Prey Determination and Feeding Seasonality of the Great Bay Harbor Seal Colony (*Phoca vitulina concolor)*

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Abstract

Atlantic harbor seals (*Phoca vitulina concolor*) are a seasonally migratory species that have been documented overwintering in Great Bay, New Jersey since 1994. Observations in 2010-2011 reported a maximum of 160 individuals (March) - representing a 45% mean annual increase since 1994. Fecal prey remains analysis, particularly recovery of sagittal otoliths of fishes, is commonly used to determine the diet of piscivores. From 1996-2010, Dr. Carol Slocum and her students at The Richard Stockton College of New Jersey collected scat samples from known haul-out sites in Great Bay. Using elutriation techniques and nested sieves, unprocessed frozen samples from The New Jersey Seal Study were elutriated and identified. In total, 573 otoliths were extracted from these samples and combined with 216 previously processed samples (for a total of 832 otoliths). Despite erosion from transit through the digestive tract, otoliths were identified to order, family, and genus species levels, where possible. Fishes of the order Gadiformes (hake-like) were a dominant component in samples, followed by Clupeiformes (herring-like) and Pleuronectiformes (flatfish-like). Prey abundance / size histograms were constructed using otolith length as a proxy for fish length. Size classes of dominant prey varied by season and species. While fishes in the order Gadiformes were dominant prey during most months, there was a distinct seasonal shift to Clupeiformes during the month of May. Known fish migration patterns in the region support this seasonal variation in species composition and abundance.

Materials and methods

Study Site

•Barrier islands in Great Bay Mullica River Estuary in the vicinity of Little Egg Inlet, New Jersey, USA (Figure 1)

Field sampling

•Collection of scat was carried out with an effort to minimize any possible disturbance to the seal population.

•Travel to the haul out site was made by boat, either from Stockton Marine and Environmental Field Station or Rutgers University Marine Field Station.

•Samples were collected in jars, one individual sample per jar (if possible), labeled on site and frozen.

Recovery of Otoliths

•Stored samples were thawed using detergent and warm water and passed through an elutriator first and then nested sieves (no. 13 and 35).

•Otoliths were extracted using soft forceps, cleaned with ethanol, dried and stored dry, in labeled scintillation vials.

Image analysis

•Photographs were obtained of all otoliths using stereo microscope, attached digital camera, and image analysis software.

•Otoliths were assigned an erosion grade and measured using the image analysis software.

•Identification was attempted using reference otoliths and otolith identification manuals by Campana and Brodeur.

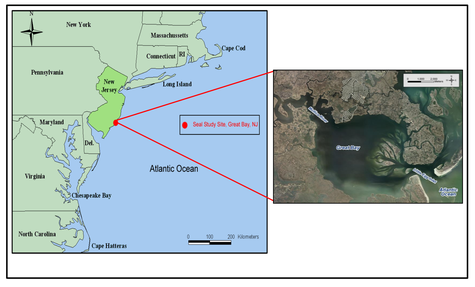
•Otoliths were identified to genus and species level wherever possible.

Data Analysis

•Known conversion factors from peer reviewed literature were applied to otolith lengths (where available) to estimate fork length of prey species.

•Occurrence of otoliths from species by month and percent order by month were determined.

•Length frequency distribution by season and species were determined.



Fig, 1

Results

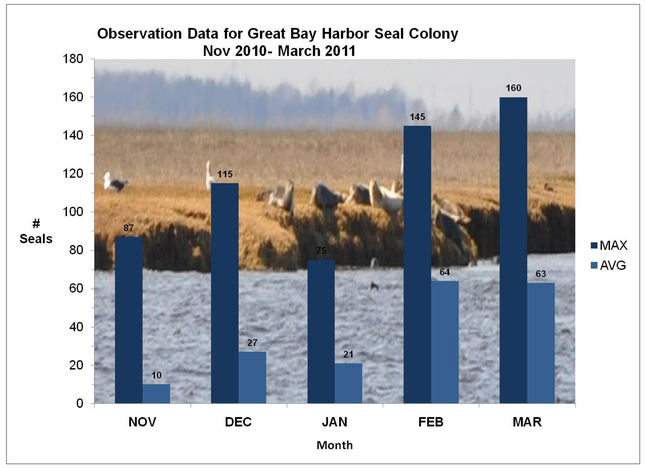
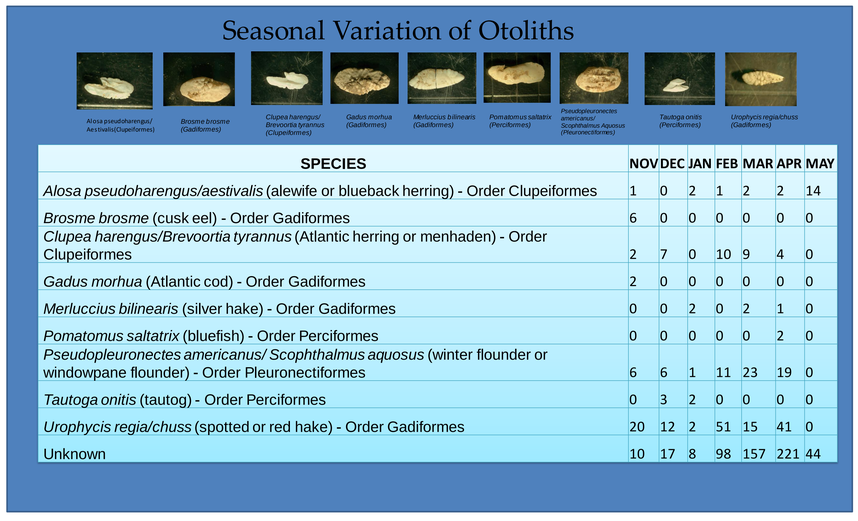


Fig. 2



SPECIES	NOV	DEC	JAN	FEB	MAR	APR	MAY
Alosa pseudoharengus/aestivalis (alewife or blueback herring) - Order Clupeiformes	1	0	2	1	2	2	14
Brosme brosme (cusk eel) - Order Gadiformes	6	0	0	0	0	0	0
Clupea harengus/Brevoortia tyrannus (Atlantic herring or menhaden) - Order Clupeiformes	2	7	0	10	9	4	0
Gadus morhua (Atlantic cod) - Order Gadiformes	2	0	0	0	0	0	0
Merluccius bilinearis (silver hake) - Order Gadiformes	0	0	2	0	2	1	0
Pomatomus saltatrix (bluefish) - Order Perciformes	0	0	0	0	0	2	0
Pseudopleuronectes americanus/ Scophthalmus aquosus (winter flounder or windowpane flounder) - Order Pleuronectiformes	6	6	1	11	23	19	0
Tautoga onitis (tautog) - Order Perciformes	0	3	2	0	0	0	0
Urophycis regia/chuss (spotted or red hake) - Order Gadiformes	20	12	2	51	15	41	0
Unknown	10	17	8	98	157	221	44

Fig. 3

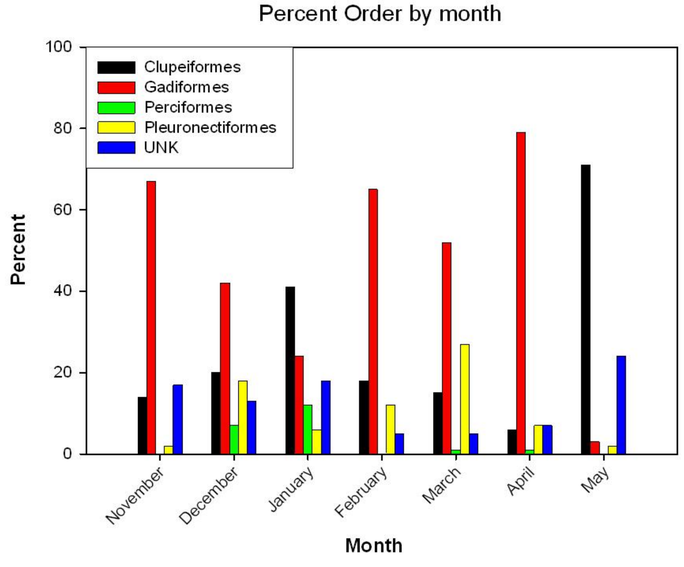


Fig. 4

Length Frequency Distributions of Most Commonly Occurring Prey

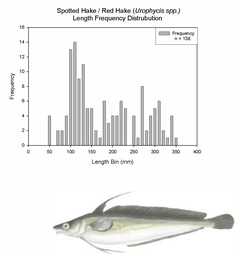


Fig. 5a

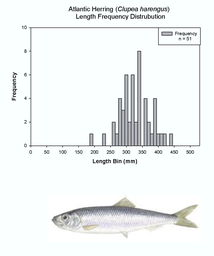


Fig. 5b

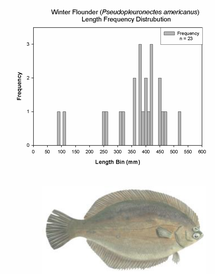


Fig. 5c

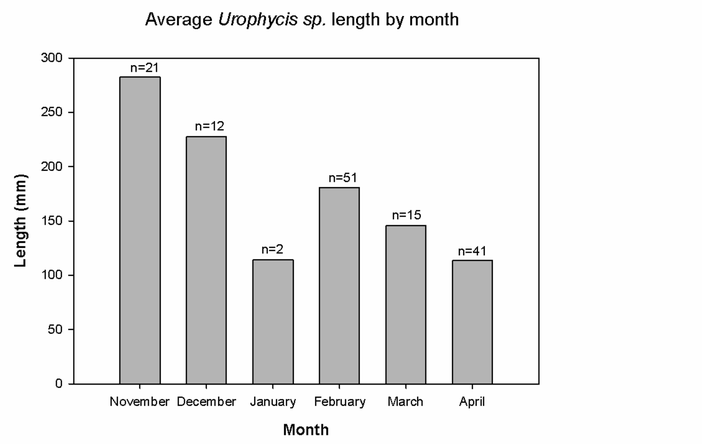


Fig. 6

Results/ Conclusions

•The maximum number of harbor seals observed ,as well as, the average number observed, increased relatively consistently over the season. (Fig. 2)

•Otoliths from fishes of the order Gadiformes (hake- like Fishes) were the predominant type found in the scat samples processed. (Fig 4)

•Of those otoliths identified as Gadiformes, most were identified as being from the Urophycis genus.(Fig 3.)

•Length Frequency Distributions showed that the length of prey fishes varied both seasonally and by species (Fig. 5 a,b and c)and most Urophycis species were found in the 150-200 mm range.(Fig. 6).

•Results indicated that other important prey species found in the scat samples were from the order Clupeiformes (herring-like) and the order Pleuronectiformes (flat fish-like). (Fig. 4)

•Known fish migration data for this region (Able and Fahay, 2010) support our general findings regarding seasonal variation in composition of prey, and specifically, the seasonal shift in May from order Gadiformes to order Clupeiformes (Fig 3).

•Some possible sources of error may be that the condition of otoliths varies between partially to completely eroded due to digestion making identification difficult; the otoliths recovered may only represent recently consumed prey; more fragile otoliths (Clupeidae) may be completely digested and therefore underrepresented in the results and larger fishes may be underrepresented because the skull of those fishes may not be consumed. Regarding January observation data, visibility was difficult and observation days were less (Spring Break) so numbers may be underestimated

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