

**TOWARDS IDENTIFICATION OF THE BOTTLENOSE
DOLPHIN (*TURSIOPS TRUNCATUS*) POPULATION
STRUCTURE IN THE NORTH-EASTERN ADRIATIC SEA:
PRELIMINARY RESULTS**

**IDENTIFIKACIJA POPULACIJSKE STRUKTURE VELIKE
PLISKAVKE (*TURSIOPS TRUNCATUS*) V SEVEROVZHODNEM
JADRANU: PRVI REZULTATI**

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Ključne besede: *Tursiops truncatus*, velika pliskavka, Jadran, fotoidentifikacija, varstvo, populacijska struktura

ABSTRACT

Two longitudinal studies on the ecology of bottlenose dolphins (*Tursiops truncatus*) are being implemented in the Northern Adriatic Sea. One has been carried out since 1987 in the Kvarnerić, Croatia, the other since 2002 in Slovenian and adjacent waters. Standard photo-identification procedures enabled us to identify 238 and 55 individual dolphins, respectively. The aim of this study was to determine the potential distribution overlap in two local populations studied and to gain insight into the ranging patterns of bottlenose dolphins in the North-eastern Adriatic Sea. Photo-identification catalogues were compared in order to determine possible matches. First results indicate little overlap between the dolphins observed in the two study areas. This information is essential for future management and conservation strategies. Further comparative studies between the two study sites and other areas will be carried out to provide more information on the status of bottlenose dolphins in the North-eastern Adriatic Sea.

IZVLEČEK

Trenutno v severnem Jadranskem morju potekata dve longitudinalni študiji o ekologiji velike pliskavke (*Tursiops truncatus*). Prva je dobila zagon že leta 1987 v Kvarneriću, Hrvaška, druga pa leta 2002 v slovenskih in sosednjih vodah. Standardni fotoidentifikacijski postopki so omogočili avtorjem pričujočega članka prepoznati 238 osebkov te vrste v Kvarneriću in 55 v slovenskih in sosednjih vodah. Namen študije je bil ugotoviti morebitno medsebojno prekrivanje obeh preučevanih lokalnih populacij in zagotoviti nov vpogled v vzorce njihovih arealov v severovzhodnem Jadranskem morju. Pri ugotavljanju morebitnega mešanja med populacijama so si avtorji pomagali s primerjavami fotografij v dveh fotoidentifikacijskih katalogih. Prvi rezultati so pokazali, da je mešanje med delfini, opaženimi v dveh preučevanih območjih, majhno. To pa je podatek, ki je nadvse pomemben za prihodnje varstvene strategije, ki zadevajo veliko pliskavko v tem delu Jadrana. Sicer pa so z namenom, da se zagotovijo nadaljnji podatki o statusu velike pliskavke v severovzhodnem Jadranskem morju, v načrtu že nove primerjalne študije v obeh preučevanih in tudi drugih območjih.

1. INTRODUCTION

The bottlenose dolphin (*Tursiops truncatus*) is the only cetacean species regularly observed in the Northern Adriatic Sea in recent times (Kryštufek et Lipej 1993, Notarbartolo di Sciarra et al. 1993, Bearzi et Notarbartolo di Sciarra 1995, Bearzi et al. 2004) and one of the most studied cetacean species in the world (Shane et al. 1986, Leatherwood et Reeves 1990, Connor et al. 2000, Bearzi et al. 2009). However, the knowledge on the status of this species in the Adriatic Sea is still far from complete.

The first long-term study on the ecology of bottlenose dolphins in the Adriatic started in 1987 by the Tethys Research Institute and is now being implemented in the Kvarnerić, Croatia, by the Blue World Institute of Marine Research and Conservation (Bearzi et al. 1997, 1999, Mackelworth et al. 2003, Rako 2006, Fortuna 2006). The size of the local bottlenose dolphin population has been estimated to approximately 100-130 dolphins (Fortuna 2006). The animals are present in the area year-round and the local population has been resident at least over the last 20 years (Bearzi et al. 1997, Fortuna 2006).

A similar study was initiated in Slovenian waters in 2002 by Morigenos - Marine Mammal Research and Conservation Society (Genov et Fortuna 2005, Genov et Wiemann 2005, Genov et al. 2008). The project was initially focused on Slovenian waters, but soon expanded to the neighbouring areas in Croatia and Italy, due to the small size of Slovenian waters alone and the transboundary nature of dolphins' ranging patterns. The project focuses on bottlenose dolphin distribution, abundance, social structure, behaviour, fishery interactions and influence of maritime traffic on dolphins. Land-based and boat-based surveys were carried out between 2002 and 2008. Group follow protocol (Mann 1999, 2000) was used each time the dolphin groups were encountered and standard photo-identification procedures (Würsig et Jefferson 1990) were carried out. Dolphins can be seen in the study area year-round. Resighting rates within and between years suggest that at least some individuals are resident in the area and the size of the local bottlenose dolphin population has been estimated to approximately 70 dolphins (Genov et al. 2008). Observations of feeding behaviour and mother-calf pairs suggest that the area is used for feeding, breeding and nursing (Genov et al. 2008).

The aim of this study was to determine whether these were the same or different dolphins and therefore if the two local populations mix or overlap in distribution.

2. MATERIAL AND METHODS

Study areas are shown in Figure 1. Survey protocols and field methods for these studies are described in detail in Fortuna (2006) and in Genov et al. (2008). In both studies, non systematic boat surveys and photo-identification were applied. Photo-identification catalogues (Figure 2) of both local populations were compared in order to determine the presence of possible matches and thus an overlap between the animals inhabiting the two respective study areas. Only Morigenos dataset from 2002 to 2005 and Blue World dataset from 2001 to 2005 were considered for this particular analysis. Considering that the two datasets time-frame was

the same, any bias due to mark-loss was believed to be minimal. All photographs in the two catalogues were visually examined. Each catalogue was examined independently in turn, thus datasets were cross-checked for possible matches.

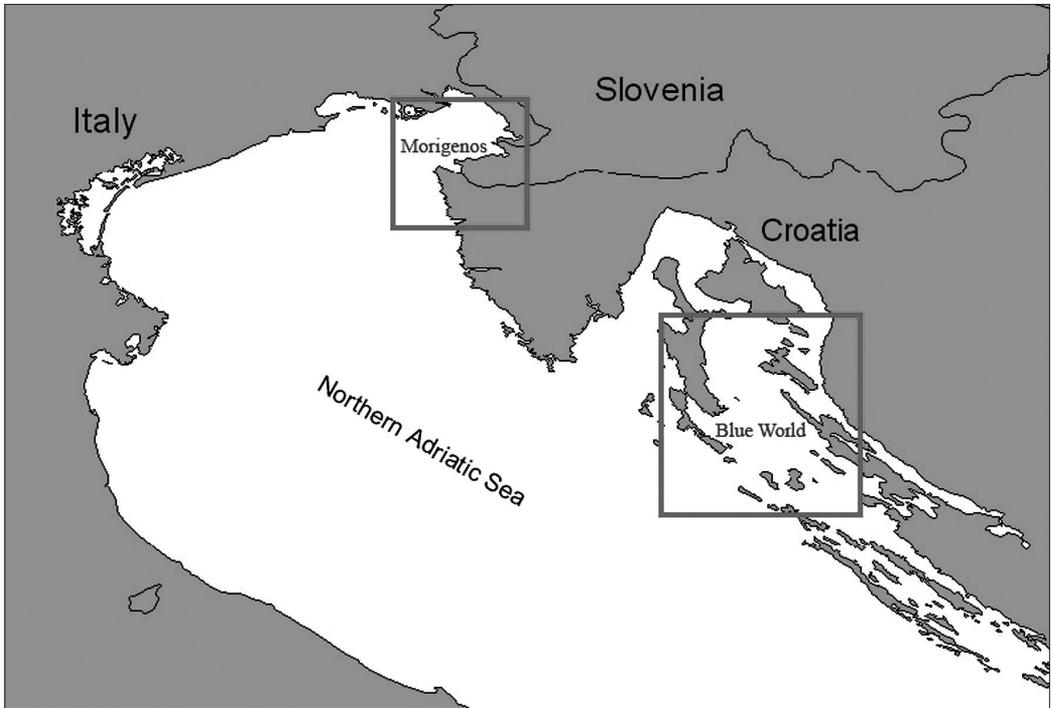


Figure 1: Study areas. The two study areas are roughly 150km apart.

Slika 1: Preučevani območji sta med seboj oddaljeni približno 150km.



Figure 2: A bottlenose dolphin (*Tursiops truncatus*) showing distinct identifying marks on the dorsal fin. (Photo: Tilen Genov)

Slika 2: Velika pliskavka (Tursiops truncatus) z vidnimi identifikacijskimi znamenji na hrbtni plavuti. (Foto: Tilen Genov)

3. RESULTS AND DISCUSSION

During the study period, a total of 51 sightings were recorded and 55 individuals photo-identified in Slovenian and adjacent waters. A total of 263 sightings were recorded and 238 individuals photo-identified in the Kvarnerić. No matches between the two study areas were found for that study period. These preliminary results suggest that two separate local populations are present in the two study areas, and they appear to mix rarely. However, these results should be considered preliminary. They certainly do not mean that the two local populations are completely separated or genetically isolated. In fact, genetic evidence has shown that all Adriatic dolphins likely belong to a single genetic population (Natoli et al. 2005). Furthermore, there is a possibility of future matches, as the number of identified individuals in Morigenos' catalogue has recently increased to 101 animals (Genov et al. 2008). Moreover, adjacent areas in western Istria are additionally being covered as a result of a cooperative project, carried out since 2005 by the Blue World and Morigenos, which could lead to potential future matches.

The two study areas are roughly 150 km apart (Figure 1). The significance of this distance is debatable for bottlenose dolphins, which often live in relatively restricted home ranges, but are known to be capable of travelling long distances in short time. For example, Würsig (1978) reported bottlenose dolphins travelling more than 300 km in one direction and then returning to the original site. They therefore made at least a 600 km round trip. However, a resident local population of bottlenose dolphins around Île de Sein (Brittany, France) always stays within an area not larger than 5 km² and another local population in the nearby Molene archipelago uses a range of about 70 km² (Liret et al. 1996). In Moray Firth (Scotland), individual bottlenose dolphins were seen travelling 218 km in 2 days, 190 km in 5 days and 65 km in 1 day, respectively (Wilson et al. 1997, 2004). All these cases represent »coastal« form of bottlenose dolphins. In the south-eastern United States, an »offshore« form male bottlenose dolphin, tracked with a satellite-linked transmitter, travelled 4,200 km in 47 days, while an »intermediate « form (intermediate form between »coastal« and »offshore« form) male bottlenose dolphin travelled 2,050 km in 43 days (Wells et al. 1999). Therefore, the ranges of bottlenose dolphins seem to vary a great deal. Although many bottlenose dolphins clearly concentrate their activities within certain ranges, it is still unclear how limiting these ranges are. For now, long-distance movements or seasonal migration have not been observed in the North-eastern Adriatic. However, dolphins seem to have relatively large permanent ranges, which (in both studies) appear to be bigger than the chosen study areas (Bearzi et al. 1997, Genov et al. 2008). Our coverage of the dolphins' range is therefore limited.

Photo-identification data from the Kvarnerić has shown that dolphins using the »inside« part of the archipelago (between islands) also occasionally use the west side of the island (»outside« the island chain). But other animals found occasionally on the west side (often just once) and considered "visitors", were never or rarely seen inside the archipelago. It is therefore possible that Lošinj and the other islands form some sort of a natural barrier (a bottleneck), which reduces the amount of flow between these areas, at least to some extent. However, it should also be noted that the areas west of Lošinj are ecologically somewhat more similar to the area of the Gulf of Trieste and western Istria, while the areas east of Lošinj (inside the

archipelago) are substantially different in terms of depth, bottom topography and habitat types. This could suggest that the two local populations or »social groups« have different ecologies. In fact, the behaviour, feeding activities and intermixing of groups in both areas appear to differ (Bearzi et al. 1997, Genov et al. 2008).

The comparisons with other areas are needed in order to gain additional insights into the ranging patterns of the Northern Adriatic bottlenose dolphins. For example, 42 bottlenose dolphins have been identified off Venice by the Tethys Research Institute (S. Bonizzoni, pers. comm.). Comparison with that catalogue could potentially provide more matches between Morigenos' catalogue and Venice catalogue for two reasons. Firstly, the distance between the two areas is shorter. Secondly, the lack of natural barriers, such as the islands delimiting the Kvarnerić archipelago and/or the presence of one of the main Adriatic currents along the outer margins of Kvarnerić islands could be responsible for differences in ecologies and therefore distribution of different groups or local populations of bottlenose dolphin.

The question remains regarding the population structure of bottlenose dolphins in the North-eastern Adriatic. Several hypotheses are possible: a) one single and very large population with small local populations or sub-populations (social groups); b) scattered and distinct local populations; c) slightly overlapping local populations; d) one single continuous, but relatively small local population. The answer to this question has direct conservation implications. For the bottlenose dolphin, fluid social groups are regarded typical, but dolphins do not disperse far from their natal groups (Natoli et al. 2004, Connor et al. 2000). Differences in the distribution of prey, reflecting differences in habitat, may be defining the geographical range and patterns of association in local populations. Local populations of bottlenose dolphins are habitat dependent in a way that likely defines patterns of movement. They have been shown to favour specific habitat types, which is consistent with our observations.

The degree of mixing or genetic isolation between populations can only be determined after individual population units have been identified through consideration of (ideally) behaviour, morphology and genetics (Shane et al. 1986). Therefore, other forms of evidence are needed to confirm the results of photo-identification. But even if Adriatic dolphins belong to just a single genetic population, local populations might still be sufficiently separated in social terms to be considered as separate conservation units.

4. CONCLUSION

This study clearly represents only the first step in the attempt to define the population structure and ranging patterns of the North-eastern Adriatic bottlenose dolphins. As the number of photo-identified individuals in Morigenos catalogue is still rising, further comparative studies between the two study sites and other areas will be carried out. Yet this study represents an important step in understanding their distribution and population structure and this has implications on the management and conservation of Adriatic dolphins. In one way, the absence of matches could be a positive result, indicating the likely existence of a »bigger« population in relative terms. It is worth noting that the Kvarnerić population is

small and showing a declining trend in abundance between 1995 and 2003 (Fortuna 2006). Future research in the region, taking both photo-identification and genetics into account, will provide additional insights into the population structure of the Adriatic bottlenose dolphins. This information is essential for future management and conservation strategies.

5. SUMMARY

Two long-term studies on the ecology of bottlenose dolphins (*Tursiops truncatus*) are being implemented in the northern Adriatic Sea. One is being carried out since 1987 in the Kvarnerić, Croatia, the other since 2002 in Slovenian and adjacent waters. Standard photo-identification procedures enabled us to identify 238 and 55 individual dolphins, respectively. The local Kvarnerić population has been estimated at approximately 100-130 animals, the local population from Slovenian and adjacent waters at approximately 70 animals. The aim of this study was to determine the potential distribution overlap in two local populations studied and to gain insight into the ranging patterns of bottlenose dolphins in the north-eastern Adriatic Sea. Photo-identification catalogues were compared in order to determine possible matches. Only datasets collected between 2001 and 2005 were considered for this particular analysis. The resulting lack of matches indicates little overlap between the dolphins observed in the two study areas, although it is unlikely that the two local populations are completely genetically separated. This information is essential for future management and conservation strategies, as the two local populations should be regarded as two separate conservation units. Further comparative studies between the two study sites and other areas will be carried out to provide more information on the status of bottlenose dolphins in the North-eastern Adriatic Sea.

POVZETEK

Trenutno v severnem Jadranskem morju potekata dve longitudinalni študiji o ekologiji velike pliskavke (*Tursiops truncatus*). Prva se je začela že leta 1987 v Kvarneriću, Hrvaška, druga pa leta 2002 v slovenskih in sosednjih vodah. Standardni fotoidentifikacijski postopki so omogočili avtorjem pričujočega članka prepoznati skupaj 238 osebkov te vrste v Kvarneriću in 55 v slovenskih in sosednjih vodah. Sicer pa je lokalna populacija v Kvarneriću ocenjena na 100-130, v slovenskih in sosednjih vodah pa na približno 70 velikih pliskavk. Namen študije je bil ugotoviti morebitno medsebojno prekrivanje obeh preučevanih lokalnih populacij in zagotoviti nov vpogled v vzorce njihovih arealov v severovzhodnem Jadranskem morju. Pri ugotavljanju morebitnega mešanja med populacijama so si avtorji pomagali s primerjavami fotografij v dveh fotoidentifikacijskih katalogih. Za pričujočo analizo so bili upoštevani le podatki, pridobljeni med letoma 2001 in 2005. Ugotovljeno pomanjkanje prekrivanja med obema katalogoma kaže na majhno mešanje med delfini, opazovanimi v obeh preučevanih območjih, vendar je možnost, da sta lokalni populaciji genetsko povsem ločeni, majhna. Ta podatek je vsekakor nujen za prihodnje strategije upravljanja in varstva, saj je treba na dve lokalni populaciji gledati

kot na dve ločeni enoti varstva. Z namenom, da se zagotovijo nadaljnji podatki o statusu velike pliskavke v severovzhodnem Jadranskem morju, pa so v načrtu že nove primerjalne študije v obeh preučevanih in tudi drugih območjih.

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