

Communication

First record of cetacean killed in an artisanal Fish Aggregating Device in Italian waters

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Simple Summary: Fish Aggregating Devices are floating structures used to create shadows and aggregate pelagic fish. In tropical and subtropical waters, the dangerous impact of these structures, due to high levels of bycatch, is well known. We report the first case of a cetacean killed by fish aggregating device and stranded near on the coast Rome, Italy (Central Tyrrhenian Sea). The post-mortem evaluation, the difference in degradation between the tail (necrosis) and peduncle, and the marked malnutrition confirm that this specimen was still alive at the time of entanglement. Although this is the first verified case of a cetacean killed by a fish aggregating device in Italian waters, management and control actions need to be improved to avoid this threat to marine biodiversity.

Abstract: Fish Aggregating Devices (FADs) are anchored floating structures often made with cheap scrapped materials and used to aggregate pelagic fish under their artificial shadow. Globally, the dangerous impact of FADs has well known. They pose a severe threat due to known and unknown levels of bycatch, the danger to navigation, and their high potential to become marine litter. Entanglement and consequent mortality in FADs of protected species and species of conservation concern (e.g., sharks, sea turtles, and cetaceans) are a serious concern for several international inter-governmental bodies (e.g., EU, GFCM, and IWC). This work describes the first case of a cetacean, a striped dolphin (*Stenella coeruleoalba*), killed by a FAD in the Mediterranean Sea. This dolphin was found stranded along the coast of the central Tyrrhenian Sea. The evidence suggests that this specimen suffered a painful death. Although this is the first confirmed case of a cetacean killed by a FAD in Italian waters, given the extent of the deployment of FADs, the scale of this type of interaction with protected species might be seriously underestimated. Therefore, actions and monitoring need to be implemented urgently to effectively protect and conserve marine biodiversity.

Keywords: FAD; bycatch; striped dolphin; Mediterranean Sea; Italian seas.

1. Introduction

Fish Aggregating Devices (FAD) have been used by fishermen in the Mediterranean Sea for thousands of years [1]. Until the end of the 1990s, from August to December, in the Mediterranean waters around Malta, Tunisia, Sicily, and Majorca, over 2,300 boats were using anchored FADs (FAD) to target dolphinfish (*Coryphaena hippurus*) [2]. FADs (usually 1-2m²) are usually anchored in specific locations, ranging from very coastal to offshore waters (over depths up to 3500m) [3]. Within the Mediterranean, they are usually made of various floating scrap materials [3]. Even though these FADs are targeting dolphinfish using special encircling nets, pilotfish (*Naucrates ductor*) and greater amberjack (*Seriola dumerili*) are common bycatch species [2].

In times of industrial fishery expansion and technological advances, this practice acquired globally a massive scale particularly linked to the industrial tuna fishery [1]. In some regions of the world, FADs have an important impact on a wide range of vulnerable and protected species, many of which are caught accidentally during fishing operations [4] or become entangled in the elements of these

devices. These include sea turtles, sharks, and many juvenile fish and fish species that are not the targeted catch of these fisheries [4].

The EU and the General Fisheries Commission for the Mediterranean (GFCM) share fishery policy principles on the need to ensure a sustainable ecosystem-based management framework for fisheries, which guarantees adequate protection of vulnerable species and sensitive habitats [5,6]. Fishing practices negatively affecting the whole marine ecosystem or elements of it need to be carefully managed or even prohibited [5,6].

Because of the impact of the use of FADs on essential fish, vulnerable marine ecosystems and species, and the danger that pose to navigation, the GFCM started raising the attention on these fishing devices almost 20 years ago [7]. More recently, the GFCM has established a set of production and deployment rules [8] that, if not followed, made them within the Mediterranean Sea illegal gears. These rules specify, *inter alia*, that FADs are allowed if they meet all the following standards:

- (i) They target the common dolphinfish, only for vessels that hold a valid fishing authorization issued by the competent authorities.
- (ii) All their elements are made of biodegradable materials.
- (iii) Their surface elements are made of '*material that involve minimal risk of entangling non-target species, especially vulnerable species, or affecting other vessels*'.
- (iv) They are reliably locatable once deployed.
- (v) Their main rope is equipped with '*an appropriate number of counterweights*' to make it sink to the sea bottom if the surface elements drift away.
- (vi) They are properly marked to be readily identified (*i.e.*: visible registration numbers of fishing vessels).
- (vii) Vessels deploying FADs must record and report back to their national Authorities all information on their fishing activities, including any loss of FADs with their latest position.

In addition, according to the GFCM recommendations national fishery authorities must ensure that FADs are regularly maintained and replaced as necessary.

Currently in the GFCM registry [9] of "Authorized vessels using fish aggregating devices for the exploitation of common dolphinfish in the Mediterranean (GSAs 1 to 27)" there are 404 vessels from three Mediterranean countries: Italy (261), Malta (104) and Spain (39). Most of these 404 vessels belong to the fleet segments VL6-12 (302 vessels) and VL12-24 (86 vessels). Considering that vessels deploy an average of 30 to 100 FADs [2,10], it can be estimated that there are at least between 12,000 and 40,000 registered FADs around the Mediterranean Sea [2,10]. However, numbers could be much higher (*e.g.*, 70,000-230,000) if considering the original census of 2,300 vessels using FADs [2].

These numbers make this fishing practice a massive potential source for (a) incidental captures of protected and vulnerable species (including fish), (b) marine litter [11] and (c) risk for navigation.

In addition, within the Mediterranean most of existing artisanal FADs are not used in legitimate fishing operations either because they are not conducted by authorized vessels, or because they do not meet any (or most) of the GFCM recommendations linked to FAD design to minimize the risk of entanglement for vulnerable species, plastic pollution and navigation risk. Between 2017 and 2022, a study carried out in the southern Tyrrhenian Sea recorded 1,739 illegal FADs, which were deployed in waters of depths ranging between 526 and 3,518 m [3].

Cetaceans in Italy are protected from killing and disturbance under national and European legislation. In particular, by the Italian Law 157/1992, the EU Council Directive 92/43/EEC and the Italian Presidential Decree 367/1997 and subsequent modifications.

2. Materials and Methods

The Italian Stranding Network is a complex system that relies on the cooperation between the Coast Guard, local health authorities, National Center for diagnostic investigations of stranded marine mammals (*Centro di referenza nazionale per le indagini diagnostiche sui mammiferi marini spiaggiati*, CReDiMa) that coordinates the *Istituti Zooprofilattici Sperimentali* (Public Health Institutes) distributed on the National territory, universities, Natural History Museum of Milan and volunteers of associations/organizations as the *Centro Studi Cetacei* [12,13] and it operates in line with ACCOBAMS guidelines on this matter [14].

Concerning this specific event, we collected all evaluations and body measurements on site except for tail width and peduncle circumference due to their corruption. The post-mortem examination was performed by the staff of the *Istituto Zooprofilattico Sperimentale del Lazio e della Toscana*, located in Rome.

This note concerns the stranding of a male striped dolphin (*Stenella coeruleoalba*) (Meyen, 1833) (Cetartiodactyla, Delphinidae), found on 29th November 2019, along the west coast of the central Tyrrhenian Sea, precisely in Marina di Ardea near Rome (Fig. 1).

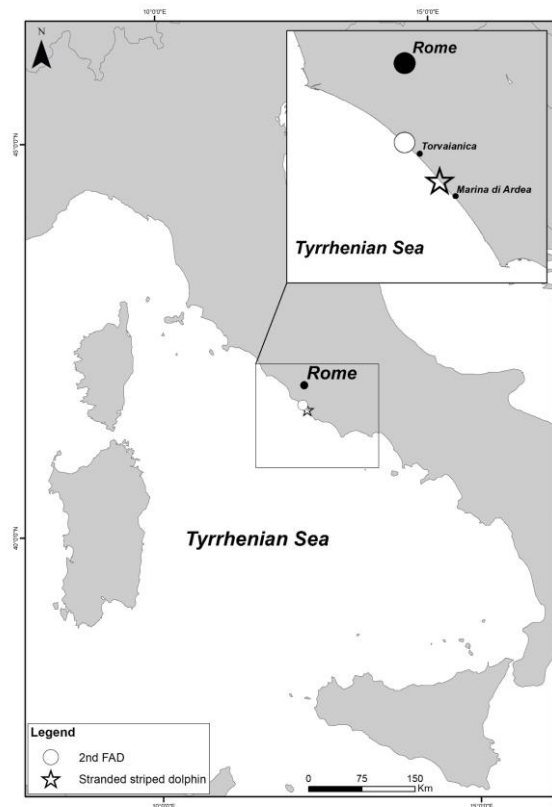


Figure 1. Location of the stranding (★) and location of parts of a second illegal FAD (○).

3. Results

The 176 cm long striped dolphin was in an advanced state of decomposition (code 3/4) and presented a poor nutritional status. The dolphin was entangled in a nylon rope likely used to anchor an illegal FAD to the bottom (Fig. 2A). The rope was so tightly wrapped around the end of its peduncle, in proximity of the tail, which had implanted deep into its tissues and had led to hematomas and necrosis in the surrounding tissues, including the whole tail (Fig. 2B).



Figure 2. Photographic evidence by V. Manfrini: (a) beached striped dolphin (*Stenella coeruleoalba*) and remains of an illegal FAD (recycled plastic bottles, nylon ropes, dark green plastic sheet, with not vessel registration numbers); (b) detail on the peduncle (hematomas) and tail (necrotic tissue) of the striped dolphin with the FAD parts.

The post-mortem examination showed an empty gastrointestinal system, with no food remaining. Regarding the tail, the state of decomposition of the tissues was severe and much worse than the rest of the body. It was considered an expression that the stricture and the following necrosis occurred when the animal was still alive. No other findings emerged from the exams of the organs. PCR tests detected the presence of Herpesviruses in brain and lung tissue. Histological examination was attempted only on the lung to highlight signs of drowning/asphyxia. Unfortunately, no confirming lesions were found due to the poor state of conservation.

Few days later, just 9 km north from the stranding location (Fig. 2) a floating part of a new illegal FAD was found (Fig. 3).



Figure 3. Parts of an illegal FAD located 9 km north the beached animal (see Fig. 1).

Photo

by E. Santini

4. Discussion

Opportunistic reports of cetacean entanglements in FADs exist for sperm whales (*Physeter macrocephalus*) in Guadalupe [15] and they are suspected in the whole Caribbean region for various other cetacean species [16]. Sperm whales and sei whales (*Balaenoptera borealis*) are known to interact with FAD structures, increasing the likelihood of accident [16]. In addition, two curious accounts of a sperm and a humpback whale (*Megaptera novaeangliae*) opportunistically used as FADs themselves have been described in industrial tuna and shark fisheries in Ecuador. This fishery, as others in South American countries, is known to use all sorts of floating objects to attract and capture pelagic fish, often in combination with marine mammal as baits [17].

According to the existing literature, this is the first case of a cetacean entangled in a FAD in the Mediterranean Sea. The evidence gathered by the post-mortem examination - particularly on the necrotic tissue around the peduncle, the emaciated body, and the empty stomach - suggests that, after becoming entangled into the rope of an artisanal FAD, this young animal [18] survived for some time dragging parts of the illegal FAD's structure.

In Italy FADs are mainly used in southern regions [2,3,11]. However, the Mediterranean numbers reported in the GFCM registry and in official national registries seem severely underestimating the situation described by several authors, with a lot of traditional FADs deployed illegally [e.g., 2,3,10,11,19]. It is also unclear why Tunisia is not reporting any activity linked to the use of FADs, since Tunisian fishermen were historically known to use such fish aggregating devices [2].

Past experimental studies demonstrating that traditional FADs made with palm leaves provided a much less efficient attractant device for some very precious catch (*i.e.*: the greater amberjack, *Seriola dumerili*) compared to floats made of large diameter ropes made of polypropylene [19] might have incentivized the bad habit to take advantage of much cheaper and readily available scrapped non-biodegradable plastic materials. It is well-established that, within the Mediterranean Sea, FADs usually contain a large proportion of non-biodegradable materials, including discarded detergent plastic bottles (5L), parts of tires, polystyrene slabs often wrapped in plastic sheets, polyethylene, sisal or nylon ropes and anchoring limestone or concrete blocks [3,11]. The fact that these fishing devices are made of scrapper material do not incentivize fishers to recovering them when they are lost. Few Authors suggested that their loss or abandonment equates to "dumping", contravening international marine pollution law [11,21]. In particular, their systematic loss would breach the Annex V of MARPOL [11,20]. In any case, these artisanal FADs are clearly not even in line with established GFCM and EU fishery standards [8] that would allow preventing entanglements of on target species, by minimizing pollution and losses and maximizing recovery of lost FADs and [21].

This paper provides one record of a likely highly underestimated issue for cetaceans and other protected species, as depending on the status of the carcasses, many of such entanglements might go undetected, and there is not yet a protocol to systematically gather evidence on stranding events that would allow to estimate the rate of such interaction. Even though the Mediterranean striped dolphin is listed as Least Concern by the IUCN [22], this is a species strictly protected under the EU Habitat Directives Annex IV. The same applies to the loggerhead sea turtle (*Caretta caretta*) also listed under the EU Habitat Directives Annex IV and it is known to be bycaught I FADs in the southern Tyrrhenian Sea [23] at unknown levels. Under European legislation, all species listed in EU Habitat Directives Annex IV needs to be protected from human-induced disturbance and mortality, and monitoring programs need to be in place to estimate bycatch rates (see article 12 paragraph 4 of the EU Council Directive 92/43/EEC).

The described scenario is particularly worrisome considering that over 82% of the anchored FADs deployed annually across the world are in the Mediterranean [19] and that the estimated amount of lost or abandoned FADs is enormous [3,11]. In 2018, the IWC expressed concern at the rapid increase in deployment of FADs in many parts of the world and the links with entanglement of cetaceans [16]. We share the IWC concern and call for the urgent enforcement of existing GFCM and EU fishery standards in regard to FADs deployment, especially in the Mediterranean Sea.

Author Contributions: Conceptualization, V.M. and C.F.; methodology, V.M. and C.C.; investigation, V.M. and C.C.; writing—original draft preparation, V.M. C.F., and C.C.; writing—review and editing, V.M. C.F., and C.C.; visualization, V.M. and C.F.; supervision, V.M. and C.F. All authors have read and agreed to the published version of the manuscript.

Note: At the time of operations and data collection, Valerio Manfrini's affiliation was *Centro Studi Cetacei Onlus*.

Funding: This research received no external funding.

Data Availability Statement: "Not applicable" here.

Acknowledgments: We want to thank the Marshal Massimo Costabile and his personnel of the Coast Guard of Torvaianica (Rome), Dvm Natalino Cerini of ASL Roma 6 (Local Health Authority), personnel of Polizia Locale of Ardea (Rome) (Local Police), and Nucleo Protezione Civile "AIRONE" (Civil Protection Unit). We are grateful to Mr. Marco Loia and Dr. Elena Santini (Italian Institute for Environmental Protection and Research) for preparing the map in Figure 1 and providing photo in Figure 3 respectively.

Conflicts of Interest: The authors declare no conflict of interest.

This work is dedicated to the memory of Gianni Pavan (University of Pavia, Italy)

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