



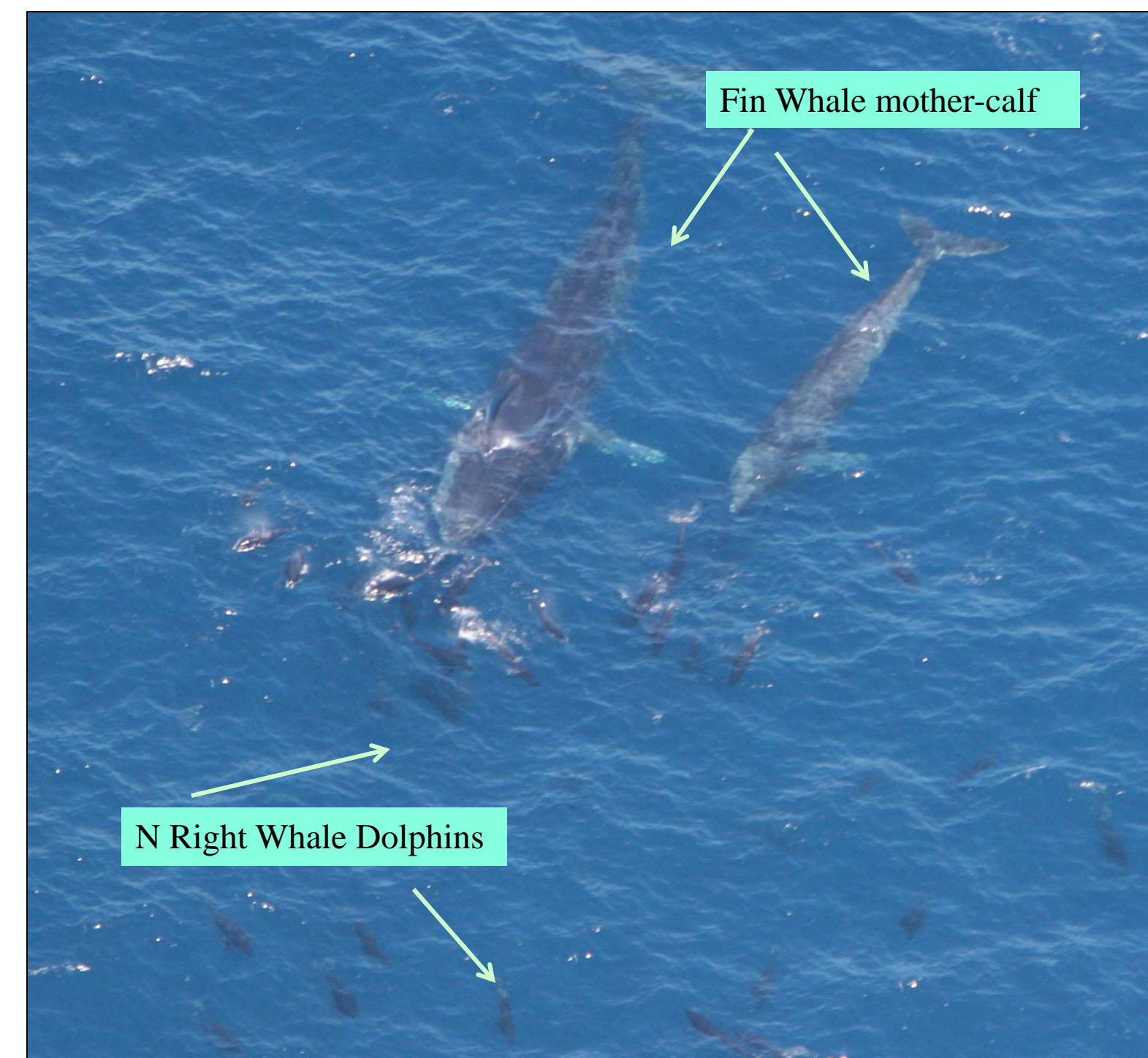
# Behavior and Group Characteristics Differ in Mixed-Species Associations (MSA) of Cetaceans in the Southern California Bight



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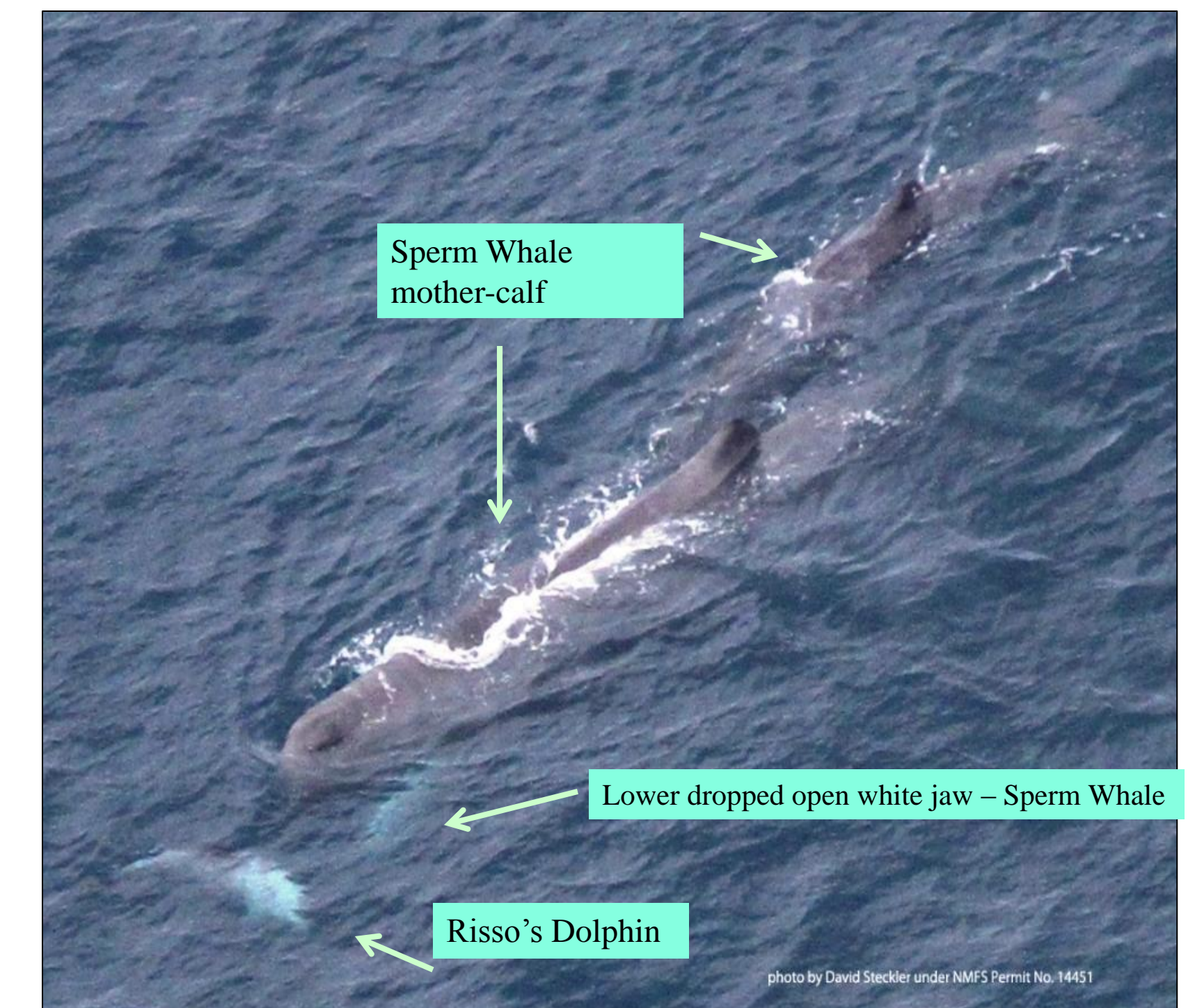
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Fin whale mother-calf pair following a group of >1,000 northern right whale dolphins for ~1 hr. Dolphins bow rode off the whales' heads and the calf chased the dolphins' tails, as documented in video and photographs. The fin whale calf was also videotaped nursing. Photo by Lori Mazzuca/Permit No. 14451.

Effects of mixed-species associations (MSA [at least two different species swimming together and/or interacting]) on cetacean behavior rarely have been quantified, but are important for identifying and differentiating potential anthropogenic impacts. Baseline marine mammal behavior was assessed during 83,005 km of U.S. Navy supported aerial line-transect surveys in the Southern California Bight during 2008-2013. Multinomial logistic regression was used to assess effects of MSA on group size, maximum nearest neighbor distance (a "cohesion" index, in body lengths), behavior state, and heading. Two percent (50) of 2,536 sightings were MSA involving 13 species (5 baleen whales, 7 toothed whales, 1 pinniped). Behavior and group size of some species differed significantly in MSA vs. non-MSA. MSA were predominated by Risso's dolphins (46%; 23 of 50 MSA). Risso's dolphins were most frequently associated with bottlenose dolphins (35% of 23 Risso's MSA groups) followed by northern right whale dolphins (NRWD; 2% of 23). Risso's dolphins tended to change headings more often in MSA ( $p < 0.10$ ), socially interacting by moving/orienting toward or away from other species. Notable MSA included a Risso's dolphin chasing/charging a lone minke whale, a Risso's dolphin repeatedly charging the heads of sperm whales that reacted by opening their mouths, and a mother/calf fin whale closely following/interacting with ~1,000 NRWD. Risso's dolphin mean group size was significantly higher in MSA (26) vs. non-MSA (15). Group cohesion generally decreased in MSA vs. non-MSA but not significantly. Speculated explanations for the observed MSA include kleptoparasitism, feeding, defense of conspecifics, "floating maritories," play, harassment, and social interest. Increased group sizes and tighter cohesion in MSA may indicate elevated defensiveness and/or facilitate social interactions. Interspecific interactions have remained historically uncommon in the SCB, but similar proportionally based on similar spatial/temporal effort (2-6%). MSA likely involve both benefits and risks to members, depending on species and motivations.

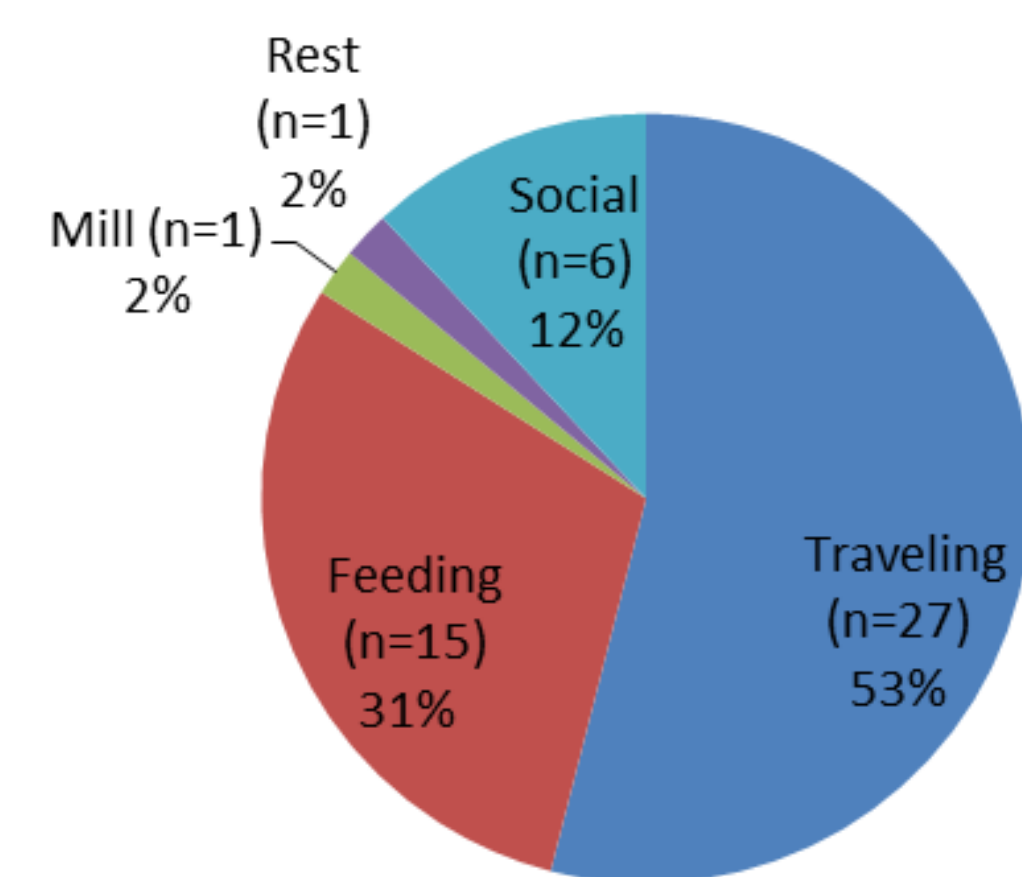


Zoomed-in high-definition (HD) photo of a sperm whale and calf with a Risso's dolphin that just charged the whale's head. Note sperm whale's open jaw with white lips showing on lower jaw. Photo taken at 457 m altitude & ~1 km distance on 14 May, 2011, ~44 km SW of San Diego.

## INTRODUCTION:

- Baseline marine mammal behavior was assessed during 83,005 km of U.S. Navy supported aerial line-transect surveys in the Southern California Bight during 2008-2013.
- MSA = at least two different species swimming together and/or interacting
- Group size, maximum nearest neighbor distance (a "cohesion" index, in body lengths), behavior state, and heading was noted for all sightings

## Observed Behavior States

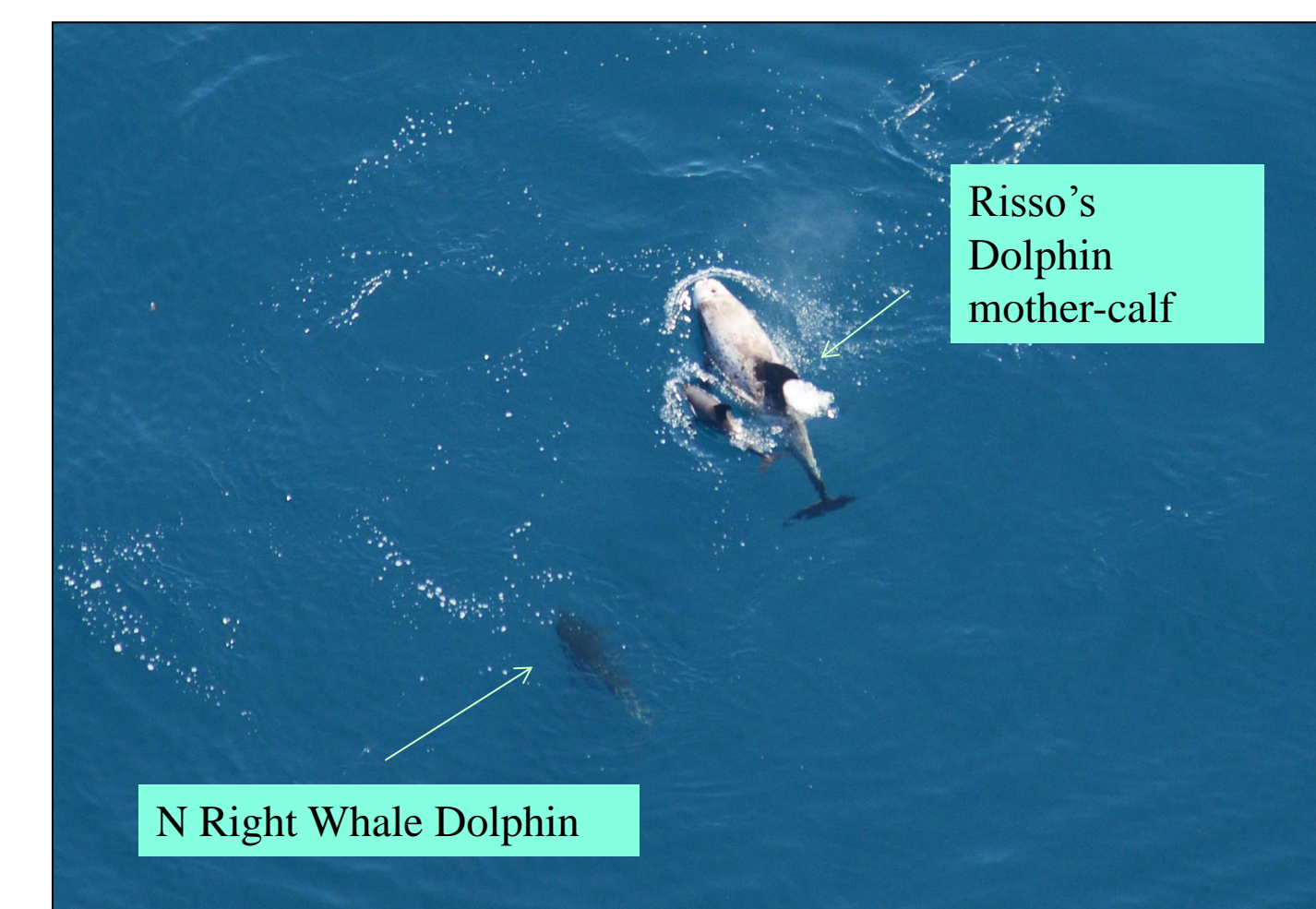


## HIGHLIGHTS:

- > 50 of 2,536 sightings (2%) were MSA
- > At least 13 species involved
- > Number of marine mammal species seen together ranged from 2-3
- > Predominant observed behavior was travel ( $n=27$ ; 53%)
- > On 4 occasions, MSA involved 3 species:
  1. Sperm whales, Risso's dolphins, and northern right whale dolphins
  2. Risso's dolphins, California sea lions, and unidentified dolphins
  3. Pacific white-sided dolphins, common dolphins, and California sea lions
  4. Fin whale, minke whales, and a humpback whale
- > Risso's dolphins were most frequently associated with another marine mammal:
  - 7% of the time ( $n = 23$ )
  - Group cohesion decreased in MSA
  - Mean group size increased in MSA
  - Most frequently associated with bottlenose dolphins ( $n = 8$ ; 35%)
  - Change their headings more often when mixed with another species

## SUMMARY OF MSA

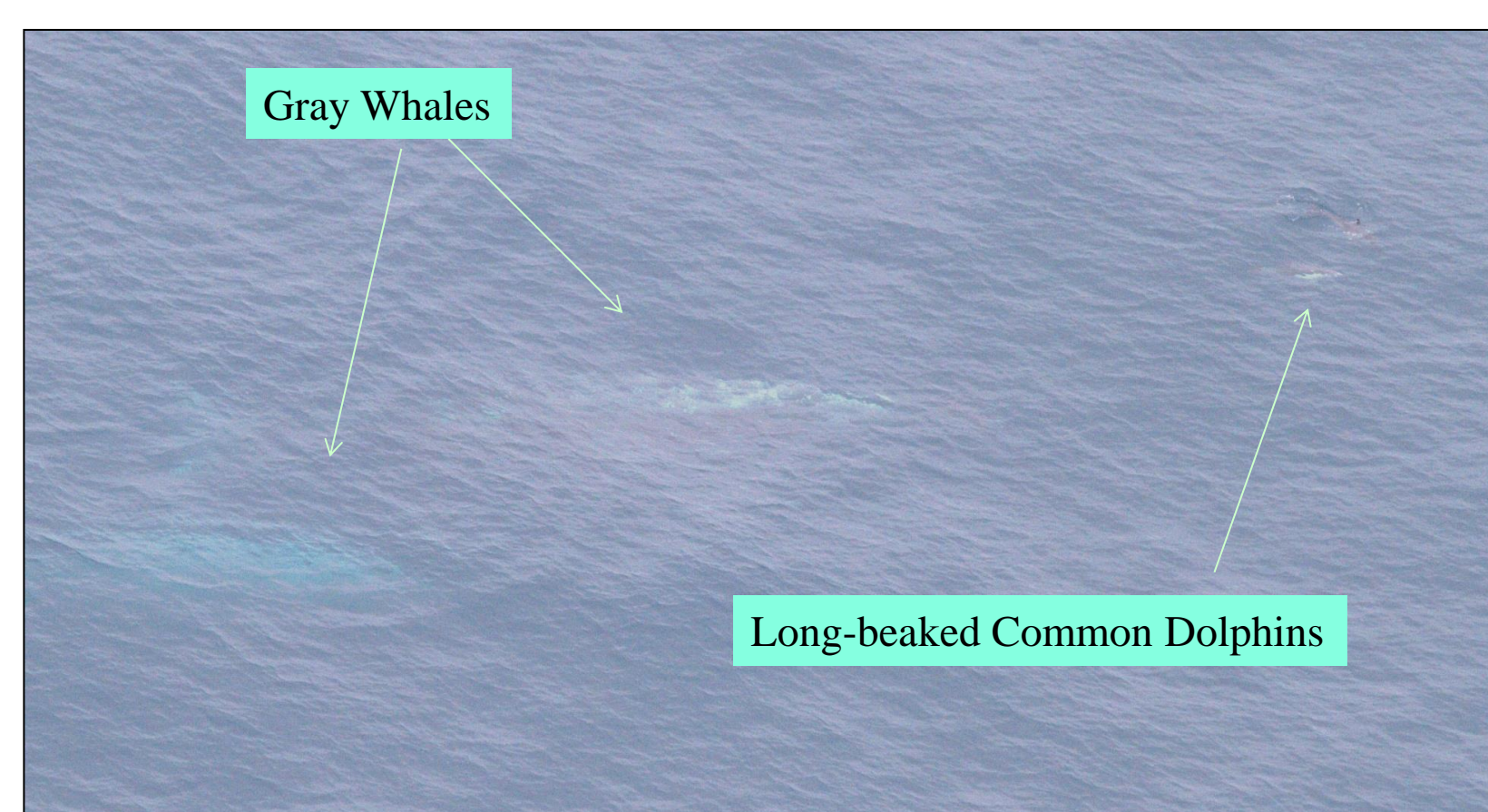
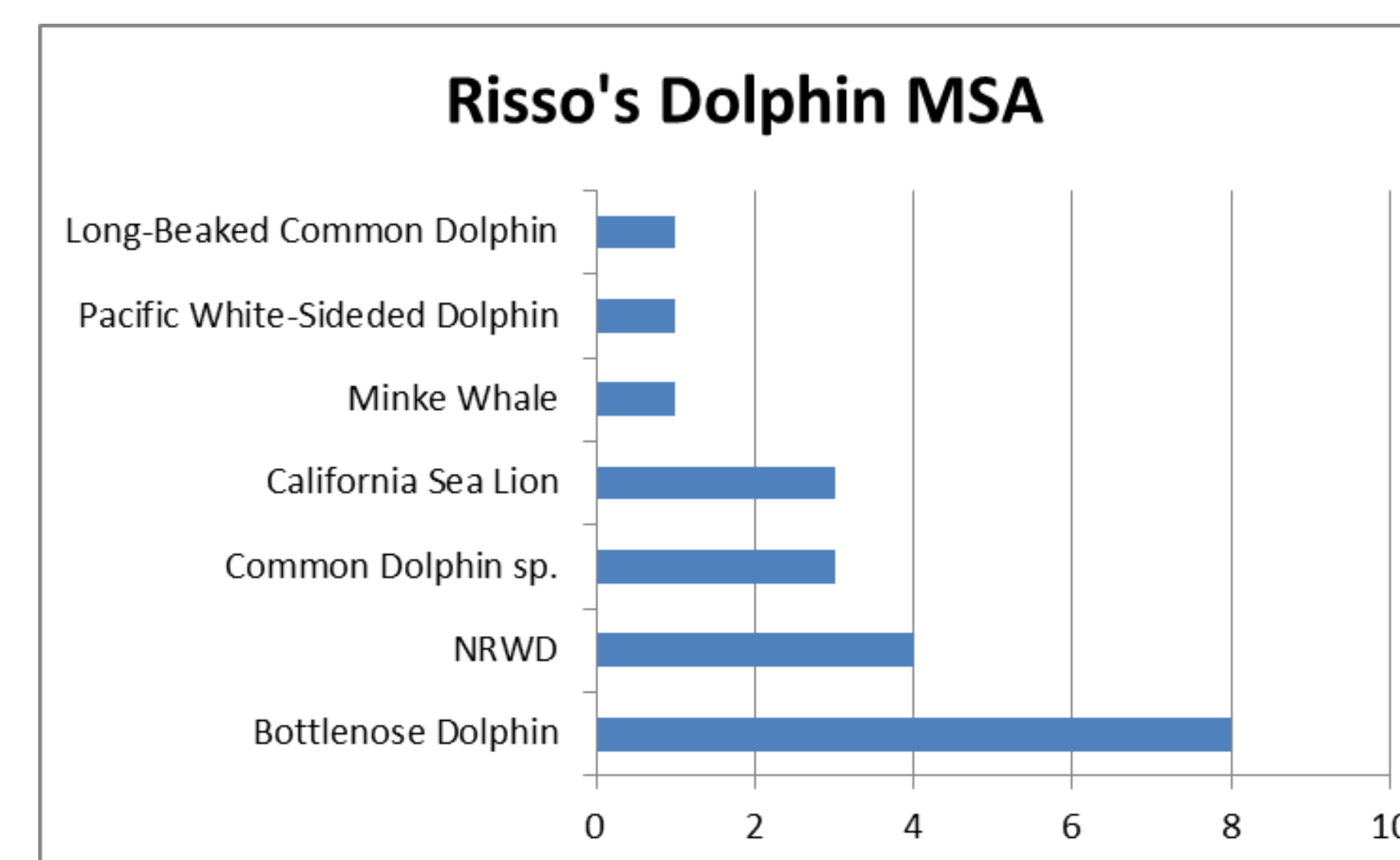
| Number of Sightings | Species Seen Together  |
|---------------------|--|
| 8                   | Risso's Dolphin, Bottlenose Dolphin                                  |
| 5                   | Fin Whale, Blue Whale  |
| 5                   | California Sea Lion, Common Dolphin sp.                              |
| 4                   | Risso's Dolphin, Northern Right Whale Dolphin                        |
| 3                   | Risso's Dolphin, Common Dolphin sp.                                  |
| 3                   | Risso's Dolphin, California Sea Lion                                 |
| 2                   | Short-Beaked Common Dolphin, California Sea Lion                     |
| 1                   | Bottlenose Dolphin, Common Dolphin sp.                               |
| 1                   | Short-Beaked Common Dolphin, Pacific White-Sided Dolphin             |
| 1                   | Fin Whale, Northern Right Whale Dolphin                              |
| 1                   | Unidentified Dolphin, Unidentified Dolphin                           |
| 1                   | Fin Whale, Fin/Sei Whale   |
| 1                   | Common Dolphin sp., California Sea Lion, Pacific White-Sided Dolphin |
| 1                   | Risso's Dolphin, California Sea Lion, Unidentified Dolphin           |
| 1                   | Common Dolphin sp., Blue Whale                                       |
| 1                   | California Sea Lion, Unidentified Dolphin                            |
| 1                   | Risso's Dolphin, Long-Beaked Common Dolphin                          |
| 1                   | Risso's Dolphin, Sperm Whale, Northern right whale dolphin           |
| 1                   | Gray Whale, Bottlenose Dolphin                                       |
| 1                   | Fin Whale, Common Dolphin sp.  |
| 1                   | Gray Whale, Long-Beaked Common Dolphin                               |
| 1                   | Humpback, California Sea Lion  |
| 1                   | Fin Whale, Minke Whale, Humpback Whale                               |
| 1                   | Risso's Dolphin, Minke Whale   |
| 1                   | Fin Whale, Minke Whale   |
| 1                   | Risso's Dolphin, Pacific White-Sided Dolphin                         |
| 1                   | Short-Beaked Common Dolphin, Northern Right Whale Dolphin            |
| 50                  | Total  |



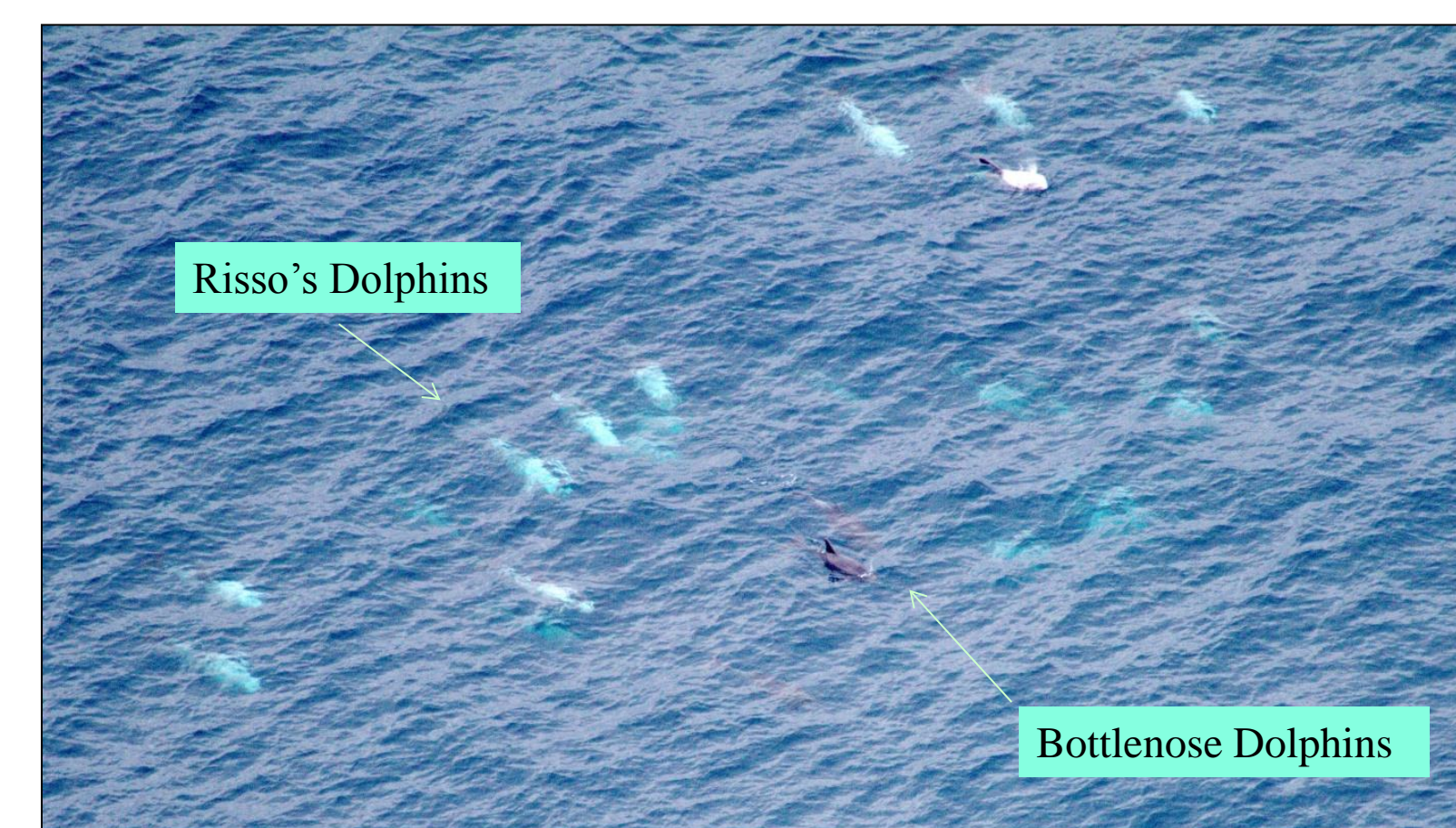
Risso's dolphin mother/calf pair with a northern right whale dolphin that repeatedly circled and appeared to harass the Risso's pair for ~10 min. Photographed 30 March 2013 by M. Smultea/NMFS permit 14451.

## Why do Different Marine Mammals Species Associate?\*

- Increased protection from predators via dilution
- Increased prey detection/consumption
- Larger group size increases predator confusion (similar to fish schools)
- Play
- Social interactions
- Kleptoparasitism
- Communal foraging
- Social parasitism
- Other ?????



A pair of gray whales subsurface swimming with long-beaked common dolphins. Photographed 30 March 2012 by M. Smultea/NMFS permit 14451.



Risso's dolphins mixed with two bottlenose dolphins. Photographed 13 March 2012 by D. Steckler/NMFS permit 15369.



California sea lion with a humpback whale. Photographed 26 March 2013 by J. Biondi/NMFS permit 14451.

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GALVESTON