Biol. Mar. Mediterr. (2025), 29 (1): 186-189 www.biologiamarinamediterranea.it

53° Congresso SIBM: Cetacei

F.C. SANTACESARIA[1,2], G. CIPRIANO[1], S. BELLOMO[2], N. CLEMENTE[2], C. FANIZZA[2], S. LALINGA[2], R. MAGLIETTA[3], V. POLLAZZON[2], P. RICCI[1], R. CARLUCCI[1]

[1]Dipartimento di Bioscienze, Biotecnologie e Ambiente, Università degli studi di Bari, via Orabona 4, 70125 Bari, Italia
[2]Jonian Dolphin Conservation, Taranto
[3]STIIMA-CNR, Bari
lia@joniandolphin.it; francesca.santacesaria@uniba.it

EVIDENCE OF MALE ALLIANCES IN THE RISSO'S DOLPHIN POPULATION OF THE NORTHERN IONIAN SEA

EVIDENZE DELLA PRESENZA DI ALLEANZE MASCHILI NEI GRAMPI OSSERVATI NEL MAR IONIO SETTENTRIONALE

Abstract - *The study of cetacean social organization and the population dynamics provides valuable insights for developing effective conservation and management plans. This study analysed the strength of relationships among 64 photo-identified specimens sighted at least 10 times from July 2016 to September 2022, measuring the simple ratio association index (AI). The analysis revealed strong bonds (0.80<AI≤1.00) in 31 dyads, among these 25 being male-male, 5 female-male and 1 female-female associations. Four subgroups of males, organised in persistent and long-term associations were observed, revealing male alliances. Additionally, a strong bond between one subgroup of males and a potentially breeding female was reported, suggesting that male alliances could occur in a reproductive context. As the first analysis indicating the occurrence of male alliances, this study supports the hypothesis of a more complex and structured society in Risso's dolphin population of the Northern Ionian Sea.*

Keywords: Grampus griseus*, Gulf of Taranto, social organization, association pattern, male alliances*

Introduction - The study of the social structure synthesizes a vital class of ethological and ecological relationships that often serves as key determinants of population biology, shaping how a population responds to both ecological and anthropogenic factors (Whitehead, 2008). Thus, investigating the social organization and population biology of cetaceans, which are top predators and important sentinels of the health of the marine ecosystems, provides opportunities to study responses to anthropogenic disturbance and offers useful information for developing effective conservation and management plans (Whitehead, 2008). The aim of the present study is to investigate and better understand the social organization of Risso's dolphin, *Grampus griseus* (Cuvier, 1821) in the Northern Ionian Sea. For this species in the Mediterrean Sea, a recent review of its conservation status by the International Union for Conservation of Nature (IUCN) let to a shif from "Data Deficient" to "Endangered" status, based on criterion A2bc , which reflects a population reduction exceeding 50% over the last decade (ACCOBAMS, 2021). Although some knowledge gaps regarding Risso's dolphin within the Mediterranean basin have been addressed, its new conservation status enhances the urgent need of more comprehensive undestanding of its population biology. Currently, knlowledge of its social structure ramains limited both globally and in Mediterrean Sea (Hartman *et al*., 2008; Santacesaria *et al*., 2022). A first analysis carried out in Azores showed a stratified social organization, sized between fission-fusion and matriarchal society, based on age and sex classes, suggesting diet as the key factor in the evolution of Risso's dolphin society. In contrast, studies in the Ligurian Sea and in the Northern Ionian Sea revealed a fluid social structure, characterized by relatively weak individual bonds, and a typical fission-fusion society was described (e.g. Santacesaria *et al*., 2022). However, results, reported in the Northern Ionian Sea,

highlited also the prensence within the population of several subgroups with strong association among individuals and the temporal analysis revealed the occurence of preferred association within and between different sex and age classes. This suggested the existence of a permanent core membership with a certain degree of organization based on sex and age classes, similar to that observed in Azores. Thus, this study aimed to investigate the strenght of relationships (in terms of time that each dyad spends in association) in order to assess the existence of a more stratified social organization.

Materials and Methods - Data were collected from July 2016 to September 2022 during standardized vessel-based surveys carried out in the Northern Ionian Sea following the Line Transect Distance Sampling approach. When a dolphin or a group had been sighted, date, geographic coordinates, depth (m), time of first and end contact, group size and the predominant behavioural state were recorded. Photo-identification data were collected by a minimum of two photographers positioned on the bow of the research vessel, using a digital camera Nikon D3300 with Nikon AF-P 70-300 mm, f 4,5-6,3G ED lens. The Risso's dolphin photo-ID process was carried out using the automated photo-identification pipeline based on SPIR (Maglietta *et al.,* 2018). Finally, all the photo-identified individuals were classified, according to Carlucci *et al.* (2020), into age (adult, subadult, calf) and sex (female, male, undetermined) classes. In order to ensure independence of sampling and minimize possible autocorrelation of sightings during analysis, all sightings of identified individuals were separated by at least 1 day. Data were analyzed using the compiled version of SOCPROG 2.9 software (Whitehead, 2009). The association index (AI) was estimated for each individual calculating the simple ratio index (ratio of the numer of sampling periods in which two individuals were recorded as associatied divided by the number of sampling periods in which at least one of them was identified). Moreover, the association analysis was performed using as selection criterion the number of times that an animal was sighted, aiming to find a balance between the maximum number of individuals and a good quality of the analysis. On this purpose, only individuals re-sighted at least 10 times were used for the analysis. For each individual, the mean value of simple ratio association index with all other individuals and the maximum value of association index was calculated, as well as the means and standard deviations of these measures over all individuals. Hierarchical cluster analysis and the network analysis were performed to illustrate relationships between individual dolphins and any grouping within the population. A cophenetic correlation coefficient (CCC) greater than 0.80 and a modularity greater than 0.30 indicated that the division into clusters is sensible (Whitehead, 2009). Finally, the results obtained were used to assess the occurrence of male alliances. According to Gerber *et al.* (2021), males are defined as "allies" if they show an AI > 0.80; if they are each other's top associates, or if the individual is the second closest associate of a male pair; if the dyad's AI is greater than the average of the maximum AI values calculated during the study period.

Results – During the study period, 141 sightings of Risso's dolphin occurred in study area. Photo-identification data were collected in 137 daily surveys and 180 individuals were identified. The number of sightings for each individual varies from 1 up to 63 with a mean value of re-sightings of 10.3 ± 11 (SD). For the association pattern and social structure analysis, all sightings of identified individuals separated by at least 1 day were considered and a number of re-sightings>10 was applied as selection criterion, resulting

in 102 daily surveys and 64 individuals (31 male, 19 female, 14 undetermined) used for the analysis. The mean value of simple ratio association index over all individuals was 0.18 ± 0.04 (SD) (n=64 individuals), ranging from 0.10 to 0.25; the mean value of maximum association index was 0.74 ± 0.14 (SD), ranging from 0.35 to 0.95. The analysis revealed strong bonds (0.80<AI≤1.00) in 31 dyads, among these 25 being male-male, 5 female-male and 1 female-female associations. The cluster representation consisted of two clusters, comprising 29 and 35 individuals, respectively. Within these clusters, several subgroups, mainly composed of male individuals, were observed (Fig. 1). Specifically, four male subgroups were organized into persistent, long-term associations of varying sizes (pairs, triplets, and quadruplets) and meet the assumptions outlined by Garber *et al.* (2021) for defining male alliances. These alliances are illustrated in the network diagram shown in Fig. 2. Regarding female-male association, a strong bond between individuals of one male subgroup and a potentially breeding female, called "SURF" was reported.

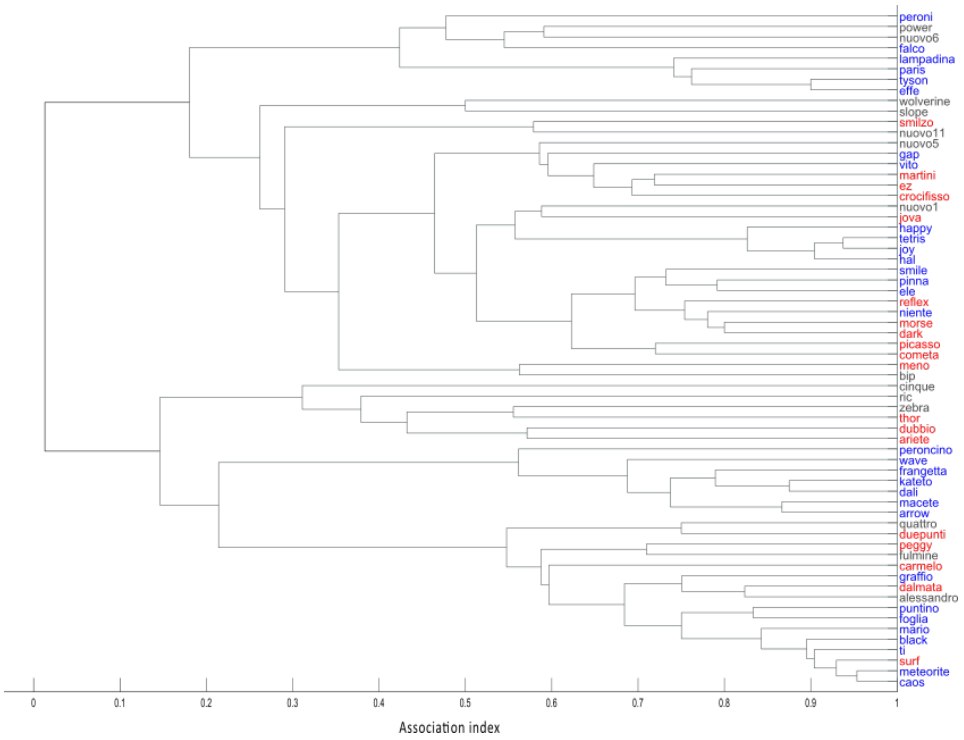

Fig. 1 - Cluster representation of the social organization of Risso's dolphins in the Northern Ionian Sea. Male reported in blue, female in red, undetermined in grey.
Rappresentazione in cluster dell'organizzazione sociale del grampo nel Mar Ionio Settentrionale. I maschi sono riportati in blu, le femmine in rosso, gli indeterminati in grigio.

Conclusions - The understanding of social organization of Risso's dolphins is required to identify useful and appropriate management and conservation actions, defining as human activities could affect dolphins and their environment. Previous works describe the social organization of this species in the Mediterrean Sea with a fission-fusion model (e.g. Santacesaria *et al.,* 2022). However, a certain degree of social stratification, based on age and sex classes, was noted in the Northern Ionian Sea supporting the hypothesis of a more structured social organization and highlighting the presence of male alliances within the population. According to Gerber *et al*. (2021), in fission-fusion societies, these types of alliances are crucial for ensuring male fitness, as males without alliances

produce none or very few offspring. The presence of a strong bond between a reproductive female and a male alliance suggests that, even in the study area, these alliances may occur in a reproductive context. These results emphasize the role of the study area as a critical habitat for Risso's dolphin, serving also as a reproduction site, essential for the conservation of this endangered species.

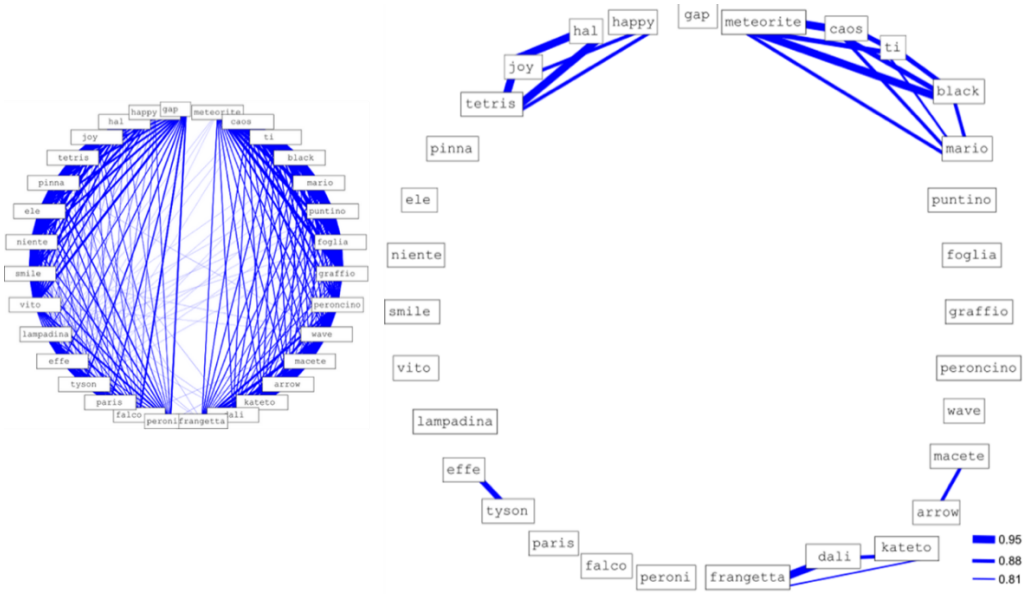

Fig. 2 - Network analysis diagram: a) representation of different bonds occurring among male individuals; b) representation of male alliances observed. The size of the line is proportional to the AI value.
Diagramma della network analysis*: a) rappresentazione dei diversi legami che si verificano tra individui di sesso maschile; b) rappresentazione delle alleanze maschili osservate. La dimensione della linea è proporzionale al valore AI.*

References

ACCOBAMS (2021) - Conserving Whales, Dolphins and Porpoises in the Mediterranean Sea, Black Sea and Adjacent Areas: An ACCOBAMS Status Report. In: Notarbartolo di Sciara G., Tonay A.M., (eds), *ACCOBAMS Monaco,* Monaco: 50–52.

CARLUCCI R., BAŞ A.A., LIEBIG P., RENÒ V., SANTACESARIA F.C., BELLOMO S., FANIZZA C., MAGLIETTA R., CIPRIANO G. (2020) - Residency patterns and site fidelity of *Grampus griseus* (Cuvier, 1812) in the Gulf of Taranto (Northern Ionian Sea, Central-Eastern Mediterranean Sea). *Mammal Res.*, **65**(3): 445-455.

GERBER L., WITTWER S., ALLEN S.J., HOLMES K.G., KING S.L., SHERWIN W.B., WILD S., WILLIEMS E.P., CONNOR R.C., KRUTZEN M. (2021) - Cooperative partner choice in multi-level male dolphin alliances. *Sci. Rep.*, **11**: 6901.

HARTMAN K.L., VISSER F., HENDRIKS A.J.E. (2008) - Social structure of Risso's dolphins (*Grampus griseus*) at the Azores: a stratified community based on highly associated social units. *Can. J. Zool.***, 86** (4): 294-306

MAGLIETTA R., RENÒ V., CIPRIANO G., FANIZZA C., MILELLA A., STELLA E., CARLUCCI R. (2018) - DolFin: an innovative digital platform for studying Risso's dolphins from the Northern Ionian Sea (Central- eastern Mediterranean). *Sci. Rep.*, **8**: 17185.

SANTACESARIA F.C., FANIZZA C., BELLOMO S., CARLUCCI R., CLEMENTE N., CRUGLIANO R., LALINGA S., MAGLIETTA R., POLLAZON V., CIPRIANO G. (2022) - Preliminary analysis of Risso's dolphin social structure in the Gulf of Taranto (Northern Ionian Sea, Central Eastern Mediterranean Sea). *2022 IEEE International Workshop on Metrology for the Sea; Learning to Measure Sea Health Parameters, MetroSea 2022 - Proceedings*: 242-246

WHITEHEAD H. (2008) - *Analyzing animal societies: quantitative methods for vertebrate social analysis*. University of Chicago press, Chicago: 320 pp.

WHITEHEAD H. (2009) SOCPROG programs: analysing animal social structures. *Behav. Ecol. Sociobiol.*, **63**: 765–778.