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Recieved: 2019-02-16 02:40:18
Accepted: 2019-09-28 16:50:18

Article Type: Research Article
Volume: 24
Issue: 1
Month: February
Year: 2020
Pages: 49-54

How to cite
Sefa Ayhan Demirhan, Arif Alkan, Emrah Şimşek; (2020), Artificial reef application from the Iskenderun Bay, Northeastern Mediterranean, Turkey; an experimental study. Sakarya University Journal of Science, 24(1), 49-54, DOI: 10.16984/saufenbilder.527933
Access link
http://www.saujs.sakarya.edu.tr/tr/issue/49430//527933

New submission to SAUJS
http://dergipark.gov.tr/journal/1115/submission/start
Artificial reef application from the Iskenderun Bay, Northeastern Mediterranean, Turkey; an experimental study

Sefa Ayhan Demirhan¹, Arif Alkan², Emrah Şimşek³

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 Yumurtalik 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](image)

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](image)

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](image)

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>
<thead>
<tr>
<th>Species</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Mugil</em> spp.</td>
<td>32</td>
</tr>
<tr>
<td><em>Sparus aurata</em></td>
<td>16</td>
</tr>
<tr>
<td><em>Epinephelus</em> spp.</td>
<td>1</td>
</tr>
<tr>
<td><em>Lichia amia</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Siganus rivulatus</em></td>
<td>30</td>
</tr>
<tr>
<td><em>Diplodus annularis</em></td>
<td>14</td>
</tr>
<tr>
<td><em>Lithognathus mormyrus</em></td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>121</td>
</tr>
</tbody>
</table>

3. RESULTS AND DISCUSSION

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.
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.

4. ACKNOWLEDGMENTS

This research was supported by Mustafa Kemal University Scientific Research Projects Coordination Unit. Project Number: MKU-BAP 8682. The authors are thankful to Menderes Şereflışan (Iskenderun Technical University, Turkey) for his kind support to during diving stage of this study. The authors also thankful to Iskenderun Municipality for supplying the concrete materials.

REFERENCES


[22] D. Ergüden and C. Turan, “Recent Developments in Alien Fish Fauna of the


