Focal behavioral observations and fish-eating killer whales: Improving our understanding of foraging behavior and prey selection

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Poster presented at the 16th Biennial Conference on the Biology of Marine Mammals, December 2005, San Diego, California

Why this is important –

- *"Southern resident"* killer whales in the NE Pacific Ocean were listed under the U.S. Endangered Species Act in November 2005
- Prey availability/quality has been cited as a potential risk factor
- Only limited information is available on their foraging behavior/prey selection despite long-term studies
- Limited information is likely associated with a lack of systematic behavioral research to determine cues associated with predation events

What we did –

In late summer 2004 and summer and fall 2005 we followed *southern resident* killer whales in a 6m vessel in the inland waters of Washington State to:

1) collect behavioral information associated with individual foraging
   - we looked for and classified behavioral cues; i.e., changes in speed and direction, associations with other whales, dive durations
2) collect remains from predation events to determine prey selection
   - prey remains were collected with a fine mesh net
     Species identification was determined from:
     > identifying characteristics of fish scales
     > PCR analyses of fish tissue

Focal follows were undertaken on 25 days, totaling 170.25 hours of effort across 5 months (see Table for distribution of effort).

Effort by month

Dates	# days of effort	# hours on effort	# of cues	# of prey samples collected
Jun 2005	6	43.1	17	2
Jul 2005	5	34.6	22	12
Aug 2005	5	37.6	52	18
Aug/ Sep 2004	6	47.6	23	10
Oct 2005	2	7.4	22	7

Foraging behavior can be very subtle

Previous studies indicated that foraging was typically associated with high energy behaviors such as chases, fast directional and fast non-directional surfacings.

Although we collected prey remains from nearly half (18 of 37, 49%) of these cues, we collected a substantial proportion (31 of 99, 31%) and a greater number (31 vs. 18) from more subtle, lower energy behaviors - moderate directional or non-directional swimming, converging with other whales, surfacing after long dive (see table below).

Success of prey remains collection based on behavior cues

Behavior state	# of cues observed	# associated collections
High energy i.e., chase, fast directional, fast non-directional	37	18
Low energy i.e., moderate directional or non-directional, converge with others, surfacing after long dive	99	31

Prey selected were all salmon, primarily chinook

Previous studies indicated that salmon, and particularly chinook, were preferred prey, but sample size was small and distributed over the past 30 years

Of the samples we collected 49 individual fish were identified. The majority (75%) were chinook, 18% were chum (mostly from October), and 6% were coho

Implications for Recovery goals

- Systematic focal animal behavioral observations provides a variety of information that will be useful for management needs.
- Obtaining a representative sample across seasons is an important first step in establishing current baseline prey selection against which to evaluate future trends. Determining which cues represent foraging behavior will likely allow foraging rate determination – potentially a reflection of prey availability. Locations of predation events will contribute to critical habitat delineation. Identification of prey to species, and ideally to stock, will provide important information on how to better manage prey resources.
- Focal behavior follows also lends itself to the collection of fecal material from known animals. Fecal samples collected as part of this study will potentially provide additional information on prey selection (through genetics) as well as contribute tissue for whale genetics studies and material suitable for assessment of health parameters.

For more information on related research see http://www.cascadiaresearch.org/robin/kwindex.htm

Acknowledgements

Funding was provided by the Northwest Fisheries Science Center of NOAA Fisheries. Megan Ferguson and Candi Emmons provided assistance in the field and with defining data protocols. A number of other individuals assisted in the field with data collection, including Sarah Courbis, Erin Falcone, Andy Foote, Mike Ford, Debbie Giles, Allison Gill, Dawn Grebner, Jessica Huggins, Linda Jones, Kari Koski, Sabre Mahaffy, Melanie Paquin, Frankie Robinson, Jodi Smith, and Adam U. John Sneva (WDFW) identified salmon species from scales. Piper Schwenke (NWFSC) identified prey using genetic markers. This research was undertaken under NMFS GA No. 781-1725-1 (issued to the N.W. Fisheries Science Center). Kari Koski and The Whale Museum's Soundwatch program provided extremely valuable assistance with their public awareness program, and we thank the Whale Watch Operators Association North West for their cooperation. Friday Harbor Labs provided logistical assistance, and Ken Balcomb, Ron Bates and Mark Sears provided sighting information. Background photo by Candi Emmons.