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## ON THE OCCURRENCE OF RIBBON FISH *TRACHIPTERUS TRACHYPTERUS* (GMELIN, 1789) IN THE GULF OF TRIESTE (NORTHERN ADRIATIC SEA)

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### ABSTRACT

*Five adult specimens of ribbon fish Trachipterus trachipterus were registered in the Gulf of Trieste during the summer of 2006. The species is widely distributed, but the records in this area are rare. The morphometric and meristic characteristics and the stomach contents of four specimens are described. Comparison with other reports of rare species in the same area and evolution of the thermohaline properties in the Gulf of Trieste are also considered.*

**Key words:** *Trachipterus trachipterus*, stomach contents, rare species, Gulf of Trieste, Adriatic Sea

## SEGNALAZIONI SULLA COMPARSA DEL PESCE NASTRO *TRACHIPTERUS TRACHYPTERUS* (GMELIN, 1789) NEL GOLFO DI TRIESTE (ADRIATICO SETTENTRIONALE)

### SINTESI

*Cinque esemplari adulti di pesce nastro Trachipterus trachipterus sono stati ritrovati nel Golfo di Trieste durante l'estate 2006. La specie presenta un'ampia distribuzione geografica ma le segnalazioni in queste acque sono rare. Vengono riportate le caratteristiche morfometriche e meristiche e vengono descritti i contenuti stomacali di quattro esemplari. I ritrovamenti vengono confrontati con altre segnalazioni di specie rare nella stessa area e vengono evidenziate alcune relazioni con le caratteristiche termoaline del Golfo di Trieste.*

**Parole chiave:** *Trachipterus trachipterus*, contenuti stomacali, specie rare, Golfo di Trieste, Mare Adriatico

## INTRODUCTION

The ribbon fish *Trachipterus trachipterus* (Gmelin, 1789) is a meso-pelagic species, resident primarily between 200 and 1000 m. It inhabits tropical and subtropical waters of every ocean, occurring in central Pacific Ocean, Japan, New Zealand, south-eastern coasts of Africa and Mediterranean Sea (except eastern Black Sea) (Fischer *et al.*, 1987; Jardas, 1996). Belon (1553) initially named the species *Falx venetorum*. In the Mediterranean, common names for this species exist in France ('poisson ruban'), Greece ('kordélla'), Israel ('trakhipterus'), Italy ('pesce nastro'), Slovenia ('kosica'), Croatia ('mač srebrnjak'), Malta ('fjamma'), Monaco ('pisciu rüban'), Spain ('lista') and Turkey ('kâğit') (Bini, 1969), but no dialectal names are known in the Adriatic Sea (Šoljan, 1975). It is occasionally caught by purse seines, trawling nets and long-lines (Fischer *et al.*, 1987). The species is sporadically recorded in all Italian seas, but only in the Messina Strait it occurs 1–10 times per year (Costa, 1991). Between 1875 and 1980, only 46 adult individuals were recorded in the Adriatic (Jardas, 1980).

More frequently, ribbon fishes are seen dead, floating on the surface or washed to the beach either by waves or tides. Their presence at the surface is probably not normal (Bini, 1969).

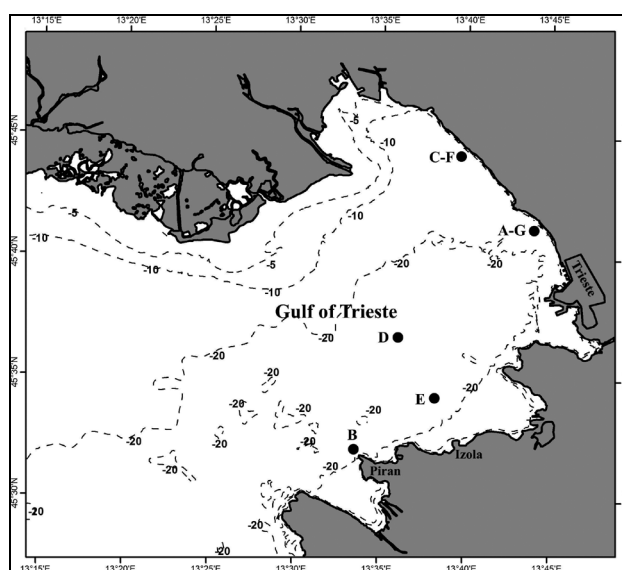
The data on biology and ecology of this species are very scarce. The aim of this paper is to provide new additional data on its occurrence in the Gulf of Trieste and on its distribution and biology in the Adriatic Sea.

## MATERIAL AND METHODS

Between July and September 2006, five specimens of ribbon fish *Trachipterus trachypetrus* (Trachipteridae) were recorded in the Gulf of Trieste.

The first specimen was recorded on July 31, at a depth of 1.5 m, inside the little harbour of "Filtri di Aurisina", in front of the Department of Biological Oceanography of the National Institute of Oceanography and Applied Geophysics (OGS) of Trieste (Fig. 1). In August, two adult specimens were caught off Izola (Slovenia): the first at the beginning of August by a pelagic trawling net, the second on August 10 by a monofilament gillnet, set about 2 NM from the coast (V. Žiža, *pers. comm.*). In September, two other adult specimens were registered: one on September 2, caught by hands at a depth of 0.5 m outside of the same little harbour where the first specimen was found; the other along the seaside of Barcola (Trieste) (N. Bressi, *pers. comm.*). The two adult specimens found at Aurisina were alive, moving slowly with one side turned obliquely.

A juvenile specimen of *T. trachipterus*, found on 15 April 2004 in the coastal waters of Piran (Slovenia), was used to compare the morphology between adult and juvenile stages. The specimen was dead and injured, lack-



**Fig. 1:** Locations of *T. trachipterus* records in the Gulf of Trieste: A (05/08/03, Barcola), B (15/04/04, Piran), C (31/07/06, Aurisina Filtri), D (?/08/06, off Izola), E (10/08/06, 2 NM off Izola), F (02/09/06, Aurisina Filtri), G (?/09/06, Barcola).

**Sl. 1:** Lokacije v Tržaškem zalivu, na katerih je bila zabeležena kosica *T. trachipterus*: A (05/08/03, Barkovlje), B (15/04/04, Piran), C (31/07/06, Nabrežina Filtri), D (?/08/06, Izola), E (10/08/06, 2 NM stran od Izole), F (02/09/06, Nabrežina Filtri), G (?/09/06, Barkovlje).

ing the caudal part. It was preserved in 10% buffered formalin at the laboratory of the Marine Biological Station Piran (National Institute of Biology).

In the laboratory, meristic (Tab. 1) and morphometric (Tab. 2) characteristics were described and the fishes accurately identified according to Bini (1969), Šoljan (1975), Fischer *et al.* (1987), Costa (1991) and Jardas (1996). Length measurements were taken to the nearest 1 mm and weight measurements to the nearest 0.1 g. The stomach of each fish was dissected under a stereomicroscope and the whole content was washed out on a petri dish and examined individually (at 70X magnification). Each prey item was counted and determined at the lowest possible taxonomical level. Comparisons with description of other specimens found in the Mediterranean were made.

## RESULTS AND DISCUSSION

## Morphology

This species possesses all the characteristics of fish living at very great depths. The body is elongated and laterally compressed. Largest height is immediately behind the short head. Colour is silvery, with 3 (sometimes 4) dark blotches over lateral line and 1 in ventral position,

near the head. Fins are red-orange, with a delicate connective membrane (Fig. 2). Dorsal fin is long, as the whole length of the back, with the first few rays elongated in juveniles, but often reduced in adults. Anal fin is absent. Pectoral fins are short and inserted horizontally. Ventral fins are inserted on the ventral profile, with 3–9 very elongated rays in juveniles, but small or absent in adults. Caudal fin consists of two fascicles of rays, the upper elongated and directed upwards, the lower rudimentary and sub-horizontal. Frontal space is black. Eyes are big and circular (Fig. 3). Mouth is small and very protrusible. Teeth are subtle and projecting backwards. The skin is scaleless, but uniformly covered by little bony tubercles (only in adults). The lateral line is formed by bony plates, each with a spine projecting ahead (more evident in the caudal region).

The general shape of body and fins are greatly modified during maturation of the individuals. The body in juveniles is higher, but shorter, and the anterior profile of the head is more steep (Fig. 4). The eyes are located in the centre of the head in juveniles, while in adults they are situated near the dorsal profile.

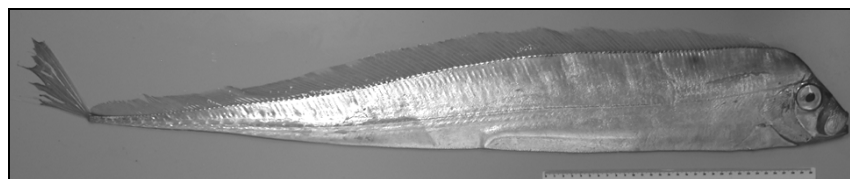
In adults, some characters are drastically reduced. In young specimens, the first 5–6 dorsal fin rays and the

ventral fin rays are extraordinarily long and provided with appendages. At the length of 10 cm, rays of the dorsal and ventral fins become shorter and the caudal fin become similar to a fan. In adults, the swimming bladder is heavily reduced and the teeth are less abundant.

Generally, they hold their body in vertical position, with head upwards and undulating their long dorsal fin. The juveniles use the elongated fins (dorsal, ventral and pectoral) like sails, drifting passively in the current.

Meristic characters (Tab. 1) of the analysed specimens are in agreement with data from specimens of the Adriatic Sea (Jardas, 1980) and other Italian seas (Bini, 1969). The differences recorded in the number of ventral fin rays and teeth in the upper jaw are due to the different life stage of the individuals analysed; in adults, in fact, these characters tend to be reduced.

The species reaches 300 cm (Tortonese, 1970; Šoljan, 1975), but the biggest specimen recorded for the Adriatic Sea was 160 cm long; it was caught in Bakar Bay (near Rijeka, Croatia) in 1951 (Jardas, 1980). Total length of the 33 individuals measured in the Adriatic Sea from 1888 to 1979 ranged between 13.7 and 160.0 cm, and 9 of them were more than 100 cm long (Jardas, 1980).



**Fig. 2:** Specimen of *T. trachipterus* caught on 31 July 2006 in front of the Institute for Biological Oceanography (OGS) of Trieste (30 cm barr is visible right down).

**Sl. 2:** Osebek vrste *T. trachipterus*, ujet 31. julija 2006 pred tržaškim Inštitutom za biološko oceanografijo (OGS) (30 cm merilo v desnem spodnjem kotu).

**Tab. 1:** Meristic characters in each of the specimens recorded recently in the Gulf of Trieste compared with those recorded by other authors (\* referred to juveniles; n.d. not determinable).

**Tab. 1:** Meristični podatki osebkov, nedavno zabeleženih v Tržaškem zalivu, primerjani s podatki drugih avtorjev (\*mladostni osebkji; n.d. nedeterminirani).

Meristic characters	Specimen				Author	
	15/04/04	31/07/06	10/08/06	02/09/06	Bini (1969)	Jardas (1980)
dorsal fin rays D	n.d.	160	180	165	125–187	126–181
ventral fin rays V	5	3	0	0	8*	5–7*
pectoral fin rays P	10	10	11	10	11	9–12
caudal fin rays (upper lobe)	n.d.	8	9	7	6–8	7–8
caudal fin rays (inferior lobe)	n.d.	6	5	6	3–6	
spines along lateral line	n.d.	97	94	91		
right lower jaw (dental) teeth	5*	5	5	5	4–5*	
left lower jaw (dental) teeth	5*	4	4	5	4–5*	
vomer teeth	1*	1	1	1	some*	
right upper jaw (praemaxillary) teeth	7*	7	5	3	8–10*	
left upper jaw (praemaxillary) teeth	4*	5	4	2	8–10*	
gillrakers (1 <sup>st</sup> branchial arch)	12*	13	13	13		

**Tab. 2: Morphometric characters and organ weights in the specimens recorded in the Gulf of Trieste (n.d. not determinable).****Tab. 2: Morfometrični podatki in teža organov osebkov, zabeleženih v Tržaškem zalivu (n.d. nedeterminirani).**

Date	15/04/04	31/07/06	10/08/06	02/09/06
Preservation	formol	frozen	formol	frozen
<b>Morphometric characters (mm)</b>				
total length (TL)	n.d.	998	1033	1205
standard length (SL)	n.d.	878	925	1067
preorbital length	5	26	23	39
eye horizontal diameter	9	32	35	36
head length (C)	28	97	98	111
head height	37	107	105	124
interorbital space	6	21	22	24
predorsal length (LPD)	7	51	55	68
prepectoral length (LPP)	29	93	99	108
preventral length (LPV)	33	105	111	118
maximal body height	39	108	108	126
preanal length (LPA)	110	400	405	500
caudal peduncle height	n.d.	10	11	12
dorsal fin rays maximal length	29	55	68	76
dorsal fin length	n.d.	835	882	990
pectoral fin length	7	26	33	42
caudal fin length (upper lobe)	n.d.	120	125	137
caudal fin length (lower lobe)	n.d.	0.8	1.2	2
ventral fin length	46	0	0	0
sex	n.d.	male	male	male
<b>Weight (g)</b>				
total weight	n.d.	495.2	477.7	1036.3
gutted weight	n.d.	411.7	406.8	956.0
heart	n.d.	0.6	0.8	0.8
stomach	1.4	11.6	22.5	27.1
empty stomach	0.6	7.3	20.9	21.1
liver	n.d.	2.7	6.8	10.3
piloric caeca	n.d.	4.7	8.0	10.3
intestine	n.d.	1.6	2.6	5.6
gonads	n.d.	0.9	1.1	1.6

### Diet

Data about the diet of this species are scarce. Bini (1969) and Tortonese (1970) consider the diet exclusively carnivore, including cephalopods, shrimps, pelagic and benthic fishes, or, rather, mid-water fishes (Dulčić & Lipelj, 1997) and bathypelagic fishes (Costa, 1991).

In the stomachs of ribbon fishes caught in the Gulf of Trieste, both animal and vegetal organisms were found (Tab. 3). Those of adult specimens contained rests of teleost fishes, fragments of algae, marine phanerogams and earth-plants (Fig. 5). The stomach of the juvenile individual presented a wider diet spectrum, comprising numerous Copepods. Probably the vegetal fragments of earth-plants were accidentally ingested.

Jardas (1980) analysed the stomach content of 4 specimens and in 2 of them found *Cymodocea nodosa*, algal fragments of *Dilophus fasciata*, *Cystoseira fimbriata*, leaves of *Pinus* sp. and pieces of other earth-plants. He also found remains of polychaetes and other smaller shrimps, *Enteromorpha intestinalis*, *Coccinella septempunctata*, the cigarette filter and pieces of various plastic objects. The diversity of ingested objects indicates that the species is a voracious predator, eating virtually everything when missing its natural prey. According to the same author, this also indicates that the collected individuals were active for a certain period in the littoral region, though the area does not represent their natural environment.

**Tab. 3: List of prey items found in the stomachs of *T. trachypterus* from the Gulf of Trieste.****Tab. 3: Seznam enot plena, najdenega v želodcih kosice *T. trachypterus* iz Tržaškega zaliva.**

Prey items		Specimens				
group	species	15/04/04	31/07/06	02/09/06	10/08/06	
Diatoms	<i>Coscinodiscus</i> sp.	1				
Dinoflagellates	<i>Protoperidinium</i> sp.	1				
Algae	<i>Cladophora dalmatica</i>		fragments			
	<i>Rhizoclonium riparium</i>		fragments			
Marine Phanerogams	<i>Cymodocea nodosa</i>			leaves and rhizome	leave	
Earth-plants	<i>Cupressus cupressus</i>			leaves		
	<i>Betula pendula</i>	1 seed				
Cladocerans	<i>Evadne nordmanni</i>	1				
Copepods	<i>Acartia clausi</i>	1				
	<i>Temora longicornis</i>	8				
	<i>Temora stylifera</i>	2				
	<i>Diaixis pigmoea</i>	1				
	<i>Calanus helgolandicus</i>	1				
	Calanidae	9				
	Clauso-Paracalanidae	19				
	<i>Oithona plumifera</i>	23				
	<i>Oithona nana</i>	1				
	<i>Corycaeus</i> sp.	5				
	<i>Euterpina acutifrons</i>	5				
	<i>Microsetella rosea</i>	2				
	Copepoda nauplius	1				
	Isopods	Isopoda	3			
	Decapods	Alpheidae	1			
Bony fishes	<i>Engraulis encrasicolus</i>			1		
	Teleostea	3				

### Parasites

On the skin of the specimen caught on 31 July 2006, 32 individuals of *Paragnathia formica* (Isopoda) and 2 parasitic Copepods of the genus *Caligus* (Cyclopoida) were counted.

### Reproduction

Dulčić (1996) found, for the first time in the Adriatic, a larval specimen of *T. trachypterus* at Stončica near Vis Island (southern Adriatic). Bini (1969) reports that eggs and larvae of this species are found in the plankton of Messina Strait from November to May, suggesting that the spawning period extends to the whole year. On the beaches of the same strait, juvenile and adult specimens are generally recorded in March, April and May (Costa, 1991). Jardas (1980) observed that its higher frequency along the eastern Adriatic coasts during spring and summer months is correlated with the spawning period. All the adult specimens analysed in this work were males.



**Fig. 3: Detail of head in adult *T. trachypterus*.**  
**Sl. 3: Detajl glave odrasle kosice *T. trachypterus*.**

**Tab. 4: Date, location, length and reference of records of *T. trachypterus* in the Gulf of Trieste.**  
**Tab. 4: Datum, lokacija, dolžina in vir kosic *T. trachypterus*, zabeleženih v Tržaškem zalivu.**

Date	Locality	Length (cm)	Reference
1888	Gulf of Trieste	adult	Marcuzzi (1972)
1888	Gulf of Trieste	juvenile	Marcuzzi (1972)
?	Grignano	108	Jardas (1980)
?	Grignano	83	Jardas (1980)
?	Gulf of Trieste	67	Jardas (1980)
?	Gulf of Trieste	75	Jardas (1980)
02/1992	Ronek cape	110	Dulčić & Lipej (1997)
1992	Grignano	114	Bussani (1992)
05/08/2003	Barcola	105	R. Auriemma ( <i>pers. comm.</i> )
15/04/2004	Piran	~25	this work
31/07/2006	Aurisina	100	this work
~01/08/2006	Gulf of Trieste	adult	V. Žiža ( <i>pers. comm.</i> )
10/08/2006	2 NM off Izola	103	this work
02/09/2006	Aurisina	120	this work
09/2006	Barcola	110	N. Bressi ( <i>pers. comm.</i> )

#### Comparison with other records

In the Mediterranean Sea, the occurrence of the species is rarely documented, although it is occasionally caught in the Aegean Sea (Papakonstantinou, 1988; Bilecenoglu *et al.*, 2002), Messina Strait (Costa, 1991) and the western Mediterranean (Tortonese, 1958; Fabre, 1967). Since the recorded specimens of *T. trachypterus* have been caught with different fishing gears, its rarity does not seem to be connected with the use of inappropriate fishing techniques. This fact supports the belief that this species is truly rare.

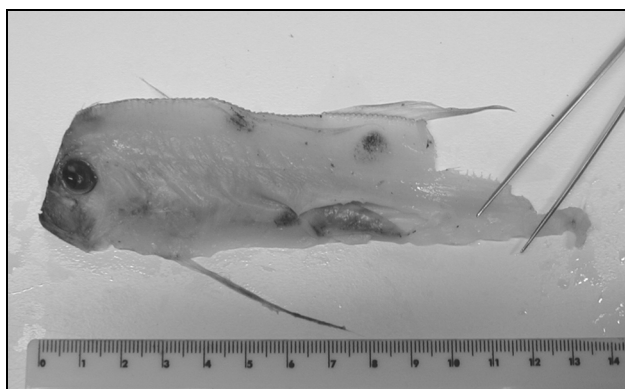
In the Adriatic Sea, *T. trachypterus* was for the first time reported by Kolombatović (1881), but Faber (1883) described this species as generic, although rare, reporting it for Trieste, Venice and Dalmatia. Jardas (1980) reported on the capture of 46 specimens from the Adriatic Sea since 1875. Six of those individuals were no doubt from the Gulf of Trieste: 2 were recorded in 1888 and 4 between 1939 and 1951 (Tab. 4). There are no documented records for the 1951–1991 and 1993–2002 periods.

During the summer of 2006, i.e. in the same period when the records presented in this work were made, an adult specimen, about 1 meter long, was washed up by tide at Brussa (Caorle, Italy) on July 9 (A. Colla, *pers. comm.*). On 4 August 2006, another specimen of about 40 cm was caught at Dugi otok (central-eastern Adriatic) in the shallow waters of a little harbour by a fisherman using a harpoon (N. Burba, *pers. comm.*). Previous records had not been so frequent: on 15 April 2004, the juvenile specimen analysed in this work was registered at Piran, whereas on 5 August 2003, an adult specimen, 105 cm long, was found at the Barcola seaside (Trieste) (R. Auriemma, *pers. comm.*). In 1992, however, records

of *T. trachypterus* were relatively common in the middle and northern parts of the Adriatic. In that year, sport-fishermen caught a 114 cm long specimen in the vicinity of Grignano harbour the Gulf of Trieste (Bussani, 1992).

According to Jardas & Pallaoro (1996), the occurrence of *T. trachypterus* in central and northern regions of the Adriatic might be associated with some special climatological and oceanographical conditions in 1992 and 1994, such as inputs of intermediate waters (50–100 m) from the eastern Mediterranean into the Adriatic, which influenced the increase in salinity and temperature (Buljan, 1953; Jardas, 1980; Vučetić, 1982). Pallaoro (1988) stated that the Adriatic ingressions in the 1986–87 period caused more rare species, such as *Centracanthus cirrus*, *Aulopus filamentosus*, *Pseudocharanx dentex*, *Synodus saurus*, *Centrolophus niger*, to appear in the central Adriatic region. The unusual abundance of such rarely found fish species compared to the non-ingression periods gives indication of their interdependence. Dulčić *et al.* (1999) found that most of new occurrences of fish species were recorded in the 1985–1987 and 1990–1995 periods, when 11 subtropical and tropical fishes were recorded for the first time.

Also in the Gulf of Trieste, which is the northernmost part of the Mediterranean Sea, thermohaline anomalies, occurring in spring-summer periods, have been related to advective flow of high salinity waters from the South into the basin (Celio *et al.*, 2002). For this region, the specific ichthyological list accounts as new species *Plectorhincus mediterraneus* (Lipej *et al.*, 1996), *Epinephelus marginatus* (Dulčić & Lipej, 1997), *Coryphaena hippurus* (Dulčić & Lipej, 1997), *Sphyræna sphyraena* (Žiža, 1997), *Ruvettus pretiosus* (Bettoso & Dulčić, 1999) and *Brama brama* (G. Barbieri, *pers. comm.*). It is interesting that in a less recent paper, Bus-



**Fig. 4:** Juvenile specimen found on 15 April 2004 off Pirana.

**Sl. 4:** Mladostni osebek, najden 15. aprila 2004 v bližini Pirana.

sani & Feoli (1976) reported some other species rare for the Adriatic (especially for its northern part), such as *Centrolophus niger*, *Trachinotus ovatus*, *Naucrates ductor* and *Polyprion americanus*.

It is difficult to accurately interpret long-term observations of coastal water thermohaline properties, considering that signals of interannual variations in seasonal temperature and salinity are strongly influenced by many agents, such as the shallowness of the water column, the freshwater inputs from rivers, the tidal amplitude and the action of wind (Orlić *et al.*, 1992). However, all changes in marine life may also suggest the changing of ocean conditions (Tonn, 1990), since marine flora and fauna integrate medium-term changes in ambient conditions (Soule & Keppel, 1988).

The status of the ribbon fish needs to be evaluated on a continuous basis, as it is becoming increasingly apparent that uncommon species can be essential indicators of environmental changes (Swabby & Potts, 1990).

## O POJAVLJANJU KOSICE *TRACHIPTERUS TRACHYPTERUS* (GMELIN, 1789) V TRŽAŠKEM ZALIVU (SEVERNI JADRAN)

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### POVZETEK

V poletnih mesecih 2006 je bilo v Tržaškem zalivu zabeleženih pet odraslih osebkov kosice *Trachipterus trachipterus*. Čeprav je vrsta razširjena v večjem delu tega območja, so podatki o njej redki. Avtorja opisujeta morfološke in meristične značilnosti vrste in strukturo hrane v želodcih štirih osebkov. Napravljena je tudi primerjava z drugimi podatki o redkih vrstah v istem območju in opisan razvoj termohalinskih značilnosti v Tržaškem zalivu.

**Ključne besede:** *Trachipterus trachipterus*, struktura hrane v želodcih, redka vrsta, Tržaški zaliv, Jadransko morje



**Fig. 5:** Stomach content of the specimen caught on 31 July 2006.

**Sl. 5:** Struktura hrane v želodcu osebkov, ujetega 31. julija 2006.

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