

Diet and Condition of American Alligators in 4 Florida Lakes

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Abstract: We examined stomach contents from 219 American alligators (*Alligator mississippiensis*) collected from 4 Florida lakes. Fish, mostly shad (*Dorosoma* spp.), bowfin (*Amia calva*), and gar (*Lepisosteus* spp.) occurred in 55.3% of the stomachs and was the most important food group (57.5%) by volume. Apple snails (*Pomacea paludosa*) and crayfish (*Procambarus* spp.) were important invertebrate prey (66.7% occurrence and 6.6% by volume). Of the 195 stomachs having a dominant food type (>50% of the total food volume), most (72%) contained one food type exceeding 90% of the total food volume. The predominant food type differed by lake ($P < 0.001$), sex ($P = 0.056$), and size ($P < 0.001$) of the alligator. In general, the dominant food type changed from invertebrate to vertebrate with an increase in alligator size. Alligator length-weight relationships (condition) were examined for variation associated with diet. For large alligators (2.89 m total length [TL]), increasing probability of dominance by the fish food type was associated with better condition. Fish were more likely to be the dominant food for alligators in lakes with the highest chlorophyll *a* concentrations. Food resources limitations may affect alligator diet and condition at some locations. Information on dietary constraints and condition may be useful in managing American alligators for commercial and conservation purposes.

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Crocodylians are opportunistic predators and exhibit a varied diet (Cott 1961, Gorzula 1978, Webb et al. 1982, Magnusson et al. 1987, Thorbjarnarson 1993). Dietary differences among American alligators usually are attributed to prey availability and suitability (reviewed by Wolfe et al. 1987). Variation in the quality and volume of

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food may influence alligator nutrition, and affect growth (Chabreck 1971) and reproduction (Joanen and McNease 1987). Consequently, food resource availability may partially regulate alligator populations by altering fecundity and survivorship (Rooted et al. 1991). American alligators occupy a variety of wetland habitats in Florida (Hines 1979), and diet may influence population dynamics at some locations. Information on alligator diet and condition (i. e., length-weight relationship) may be useful in interpreting variation in growth rates (Jacobsen and Kushlan 1989) and reproductive success (Woodward et al. 1993) and evaluating populations that appear to be "nutritionally impoverished" (Abercrombie 1989) "stunted versions of the species" (Dalrymple 1996).

Indices of crocodylian prey importance were described and critically reviewed by Webb et al. (1982). Previous studies of American alligator diet in Florida included part of a regional sample (Kellogge 1929), stomach contents of a road-killed alligator (Kinsella 1982), juvenile specimens (Forgarty and Albury 1988, Delany 1990), hunter-harvested (Delany and Abercrombie 1986) and nuisance alligators (Delany et al. 1988), and samples from the southern Everglades (Barr 1997). The objectives of this study were to describe the August–September diet of alligators from 4 lakes in Florida, examine effects of alligator length, sex, and lake on the probability of a specific food type being the predominant food item of a stomach, and determine if the length-weight relationship in alligators was associated with differences in diet.

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Methods

Alligators were harvested by hunters during 1800–0100 hours between 26 August and 30 September 1985 in peninsular Florida from lakes Oklawaha (Putnam County), George (Putnam and Volusia counties), Hancock (Polk County), and Trafford (Collier County) (Table 1). Lake, total length (TL), weight (W), and sex were recorded for each alligator. Stomachs from a sub-sample of alligators 1.09–3.89 m TL were frozen prior to analysis. After thawing, stomach contents were removed and separated and food items were identified and tallied. Volumes were determined by water displacement. All statistical tests were performed using the SAS System (SAS Inst. 1990).

Diet

Each alligator was classified according to which food type (invertebrate, fish, other vertebrate) was found in greatest volume in the stomach. Alligators with no food ($N=21$) or no majority prey type in the stomach ($N=3$) were excluded from the sample. We obtained maximum likelihood fits of multinomial logit models (Agresti 1990) using the CATMOD procedure (SAS Inst. 1989). The models specified prey category dominance probabilities as functions of lake, sex, TL, and their interactions.

Table 1. Characteristics of study lakes in peninsular Florida^a.

Lake	Maximum depth (m)	Area (ha)	pH	Alkalinity (mg/liter)	Secchi depth (m)	Chlorophyll <i>a</i> (mg / m ³)	Description of adjacent marsh
Oklawaha	4.0	8,600	7.7	101	1.9	6.7	Dominated by cattail (<i>Typha</i> spp.) and sedges (<i>Cyperus</i> spp.)
George	4.0	18,623	8.4	59	0.7	48.2	Comprised of water shield (<i>Brasenia schreberi</i>), cattail, water lily (<i>Nymphaea</i> spp.), maiden cane (<i>Panicum hemitonon</i>), and giant reed (<i>Phragmites</i> spp.)
Hancock	3.0	1,830	9.4	76	0.2	144.0	Cypress swamp, with little herbaceous vegetation extending beyond the tree line
Trafford	3.0	1,397	8.4	111	1.0	27.7	Dominated by cattail, maiden-cane, and sawgrass (<i>Cladium jamaicense</i>)

a. Chemical and trophic information is from Canfield (1981).

We considered only hierarchical models, i. e., those models containing all constituent lower-order effects for any proposed high-order effect. From this set we used the Akaike Information Criterion (AIC) (Akaike 1974) to find a parsimonious model that fit the data. We performed pairwise Wald tests of the dominance probabilities for a given prey type at three reference values for TL (\bar{x} and $\bar{x} + SD$): 1.644 m, 2.266 m, and 2.889 m; we estimated variances and covariances of dominance probability estimates for use in these tests by application of the delta method.

Relationship Between Length and Weight

For many animals, the relationship

$$W = \alpha(TL)^\beta \quad (1)$$

holds within localities, sexes, and stages of maturity (Le Cren 1951). Equation (1) can be restated as

$$\ln W = \ln \alpha + \beta \ln TL = \gamma + \beta \ln TL \quad (2)$$

where $\gamma = \ln \alpha$. We fit the model

$$\ln W_{ijk} = \gamma_{ij} + \beta_{ij} \ln TL_{ijk} + \epsilon_{ijk}, \quad (3)$$

using ordinary least squares (OLS), where the indices on W , TL , and ϵ (experimental errors, assumed identically distributed independent normal random variables with zero mean and constant variance) refer to the k th individual of the j th sex in the i th lake, $I = 1, \dots, 4$, $j = 1, 2$, $k = 1, \dots, n_{ji}$. We classified an observation as an outlier (e.g., bobtailed individuals) if the absolute value of the studentized residual (Neter et al. 1985) exceeded 3.291. Outliers were removed from the dataset prior to any subsequent analysis.

We suspected that major shifts in the diet of alligators as TL increased might be accompanied by changes in the length-weight relationship. To test for departures from linearity in the relationship between $\ln W$ and $\ln TL$, we fit the following model (presented using SAS syntax)

$$\begin{aligned} \text{LOGW} = & \text{LAKE} & (4) \\ & \text{SEX} \\ & \text{LAKE} * \text{SEX} \\ & \text{LOGTL} \\ & \text{LOGTL} * \text{LAKE} \\ & \text{LOGTL} * \text{SEX} \\ & \text{LOGTL} * \text{LAKE} * \text{SEX} \\ & \text{LOGTL} * \text{LOGTL} \\ & \text{LOGTL} * \text{LOGTL} * \text{LAKE} \\ & \text{LOGTL} * \text{LOGTL} * \text{SEX} \\ & \text{LOGTL} * \text{LOGTL} * \text{LAKE} * \text{SEX} \\ & \text{LOGTL} * \text{LOGTL} * \text{LOGTL} \\ & \text{LOGTL} * \text{LOGTL} * \text{LOGTL} * \text{LAKE} \\ & \text{LOGTL} * \text{LOGTL} * \text{LOGTL} * \text{SEX} \\ & \text{LOGTL} * \text{LOGTL} * \text{LOGTL} * \text{LAKE} * \text{SEX} \end{aligned}$$

and tested Type 1 hypotheses (Milliken and Johnson 1984). Because of imbalance in the data, we also tested Type 1 hypotheses in a version of model (4) in which the ordering of the LAKE and SEX terms was reversed. In this way, we tested polynomial trends (up to a cubic) and heterogeneity of those trends among lake-sex combinations. A final model for $\ln W$ as a function of $\ln TL$ was selected as the hierarchical model containing the highest order terms that were significant according to a Type 1 hypothesis test.

To evaluate whether differences in predominant prey type were reflected in differences in alligator weight, we regressed predicted $\ln(\text{weight})$ for lake-sex groups at given reference lengths, on the estimated dominance probability of a given prey type at the given reference lengths; a separate OLS regression was performed for each combination of sex, TL reference length, and prey type. Because stomach contents of a given animal did not necessarily represent long term diet patterns and their influence on weight, only a between-lakes analysis was appropriate for examining the relationship between diet and condition. Thus there were only 4 experimental units (i.e., lakes) for each regression in the examination of the relationship between diet and condition.

Results

Diet

We collected 130 stomachs from 361 harvested males and 89 stomachs from 210 harvested females. Most stomachs (198) contained food (Table 2). Of the 195 alligator stomachs in the logistic regression analysis sample, 92 (47%) contained only a single food type, 141 (72%) contained 1 food type $>90\%$ of total food volume, and 171 (88%) contained 1 food type $>70\%$ of total food volume. The majority food type

in every stomach exceeded 50% of total volume. Overall frequencies for majority food types were: invertebrate (31%, $N=61$), fish (48%, $N=94$), and other vertebrates (21%, $N=40$).

The multinomial logit model with the lowest AIC (AIC=359.609, likelihood ratio $\chi^2=273.20$, 294 df, $P=0.803$) contained the main effects Lake ($P< 0.001$), Sex

Table 2. Total and percent composition of aggregate item occurrence and aggregate food volume in 219 American alligator stomachs collected from 4 Florida lakes, 26 August–30 September 1985. Species or genera comprising <1% of aggregate food volume are not itemized, but are included in the totals for the class.

Item	Occurrence		Volume	
	<i>N</i>	%	(ml)	%
Vertebrates (total)	285	70.8	25,065	93.4
Fish (total)	212	55.3	15,431	57.5
Shad (<i>Dorosoma</i> spp.)	38	12.3	4,166	15.5
Bowfin (<i>Amia calva</i>)	7	3.2	3,413	12.7
Nile perch (<i>Tilapia aurea</i>)	31	5.0	1,143	4.3
Gar (<i>Lepisosteus</i> spp.)	9	2.7	1,131	4.2
Yellow bullhead (<i>Ictalurus natalis</i>)	12	5.5	908	3.4
Sunfish (<i>Lepomis</i> spp.)	11	5.0	509	1.9
Lake chubsucker (<i>Erimyzon sucetta</i>)	1	0.5	500	1.9
White crappie (<i>Pomoxis annularis</i>)	1	0.5	310	1.2
Catfish (<i>Ictalurus</i> spp.)	19	6.8	278	1.0
Largemouth bass (<i>Micropterus salmoides</i>)	6	2.7	276	1.0
Undetermined	42	18.3	2,432	9.1
Reptiles (total)	48	18.3	4,739	17.7
Florida red-bellied turtle (<i>Pseudemys nelsoni</i>)	17	7.8	2,164	8.1
Florida softshell turtle (<i>Apalone ferox</i>)	3	1.4	601	2.2
Yellow-bellied turtle (<i>Trachemys scripta</i>)	1	0.5	412	1.5
American alligator (<i>Alligator mississippiensis</i>)	1	0.5	765	2.9
Water snake (<i>Nerodia</i> spp.)	7	3.2	275	1.0
Amphibians (Greater siren, <i>Siren lacertina</i>)	4	1.8	801	2.9
Birds (total)	14	17.0	2,555	9.5
Common moorhen (<i>Gallinula chloropus</i>)	5	2.3	1,251	4.7
Anhinga (<i>Anhinga anhinga</i>)	2	0.9	905	3.4
Mammals (total)	7	1.8	1,539	5.7
Opossum (<i>Didelphis marsupialis</i>)	1	0.5	1,350	5.0
Invertebrates (total)	1,879	66.7	1,776	6.6
Crustaceans (total)	346	34.7	1,209	4.5
Crayfish (<i>Procambarus</i> spp.)	136	31.0	1,181	4.4
Snails (total)	1,452	42.0	517	1.9
Apple snail (<i>Pomacea paludosa</i>)	1,442	39.7	513	1.9
Total food	2,164	90.4	26,841	100.0
Plant material	—	39.7	11,001	—
Debris	—	54.3	1,306	—
Empty	—	0.9	—	—
Total contents	—	—	39,148	—

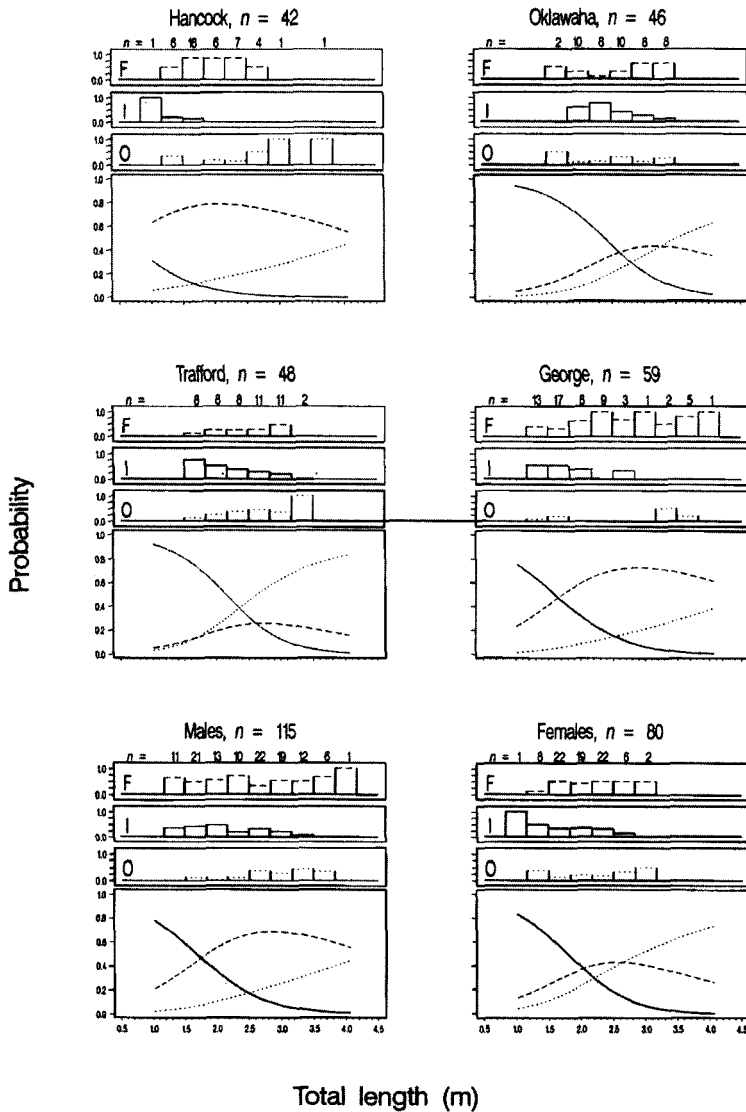


Figure 1. Estimated probability of dominance of stomach contents by invertebrate (solid line), fish (dashed line), or other vertebrate (dotted line) food types, as a function of total length, for American alligators, collected from 4 Florida lakes, 26 August–30 September 1985. Proportion of the sample with the dominant food of a given type indicated by bar charts (I = invertebrate, F = fish, O = other vertebrate), with the sample size indicated for each bar.

Table 3. Pairwise contrasts between sexes of food type dominance probabilities at 3 reference values for total length (TL), for American alligators collected from 4 Florida lakes, 26 August–30 September 1985.

TL (m)	Estimated dominance probability			Variance of difference	P-value
	Male	Female	Difference		
Fish					
1.644	0.4261	0.2856	0.1405	0.00778	0.1111
2.266	0.6209	0.4137	0.2072	0.00828	0.0227
2.889	0.6795	0.4152	0.2643	0.01200	0.0158
Invertebrates					
1.644	0.5130	0.5730	-0.0601	0.00908	0.5283
2.266	0.2409	0.2675	-0.0266	0.00532	0.7152
2.889	0.0850	0.0865	-0.0016	0.00101	0.9609
Other vertebrates					
1.644	0.0609	0.1413	-0.0804	0.00171	0.0516
2.266	0.1382	0.3188	-0.1806	0.00693	0.0300
2.889	0.2355	0.4983	-0.2628	0.01375	0.0251

($P=0.056$), and TL ($P<0.001$), and no interaction terms. Each pair of lakes differed in pattern of food type dominance; however, the difference between lakes Oklawaha and Trafford was not significant ($P=0.081$ for the 2 degree of freedom pairwise contrast testing H_0 : the distribution of dominance probabilities differed between lakes Oklawaha and Trafford; $P<0.01$ for each of the 5 other pairwise lake contrasts).

For both sexes and all lakes except Hancock, estimated dominance probability for the invertebrate food type was large for small alligators and decreased as TL increased (Fig. 1). The dominance probability for the invertebrate food type did not differ between the sexes at any of the reference TL values (Table 3); however, that probability was lower in Lake Hancock than in each of the other lakes at each reference TL value (Table 4).

The dominance probability of the fish food type was consistently high over the sample range of TL for Lake Hancock; however, for both sexes and all lakes except Hancock, the dominance probability for the fish food type was low for small alligators, was largest for alligators of moderate size, and decreased as the dominance probability of the other vertebrate food type increased with size for larger alligators (Fig. 1). The dominance probability for the fish food type was higher for males than for females at TL=2.266 m and TL=2.889 m, but did not differ strongly between sexes at TL=1.644 m (Table 3). The dominance probability for the fish food type was higher in lakes Hancock and George than in lakes Oklawaha and Trafford at each reference TL value (Table 4).

For all lakes and both sexes, the dominance probability for the other vertebrates food type was low for small alligators and increased with TL (Fig. 1). The dominance probability for the other vertebrates food type was higher for females than for males at each TL reference value (Table 3) and did not differ among lakes at TL=1.644 m (Table 4).

Table 4. Pairwise contrasts between lakes of food type dominance probabilities at 3 reference values for total length (TL), for American alligators collected from 4 Florida lakes, 26 August–30 September 1985.

TL (m)	Lake	Estimated dominance probability	P-value for contrast		
			Oklawaha	Trafford	George
Fish					
1.644	Hancock	0.7652	<0.0001	<0.0001	0.0032
	Oklawaha	0.1375		0.8597	0.0002
	Trafford	0.1268			<0.0001
	George	0.4654			
2.266	Hancock	0.7807	<0.0001	<0.0001	0.2145
	Oklawaha	0.2931		0.4687	0.0005
	Trafford	0.2266			<0.0001
	George	0.6634			
2.889	Hancock	0.7278	0.0161	<0.0001	0.9877
	Oklawaha	0.4194		0.1072	0.0052
	Trafford	0.2526			<0.0001
	George	0.7260			
Invertebrates					
1.644	Hancock	0.1220	<0.0001	<0.0001	0.0002
	Oklawaha	0.8191		0.4011	0.0006
	Trafford	0.7505			0.0114
	George	0.4828			
2.266	Hancock	0.0401	<0.0001	<0.0001	0.0042
	Oklawaha	0.5628		0.2704	0.0027
	Trafford	0.4322			0.0459
	George	0.2218			
2.889	Hancock	0.0121	0.0005	0.0103	0.0706
	Oklawaha	0.2595		0.1859	0.0085
	Trafford	0.1552			0.1494
	George	0.0782			
Other vertebrates					
1.644	Hancock	0.1128	0.1611	0.8783	0.2098
	Oklawaha	0.0434		0.0837	0.7811
	Trafford	0.1226			0.1661
	George	0.0518			
2.226	Hancock	0.1792	0.6766	0.1211	0.4140
	Oklawaha	0.1441		0.0254	0.6650
	Trafford	0.3412			0.0113
	George	0.1149			
2.889	Hancock	0.2602	0.6362	0.0089	0.5687
	Oklawaha	0.3211		0.0187	0.2632
	Trafford	0.5922			0.0004
	George	0.1958			

Relationship Between Length and Weight

Seven outliers were detected and removed from the dataset. Type I hypothesis tests from the model (4), and its reverse-order counterpart, gave no evidence of any cubic trend ($P > 0.30$ for each term containing LOGTL * LOGTL * LOGTL in the

Table 5. Pairwise contrasts between lakes of weight (kg) of alligators at given total lengths (TL) for American alligators collected from 4 Florida lakes, 26 August–30 September 1985.

TL (m)	Lake	Predicted weight (kg)	SE ^a	<i>P</i> -value for contrast		
				Oklawaha	Trafford	George
Female						
1.644	Hancock	15.25	0.299	0.0060	0.0003	0.5463
	Oklawaha	13.21	0.637			
	Trafford	13.25	0.440			
	George	15.52	0.346			
2.266	Hancock	43.54	0.851	0.0003	<0.0001	<0.0001
	Oklawaha	38.80	0.976			
	Trafford	38.24	0.834			
	George	51.78	1.137			
2.889	Hancock	109.53	5.872	0.0434	0.0077	0.2602
	Oklawaha	80.59	11.427			
	Trafford	80.41	8.229			
	George	118.63	5.493			
Male						
1.644	Hancock	13.80	0.382	0.5269	0.0019	0.0116
	Oklawaha	14.22	0.556			
	Trafford	12.15	0.362			
	George	14.97	0.245			
2.266	Hancock	46.20	1.500	<0.0001	<0.0001	0.1114
	Oklawaha	39.78	0.660			
	Trafford	36.62	0.784			
	George	49.14	1.030			
2.889	Hancock	108.52	3.932	<0.0001	<0.0001	0.2467
	Oklawaha	89.71	1.121			
	Trafford	82.92	1.375			
	George	113.67	1.917			

a. Computed using the delta method.

models). There was evidence of a dependence of quadric trend on lake-sex combination ($P=0.023$ for the Type 1 hypothesis test for $\text{LOGTL} * \text{LOGTL} * \text{LAKE} * \text{SEX}$). Thus, the final model selected was

$$\ln W_{ijk} = \gamma_{ij} + \beta_{ij} \ln \text{TL}_{ijk} + \eta_{ij} (\ln \text{TL}_{ijk})^2 + \epsilon_{ijk}. \quad (5)$$

No lack of fit was suggested from visual inspection of the smoothed (cubic spline) curve fitted to the raw residuals from model (5) plotted against $\ln \text{TL}$.

Diet and Condition

The condition of alligators in lakes Hancock and George tended to be better than in lakes Oklawaha and Trafford, with those differences becoming stronger with increasing TL (Table 5). Although the ordering of alligator condition did not consistently reflect the ordering according to dominant food type probabilities at given reference lengths, a pattern for some food type-sex combinations was evident. Regression of estimated $\ln(\text{weight})$ on estimated dominance probability for a given food type,

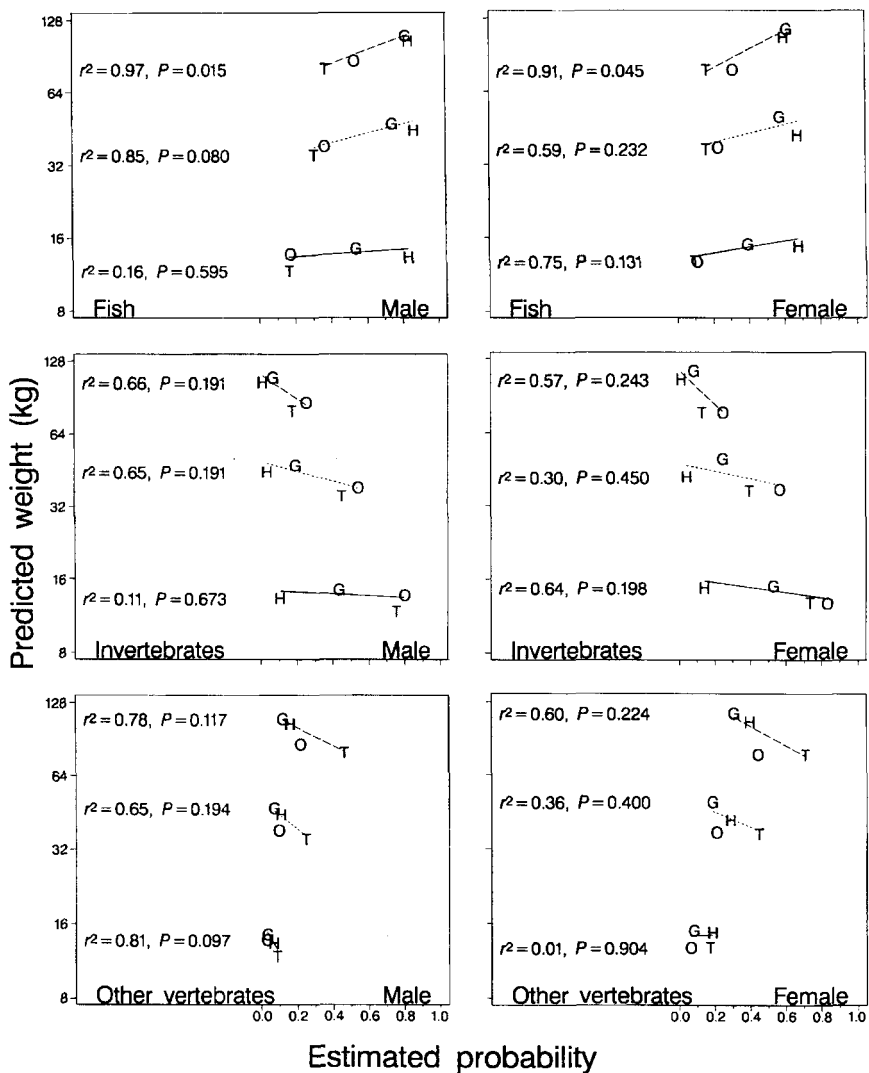


Figure 2. Estimated $\ln(\text{weight})$ regressed on estimated probability that the food type was dominant, at given reference total lengths, for given food type and alligator sex, for American alligators collected from 4 Florida lakes, 26 August–30 September 1985. Plotting symbols for lakes are H = Hancock, O = Oklawaha, T = Trafford, and G = George. Predicted values are indicated by line of long dashes for reference total length 2.889 m, line of short dashes for reference total length 2.266 m, and solid line for reference total length 1.644 m.

performed separately at each reference TL value for each sex, suggested that weight of larger males and females increased with increasing probability of dominance by the fish food type ($P \leq 0.045$) (Fig. 2). No such relationship was evident for the invertebrate food type ($P > 0.191$ for each regression) and only a weak relationship was evident for small males for other vertebrate food type ($P = 0.097$).

Discussion

The wide variety of prey consumed by American alligators in Florida and a transition from invertebrate to vertebrate foods with increase in TL was consistent with other studies (Giles and Childs 1949, Fogarty and Albury 1968, Valentine et al. 1972, Delany and Abercrombie 1986, Taylor 1986, Platt et al. 1990). Dietary differences among locations, sex, and size classes may be related to differences in foraging behavior (Platt and Brantley 1991) and variation in prey species encountered in different habitat types (Delany and Abercrombie 1986). Dodson (1975) related shifts in diet among size classes to ontogenetic skull changes that allow access to larger prey. The relative proportion of some food types used by alligators in Florida also may vary with season (Delany et al. 1988).

Fish, mostly shad, bowfin, and gar, were the most important food by volume. The dominance of fish in the diet was generally low for small alligators, largest for alligators of moderate size, and decreased as the dominance probability of the other vertebrate foods (mostly turtles) increased with the size for large alligators. Because of different digestive rates of food items, fish were probably under-represented in the diet (Delany and Abercrombie 1986). Observations of fish prevalence in the diet differed from samples obtained elsewhere in the species' range where mammals and crustaceans were more available (Taylor 1985, Wolfe et al. 1987, Platt et al. 1990). Fish density has been shown to increase with lake trophic state in Florida lakes (Bachmann et al. 1996). In our study, the fish food type was more likely to be dominant in the 2 study lakes with the highest chlorophyll *a* concentrations (lakes Hancock and George) than in the 2 lakes with the lowest chlorophyll *a* concentrations (lakes Oklawaha and Trafford). The apparent increase in the dietary dominance probability of fish with increasing lake trophic state may be due to increasing availability of fish.

Other vertebrates (reptiles, mammals, birds, and amphibians) constituted a smaller portion of the total food volume. The dominance probability of vertebrates other than fish in the diet was low for small alligators but increased with TL. The other vertebrates food type was more likely to be the predominant diet category for females than for males. Except for amphibians, this food category was probably over-represented in the diet due to their prolonged retention times in stomachs (Delany and Abercrombie 1986). Reptiles (mostly turtles) were the most prevalent prey item in this category. Mammals are infrequent in stomachs sampled in Florida (but see Kinsella 1982); however, they are the predominant food for alligators in coastal marshes of the southeast where nutria (*Myocastor coypys*) and muskrat (*Ondatra zibethicus*) are abundant (Wolfe et al. 1987). Birds and amphibians are usually minor dietary components throughout the alligator's range (reviewed in Wolfe et al. 1987).

Invertebrate remains occurred frequently but constituted only a small portion of the food volume. Crayfish and apple snails accounted for most of this food category, and were probably over-represented because of their persistence in stomachs (Delany and Abercrombie 1986). The diet of alligators >1.22 m TL usually indicates a transition from invertebrates to fish and other vertebrates with increasing TL (Delany 1990, Platt et al. 1990). Invertebrates were more likely to be predominant in the diet of small (1.644 m TL) alligators in lakes Oklawaha and Trafford than those in lakes Hancock and George.

The increased energy requirements of larger crocodylians may be met by switching to larger prey (Thorbjarnarson 1993). If prey species are equally available, alligators selecting the largest items would maximize feeding efficiency (Wolfe et al. 1987). The length-weight relationship of a crocodylian provides a measure of how much food intake exceeds that needed for homeostasis and growth (Taylor 1979), and may indicate habitat quality. Taylor (1979) found that prey consumed and condition of subadult saltwater crocodiles (*Crocodylus porosus*) varied between wetland habitats and salinities. Similarly, Rootes et al. (1991) reported differences in the diet and length-weight relationships of American alligators sampled from estuarine and palustrine wetlands in Louisiana. However, differences in prey species and food volumes consumed by alligators in 3 lakes in north-central Florida were not associated with significant differences in condition (Delany and Abercrombie 1986). In our study, differences in size related shifts in diet by lake were reflected in the weight-length relationship of alligators. For large alligators, increasing probability of dominance by the fish food type was associated with better condition.

Crocodylians exhibit low metabolic demand (Coulson and Hernandez 1983) and high food conversion rates (Webb et al. 1991). However, dietary constraints may limit some populations. Charbreck (1971) associated low food volume with poor nutrition and consequent growth rate reduction in American alligators. Increased growth rates within a population were associated with certain size classes exploiting a previously unavailable food resource (fish) (Delany 1990). Variation in alligator growth rates among populations also may be related to food availability (reviewed by Rootes et al. 1991), and the length of the annual activity/feeding period (reviewed by Wilkinson and Rhodes 1997). Alligators in Everglades National Park have a relatively prolonged feeding period; however, their slow growth rates were attributed to possible food resource limitations, especially during periods of high water level when prey is dispersed (Jacobsen and Kushlan 1989, Dalrymple 1996). Unlike other locations in Florida where fish were the predominant food (Delany and Abercrombie 1986, Delany et al. 1988, this study), Barr (1997) found the diet of alligators in the southern Everglades dominated by water snakes (*Nerodia* sp.) and aquatic salamanders (*Siren* sp. and *Amphiuma* sp.).

Variation in the diet of alligators also may influence egg viability. Nutritional studies (McNease and Joanen 1981, Joanen and McNease 1987) of captive alligators indicated that a diet of mammals rather than fish may improve condition and increase reproductive potential. In contrast, Nobel et al. (1993) related increased fatty acid composition and hatchability of alligator eggs to a maternal diet of marine fish. The

nutritional status of wild alligators may influence clutch size (Jacobsen and Kushlan 1989) and hatching rates (Heinz et al. 1991, Woodward et al. 1993) at some locations in Florida.

Most Florida residents consider the American alligator an important economic, aesthetic, and ecological resource (Hines and Scheaffer 1977), and current management plans are designed to maintain healthy, visible populations (Anon. 1994). Information on factors affecting alligator condition, growth, and reproduction may be helpful in evaluating harvest strategies and conservation efforts. Results from our study support assumptions of food resource limitations for some alligator populations. However, differences in diet among lakes may have been confounded with other factors such as alligator population structure and hunting history that might have affected condition. Although our data suggested an association between the dominance of the fish food type and condition for large alligators, determining causality would be speculative. Information on prey availability and the nutritional requirements of wild alligators is needed to fully assess diet and condition.

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