

POPULATION SIZE AND DISTRIBUTION OF BOTTLENOSE DOLPHINS (*Tursiops truncatus*) AROUND THE LOŠINJ AND CRES ARCHIPELAGO

A. Wiemann¹, P. C. Mackelworth^{1,2}, D. Holcer^{1,3} and C. M. Fortuna^{1,4}

- ¹ Blue World Institute of Marine Research and Conservation, Zad Bone 11, 51551 Veli Lošinj, Croatia, www.blue-world.org, adp@blue-world.org,
² Department of Geography, 26 Bedford Way, University College London, London WC1H 0AP, UK, pcm@pmackelworth.freeserve.co.uk,
³ Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia, Drasko.Holcer@hpm.hr,
⁴ Central Institute of the Marine Applied Research, Via di Casalotti 300, IT-00166 Roma, Italy, c.fortuna@icram.org

Introduction

Little is known about the occurrence and distribution of cetacean species in Croatian waters. During the last decade bottlenose dolphins (*Tursiops truncatus*) were the only regularly sighted cetaceans in the Northern and Central Adriatic Sea.



The Adriatic Dolphin Project has monitored the resident bottlenose dolphin population of the Lošinj and Cres archipelago since 1987. During the long-term study, research has particularly focused on the socio-ecology of the population. Population estimation is regarded essential to determine the population size and trend of animal species in any environment. Only with this information it is possible to establish and develop the implementation of management and conservation strategies for vulnerable populations. Our aim is to evaluate how many dolphins frequent the study area and to identify the importance of this habitat for this cetacean species.

MATERIALS AND METHODS

The study site is located around the coastal waters of the eastern part of the Lošinj-Cres archipelago and comprises of about 1000 km². Data was collected during boat-based photo-identification surveys, conducted during the months of May to October of the years 2001 and 2002. Individual dolphins were recognized using natural markings on their dorsal fins and surrounding flanks. To minimize bias, dolphin markings were placed into different marking categories and picture quality was graded. Population size and trend was estimated based on all good quality photographs of reliably marked dolphins applying the POPAN model of SOCPROG 1.3. The distribution of individuals in the study area was described by calculating the residency rate during the field season.

RESULTS

During 143 boat surveys, a total of 71 dolphin groups were encountered. It was found that a 'Mortality + Trend Model', was best fit to describe the population. The estimated number of dolphins with reliable markings accounted for 100 individuals (95% CI = 81.9 – 125.5, SE = 13.6). The combined mortality, mark change and emigration rate was estimated at 0.02 % per year with a positive trend of 0.05 % per year. The total number of dolphins in this population was estimated to be 128 (95% CI = 105.9 – 158.4, SE = 15.8), including also the unreliably marked dolphins, among them juveniles and calves. The emigration and re-immigration model best described the residency pattern of the dolphins, indicating that, individuals may enter, leave and re-enter the study site during the field seasons. At any given time during the field season an average of 49 individuals were present within the study site.

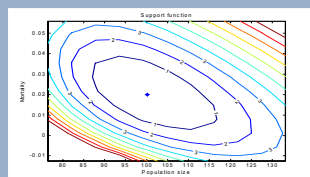


Fig. 1. Support surface contours for estimates of population size and mortality rate of reliably marked individuals, based on mortality + trend model.

Dataset	Model	Population estimate	Mortality (% per year)	Trend (% per year)	AIC
N=122	Closed	132			570
		(122.2-157.7)			
	Mortality	102	0.03		562
		(84.4-128.7)	(0.01-0.06)		
	Mortality + trend	100	0.02	0.05	553
		(81.9-125.5)	(0.005-0.04)	(0.02-0.08)	

Table 1

Population estimates for all reliably marked individuals (95% CI in brackets). Best-fit models based on Akaike Information Criterion (AIC) are given in italics.

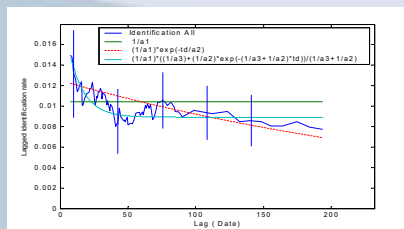


Fig. 2. Lagged Identification rate (probability of re-identifying animal after a certain time lag) of bottlenose dolphins in the Lošinj-Cres Archipelago. Vertical lines are jack-knife error bars.

Table 2

Estimated residency parameters (+/- SE) for all individuals in both years. Best-fit models based on Akaike Information Criterion (AIC) are given in *italics*.

Dataset	Model	No. of dolphins in study area at any given time	Mean no. of days dolphins inside study area	Mean no. of days dolphins outside study area	AIC
N=122	Closed	96 +/- 14			2503
	Mean residence	80 +/- 17	328 +/- 281		2497
	<i>Emigration & re-immigration</i>	<i>49 +/- 59</i>	<i>19 +/- 178</i>	<i>25 +/- 97</i>	2495

DISCUSSION AND CONCLUSION

The result of this study varies slightly from the population estimate of 1997 (Total of 113 individuals, 95% CI = 107 – 121, SE = 6.967), which accounts to the use of a different modelling program, as well as a different sampling size and categories. Nevertheless the Lošinj-Cres population estimate remains small and well below the IUCN's classification of 'critically endangered isolated populations' with less than 250 individuals. The positive mortality trend is not significant.

Thus it is important to continue the monitoring of the population size and trend, in order to develop and implement a concept to ensure the survival of this population. The results also imply that the study area is only part of the entire home range of the dolphins.

The large standard errors of the residency periods inside and outside the study area seem to indicate that individuals spend more variable time periods inside and outside and that the field season failed to sample a large number of exits from and re-entries to the study area. This could be linked to either ecological factors and/or human activity.

Hence, further studies in other parts of the Adriatic are needed to determine the accurate status of the bottlenose dolphins in Croatian waters and to assess the importance of further potential habitats for this population.

REFERENCES

- Bearzi, G., Politi, E., and Notarbartolo di Sciarra, G. 1999. Diurnal behaviour of free-ranging bottlenose dolphins in the Kvarneric (Northern Adriatic Sea). *Mar. Mamm. Sci.* 15 (4): 1065-1097.
 Fortuna, C.M., Wilson, B., Wiemann, A., Riva, L., Gaspari, S., Matesic, M., Oehen, S., and Pribanic, S. 2000. How many dolphins are we studying and is our study area big enough? *Proceedings of the 13th annual conference of the European Cetacean Society.* 370-373.
 Gowans, S., Whitehead, H., Arch, J.K. and Hooker, S.K. 2000. Population size and residency patterns of northern bottlenose whales (*Hyperoodon ampullatus*) using the Gully, Nova Scotia. *J. Cetacean Res. Manage.* 2 (3): 201-210.
 Whitehead, H. 1999a. Programs for analyzing social structure. <http://is.dal.ca/hwhite/manual.htm>
 Wuersig, B., and Jefferson, T.A. 1990. Methods of photo-identification for small cetaceans. *Reports of the International Whaling Commission.* (Special Issue 12): 71-78.

ACKNOWLEDGEMENTS

We would like to express our gratitude to The Blue World Institute for Marine Research and Conservation visiting researchers, staff, students and volunteers who contributed to this work. This study was partially carried out within the research project No. 183007 of the Ministry of Science and Technology of Croatia, under the permit no. UP/1612-07/01-33/0151 of the Ministry of Environmental Protection and Physical Planning of Croatia.