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*Research article/Araştırma makalesi*

# Occurrence of the Mediterranean Monk seal (*Monachus monachus*) in Yeşilovacık bay (Mersin, Turkey); a case report for anthropogenic impact assessments

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**Abstract**

Up to 2013 there was a small-scale mine loading port with small pier in Yeşilovacık bay. Then the new pier extending to open sea in south west direction was built. The impact assessments of the former and later port on the monk seal were evaluated by monitoring their activities in the bay.

The monk seal records were very rare during the period of extensive commercial fishing and small scale mine loading activity in 2012. In period of the construction, although monk seal was less frequently observed on the rocky east shore, on the sandy beach and harbor area, a new pup was seen around the same breeding cave with the distance of approximately 500 meters to new pier. In our monitoring period, the daily activities of monk seal were mostly recorded between 8-12 am based total of 21 monk seal records. The speed of a juvenile were recorded as maximum 16.8 km/ h during fish chasing in the evening.

Our findings supported that major threat on the monk seal are by catch in gill nets, bottom trawl nets, over-fishing and deliberate killing more than the pier constructions caused noise, turbidity and over-lighting. Up to 2017, the observing frequencies are getting increased in the harbor area. The reason for that is though due to the alternative employment for local people, which mitigates the conflicts between monk seals and fishermen.

**Key words:** Monk seal, threats, Yeşilovacık bay, Turkey

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# Yeşilovacık Koyu'ndaki (Mersin, Türkiye) Akdeniz Fokunun (*Monachus monachus*) Varlığı; antropojenik etki değerlendirmesi vaka raporu

**Özet**

Yeşilovacık körfezinde, 2013 yılına kadar küçük bir iskele ve küçük ölçekli bir maden yükleme limanı bulunmaktaydı. Daha sonra güneybatı yönünde açık denize uzanan yeni iskele inşa edilmiştir. Eski ve sonraki yapılan limanın Keşiş fokunun üzerindeki etkileri, bunların körfezdeki faaliyetlerinin izlenmesi ile değerlendirilmiştir.

Keşiş foku kayıtları, 2012 yılında yaygın ticari balıkçılık ve küçük çaplı mayın yükleme faaliyetleri sırasında çok azdı. İnşaat döneminde, kayalığın doğu kıyısında, kumlu plaj ve liman bölgesinde Keşiş foku daha az gözlenmiş olmasına rağmen, yeni bir yavru aynı üreme mağarasının etrafında yeni iskeleye yaklaşık 500 metre uzaklıkta gözlenmiştir. İzleme periyodumuzda, kaydedilen toplam 21 fokun günlük faaliyetleri çoğunlukla gündüz 8-12 saatleri arasında kaydedildi. Yavruların maksimum hızı akşam balık avlamaları sırasında 16,8 km/s olarak kaydedildi.

Bulgularımız, balık ağları, dip trol ağları, aşırı avlanma ve kasıtlı öldürmenin Keşiş foku üzerindeki en büyük tehditler olarak, gürültü, bulanıklık ve aşırı aydınlatmaya neden olan iskele yapımlarından daha fazla olduğunu desteklemiştir. 2017 yılına kadar liman bölgesinde gözlem frekansları gittikçe artmıştır. Bunun sebebi foklar ve balıkçılar arasındaki çatışmaları azaltan, yerel halkın alternatif istihdamıdır.

**Anahtar kelimeler:** Keşiş foku, tehditler, Yeşilovacık körfezi, Türkiye

## 1. Introduction

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*Monachus monachus* (Hermann, 1779) which belongs to the genus *Monachus* (Fleming, 1822) is distributed in Mediterranean cost of Turkey as a single seal species (Mursaloğlu, 1964; Gücü et al., 2004; Güçlüsoy, 2008; MOm, 2009). Preliminary studies about The Mediterranean monk seal on Turkish cost was started by Bahtiye Mursaloğlu establishing a monitoring station at Alaçatı town of İzmir province (Mursaloğlu 1964, 1984, 1986, 1992). The population size was estimated approximately 300 – 350 individuals in the eastern Mediterranean Sea by MOm (2009) and up to 600 by Johnson et al. (2006) and around 700 by (Karamanlidis et al., 2015) in the Mediterranean population. Apart from these, some reports indicated that the abundance of the monk seal population decreased (Aguilar, 1999; Johnson et al., 2006), and thus Mediterranean monk seal is classified as endangered species according to IUCN criteria (IUCN, 2017).

On Turkish coasts, the researches were increasingly focused on the Mediterranean monk seal due to the threats for the Turkish population (Berkes, 1978; Berkes et al., 1979; Öztürk and Dede, 1995; Veryeri et al., 2001; Güçlüsoy and Savaş 2003a, b; Gücü et al., 2004; Güçlüsoy et al., 2004; Kıraç and Güçlüsoy, 2008; Danyer et al., 2013). However, the precise data on Turkish population are absent, 9 individual around Foça and 22 around the west cost of Antalya province were reported by Güçlüsoy and Savaş (2003a) and Gücü et al., (2004), respectively.

Androukaki et al. (1999, 2006) listed the main threats for the Mediterranean monk seal in Greece as gradual destruction of the coastal ecosystem, tourism, deliberate killings, drowning in fishing gear. They also noticed marine pollution, over-fishing and stochastic events (virus outbreak and an oil spill as potential and imminent threats). According to the IUCN mammal review, the primary threats to marine mammals were accidental deaths and pollution, and it was also suggested that harvesting remained a major threat for half of the marine mammal species in the world (Schipper et al., 2008). Gonzales and Larrinoa (2013) also reported that the most frequent negative interactions between monk seals and fisheries were by catch in gillnets and bottom trawl nets.

On Turkish coasts, there are many hotspot locations for the Mediterranean monk seal; one in Black sea, one in Marmara Sea, a few in Aegean (western coast) and Mediterranean (southern coast). This research is focused on southern population around Taşucu with long term monitoring in Yeşilovacık bay of Mersin province (Figure 1, 2), especially Taşucu coast is well known location for the Mediterranean monk seal with suitable breeding caves. Yeşilovacık bay is located at 30 km west of Taşucu town, and covers a long sand coast and rocky slope in eastern side with a cave (Figure 2). There was a small port in Yeşilovacık bay used by fishermen and small vessels transporting sand mine. After a large concrete plant started to be built around Yeşilovacık town, new and large port come into the agenda for intensive transporting, and NGOs reacted to the investment as harmful to local monk population. This research focused on the situation of monk population using the bay before and after new port construction and also human – monk conflict along with long term monitoring between 2012 and 2017.

## 2. Materials and methods

The study was conducted between 2012–2017 in Yeşilovacık bay (Mersin province) of Eastern Mediterranean coast of Turkey to determine the Mediterranean monk seal activity (Figure 1, 2). For this purpose, all around the bay, 6 monitoring spots were determined and these spots were observed weekly by cameras and direct observations. Also a camera was mounted in front of the suspected breeding cave (Figures 3, 4) and camera records were weekly controlled during the period. The chasing speed of the monk seal was calculated based on the distance between two points in the harbor and chasing time of this distance on video records (m/sec). Also major fishes and invertebrate fauna which are the food source of the seal are also investigated by scuba diving.

## 3. Results

The studies conducted on the Yeşilovacık bay provide us to compare the seal activity for the bay before and after the new port construction (Table 1). Prior to the construction of the new port, small-scale loading activities were carried out in the port. According to the long term observations by Dr. Deniz Ayas who is working on marine biology around the Mersin Bay, monk seal observation was very rare before the construction of the new port.

During the study period of 2012 – 2017, anthropogenic factors such as fishing, netting and other disturbing factors were taken under control in the bay via employing security officers and a specialist. 21 seal records were taken from one adult female and two pups at Yeşilovacık bay. Of these records, 17 are video or photograph and 4 are visual recordings. In addition, the most of records were made from pups (17 records) and 4 from adult female (Table 1, Figure 5, 6, 7). It was also determined that the daily activity ranges from early morning until late night with the latest records from 01: 33 am. However the most activities (n=7) were observed between 8 – 12 am. The first juvenile surviving his life has frequently used both port and harbor to find foods (Figure 8, 9) the speed of the first juvenile at an age of three year old were recorded as 11 km /h, 14.4 km/ h and 16.8 km/ h in the distances of 30-35 meters for fish chasing in the evening video records (Figure 10).

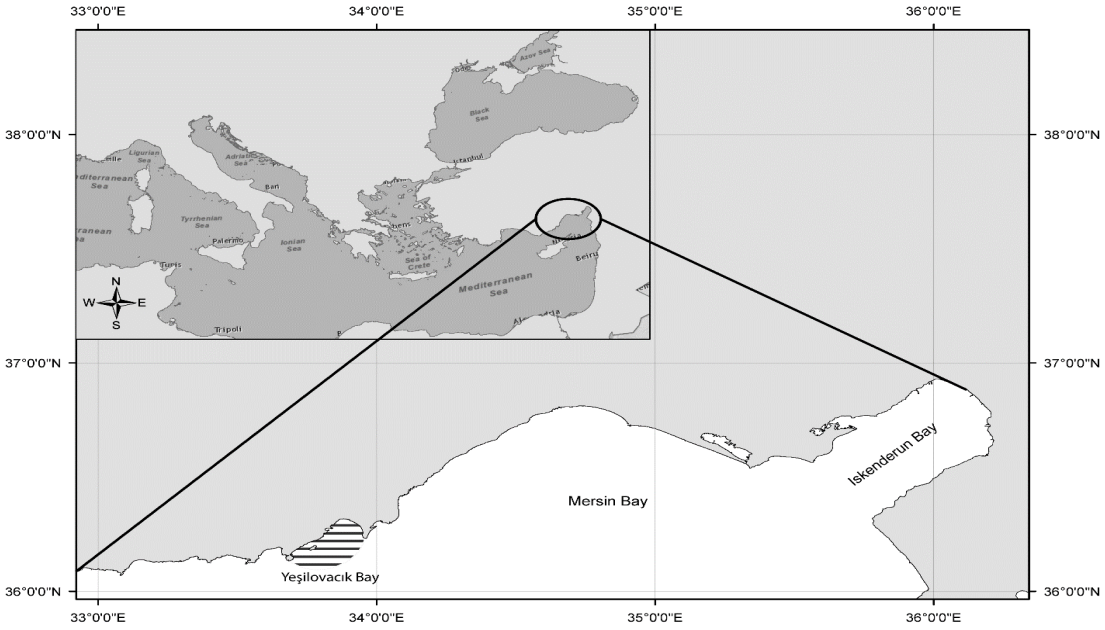


Figure 1. Yeşilovacık bay of Mersin provinces

Figure 2. Yeşilovacık bay and the rocky slopes (arrows) on the eastern cost


Figure 3. Former port (left), mounted camera (middle) and position of breeding cave (right) (arrows showed the location of the camera (1) and the cave (2))

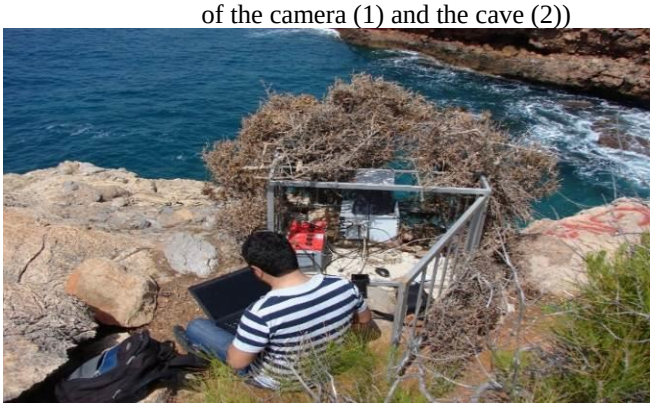

Figure 4. Mounted camera system directed to the cave

The activity of the juvenile varied from day time to evening but adult showed tendency towards late afternoon and evening. It is also observed that especially, the juvenile prefers to chase food under the pier without being disturbed by human activities. Reason for this is there is a restricted area for fisheries around the pier probably abundant with the fish and invertebrates. Fishes that were more abundantly observed around the pier are *Liza* spp., *Siganus* spp., *Pagellus* spp., *Nemipterus randalli*, *Sphyraena* spp., *Diplodus vulgaris*, *Diplodus sargus*, *Oblada melanura*, *Epinephelus* spp., *Saurida lessepsianus*. In addition to the fishes, some invertebrates in the littoral zone of port filling and pier pillars such as Mollusc (*Chthamalus stellatus*, *Brahiodontes pharaonis*, *Patella caerulea*), shrimp and prawn (*Penaeus semisulcatus, Marsupenaeus japonicus, Melicertus kerathurus, Parapenaeus longirostris, Metapenaeus monoceros*), carps (*Callinectes sapidus* and *Portunus segnis*), cephalopods (*Sepia officinalis*, *Loligo vulgaris*) were observed. Of two juvenile monk seals under monitoring, one was found dead (borne in October 2013) on the sandy beach of the bay in February 2014.

The nearest monk seal cave in the bay is Balıklı cave (sometime misused as Kaklık slit), which is located on the east coast of the bay and is about 500 meters away from the harbor is the only known breeding cave in the bay. According to our estimation, the birth should occur between September and early November. So the port construction was interrupted not to disturb the breeding monk seal. This cave was used by a female, and it gave birth to two pups in the successive years of 2012 and 2013 during the five years monitoring. Human-induced attack with explosive was done in front of the breeding cave, and many death fishes were observed around the cave. However this attack did not cause the seal's death and monk seals continue to inhabit the cave and the bay.

Table 1. Mediterranean monk records on Yeşilovacık bay

| **Date and hours** | **Locations** | **Sex** | **Record types** | **Comments** |
|---|---|---|---|---|
| 30.12.2012 / $16^{49}$ | Cave entrance | Adult female | Photograph | Mother and pub in the cave; breast-feeding period |
| 20.01.2013 / $11^{28}$ | Cave entrance | First juvenile | Photograph | First juvenile born in the cave, and first observation out of the cave |
| 24.02.2013 $12^{12}$ | Cave entrance | First juvenile | Photograph and video | First juvenile was observed in front of cave |
| 20.12.2013 $16^{00}$ | Swimming around the cave | First juvenile | Photograph | First juvenile was observed in swimming to entering the cave |
| 16.02.2014 $09^{34}$ | In the port area | Second juvenile | Photograph and video | The photograph of second juvenile before dying |
| 17.02.2014 $14^{15}$ | In the port area | Second juvenile | Photograph | The photograph of second juvenile before dying |
| 01.05.2014-$11^{25}$ | Swimming around the cave | First juvenile | Photograph | The first juvenile at an age of 1.5 year old swimming from the cave to open ocean still use the cave |
| 03.02.2015-$14^{31}$ | In the port area | First juvenile | Photograph | First juvenile which is at an age of 2.5 year old is feeding under the port, and leaving the port to ocean with fish caught |
| 10.03.2015-$17^{30}$ | Swimming around the cave | First juvenile | Photograph and video | First juvenile swimming from the port to the cave after the feeding activity around the port |
| 13.03.2015-$11^{00}$ | In the harbor | Adult female | Photograph and video | Adult female swimming and searching the food in the harbor |
| 16.04.2015 $20^{15}$ | In the harbor | Adult female | Photograph and Video | Adult female swimming and searching the food in the harbor |
| 29.04.2015 $10^{03}$ | Swimming around the cave | First juvenile | Photograph and Video | First juvenile swimming from the port to the cave |
| 28.01.2016-$16^{05}$ | In the port area | Adult female | Visual record | Adult female chasing the fish under the port |
| 12.02.2016-$21^{30}$ | In the port area | First juvenile | Video | Feeding activity under the port |
| 16.02.2016-$17^{34}$ | In the port area | First juvenile | Photograph and Video | Feeding activity under the port |
| 27.09.2016-$17^{05}$ | In the harbor | First juvenile | Photograph and Video | Feeding activity under the port and in the harbor |
| 22.01.2017-$01^{01}$ | In the port area | First juvenile | Photograph and Video | Feeding activity under the port |
| 28.02.2017-$22^{43}$<br>25.05.2017- 9.30<br>08.06.2017- 18.50<br>18.06.2017- 1.33 | In the port area | First juvenile | Video<br>Visual record | Feeding activity under the port |

Figure 5. The seals were recorded around the breeding cave

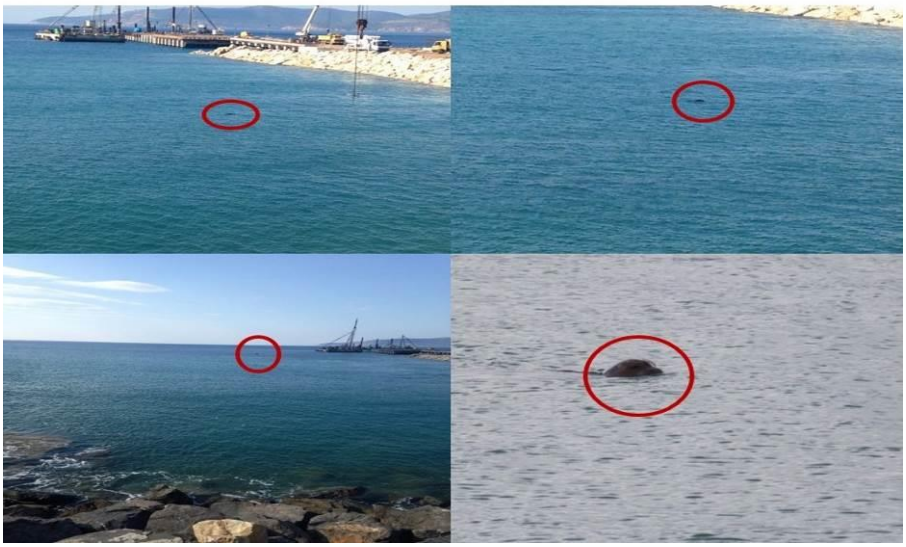

Figure 6. The seal were seen between rocky coast and pier

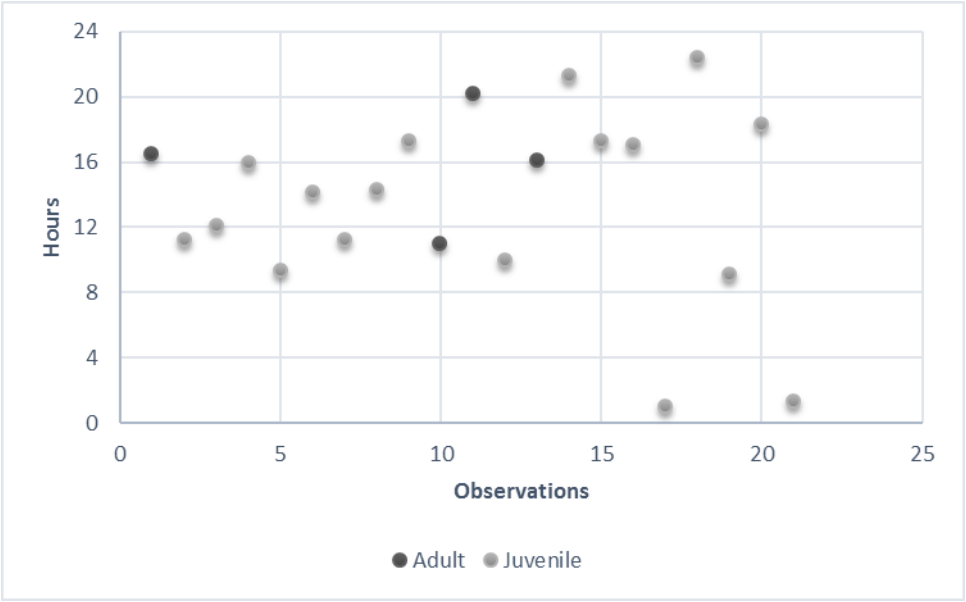


Figure 7. Recorded activities of The Mediterranean monk seals between November 2012 and June 2017.

Figure 8. The seals were recorded in very proximity to the cost and boats


Figure 9. The seal hunting in harbor without any anthropogenic threats


Figure 10. The seals hunting in harbor; their chasing speed was calculated based on video records.

## 4. Conclusions and discussion

The major threat to the seal is originated from fishermen which frequently kill monk seals for breaking up fish nets. In consistent with our opinion, some of the seal dead found on the cost between Antalya and Hatay were shot by gun (Figure 11). The fishermen of Yeşilovacık had the same attitude towards the seal. In the beginning of the harbor construction, a number of measures were taken to protect the seals in the bay, and also the protection measures were increased by employing security officers and a specialist. Under the measurements, fishing along the eastern rocky slopes were hindered, harbor and port were observed through the day, and the training was given to company employees for raising the awareness. Also the cameras were placed on the rocky hillside on the east coast (especially in front of the cave) and into the harbor, and also visual observations were made during the day. The dead juvenile (born in October 2013) was found lying on the sandy beach in February, 2014. In the investigation of local authorities, the cause of death was not human attack and was reported as infection but our opinion on this death was malnutrition due to stormy ocean in winter. Neves and Pires (1999) stated that the starvation, waves surging into caves and separation from mother can cause the death of newborn pups. Habitat destruction and using the cave without an internal beach have been identified as a major threat to the eastern Mediterranean population of monk seal (Güçlüsoy and Savaş 2003 a, Gücü et al 2009 a,b, Kıraç et al 2013). Danyer et al. (2013) examined a dead monk seal found in Antalya coast and reported the death causes as endoparasite, internal bleeding, and systemic infection. Neves (1998) reported that *Liza aurata*, *Sephia officinalis* are among the food of adult seal but crabs and limpets of the mostly sub adult. Such food

types are abundant around the pier, and it is thought that the lack of food is not the cause of the juvenile death. But the reason is probably the juvenile seal's being unable to reach food due to severe weather conditions.


Figure 11. The seal deaths between Antalya and Hatay coasts (http://www.iha.com.tr/haber-hatayda-olu-fok-bulundu-253438/, http://www.iha.com.tr/haber-dumana-otopsi-yapilacak-274926/, http://www.aksam.com.tr/doga-hayvan/gazipasada-olu-akdeniz-foku-kiyiya-vurdu/haber-235898, http://www.yabantv.com/haber/13988-antalyanin-maskotu-%E2%80%98dumani-katlettiler, http://www.milliyet.com.tr/yavru-foku-vurdular-/gundem/detay/1845536/default.htm-yeşilovacık.

The area where Yeşilovacık bay is located is especially important for the seal population in the eastern Mediterranean, many caves used by the seal are known between Yeşilovacık and Taşucu town which is on the east of Yeşilovacık bay (Güçlüsoy et al 2004, Gücü et al. 2004, Ok 2006, Gücü 2010). Although it is known that there are more seal populations around Taşucu town, only one adult female with two litters were monitored in Yeşilovacık bay during the study period, this finding supported the idea that adult female depends on the breeding cave and has relatively smaller home range than male. In support of our suggestion, most of the seals recorded dead between Antalya and Hatay coasts were males, especially, adult specimens (Figure 11).

According to our estimation, the birth should occur between September and early November, when the considering the gestation period as eleven months (Pastor and Aguilar 2003), it can be said that the mating occurs in January – February. According to some references, it was reported that the births occur through the year (Gazo et al. 1999, 2000 and Pastor and Aguilar 2003) but no such an observation was made in Yeşilovacık bay in the period of 5 years. Our finding on pupping is consistent with Gücü et al (2004) and Pires et al (2008).

The view of the port before and after construction is given in Figure 12. During the port construction, the construction was interrupted to prevent the seal from being disturbed by noise (piling up caused by staking into the sea) in the breeding season (September and November). After the construction was completed, it was determined that there was no regular excessive noise to scare the seals. After this interval, the port was in the operation, up to now 121 indigenous people of Yeşilovacık were employed as trucks drivers (60), cleaner and security (11), mariner and loader (38) and others (12). When the considering the population of Yeşilovacık town with 2024 people in 2016, The number of employed people in the port is about 6 % of the population of Yeşilovacık. When the Turkish families are generally thought to be composed of 4-5 persons, the number of people benefiting from the port is about 24 % of total population, this number does not cover the people who work in the nearby cement factory providing cargo to the port. This was considered the major factor to mitigate the conflict between the seal and indigenous people. However, fishing activities such as gillnets and bottom trawl nets continue the threat on the Mediterranean monk seal around the Yeşilovacık and Taşucu. The deliberate killing was reported to be major threat on monk seal in Turkish coast (Güçlüsoy et al 2004, Kıraç et al. 2013). This was supported by the fact that some dead monk seals found between Antalya and Hatay were reported to be shot by gun, especially two dead in Gazipaşa coast, therefore the restriction of fisheries and establishment of the protected area should be recommended to the authority in the shore line with the pupping caves.

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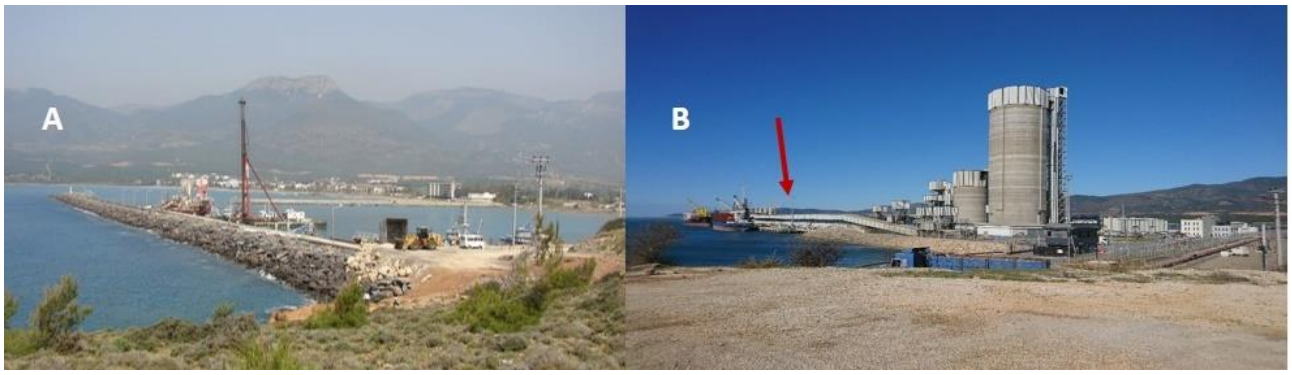


Figure 12. The port before (A) and after (B) construction (arrow shows new pier).

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