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Artificial reef application from the Iskenderun Bay, Northeastern Mediterranean, Turkey; an experimental study

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Abstract

The aim of this study is to analyze the changes of economic fish species in the Iskenderun Bay by providing life and conservation area for fish species. Therefore, the study was carried out by building 172 artificial reefs (150 cubic and 22 octagonal) in September 2013, on the southern coastline of the Iskenderun Bay 7-8 m in depths far from the 300 m shore, located in the Eastern Mediterranean. The visual census technique was done to state fish species and abundance. Observations were made with four scuba dives between January 2014 and October 2014. As a result of these observations, 121 individuals belonging to 7 fish species were detected. The maximum number of individuals (32) in the sample were *Mugil* spp. it belongs to species. The minimum number of individuals of observed species were *Lichia amia* (1) and *Epinephelus* spp. (1). Furthermore, it was observed that mollusk varieties and some algae species which are *Codium fragile* and *Laurensia papillosa* were located.

Keywords: Artificial Reef, Iskenderun Bay, Northeastern Mediterranean, Visual Census Technique

1. INTRODUCTION

Artificial reefs are defined as "all kinds of structures deliberately submerged to the sea floor in order to imitate some features of natural reefs" by European Artificial Reefs Research Network (EARRN). Reef areas are reproduction, nutrition and protection areas for many fish and marine species [1, 2]. Artificial reefs are used in various coastal countries, primarily for sustainable

ecosystem [3]. Artificial reef applications have become an important issue in recent years due to their positive effects on sustainable ecosystem, prevention of overfishing and illegal fishery [4-7]. Sustainable ecosystem is very important issue for fisheries management [8, 9]. Japan is the oldest country with experience in artificial reef application and Japan was the one of the first countries to have a scientific approach to this field [10]. Scientific artificial reef studies in Turkey

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were started Hekim Island from Izmir Bay, in 1991 with Hekim Island project. [1, 11, 12] After Hekim Island Project, thirty-four artificial reef projects have been carried out in Turkey since 1991. Later in 2008 with increasing demand, The National Artificial Reef Master Plan was formulated by the Directorate General for Fisheries and Aquaculture of the Ministry of Agriculture and Forestry and pilot projects were carried out [13, 14].

Artificial reefs and fish aggregating devices (FADs) have used to vary marine habitats to growth fishery productivity. Artificial reefs improve marine fisheries through both aggregation and production of marine resources [15]. FADs can also improve resource production [16, 17]. Artificial reefs range widely in design. Artificial reefs have many main purposes such as educating fishing or diving openings by providing an assembly on and around which plants and animals can aggregate, improving surfing by altering wave, protecting the coastline from storm flow and erosion by changing coastal processes such as sediment transport, enhancing commercial fishing or recreational fishing, assisting in the rehabilitation of degraded fisheries, providing underwater tourist attractions for diving, restoring, mitigating or offsetting damage or loss of natural reefs or other habitats, supporting aquaculture or marine ranching and providing research chances [1, 18-20].

Iskenderun Bay is located at the Northeastern-Mediterranean Sea with an area of approximately 2275 km², and a width of approximately 35 km [21]. Iskenderun Bay has a very wide continental shelf and the depth within this region does not exceed 90 m [22]. At the same time, the region has rich biodiversity and fisheries resources [5]. Therefore, Iskenderun Bay has a high potential for fisheries [23]. This could mean problems from time to time for Iskenderun Bay. Because, there are overfishing and illegal fishing activities in the region [21]. On the other hand, Iskenderun Bay contains many natural reefs and potential recreational fishing areas [2, 24, 25]. But, as a result of the overuse of these areas, the bay has become covered with ghost fishing nets [26]. That's way artificial reef plays important role for

sustainable ecosystem, sustainable fishery and underwater tourism. The initial artificial reef project in Iskenderun Bay was started in Yumurtalık in order to support the fishermen and create alternative fishing areas [27]. After this project, the first scientific artificial reef data was presented from Iskenderun Bay in 2015. [5].

2. MATERIALS AND METHODS

Experiments were carried out in the Iskenderun Bay on November 2013 and continued until October 2014 at 36° 35 '43.5" N, 36° 10' 30.3 " E. (Figure 1). As the soil structure is sand, a region with a light rocky area was found and reefs were placed at a depth of 7.5 meters and the location of the area where the study was made without any obstacle for marine traffic.



Figure 1. Study area

The first aim in artificial reef applications to be made for fishing and other purposes is to increase the living population in the environment and to support the natural life [10, 20]. In order to prevent natural balance, the use of materials of a standard and feature that is not harmful to living organisms in the environment is very important [28]. Concrete material is compatible with marine environment, durable and long life. It is easy to procure and has the flexibility to pour in various designs as desired [29]. For this reason, the reefs

were designed from concrete materials because of their long life and economic characteristics.

The study was carried out by building 172 concrete materials (150 cubic and 22 octagonal) in September 2013. Our concrete blocks were prepared in two different types. The first group of concrete reefs were 50cm x 50cm x 50cm in size and the concrete thickness is 150 pieces manufactured in 5cm thickness. (Figure 2).



Figure 2. Cubic concrete materials

The second group of concrete reefs were octagonal in shape and each side is 60 cm, height is 40 cm, concrete thickness is 12 cm and circular parts are 10 cm radius in the edge parts (Figure 3).



Figure 3. Octagonal concrete materials

With the help of a truck crane, reefs connected with cloth slings were transferred to the service ship, transported to the area and deployed on the seafloor (Figure 4).



Figure 4. Underwater view of artificial reefs

In artificial reef studies, combined gill net-trammel net, hand line, and visual census methods are generally used as a sampling method [30, 31]. In this study, only visual census technique was used to determine species with four dives between January 2014 and October 2014. However, no statistical evaluation was conducted in the study because of different sampling methods were not used.

3. RESULTS AND DISCUSSION

As a result of diving observations, 121 individuals belonging to 7 fish species were detected. The maximum number of individuals in the sample were *Mugil* spp. it belongs to species. The minimum number of individuals of observed species were *Lichia amia* and *Epinephelus* spp. (Table 1). Furthermore, it was observed that mollusk varieties and some algae species which are *Codium fragile* and *Laurensia papillosa* were located.

Table 1. Abundance of fish species on the reef site

Species	Amount
<i>Mugil</i> spp.	32
<i>Sparus aurata</i>	16
<i>Epinephelus</i> spp.	1
<i>Lichia amia</i>	1
<i>Siganus rivulatus</i>	30
<i>Diplodus annularis</i>	14
<i>Lithognathus mormyrus</i>	27
Total	121

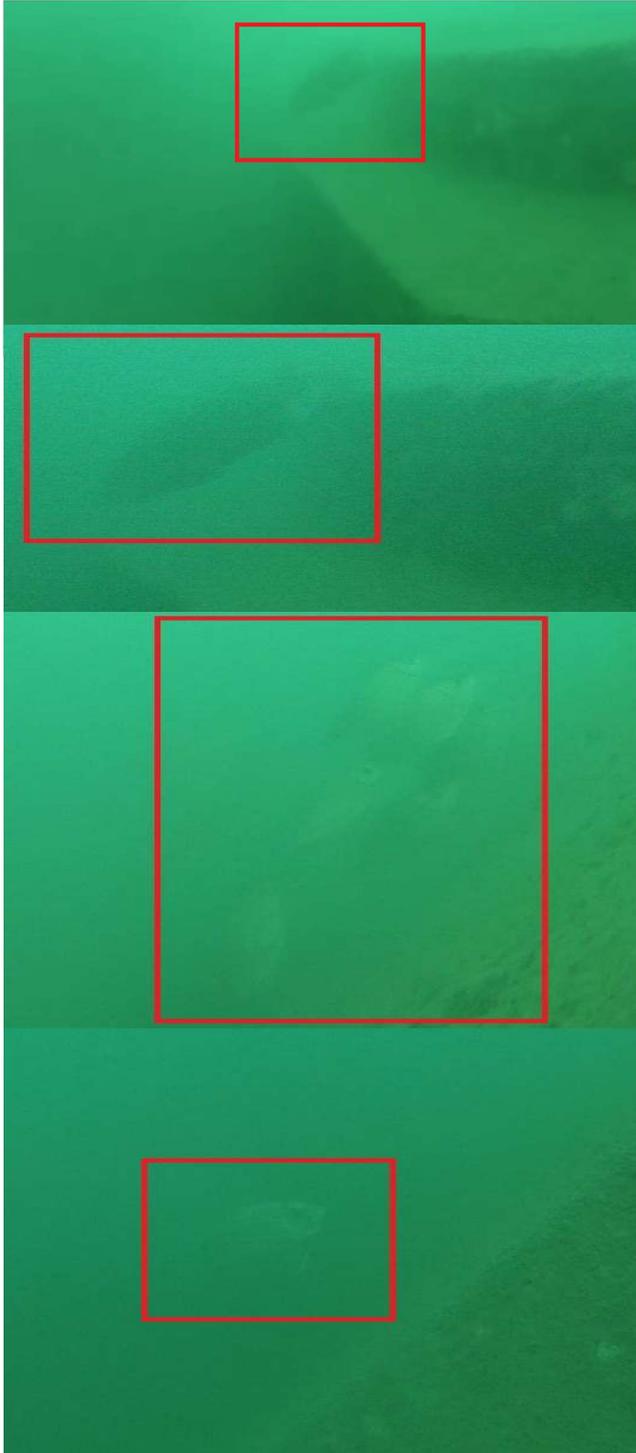


Figure 5. Some underwater photographs of fish observed on artificial reefs

Although the observation period and the method are not sufficient, abundance of fish species showed that the reefs are effective. Some underwater photographs of different species on reef site given Figure 5. Therefore, it is normal to come across the fish in less abundance [5, 10, 20,

33]. It was important to see *Epinephelus* spp., one of the minimum numbers of observed fish species, on reef site. Because, catch, sale and transport of *E. aeneus* was banned by Republic of Turkey Ministry of Agriculture and Forestry between 2016 and 2018. *E. marginatus* has been evaluated as “Endangered” according to the IUCN Red List of Threatened Species since 2011. Therefore, protection of fish species and habitat is crucial topic for sustainable ecosystem [9, 34]. In previous studies, new artificial designs were carried out for *Octopus vulgaris* [35]. Whereat, special design artificial reef also can be created in the future for grouper species.

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REFERENCES

- [1] A. Lök, C. Metin, A. Ulaş, F. O. Duzbastılar and A. Tokaç, “Artificial reefs in Turkey,” *ICES Journal of Marine Science*, vol. 59, pp. S192–S195, 2002.
- [2] A. Demirci, N. Uygur, E. Şimşek, M. Şereflişan and Y. Mazlum, “Natural Reefs and Ghost Nets in Iskenderun Bay,” In: *Underwater Science and Technology Conference (SBT 2013)*, 2-3 November, Hatay, pp. 27-33, 2013.
- [3] S. Tunca, B. Miran and V. Ünal, “Benefits of artificial reefs in Altınoluk (Northern Aegean), Turkey: Assessment of potential users' opinions via fuzzy pair wise comparison approach,” *Ege Journal of Fisheries and Aquatic Sciences*, vol. 30, no. 3, pp. 99-104, 2013.
- [4] A. Lök, F. O. Düzbastılar, B. Gül, A. Özgül and A. Ulaş, “The role of artificial reefs in fisheries management in Turkey,” In: S. A. Bortone, F.P. Brandini, G. Fabi

- and S. Otake (Eds.), *Artificial Reefs in Fisheries Management USA*: CRC Press, Chap. 10, pp. 155-166, 2011.
- [5] G. Gökçe, "Design, deployment and fish assemblages of artificial reefs in Iskenderun Bay, Turkey: initial experiences," *Journal of Applied Ichthyology*, vol. 31, no. Suppl. 3, pp. 35-40, 2015.
- [6] F. O. Düzbastılar, A. Lök, A. Ulaş and C. Metin, "Recent developments on artificial reef applications in Turkey: Hydraulic experiments," *Bulletin of Marine Science*, vol. 78 no. 1, pp. 195-202, 2006.
- [7] M. Ulugöl, and F. O. Düzbastılar, "A case study for preventing illegal trawl fishery: The application of anti-trawl artificial reef and design criteria," *Ege Journal of Fisheries and Aquatic Sciences*, vol. 33, no. 1, pp. 27-34, 2016.
- [8] M. F. Can and A. Demirci, "Fisheries Management in Turkey," *International Journal of Aquaculture*, vol. 2, no. 7, pp. 39-47, 2012.
- [9] E. Şimşek and A. Demirci, "Barotrauma Treatment Effects on Survival Rates for Some Discarded Fish by Trawl Fishery," *Fresenius Environmental Bulletin*, vol. 27, no. 7, pp. 4867-4873, 2018.
- [10] A. Alkan, "Artificial reef on the southern coast of the gulf of Iskenderun," *Mustafa Kemal University, Institute of Science, Master of Science Thesis*, pp. 26, 2014.
- [11] A. Lök, "Evaluation of fish fauna associated with experimental artificial reefs in Hekim Island in Izmir Bay (Aegean Sea, Turkey)," *Aegean University, Institute of Natural and Applied Sciences, Master of Science Thesis*, pp. 54, 1995.
- [12] A. Lök and A. Tokaç, "Turkey: A New Region for Artificial Habitats," In: Jensen A.C., Collins K.J., Lockwood A.P.M. (eds) *Artificial Reefs in European Seas*, Springer, Dordrecht, pp. 21-30, 2000.
- [13] A. Tokaç, V. Ünal, Z. Tosunoğlu, A. Lök, T. Ceyhan and H. Özbilgin, "Summary and analysis of the available information for the ecosystem approach to fisheries management in Turkey," In: Leonart J., Maynou F. (eds), *The Ecosystem Approach to Fisheries in the Mediterranean and Black Seas*. *Sci. Mar.* 78S1, pp. 29-36, 2014.
- [14] S. Tunca, B. Miran and V. Ünal, "Perception and demand for artificial reef by relevant local groups in Altınoluk (Turkey)," *Ege Journal of Fisheries and Aquatic Sciences*, vol. 31, no. 1, pp. 5-10, 2014.
- [15] A. Özgül, A. Lök, T. T. Tanrıkul and J. Alós, "Home range and residency of *Scorpaena porcus* and *Scorpaena scrofa* in artificial reefs revealed by fine-scale acoustic tracking," *Fisheries Research*, vol. 210, no. 22-30, 2019.
- [16] J. A. Bohnsack and D. L. Sutherland, "Artificial reef research: a review with recommendation for future priorities," *Bulletin of Marine Science*, vol. 37, pp. 11-39, 1985.
- [17] A. Özgül, A. Lök and F. O. Düzbastılar, "Two experimental fish aggregating systems (fads) in the Aegean Sea: their design and application," *Brazilian Journal of Oceanography*, vol. 59, pp. 13-19, 2011.
- [18] Jr. W. Seaman and L. M. Sprague, "Artificial habitats for marine and freshwater fisheries," *Academic Press*, pp. 285, 1991.
- [19] W. Seaman and A. C. Jensen, "Purposes and practices of artificial reef evaluation," In: *Artificial reef evaluation with application to natural marine habitats*. W. Seaman, Jr(Ed.). CRC Press, NJ. pp. 1-19, 2000.
- [20] A. Alkan, S. A. Demirhan and E. Şimşek, "Artificial Reef Observations on the Southern Coastline of the Iskenderun Bay," *International Advanced Researches & Engineering Congress Proceeding Book*, pp. 2230, 2017.
- [21] M. F., Can, A. Demirci and S. Demirci, "Fisheries in Iskenderun Bay," *Report of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB)*, pp. 50, 2006
- [22] D. Ergüden and C. Turan, "Recent Developments in Alien Fish Fauna of the

- Gulf of Iskenderun and Mersin,” *Biyoloji Bilimleri Araştırma Dergisi*, vol. 6, no. 1, pp. 17-22, 2013.
- [23] S. Gezmen, E. Şimşek and A. Demirci, “Evaluation of Dynamics of Fish Retail Trade in Iskenderun,” *Journal of Aquaculture Engineering and Fisheries Research*, vol. 1, no. 1, pp. 33-44, 2015.
- [24] S. Demirci and E. Arslantaş, “Economic potential and environmental effects of recreational fishing activity in coast of Iskenderun Bay,” *Fresenius Environmental Bulletin*, vol. 27, no. 12A, pp. 9352-9356, 2018.
- [25] A. Demirci, E. Şimşek, S. Demirci, Ö. Akar and O. Bayraktar, “Recreational Fishing Competitions in Turkey,” *International Ecology 2018 Symposium Abstract Book*, pp. 505. 2018.
- [26] Y. Mazlum, A. Demirci, E. Şimşek, N. Uygur, M. Şereflişan and O. A. Ayan “Farklı Derinliklerde Zemin ve Habitatların Balıkçı Ağlarından Arındırılması,” *Hatay’ın Çevre Sorunları ve Çözüm Önerileri Sempozyumu Bildiri Özetleri Kitabı* pp. 46, 2015.
- [27] G. Gökçe and M. Çekiç, “Artificial reef application for fishing in northern Mediterranean Sea,” In: 13. Underwater Science and Technology Conference, 7-8 November, Turkish Republic of Northern Cyprus, pp. 93-97, 2009.
- [28] F. O. Düzbastılar and A. Lök, “Primary materials in construction of artificial reefs,” *Ege Journal of Fisheries and Aquatic Sciences*, vol. 21, no. 1-2, pp. 181-185, 2004.
- [29] R. R. Lukens, “Guidelines for marine artificial reef materials. Gulf States Marine Fisheries Commission, Number 38, Ronald R. Lukens (Project Coordinator), January, pp. 118, 1997.
- [30] S. A. Bortone, M. A. Samoilys and P. Francour, “Fish and macroinvertebrate evaluation,” In: *Artificial reef evaluation with application to natural marine habitats*. W. Seaman (Ed.) CRC Press, Boca Raton, Florida, pp. 127–164, 2000.
- [31] A. Ulaş, F. O. Düzbastılar, A. Lök and C. Metin, “A pre-study for determining of efficiency of fish sampling methods on artificial reefs,” *Ege Journal of Fisheries and Aquatic Sciences*, vol. 24, no. 3-4, pp. 287-293, 2007.
- [32] A. Lök and B. Gül, “Evaluation of fish fauna associated with experimental artificial reefs in Hekim Island in Izmir Bay (Aegean Sea, Turkey),” *Ege Journal of Fisheries and Aquatic Sciences*, vol. 22, no. 1-2, pp. 109-114, 2005.
- [33] E. Şimşek and A. Demirci, “Analysis of Factors Affecting Life Fate of Groupers after Fishing Operations,” *Natural and Engineering Sciences*, vol. 1, no., 3, 40, 2016.
- [34] A. Ulaş, A. Lök, F. O. Düzbastılar, A. Özgül and C. Metin, “A new artificial reef design for octopus (*Octopus vulgaris* cuvier, 1797) in the Aegean Sea and preliminary results,” *Brazilian Journal of Oceanography*, vol.59, no. SPE1, pp. 21-25, 2011.