

Relationship of Social Vocalizations to Pod Size, Composition, and Behavior in the Hawaiian Humpback Whale

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Brief History

- Paucity of published data on social sound vocalizations.
- Social sounds have been documented in Hawaii, and Alaskan feeding grounds.
- First year of a five year study.
- Social sounds from mother/calf pods and resting pods have not been documented in the published literature, to date.

Background Information

- Tyack (1983) and Silber (1986) reported that social sounds were produced mainly in groups of three or more adults engaged in competitive behavior.
- Social sounds in surface active (SA) group may broadcast location of SA groups; may establish social dominance; occur when new animal joins.
- Green, in 1992, recorded social sounds from 25% of pods approached including mother/calf interactions. These findings were not published and it was determined that further investigation was necessary.

Definitions

- **Songs** are defined as rhythmic and continuous. Songs can have small repetitive units which are organized into themes that occur in a specific sequence.
- **Social Sounds** (S.S.) are non-song, non-repetitive, non-rhythmic sounds that do not have a consistent or continuous pattern. Erratic production often followed by silence.

Purpose

- To determine if whales and specifically calves produced social sounds.
- To collect baseline social sound data using an underwater video camera equipped with a hydrophone.
- To use these data to determine if vocalization rate of social sounds is affected by pod composition, pod size and/or behavioral state.
- To analyze characteristics of humpback whale social sounds.

Hypothesis

- We assumed that whales and specifically, calves, make social sounds.
- We assumed the null hypothesis that pod composition, pod size, and/or pod behavioral state would not affect whale social sound vocalization rate.

Materials and Methods

- Pods were studied in waters between Maui, Lanai and Kahoolawe, Hawaii during the 2001 season.
- Used an underwater video camera with a hydrophone to simultaneously record sounds, videotape behavior, and pod composition.
- This type of video/hydrophone system allowed accurate visual correlations of social sounds with behavior; at times could localize individual whale sounds, especially with calves.

Charismatic Megafauna

Many observations and recordings were within 100 yards; Diver and vessel positioned forward of approach.

Results

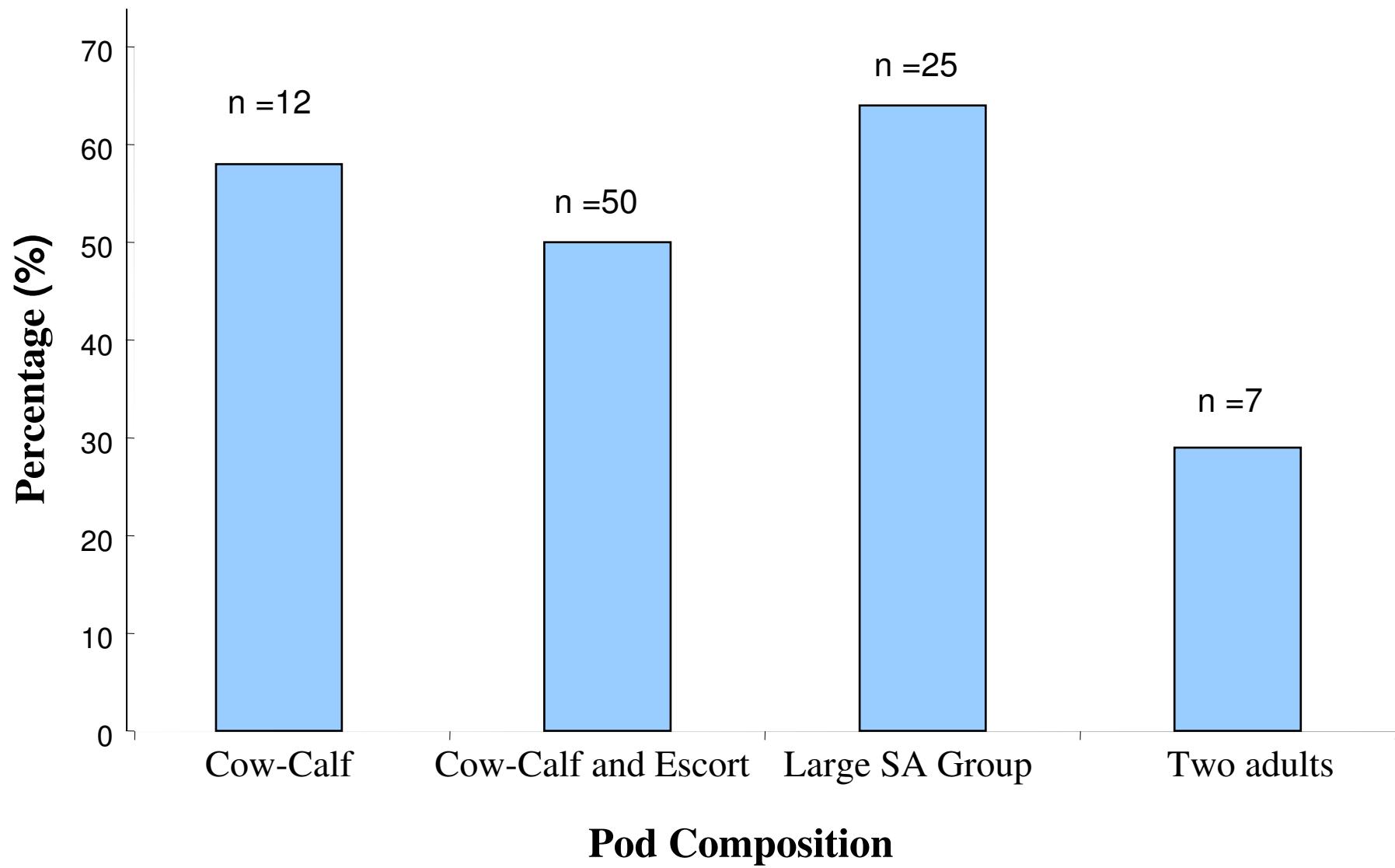
- Determined percentages of pods making social sounds; Social sounds were found in pods of all sizes and composition except singletons, mothers with yearlings, & “fast-travel” pods.
- Social sounds are produced by calves.
- Determined vocalization rates for different pod types, sizes, compositions.
- Tested H_0 : whale S.S. vocalization rate is not affected by composition, size &/or behavioral state of pods by using t-tests for statistical comparison.
- Found no difference in S.S. vocalization rate when pod size and/or pod behavioral state were compared.

Results

- Mother/calf (m/c) pods (58%) and large SA groups (64%) vocalize with S.S.; also found S.S. in resting pods.
- Mean vocalization rates differed significantly with pod composition.
- Social sounds found in SA groups, as in Silber and Tyack (with overlapping sounds); 89% of groups over 6 animals had social sounds.
- S.S. variable in structure, frequency, temporal nature; Resting and m/c sounds were generally of low amplitude.

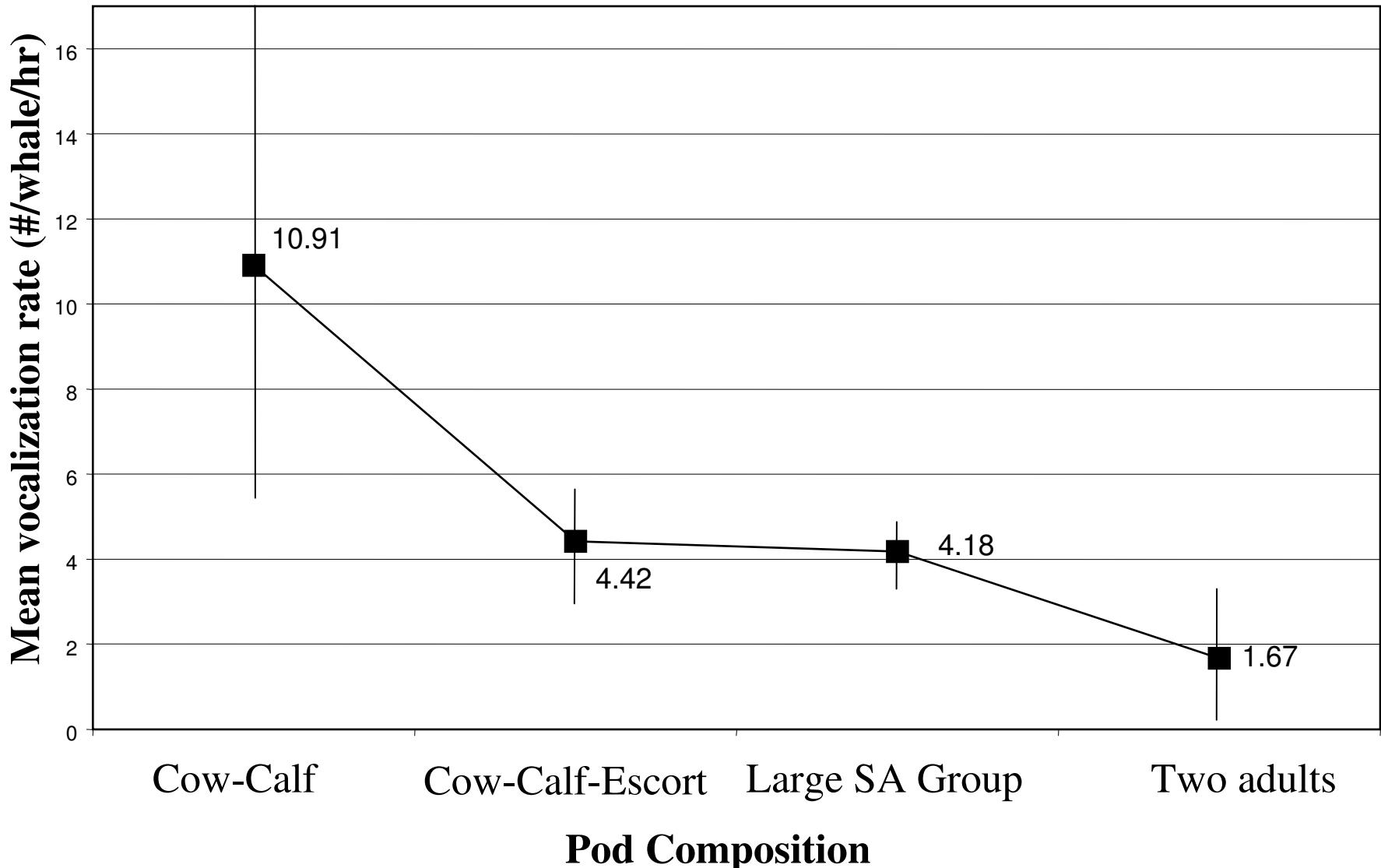
Results

Pod Composition Vocalization Percentage



Results

Mean Vocalization Rate of Pod Compositions with Standard Error Bars.



Results

Mother-calf pods had greater mean vocalization rates and were significantly different from:

- Large surface active pod mean vocalization rates ($p>0.05$)
- Adult pair mean vocalization rates.
($p>0.05$)

Discussion

These results differ from
previous reports:

- Tyack (1983) reported social sounds were produced mainly by whales in groups, in which males are competing for access to a female (Tyack and Whitehead 1983). (*We found more diversity in pod compositions that produced S.S.*)
- Silber (1986): found no social sounds from mother/calf pods & significant correlations between vocalization rates and group size. (*We found mother/calf pods produced S.S. and specifically, calves made the sounds.*)

Discussion

- Data from this study suggest that social sound vocalizations are not limited to competitive interactions.
- Social sounds may have a broader functionality than to demonstrate aggression or agitation since found in different behavioral contexts.
- Mother/calf pod sounds were mainly from the calf (“*Asymmetry of Recognition*”?); Also we had one instance of “isolation” call or contact call from the calf (*Alarm call?*).

Discussion: Sources of Bias?

- Diver in water with various types of pods, but whales may be making vocalizations because of novel stimulus i.e. diver presence.
- Bias of working with pods that are not bothered by approaches (i.e. difficult to work fast moving pods).
- May not be picking up sounds from other whales in the pod that are further away from Hydrophone.

Conclusion Remarks

- Found that social sounds attenuate quickly underwater; Often not audible to diver until analysis (may be reason other studies have not documented social sounds).
- Future Studies:
 1. To determine the significance of mother-calf social sounds.
 2. To determine if sounds are biologically meaningful (After Clarke 1982; Maeda, Koido & Takemura 2000).
 3. To categorize temporal and spectral characteristics of sounds.

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