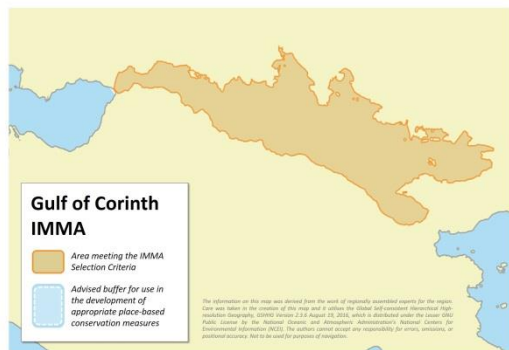


Gulf of Corinth Important Marine Mammal Area - IMMA

Description

The Gulf of Corinth (GoC) is a small, long, and semi-enclosed embayment in Central Greece between the Ionian and Aegean Seas in the Northeast Mediterranean (Ionian Sea IMMA sub-region). The GoC opens to the Gulf of Patras and the Ionian Sea to the west through the 2-km wide Rio-Antirio Strait (maximum depth 66 m). Passage to the waters of the Saronic Gulf and the Aegean Sea to the east is possible through the long (5.8 km), narrow (21 m), and shallow (minimum depth 7 m) Corinth Canal. It is impassable for most modern large ships and also largely inaccessible to cetaceans (Frantzis and Herzing, 2002). Very steep slopes, particularly along the southern coasts, characterize the GoC. The depth increases rapidly to reach a maximum of 935 m centrally. The central portion of the GoC includes a vast extension of waters 500–900 m deep, encompassing 900 km². The Gulf's western quarter is shallower (200–400 m), with a constriction less than 2 km wide, and two more shallow bays are found in its northern part. From a total of 2,336 km² of sea surface only 23 % lies over depths up to 100 m, while 38 % lies over depths of 500–935 m.

All the above described characteristics of the GoC make it look like a miniature of the Mediterranean Sea, but also a unique place worldwide regarding the characteristics of its dolphin populations/societies. The GoC is inhabited by four cetacean species: all the four most common dolphin species of the Mediterranean Sea. Striped dolphins, common dolphins and a single Risso's dolphin inhabit the deep pelagic part of the GoC. Bottlenose dolphins inhabit only the shallow waters; mainly two bays in the north of the gulf and its western shallow part (Frantzis and Herzing,



Area Size

2,379 km²

Qualifying Species and Criteria

Common dolphin - *Delphinus delphis*
Criterion A; B (i); C (i, ii); D (i)

Striped dolphin - *Stenella coeruleoalba*
Criterion A; B (i, ii); C (i, ii); D (i)

Marine Mammal Diversity

[*Tursiops truncatus*, *Grampus griseus*,
Monachus monachus]

Summary

The Gulf of Corinth is a small, semi-enclosed embayment in Greece. Its marine topographic variations, including continental shelf areas, steep bottom relief, and deep waters, offer suitable habitat for Vulnerable Mediterranean striped dolphins (*Stenella coeruleoalba*) and Endangered common dolphins (*Delphinus delphis*). Recent mark-recapture surveys showed that there are only twenty-two common dolphins in the Gulf of Corinth, likely to be Critically Endangered locally. The area is unique for its diverse and mixed-species dolphin societies.

2002; Bearzi, 2016). Although very few, monk seals still survive in the GoC (Bearzi et al., 2016). In 2003 the Mediterranean population of common dolphins was classified as Endangered in the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN), based on observed declines in the number of animals and extent of occurrence, as well as deterioration in the quality of habitat in large portions of the Mediterranean Sea (Bearzi, 2006). The coastal waters of western Greece host the closest population unit of common dolphins to that of the GoC. Apart the GoC, this is the only known place of the entire Ionian and Adriatic Seas where common dolphins still survive (with a very small population unit there as well). Bearzi et al. (2008) documented a precipitous decline for this population unit from 150 (in 1996) to only 15 (in 2007) in the Inner Ionian Archipelago. Although recent work by Gonzalvo and Costa (2016) and sightings of pods of more than 30 individuals (Frantzis et al., unpublished data) indicate common dolphin persistence in the area, the total population unit numbers only few tens of animals, and certainly much fewer than 100 (Gonzalvo and Costa, 2016). Common dolphins in the GoC live in a completely different habitat compared to those in the Ionian Sea and the Greek Seas in general, where they are known to inhabit shallow coastal waters over depths that rarely exceed 200 m (Frantzis et al., 2003; Frantzis, 2009; Giannoulaki et al., 2017). In the GoC common dolphins are pelagic, inhabiting mainly waters above depths of 500-900 m and certainly not less than 200 m (Frantzis et al., 2003; Frantzis, 2009; Bearzi, 2016). Common dolphins are absent in the western shallow part of the Gulf of Corinth and the waters of the Gulf of Patras that separate them from the Ionian population unit. Therefore, they are isolated according to all evidence (Frantzis et al., 2003; Frantzis, 2009; Bearzi et al., 2016). Their population size is extremely low and estimated to be only 22 animals (2011-2015 study period; Bearzi et al., 2016), and this is probably why they cannot form pure common dolphin pods, but live permanently in mixed pods mainly with striped dolphins (Frantzis and Herzing, 2002; Bearzi, 2016). Common dolphins in the GoC constitute a

geographically distinct conservation unit that likely has little demographic and genetic exchange and faces a high risk of extinction due to its small population size, limited distribution, and suspected hybridization would qualify as Critically Endangered under standard criteria provided by the IUCN Red List to assess extinction risk (IUCN, 2012a,b). The Mediterranean populations of striped dolphins (Aguilar and Gaspari, 2012) as well as of common bottlenose dolphins (Bearzi et al., 2012) have been classified as Vulnerable in the IUCN Red List of Threatened Species. The status of Risso's dolphins is poorly known and their Mediterranean subpopulation is classified as Data Deficient (Gaspari and Natoli, 2012). However, only two individuals of this species were living in the GoC when first encountered and described by Frantzis and Herzing (2002). One of them was last observed in 2001 and might have stranded in 2004 according to unconfirmed reports. The second and now unique individual in the GoC is still observed (pers. obs. 2015; Bearzi et al., 2016), 19 years after its first observation.

Criterion A - Species or Population Vulnerability

In 2003 the Mediterranean population of common dolphins was classified as Endangered in the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN), based on observed declines in the number of animals and extent of occurrence, as well as deterioration in the quality of habitat in large portions of the Mediterranean Sea (Bearzi 2006). The population units of short-beaked common dolphins in the GoC and the neighbouring inner Ionian Sea Archipelago (numbering together less than 100 animals; see previous section) are the last representatives of this species in the entire Adriatic and Ionian Seas, while they are also absent in the largest portion of the eastern Mediterranean Sea.

The Mediterranean populations of striped dolphins (Aguilar and Gaspari, 2012) and common bottlenose dolphins (Bearzi et al.,

2012) were classified as Vulnerable in the IUCN Red List of Threatened Species.

The GoC contains important habitat for the recovery of the declining short-beaked common dolphins. It is an important habitat for the vulnerable striped dolphins, where this species shows the highest density in comparison to all other Mediterranean areas (see Sub-criterion Bii). Finally, it is habitat also for common bottlenose dolphins and monk seals, although likely of secondary importance for the Mediterranean populations of these two species (Frantzis and Herzing, 2002; Bearzi, 2016).

Criterion B: Distribution and Abundance

Sub-criterion Bi: Small and Resident Populations

Both common dolphins and striped dolphins are resident and according to all evidence isolated in the semi-enclosed GoC (Frantzis et al., 2003; Frantzis, 2009; Bearzi et al., 2016). They are absent in the western shallow part of the GoC and the waters of the Gulf of Patras that separate them from the Ionian population units (Frantzis et al., 2003; Frantzis, 2009; Bearzi et al., 2016).

Considering that the Ionian population unit of common dolphin's number fewer than 100 individuals, the estimated 22 individuals that inhabit the GoC are a large proportion of the entire Adriatic and Ionian sub-population. Although much more, the estimated approximately 1,300 striped dolphins represent an unknown proportion of the Ionian or eastern Mediterranean striped dolphin sub-population.

Criterion B: Distribution and Abundance

Sub-criterion Bii: Aggregations

The GoC is the permanent habitat of about 1,300 isolated striped dolphins (Frantzis et al., 2003; Frantzis, 2009; Bearzi et al., 2016). Considering the relatively small surface of the sea area that they occupy, they likely

represent the highest permanent concentration of the species in the entire Mediterranean Sea: >1.5 dolphin's km^{-2} (they occupy about 800 km^2 waters mainly of depths over 500 m in the GoC). For comparative purposes, the striped dolphin density in the Pelagos Sanctuary has been estimated 0.23 dolphin's km^{-2} (Lauriano et al., 2010) and a mean density of 0.489 dolphin's km^{-2} was estimated for the central Spanish Mediterranean Sea (Gómez de Segura et al., 2006).

Criterion C: Key Life Cycle Activities

Sub-criterion Ci: Reproductive Areas

Given that both the short-beaked common dolphin and the striped dolphin population units in the GoC are isolated (Sub-criterion Bi), their entire life cycle is completed only inside the GoC. Striped dolphin newborns are commonly observed during summer, which is the calving season according to stranding data. Newborn and young calf (total length $<1 \text{ m}$) mortality is recorded from July to early September with a clear peak in late July to August, as in the rest of Greece (Frantzis; 2009; Frantzis et al., unpublished data).

Criterion C: Key Life Cycle Activities

Sub-criterion Cii: Feeding Areas

Given that both the short-beaked common dolphin and the striped dolphin population units in the GoC are isolated (see Sub-Criterion Bi), they totally depend on the semi-enclosed GoC ecosystem for their feeding. Squids that are commonly observed at surface during surveys or while following dolphins are a likely important prey (Bearzi et al., 2016).

Criterion D: Special Attributes

Sub-criterion Di: Distinctiveness

The dolphin societies in the GoC are definitely distinct as a whole because of their unique behavioural and ecological characteristics (see

Q4). There are some indications that the striped dolphins in the GoC might be genetically different from neighbouring populations, but the available samples that have been analysed so far are not enough for definitive conclusions.

Actually, as stated earlier (Q4), the mixed species dolphin societies in the GoC are unique in the world for three reasons: i) the striped dolphin population unit in the GoC is the only one known to inhabit a semi-enclosed gulf and be resident and isolated from other pelagic population units of this species, ii) the permanent three-species mixed pods of dolphins in the GoC is a unique phenomenon of marine mammal symbiosis between species of different ecological needs and behavioural characteristics, iii) the GoC is the only known area in the world, where hybrids between the two different genus of *Stenella* and *Delphinus* are naturally and continuously produced and survive.

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Annex I

List of Primary and Secondary Species

Primary Species – Meet the IMMA Selection Criteria

Scientific Name	Common Name of Species	Population / Subpopulation Name	IUCN Red List Status
<i>Delphinus delphis</i>	Common dolphin	Mediterranean Subpopulation	Critically Endangered (special case presented in Bearzi et al., 2016 for use of non-IUCN Red List status)
<i>Stenella coeruleoalba</i>	Striped dolphin	Mediterranean Subpopulation	Vulnerable

Secondary Species – Do not individually meet the IMMA Selection Criteria but are present within the area

Scientific Name	Common Name of Species	Population / Subpopulation Name	IUCN Red List Status
<i>Tursiops truncatus</i>	Common bottlenose dolphin	Mediterranean Subpopulation	Vulnerable
<i>Grampus griseus</i>	Risso's dolphin	Mediterranean Subpopulation	Data Deficient
<i>Monachus monachus</i>	Mediterranean monk seal	Mediterranean Subpopulation	Endangered