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Comparisons of the behavioral ecology of three delphinid and three baleen whale species:



RISKS and REWARDS of group living

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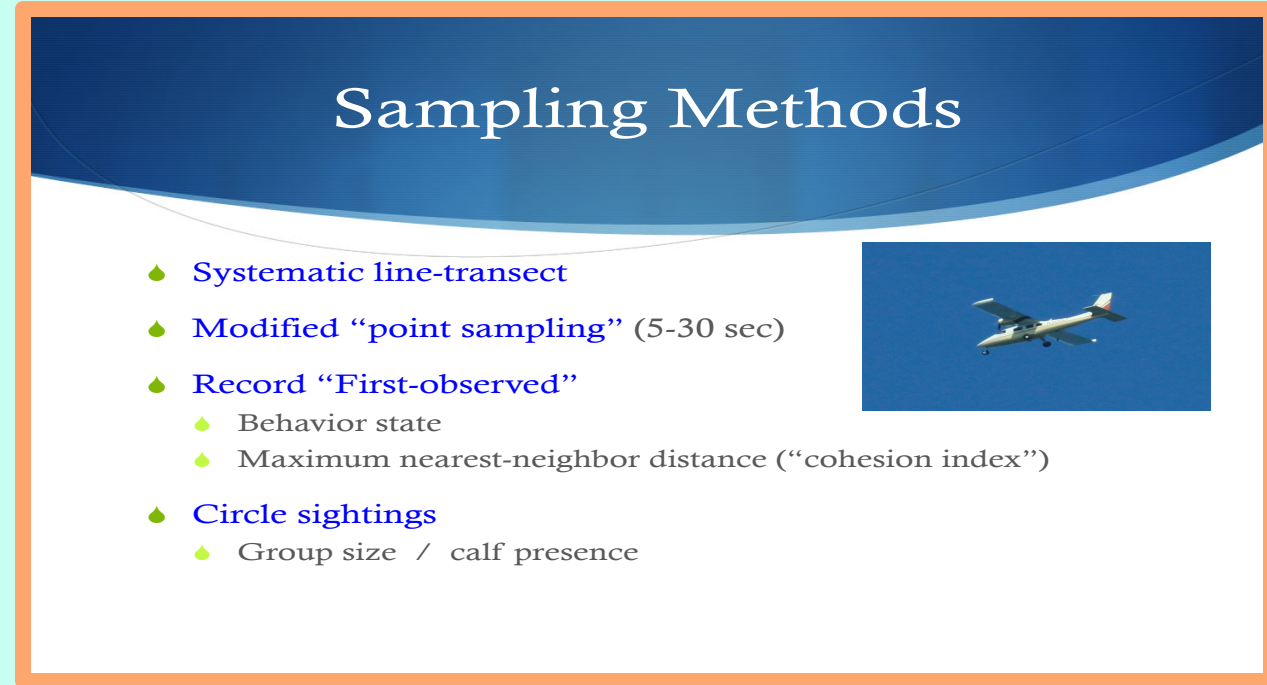
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ABSTRACT

The behavioral ecology of offshore delphinids and baleen whales is poorly known. A comparative approach was used to **assess group size and behavior versus risks/rewards of group living** in the Southern California Bight, U.S. Scan sampling/photographs/video **documented first-observed group size, behavior state, and group cohesion** (i.e., maximum nearest-neighbor distance (MNND - in body lengths[BL]), during 72,467 km of aerial surveys between 2008-2013. **Regression modeling** analyses involved 566 common, 293 Risso's and 96 bottlenose dolphin groups and 115 fin, 78 gray and 62 blue whale groups. **Species body size, group size, and MNND were correlated.** Group size, MNND and behavior state were significantly influenced by species, sub-region, calf presence, time of day/year, water depth, and/or slope/aspect. Group size was significantly larger for common dolphin sp. (combined) (277.1) vs. bottlenose (19.2) and Risso's (18.4) and with calf presence. MNND was significantly less for commons (5.1 BL) vs. Risso's (6.7). Group size was larger for grays (2.2) vs. fins (1.6) and blues (1.7). Gray MNND (1.5) was significantly closer than fins (5.1) and blues (12.6). Risso's groups were observed resting 13 times more often (38%) than commons (3%). Smaller group size and more daytime resting of Risso's match presumed nocturnal foraging patterns of this species. Larger tighter groups and frequent daytime foraging of commons match clumped, high-density schooling fish distribution. **Larger tighter common and gray whale groups match presumed higher predation pressure associated with smaller relative body size.** Results indicate species ecological diversion in the same habitat in response to *differing predation pressure and food resource availability as predicted by terrestrial mammal group-living patterns*. Data lend insight into baseline behavior and ecological triggers influencing behavior. This information is needed to differentiate potential impacts of anthropogenic sources. Larger group size benefits include reduced predation pressure and improved prey detection/mate access, at the **risk of increased** resource competition.

METHODS

aerial surveys Southern California 2008 - 2013



Statistical tests: GLM, t-test, ANOVA
*** p < 0.05



COMMON DOLPHIN

- groups tighter than Risso's & bottlenose***
- group size bigger than Risso's & bottlenose***
- Never seen alone***

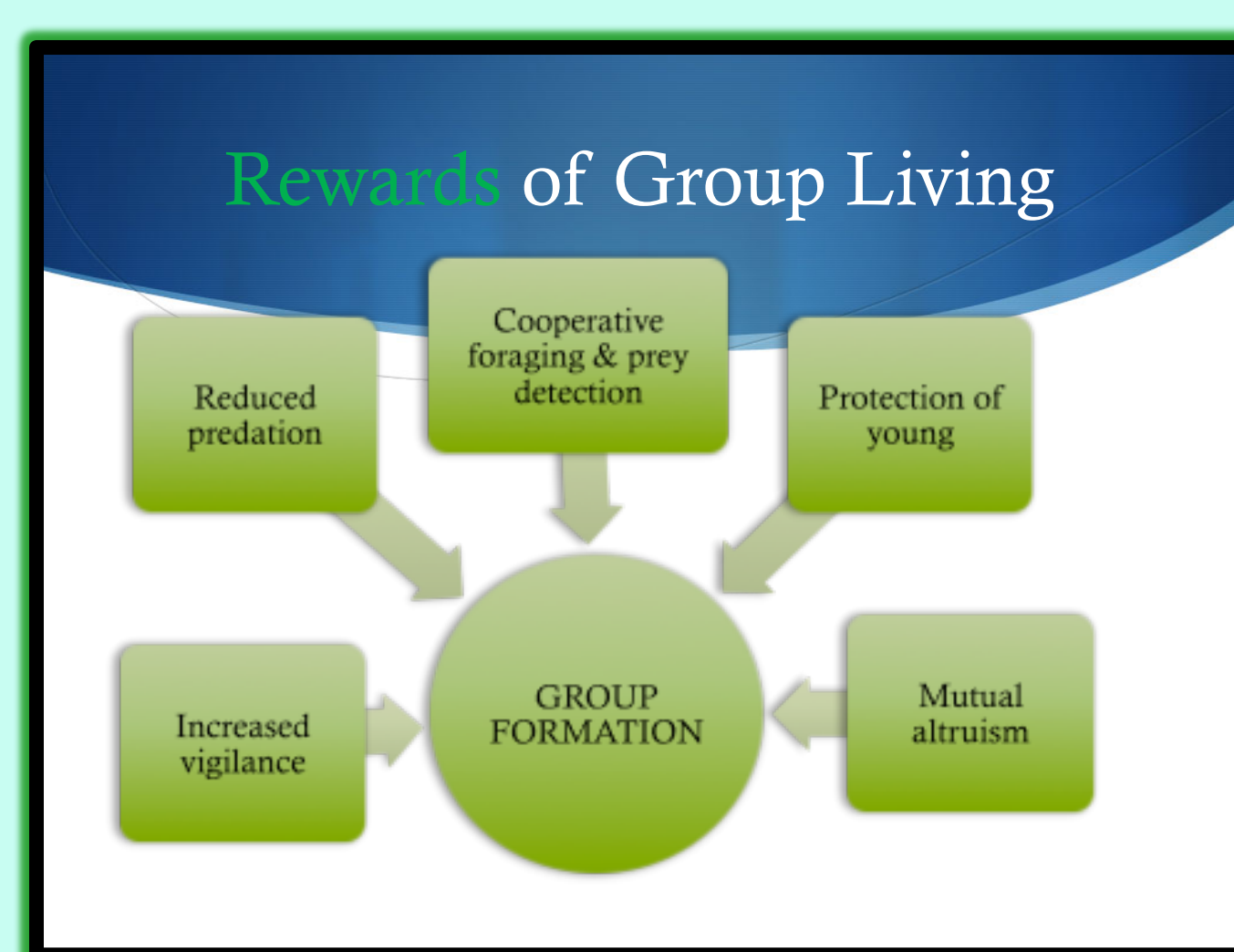
Photo by B. Würsig/NMFS permit 14451



RISSE'S DOLPHIN

- groups looser than common dolphins***
- group size smaller than commons***
- rarely seen alone
- (no significant differences bottlenose & Risso's)

Photo by B. Würsig/NMFS permit 14451



Hypotheses & Predictions

Body size ↑ Group size ↓ Group cohesion ↓

	DOLPHINS			WHALES		
Body size	Common <	Bottlenose <	Risso's	Gray <	Fin <	Blue
Group size	Common <	Bottlenose <	Risso's	Gray >	Fin >	Blue
Group cohesion (max. nearest neighbor distance in BODY LENGTHS)	Common <	Bottlenose <	Risso's	Gray >	Fin >	Blue



GRAY WHALE

- groups tighter than blue & fin***
- group size > than fin & blues***
- less likely to be alone than fin & blue***

Photo by B. Würsig/NMFS permit 14451



FIN WHALE

- groups tighter than blues, looser than grays***
- group size smaller than grays***
- more likely to be alone than grays***

Photo by J. Biondi/NMFS permit 14451



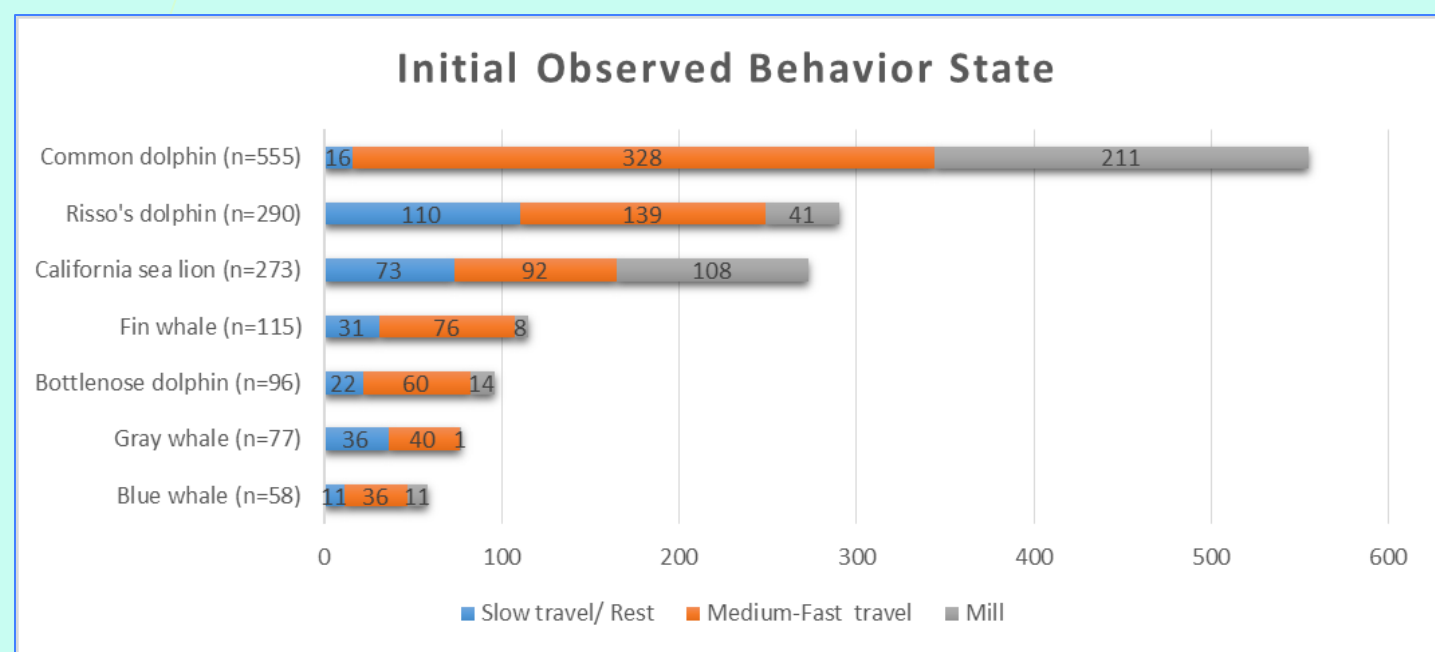
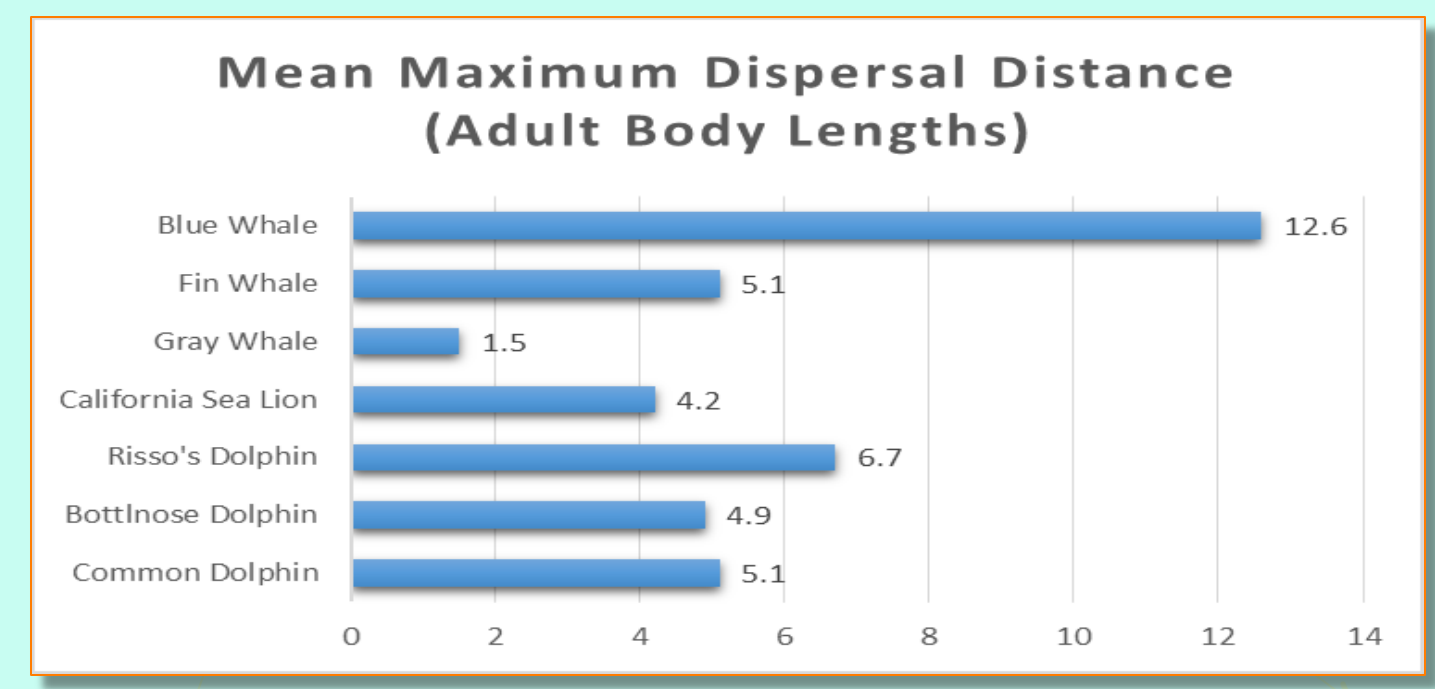
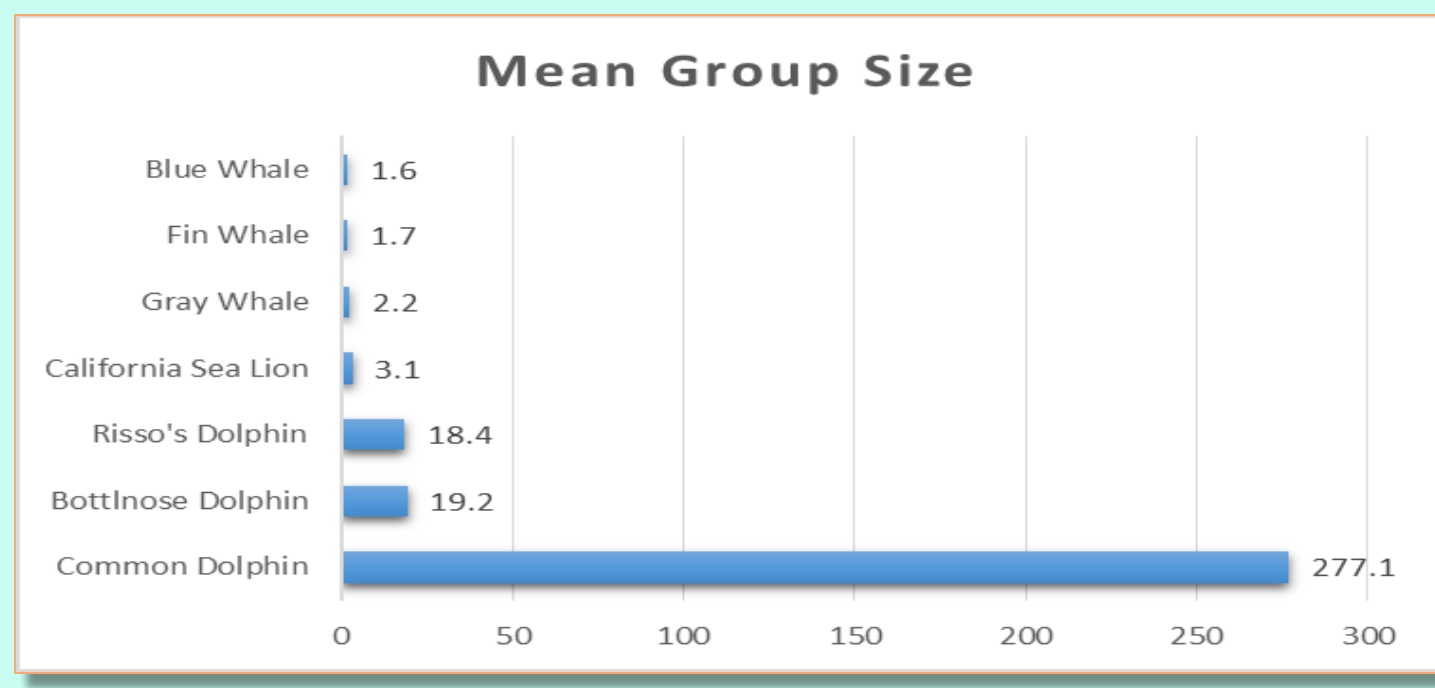
BLUE WHALE

- groups looser than grays***
- group size smaller than grays***
- most likely to be alone***

Photo by D. Steckler/NMFS permit 14451

RESULTS

1,210 cetacean sightings 72,467 km aerial surveys

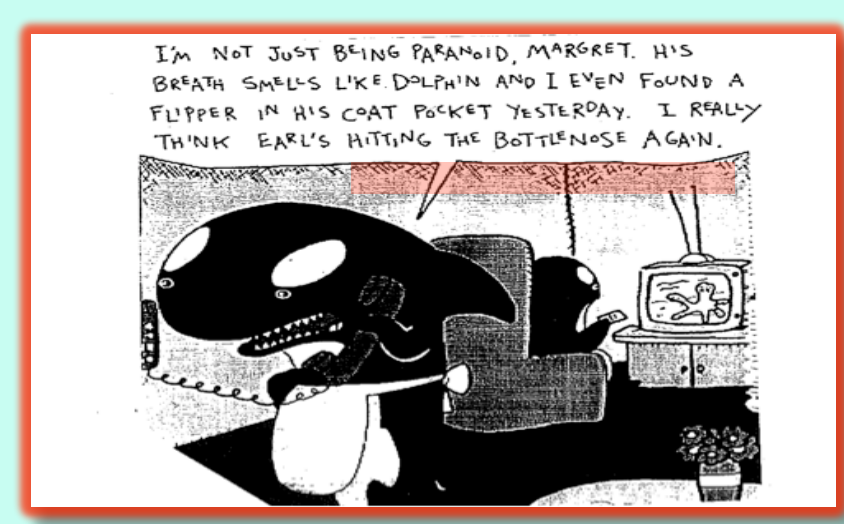


SUMMARY

Optimizing Risks & Rewards

	Common dolphin (n=566)	Bottlenose dolphin (n=96)	Risso's dolphin (n=293)	Gray whale (n=115)	Fin whale (n=78)	Blue Whale (n=62)
Body size (m)	1.9 <	2.9 <	3.1 <	13.9 <	21.7 <	23.7
Group*** size	277.1 >	19.2 >	16.7 >	2.2 >	1.7 ≈	1.6
Group Cohesion***	4.9 ≈	5.1 <	6.7	1.5 <	5.1 <	12.6
Predation Risk (relative)	High	High?	Medium?	Medium	Low	Low

*** p < 0.05



Cetaceans are hardly ever "individuals" but are instead **socially complex groups** of animals.

It is critically necessary that an **evaluation of disturbance includes evaluation of GROUP BEHAVIOR and SOCIAL INTERACTIONS** e.g., distances apart, rates of affiliation/disaffiliation, potential changes or masking of vocalizations, etc.

Changes in overall group behavioral patterns and social disruption are important as potential responses to anthropogenic activities.

CONCLUSIONS - Hypotheses are supported

Cetacean species exhibit ecological diversion in the same habitat in response to **differing predation pressure and food resource availability** as predicted by terrestrial mammal group-living patterns.

As cetacean **body size increases**,

- group size & cohesion decrease
- individuals are more likely to occur alone

Thus, as expected, **blue whales (largest cetacean) occur in small, dispersed groups and are significantly more likely to occur alone than all other (smaller) cetaceans**

- this correlation continues with other species as species body size decreases

Larger, tighter common dolphin and gray whale groups match presumed higher predation pressure associated with smaller relative body size (delphinids and baleen whales, respectively).

- Killer whale predation on whales is common in California waters,
- Shark predation is common on small dolphins and pinnipeds

Larger group size benefits include **reduced predation pressure and improved prey detection/mate access**, at the risk of increased resource competition.

Data lend insight into baseline behavior and ecological triggers influencing behavior. This information is needed to differentiate naturally-occurring behavior vs. potential impacts of anthropogenic sources.

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