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Diurnal Behavior and Group Size Patterns of Common Dolphins (*Delphinus* spp.) during 2008-2010 Aerial Surveys off San Diego, California

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ABSTRACT

Aerial surveys offer an ideal observation platform to document the behavior and group size of dolphin species over a wide range in offshore waters in a short period. Eight aerial surveys were conducted near San Clemente Island off southern California, Oct/Nov 2008, Jun/Jul/Nov 2009 and May/Jul/Sep 2010 to monitor behavior of marine mammal species using line-transect and focal-behavioral circling methods. An estimated 94,867 short-beaked (*Delphinus delphis*) and long-beaked (*Delphinus capensis*) common dolphins were observed during 346 separate events. Number of sightings, mean group size and initial group behavior state were recorded and compared by diurnal periods. Daytime observation hours were divided into three periods, following the methods of Bearzi et al. (1999): “morning” (08:01-11:59)(n = 71 sightings, individuals = 22,777), “early afternoon” (12:00-15:59)(n = 191, individuals = 52,926), and “late afternoon” (16:00-19:59)(n = 85, individuals = 19,164). Sighting rates were highest in the early afternoon (4.1 indiv./km) followed by late afternoon (3.9 indiv./km) and morning (3.3 indiv./km). Mean group size was highest in the “morning” (321 ± 455.8), followed by “early afternoon” (277 ± 354.5) and “late afternoon” (225.5 ± 276.0). During the “morning”, initial group behavior was most frequently surface-active mill (44%) followed by travel (29%) and surface active travel (13%). During the “early afternoon”, travel (35%) occurred most frequently, followed by surface-active mill (33%) and surface-active travel (24%). During the “late afternoon”, surface-active mill (35%) occurred most frequently, followed by travel (28%) and surface-active travel (27%). Social and apparent foraging behaviors typically occurred during surface-active behavior states. Results suggest that groups of common dolphins of both species aggregate in larger numbers and are generally exhibiting more surface-active mill behavior during the morning than early and late afternoon, potentially corresponding with socializing and foraging strategies. Further data gathering and multivariate analyses are underway to elucidate more specific diurnal trends and behavioral correlations.

INTRODUCTION

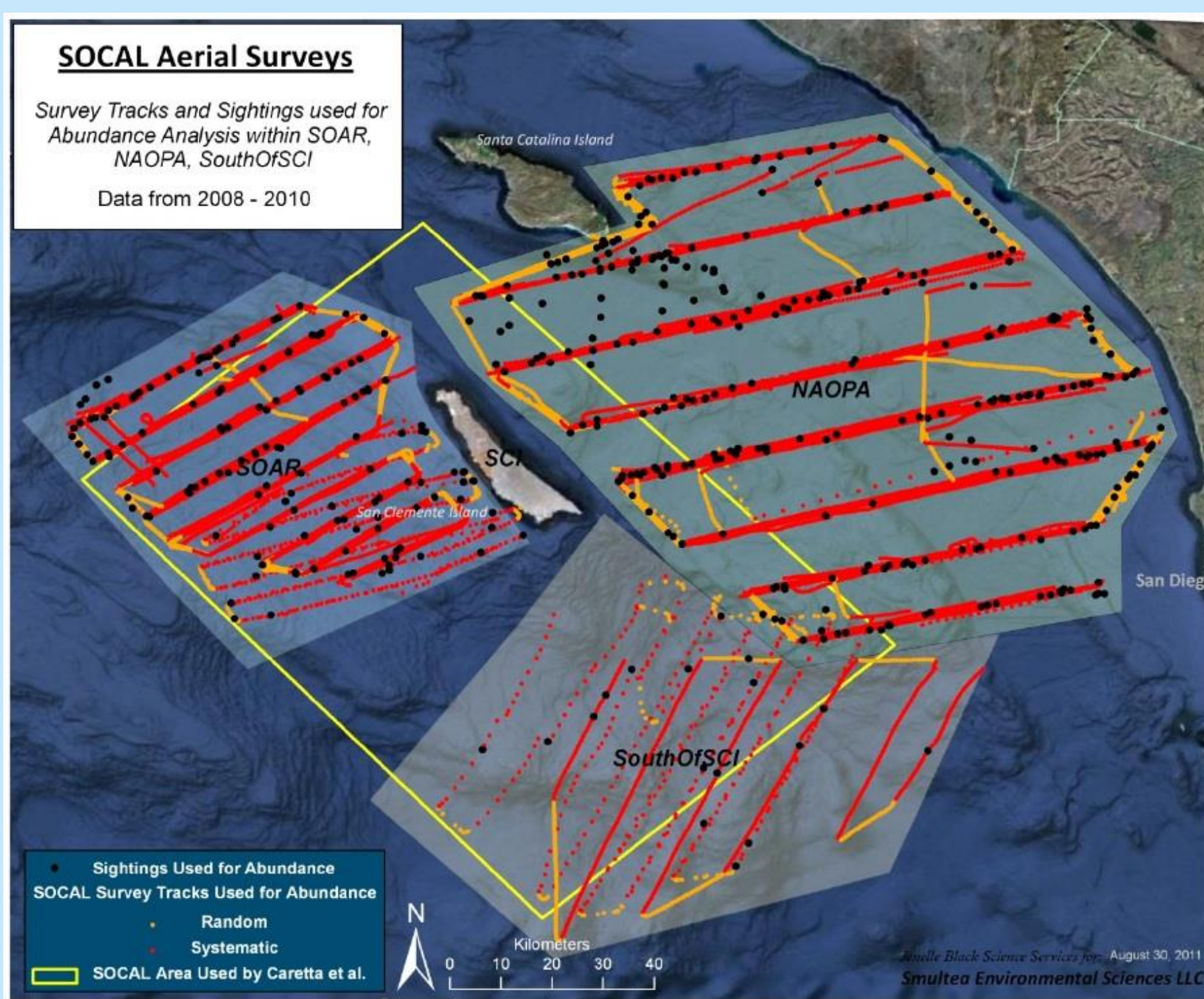
In 2008-2010, Smultea Environmental Sciences (SES) conducted aerial surveys in the Southern California Bight to monitor and collect baseline data on marine mammal abundance, density, distribution and behavior during, before, and after Navy Major Training Events involving mid-frequency active sonar.

METHODS

- Search:** line-transect and random surveys to collect initial sighting location, and behavior data using modified point sampling. Line transects flown at altitude 1000 ft
- Verify:** subsequent circling and photographing sighting to verify species, estimate group size/composition. Focal sessions flown at 1500 ft altitude (when circling).
- Analysis:** For analysis of daily patterns, behavioral data and group size were pooled in three daytime categories following the methods of Bearzi et al. (1999): “morning” (0801-1159), “early afternoon” (1200-1559), and “late afternoon” (1600-1959).



>37,000 km of line transect & focal behavior surveys were conducted from this twin-engine Partenavia aircraft by 2 observers and 1 recorder during summer and fall off Southern California.

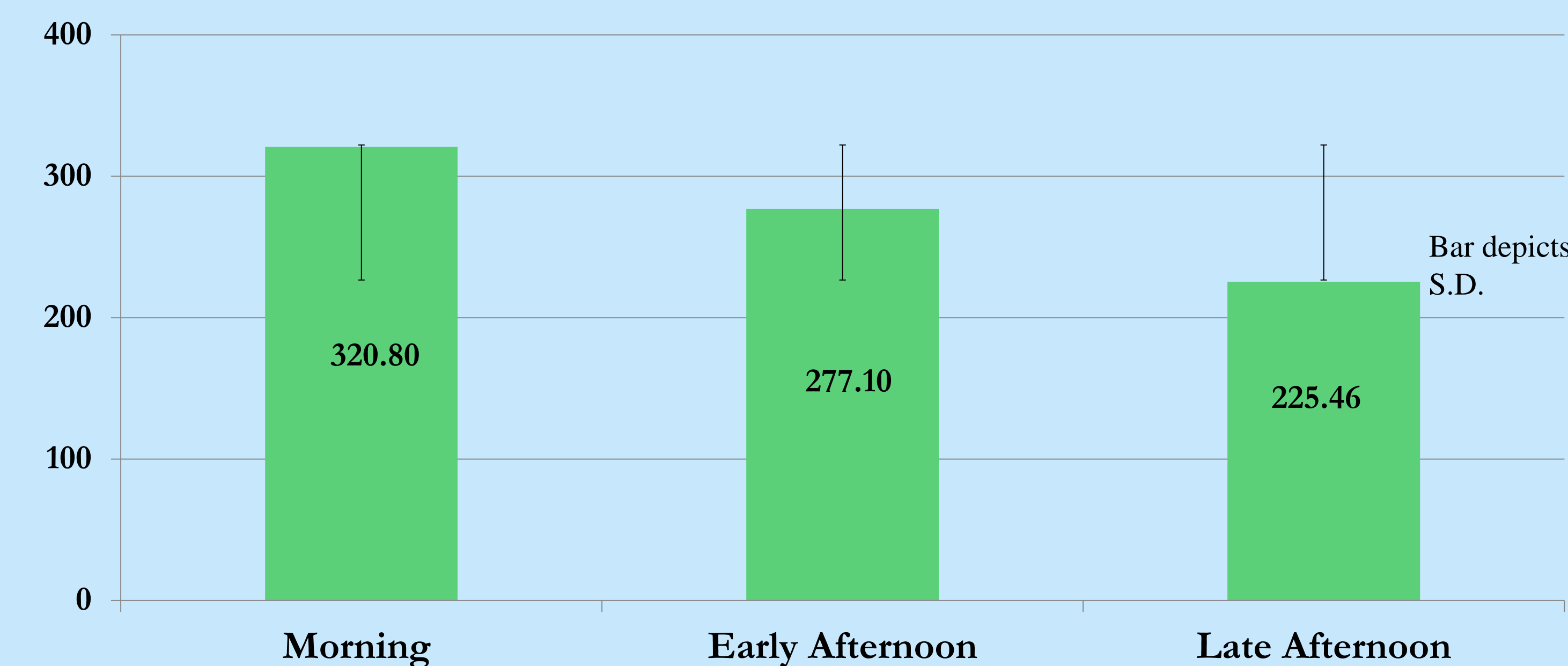


RESULTS

	"Morning"	"Early Afternoon"	"Late Afternoon"	TOTAL
Period	0801-1159	1200-1559	1600-1959	
# Sightings	71	191	85	347 groups
# Individuals	22,777	52,926	19,164	94,867 indiv.
Obs. effort (km)	6,945 km	12,832 km	4,959 km	24,736 km
Obs. effort (hr)	34 hr	62 hr	23 hr	~ 120 hr
Sighting Rates (# indiv./km)	3.28	4.12	3.86	
Sighting Rates (# indiv./hr)	669.91	853.65	833.22	
Mean group size	321 (+/- 455.8)	277 (+/- 354.5)	225.5 (+/- 276.0)	

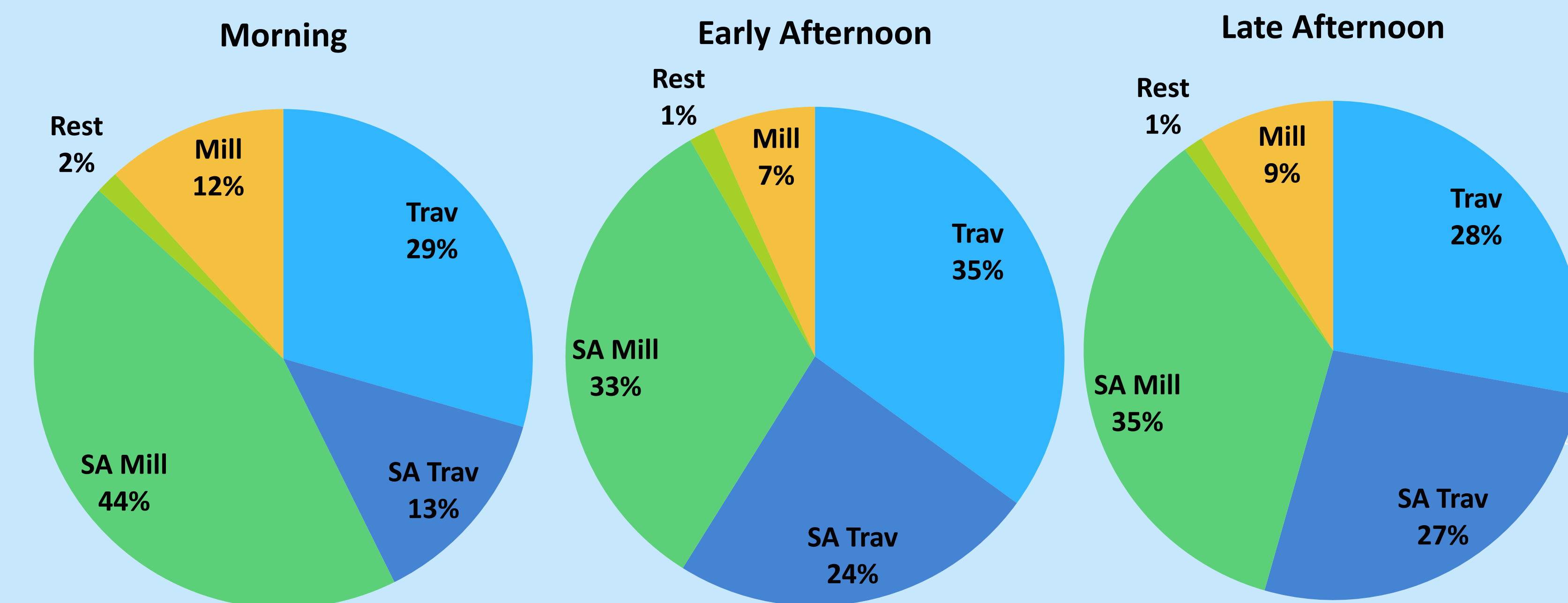
Mean Group Size by Time of Day

- Mean group size decreased across the day indicating that larger groups congregate in the morning and dissipate as the day progresses.



Behavior by Time of Day

- Mill/surface-active mill behaviors DECREASED across the day
- Travel/surface-active travel behaviors INCREASED in the afternoon.



CONCLUSIONS

- Delphinus* spp. groups aggregated in higher numbers and were more surface-active mill (with less travel) in the morning vs. afternoons.
- Surface-active mill behaviors are thought to correspond with foraging and socializing.
- Results thus imply that socializing and foraging prevail in the morning and decrease across the day.
- These trends match diel patterns in the eastern Pacific Ocean where group size of spotted, spinner and common dolphins declines across the day and evening, potentially as prey availability increases (Scott and Cattacnach 1998)

Acknowledgements

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