Bubble Net Fishing Behavior

Image is in public domain.

Background Knowledge on Humpback Whales

* In the Baleen Whale Family
* Adults measure 39–52 ft long, weigh 79,000 lbs
* Feed mostly only during the summer in polar areas
* Migrate 4,000 miles in the winter to tropical areas
* Live off fat reserves to give birth
* Must consume 4400-5000 lbs. of food to store up for winter

[Strange phrase: More information is needed. When and where do they give birth?]

Source 5

Topic Question

* Is the bubble net hunting behavior a fixed action pattern?

Courtesy of National Oceanic and Atmospheric Administration. Image is in public domain.

What do Humpback Whales Eat?

* Krill
* Small Schooling Fish
  * Atlantic Salmon
  * Atlantic Herring
  * Atlantic Mackerel
  * Pollock
  * Haddock

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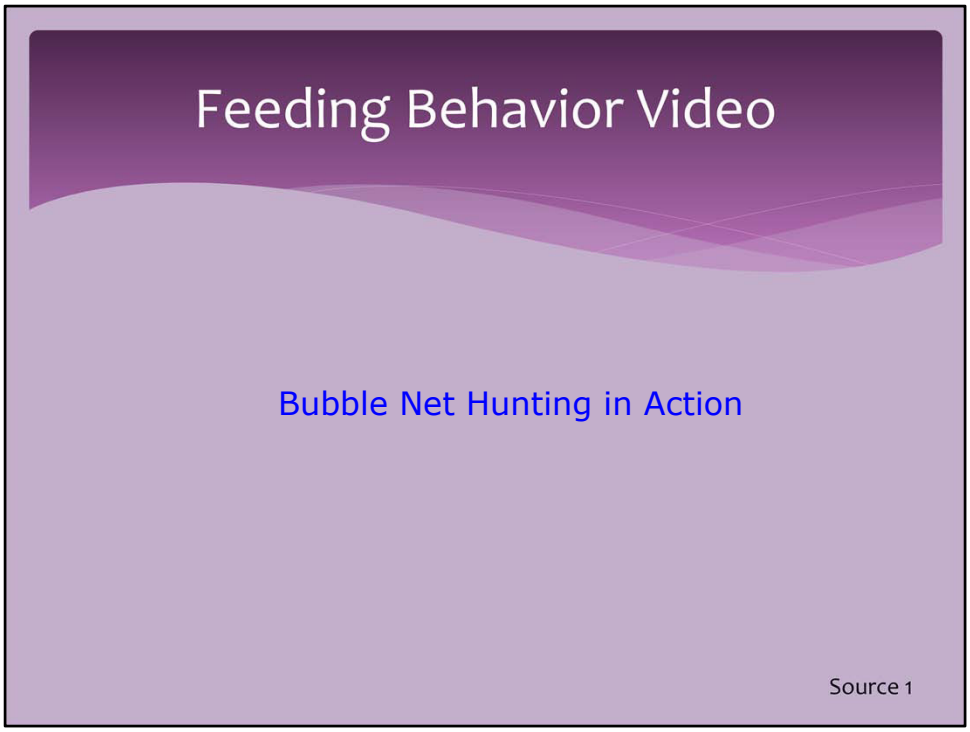
Source 6



Click the link to start the video. Do not play entire video, too long for presentation

Bubble Net Technique

- Around 12 whales swim in a shrinking circle
- Blow bubbles below a school of prey
- Some blow bubbles, some lunge to eat, and others make calls

Courtesy of Christin Khan, National Oceanic and Atmospheric Administration. Image is in public domain.

Source 6

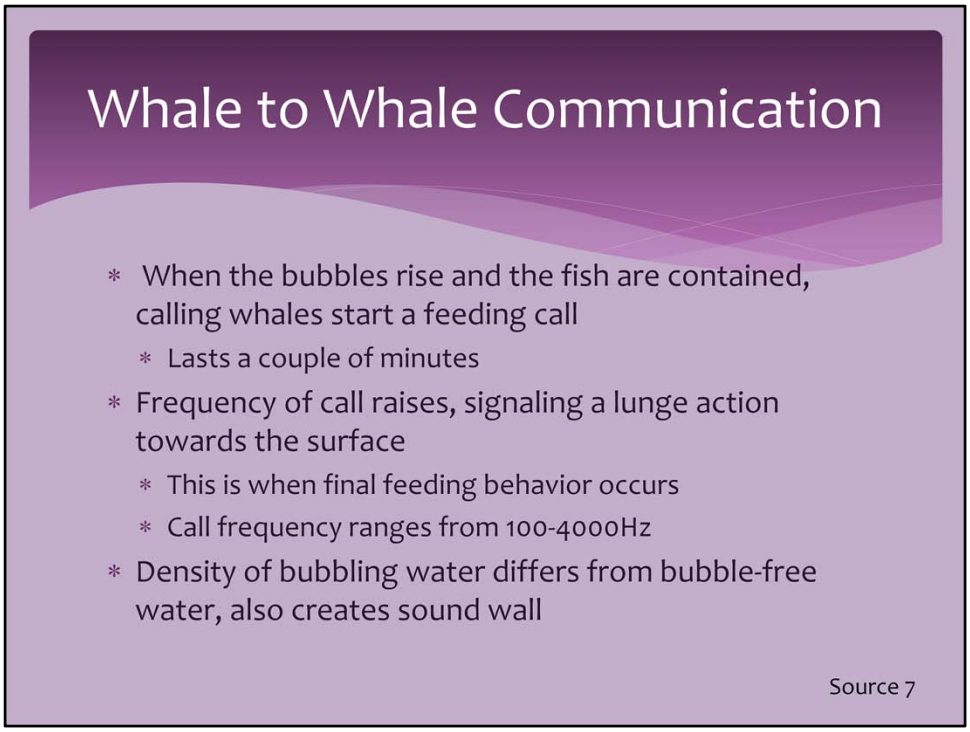
Logistics

* Original outer ring can begin at up to 30 meters in diameter, then shrinks
* The whales confine the school to smaller cylinders with bubbles
* Once a dense cylinder forms, whales begin to lunge feed

Source 3

Figure removed due to copyright restrictions.
Reference: Figure 1 & 3a,b from Leighton, Tim,Dan Finfer,et al. "An Acoustical Hypothesis for the Spiral Bubble Nets of Humpback Whales and the Implications for Whale Feeding." *Acoustics Bulletin* 22, no. 1 (2007): 17-21.

Physical representation of bubble net fishing behavior



Last bullet point is the main reason why the bubble net hunting behavior works

Result of Bubble Net Hunting

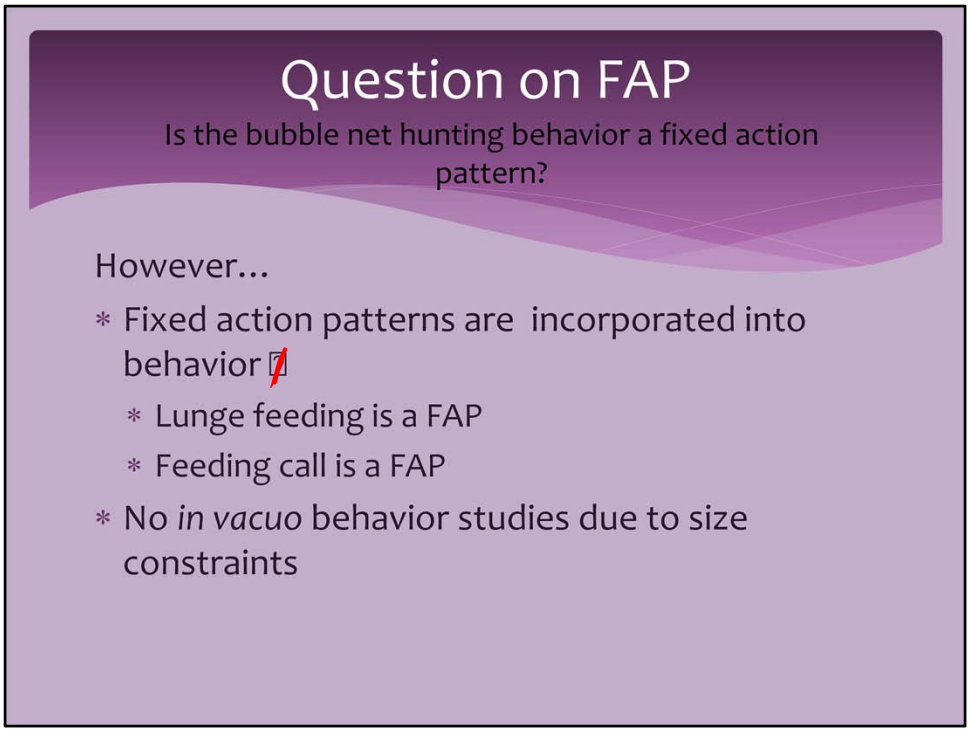
* When lunging call is heard, whales swim up to surface
  * Navigate through the bubble net with mouths open
* Thousands of fish swallowed in one lunge
* Excess water is drained through plated mouth grooves

Source 6

Question on FAP

Is the bubble net hunting behavior a fixed action pattern?

* Most likely, no.
  * Around 1,000 whales in the wild exhibit this behavior
* Localized to specific regions
  * Observed in Alaska, Antarctica, and West Coast of South America
* **Hypothesis: fewer resources increase frequency of bubble net hunting behavior**



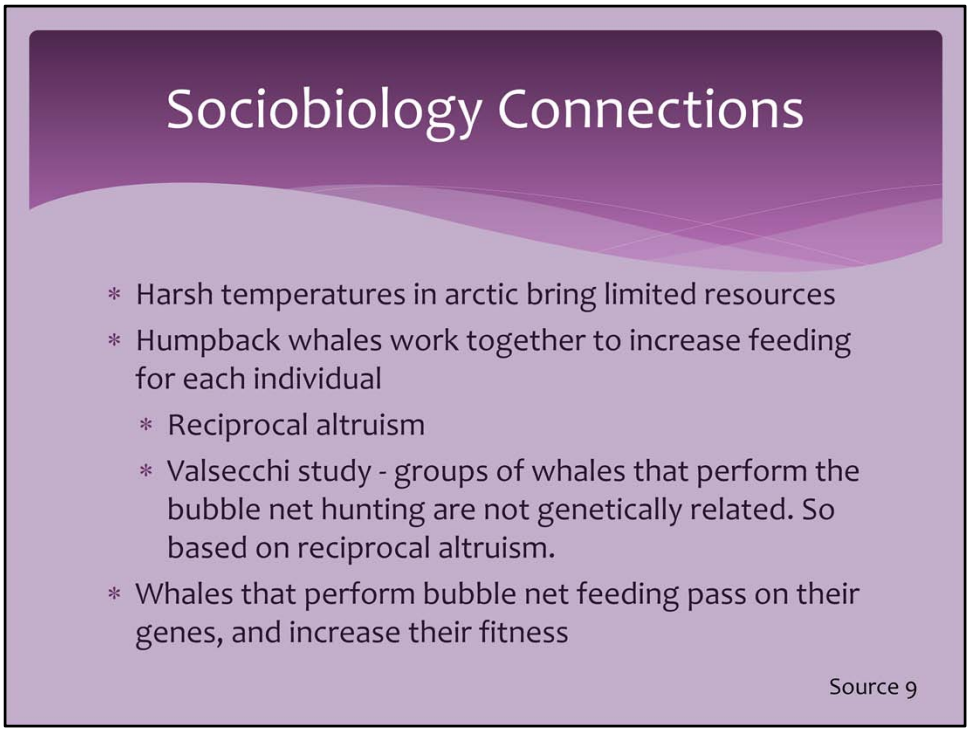
The whales are too large so the tank to hold a dozen whales at once is near impossible

You could feed a group of whales very frequently so they have no need of the group feeding pattern. Would they do it anyway?

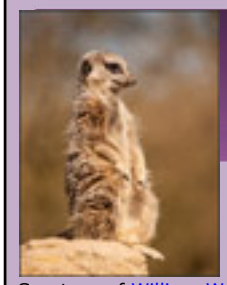
Evolutionary Reasoning

* Due to long distance migration, need an effective feeding behavior
* Teamwork increases survival, thus increasing fitness and ability to pass on genes

Figure removed due to copyright restrictions. Please see the map of the long migration of the Humpback whale from Grid-Ardenal©.



Valsecchi study focused on whether bubble net fishing was based on purely reciprocal altruism or whether there was more of a genetic link that caused kin to pass the behavior down through the species.



Connections from 9.20
Compare to Meerkats

Communication

* Meerkats: sentry stands guard while others dig for food. Guard gives reassuring or concerning calls.
* Humpback whales: perform a feeding call song during the bubble net behavior to signal the lunge

Altruism

* Meerkats: some stand guard while others search for food. Also, protect young that aren't their own.
* Humpback whales: They forgo independency to work together in bubble net feeding

Future Work

- Examine similar behavior seen in other species
  - Dolphins create bubbles as well, seemingly for play rather than feeding
- Attempt to create in vacuo experiment
  - Requires funds and large enough location
- Follow the fitness of humpback whales that either perform bubble net feeding or not

Image is in public domain.

Source 4

This slide is to discuss future implications with the behavior and what we can do next.

Need evidence of the learned nature of this kind of feeding. How are the young whales taught? What are the ages of the whales participating? Do all the whales in a group participate?
(From your descriptions, this type of feeding could be a conditional behavior, practiced only under certain conditions.)

In Conclusion

- Bubble net feeding is a group effort for humpback whales to maximize food intake and minimize energy output
  - Uses a combination of humpback whale FAPs and exploits prey FAPs
- The behavior is an adaptation to the harsh, arctic environment
- Less resources: promotes teamwork: maximizes energy intake[1]

Source 3

Works Cited

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20% Relevance to class: Cite specific ideas or principles of ethology and sociobiology
20 .
.

20% Sources: search effort, reading effort, adequacy for the report and accuracy of understanding
20 .
.

20% Organization of ideas with helpful use of headings; clarity of descriptions
19 .
.

20% Examples used to explain the topic clearly and effectively; interest shown by student and generated in audience
19 .
.

20% Critique of studies read and future directions (your ideas about relevant work you think should be done if you were working in this field).
16 .
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94/100

9.20 Animal Behaviour

Fall 2013