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Assessment of Contamination by Xenobiotics (Lead and Cadmium) in the Muscle Tissue of two Teleost Spotted Weever (*Trachinus Araneus,*Cuvier, 1829) and the Axillary Seabream, (*Pagellus Acarne*, Risso, 1826) in the Algerian West Coast

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ABSTRACT

Metals pollutants differ from other chemical pollutants by a low biodegradability and a high capacity to bioaccumulate along the food chain, which could be detrimental to the population as well as the flora and fauna. Our study focused on the assessment of contamination by the toxic metals: lead and cadmium in muscle and liver from two bioindicators in the western Mediterranean coast of Algeria, the axillary seabream (*Pagellusacarne*,Risso, 1826) and bright spider (*Trachinusaraneus* Cuvier, 1829). The concentrations of the metal elements were determined by Atomic Absorption Spectrophotometry flame, depending on two parameters (size, organs and seasonal). And levels of metal accumulation were determined. The present study showed the ubiquity of two toxic trace elements (Cd and Pb) in both organs of both species. The results show differences more or less marked between the two species and organs as well as significant in the two metals analyzed variations. Although average metal concentrations measured in fish muscle are low, high levels of Pb and Cd were observed in the liver of two species of fish. This is due to biomagnification of these elements in both biological bioindicators who occupy high trophic level of the marine food chain. The treatment has stressed no statistically significant difference between the heavy metal content of the two species in the muscle against by significant values are noted in the liver. Similarly, it is clear that the chemical pressure is well marked among younger aquatic individuals. The concentrations of heavy metals recorded in the edible parts of poisons were within the Maximum Dose Permissible (MPD). They are safe for human consumption, but can lead to serious dysfunction in these fish.

Keywords:
Axillary seabream,*Pagellusacarne*, Spottedweever,*Trachinusaraneus*, lead, cadmium,marine pollution, MPD, Bay of Oran, Algeria.

I. INTRODUCTION

Metal contaminants released from current and past human activities are ubiquitous in the environment, especially in the sediments of rivers, these compounds tend to accumulate, which pose a potential threat to aquatic organisms.

It is in this context that our work is. This is to assess the state of the quality of the coastal environment by studying contaminants (Cd, Pb) in muscle and organs and liver muscle of the living spider caught in the Bay of Oran since it forms an important link in the trophic chain.

II. METHODS AND MATERIAL

Oran Bay (Fig. 1) is located north west of Algeria and South West of the Mediterranean, it belongs to the Coast Mountains Tel Septentrional (Jebel Murdjadjo and Khar) (Leclaire, 1972).

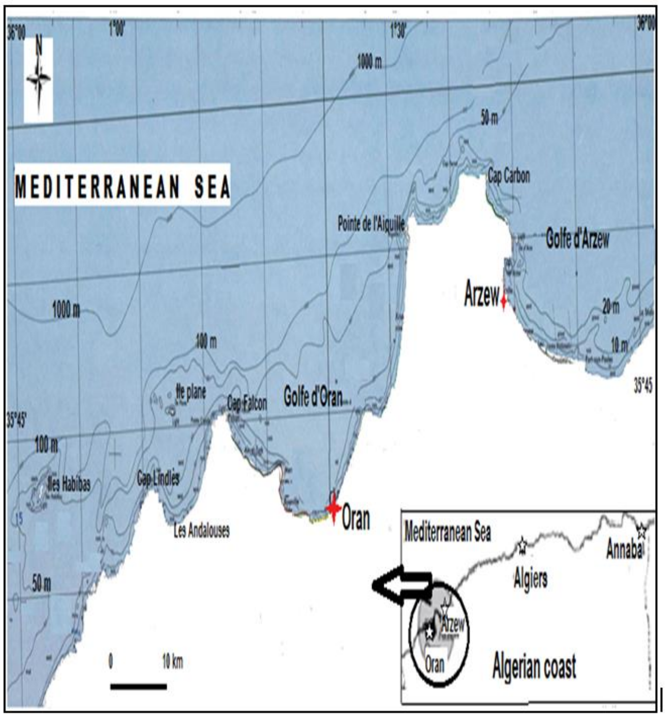

Figure 1: Geographical position of the study area: the Bay of Oran

Bright (Fig. 2) are a family of marine fish perciformes. Vivid found in the eastern Atlantic and the Mediterranean to the Black Sea. They stand near the coast in summer and offshore in winter. Bright spider Trachinusaraneus(Cuvier, 1829) (Fig. 2) is a coastal benthic species that lives buried in the substrate on coarse detrital sandy and sandy mud, up to about 100 m depth are revealing that their spines erected and the top of their head (Geistdoerfer 1983; Skeie, 1966).

The axillary seabream (Fig. 3) is found in the Mediterranean, Atlantic, in the Canary Islands, Cape Verde ... It usually lives at a depth of between 40 and 100 m (max 500 m).

Figure 2 : The random spider Trachinus araneus Cuvier, 1829.

Figure 3 : The axillary seabream Pagellus acarne Risso, 1826

Sampling took place over one year from July 2013 to June 2014, both organs were removed: liver, and muscle.

The first step in our technique is to group individuals into batches of size classes. In a second step, one proceeds with mineralization (wet flue), depositing 1 g fresh weight of each sample (muscle, liver) in a flask to which was added 1 ml of nitric acid (HNO3) and 65% purity the temperature at 95 °C is heated for one hour, after cooling, the complete contents to 4 ml of double-distilled water, the solution is ready to mix with the atomic absorption spectrophotometry flame (SAA af) (Amiard et *al*, 1987).

III. RESULT AND DISCUSSION

Each series of samples of our mineralization is automatically accompanied by a hand, of a mineralization white, comprised of reactant-containing solutions of mineralization (nitric acid) and suffer from the same experimental conditions as the sample, and secondly, by a series of samples of inter-calibration of a standard biological material Fucus sp 140/TM coded, provided by the International Atomic Energy Agency, Monaco (IAEA, 1995), allowing, thus defining the coefficients variation for each of the desired metals: lead (Pb) and cadmium (Cd) and check the correctness and accuracy of the protocol analytique.les results are summarized in Table 1.

Table 1: Results obtained from the inter calibration exercises expressed in ppm dry weight P. acarne and T. araneus

Element	**Reference Value (A.I.E.A, 1995, Monaco)**		**Value Found**	
	Min - Max	**Medium**	***P. acarne***	***T. araneus***
Cadmium	(0,50 - 0,57)	0,53	0,54	0,55
Lead	(1,91-2,47)	2,19	2,32	2,45

These intercalibration exercises have shown that our analyzes were carried out in satisfactory conditions, the analytical technique used was reliable and accurate.
The average water content in the muscle of the axillary seabream is 72.51% andthat of the living spider is 76.06%. We adapted this mode of expression, because it allows a good comparison with different values from the literature.

Changes in levels of heavy metals (Pb, Cd)
Figures 4 and 5 leaves appear that individuals of both species display higher average concentrations of lead and cadmium. The rate of cadmium is noticeably lower for two fiches

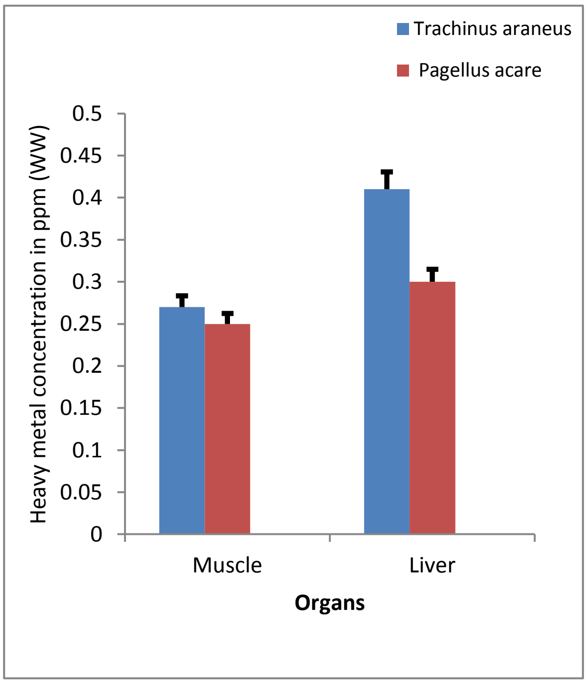

Figure 4 : Change in mean levels Lead (mean ± SD ppm WW) muscle and liver of Pagellu sacarne and Trachinus araneusand fished in the bay of Oran.

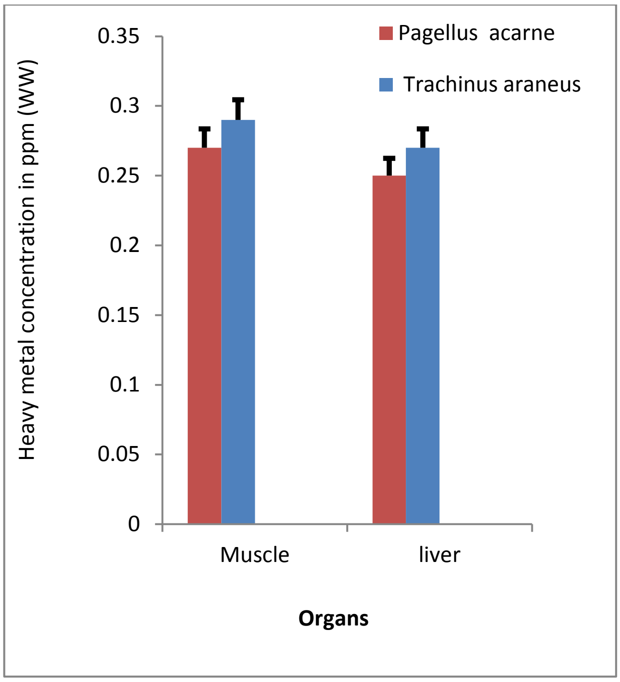

Figure 5: Change in mean levels cadmium (mean ± SD ppm WW) muscle and liver of Pagellus acarne and Trachinus araneus and fished in the bay of Oran.

The mean levels of Pb found in the different organs of the living spider and the axillary seabream show that the highest value is in the range of 0.33 mg /kg and 0,26 mg /kg successivelyobtained in the Liver. While the content is zero in the muscles. According to the contents, we can establish an order of accumulation of Pb in different organs of the two species: Liver> Muscle

The mean levels of Cd found in the different organs of the living spider and the axillary seabream show that the highest level is in the range of 0,29 mg / kg and 0,25 mg/kg obtained in the liver. While the lowest level is in the range of 0.016 mg / kg obtained in muscles. According levels can establish an order of Cd accumulation in different organs of the two species: Liver > Muscle.

We based on the results shown in Figure 3, we see that cadmium levels bioaccumulate in the liver of the living spider are (0,27±0,02ppm WW (Wet Weight)) and the *Pagellus acarne* of are (0,25±0,04 ppm WW). However, no significant difference was observed in the levels of Cd in the muscle compared to that observed in the liver in two species (Fig. 5).

Comparison of lead levels showed no significant difference between the liver and muscle samples from two fiches, they are generally of the same order of magnitude (Fig. 4).the levels of metal pollutants livers of bioindicator organism are greater than those observed in the muscles, expressed as total concentration, or individual for Pb and Cd One possible explanation is the presence in the physiological state of these elements in liver tissue as enzyme co-factors, but also the fact that they are subject to more rapid elimination from the muscle, as described by several authors for cadmium (Marcovecchio & Moreno, 1993; Cinier et *al*., 1999; Belhoucine et *al*., 2014).

According Ramade (1979), teleost fish, metallic elements are particularly concentrated in the liver but also in the kidneys and more modestly in the muscles. Thus, Powell et *al* (1981) had already shown that heavy metals were concentrated in the organs of teleost decreasingly: Liver> Kidney> Muscle.

Many studies emphasize the affinity of heavy metals such as Cu, Zn and Cd in the liver with storage capacity and regulation of these metals have been widely described in the literature in fish (Kalay & Canli, 2000; Usero et *al*, 2003. De Boeck et *al*, 2004. Oliveira Ribeiro et *al*, 2005).

Seasonal variations seem to govern the distribution of heavy metals. Indeed, we found that these fluctuate significantly in the liver and muscle of two fishes. This bioaccumulation of trace metals in these specimens of western Algeria experienced a sharp seasonal variation (Fig 6 and 7). It is possible that the high concentrations of heavy metals encountered during the summer, would be attributed to the importance of boating activity during this period. Moreover, Sadiq (1992) argues that an increase in the temperature and salinity of sea water increased bioaccumulation of xenobiotics. Indeed, these two factors are highest during the summer season in Algerian waters (Boutiba, 1992), thus promoting the bioaccumulation of micropollutants in summer compared to other seasons. The seasonal factor is important and many studies have also shown that metal concentrations in marine species vary seasonally (Majori et al, 1978;.Cossa et al., 1990; Augier et al., 1992; and Bei al., 1998; Wright and Mason, 1999; Kaimoussi et al., 2000; Orban et al, 2002, Belhoucine et *al*., 2014).

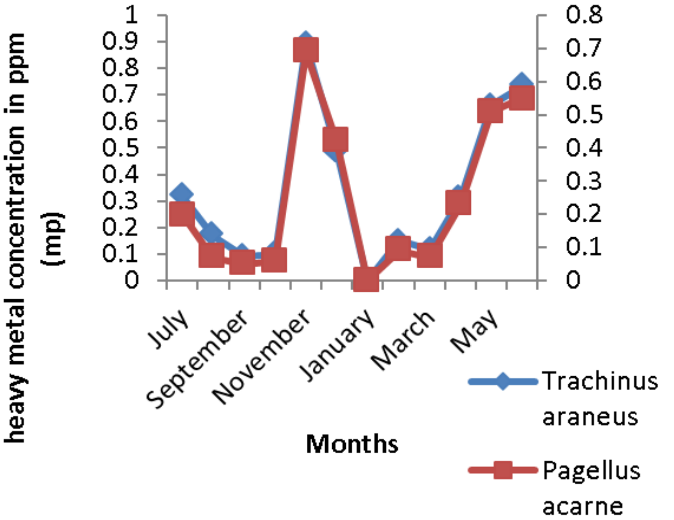

Figure 6 : Changes in concentrations of Cadmium (mean ± SDWW ppm) based on the months in Pagellus acarne and Trachinus araneus caught in the Bay of Oran.

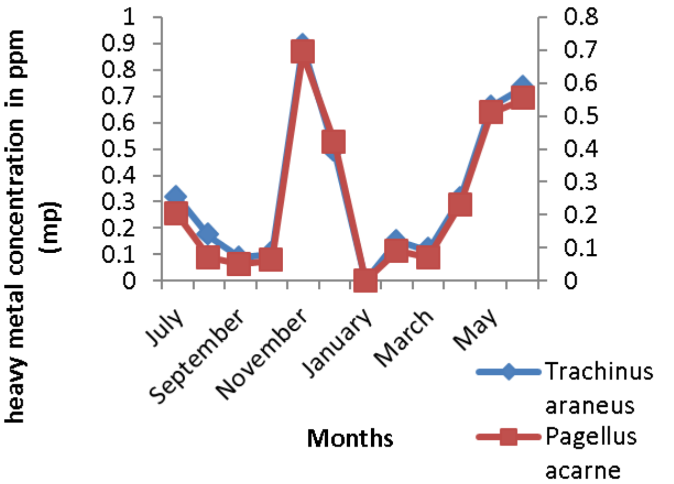

Figure 7: Changes in concentrations of Lead (mean ± SD ppm WW) based on the months in Pagellus acarne and Trachinus araneus caught in the Bay of Oran.

The obtained results point out that the average concentrations of heavy metals in the flesh and liver of the living spider are larger than those obtained from *Pagellus acarne*. This is probably due to the fact that the living spider is a coastal benthic species that is common on sandy bottoms and sandy-muddy coasts. It is not very active and stands buried in sediment which represents a reservoir traces elements and consequently the fish to living in this environment will be contaminated by this metal pollution.

Location level of metal contamination *Trachinus araneus* and *Pagellus acarne* against the maximum permissible dose (MPD).

Table 2: Comparison of heavy metal concentrations (ppm WW) in *Trachinus araneus* and *Pagellus acarne* against the maximum permissible dose (MPD)
(a) Augier et *al*, (1988) – (b) G.I.P.P.M (1973) – (c) C.N.R.S (1971) (d) O.M.S (1971) – (e) F.A.O (1971) – (f) CSHPF (1990) **-** (g) CNRMS d'Australie (1992)– (h) I.O.P.R (1996)

Metal / Species	**Cadmium**	**Lead**
Presentstudy ***Trachinusaraneus***	1,689 ppm **W.W** 0,412 ppm **D.W**	5,803 ppm **W.W** 1,416 ppm **D.W**
Present**study *P. acarne***	**0,24±0,11** ppm **D.W**	**0,27±0,16** ppm **D.W**
Fishes	1 ppm **D.W** (a) 0.15-3 ppm **D.W** (h) 0.1 ppm **W.W** (f)	0.3 à 6 mg/Kg **D.W** (b) 0.5mg/Kg **W.W** (f)

Location level metal contamination of *P. acarne and the T. araneus*from the maximum permissible dose (MPD) estimating quantities of heavy metals in ecosystems and organisms is an important part of the work and research carried out in ecotoxicology (Huang et *al*., 2007). These xenobiotics are problematic because of their persistent nature and toxicity. This is because the regulations impose on the low thresholds.

By comparing our results of heavy metals in the*P. Acarne and the T. araneus*from the tolerated threshold (Tab. 2) muscle, we could deduce that the values recorded in the Bay of Oran remain below the critical values of contamination.

We see only the average doses of heavy metals found in the compared with those from the literature relating to MPDaxillary seabream and the Spotted weever are not worrisome.
There is currently, no indication that the levels are high enough to cause morbidity or mortality among the fish themselves or ask threats to human health from the consumption of these fish.

This fact does not diminish the potential risk to humans in the medium and long term if urgent measures are not put in place to monitor the safety of seafood, vectors of toxic agents, particularly lead and secondary cadmium, since these metals recorded alarming levels for public health. The reliable assessment of the risks posed by these pollutants on both human health and the environment is a major challenge (Maroni et *al.*, 2000; Eason and O'Halloran, 2002; Alavanja et *al.*, 2004).

Changes in average concentrations of trace heavy metals (mean ± SD PF ppm) in different marine organisms

Pollutant concentrations of animal species reflect a more representative average situation of the state of a medium.

The concentrations of trace metals observed in the muscles of both targeted species sin in the Bay of Oran are comparable to those measured in other fish species caught in areas of the Algerian west coast (Table 3).

Table 3: Changes in mean levels of heavy metal traces (mean ± SD WW ppm) in different marine organisms caught along the coast of Oran.

Metals Species	**Cd**	**Pb**	**Authors**
Boops boops	0,02±0,01	0,40±0,18	Aoudjit (2000)
Mullus barbatus	0,08±0,02	1,19±0,04	Bensahla (2001)
Mullus surmuletus	0,15±0,01	0,23± 0,98	Borsali (2006)
Sardinella aurita	0,01±0.08	0,29±0,01	Benamar (2006)
Trachurus trachurus	0,01±0,003	0,06±0,04	Benadda (2009)
Diplodus argus	0,11±0,12	0,32±1,85	Ayad (2010)
Mullus cephalus	0.3±0.02	0.4±0.021	Bouhadiba (2011)
Pagellus acarne	3,15± 0,17	2,16±1,19	**Present study**
Trachinus araneus	0.01±0.07	0.01±0.08	

IV. CONCLUSION

Because of the large volume of water in the Mediterranean has a great capacity to absorb pollution, but the large amounts of waste discharged cannot be assimilated in coastal areas. This pollution is such a serious threat, and anxiety is so high in public opinion that states seek individually and jointly, all the necessary tools to stop, reduce or stop this marine pollution.

Man, the end consumer marine products and occupying the final link in the food chain, may at any time be vulnerable. The use of marine organisms for evaluating and determining the level of contamination has been facing in the light of this objective.

The results of this study revealed that : The two metal elements bioaccumulate in the liver tissue better than in the trace elements among the muscle tissue lead concentration still much higher than the cadmium.

Compared to the size of individuals, juveniles are more contaminated than adults because as and as they age, fish salt out some of the contaminants from their bodies lay. Their size is often based on their age, larger fish contain less contaminants, this factor is closely linked to growth imposes on individuals a diet rich. The latter being carnivorous type, it potentially increases the risk of bioaccumulation.

The average concentrations of metals seems well below the maximum permissible dose (MPD), it seems not presented a real danger to the consumer, but it should be remembered that these micro have a cumulative effect through the food chain, and they also have a detrimental long-term effect on public health.

For the sound management and control of water pollution, we must come to study everything related inputs (expenses), the distribution and fate of contaminants, including heavy metals from land that drain into aquatic ecosystems. It is particularly important to study the quantity and quality characteristics, and the routes they travel when they disperse, their destiny and their effects on biota.

V. REFERENCES

[1] A.I.E.A., - Echantillons pour comparaisons inter-oratoire -Matière de référence. Doc. Des Services de contrôle de la qualité des Analyses. 1995. 40p.

[2] Alavanja, M. C., Hoppin, J. A. & Kamel, F, Health effects of chronic pesticide exposure cancer and neurotoxicity. 2004 .Annu Rev Public Health 25: 155-197.

[3] Amiard-Triquet, C., Pinneau, A., Boiteau, H. L., Metayer, C. & Amiard-Triquet, C., Application de la Spectrophotomètrie d'absorption atomique Zeeman au dosage de 8 éléments traces (Hg, Cd, Cr, Mn, Ni, Pb,Se) dans les matières biologiques solides. 1987. Waters 21 (6), 693-697.

[4] Augier, H., Park, W. & Ramondo, G., Study of geographical and seasonal metal variation in different parts of the sea urchin Paracentrotus lividu,, from three Provencal Tet Areas. 1992. 75-89.

[5] Bei, F., Catsiki, V.A. & Stroggyloudi, E., Seasonal and spatial variations of Cu, Cr, Ni and Pb concentrations in Mytilus galloprovincialis of Saranikos Gulf, Greece. 1998. Rapports de la Comission Internationale pour l'Exploitation Scientifique de la Mer Méditerranée 35 (2).

[6] Belhoucine, F., Alioua, A., Bouhadiba, S., Boutiba ,Z.,. Impact of some biotics and abiotics factors on the accumulation of heavy metals bya biological model Merluccius merluccius in the bay of Oran in Algeria. 2014. Journal of Biodiversity and Environmental Sciences (JBES). 5 (6):33-44.

[7] Boutiba, Z., Les mammifères marins d'Algérie statut, Répartition, Biologie et Ecologie. Thèse Doctorat d'Etat. 1992 . Université d'Oran, 512p.

[8] Cinier, C., Petit-Ramel, M., Faure, R., Garin, D. & Bouvet, Y., Kinetics of cadmium accumulation and elimination in carp Cyprinus carpiotissues. 1999. Comparative Biochemistry and Physiology C. 122, 345-352.

[9] Cossa, D., Augier, D., Averty, B., Luçon, M., Masselin, P., Noel, J. & Sanjuans, J., Niveaux de concentration en métaux, métalloïdes et composés organochlorés dans les produits de la pêche côtière Française. IFREMER. 1990. Service de la documentation et des publications. Centre de Brest.

[10] De Boeck, G., Meeus, W., De Coen, W. & Blust, R., Tissue-specific Cu bioaccumulation patterns and differences in sensitivity to waterborne Cu in three freshwater fish : rainbow trout (Oncohynchus mykiss), common carp (Cyprinus carpio), and gibel carp (Carassius auratusgibelio). 2004. Aquatic Toxicology, 70: 179-188.

[11] Eason, C. & O'Halloran, K., Biomarkers in toxicology versus ecological risk 2002. Assessment.Toxicology. 181-182, 517-521.

[12] Geistdoerfer, P., Nouvelles captures et redescription d'un poisson Zoarcidae (Pisces, Perciformes, Zoarcoidei) des sites hydrothermaux de la ride du Pacifique oriental. 1986. Bull. Mus. natn. Hist. nat., Paris, 4esér, 8 A4, 969-980.

[13] GIPPM, Rapport du Groupe d'Etudes des Problèmes de Pollution des Mers (Interministériel), pour « une politique de lutte contre la pollution des mers 1973. Cahier Option Medit.

[14] Huang, H., Wu, J. Y. & Wu, J. H., Heavy metal monitoring using bivalved shellfish from Zhejiang coastal waters, East China Sea. 2007. Environmental monitoring and assessment 129: 315-320.

[15] Kaimoussi, A., Chafik, A., Cheggour, M., Mouzdahir, A. & Bakkas, S., Seasonal variations of metal concentrations (Cd, Cu, Zn, Fe and Mn) in mussel Mytilus galloprovincialis from El jadida coastline (Morocco). 2000.Mar. Life, 10(1-2): 77-85.

[16] Kalay, M. &Canlý, M., Elimination of essential (Cu, Zn) and nonessential (Cd, Pb) metals from tissue of a freshwater fish Tilapia zilli. 2000. Turkish J. Zool., 24: 429-436.

[17] IOPR, Fragile Méditerranée. Reconquête d'un équilibre écologique. Doc. Institut Océanographique Paul Ricard. Ed : 1996. Edisud, Aix-en-provence. 252p.

[18] Leclaire, L., La sédimentation holocène sur le versant Méridional du bassin Algéro-Baléares (Précontinent Algérien). Tome XXIV. 1972 .Edition de Muséum, Paris, France, 391p.

[19] Majori, L., Nedoclan, G., Modonutti, G.B. & Daris, F., - Study of the seasonal variations of some trace elements in the tissus of Mytilus galloprovincialis taken in the Gulf of Trieste. 1978. Rev. Int. Océanogr. Méd., 39: 37-50.

[20] Marcovecchio, J.E. & Moreno V.J., Cadmium, zinc and total mercury levels in the tissues of several fish species from La-Plata River estuary, Argentina. 1993.Environmental Monitoring and Assessment 25: 119-130.

[21] Maroni, M., Colosio, C., Ferioli, A. & Fait, A., Biological monitoring of Pesticide Exposure: a review. 2000. Introduction. Toxicology 143, 1-118.

[22] Oliveira Ribeiro, C. A., Vollaire, Y., Sanchez-Chardi, A. & Roche, H., Bioaccumulation and the effects of organochlorine pesticides, PAH and heavy metals in the Eel (Anguilla anguilla) at the Camargue Nature Reserve, France. 2005. Aquatic Toxicology, 74(1): 53-69.

[23] Orban, E., Di Lena, G., Nevigato, T., Casini, I., Marzetti, A. & Caproni, R., Seasonal changes in meat content, condition index and chemical composition of mussels (Mytilus galloprovincialis) cultured in two different Italian sites. 2002 .Food Chemistry, 77: 57-65.

[24] Powell, J.H., Powell R.E & Fielder D.R Trace elements concentrations in tropical marine fish at Bougai ville, Island, Papua New Guinea. Water.1981. Air and Soil Pollut.,16: 143-158.

[25] Ramade, F., 1979. Ecotoxicologie. Masson. Ed. Fr: 228p.

[26] Sadiq, M., Toxic metal chimistry in marine environments. 1992. Ed. Marcell Dekker, INC, 390p.

[27] Skeie, E., Weeverfish stings: frequency, occurrence, clinical course, treatment and studies on the venom apparatus of the weeverfish, the nature of the toxin, and immunological aspects. 1966. Dan Med Bull 13:119-121.

[28] Usero, J., Izquierdo, C., Morillo, J. & Gracia, I., Heavy metals in fish (Solea vulgaris, Anguilla anguilla, Liza aurata) from salt marshes on the southern Atlantic coast of Spain. 2003. Environment International, 29: 949-956.