x	III-12 21x	III-13 1x
ventral fin V		I-5 270x			I-5 22x	
pectoral fin P	I-12 1x	I-13 264x	I-14 5x	I-12 2x	I-13 20x	I-14 0x
caudal fin C	11 3x	12 267x	13 0x	12 0x	13 22x	14 0x

GÜNTHER, MOREAU, GOURRET and CAPORACCO mentioned differences between the two "species" but, if statistical analyses of their data were made, these probably would not be significant.

FINS

Results of spine and ray counts are shown in table 2. No significant differences were found between the females or males of the "*giofredi*" phase, nor between the "*giofredi*" and "*julis*" group. Slight deviations are found in a very few cases. But *C. julis* can be characterised by the formula: D IX-12; A III-12; V I-5; P I-13 and C 12. The different formulae for *C. giofredi* and *C. julis* as given by MOREAU, CAPORACCO and others, are most probably incorrect.

DISCUSSION

The mediterranean Labrid fish *C. julis* (Linnaeus, 1758) has been separated into *C. giofredi* (Risso 1810) and *C. julis* because of striking differences in body colours and the shape of the dorsal fin. The latter group has three elongated spines in the dorsal fin, while the size of the "*giofredi*" group is significant smaller. But in this study no significant differences were found between the two habitus' for: the colour of the eye or the caudal fin, the relation of total length, head, snout, or belly length to the standard length or the number of scales or spines and rays, though many authors used differences in these features to further separate the two colour groups into two species. They have made no record of the number of individuals studied for body and colour characteristics, but I assume most of them only used a very low number. Moreover, the differences distinguished were probably in most cases not statistically significant.

The results obtained in this study, showing that so many important characteristics proved to be similar, agrees with the findings of REINBOTH (1957) who, with testosterone injections, brought about a change from the "*giofredi*" into the "*julis*" pattern, demonstrating these phases belong to the same species *C. julis*.

For a long time the two colour patterns were considered to be a sexual dichromatism. However, one third of the specimens of

the "*giofredi*" group examined in this study were males with active, functional testes. It is therefore incorrect to identify the "*giofredi*" with "females", to name this wrasse protogynous or to consider the males in the "*giofredi*" colours to be immature individuals as has been done often. Quite the contrary, I consider the "*julis*" males as rather senile.

Seven specimens were found with intermediate colours and almost no gonads. This does not contradict the theories of REINBOTH (1957) and BACCI and RAZZANTI (1957, 1958) that *C. julis* can change both colour and sex, from the "*giofredi*" into the "*julis*" phase. According to the theory of REINBOTH (1962) the "*giofredi*" type males should not change colours or sex; all the "*julis*" coloured males should have been females before. Since no histological investigations were carried out by this author, she is not able to confirm or contradict this theory. However, she is not convinced of its validity because after a certain size (12,0 cm) non individuals, males or females, were found with the "*giofredi*" colours. Having REINBOTH's theory in mind it may suggest that after attaining a certain size, the "*giofredi*" males die or stop growing, while the females continue growing and change colour and sex. If that were so, if the "*giofredi*" males stop growing, one would expect to find a higher number of "*giofredi*" males with this "terminal" size, but instead of this the number of "*giofredi*" males decreases after the size of 8,6 cm and the standard length distribution histogram (figure 1) is apparently normal in shape, not skewed. As yet I fail to see why the "*giofredi*" males could not also change into the other, more brightly coloured phase as they grow older.

Before we can fully understand the complicated problems of the sexuality of the wrasses much more investigations will have to be carried out.

SUMMARY

Of 292 specimens of the Mediterranean wrasse *Coris julis* (Linnaeus), 263 had rather sober, brown-white colours, 22 had very bright turquoise colours, while the colours of 7 specimens were intermediate. Many authors have separated the two colour groups into the species *C. giofredi* (brown-white) and *C. julis* (turquoise). In addition to the difference in body colour this author found the "*julis*" individuals to be significantly larger, to show an elongation of the first three dorsal spines and a different eye/standard length relation. There was a slight difference in the depth/standard-length relation. But no significant differences were found in this

study in the number of scales, spines, rays or in the relation of resp. head-, snout- or bellylength with the standardlength in the two colour groups.

With so many important characteristics being similar, the conclusions of BACCI and RAZZANTI (1957, 1958) and REINBOTH (1957) that the wrasse during its life changes from the brownish into the turquoise colours, so both colour patterns belong to the same species appear to be correct. Former authors used only a few specimens in their investigations of described differences that are statistically not significant.

The number of individuals of the " *julis* " colours was significantly lower than that of the " *giofredi* " phase. The gonads of these larger " *julis* " specimens were relatively small. They were either males or had almost no gonads at all. Among the " *giofredi* " group a significantly greater percentage was female, but about 30% proved to be real functional males. It would, therefore, be erroneous to consider this species as absolutely protogynous or to consider the colour dichromatism as a simple sexual dichromatism. Not any habitus differences are found between the females and males of the " *giofredi* " group, only the average length of the females is slightly greater.

Although both colour phases frequent the same spots, a slight difference was noticeable in their behaviour : the " *julis* " individuals were more solitary, moved more slowly and sometimes showed aggressive territorial defence.

RÉSUMÉ

Sur 292 spécimens de la Girelle de Méditerranée *Coris julis* (Linnaeus), 263 ont des teintes brunes et blanches assez discrètes, 22 des teintes turquoises très brillantes, alors que les teintes de 7 spécimens sont intermédiaires. De nombreux auteurs ont séparé les deux groupes de coloration en deux espèces, *C. giofredi* (brun-blanc) et *C. julis* (turquoise). En plus des différences de coloration du corps, l'auteur a trouvé que les individus " *julis* " sont significativement plus grands, présentent un allongement des trois premières épines dorsales, et un rapport œil/longueur moyenne différent. Il y avait une légère différence dans le rapport profondeur/longueur moyenne. Mais aucune différence significative n'a été découverte dans le présent travail, que ce soit dans le nombre d'écaillés, d'épines, de rayons, ou dans le rapport de la longueur

de la tête, du museau ou du ventre avec la longueur standard dans les deux groupes de coloration.

Devant un tel nombre de caractéristiques importantes identiques, les conclusions de BACCI et RAZZANTI (1957, 1958) et REINBOTH (1957) suivant lesquelles la Girelle change au cours de sa vie de la coloration brune vers la coloration turquoise, sont confirmées. Les auteurs précédents ont utilisé seulement un petit nombre de spécimens pour leurs recherches, ou ont décrit des différences qui ne sont pas statistiquement significatives.

Le nombre d'individus portant les teintes "*julis*" s'est révélé significativement plus faible que celui des individus en stade "*giofredi*". Les gonades de ces spécimens "*julis*" de plus grande taille sont relativement petites. Ce sont, ou bien des mâles, ou bien des individus chez lesquels les gonades ont totalement disparu. Parmi les individus "*giofredi*" un pourcentage significatif plus important de femelles existe, mais environ 30 % des animaux sont des mâles fonctionnels. Il serait donc faux de considérer cette espèce comme totalement protogyne, ou d'admettre que les deux types de coloration constituent un simple dichromatisme sexuel. Par ailleurs, aucune différence d'habitus n'a pu être relevée entre les femelles et les mâles du groupe "*giofredi*", seule la longueur moyenne des femelles est légèrement plus grande.

Quoique les deux types de coloration fréquentent les mêmes stations, une légère différence existe dans leur comportement : les individus "*julis*" sont plus solitaires, se déplacent plus lentement, et montrent parfois un comportement agressif de défense de territoire.

ZUSAMMENFASSUNG

Es sind 292 Exemplare von *Coris julis* (Linnaeus) untersucht worden; von diesen zeigten 263 schlichte braun-weiße Farben, 22 waren von heller Türkis-Farbe, während 7 intermediäre Farbe zeigten. Viele Autoren haben die Tiere dieser beiden Farbgruppen in zwei verschiedene Arten untergebracht : *Coris giofredi* (braun-weiß) und *Coris julis* (Türkis). In der vorliegenden Untersuchung wurde gefunden dass die "*julis*" Exemplare gesichert grösser waren, eine Verlängerung der ersten drei Flossenstrahlen der Dorsalen und ein kleineres Auge/Standardlänge Verhältnis zeigten. Es stellte sich heraus dass es auch einen kleinen Unterschied gibt in das Körperhöhe/Standardlänge Verhältnis. Aber keine Differenzen wurden gefunden zwischen beide Farbgruppen in der Zahl der Schuppen, der Flossenstrahlen, oder in dem Verhältnis zwischen

Kopf-, beziehungsweise Schnauze- oder Bauchlänge und die Standardlänge.

Wo soviele wichtigen Kennzeichen gleich sind muss der Schluss BACCI's und RAZZANTI's (1957, 1958) und REINBOTH's (1957) dass beide Farbmuster einer einzigen Art zugehören und dass der Labriden während das Leben vom braun-weissen im Türkis Habitus verwandeln, richtig sein. Frühere Autoren haben mehrere Differenzen zwischen beiden Arten fest gestellt, die entweder nicht gesichert oder an nur wenigen Exemplaren beobachtet wurden.

Die Anzahl der "julis" Exemplare war immer niedriger als bei der "giofredi" Farben. Dieser "julis" Exemplare hatten verhältnismässig kleine männlichen Geschlechtsorgane oder überhaupt keine Gonaden. In der "giofredi" Gruppe waren 70 % der Exemplare Weibchen aber 30 % normal funktionsfähige Männchen. Es ist also unrichtig die Gattung *C. julis* als absolut protogynisch zu betrachten oder zu meinen dass es sich hier um einen einfachen Sexual-Dichromatismus handelt. Die Weibchen und Männchen der "giofredi" Gruppe zeigen keine Unterschiede im habitus, nur ist die mittlere Länge der Weibchen ein wenig grösser. Wenn auch beide Farbengruppe an derselben Stelle gefunden werden, so zeigt sich doch ein geringes Unterchied im Verhalten: die "julis" Exemplare bewegen weniger lebhaft, sind mehr solitär und zeigten mitunter ein aggressives Verhalten im Verteidigung ihres Territoriums.

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