A Preliminary Assessment of the Caloric Content of Some Middle Atlantic Bight Apex Predators and Their Prey

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INTRODUCTION

The study of energy flow through ecological systems or subsystems is attracting considerable interest and efforts are being made to assess and model the flow of energy from the primary producers through the consumer species. Essential to energy flow studies is the determination of the energy value of biological material which is produced, assimilated or transferred within trophic webs. The vast bulk of the investigation in this area have been on the lower levels of the trophic web, naturally, where most of the energy in an ecosystem resides, and little has been done with the apex consumers. This report presents data on the caloric value of tissue from ten species of apex consumers or predators and some of their principal prey items.

METHODS

The eight species of predators examined were supplied by the NEFC's Apex Predator Study, Narragansett Laboratory, Narragansett, R. I. and the remaining species examined were collected in 1979, during the quarterly environmental monitoring cruises of the NEFC's Ocean Pulse Program. In cases where the species being examined is very large (>1 kg) a steak was cut from the mid-section for use in the analysis, otherwise the whole organism was included in the analysis. All organisms used were fresh frozen, and collected in the Middle Atlantic Bight.

To prepare each species for analysis the organism or the tissue being used was chopped, flaked or mechanically blended to create a homogenate. Subsamples of the homogenate were then dried in a vacuum chamber, at room temperature, to constant weight. The samples were then ground in a mill to pass through a 60 mesh seive. The ground material was then compacted into pellets, approximately 1 gm in weight, and oxidized in a Parr[1] Adiabatic Calorimeter (model 1241) using the standard 1108 combustion bomb (Parr Instrument Co., 1969). At least five replicate pellets were individually combusted for each species sample. Acid corrections were not made because of the small error (<1%) anticipated to be produced by this factor (Paine, 1964). Additional samples of the dried homogenate, for each species, were placed in a muffle oven at 500°C for 4 hrs to determine ash content and reburned at 850°C to determine $CaCO_3$ content for endothermic considerations (Paine, 1966). Caloric content of the material burned was calculated according to Parr Instrument Co. (1968).

RESULTS

The results of this preliminary study are presented in Table 1.

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[1]Reference to commercial products in this report does not imply endorsement by the authors or the National Marine Fisheries Service.

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The ten samples of sharks and other apex predators were supplied by Charles Stillwell of NOAA, NMFS, NEFC, Narragansett, R. I.

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Table 1. The caloric equivalents of ten species of apex predators and some of their prey items.

Species	Sample Type	#Indiv/ Sample	No. Burns	$\bar{x}$ cal/gm dry wt. (± SD)	% Ash	%$CaCO_3$
Lamna nasus (Porbeagle shark)	dorsal muscle	1	7	4780 ± 108	5.6	4.9
Carcharhinus milberti (sandbar shark -pup)	mid section	1	6	4661 ± 253	8.4	7.2
C. milberti (adult)	dorsal muscle	1	6	4851 ± 138	5.9	5.1
Prionace glauca (blue shark - pup)	mid section	1	6	4240 ± 114	8.5	6.9
P. glauca - adult	dorsal muscle	1	6	4530 ± 66	6.45	5.2
Isurus oxyrinchus (mako shark)	dorsal muscle	1	5	4927 ± 190	5.3	4.8
Lophius americanus (goosefish)	whole juveniles	4	6	4352 ± 138	13.4	9.9
Thunnus albacares (yellowfin tuna)	dorsal muscle	1	6	5647 ± 108	4.6	5.4
Xiphias gladius (swordfish)	dorsal muscle	1	5	6578 ± 152	4.4	4.7
Acanthocybium solanderi (wahoo)	dorsal muscle	1	6	5701 ± 285	5.5	3.8
Pomatomus saltatrix (bluefish)	mid sect.steak	1	5	5683 ± 194	4.9	0.3
Lagenorhynchus acutus (Atl. white sided dolphin)	dorsal muscle	1	10	7981 ± 209	1.0	1.0
Scomber scombrus (Atl. mackerel)	whole individual	5	47	5650 ± 205	7.8	7.4

Table 1. Continued

Species	Sample Type	# Indiv/ Sample	No. Burns	$\bar{x}$ cal/gm dry wt. (± SD)	% Ash	% $CaCO_3$
Raja erinacea (little skate)	whole individual	3	23	4389 ± 201	14.1	12.1
Alosa pseudoharengus (alewife herring)	whole individual	5	7	5048 ± 213	11.5	10.0
Urophycis chuss (red hake)	whole individual	5	5	4666 ± 165	13.1	11.5
Illex illecebrosus (short-fin squid)	whole individual	5	5	5024 ± 227	6.7	0.7
Loligo peali (long-fin squid)	whole individual	5	5	5537 ± 289	5.0	-