ISSN: 2458-8989

Natural and Engineering Sciences

NESciences, 2024, 9 (1): 01-09 doi: 10.28978/nesciences.1472086

Capture of a New-born Shortfin Mako Shark *Isurus Oxyrinchus* (Lamniformes: Lamnidae), with Updated Records from the Turkish Marine Waters

Okan Akyol [1*], Christian Capape [2]

[1*] Ege University, Faculty of Fisheries, Urla, Izmir, Türkiye.
E-mail: okan.akyol@ege.edu.tr

[2] Université De Montpellier, Montpellier cedex 5, France.
E-mail: capape@univ-montp2.fr

Abstract

The study reports on the capture of a new-born specimen of shortfin mako shark *Isurus oxyrinchus* Rafinesque, 1810 off Karantina islet coast, Urla, Izmir (north Aegean Sea). This specimen measured 761 mm in total length and weighed 2900 g. The historical and recent captures of the species in the area shows the presence of new-born, juvenile and adult males and females. The distribution of these specimens suggests the potential occurrence of a nursery ground in the same area. To preserve the extirpation of the species throughout the area where it finds favourable environmental parameters to live, a management plan should be conducted to ensure the establishment of a viable population in the Turkish marine waters.

Keywords:

Lamnidae, economic interest, fishing pressure, distribution, management, nursery ground, eastern mediterranean sea.

Article history:

Received: 02/02/2024, Revised: 11/03/2024, Accepted: 05/04/2024, Available online: 30/05/2024

Introduction

Shortfin mako shark *Isurus oxyrinchus* Rafinesque, 1810 is a pelagic fish displaying a high commercial interest and is frequently caught by commercial fisheries, mainly as bycatch of pelagic longliners, pelagic drift netters, purse seiners and by recreational anglers (Mollet et al., 2000; Carpentieri et al., 2021). The short fin mako shark has a circumglobal distribution from 50°N (60°N in the north Atlantic) to 50°S (Ebert et al., 2021). *I. oxyrinchus* is known in the eastern Atlantic from Norway to Portugal (Quéro et al., 2003; Abdullah, 2020); *I. oxyrinchus* occurs from the coast of Morocco (Lloris & Rucabado, 1998), continuously to South African waters (Ebert & Stehmann, 2013; Sánchez et al., 2023; Brahmaiah et al., 2021).

**Corresponding Author: Okan Akyol, E-mail: okan.akyol@ege.edu.tr*

Isurus oxyrinchus is documented throughout the entire Mediterranean Sea (Quéro, 1984; Serena et al., 2020; Barone et al., 2022). *I. oxyrhinchus* was commonly caught in the Mediterranean coast of France (Capapé, 1977) and the Italian Seas (Tortonese, 1956) but faced in these areas to a fishing pressure and progressively a drastic decline (Capapé et al., 2000; Feretti et al., 2008). Southward, *I oxyrinchus* is recorded from the Maghreb Shore (Rafrafi-Nouira et al., 2015), the Libyan coast (Shakman et al., 2023) and the Egypt (El Sayed et al., 2017). Eastward, it was caught in the Adriatic Sea (Udovicic et al., 2018) and reached the Levantine Basin (Golani, 1996; Ali, 2018; Bariche & Fricke, 2020; Mishra et al., 2023).

Contemporary occurrence of *Isurus oxyrinchus* in Turkish waters is mentioned in Bilecenoğlu et al., 2014) and historical captures of the short fin mako shark in the area suggest that it appears to be sporadically caught in the Turkish marine waters (Kabasakal, 2015, 2017a,b; Kabasakal & De Maddalena, 2011; Kabasakal & Kabasakal, 2013; Suljić, 2021; Robles et al., 2015). The purpose of the present paper is the record a new-born specimen together with a literature review to assess the actual status of the species in the same area (Sreenivasulu et al., 2024; Srkalović et al., 2020; Ferretti et al., 2008).

Material and Methods

On 25 April 2023, an individual of *Isurus oxyrinchus* (761 mm TL, Fig. 1) was caught by a commercial trammel net, having 72 mm stretched mesh size, on sandy bottoms at a depth of 8 m off Karantina islet, Urla, Izmir located in the northern Aegean coast of Turkey (38°22’24’’and 26°47’27’’E *see*, Fig. 2).

Morphometric measurements were recorded to the nearest millimetre and weighed to the nearest gram are included in Table 1, with percentages of total length (%TL). Total length (TL) measured from the snout tip to the tip of the dorsal caudal-fin lobe, in which the shark is held belly down with its dorsal caudal-fin lobe depressed into line with its body axis (Compagno, 2001). The fish was fixed in 5% buffered formaldehyde solution and deposited in the Ichthyological Collection of the Fisheries Faculty, Ege University, Türkiye (ESFM-PIS/2023-002).

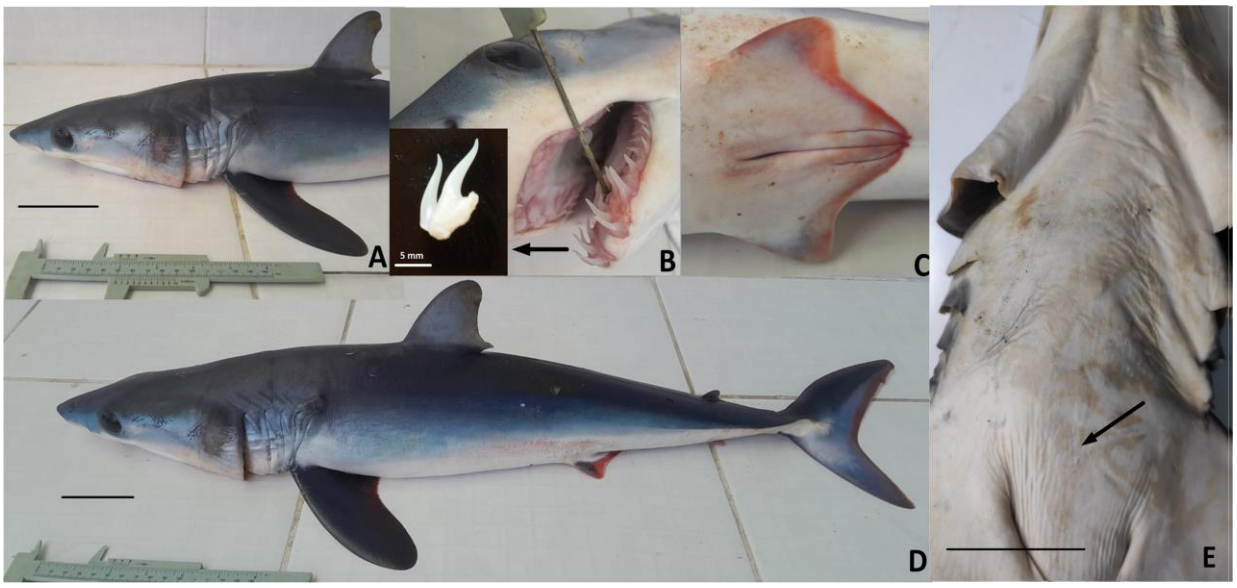

Figure 1. *Isurus oxyrinchus* specimen captured from Urla, Izmir, NE Aegean Sea. A: anterior part of the specimen, B: teeth, C: claspers, D: whole body, E: the newly closed umblical scar (scale bar: 50 mm)

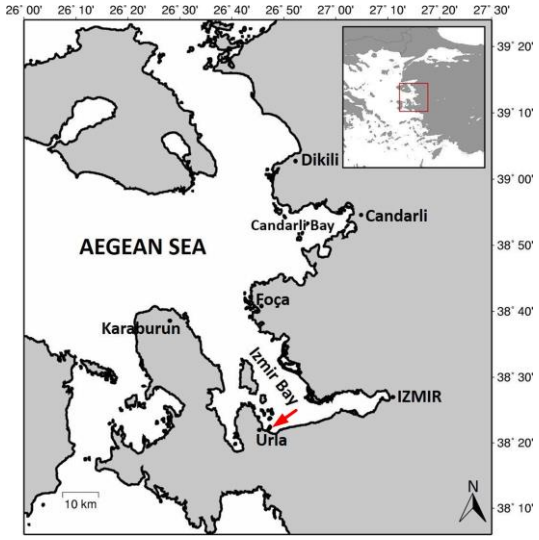

Figure 2. Capture site (red arrow) of the new-born *Isurus oxyrinchus* in the NE Aegean Sea

Results and Discussion

The specimen of *Isurus oxyrinchus* has been measured as 761 mm TL and it weighed 2900 g total body weight (TBW). The short description of the specimen: body is fusiform and snout is very pointed; first dorsal fin with an sharply pointed apex. Pectoral fins are shorter than head, falcate; and anal fin origin is below the middle of second dorsal fin base. Lower anterior teeth are strongly protruding and horizontal on jaws. Colour is blue-grey to blue above and belly is whitish. Morphology, morphometric measurements and colour pattern are in total accordance with previous definitions of the species by (Cadenat & Blache, 1981), (Compagno, 1984), (Quéro, 1984) and (Ebert & Stehmann, 2013).

Table 1. Some morphometrics with percentages of total length (TL%) and body wet weight in gram recorded in *Isurus oxyrinchus*, caught from Urla, Izmir, NE Aegean Sea

Reference	ESFM-PIS/2023-002	
Morphometric measurements	**mm**	**TL%**
Total length	761	100.0
Standard length	611	80.3
Preorbital length	60	7.9
Interorbital length	58	7.6
Snout to mouth (preoral length)	56	7.4
Snout to nostril (prenasal length)	37	4.9
Snout to first-gill slit	172	22.6
Snout to first dorsal fin (predorsal)	292	38.4
Snout to second dorsal fin	540	70.9
Snout to pelvic fin	409	53.7
Snout to anal fin	530	69.6
Eye diameter	18	2.4
Mouth width	50	6.6
Internasal width	30	3.9
Upper caudal length	155	20.4
Lower caudal length	103	13.5
Pectoral fin length	132	17.3
Width between first gill slit	62	8.1
Width between fifth gill slit	81	10.6
Clasper length	20	2.6
Total body weight (g)	2900	

The specimen exhibited flexible claspers, shorter than pelvic fins, displaying juvenile characteristics and a just closed scar on the ventral surface (Fig. 1E). The size of the specimen, 761 mm TL, is close to sizes at birth reported in the literature, that ranged between 600 and 750 mm TL (Garrick, 1967; Mollet et al., 2000), and between 680 and 775 mm (mean: 740 mm) according to Joung & Hsu (2005) with an embryo weight between 1910 – 3400 g. These patterns suggest that the present specimen could be considered as newly born or at least born of the year.

Mollet et al., (2000) noted that both sexes were thought to be adult at around 1.8 m TL, however with additional data females are adult at a larger size than males, between 2.7 and 2.8 m. These size were taken into consideration to delineate the reproductive condition of the specimens collected in Turkish waters and included in Table 2. Therefore, three categories of specimens were recorded: (1) new-borns, specimens having a TL less than 800 mm; (2) juveniles (or sub-adults), specimens having a TL less or close to size at sexual maturity; and (3) adults, specimens displaying a size oversize at sexual maturity.

The historical and recent captures of *Isurus oxyrinchus* are reported in Table 2, where it clearly seems that the three categories of specimens are present and each category comprises males and females. This distribution of specimens is in total accordance with the definition of (Heupel et al., 2007) concerning nursery grounds for sharks. The capture of the present new-born suggests the occurrence of a nursery ground for short fin mako in Turkish marine waters, where the species finds sufficient resources to develop and reproduce (Akyol & Kara, 2003; Gurbet et al., 2013). Additionally, *I. oxyrinchus* needs to be preserved throughout the area where it finds favourable environmental parameters to live. It explains why the species was listed in 2020 under Communique no. 5/1, Article 16 of Fisheries Law no. 1380 of the Republic of Türkiye, and cannot be retained on board, transhipped, landed, transferred, stored, sold or displayed, or offered for sale, and must be released unharmed and alive, to the extent possible (Official, 2020).

Acknowledgements

The authors thank Mr Ibrahim Temiztepe, Director of the Urla Fishery Cooperative, who provided them with the new-born specimen of *Isurus oxyrinchus*.

Author Contributions

OA measured and photographed the fish, and both authors drafted the main text.

Conflict of Interest

The authors declare there is no conflict of interest in this study.

Data Availability Statement

The data supporting this study's findings are available on request from the corresponding author OA.

Compliance with Ethical Standards

Local Ethics Committee Approval was not obtained because experimental animals were not used in this study.

Table 2. Updated records of *Isurus oxyrinchus* from the Turkish waters (eastern Mediterranean)

Region	Depth (m)	Gear*	Record date	Number collected	Size, TL (mm)	Condition	Sex	References
Marmaris, SE Aegean Sea	?	?	1950s	1	5850	Adult	Female	(Kabasakal & De Maddalena, 2011)
Marmaris, SE Aegean Sea	?	?	1969	1	?	?	?	(Geldiay, 1969)
Off Sığacık Bay, SE Aegean Sea	?	Pelagic longline	1990s	1	1809	?	Sub-adult	(Kabasakal, 2017a)
Kuşadası Bay, SE Aegean Sea	?	Purse seine	2000s	1	712	New-born	Male	(Kabasakal, 2017b)
Off Fethiye, SE Aegean Sea	20	?	20 June 2000	1	2000	Adult	Female	(Kabasakal, 2015)
Gulf of Mersin, NE Mediterranean	?	Bottom long line	Summer 2000	1	1000 SL	Adult	Male	(Kabasakal, 2015)
İskenderun Bay, NE Mediterranean	54	Purse seine	25 March 2010	1	698	New-born	Male	(Ergüden et al., 2013)
Gulf of Mersin, NE Mediterranean	?	Drift net	24 January 2011	1	2500	Adult	Male	(Kabasakal, 2015)
Izmir Bay, NE Aegean Sea	8	Trammel net	22 November 2011	1	1810	Adult	?	(Akyol et al., 2013)
Saros Bay, NE Aegean Sea	?	Hand line	30 March 2012	1	1236	Sub-adult	Female	(Kabasakal & Kabasakal, 2013)
İskenderun Bay, NE Mediterranean	?	Purse seine	Summer 2012	1	3800	Adult	Male	(Kabasakal, 2015)
Off Fethiye, SE Aegean Sea	1000	Pelagic longline	22 September 2012	1	900	Sub-adult	?	Akyol, Unpublished data
Gulf of Antalya, NE Mediterranean	?	Hand line	14 November 2013	1	1000	Sub-adult	Male	(Kabasakal, 2015)
Gulf of Antalya, NE Mediterranean	?	Trammel net	April 2015	1	1200	Sub-adult	Female	(Kabasakal, 2015)
Foça, NE Aegean Sea	?	Trammel net	19 May 2015	1	650	New-born	Female	(Kabasakal, 2015)
Izmir Bay, NE Aegean Sea	4	Trammel net	May 2015	1	765	New-born	Female	(Bengil et al., 2019)
Gökova Bay, SE Aegean Sea	?	Bottom long line	February 2016	1	943	Sub-adult	Male	(Bengil et al., 2019)
Edremit Bay, NE Aegean Sea	20-25	Trammel net	8 April 2016	1	747	New-born	Male	(Tuncer & Kabasakal, 2016)
Fethiye Bay, SE Aegean Sea	?	?	May 2017	1	?	?	Female	(Bengil et al., 2019)
Mersin Bay, NE Mediterranean	72	Bottom long line	18 May 2020	1	1000	Sub-adult	Male	(Ergüden et al., 2021)
Izmir Bay, NE Aegean Sea	8	Trammel net	25 April 2023	1	761	New-born	Male	This study

References

Abdullah, D. (2020). Octogonal Patch Quad Element Antenna for RADAR Applications. *National Journal of Antennas and Propagation (NJAP)*, 2(2), 27-32.

Akyol, O., & Kara, A. (2003). An investigation on the determination of catch compositions of the bottom trawling and beach-seining in the Bay of Izmir (Aegean Sea). *E.U. Journal of Fisheries & Aquatic Sciences*, 20(3), 321-328.

Akyol, O., Aydın, I. Gülşahin, A., & Kara, A. (2013). Records of three uncommon fishes from Izmir Bay (Aegean Sea, Turkey). *Journal of Applied Ichthyology*, 29, 925–926. https://doi.org/10.1111/jai.12173

Ali, M. (2018). An updated checklist of marine fishes from Syria with an emphasis on alien species. *Mediterranean Marine Science*, 19(2), 388-393. https://doi.org/10.12681/mms.15850

Bariche, M., & Fricke, R. (2020). The marine ichthyofauna of Lebanon: an annotated checklist, history, biogeography and conservation status. *Zootaxa*, 4775(1), 1-157. https://doi.org/10.11646/zootaxa.4775.1.1

Barone, M., Mazzoldi, C., & Serena, F. (2022). *Sharks, rays and chimaeras in Mediterranean and Black Seas – Key to identification*. Rome, FAO. https://doi.org/10.4060/cc0830en

Bengil, E.G.T., Akalın, M., Tüney Kızılkaya, İ., & Bengil, F. (2019). Biology of Shortfin Mako Shark (*Isurus oxyrinchus* Rafinesque, 1810) from the Eastern Mediterranean *Acta Aquatica Turcica*, 15(4), 425-432. https://doi.org/10.22392/actaquatr.545997

Bilecenoğlu, M., Kaya, M., Cihangir, B., & Çiçek, E. (2014). An updated checklist of the marine fihes of Turkey. *Turkish Journal of Zoology*, 38(6), 901-929. https://doi.org/10.3906/zoo-1405-60

Brahmaiah, B., Vivek, G.V., Gopal, B.S.V., Sudheer, B., & Prem, D. (2021). Monitoring And Alerting System based on Air, Water and Garbage Levels Using Esp8266. *International Journal of Communication and Computer Technologies (IJCCTS)*, 9(2), 31-36.

Cadenat, J., & Blache, J. (1981). Mediterranean and Atlantic sharks. *Tropical wildlife*. ORSTOM, 21, 1-330.

Capapé, C. (1977). Commented list of Selacians in the Toulon region (from La Ciotat to Saint-Tropez). *Bulletin du Muséum d' Histoire naturelle de Marseille*, 37, 5-9.

Capapé, C., Tomasini J.A., & Quignard J.P. (2000). The Pleurotrême Elasmobranchs of the Languedoc coast (southern France, northern Mediterranean). Observations biologiques et démographiques. *Vie et Milieu*, 50(2), 123-133.

Carpentieri, P., Nastasi, A., Sessa, M., & Srour, A. (2021). Incidental catch of vulnerable species in Mediterranean and Black Sea fisheries – A review. *Studies and Reviews No. 101 (General Fisheries Commission for the Mediterranean). Rome, FAO*. https://doi.org/10.4060/cb5405en.

Compagno, L.J.V. (1984). *FAO species catalogue.* Vol 4. Sharks of the world. An annotated and illustrated catalogue of sharks species known to date. Part 2. Carcharhiniformes. FAO Fish. Syn. (125), Part 1, FAO, Rome, 1-269.

Compagno, L.J.V. (2001). *Sharks of the world*. An annotated and illustrated catalogue of shark species known to date. Volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes). FAO Species Catalogue for Fishery Purposes, 2(1).

Ebert D.A., & Stehmann M.F.W. (2013). Sharks batoids and Chimaeras of the North Atlantic. *FAO species Catalogue for Fisheries Purposes*.

Ebert, D.A., Dando, M., & Fowler, S. (2021). *Sharks of the World: A Complete Guide*. Princeton, New Jersey: Princeton University Press.

El Sayed, H., Akel K., & Karachle P.K. (2017). The marine ichthyofauna of Egypt. *Egyptian Journal of Aquatic Biology and Fisheries*, 21(3), 81-116.

Ergüden D., Gürlek M., & Turan C. (2013). A young *Isurus oxyrinchus* Rafinesque, 1810 (Chondrichthyes: Lamnidae) individual captured from Iskenderun Bay, Turkey. In: Bilecenoğlu et al. New Mediterranean Marine Biodiversity Records. *Mediterranean Marine Science*, 14(2), 463–480.

Ergüden, D., Ayas, D., & Kabasakal, H. (2021). Recent occurrence of Shortfin Mako Shark, *Isurus oxyrinchus* Rafinesque, 1810 (Chondrichthyes: Lamnidae), from the north-eastern Mediterranean coast of Turkey. *COMU Journal of Marine Sciences and Fisheries*, 4(1), 79-85. https://doi.org/10.46384/jmsf.839454

Ferretti, F., Myers R.A., Serena F., & Lotze H.K. (2008). Loss of large predatory sharks from the Mediterranean Sea. *Conservation Biology*, 22(4), 952-964. https://doi.org/10.1111/j.1523-1739.2008.00938.x.

Garrick, J.A.F. (1967). Revision of sharks of genus *Isurus* with a description of a new species (Galeoidea, Lamnidae). *Proceedings of the United States National Museum*, 118(3537), 663–690.

Geldiay, R. (1969). *Important fishes found in the Bay of Izmir and their possible invasions*. Monogr. Fac. Sci., Ege Univ., 11, 1-135.

Golani, D. (1996). The marine ichthyofauna of the eastern Levanat-History, inventory and characterization. *Israel Journal of Zoology*, 42(1), 15-55.

Gurbet, R., Akyol, O., Yalçın, E. & Özaydın, O. (2013). Discards in bottom trawl fishery in the Aegean Sea (Izmir Bay, Turkey). *Journal of Applied Ichthyology*, 29(6), 1269–1274. https://doi.org/10.1111/jai.12243

Heupel, M.R., Carlson, J.K. & Simpfendorfer, C.A. (2007). Shark nursery areas: concepts, definition, characterization and assumptions. *Marine Ecology Progress Series*, 337, 287-297. https://researchonline.jcu.edu.au/2614/.

Joung, J.J., & Hsu, H.H. (2005). Reproduction and embriyonic development of the short fin mako, *Isurus oxyrinchus* Rafinesque, 1810, in the Northeastern Pacific. *Zoological Studies*, 44(4), 487-496.

Kabasakal, H. (2015). Occurrence of shortfin mako shark, *Isurus oxyrinchus* Rafinesque, 1810, off Turkey's coast. *Marine Biodiversity Records*, 8, e134, 1-7. https://doi.org/10.1017/S1755267215001104

Kabasakal, H. (2017a). Notes on historical and contemporary catches of Lamniform sharks in Turkish waters. *Annales Series Historia Naturalis*, 27(1), 51-57. https://doi.org/10.19233/ASHN.2017.07

Kabasakal, H. (2017b). On the jaws of a shortfin mako shark, *Isurus oxyrinchus*, caught off the Izmir peninsula (Central Aegean Sea, Turkey). *Annales Series Historia Naturalis*, 27(2), 151-154. https://doi.org/10.19233/ASHN.2017.18

Kabasakal, H., & De Maddalena, A. (2011). A huge shortfin mako shark *Isurus oxyrinchus* Rafinesque, 1810 (Chondrichthyes: Lamnidae) from the waters of Marmaris, Turkey. *Annales, Series Historia Naturalis*, 21(1), 21–24.

Kabasakal, H., & Kabasakal, Ö. (2013). First record of a shortfin mako shark, *Isurus oxyrinchus* Rafinesque, 1810 (Chondrichthyes: Lamnidae) from the Bay of Saroz (NE Aegean Sea). *Annales, Series Historia Naturalis* 23(1), 27–32.

Lloris, D., & Rucabado J. (998). FAO guide to species identification for fisheries purposes. *Guide d'identification des ressources marines vivantes pour le Maroc*. Rome. FAO.

Mishra, D., & Kumar, R. (2023). Institutional Repository: A Green Access for Research Information. *Indian Journal of Information Sources and Services*, 13(1), 55–58.

Mollet, H.F., Cliff G., Pratt Jr. H.L., & Stevens J.D. (2000). Reproductive biology of the female shortfin mako, *Isurus oxyrinchus* Rafinesque, 1810, with comments on the embryonic development of lamnoids. *Fishery Bulletin*, 98(2), 299-318.

Official, G. (2020). Notification on Amendments to the Communique Number 5/1 on the Regulation of Commercial Fishing.

Quéro, J.C., Porche P. & Vayne J.J. (2003). Guide to European Atlantic Fish. *Les Guides du naturaliste. Delachaux & Niestlé: Lonay (Switzerland)-Paris*.

Quéro, J.C., Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielsen J., & Tortonese, E. (1984). *Fishes of the north-eastern Atlantic and the Mediterranean*. UNESCO, Paris.

Rafrafi-Nouira, S., El Kamel-Moutalibi O., Reynaud C., Boumaïza M. & Capapé C. (2015). Additional and unusual captures of elasmobranch species from the northern coast of Tunisia (central Mediterranean). *Journal of Ichthyology*, 55(6), 337-345.

Robles, T., Alcarria, R., De Andrés, D.M., De la Cruz, M.N., Calero, R., Iglesias, S., & Lopez, M. (2015). An IoT based reference architecture for smart water management processes. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 6(1), 4-23.

Sánchez-Ancajima, R.A., Jiménez-Carrión, M., Gutierrez, F., Hermenegildo-Alfaro, A.O., Saavedra-López, M.A., Hernández, R.M., & Exebio Moya, L.R. (2023). Applications of Intelligent Systems in Tourism: Relevant Methods. *Journal of Internet Services and Information Security*, 13(1), 54-63.

Serena, F., Abella, A.J., Bargnesi, F., Barone, M., Colloca, F., Ferretti, F., Fiorentino, F., Jenrette, J., & Moro, S. (2020). Species diversity, taxonomy and distribution of Chondrichthyes in the Mediterranean and Black Sea, *The European Zoological Journal*, 87(1), 497-536, https://doi.org/10.1080/24750263.2020.1805518

Shakman, E., Siafenasar A., Etayeb K., Shefern A., Elmgwashi A., Hajaji M.A., Benghazi N., Ben Abdalha A., Aissi M., & Serena F. (2023). National Inventory and status of Chondrichthyes in the South Mediterranean Sea (Libyan Coast). *Biodiversity Journal*, 14(3), 459-480. https://doi.org/10.31396/Biodiv.Jour.2023.14.3.459.480

Sreenivasulu, G. (2024). A Hybrid Optical-Acoustic Modem Based on Mimo Ofdm for Reliable Data Transmission in Green Underwater Wireless Communication. *Journal of VLSI Circuits and Systems*, 6(1), 36-42

Srkalović, D., & Stjepić Srkalović, Ž. (2020). Groundwater Vulnerability determination of Northeastern Bosnia According to GLA Method. *Arhiv za tehničke nauke*, 2(23), 9–20.

Suljić, N. (2021). Influence of Roughty of A Rectangular Open Channel on Flow Speeds and Water Flow. *Arhiv za tehničke nauke*, 1(24), 57–64.

Tortonese, E. (1956). *Leptocardia, Ciclostomata, Selachii. In: Fauna of Italy*. Calderini, Bologna, 2.

Tuncer, S., & Kabasakal, H. (2016). Capture of a juvenile shortfin mako shark, *Isurus oxyrınchus* Rafinesque, 1810 Chondrichthyes: Lamnidae) in the Bay of Edremit, Northern Aegean Sea Turkey). *Annales Series Historia Naturalis*, 26(1), 31-35.

Udovicic, D., Ugarkovic, P., Madiraca, F., & Dragicevic´, B. (2018). On the recent occurrences of shortfin mako shark, *Isurus oxyrinchus* (Rafinesque, 1810) in the Adriatic Sea. *Acta Adriatica* 59(2), 237–243. https://doi.org/10.32582/aa.59.2.10.