

original scientific paper
received: 2002-07-15

UDC 597(262.3)

NORTHERN RANGE EXTENSION OF THE ORNATE WRASSE, *THALASSOMA PAVO* (LINNAEUS, 1758) (PISCES: LABRIDAE), IN THE EASTERN ADRIATIC

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ABSTRACT

Two adult and one juvenile specimen of *Thalassoma pavo* were caught in the areas of Rogoznica (Islet Sviban) and Primošten (Islets Grbavac, Lukovnjak and Maslinovik) in the eastern Adriatic in July and August 2001. This record extends the distribution of this species northward in the Adriatic Sea. Visual censuses were also conducted in shallow waters, where the bulk of juveniles and adults of this species were registered and encountered.

Key words: *Thalassoma pavo*, range extension, northernmost record, Adriatic Sea

MASSIMA ESTENSIONE A NORD DELLA DONZELLA PAVONINA *THALASSOMA PAVO* (LINNAEUS, 1758) (PISCES: LABRIDAE) IN ADRIATICO ORIENTALE

SINTESI

Due adulti ed un giovane esemplare di *Thalassoma pavo* sono stati catturati nelle aree di Rogoznica (isolotto di Sviban) e Primošten (isolotti di Grbavac, Lukovnjak e Maslinovik), in Adriatico orientale, durante i mesi di luglio e agosto del 2001. Tali segnalazioni estendono verso nord la distribuzione di questa specie nel mare Adriatico. La tecnica del Visual census è stata inoltre adoperata per monitorare le acque basse, dove è stata registrata ed incontrata la maggior parte degli esemplari giovani e adulti di questa specie.

Parole chiave: *Thalassoma pavo*, estensione, segnalazione più a nord, mare Adriatico

INTRODUCTION

Knowledge of mechanisms and processes regulating the size and dynamics of fish populations is important for understanding possible changes in time and, on different spatial scales, populations within their typical distribution area. Even more, such baselines are necessary for studying fish species, which are expanding their distribution limits (Guidetti, 2001). In the last decades, the natural variability of marine communities has been fully recognised and its relation with climate fluctuations hypothesised (Bianchi, 1997). Several authors observed changes in species distribution related to temperature fluctuations, and this especially in the areas close to biogeographical boundaries (Fowler & Laffoley, 1993; Southward & Boalch, 1994); it has been said that climatic shifts induce biogeographical shifts (Southward *et al.*, 1995). Grainger (1992) predicted that the foreseen global warming would probably make southern species extend their range northward. This is apparently what is happening within the Adriatic Sea, where warm-water species have been recently occurring in greater numbers in the northern sectors (Lipej *et al.*, 1996; Bettoso & Dulčić, 1999; Dulčić *et al.*, 1999; Dulčić & Grbec, 2000; Dulčić, 2002). The northward spread of thermophilic species has been considered by several authors as an indirect indication of the Adriatic and Mediterranean water warming and this seems particularly obvious when considering fish assemblages, whose changes in distribution patterns on a large spatial scale may reflect changes in the oceanographic-climatic conditions (Stephens *et al.*, 1988).

The ornate wrasse, *Thalassoma pavo* (Linnaeus, 1758), is a small protogynous labrid fish inhabiting rocky bottoms in the shallow Mediterranean littoral zone, chiefly along the southeastern coasts of the basin (Bini, 1968; Tortonese, 1975; Jardas, 1996). General biology and morphology of *T. pavo* can be found in Bini (1968) and Jardas (1996). It is distributed from Gabon to southern Portugal (Debelius, 1999), and is particularly abundant in the Azores, Madeira and Canaries (Wirtz, 1994). Within the Mediterranean, it is known to occur chiefly in the southern sectors of the basin (Francour *et al.*, 1994). Its distribution pattern leads one to consider this fish to be among the so-called Mediterranean thermophilic southern species. It is rare in the Adriatic, occurring mostly in the southern part (Jardas, 1996).

The present paper discusses northward range extension of the ornate wrasse in the Adriatic Sea and possible mechanisms and causes for such range extension.

MATERIAL AND METHODS

Adult specimens of *T. pavo* were caught by fish trap and the juvenile with a small beach seine. Visual censuses were also conducted in shallow waters, between

the surface and 5 m depth, where the bulk of juveniles and adults of this species were registered and encountered according to the method described by Guidetti (2001). Water temperature was measured during each visit. During each survey, all individuals of ornate wrasse were counted and their length (TL) measured to the nearest centimetre. Fish density was expressed as number of individuals/100 m² ($\log_{10}X+1$ transformed data) for each length category proposed by Guidetti (2002).

The specimens were identified in accordance with Jardas (1996). They were embalmed and deposited in the Ichthyological Collection of the Institute of Oceanography and Fisheries in Split, Croatia. Caught specimens were preserved in 4% buffered formaldehyde immediately after capture, subsequently measured to the nearest 0.1 mm, and weighed to the nearest 0.01 g. Reduction in length caused by preservation depends on initial lengths of the specimens and duration of storage. Meristic characteristics considered were dorsal, anal, pectoral, ventral, caudal fins, and the number of scales in longitudinal line.

RESULTS AND DISCUSSION

Two adult specimens and a single juvenile (Fig. 1) of *T. pavo* were caught in the areas of Rogoznica (Islet Svilan) and Primošten (Islets Grbavac, Lukovnjak and Maslinovik) in the eastern Adriatic in July (25.07) and August (10.08) 2001, between 3 and 5 m depth at rocky bottom with varying slopes (gentle to steep), comparatively rich in crevices and colonized by erected macroalgae.

Morphometric and meristic data are given in Table 1. Standard counts and measurements fit previous descriptions of the species, such as in Jardas (1996). Surface temperature (average value) during investigation was 24.2°C in July and 25.1°C in August. The total length examined during the study period (by visual census) ranged from 4 to 23 cm TL. Number of individuals/100 m² ($\log_{10}X+1$ transformed data) was from 0.6 to 0.8 (size-class 4-8 cm), from 1.3 to 1.6 (size class 9-13 cm), from 0.7 to 0.9 (size class 14-18 cm) and from 0.8 to 0.9 (size class 19-23 cm).

This record of ornate wrasse in the Rogoznica (Islet Svilan) and Primošten area (Islets Grbavac, Lukovnjak and Maslinovik) in the eastern Adriatic represents, to our best knowledge, the northernmost occurrence of this species in the Adriatic Sea (even though there are some indices that one male was recorded by visual census near island Prvič – cape Šilo – northern Adriatic, Kružić, pers. comm.). A successive range extension to the north from 1991 until now is presented in Fig. 2. The numbers of thermophilic species caught during the past few years have increased in the Eastern Adriatic (Dulčić & Grbec, 2000). Several species, scarce until now, are more

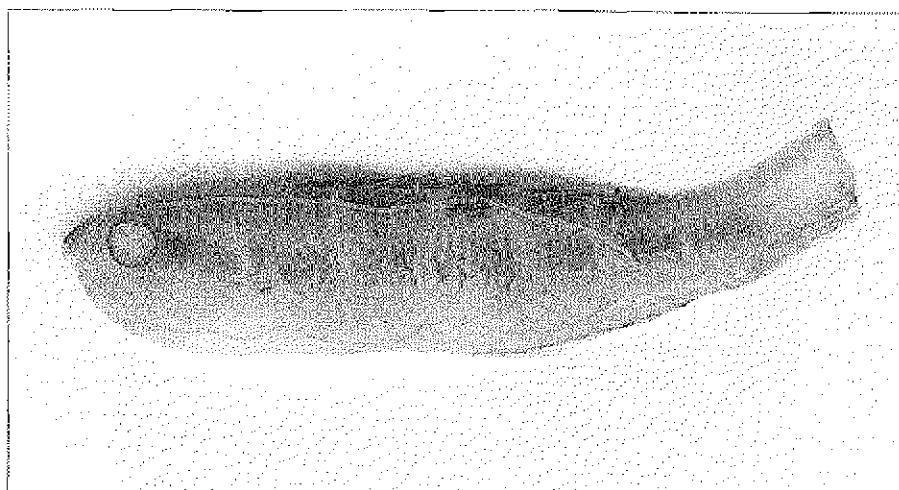


Fig. 1: Juvenile specimen of the ornate wrasse (5.3 cm TL) caught at Rogoznica (Islet Svilan).

Sl. 1: Mladostni osebek pavjega kneza (5,3 cm TL), ujet v bližini Rogoznice (otoček Svilan).

abundant, while others are new to the area. Climate change can influence marine communities by a combination of: a) direct effect on the organisms (e.g. direct influence of temperature, causing changes in survival, reproductive success, dispersal pattern and behaviour); b) effects mediated by biotic interactions; and c) indirectly through ocean currents (changes in climate may alter the emphasis of water flow and the pattern of water circulation) (Southward *et al.*, 1995). According to some authors (Stephens *et al.*, 1988; Francour *et al.*, 1994; Dulčić & Grbec, 2000), temperature is the most important large-scale variable, which could affect fish populations, while Pallaoro (1988) stated the Adriatic incursions increasing salinity and temperature caused more rare species to appear and increase abundance in the central Adriatic region. This northernmost record and increased occurrence of this species in the southern and central Adriatic could indicate a possible wider expansion to the northern parts, which has already been recorded for the other areas in the Mediterranean. The increased occurrence of *T. pavo* in the Ligurian Sea in recent years supports the hypothesis of the establishment of true populations of warm-water species in the Ligurian Sea. It is in further expansion in the Ligurian Sea and presently reproduces there, thus getting independent from the larval supply from the Tyrrhenian Sea (Vacchi *et al.*, 1999, 2001). A comparative expansion of the ornate wrasse northward in the western Mediterranean was reported, and the relationship between this event and climate changes hypothesized (Astraldi *et al.*, 1994). Several other authors (Bianchi & Morri, 1993, 1994; Francour *et al.*, 1994) also pointed out that the recent spreading of the ornate wrasse in the northernmost sectors of the western Mediterranean could be a response to ongoing seawater warming. Densities of ornate wrasse appeared to be related to the surface water

temperature, with higher densities during warmer months (Guidetti, 2002). Guidetti *et al.* (2002) pointed that climatic conditions (e.g. water temperature along the latitudinal gradient) and substrate features (e.g.

Tab. 1. Biometric (cm) and meristic data of *Thalassoma pavo* caught by fish trap and beach seine in the areas of Rogoznica and Primošten.

Tab. 1: Biometrični (cm) in meristični podatki o pavjem knezu *Thalassoma pavo*, ujetem z vršo in mrežo v območju Rogoznice in Primoštena.

Measurements (cm)	♂	♀	Juv.
Total length	19.31	12.93	5.30
Standard length	15.42	10.60	4.44
Head length	4.83	3.18	1.31
Orbital diameter	0.72	0.55	0.36
Interorbital width	1.05	0.68	0.43
Preorbital length	1.55	1.07	0.37
Postorbital length	2.51	1.59	0.71
Predorsal distance	4.65	3.35	1.29
Preventral distance	4.90	3.85	1.44
Preanal distance	8.70	5.65	2.54
Prepectoral distance	4.51	3.16	1.37
Dorsal fin length	8.63	6.23	2.42
Anal fin length	4.51	3.84	1.11
Ventral fin length	1.32	1.19	0.54
Pectoral fin length	3.27	2.03	0.92
Caudal fin length	4.69	2.58	1.12
Maximum height	4.82	3.07	1.05
Caudal peduncle height	2.18	1.49	0.59
Dorsal ray	VIII / 13	VIII / 13	VIII / 12
Anal ray	III / 11	III / 12	III / 11
Pectoral ray	15	15	15
Ventral ray	1 / 5	1 / 5	1 / 5
Lateral line scale	29	30	28

macroalgal cover, physical complexity, slope) are thus likely to affect average abundances and size structures of the ornate wrasse populations along the western Italian coast. Same authors reported that factors acting on a geographical scale are likely to influence distribution patterns of the thermophile fish *T. pavo*, although significant effects have been also observed at the smallest spatial scale examined. Finally, it could be suggested, from this perspective, that the present seawater warming and changes in hydrographic properties of the Adriatic Sea (Dulčić *et al.*, 1999; Dulčić & Grbec, 2000) is altering the observed distribution pattern of the ornate wrasse, as well as other southern fish species (Lipej *et al.*, 1996; Bettoso & Dulčić, 1999; Dulčić *et al.*, 1999; Dulčić & Grbec, 2000; Dulčić & Pallaoro, 2001; Dulčić, 2002). The present study showed that the ornate wrasse

juveniles settle and inhabit the same habitat occupied by adults, which has been confirmed by Guidetti (2001) for the Tyrrhenian Sea. This pattern is consistent with the data reported for other labrid fishes in- and outside the Mediterranean basin (Garcia-Rubies & Macpherson, 1995; Green, 1996).

In conclusion, these results highlight aspects of the population dynamics and distribution of *T. pavo* in the Adriatic Sea (especially according to mentioned possibility of its occurrence near island Prvič) and the status of this species needs to be evaluated on a continuous basis, as it is becoming increasingly apparent that uncommon species, and particularly those on the edge of their distribution, can be essential indicators of environmental changes (Swabby & Potts, 1990).

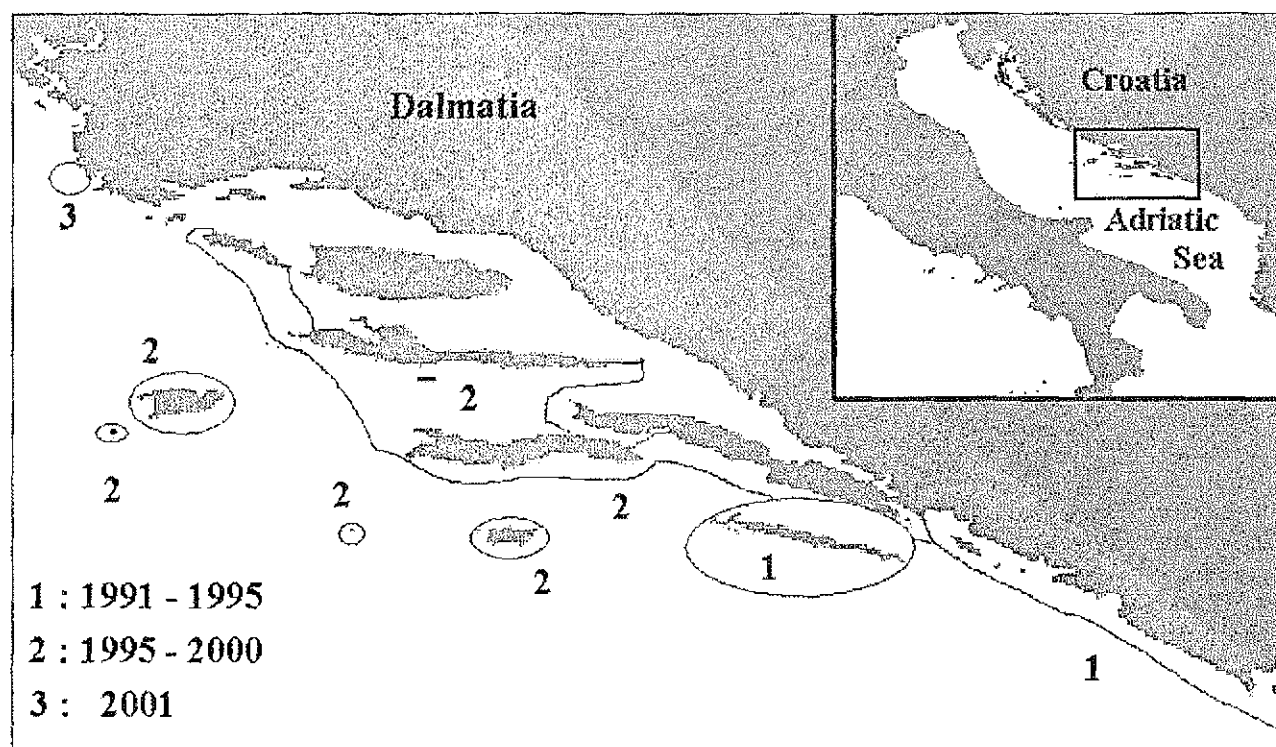


Fig. 2: The successive spreading of the ornate wrasse to the northern parts (1: 1991-1995, 2: 1996-2000 and 3: the record in 2001 – Rogoznica and Primošten area; eastern Adriatic).

Sl. 2: Sukcesivno širjenje pavjega kneza proti severu (1991-1995, 1996-2000 in zapisi v letu 2001 iz območja Rogoznice in Primoštena).

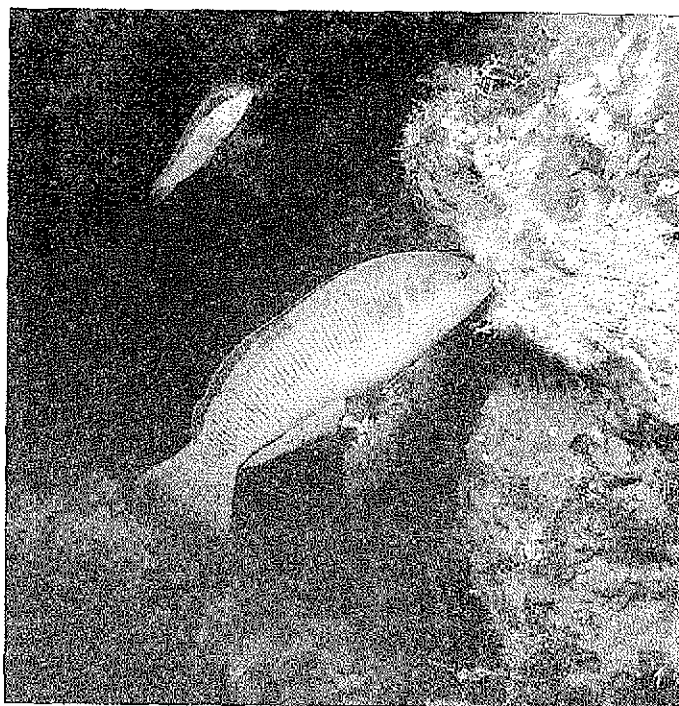


Fig. 3: Ornate wrasse (*Thalassoma pavo*) (Photo: M. Richter).

Sl. 3: Pavji knez (*Thalassoma pavo*) (Foto: M. Richter).

ŠIRJENJE AREALA PAVJEGA KNEZA *THALASSOMA PAVO* (LINNAEUS, 1758) (PISCES: LABRIDAE) V VZHODNEM JADRANU PROTI SEVERU

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POVZETEK

V juliju in avgustu 2001 so bili v Rogoznici (otoček Svilan) in v okolici Primoštena (otočki Grbavac, Lukovnjak in Maslinovik) v vzhodnem Jadranu ujeti dva odrasla in en mladostni osebek pavjega kneza *Thalassoma pavo*. S temi najdbami se je meja razširjenosti v Jadranskem morju pomaknila proti severu. V plitkih vodah so potapljači opravili tudi vizualna štetja in tam zabeležili največje število mladostnih in odraslih osebkov te vrste.

Ključne besede: *Thalassoma pavo*, meja razširjenosti, najsevernejši zapis vrste, Jadransko morje

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