

# Patterns of offspring care in northern bottlenose whales (*Hyperoodon ampullatus*)

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## Background

### Problem:

- Marine environments offer little coverage from predators, causing young offspring to be especially vulnerable<sup>2</sup>
  - Adults may mitigate this threat through different ecological and evolutionary strategies.<sup>1</sup>
- Understanding these offspring care strategies provides insight into the evolution of cooperation in social species.<sup>2</sup>

### The northern bottlenose whale (NBW):

- Highly social species that form fluid social structures, typically in ephemeral groups of 2-6 individuals.<sup>1</sup>

## Research Objectives

### Examine whether young animals receive care from individuals other than their mothers (allo-care)

1. Visualize where calves and juveniles are located in the NBW social structure.
2. Determine whether the average number of social partners differs among age classes.
3. Determine whether the strength of an association is influenced by age class.

## Methods

### Data Collection

- NBW population located in the Gully MPA
- Since 1988, the Whitehead lab has collected photographic, acoustic and visual data (27 field seasons)



### Statistical Analysis

- Social network analysis for each year (1988-2023)
- Generalized linear modelling
- Descriptive statistics



## Results

### NBW Social Network for 2021

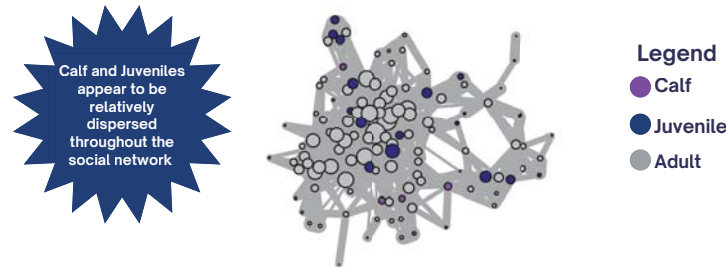


Figure 1. Social network visualization for the year 2021. Each node represents an individual, with node size scale based on social strength (interaction frequency). Nodes are coloured according to age class: purple for calves, dark blue for juveniles, and gray for adults. Edges represent social interactions between individuals, with edge width scaled by Half-Weight Index (HWI of association).

### Number of Social Partners by Age Class

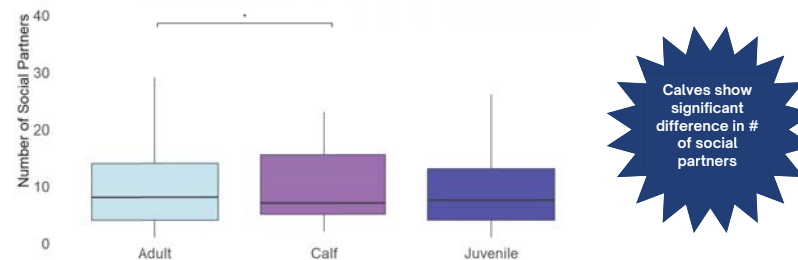


Figure 2. Box plot illustrating the number of social partners by age class for NBW. The number of social partners (degree) was analyzed using a negative binomial regression model, with significant predictors being age class and the number of days observed per year. Significant differences are noted between Adult and other categories with asterisk denoting significance (\*  $p < 0.05$ ).

### Strength for Dyadic Age Combinations

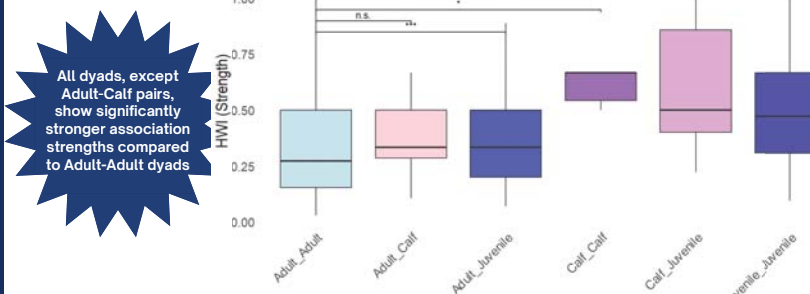


Figure 3. Box plot of Half-Weight Index (HWI) strength by dyadic age category for NBW. Significant differences are noted between Adult\_Adult and other categories with asterisks denoting significance (\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ).

## Take Aways

### Results suggest possibility of allo-care for calves

1. Calves and juveniles are relatively dispersed throughout the social networks, with moderate levels of interaction.
2. Calves having more social partners than adults implies they interact with a wider range of individuals (broader support system). Juveniles do not significantly differ in their number of partners.
3. Weaker adult-calf associations compared to adult-adult dyads may suggest calves are not exclusively associating with their mother. Juveniles are involved in stronger associations than adult-adult dyads, suggesting quality over quantity is a characteristic of their associations.

## Research Significance

- Exploring the breadth of potential “care networks” could provide insight into the functions of social relationships and patterns of cooperation.
- Social structure has implications on genetics, population biology, ecology and thus impacts conservation.

## Next Steps

1. Determine whether sex influences the probability of associating with or providing care to young animals.
2. Characterize how widespread networks of potential care-givers are for NBW calves.

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## References

