

Introduction

- Object play is important for learning and development in many species (Kuczaj et al., 2006).
- Object play influences cognitive development, survival and social skills, and problem solving (Greene et al., 2011).
- Object play is at its peak in juvenile dolphins and may decline into adulthood, suggesting that it is significant to physical development (Cappiello et al., 2018).
- Juvenile and calf age groups engage in observer roles more than other age groups (Cappiello et al., 2018).

Study objectives

- Explore **observer role** during object play (OP) in dolphins by looking at:
 - Presence of Observers vs. Solo or Mutual OP
 - Number of Observers per OP Bout
 - Observer(s) Age Category per OP Bout

Methods

- 28 underwater video sessions (30-min each) collected by DCP at RIMS in October 2019, January 2020, and March 2020 were used.
- Play bouts were coded with BORIS (Friard & Gamba, 2016) and analyzed in Microsoft Excel.
- Play bouts were coded for object type, object, posture, body parts utilized, observers, and solo or mutual object play. See **Table 1**.
- 18 dolphins engaged in object play:
 - 12 adults (A), 2 subadults (S), 2 juveniles (J), and 2 calves (C).

Table 1. List of modifiers used for each category to describe a play bout.

Categories	Modifiers list
Object type	Natural, Man-made
Object	Seaweed, seagrass, camera, trash, net/gate, researcher's fins
Posture	Horizontal dorsal side up, Horizontal ventral side up, Vertical head up, Vertical head down, On left side, On right side
Body part	See Figure 1
Observer	Number and name of dolphins watching solo/mutual play
Solo/Mutual	Solo = 1 dolphin playing with an object (Figure 2, a) Mutual = 2 or more dolphins playing with the same object (Figure 2, b)

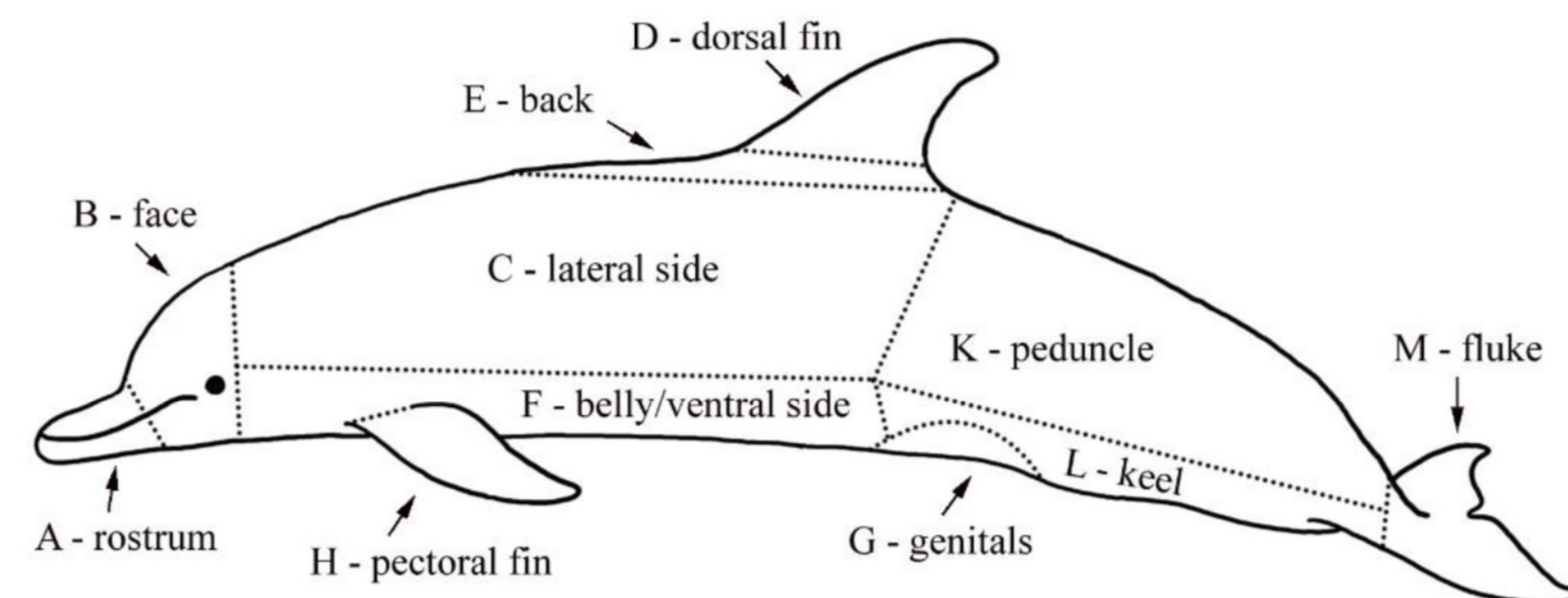


Figure 1. Illustration of the 11 body parts categories. From Dudzinski et al. (2009).

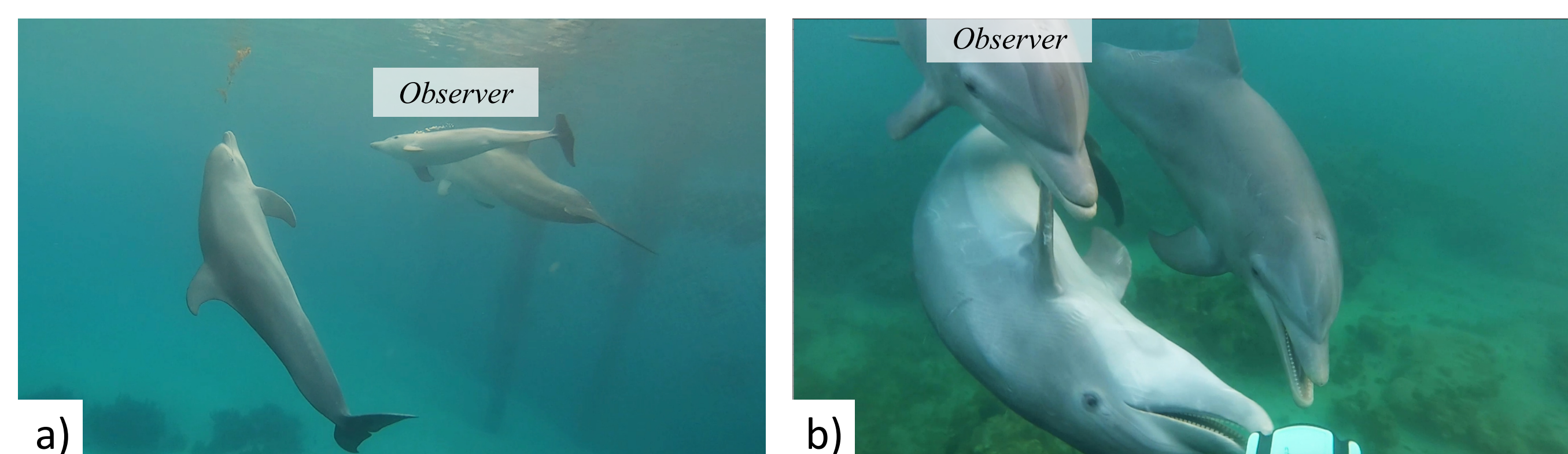


Figure 2. Examples of a) *Solo play* with seagrass (Natural object) observed by a calf and b) *Mutual play* with researcher fins (Man-made object) observed by a juvenile. For both examples, the players use their rostrum.

Results

- A total of 852 OP bouts were recorded (**Table 2**).
- There was no significant difference in the presence or absence of observer(s) based on OP being Solo or Mutual (**Table 2**).
- Adult/Subadult were present as observer(s) in more OP bout than Juvenile/Calf, though this difference was not significant (**Figure 3**).
- Most OP bouts with observers included a single observer, and rarely more than 3 observers (**Figure 4**).
- Males assumed the observer role in more OP bouts than females (**Figure 5**).
- There was no correlation between the number of observer(s) present and the length of the OP bout ($r = 0.1$).

Table 2. Count of OP Bouts per OP Category (i.e., Solo vs. Mutual) with and without observer(s).

	Observer(s)	No Observer	Total
Solo OP	153	350	503
Mutual OP	142	207	349
Total	295	557	852

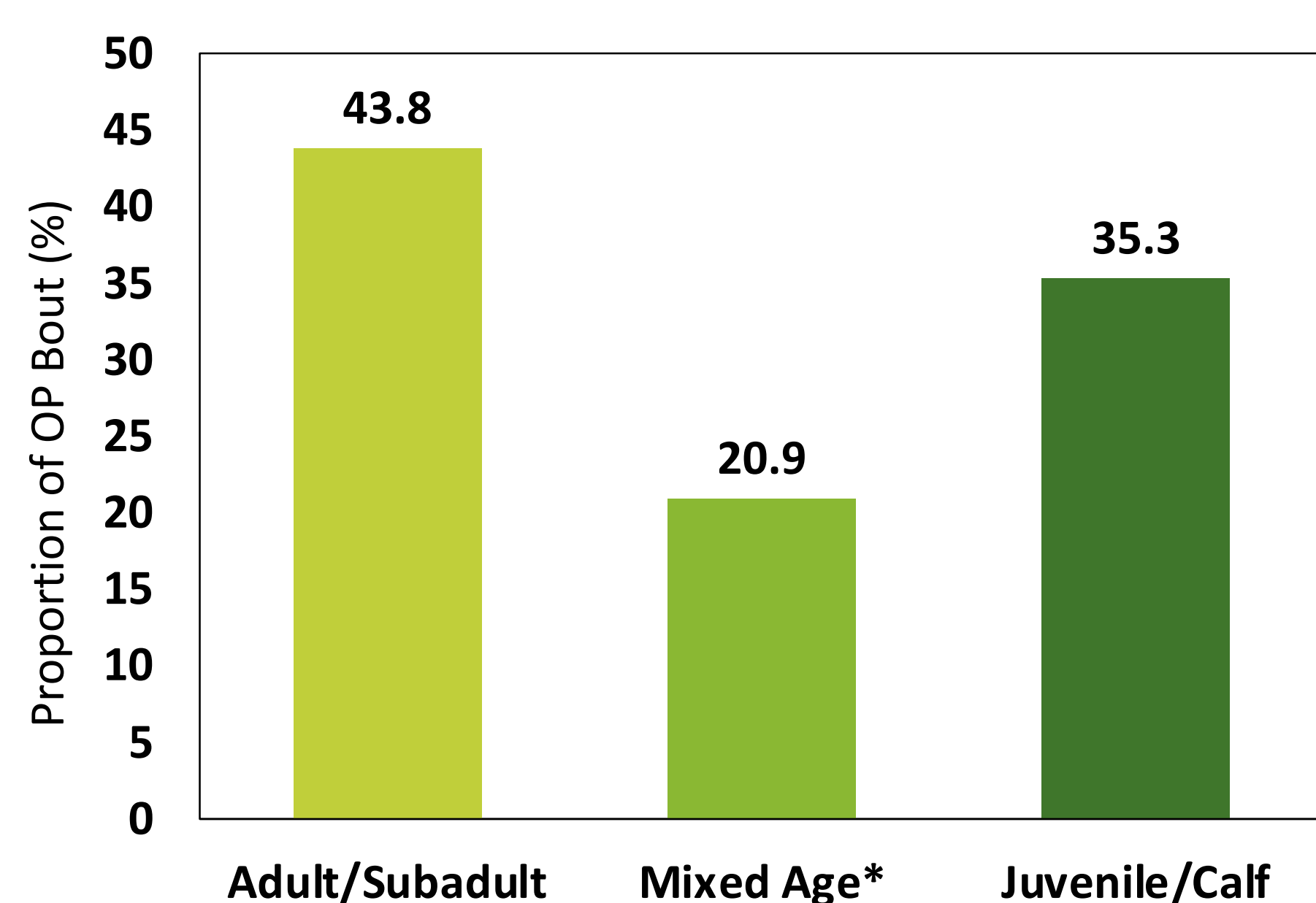


Figure 3. Proportion of OP bout individuals of each age category were present as observers. OP bout with observer(s) only (n = 295). *Mixed Age always has 2 observers present minimum.

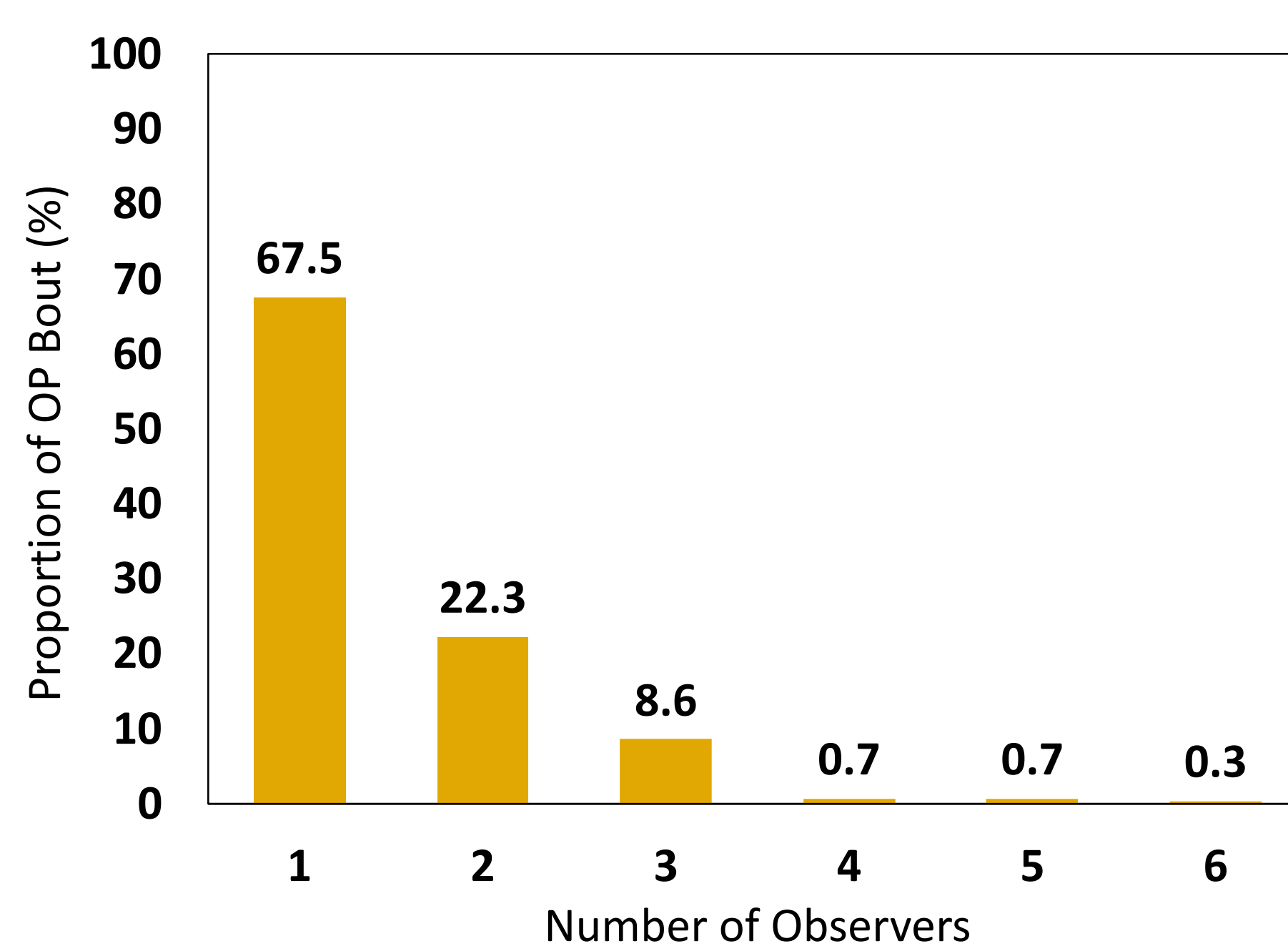


Figure 4. Proportion of OP bout with 1 to 6 observers present. OP bout with observer(s) only (n = 295).

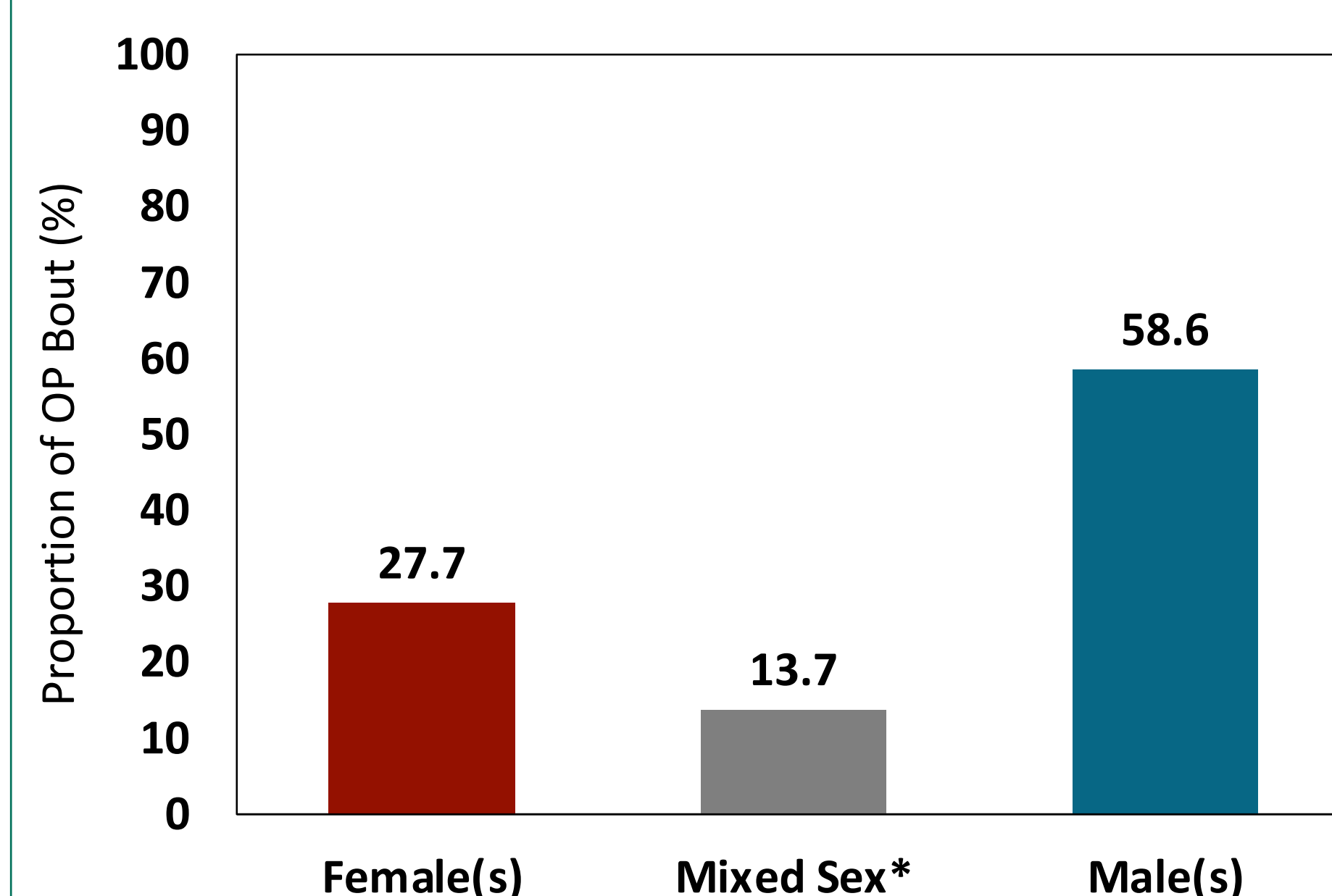


Figure 5. Proportion of OP bout individuals of each sex were present as observers. OP bout with observer(s) only (n = 295). *Mixed Sex always has 2 observers present minimum.

Discussion

- Solo and mutual play were not associated with observer(s) presence, though our sample size was too small to also include the players' and observers' age in our analyses.
- Adult/Subadult were present for more OP bouts than Juvenile/Calf, though that might be skewed by two subadult males showing more interest in object(s) than other individuals. Individual preferences and personalities could be added to our ongoing examination of observer role during object play (Highfill & Kuczaj, 2007).
- Additionally, the slight difference observed between Adult/Subadult vs. Juvenile/Calf in the observer role needs to be investigated in light of maternal style as some females might be less permissive of their calves during play bouts with peers (Dudzinski et al. 2021).
- Males were observers in more OP bouts than females, though our sex ratio was slightly skewed toward females (7:10), which might suggest that males are more likely to be observers when they are developing their social bond with other males (Dudzinski & Ribic, 2017; Gerber et al. 2020). Further investigation is needed to support this hypothesis.

References

- Cappiello, B., Hill, H., & Bolton, T. (2018). Solitary, observer, parallel, and social object play in the bottlenose dolphin (*Tursiops truncatus*). *Behav. Process.*, 157, 453–458.
- Dudzinski, K. M., & Ribic, C. A. (2017). Pectoral fin contact as a mechanism for social bonding among dolphins. *Anim. Behav. Cogn.*, 4(1), 30–48.
- Dudzinski, K. M., Ribic, C. A., Manitzas Hill, H. M., & Bolton, T. T. (2021). Evidence for maternal style among adult female dolphins when sharing pectoral fin contacts with their calves. *Anim. Behav. Cogn.*, 8(1), 52–68.
- Friard, O. & Gamba, M. (2016). BORIS: A free, versatile open-source event-logging software for video/audio coding and live observations. *Methods Ecol. Evol.*, 7, 1325–1330.

- Greene, W., Melillo-Sweeting, K., & Dudzinski, K. (2011). Comparing object play in captive and wild dolphins. *Int. J. Comp. Psychol.*, 24, 292–306.
- Gerber, L., Connor, R. C., King, S. L., Allen, S. J., Wittwer, S., Bizzozzero, M. R., Friedman, W. R., Kalberer, S., Sherwin, W. B., Wild, S., Willems, E. P., & Krützen, M. (2020). Affiliation history and age similarity predict alliance formation in adult male bottlenose dolphins. *Behav. Ecol.*, 31(2), 361–370.
- Highfill, L. E., & Kuczaj II, S. A. (2007). Do bottlenose dolphins (*Tursiops truncatus*) have distinct and stable personalities? *Aquat. Mamm.*, 33(3), 380–389.
- Kuczaj, S., Makecha, R., Trone, M., Paulos, R., & Ramos, J. (2006). Role of peers in cultural innovation and cultural transmission: Evidence from the play of dolphin calves. *Int. J. Comp. Psychol.*, 19, 223–240.

Acknowledgements

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