

## RESEARCH ARTICLE

(Open Access)

**Parapeneus longirostris stock in Adriatic sea**

J. KOLITARI<sup>4</sup>, BITETTO I.<sup>1</sup>, P. CARBONARA<sup>1</sup>, L. CASCIARO<sup>1</sup>, L. CERIOLA<sup>2</sup>, M. DUROVIC<sup>3</sup>, M.T. FACCHINI<sup>1</sup>, A. HOXHA<sup>4</sup>, Z. IKICA<sup>3</sup>, A. JOKSIMOVIC<sup>3</sup>, O. KASALICA<sup>3</sup>, G. KROQI<sup>4</sup>, G. LEMBO<sup>1</sup>, N. MILONE<sup>2</sup>, M.T. SPEDICATO<sup>1</sup>

<sup>1</sup> COISPA Tecnologia&Ricerca, Bari, Italy

<sup>2</sup> ADRIAMED (FAO)

<sup>3</sup> Institute of Marine Biology, Kotor, Montenegro

<sup>4</sup> University of Agriculture, Tirana, Albania

\*Corresponding author e-mail: jkolitari@gmail.com

**Abstract**

The stock of pink shrimp was assumed in the boundaries of the whole GSA18, lacking specific information on stock identification. In the southern Adriatic deep water pink shrimp is distributed mostly between 30 and 600 m depth although it is more abundant between 200 and 400 m depth. The eastern part the south Adriatic is characterized by high occurrence and abundance of the species, given the characteristics of the water masses (warmer and saltier). Pink shrimp is one of the target species of the central and southern Adriatic multi-species trawl catches. Nursery areas, but especially adult aggregations of females are mainly located in the eastern part of the GSA18, along the Albania coast, where a persistent spawning ground is localized. Methodic: Data Standardized LFD abundance indices (N/km<sup>2</sup>), whole GSA18 (MEDITS data 1996-2012). Length structure of landings and production by fishing segment (for west side from DCF, for the east side within a pilot study in the framework of Adriamed project and from National Statistics. Are used models and software performed using VIT on 2008-2011 data. This year an attempt with XSA has been made, given that the time series covers the mean life span at least one time. Indirect methods: XSA (Extended Survivors Analysis). Estimates of growth parameters achieved using DCF data through the analysis of length frequency distributions and von Bertalanffy model. Production data: for Italy from 2007 to 2012 from DCF; for Albania from 2008 to 2011. For Montenegro from 2008 to 2011. Albanian data have been adjusted to take into account that the export is the 64% of the total production.. Given the results from this analysis, based on the whole information from the area, it is necessary to consider that a reduction of the fishing mortality is necessary. Can be gradually achieved by multi-annual management plan. Simulations will assist the results of different harvest scenarios. Most part (59.9%) of the total production in the GSA is exerted by the Italian fleet, while Montenegrin trawlers account only for about 2.5% of the F exerted on the GSA and Albanian trawlers of about 37.6%.

**Keywords** :Parapeneuslongirostris, nursery areas, Stock assessment, abundance indices, trawl

**1. Introduction**

The Adriatic Sea is a semiclosed basin in the Mediterranean Sea. It is connected to the rest of the Mediterranean by the Channel of Otranto, which is 40 NM wide and about 741 m deep. The Adriatic Sea covers about 800 Km by latitude and from 100 to 200 Km by longitude [1]. It has a surface area, islands included, of 138 595 km<sup>2</sup>, which is around 4,6% of the total Mediterranean surface. The Adriatic is a shallow sea. Most of the bottom, about 102 415 km<sup>2</sup> or 73 %, is less than 200 m deep. The depth gradually decreases from south to north. The sea bottom of the Adriatic shelf is covered with recent sediments of various structural and mineral petrographic composition [2,3]. The muddy and sandy sediments

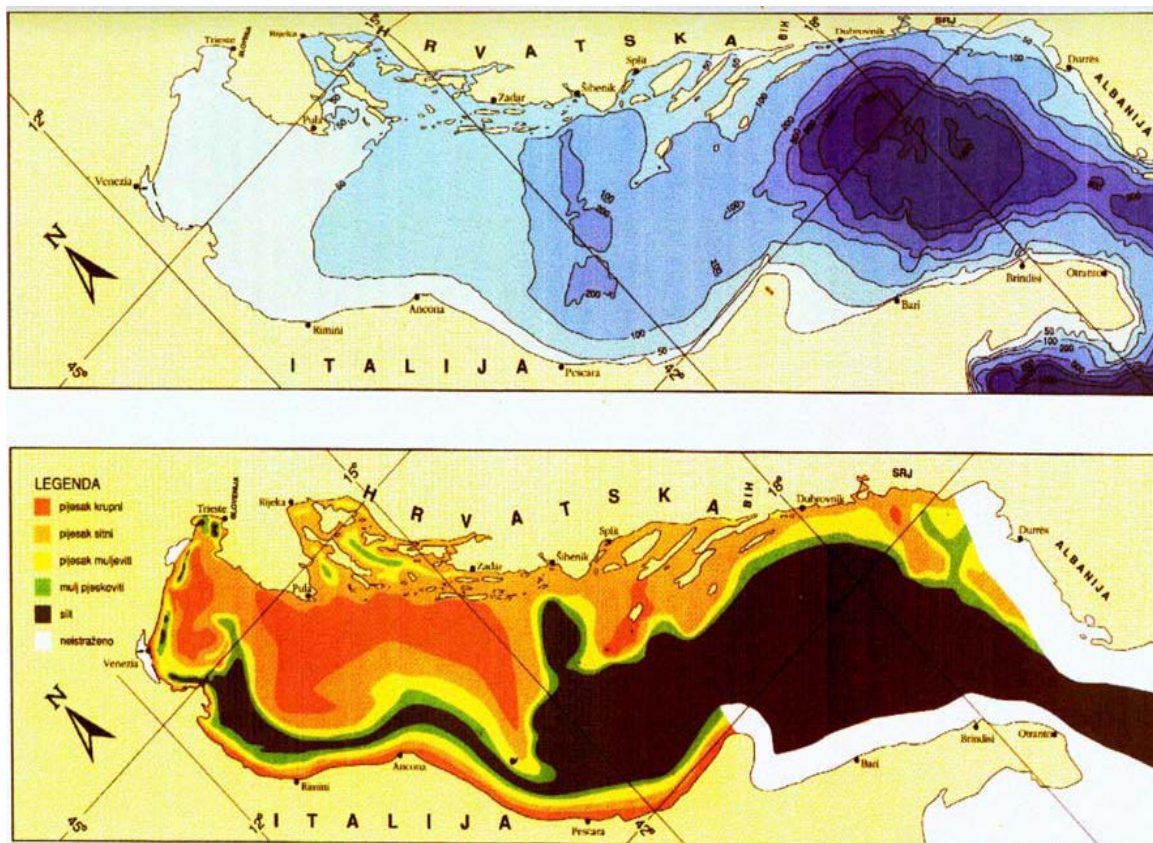
are present at the largest part of the shelf (Figure 1). They cover almost the entire south and central Adriatic Sea bottoms, together with the channel area of the north-eastern Adriatic. Muddy sediments also cover most of the northern Adriatic, smaller part of the central area and some limited areas of the southern Adriatic [4, 5, 6 ].

In the Adriatic Sea, the demersal fishery takes place on the entire continental shelf and on a part of the continental slope in the southern Adriatic [7, 8, 9, 10]. Most of the fishing activity is carried out by trawlers of various sizes and engine power. The use of fixed gear is usually limited to the area unsuitable for trawling [11, 12, 13 ]. Unlike the pelagic fishery, where mostly one or two species are targeted, in the demersal fishery the situation is more complex [14].

The demersal fishery is a multispecies fishery and the main target species are: European hake (*Merluccius merluccius*), Red mullet (*Mullus barbatus*), breams (*Pagellus spp.*), Whiting (*Merlangius merlangus*), anglerfish (*Lophius spp.*), flatfish (*Solea spp.*), (*Eledone spp.*), Common cuttlefish (*Sepia officinalis*), squids (*Loligo and Illex*), Norway lobster (*Nephrops norvegicus*) and Deepwater rose shrimp (*Parapenaeus longirostris*) [15, 16]. This species is distributed in the eastern Atlantic from Angola to Portugal and in the West Atlantic from Guyana to Massachusetts [17]. It inhabits the entire Mediterranean [18]. *Parapenaeus longirostris* can be found at depths between 20 and 700 m, but it is common and abundant on sandy-muddy bottoms between 100 and 400 m [19, 20]. During the expedition "Hvar" this decapod crustacean was not

recorded in the northern Adriatic. In the southern Adriatic (along the Italian coast) the population is the most dense at depths from 200 to 400 m [21]. More recently, it was discovered that this species was abundant along the Albanian coast [22]. *Parapenaeus longirostris* can grow up to 16 cm (males) and 19 cm (females) in total length.

However, males are usually 8 to 14 cm long and females from 12 to 16 cm long. In the Mediterranean Sea, both sexes of *P. longirostris* reach maturity in the first year of life [23]. The growth rate differs between the sexes. Size distribution and growth parameters indicate a life cycle of 3-4 years [24, 25]. In the Adriatic Sea, *P. longirostris* is fished only with bottom trawl nets. Although the biggest specimens have greater commercial value, the entire catch of *P. longirostris* is marketable.



**Figure 1.** Bathymetric map and map of sediments of the Adriatic Sea. (Hrvatski hidrografski institut, Peljar, 1999)

## 2. Material and Method

Pink shrimp is only targeted by trawlers and fishing grounds are located along the coasts of the whole GSA. Catches from trawlers are from a depth range between 50-60 and 500 m and the species may co-occur with other important commercial species as *M. merluccius*, *I. coindetii*, *E. cirrhosa*, *Lophius spp.*,

*L. boschii*, *N. norvegicus*. The EU has funded new surveys in the Adriatic since 1994 in the framework of the MEDITS (MEDiterranean International Trawl Survey) programme. This programme was organized in 1993 and sampling started in 1994. Initially, only EU member countries participated in the programme (France, Greece, Italy and Spain). Albania, Croatia and Slovenia joined the programme in 1996. It was

the first time in history that the most of the Adriatic Sea was covered by a bottom trawl survey. About twenty institutes and laboratories from seven countries were involved in the MEDITS programmer which was the first to produce such common data on this scale in the Mediterranean. It covered all the trawl able areas on shelves and the slope (at depths from 10 to 800 m) using the same, standardized protocol. Stations were selected on the basis of a stratified scheme with random selection of stations in every stratum (10-50 m; 50- 100 m, 100-200 m, 200- 500 m and over 500 m). The number of stations (Table 1) in each stratum is proportional to the surface of the stratum methodic. A special, French type of bottom trawl net (GOC 73) was used for sampling; it was constructed from IFREMER, Sete. The main characteristics of the net are a smaller mesh size of the net cod-end (10 mm knot to knot), as well as a larger vertical and horizontal opening than the ordinary commercial net used in the trawl fishery of the Adriatic. Samples were taken only during the daylight hours in the spring period. Towing time was half an hour at the stations located on the shelf and one hour at those on the slope. Qualitative and quantitative structure (number and weight) and species composition of the catch were analyzed on board. Subsamples of the target species (36 commercially important species of fish, crustaceans and cephalopods) were taken for the laboratory data analysis. Length, sex and stage of maturity of gonads were determined in laboratory using a unified methodology.

According to MEDITS survey; the stations are the same every year. Sampling and methodology of data analysis are standardized as well. During the survey MEDITS 2012 , the number of hauls was 90.

Table 1. Stations according hauls and depth strata

Depth strata (m)	Number of hauls
A ( 10 – 50)	12
B ( 51 - 100)	19
C ( 101 - 200)	32
D ( 201 - 500)	13
E ( 501 - 800 )	14
Shelf (10- 200)	63
Slope ( 201 - 800)	27
Total ( 10 – 800)	90

The data of the above are in the relevant national institutes and laboratories which participated in these investigations. Since 2001, research on the demersal communities along the eastern coast of the Adriatic (Albania, Montenegro, Croatia and Slovenia) has been organized as a part of the FAO regional Project AdriaMed. Data Standardized LFD abundance indices (N/km<sup>2</sup>), whole GSA18 (MEDITS data 1996-2012). Length structure of landings and production by fishing segment (for west side from DCF, for the east side within a pilot study in the framework of Adriamed project and from National Statistics). Are used models and software and the as

Assessment has been performed using VIT on 2008-2011 data. An attempt with XSA has been made, given that the time series covers the mean life span at least one time. Indirect methods: XSA (Extended Survivors Analysis) NEW and Prediction models: ALADYM .

### 3. Results and discussions

Nursery areas, but especially adult aggregations of females are mainly located in the eastern part of the GSA18, along the Albania coast, where a persistent spawning ground is localized. Warmer and saltier waters flowing in the eastern side are a favorable environmental condition for the preferential distribution of this species.

Estimates of growth parameters achieved using DCF data through the analysis of length frequency distributions and von Bertalanffy model . The results were :Lin<sub>f</sub>: 45 mm; K: 0.6; t<sub>0</sub>: -0.2. Size distribution and growth parameters indicate a life cycle of 3-4 years. The parameters of the length-weight relationship estimated within the DCF for sex combined and carapace length expressed in cm were: a=0.926, b=2.434

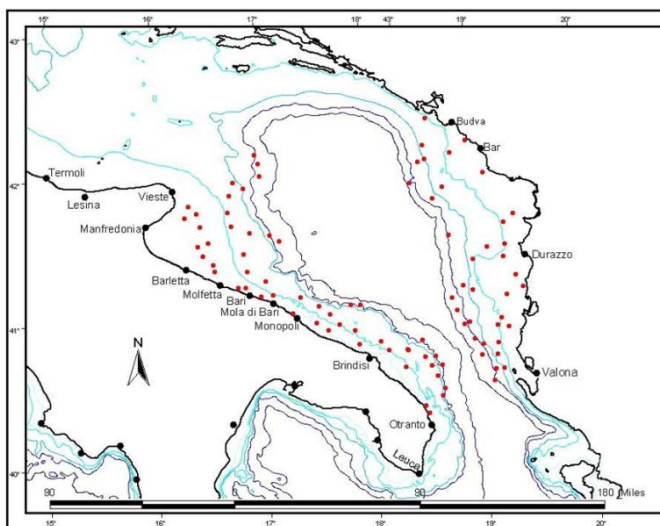
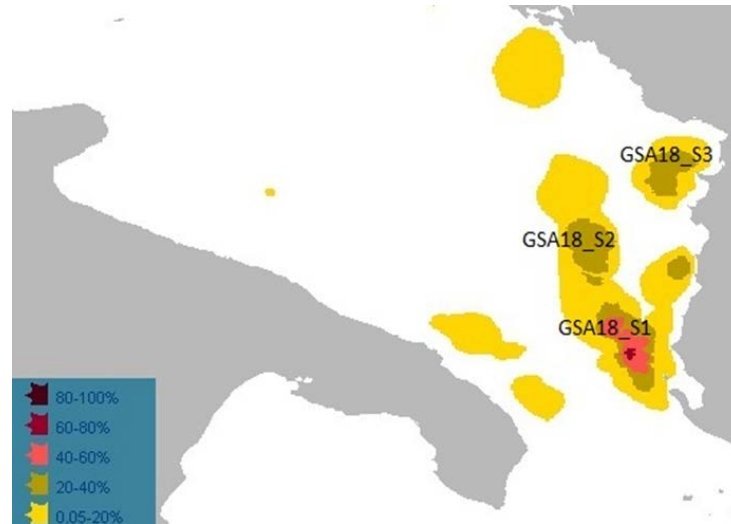
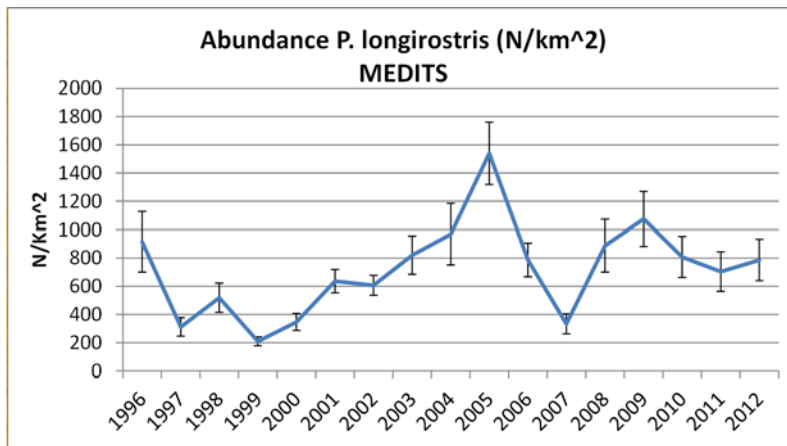


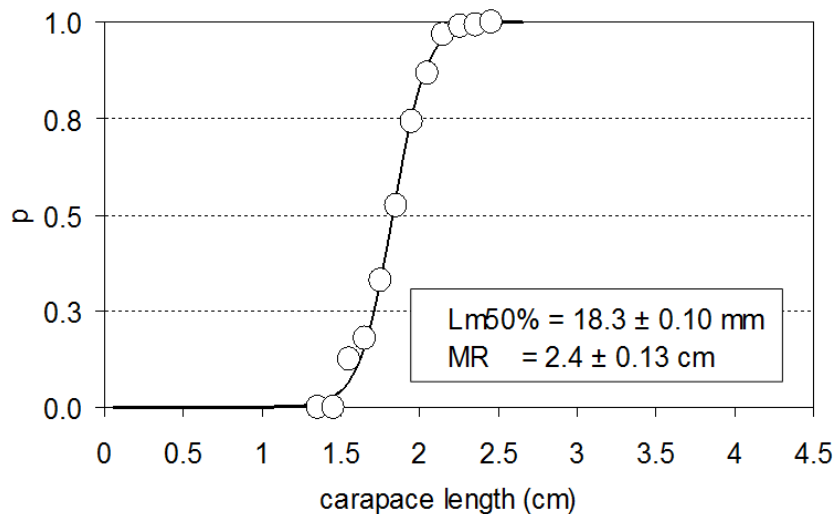
Figure 2 : GSA 18 – Survey MEDITS 2012



**Figure 3:** Position of persistent nursery (top) and spawning areas (bottom) of deep-sea pink shrimp in GSA 18 (MEDISEH Project – MAREA framework)



**Figure 4:** MEDITS Abundance index in period 1996 -2012



**Figure 5:** Maturity and Natural Mortality in *P. longirostris*

In the Mediterranean Sea, both sexes of *P. longirostris* reach maturity in the first year of life. The same maturity and natural mortality vectors of the

previous assessment performed with VIT have been used. The fishing mortality acting on the age groups shows values changing from 1 in 2009 to 1.42 in

2011, with an average over the last three years of 1.33. Sensitivity analysis with shrinkage 0.5, 1, 1.5 and 2 has been performed, and shrinkage = 0.5 has been chosen on the basis of residuals and retrospective analysis. About the date from 4 fishing fleet segments: Italian trawlers LOA <24 m, Italian trawlers LOA ≥24 m, Albanian trawlers, Montenegrin trawlers. Selectivity of all the fleet segments has been modelled until 2010 as a classical ogive with SL50 = 14.2 mm and SR=2.9 mm. From 2011 all fleet segments (except Montenegro that remains with diamond mesh size of 40 mm) have SL50 = 17 mm and SR=2.9 mm corresponding to a diamond mesh size of 50 mm (according to mesh size increase in 2010). Monthly production and effort data have been used for Italian fleet segments. For Montenegro and Albania the annual production has been split equally in the 12 months. For Montenegro the monthly effort has been used, while for Albania the effort has been assumed constant.

#### 4. Conclusions

Given the results from this analysis, based on the whole information from the area, it is necessary to consider that a reduction of the fishing mortality is necessary. The BRPs F0.1 can be gradually achieved by multi-annual management plan. Simulations will assist the results of different harvest scenarios. Most part (59.9%) of the total production in the GSA is exerted by the Italian fleet, while Montenegrin trawlers account only for about 2.5% of the F exerted on the GSA and Albanian trawlers of about 37.6%.

#### 5. Recommendations

- Status quo until 2021.
- Reduction to F0.1 level until 2020, with a gradual annual decrease.
- Increase in mesh size (60 mm for Italy and Albania and 50 mm for Montenegro); fishing ban from
- August to October for all fleet segments.

#### 6. References

1. Mozetic P, Fonda S, Cataletto B, and Malej A, **Seasonal and inter-annual plankton variability in the Gulf of Trieste (northern Adriatic)** *RICES Journal of Marine Science*, 1998, 55: 711–722.
2. Marano G, De Zio V, Pastorelli A, Rizzi E, Ungaro N, Vaccarella, R. **Considerazioni sullo stato di sfruttamento delle risorse demersali (Basso Adriatico)**. *Atti Sem. sullaRegolaz. SforzoPesca. Biol. Mar. Medit.* 1994, 1 (2): 89-94.
3. Abella A.J, Serena F. **Stato di sfruttamento del nasello nei compartimenti di pesca di Livorno e Viareggio**. *Biol. Mar. Medit.*, 1998, 5(2): 136-150.
4. Fiorentini L, Dremiere P.Y. **ESMED Efficacy and selectivity of trawl used for the MEDITS project**. *Study Proposal*, 1999, 95/29:118.
5. AdriaMed. **Priority topics related to shared demersal fishery resources of the Adriatic Sea**. *Report of the first meeting of the AdriaMed Working Group on shared demersalresources. FAO-MiPAF Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea*. 2000, GCP/RER/010/ITA/TD-02: 21.
6. **International bottom trawl survey in the Mediterranean: the MEDITS programme**. *ICES CM* 1997-03: 16.
7. Frogliola C. **Contribution to the knowledge of the biology of Parapeneus longirostris(Lucas) (Decapoda, Penaeoidea)**. *Quad. Lab. Tecnol. Pesca*, 1982, 3(2-5): 163-168.
8. General Fisheries Commission for the Mediterranean (GFCM). **Report of the twenty six session. LaccoAmeno, Ischia, Italy**, 10-13 September 2001. GFCM Report. No 26.Rome, FAO, 27.
9. Mannini P, Massa F. **Brief overview of Adriatic fisheries landing trends, 2000**, (72-97).
10. Massa F and Mannini P, **Report of First Meeting of the Adriamed Coordination Committee**. **FAO-MiPAF Scientific Cooperation to Support responsible Fisheries in the Adriatic sea**. GCP/RER/010/ITA/TD-2001: 31-49.
11. Marano G, De Zio V, Pastorelli A, Rizzi E, Ungaro N, Vaccarella R. **Considerazioni sullo stato di sfruttamento delle risorse demersali (Basso Adriatico)**. *Atti Sem. sullaRegolaz. SforzoPesca. Biol. Mar. Medit.* 1994, 1 (2): 89-94.
12. Marano G, Ungaro N, Marano C.A, Marsan R. **La ricerca sulle risorse demersali del bacino Adriaticosud-occidentale (anni 1985-97): sintesi dei risultati**. *Biol. Mar.Medit.*, 1998, 5 (3): 109-119.
13. Marano G, Ungaro N, Marzano M.C, Marsan R. **Le risorse demersali dell'Adriaticopugliese: Analisi di una serie storica ('85-'95) relative ai**

- dati di cattura e demografiadegli stock.**  
*Biol.Mar. Medit*, 1998, 5 (2): 52-67.
14. Pastorelli A.M, Vaccarella R, Marano G, Ungaro, N. **I crostacei dei fondi strascicabili del basso Adriatico.** *Nova Thalassia*, 1996, 12: 27-35.
  15. Pastorelli A.M, Vaccarella R, de Zio V. **Distribuzione dei cefalopodico merciali nel basso Adriatico.** *Biol. Mar. Medit*, 1995, 2 (2): 501-502.
  16. Relini G. **I progressi della ricerca italiana sulla pescaa strascico.** 1998, *Biol. Mar. Medit.*, 5(2).
  17. Ungaro N, Marano, C. A, D'Uggento, A. **Relazioni tra specie demersali del bacino Adriatico sud-occidentale: Analisi statistica di serie storiche.** *Biol. Mar. Medit.*, 1998, 5 (1):196-202.
  18. Ungaro N, Marano G, Vaccarella R. **Comparazione tra aree batialis tra scicabilidel basso Adriatico mediante l'utilizzo dell'analisi fatto riale delle corrispondenze.** 1996, *Biol.Mar. Medit.* 2 (2): 185-189.
  19. Arneri E, Piccinetti C. **Evaluation de l'effort de pêche au chalut en haute etmoyenne Adriatique.** *FAO Fish.Rep.* 1988, 394: 230-233.
  20. Bombace G, Cingolani N, Coppola S.R., Mortera, J report . **Summary on the quality check sample survey of fisheries catch and effort statistics – Adriatic Sea.** *FAO Fish.Rep.* 1988, 394: 245-250.
  21. Fabi G, Sbrana M, Biagi F, Grati F, Leonori O, Sartor P. **Trammel and gill net selectivity for Lithogna thusmormyrus (L.), Diplodusannularis (L.) and Mullus barbatus (L.) in the Adriatic and Ligurian seas.** *Fishery Research*, 2001, 1224: 1-14.
  22. Fiorentini L, Cosmi G. **Some remarks on the Italian bottom trawl.** *FAO Fish.Rep*,1981, 253: 125- 130.
  23. Ungaro N, Marano G, Marsan R, Osmani K. **Demersal fish assemblage biodiversity as an index of fishery resources exploitation.** *Ital. J. Zool.*, 1998, 65 suppl: 511-516.
  24. Ungaro N, Marano C.A, Marsan R, Martino M, Marzano M. C, Strippoli G, Vlora A. **Analysis of demersal species assemblages from trawl surveys in the South Adriatic sea.** *Aquat. Living Resour*, 1999, 12 (3): 177-185.
  25. Vaccarella R, Marano G, Piccinetti C, Manfrin G, Rizzi E, Ungaro N. **Nota su alcuni fondi strascicabili e mesobatiali dell' Adriaticopugliese,** *Oebalia*, 1992, suppl.XVII: 109-116.