Esteban

Long-term social structure dynamics of short-finned pilot whales on Madeira Island

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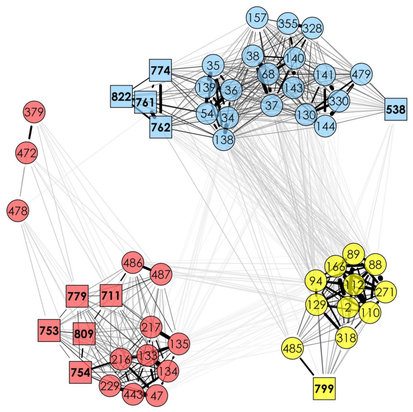
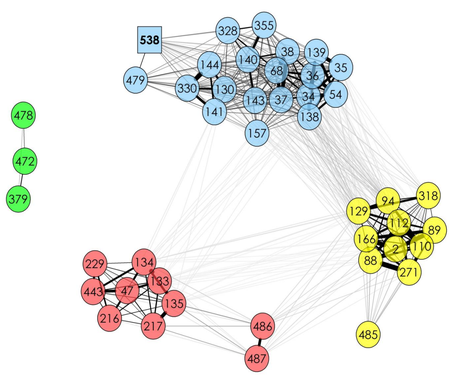
A: 1997-2019 (M=0.55)



B: 1997-2013 (M=0.50)



C: 2014-2019 (M=0.65)

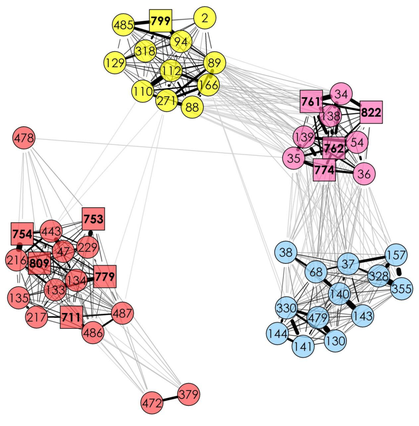


Figure 1. Network diagrams and corresponding modularities (M)

METHODOLOGY

We analysed the dynamics of the social structure of short-finned pilot whales (*Globicephala macrorhynchus*) off the coast of Madeira.

Photo-id images from 1997-2019 were used, using only good quality pictures, of marked individuals, observed more than four years and seasons, and in more than five sampling periods (i.e. day). Naming these individuals as core resident.

We used the following method, over all study period and/or in two subperiods (1997-2013; 2014-2019):

Half-weight association index (HWI): calculate strength of associations[1].

Modularity (M): determine cluster structure[2].

Standardized lagged association rate (SLAR): stability of associations over time[3] .

Lagged identification rate (LIR): presence /absence of individuals [4].

Kernel density estimates (KDEs): determine core areas by clusters [5].

Turnover: percentage of emigrated/dead and immigrated/born individuals

Table 1. Social network metrics

	Period	Red	Yellow	Blue
Cluster size	97-13	13	11	20
	14-19	18	12	23
	97-19	18	12	24
Turnover	97-19	27%	8%	22%
Mean HWI (Max)	97-13	0.23 (0.62)	0.47 (0.70)	0.33 (0.65)
	14-19	0.28 (0.66)	0.42 (0.67)	0.23 (0.73)
	97-19	0.22 (0.56)	0.42 (0.68)	0.24 (0.64)

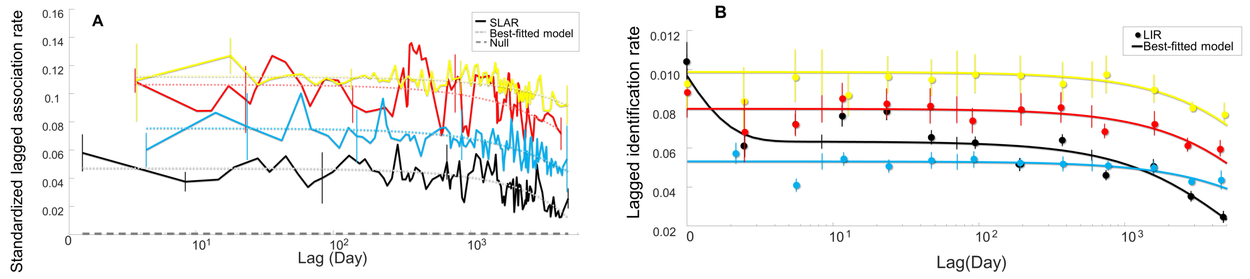


Figure 2. A: SLAR and B: LIR

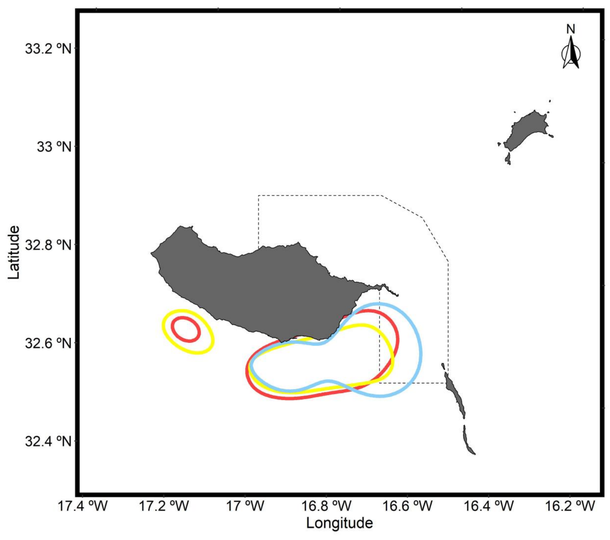


Figure 3. Overlap of Kernel density core areas by clusters (yellow, red and blue)

RESULTS - DISCUSSION

Almost 9,000 dorsal fin images of 54 core resident individuals were analysed. Their social structure is well differentiated (Fig. 1A, Table 1). The decline of SLAR and LIR in all clusters suggest that associations decrease with time (decreased by half in 18–54 years) (Fig. 2). A large overlapping between clusters was found, suggesting that their structure is not driven by spatial factors (Fig. 3). Higher turnovers, and lower mean HWI were found in the red and blue cluster (Table 1), probably explaining the split of the blue cluster (Fig. 1A&B) and the incorporation of the green cluster into the red cluster (Fig. 1B) in the second period.

CONCLUSION

Core resident short-finned pilot whales in Madeira showed long-term stability of associations. However, clusters are dynamic, probably because of the increase in the number of individuals over time, it is more difficult to maintain the same level of association in larger groups.

MORE INFO?

REFERENCES

(1) Whitehead 2008 The University of Chicago Press.
(2) Lusseau and Newman 2004 Proc R Soc Ser B.
(3) Whitehead 1995 Behav Ecol.
(4) Whitehead 2001 Ecology.
(5) Worton 1989 Ecology.

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