FISHBYTE
Editor: G. Silvestre

Fisheries Section
of the Network of Tropical Aquaculture
and Fisheries Professionals (NTAFP)

Consumption to Biomass (Q/B) Ratio and Estimates of Q/B-predictor Parameters for Caribbean Fishes

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Abstract

Estimates of the Q/B ratio and parameters of equations to 'predict' Q/B values for 116 fish stocks in the Gulf of Salamanca, Colombia are presented. A compilation of these estimates available for Caribbean Sea fishes (264 stocks) is also provided for comparison purposes. General trends in the value of Q/B resulting from differences in the equation and parameter values used are briefly discussed.

Introduction

Consumption is one of the required input parameters for the construction of Ecopath (trophic) models (Christensen and Pauly 1993). In Ecopath, consumption (Q) of species or groups is expressed relative to their biomass (B) via Q/B. Consumption is the intake of food by a species/group over a time period, usually expressed on an annual basis (Christensen and Pauly 1993). The Q/B ratio has been defined as the number of times a population consumes its own weight in a year (see Pauly 1986).

A number of empirical approaches have been derived for the estimation of Q/B which make use of relatively easy-to-obtain parameters of fish populations (Palomares and Pauly 1989; Pauly 1989; Pauly et al. 1990; Jarre et al. 1991; Palomares and Pauly 1998). The vast majority of published Ecopath models have been constructed using empirically derived Q/B values (see Christensen and Pauly 1993). It is of considerable interest to explore the coherence of published Q/B and Q/B-predictor parameter values for the same species occurring in similar habitats. It is also useful to have a compilation of Q/B values for future use in the construction of Ecopath models. These can be used as input values in cases when local Q/B estimates are unavailable for the species or for comparison purposes. This paper gives a compilation of Q/B and Q/B-predictor parameters for fish stocks caught in the Caribbean, particularly from the Gulf of Salamanca (between latitude 11°00´-11°19´N and longitude 74°12´-74°50´W).

Materials and Methods

Bottom trawl surveys were carried out in the Gulf of Salamanca during different time periods between 1995 and 1998 (García 1999). Demersal fishes were collected, counted, measured and a high proportion of the fish samples was photographed for estimation of the aspect ratio of their caudal fin. Asymptotic weight was obtained from asymptotic length using length-weight relationships (García et al. 1998; Duarte et al. 1999a) in cases where the parameters were available (Duarte et al. 1999b). In other cases asymptotic weight was estimated from maximum sizes caught using the relationship (Pauly 1984):

$$W_\infty = W_{max}/0.86$$

From the photographs, the aspect ratios were estimated using an image-analyzing program developed for the purpose (Matlab 5 software, MathWorks, Inc. 1998). As ambient bottom temperatures at capture were available, mean environmental temperature for each species was computed for use in the predictive equations.

Stomach contents were also studied (Melo 1998; Navajas 1998; Duarte and García 1999a, 1999b; Duarte et al. 1999b; Schiller and García, in press) from which food type was assigned. Following Opitz (1996), the food type values were set based on the proportion of plants in the diet when estimating Q/B.

The study in Gulf of Salamanca resulted in independent Q/B estimates for 116 fish stocks. Q/B values and Q/B-predictor parameters for Caribbean fishes were compiled using Opitz (1996) as the main source, as most other work is not comprehensive or expresses Q/B values for aggregate species (groups) rather than for individual species. This resulted in compilation of parameters for 264 fish stocks. In order to assure comparability, the published Q/B-predictor parameters were used to re-estimate Q/B values of fish stocks obtained from the literature using often Q/B empirical equations.

For estimation of Q/B values, three empirical models were used: (1) Palomares and Pauly (1989); (2) Palomares and Pauly (1998); and (3) Pauly et al. (1990). These are expressed, respectively, in the form:

$$Q/B = 3.06 * W_{\infty}^{-0.2018} * Tc^{0.6121} * A^{0.5156} * 3.53^{HD} \quad \ldots(1)$$

$$Q/B = 10^{(7.964 - 0.204 \log W_{\infty} - 1.965T + 0.083A + 0.532h + 0.398d)} \quad \ldots(2)$$

$$Q/B = 10^{6.37} * 0.0313^{T} * W_{\infty}^{-0.168} * 1.38^{P} * 1.89^{HD} \quad \ldots(3)$$

where: Q/B is the annual food consumption/biomass ratio of each fish population; W_{∞} is the asymptotic weight of the population (wet weight, in g); Tc is the mean annual habitat temperature for the fish population in question (in ^{o}C); T is the mean annual habitat temperature for the fish population expressed as 1,000/(Tc + 273.1); A is the aspect ratio of the caudal fin; HD is the feeding type (0 for carnivores and 1 for herbivores and detritivores); h and d are binary variables for types of food consumed (h=1, d=0 for herbivores; h=0, d=1 for detritivores; h=0, d=0 for carnivores); and P is a feeding type variable (1 for apex and/or pelagic predators and/or zooplankton feeders, and 0 for other feeding types).

These empirical models are described at length in Christensen and Pauly (1992). Model (1) is more often used in the published literature. Model (2) includes more cases and parameters than Model (1). Model (3) is employed for species that do not use their caudal fin as the (main) organ of propulsion and does not have a measure of aspect ratio. Instead, feeding type is used as predictor variable, which may also reflect activity levels of the fish. The transformation of mean habitat temperature suggested by Regier et al. (1990) was used for model (2) and (3).

Results and Discussion

The resulting compilation of Q/B values and Q/B-predictor parameters for fishes with measures of the aspect ratio of the caudal fin are given in Table 1. Table 2, on the other hand, presents the Q/B values and related parameters for fishes without measures of the aspect ratio of the caudal fin.

It is interesting to note that there are differences in the value of Q/B estimates for the same species as a result of using different empirical formulas and in the predictor parameters used (for instance, in aspect ratios). The general trends in the value of Q/B resulting from use of different predictive equations and parameters are discussed in detail below.

It can be noted in Table 1 that there are differences in the measures of aspect ratio for the same species for instance *Haemulon aurolineatum*, *Echeneis naucrates* and several *Lutjanus* species. The differences may be due to the method used in measuring the height and surface area, the type of image (i.e., photograph or drawing), disposition of the caudal fin, and/or a combination of these factors. Palomares and Pauly (1998) provided two conditions to obtain a better estimate of the aspect ratio, i.e., (1) the disposition of the caudal fin in estimation should mimic the disposition during swimming, and (2) the surface area should be calculated extending to the narrowest part of the caudal peduncle.

W_{∞} is another Q/B-predictor parameter that was found to show some variations among the same fish species (see Tables 1 and 2). Although variations in W_{∞} can be due to different ecological conditions and level of exploitation, a significant part of this variation can also be attributed to differences in sampling procedures (including the variation introduced using different estimation methods). The vulnerability of fish to different sampling gears may vary and gears can be selective to a particular size range and hence may influence the W_{∞} estimates based on the size ranges of the collected fish samples. In this regard, it is suggested that the accuracy of W_{∞} estimates should be evaluated before they are used in the empirical models to predict Q/B.

The estimates of Q/B using Model (2) has consistently yielded relatively higher Q/B values (i.e., about 25% higher) when compared with the estimates using empirical Model (1). The empirical model presented in Palomares and Pauly (1998) was based on 108 cases including the 33 cases from Palomares and Pauly (1989). Hence, the empirical equation (Model 2) may be more robust and preferred for use in estimating Q/B values. It is interesting to note that the effect of temperature on Q/B estimates was about two times as strong as the effect of aspect ratio (Palomares and Pauly 1998) however Palomares and Pauly (1989) concluded that aspect ratio alone has explained 50% of the variance of Q/B values.

In terms of the ranking of fish families based on the mean values of Q/B-predictor parameters, the first two columns in Table 3 show the ranking of the fish families in the Caribbean from highly to less active with aspect ratio as a measure of general activity of the fish. For example, Scombrids (which are classified as pelagic fish, with streamlined body shape, and active fishes) showed the highest mean aspect ratio. However, demersal representatives like bonefishes (Albulidae) and ladyfishes (Elopidae) ranked second to scombrids which may indicate that high activity seems not to be confined only to fishes in the pelagic environment. Jarre et al. (1991) mentioned that high values of aspect ratio may also occur among less active and deep-bodied fishes which would use their lobes that are spread apart to assure a stronger propulsive effect instead of caudal fins. This observation is not applicable in the case of Albulidae and Elopidae, which are elongate, but may rather be relevant for several carangid species. In view of this, Pauly (1989) and Jarre et al. (1991) explored the inclusion of other shape-related variables such as body depth and caudal peduncle height in the empirical equations. However, Palomares and Pauly (1998) concluded that such variables have no relation with Q/B once food type and temperature are properly accounted for. In addition, the use of aspect ratio as a Q/B-predictor parameter especially for empirical Models (1) and (2) has been emphasized.

Food type (as a proportion of plants in the diet) showed that species with higher proportion of plants in their diet tend to have higher estimated Q/B values (for example Engaulidae). The ranking according to the proportion of plants in diet (HD) also demonstrates the overwhelming prevalence of carnivores in Caribbean fishes, although a distinction should probably be made between families whose representatives preferentially inhabit seagrasses, benthic algal turfs and coral reefs where plant eating fish families are more common, as compared to pelagic and soft-bottom dwelling families where they tend to be carnivorous. It should be noted however that this trend does not include fishes in their early life stages, which are mainly herbivorous and plankton feeders.

Size distribution has been found to serve as ecological scaling factor that determines trophic energy flow within communities (see Dickie et al. 1987), hence ranking in terms of fish size may provide a rapid assessment of the role of fish families in a given ecosystem. However, larger fish for example family Ginglymostomidae tends to have a lower Q/B as compared to smaller fishes such as Engraulidae.

The compilation also indicates that some Q/B predictor parameters show different effects to estimates of Q/B values (i.e., mean aspect ratio has positive relation to Q/B while mean size have a negative relation to Q/B). For example, Scombridae have a higher mean aspect ratio than Albulidae and Elopidae, but they have a lower mean Q/B estimate than these families because scombrids are on the average much bigger than bonefishes and ladyfishes (see Table 3). This general trend further confirms the conclusion of Palomares and Pauly (1998) that asymptotic weight has a stronger effect on Q/B value than aspect ratio (as a measure of fish activity).

The compilation of Q/B ratio and Q/B-predictor parameters presented here should be useful for construction of Ecopath models particularly in tropical conditions. However, the variations of estimates of Q/B values and the influence of a particular Q/B-predictor parameter for a given fish species is a clear sign that care must be exerted when using the empirical models as well as the Q/B values presented here.

Acknowledgements

This work was financially supported by COLCIENCIAS Grant 2105-09-176-94 and the Instituto de Investigaciones Marinas y Costeras, INVEMAR. Financial support for Luis O. Duarte is given by a Ph.D. scholarship from the Deutscher Akademisher Austau-schdienst (DAAD). We thank C. Moffat at the Department of Oceanography, University of Concepcion, Chile, for his help with image-analyzing software pro-gramming.

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Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text.

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
Acanthuridae	*Acanthurus bahianus*	2.2	28.0	288.0	0.9	0.0	0.9	34.5	39.1	Opitz (1996), Table 3.8
	Acanthurus bahianus	2.4	27.0	232.6	1.0	0.0	1.0	42.9	46.6	This study
	Acanthurus chirurgus	1.8	28.0	820.0	0.9	0.0	0.9	24.8	28.9	Opitz (1996), Table 3.8
	Acanthurus chirurgus	1.9	27.5	1162.8	0.8	0.0	0.8	21.9	24.8	This study
	Acanthurus coeruleus	1.9	28.0	983.0	0.9	0.0	0.9	24.5	28.3	Opitz (1996), Table 3.8
Achiridae	*Achirus lineatus*	1.5	27.2	87.2	0.0	0.0	0.0	11.6	14.2	This study
Albulidae	*Albula nemoptera*	4.4	27.5	662.8	0.0	0.0	0.0	13.5	16.5	This study
	Albula vulpes	5.0	27.3	1046.5	0.0	0.0	0.0	13.0	16.6	This study
Antennariidae	*Antennarius multiocellatus*	1.2	28.0	70.0	0.0	0.0	0.0	11.1	14.6	Opitz (1996), Table 3.8
	Antennarius striatus	0.8	28.0	70.0	0.0	0.0	0.0	8.9	13.5	Opitz (1996), Table 3.8
Apogonidae	*Apogon conklini (Phaeoptyx conklini *)*	1.7	28.0	3.3	0.0	0.0	0.0	24.5	29.9	Opitz (1996), Table 3.8
	Apogon maculatus	1.5	28.0	37.0	0.0	0.0	0.0	14.1	17.6	Opitz (1996), Table 3.8
Ariidae	*Arius felis*	1.9	26.0	343.0	0.0	0.0	0.0	9.7	10.9	Vega-Cendejas et al. (1993), Table 4
	Bagre marinus	1.8	26.7	814.0	0.0	0.0	0.0	8.0	9.3	This study
	Cathorops spixii	1.9	26.0	434.0	0.0	0.0	0.0	9.2	10.4	Vega-Cendejas et al. (1993), Table 4
	Cathorops spixii	2.4	25.7	233.5	0.0	0.0	0.0	11.6	12.7	This study
Atherinidae	*Allanetta harringtonensis*	1.7	28.0	11.0	0.0	0.0	0.0	19.2	23.4	Opitz (1996), Table 3.8
	Atherinomorus stipes	1.9	28.0	16.0	0.0	0.0	0.0	18.6	22.4	Opitz (1996), Table 3.8
Aulostomidae	*Aulostomus maculatus*	1.7	28.0	777.0	0.0	0.0	0.0	8.1	9.8	Opitz (1996), Table 3.8
Balistidae	*Balistes carolinensis*	2.4	28.0	611.0	0.5	0.0	0.5	19.2	21.8	Opitz (1996), Table 3.8
	Balistes carolinensis	1.9	27.1	1223.2	0.0	0.0	0.0	7.6	8.8	This study
	Balistes vetula	2.0	28.0	2586.0	0.1	0.0	0.1	8.0	9.4	Opitz (1996), Table 3.8
	Balistes vetula	2.5	27.0	2441.9	0.0	0.0	0.0	7.7	8.7	This study
	Canthidermis sufflamen	1.7	28.0	4783.0	0.3	0.0	0.3	7.7	9.2	Opitz (1996), Table 3.8
	Melichthys niger	2.3	28.0	960.0	0.8	0.0	0.8	23.3	26.3	Opitz (1996), Table 3.8
Batrachoididae	*Porichthys plectrodon*	0.5	24.0	23.8	0.0	0.0	0.0	8.0	12.9	This study
Belonidae	*Platybelone argalus argalus*	2.7	28.0	150.0	0.0	0.0	0.0	14.1	16.4	Opitz (1996), Table 3.8
	Strongylura notata (Strongylura notata notata)*	1.4	26.0	100.0	0.0	0.0	0.0	10.4	12.6	Abarca-Arenas and Valero-Pacheco (1993), Table 1
	Strongylura timucu	1.7	28.0	110.0	0.0	0.0	0.0	11.9	14.5	Opitz (1996), Table 3.8
	Tylosurus crocodilus (Tylosurus crocodilus crocodilus)*	3.1	28.0	1400.0	0.0	0.0	0.0	9.8	11.4	Opitz (1996), Table 3.8
Blenniidae	*Entomacrodus nigricans*	1.0	28.0	13.0	0.8	0.0	0.8	40.9	55.4	Opitz (1996), Table 3.8
	Ophioblennius atlanticus	0.9	28.0	35.0	0.9	0.0	0.9	32.9	46.0	Opitz (1996), Table 3.8
	Parablennius marmoreus	1.3	28.0	10.0	0.7	0.0	0.7	39.8	50.9	Opitz (1996), Table 3.8
	Scartella cristata	1.2	28.0	27.0	0.9	0.0	0.9	39.5	51.0	Opitz (1996), Table 3.8
Bothidae	*Bothus lunatus*	1.1	28.0	3000.0	0.0	0.0	0.0	4.9	6.6	Opitz (1996), Table 3.8
	Bothus ocellatus	1.5	28.0	180.0	0.0	0.0	0.0	10.2	12.7	Opitz (1996), Table 3.8
Callionymidae	*Diplogrammus pauciradiatus*	0.6	20.0	1.0	0.0	0.0	0.0	14.7	20.5	Pauly (1989), Table 2
Carangidae	*Alectis ciliaris*	4.8	28.0	10700.0	0.0	0.0	0.0	8.1	10.4	Opitz (1996), Table 3.8
	Caranx bartholomei	4.1	28.0	9862.0	0.0	0.0	0.0	7.6	9.1	Opitz (1996), Table 3.8
	Caranx bartholomei	3.2	26.4	2616.3	0.0	0.0	0.0	8.5	9.5	This study
	Caranx crysos	4.2	28.0	2314.0	0.0	0.0	0.0	10.3	12.6	Opitz (1996), Table 3.8
	Caranx crysos	4.1								Jarre et al. (1991), Table 2

Note:
[a] Aspect ratio
[b] Mean habitat temperature
[c] Using Palomares & Pauly 1989 equation
[d] Using Palomares & Pauly 1998 equation
* valid name in FishBase

Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text. *(continued)*

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
	Caranx crysos	3.6	26.7	2558.1	0.0	0.0	0.0	9.0	10.3	This study
	Caranx hippos	3.8	28.0	8490.0	0.0	0.0	0.0	7.5	8.9	Opitz (1996), Table 3.8
	Caranx hippos	3.6	27.4	1511.6	0.0	0.0	0.0	10.2	11.8	This study
	Caranx latus	4.5	28.0	6250.0	0.0	0.0	0.0	8.7	10.9	Opitz (1996), Table 3.8
	Caranx latus	4.3	28.7	337.2	0.0	0.0	0.0	15.7	19.8	This study
	Caranx lugubris	5.5	28.0	6554.0	0.0	0.0	0.0	9.6	13.0	Opitz (1996), Table 3.8
	Caranx ruber	4.5	28.0	3160.0	0.0	0.0	0.0	10.1	12.6	Opitz (1996), Table 3.8
	Caranx ruber	3.9	27.0	3036.0	0.0	0.0	0.0	9.2	10.8	Palomares and Pauly (1989), Table 2
	Chloroscombrus chrysurus	4.1	26.4	388.4	0.0	0.0	0.0	14.1	16.4	This study
	Decapterus macarellus	3.8	28.0	750.0	0.0	0.0	0.0	12.3	14.7	Opitz (1996), Table 3.8
	Decapterus punctatus	3.7	28.0	573.0	0.0	0.0	0.0	12.7	15.1	Opitz (1996), Table 3.8
	Hemicaranx amblyrhyncus	2.3	27.7	965.1	0.0	0.0	0.0	8.9	10.3	This study
	Oligoplites saurus	3.1	28.0	334.0	0.0	0.0	0.0	13.1	15.2	Opitz (1996), Table 3.8
	Oligoplites saurus	3.4	26.0	287.0	0.0	0.0	0.0	13.5	15.0	Abarca-Arenas and Valero-Pacheco (1993), Table 1
	Selar crumenophthalmus	3.5	28.0	1240.0	0.0	0.0	0.0	10.7	12.6	Opitz (1996), Table 3.8
	Selar crumenophthalmus	3.4	26.6	707.3	0.0	0.0	0.0	11.3	12.7	This study
	Selene brownii	3.4	25.6	729.2	0.0	0.0	0.0	11.0	12.0	This study
	Selene setapinnis	3.7	26.8	414.9	0.0	0.0	0.0	13.4	15.5	This study
	Selene vomer	4.2	26.8	997.5	0.0	0.0	0.0	12.0	14.3	This study
	Seriola dumerili	4.5	28.0	80000.0	0.0	0.0	0.0	5.2	6.5	Opitz (1996), Table 3.8
	Seriola rivoliana	3.5	24.7	494.2	0.0	0.0	0.0	11.9	12.9	This study
	Trachinotus carolinus	2.7	27.4	3139.5	0.0	0.0	0.0	7.7	8.7	This study
	Trachinotus falcatus	3.9	28.0	36000.0	0.0	0.0	0.0	5.7	6.8	Opitz (1996), Table 3.8
	Trachinotus falcatus	4.0	26.2	3953.5	0.0	0.0	0.0	8.7	10.0	This study
	Trachinotus goodei	5.0	28.0	3900.0	0.0	0.0	0.0	10.2	13.3	Opitz (1996), Table 3.8
	Trachinotus goodei	4.5	28.1	808.1	0.0	0.0	0.0	13.2	16.5	This study
Chaetodontidae	*Chaetodon aculeatus*	1.9	28.0	19.0	0.0	0.0	0.0	17.8	21.5	Opitz (1996), Table 3.8
	Chaetodon capistratus	2.5	28.0	120.0	0.0	0.0	0.0	14.4	16.8	Opitz (1996), Table 3.8
	Chaetodon capistratus	2.6	26.6	104.7	0.0	0.0	0.0	14.5	16.2	This study
	Chaetodon sedentarius	2.3	28.0	130.0	0.0	0.0	0.0	13.5	15.8	Opitz (1996), Table 3.8
	Chaetodon sedentarius	1.8	27.7	139.5	0.0	0.0	0.0	11.8	14.0	This study
	Chaetodon striatus	2.4	28.0	164.0	0.0	0.0	0.0	13.1	15.3	Opitz (1996), Table 3.8
Cirrhitidae	*Amblycirrhitus pinos*	1.5	28.0	15.0	0.0	0.0	0.0	16.9	21.1	Opitz (1996), Table 3.8
Clinidae	*Labrisomus nuchipinnis*	1.3	28.0	137.0	0.0	0.0	0.0	9.9	12.9	Opitz (1996), Table 3.8
Clupeidae	*Brevoortia patronus*	1.7	25.0	362.0	0.0	0.0	0.0	8.8	9.8	Palomares and Pauly (1989), Table 2
	Harengula clupeola	2.7	28.0	240.0	0.0	0.0	0.0	12.9	14.9	Opitz (1996), Table 3.8
	Harengula humeralis	2.9	28.0	440.0	0.0	0.0	0.0	12.4	14.3	Opitz (1996), Table 3.8
	Harengula jaguana	2.5	26.0	135.0	0.0	0.0	0.0	13.3	14.6	Vega-Cendejas et al. (1993), Table 4
	Jenkinsia lamprotaenia	2.2	28.0	13.0	0.0	0.0	0.0	21.0	24.7	Opitz (1996), Table 3.8
	Ophistonema oglinum	3.1	28.0	730.0	0.0	0.0	0.0	11.2	13.0	Opitz (1996), Table 3.8
	Ophistonema oglinum	2.8	26.0	158.0	0.0	0.0	0.0	13.7	15.0	Vega-Cendejas et al. (1993), Table 4
	Opisthonema oglinum	2.4	27.5	222.1	0.0	0.0	0.0	12.3	14.1	This study
	Pellona harroweri	1.6	26.7	81.4	0.0	0.0	0.0	12.2	14.4	This study
Coryphaenidae	*Coryphaena hippurus*	2.4								Jarre et al. (1991), Table 2
	Coryphaena hippurus	3.3	25.0	147000.0	0.0	0.0	0.0	3.7	3.9	Palomares and Pauly (1989)
Dactylopteridae	*Dactylopterus volitans*	1.6	28.0	1825.0	0.0	0.0	0.0	6.6	8.1	Opitz (1996), Table 3.8
	Dactylopterus volitans	1.6	25.7	139.5	0.0	0.0	0.0	10.5	12.1	This study
Diodontidae	*Cyclichthys antennatus*	1.4	28.0	1420.0	0.0	0.0	0.0	6.5	8.2	Opitz (1996), Table 3.8
	Cyclichthys schoepfi	0.9								Jarre et al. (1991), Table 2
	Diodon holocanthus	1.4	28.0	11300.0	0.0	0.0	0.0	4.2	5.3	Opitz (1996), Table 3.8
	Diodon holocanthus	1.6	27.4	1005.8	0.0	0.0	0.0	7.4	8.9	This study
	Diodon hystrix	1.1	28.0	18446.0	0.0	0.0	0.0	3.4	4.6	Opitz (1996), Table 3.8
Echeneidae	*Echeneis naucrates*	1.1	28.0	2080.0	0.0	0.0	0.0	5.3	7.1	Opitz (1996), Table 3.8

Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text. (continued)

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
	Echeneis naucrates	0.8								Jarre et al. (1991), Table 2
	Echeneis naucrates	1.5	26.5	872.1	0.0	0.0	0.0	7.0	8.4	This study
	Remora remora	1.6	28.0	1700.0	0.0	0.0	0.0	6.7	8.2	Opitz (1996), Table 3.8
Elopidae	*Elops saurus*	3.4	28.0	444.0	0.0	0.0	0.0	12.9	15.2	Opitz (1996), Table 3.8
	Elops saurus	4.7	28.2	930.2	0.0	0.0	0.0	13.2	16.9	This study
Emmelichthyidae	*Inermia vittata*	2.9	28.0	282.0	0.0	0.0	0.0	13.1	15.2	Opitz (1996), Table 3.8
Engraulidae	*Anchoa lyolepis*	1.8	28.0	8.0	1.0	0.0	1.0	73.3	85.8	Opitz (1996), Table 3.8
Ephippidae	*Chaetodipterus faber*	3.1	28.0	9000.0	0.1	0.0	0.1	7.3	8.5	Opitz (1996), Table 3.8
	Chaetodipterus faber	2.7	27.0	1207.3	0.1	0.0	0.1	10.5	11.8	This study
Fistulariidae	*Fistularia tabacaria*	1.7	28.0	10800.0	0.0	0.0	0.0	4.7	5.7	Opitz (1996), Table 3.8
	Fistularia tabacaria	1.3	27.4	529.1	0.0	0.0	0.0	7.5	9.5	This study
	Fistularia petimba	1.3	27.0	465.0	0.0	0.0	0.0	7.6	9.6	This study
Gerreidae	*Diapterus auratus*	2.7	26.0	99.0	0.0	0.0	0.0	15.0	16.4	Abarca-Arenas and Valero-Pacheco (1993), Table 1
	Diapterus auratus	3.2	27.6	581.4	0.0	0.0	0.0	11.8	13.6	This study
	Diapterus rhombeus	1.7	28.0	151.2	0.0	0.0	0.0	11.4	13.8	This study
	Eucinostomus argenteus	1.9	28.0	290.0	0.0	0.0	0.0	10.5	12.5	Opitz (1996), Table 3.8
	Eucinostomus argenteus	3.5	26.0	29.0	0.0	0.0	0.0	21.6	24.2	Vega-Cendejas et al. (1993), Table 4
	Eucinistomus argenteus	2.4	25.9	235.7	0.0	0.0	0.0	11.7	12.8	This study
	Eucinostomus gula	2.8	26.0	14.0	0.0	0.0	0.0	22.5	24.8	Vega-Cendejas et al. (1993), Table 4
	Eucinostomus gula	2.2	26.8	278.0	0.0	0.0	0.0	11.1	12.5	This study
	Eugerres plumieri	2.4	26.1	504.3	0.0	0.0	0.0	10.2	11.2	This study
	Gerres cinereus	3.9	28.0	690.0	0.0	0.0	0.0	12.7	15.3	Opitz (1996), Table 3.8
	Gerres cinereus	2.9	26.5	511.6	0.0	0.0	0.0	11.2	12.4	This study
Gobiidae	*Coryphopterus glaucofraenum*	1.1	28.0	10.5	0.4	0.0	0.4	26.9	36.0	Opitz (1996), Table 3.8
	Gnatholepis thompsoni	1.0	28.0	4.1	0.7	0.0	0.7	39.3	54.9	Opitz (1996), Table 3.8
	Gobiosoma evelynae	0.8	28.0	2.2	0.0	0.0	0.0	17.8	27.2	Opitz (1996), Table 3.8
Grammidae	*Gramma loreto*	1.1	28.0	15.0	0.0	0.0	0.0	14.5	19.6	Opitz (1996), Table 3.8
	Gramma melacara	1.4	28.0	30.0	0.0	0.0	0.0	13.9	17.8	Opitz (1996), Table 3.8
Grammistidae	*Rypticus saponaceus*	1.4	28.0	685.0	0.0	0.0	0.0	7.4	9.4	Opitz (1996), Table 3.8
Haemulidae	*Anisotremus surinamensis*	2.7	28.0	4770.0	0.0	0.0	0.0	7.1	8.1	Opitz (1996), Table 3.8
	Anisotremus surinamensis	2.8	26.4	2325.6	0.0	0.0	0.0	8.1	8.9	This study
	Anisotremus virginicus	2.8	28.0	850.0	0.0	0.0	0.0	10.3	11.9	Opitz (1996), Table 3.8
	Anisotremus virginicus	1.9	27.0	523.3	0.0	0.0	0.0	9.1	10.5	This study
	Conodon nobilis	1.2	25.8	1027.9	0.0	0.0	0.0	6.1	7.6	This study
	Haemulon album	2.8	28.0	5300.0	0.0	0.0	0.0	7.0	8.1	Opitz (1996), Table 3.8
	Haemulon album	2.3	26.9	1133.7	0.0	0.0	0.0	8.5	9.6	This study
	Haemulon aurolineatum	2.4	28.0	188.0	0.0	0.0	0.0	13.0	15.1	Opitz (1996), Table 3.8
	Haemulon aurolineatum	5.7	23.0	436.0	0.0	0.0	0.0	15.0	18.3	Pauly (1989), Table 2
	Haemulon aurolineatum	2.1	26.3	424.4	0.0	0.0	0.0	9.7	10.9	This study
	Haemulon bonariense	2.5	28.0	385.0	0.0	0.0	0.0	11.2	13.0	Opitz (1996), Table 3.8
	Haemulon carbonarium	2.8	28.0	861.0	0.0	0.0	0.0	10.3	11.9	Opitz (1996), Table 3.8
	Haemulon carbonarium	2.5	28.4	441.9	0.0	0.0	0.0	11.2	13.1	This study
	Haemulon chrysargyreum	2.6	28.0	251.0	0.0	0.0	0.0	12.6	14.6	Opitz (1996), Table 3.8
	Haemulon chrysargerium	1.6	28.0	139.5	0.0	0.0	0.0	11.0	13.6	This study
	Haemulon flavolineatum	2.5	28.0	480.0	0.0	0.0	0.0	10.8	12.5	Opitz (1996), Table 3.8
	Haemulon flavolineatum	3.9	23.0	136.0	0.0	0.0	0.0	15.6	16.5	Pauly (1989), Table 2
	Haemulon macrostomum (Haemulon macrostoma)*	2.7	28.0	1795.0	0.0	0.0	0.0	8.6	10.0	Opitz (1996), Table 3.8
	Haemulon melanurum	1.8	28.0	427.0	0.0	0.0	0.0	9.4	11.2	Opitz (1996), Table 3.8
	Haemulon melanurum	1.7	28.0	383.7	0.0	0.0	0.0	9.3	11.3	This study
	*Haemulon parrai (H.parra *)*	2.5	28.0	1265.0	0.0	0.0	0.0	9.0	10.4	Opitz (1996), Table 3.8
	Haemulon plumieri	2.9	28.0	1360.0	0.0	0.0	0.0	9.4	10.9	Opitz (1996), Table 3.8
	Haemulos plumieri	2.4	26.0	616.0	0.0	0.0	0.0	9.7	10.6	Vega-Cendejas et al. (1993), Table 4

Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text. (continued)

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
	Haemulon plumieri	2.6	27.5	581.4	0.0	0.0	0.0	10.6	12.1	This study
	Haemulon sciurus	2.5	28.0	1185.0	0.0	0.0	0.0	9.0	10.4	Opitz (1996), Table 3.8
	Haemulon sciurus	3.0	23.0	920.0	0.0	0.0	0.0	9.3	9.4	Pauly (1989), Table 2
	Haemulon steindachneri	2.0	28.0	360.0	0.0	0.0	0.0	10.3	12.2	Opitz (1996), Table 3.8
	Haemulon steindachneri	2.0	26.9	833.1	0.0	0.0	0.0	8.4	9.6	This study
	Haemulon striatum	1.8	28.0	400.0	0.0	0.0	0.0	9.6	11.5	Opitz (1996), Table 3.8
	Orthopristis chrysoptera	2.5	28.0	900.0	0.0	0.0	0.0	9.5	11.0	Opitz (1996), Table 3.8
	Orthopristis chrysoptera	1.8	26.0	249.0	0.0	0.0	0.0	9.9	11.3	Vega-Cendejas et al. (1993), Table 4
	Orthopristis ruber	2.5	28.0	330.0	0.0	0.0	0.0	11.6	13.5	Opitz (1996), Table 3.8
	Pomadasys corvinaeformis	1.3	25.8	249.7	0.0	0.0	0.0	8.5	10.3	This study
Hemiramphidae	*Hemiramphus balao*	2.7	28.0	614.0	0.0	0.0	0.0	10.8	12.5	Opitz (1996), Table 3.8
	Hemiramphus brasiliensis	3.2	28.0	298.0	0.8	0.0	0.8	37.9	43.0	Opitz (1996), Table 3.8
Holocentridae	*Holocentrus ascensionis*	2.6	28.0	838.0	0.0	0.0	0.0	10.0	11.5	Opitz (1996), Table 3.8
	Holocentrus ascencionis	2.3	27.1	395.4	0.0	0.0	0.0	10.5	12.0	This study
	Holocentrus coruscus	3.0	28.0	57.0	0.0	0.0	0.0	18.4	21.5	Opitz (1996), Table 3.8
	Holocentrus rufus	2.2	28.0	583.0	0.0	0.0	0.0	9.8	11.5	Opitz (1996), Table 3.8
	Myripristis jacobus	2.5	28.0	397.0	0.0	0.0	0.0	11.2	13.0	Opitz (1996), Table 3.8
	Myripristis jacobus	1.9	23.9	220.9	0.0	0.0	0.0	10.0	10.7	This study
	Neoniphon marianus	3.0	28.0	163.0	0.0	0.0	0.0	14.9	17.3	Opitz (1996), Table 3.8
	Plectrypops retrospinis	1.7	28.0	57.0	0.0	0.0	0.0	13.8	16.8	Opitz (1996), Table 3.8
	Sargocentron vexillarium	2.7	28.0	181.0	0.0	0.0	0.0	13.6	15.8	Opitz (1996), Table 3.8
Kyphosidae	*Kyphosus incisor*	2.8	28.0	6122.0	1.0	0.0	1.0	24.4	27.1	Opitz (1996), Table 3.8
	Kyphosus sectatrix	2.9	28.0	9139.0	1.0	0.0	1.0	22.8	25.3	Opitz (1996), Table 3.8
Labridae	*Bodianus rufus*	1.2	28.0	1560.0	0.0	0.0	0.0	5.9	7.7	Opitz (1996), Table 3.8
	Clepticus parrae	1.8	28.0	447.0	0.0	0.0	0.0	9.4	11.2	Opitz (1996), Table 3.8
	Halichoeres bivittatus	1.3	28.0	230.0	0.0	0.0	0.0	8.9	11.6	Opitz (1996), Table 3.8
	Halichoeres maculipinna	1.3	28.0	25.0	0.0	0.0	0.0	13.8	18.1	Opitz (1996), Table 3.8
	Halichoeres poeyi	1.2	28.0	150.0	0.0	0.0	0.0	9.4	12.4	Opitz (1996), Table 3.8
	Halichoeres radiatus	1.6	28.0	2283.0	0.0	0.0	0.0	6.3	7.7	Opitz (1996), Table 3.8
	Lachnolaimus maximus	1.5	28.0	7728.0	0.0	0.0	0.0	4.8	5.9	Opitz (1996), Table 3.8
	Thalassoma bifasciatum	1.1	28.0	97.0	0.0	0.0	0.0	9.7	13.3	Opitz (1996), Table 3.8
	Xyrichtys novacula	1.5	28.0	230.0	0.0	0.0	0.0	9.6	12.0	Opitz (1996), Table 3.8
	Xyrichtys splendens	1.5	28.0	50.0	0.0	0.0	0.0	13.1	16.4	Opitz (1996), Table 3.8
Lutjanidae	*Lutjanus analis*	2.1	28.0	5511.0	0.0	0.0	0.0	6.0	7.0	Opitz (1996), Table 3.8
	Lutjanus analis	1.8	26.7	12957.0	0.0	0.0	0.0	4.5	5.2	This study
	Lutjanus apodus	2.0	28.0	3502.0	0.0	0.0	0.0	6.5	7.6	Opitz (1996), Table 3.8
	Lutjanus apodus	0.5	26.5	1337.2	0.0	0.0	0.0	3.8	6.5	This study
	Lutjanus bucanella (*L. buccanella**)	1.3	27.0	34.9	0.0	0.0	0.0	12.6	16.0	This study
	Lutjanus campechanus	1.4	28.0	18000.0	0.0	0.0	0.0	3.9	4.9	Opitz (1996), Table 3.8
	Lutjanus campechanus	1.4	20.0	13000.0	0.0	0.0	0.0	3.4	3.5	Palomares and Pauly (1989), Table 2
	Lutjanus cyanopterus	2.2	28.0	70000.0	0.0	0.0	0.0	3.7	4.3	Opitz (1996), Table 3.8
	Lutjanus cyanopterus	0.9	26.3	1058.1	0.0	0.0	0.0	5.3	7.2	This study
	Lutjanus griseus	2.1	28.0	1590.0	0.0	0.0	0.0	7.7	9.1	Opitz (1996), Table 3.8
	Lutjanus griseus	1.5	25.8	1802.3	0.0	0.0	0.0	6.1	7.1	This study
	Lutjanus jocu	2.1	28.0	13380.0	0.0	0.0	0.0	5.0	5.9	Opitz (1996), Table 3.8
	Lutjanus jocu	1.4	26.9	7441.9	0.0	0.0	0.0	4.5	5.5	This study
	Lutjanus mahogoni	2.1	28.0	980.0	0.0	0.0	0.0	8.5	10.0	Opitz (1996), Table 3.8
	Lutjanus mahogoni	1.9	26.8	372.1	0.0	0.0	0.0	9.8	11.2	This study
	Lutjanus synagris	2.0	28.0	1213.0	0.0	0.0	0.0	8.0	9.4	Opitz (1996), Table 3.8
	Lutjanus synagris	1.5	27.7	1352.3	0.0	0.0	0.0	6.7	8.3	This study
	Lutjanus vivanus	1.4	27.1	872.1	0.0	0.0	0.0	7.1	8.7	This study
	Ocyurus chrysurus	3.0	28.0	3570.0	0.0	0.0	0.0	7.9	9.1	Opitz (1996), Table 3.8
	Pristipomoides aquilonaris	1.6	25.2	310.3	0.0	0.0	0.0	8.9	10.1	This study
	Pristipomoides macrophthalmus	1.6	28.0	441.9	0.0	0.0	0.0	8.8	10.8	This study
	Rhomboplites aurorubens	2.4	26.6	581.4	0.0	0.0	0.0	9.9	11.0	This study
Malacanthidae	*Malacanthus plumieri*	1.4	28.0	1126.0	0.0	0.0	0.0	6.8	8.6	Opitz (1996), Table 3.8
	Caulolatilus guppyi	1.6	28.0	488.4	0.0	0.0	0.0	8.6	10.5	This study

Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text. (continued)

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
Megalopidae	*Megalops atlanticus*	3.0	28.0	160000.0	0.0	0.0	0.0	3.7	4.2	Opitz (1996), Table 3.8
	Megalops atlanticus	2.8	27.6	1064.0	0.0	0.0	0.0	9.7	11.1	This study
Monacanthidae	*Aluterus monoceros*	1.7	28.0	2500.0	0.5	0.0	0.5	12.0	14.2	Opitz (1996), Table 3.8
	Aluterus monoceros	1.2	27.8	1512.6	0.4	0.0	0.4	9.0	11.7	This study
	Aluterus schoepfii	0.7	28.0	1892.0	1.0	0.0	1.0	15.1	22.7	Opitz (1996), Table 3.8
	Aluterus scriptus	0.7	28.0	2941.0	0.4	0.0	0.4	6.8	10.5	Opitz (1996), Table 3.8
	Cantherihes macrocerus	1.5	28.0	2700.0	0.3	0.0	0.3	8.4	10.3	Opitz (1996), Table 3.8
	Cantherihes pullus	1.5	28.0	220.0	0.4	0.0	0.4	16.4	20.3	Opitz (1996), Table 3.8
	Monacanthus ciliatus	1.2	28.0	448.0	0.3	0.0	0.3	11.8	15.2	Opitz (1996), Table 3.8
	Monacanthus tuckeri	1.4	28.0	24.0	0.3	0.0	0.3	21.5	27.3	Opitz (1996), Table 3.8
	Stephanolepis settifer (s. hispidus)*	0.9	28.0	133.7	0.0	0.0	0.0	8.2	12.0	This study
Mugilidae	*Mugil curema*	2.7	28.0	767.0	1.0	0.0	1.0	36.4	40.6	Opitz (1996), Table 3.8
	Mugil curema	1.8	26.0	2400.0	1.0	0.0	1.0	22.6	24.6	Abarca-Arenas and Valero-Pacheco (1993), Table 1
	Mugil cephalus	1.4								Jarre et al. (1991), Table 2
Mullidae	*Mulloidichthys martinicus*	2.3	28.0	440.0	0.0	0.0	0.0	10.5	12.2	Opitz (1996), Table 3.8
	Pseudupeneus maculatus	2.3	28.0	393.0	0.0	0.0	0.0	10.8	12.6	Opitz (1996), Table 3.8
	Pseudupeneus maculatus	1.6	26.3	331.4	0.0	0.0	0.0	9.1	10.5	This study
	Upeneus parvus	2.0	25.5	151.2	0.0	0.0	0.0	11.5	12.7	This study
Myctophidae	*Myctophum asperum*	1.3	25.0	8.0	0.0	0.0	0.0	16.4	19.7	Palomares and Pauly (1989), Table 2
	Diaphus dumerilii	0.6	23.9	3.4	0.0	0.0	0.0	13.1	19.6	This study
Ogcocephalidae	*Ogcocephalus nasutus*	0.5	26.2	348.8	0.1	0.0	0.1	5.8	9.7	This study
Opistognathidae	*Opistognathus aurifrons*	0.8	28.0	30.0	0.0	0.0	0.0	10.8	16.1	Opitz (1996), Table 3.8
	Opistognathus macrognathus	1.1	28.0	240.0	0.0	0.0	0.0	8.3	11.2	Opitz (1996), Table 3.8
	Opistognathus whitehurstii	0.8	28.0	65.0	0.0	0.0	0.0	9.1	13.7	Opitz (1996), Table 3.8
	Opistognathus maxillosus	0.8	28.0	15.0	0.0	0.0	0.0	11.8	18.3	Opitz (1996), Table 3.8
Ostraciidae	*Latophrys polygonius*	1.2	28.0	2200.0	0.0	0.0	0.0	5.4	7.1	Opitz (1996), Table 3.8
	Lactophrys polygonius	1.6	27.4	1264.4	0.6	0.0	0.6	14.8	17.4	This study
	Lactophrys quadricornis (Acanthostracion quadricornis)*	1.1	28.0	3050.0	0.1	0.0	0.1	5.7	7.5	Opitz (1996), Table 3.8
	Lactophrys quadricornis (Acanthostracion quadricornis)*	1.5	26.0	296.0	0.0	0.0	0.0	8.8	10.4	Vega-Cendejas et al. (1993), Table 4
	Lactophrys quadricornis (Acanthostracion quadricornis)*	1.4	27.2	482.6	0.7	0.0	0.7	18.5	22.2	This study
	Lactophrys bicaudalis	1.2	28.0	5572.0	0.2	0.0	0.2	5.5	7.2	Opitz (1996), Table 3.8
	Lactophrys bicaudalis	0.8	27.1	732.6	0.0	0.0	0.0	5.3	7.9	This study
	Lactophrys trigonus	1.9	28.0	3052.0	0.1	0.0	0.1	7.1	8.4	Opitz (1996), Table 3.8
	Lactophrys triqueter	2.0	28.0	1394.0	0.0	0.0	0.0	8.0	9.4	Opitz (1996), Table 3.8
Paralichthyidae	*Syacium gunteri*	1.1	26.9	40.7	0.0	0.0	0.0	11.4	15.0	This study
	Syacium micrurum	0.8	26.3	127.9	0.0	0.0	0.0	7.8	11.0	This study
Pempheridae	*Pempheris schomburgki*	2.3	28.0	100.0	0.0	0.0	0.0	14.2	16.6	Opitz (1996), Table 3.8
Pomacanthidae	*Centropyge argi*	1.4	28.0	10.0	0.8	0.0	0.8	45.9	56.7	Opitz (1996), Table 3.8
	Holacanthus ciliaris	1.3	28.0	1988.0	0.0	0.0	0.0	5.9	7.7	Opitz (1996), Table 3.8
	Holacanthus tricolor	1.7	28.0	1306.0	0.0	0.0	0.0	7.3	8.8	Opitz (1996), Table 3.8
	Pomacanthus arcuatus	2.9	28.0	12407.0	0.1	0.0	0.1	6.7	7.7	Opitz (1996), Table 3.8
	Pomacanthus arcuatus	2.5	26.6	1046.5	0.1	0.0	0.1	9.9	11.0	This study
	Pomacanthus paru	1.8	28.0	2229.0	0.1	0.0	0.1	7.9	9.4	Opitz (1996), Table 3.8
	Pomacanthus paru	1.8	26.7	3488.4	1.0	0.0	1.0	19.8	22.1	This study
Polynemidae	*Polydactilus virginicus*	1.8	26.6	273.3	0.0	0.0	0.0	10.0	11.6	This study
Pomacentridae	*Abudefduf saxatilis*	3.0	28.0	483.0	0.1	0.0	0.1	13.3	15.4	Opitz (1996), Table 3.8
	Abudefduf taurus	2.0	28.0	900.0	0.9	0.0	0.9	28.0	31.9	Opitz (1996), Table 3.8

Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text. (continued)

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
	Chromis cyanea	1.8	28.0	93.0	0.0	0.0	0.0	12.7	15.3	Opitz (1996), Table 3.8
	Chromis multilineata	1.8	28.0	339.0	0.0	0.0	0.0	9.8	11.8	Opitz (1996), Table 3.8
	Microspathodon chrysurus	1.9	28.0	412.0	0.8	0.0	0.8	25.9	30.0	Opitz (1996), Table 3.8
	Stegastes fuscus	1.8	28.0	168.0	0.5	0.0	0.5	21.7	25.6	Opitz (1996), Table 3.8
	Stegastes leucostictus	1.3	28.0	50.0	0.2	0.0	0.2	15.8	20.3	Opitz (1996), Table 3.8
	Stegastes planifrons	1.4	28.0	68.0	0.3	0.0	0.3	16.2	20.5	Opitz (1996), Table 3.8
	Stegastes variabilis	1.5	28.0	54.0	0.5	0.0	0.5	23.2	28.4	Opitz (1996), Table 3.8
Priacanthidae	*Heteropriacanthus cruentatus*	1.8	28.0	700.0	0.0	0.0	0.0	8.5	10.2	Opitz (1996), Table 3.8
	Priacanthus arenatus	1.8	28.0	1653.0	0.0	0.0	0.0	7.2	8.6	Opitz (1996), Table 3.8
	Priacanthus arenatus	1.9	27.9	767.4	0.0	0.0	0.0	8.6	10.1	This study
Rachycentridae	*Rachycentron canadum*	1.6	28.0	33400.0	0.0	0.0	0.0	3.6	4.4	Opitz (1996), Table 3.8
Scaridae	*Scarus coelestinus*	1.1	28.0	8556.0	1.0	0.0	1.0	13.6	17.8	Opitz (1996), Table 3.8
	Scarus coeruleus	1.5	28.0	3720.0	1.0	0.0	1.0	19.3	23.2	Opitz (1996), Table 3.8
	Scarus guacamaia	1.2	28.0	23000.0	1.0	0.0	1.0	12.0	15.1	Opitz (1996), Table 3.8
	Scarus iserti	1.4	28.0	141.0	1.0	0.0	1.0	36.9	44.9	Opitz (1996), Table 3.8
	Scarus taeniopterus	1.1	28.0	1102.0	1.0	0.0	1.0	20.9	27.3	Opitz (1996), Table 3.8
	Scarus vetula	1.1	28.0	5558.0	1.0	0.0	1.0	14.4	19.0	Opitz (1996), Table 3.8
	Sparisoma aurofrenatum	1.3	28.0	324.0	1.0	0.0	1.0	29.6	36.6	Opitz (1996), Table 3.8
	Sparisoma chrysopterum	1.4	28.0	1510.0	1.0	0.0	1.0	22.9	27.7	Opitz (1996), Table 3.8
	Sparisoma radians	1.3	28.0	150.0	1.0	0.0	1.0	34.0	42.8	Opitz (1996), Table 3.8
	Sparisoma rubripinne	1.5	28.0	2734.0	1.0	0.0	1.0	20.8	24.8	Opitz (1996), Table 3.8
	Sparisoma rubripinne	0.9	26.4	535.0	1.0	0.0	1.0	21.7	28.6	This study
	Sparisoma viride	1.4	28.0	2430.0	1.0	0.0	1.0	20.7	25.1	Opitz (1996), Table 3.8
Sciaenidae	*Bairdiella chrysoura*	1.9	26.0	178.0	0.0	0.0	0.0	11.0	12.4	Vega-Cendejas et al. (1993), Table 4
	Ctenosciaena graciliirrhus	0.8	26.5	58.7	0.0	0.0	0.0	9.1	13.0	This study
	Cynoscion jamaicensis	1.1	26.7	267.4	0.0	0.0	0.0	7.7	10.1	This study
	Equetus lanceolatus	1.0	28.0	325.0	0.0	0.0	0.0	7.2	10.2	Opitz (1996), Table 3.8
	Equetus punctatus	1.3	28.0	460.0	0.0	0.0	0.0	7.7	10.0	Opitz (1996), Table 3.8
	Larimus breviceps	1.0	25.0	424.8	0.0	0.0	0.0	6.4	8.3	This study
	Menticirrhus americanus	1.4	27.0	226.7	0.0	0.0	0.0	9.1	11.3	This study
	Menticirrhus littoralis	1.1	24.2	383.7	0.0	0.0	0.0	6.7	8.3	This study
	Micropogonias furnieri	1.5	26.4	1027.4	0.0	0.0	0.0	6.8	8.2	This study
	Odontoscion dentex	1.7	28.0	318.0	0.0	0.0	0.0	9.6	11.7	Opitz (1996), Table 3.8
	Pareques acuminatus	1.3	28.0	280.0	0.0	0.0	0.0	8.8	11.2	Opitz (1996), Table 3.8
	Umbrina broussonnetii	1.3	27.0	236.7	0.0	0.0	0.0	8.8	11.0	This study
	Umbrina coroides	1.2	26.5	304.4	0.0	0.0	0.0	7.8	9.9	This study
	Umbrina millae	1.0	28.6	308.1	0.0	0.0	0.0	7.6	10.7	This study
Scombridae	*Euthynnus aletteratus*	6.3	28.0	12200.0	0.0	0.0	0.0	9.1	13.4	Opitz (1996), Table 3.8
	Euthynnus aletteratus	5.8								Jarre et al. (1991), Table 2
	Scomberomorus cavalla	6.3	28.0	34285.0	0.0	0.0	0.0	7.4	10.9	Opitz (1996), Table 3.8
	Scomberomorus cavalla	4.3	28.0							This study
	Scomberomorus brasiliensis	4.2	27.8	2220.9	0.0	0.0	0.0	10.4	12.7	This study
	Scomberomorus maculatus	4.9	28.0	4800.0	0.0	0.0	0.0	9.6	12.4	Opitz (1996), Table 3.8
	Scomberomorus maculatus	3.4								Jarre et al. (1991), Table 2
	Scomberomorus regalis	6.2	28.0	4900.0	0.0	0.0	0.0	10.8	15.8	Opitz (1996), Table 3.8
	Thunnus albacares	9.3	24.0	81920.0	0.0	0.0	0.0	6.9	13.1	Palomares and Pauly (1989), Table 2
Scorpaenidae	*Scorpaena brasiliensis*	1.0	28.0	1600.0	0.0	0.0	0.0	5.4	7.4	Opitz (1996), Table 3.8
	Scorpaena grandicornis	1.0	28.0	212.0	0.0	0.0	0.0	8.1	11.2	Opitz (1996), Table 3.8
	Scopaena plumieri (s. plumieri plumieri)*	1.0	28.0	4330.0	0.0	0.0	0.0	4.3	6.0	Opitz (1996), Table 3.8
	Scorpaena plumieri (s. plumieri plumieri)*	0.9	27.3	895.4	0.0	0.0	0.0	5.6	7.9	This study
Serranidae	*Alphestes afer*	1.2	28.0	1202.0	0.0	0.0	0.0	6.2	8.1	Opitz (1996), Table 3.8
	Alphestes afer	0.9	28.0	203.5	0.0	0.0	0.0	7.8	11.1	This study
	Cephalopholis cruentata	1.2	28.0	691.0	0.0	0.0	0.0	7.0	9.2	Opitz (1996), Table 3.8
	Cephalopholis fulva	1.5	28.0	640.0	0.0	0.0	0.0	7.8	9.7	Opitz (1996), Table 3.8
	Dermatolepis inermis	1.5	28.0	10513.0	0.0	0.0	0.0	4.5	5.5	Opitz (1996), Table 3.8

Table 1. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. For symbols see text. (continued)

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Source
	Diplectrum formosum	1.5	28.0	550.0	0.0	0.0	0.0	8.1	10.1	Opitz (1996), Table 3.8
	Epinephelus adscensionis	1.5	28.0	1981.0	0.0	0.0	0.0	6.3	7.8	Opitz (1996), Table 3.8
	Epinephelus guttatus	1.0	28.0	2919.0	0.0	0.0	0.0	4.8	6.6	Opitz (1996), Table 3.8
	Epinephelus guttatus	1.4	28.0	1880.0	0.0	0.0	0.0	6.2	7.8	Palomares and Pauly (1989), Table 2
	Epinephelus itajara	1.3	28.0	381644.0	0.0	0.0	0.0	2.0	2.6	Opitz (1996), Table 3.8
	Epinephelus itajara	1.1	28.0	814.0	0.0	0.0	0.0	6.4	8.6	This study
	Epinephelus morio	1.5	28.0	5010.0	0.0	0.0	0.0	5.1	6.4	Opitz (1996), Table 3.8
	Epinephelus niveatus	1.5	23.9	244.2	0.0	0.0	0.0	8.8	9.8	This study
	Epinephelus striatus	1.6	28.0	23800.0	0.0	0.0	0.0	3.9	4.7	Opitz (1996), Table 3.8
	Hypoplectrus aberrans	1.8	28.0	50.0	0.0	0.0	0.0	14.6	17.6	Opitz (1996), Table 3.8
	Hypoplectrus chlorurus	1.5	28.0	64.0	0.0	0.0	0.0	12.7	15.8	Opitz (1996), Table 3.8
	Hypoplectrus nigricans	1.8	28.0	90.0	0.0	0.0	0.0	12.7	15.4	Opitz (1996), Table 3.8
	Hypoplectrus puella	1.6	28.0	64.0	0.0	0.0	0.0	12.9	15.9	Opitz (1996), Table 3.8
	Mycteroperca bonaci	1.2	28.0	90000.0	0.0	0.0	0.0	2.6	3.4	Opitz (1996), Table 3.8
	Mycteroperca cidi	1.1	28.0	77000.0	0.0	0.0	0.0	2.6	3.4	Opitz (1996), Table 3.8
	Mycteroperca interstitialis	1.3	28.0	4000.0	0.0	0.0	0.0	5.0	6.5	Opitz (1996), Table 3.8
	Mycteroperca phenax	1.4	28.0	43700.0	0.0	0.0	0.0	3.2	4.0	Opitz (1996), Table 3.8
	Mycteroperca rubra	1.2	28.0	10719.0	0.0	0.0	0.0	4.0	5.2	Opitz (1996), Table 3.8
	Mycteroperca tigris	1.8	28.0	17043.0	0.0	0.0	0.0	4.5	5.3	Opitz (1996), Table 3.8
	Mycteroperca venenosa	1.1	28.0	12270.0	0.0	0.0	0.0	3.7	4.9	Opitz (1996), Table 3.8
	Paranthias furcifer	2.3	28.0	1100.0	0.0	0.0	0.0	8.7	10.2	Opitz (1996), Table 3.8
	Serranus atrobranchus	1.1	24.0	23.3	0.0	0.0	0.0	11.7	14.5	This study
	Serranus dewegeri	1.4	28.0	700.0	0.0	0.0	0.0	7.5	9.4	Opitz (1996), Table 3.8
	Serranus tabacarius	1.2	28.0	141.0	0.0	0.0	0.0	9.7	12.7	Opitz (1996), Table 3.8
	Serranus tigrinus	1.5	28.0	21.0	0.0	0.0	0.0	15.4	19.5	Opitz (1996), Table 3.8
	Serranus tortugarum	1.6	28.0	12.0	0.0	0.0	0.0	18.0	22.4	Opitz (1996), Table 3.8
Sparidae	*Archosargus rhomboidalis*	2.5	28.0	1200.0	0.8	0.0	0.8	25.5	28.7	Opitz (1996), Table 3.8
	Archosargus rhomboidalis	2.8	26.0	366.0	0.5	0.0	0.5	21.9	23.6	Vega-Cendejas et al. (1993), Table 4
	Archosargus probatocephalus	2.3								Jarre et al. (1991), Table 2
	Calamus bajonado	3.0	28.0	4500.0	0.0	0.0	0.0	7.6	8.8	Opitz (1996), Table 3.8
	Calamus calamus	3.2	28.0	1541.0	0.0	0.0	0.0	9.7	11.3	Opitz (1996), Table 3.8
	Calamus penna	3.1	28.0	2000.0	0.0	0.0	0.0	9.1	10.6	Opitz (1996), Table 3.8
	Calamus penna	2.9	26.9	1537.6	0.0	0.0	0.0	9.1	10.2	This study
	Calamus pennatula	3.0	28.0	1700.0	0.0	0.0	0.0	9.3	10.8	Opitz (1996), Table 3.8
	Calamus pennatula	2.5	25.7	1459.3	0.0	0.0	0.0	8.3	9.0	This study
	Diplodus caudimacula (D. argenteus caudimacula)*	2.9	28.0	600.0	0.8	0.0	0.8	30.8	34.7	Opitz (1996), Table 3.8
	Lagodon rhomboides	2.5	26.0	167.0	0.0	0.0	0.0	12.7	14.0	Vega-Cendejas et al. (1993), Table 4
	Pagrus pagrus	1.8	28.0	697.7	0.0	0.0	0.0	8.5	10.2	This study
Sphyraenidae	*Sphyraena barracuda*	1.6	28.0	57800.0	0.0	0.0	0.0	3.3	4.0	Opitz (1996), Table 3.8
	Sphyraena guachancho	2.0	26.5	790.0	0.0	0.0	0.0	8.4	9.5	This study
	Sphyraena picudilla	2.6	28.0	1300.0	0.0	0.0	0.0	9.1	10.5	Opitz (1996), Table 3.8
	Sphyraena picudilla	2.0	27.7	389.5	0.0	0.0	0.0	9.9	11.6	This study
Stromateidae	*Peprilus alepidotus*	2.6								Jarre et al. (1991), Table 2
Synodontidae	*Saurida brasiliensis*	2.1	24.0	116.3	0.0	0.0	0.0	12.0	12.7	This study
	Saurida normani	2.3	25.7	255.8	0.0	0.0	0.0	11.2	12.3	This study
	Synodus intermedius	2.4	28.0	1103.0	0.0	0.0	0.0	8.9	10.4	Opitz (1996), Table 3.8
	Synodus foetens	2.7	28.0	1100.0	0.0	0.0	0.0	9.5	10.9	Opitz (1996), Table 3.8
	Synodus foetens	2.1	25.7	232.6	0.0	0.0	0.0	10.8	11.9	This study
	Synodus poeyi	1.5	24.0	17.4	0.0	0.0	0.0	14.9	16.7	This study
	Synodus synodus	2.4	28.0	400.0	0.0	0.0	0.0	11.0	12.8	Opitz (1996), Table 3.8
Tetraodontidae	*Canthigaster rostrata*	1.5	28.0	82.0	0.2	0.0	0.2	15.1	18.6	Opitz (1996), Table 3.8
	Sphoeroides spengleri	1.6	28.0	92.0	0.1	0.0	0.1	13.2	16.3	Opitz (1996), Table 3.8
	Lagocephalus laevigatus	1.9	27.8	1540.7	0.0	0.0	0.0	7.5	8.8	This study
Triglidae	*Prionotus punctatus*	0.9	26.5	325.6	0.0	0.0	0.0	6.7	9.3	This study
	Prionotus stearnsi	1.2	24.0	232.6	0.0	0.0	0.0	7.9	9.3	This study

Table 2. Estimated Q/B ratio of Caribbean fishes and associated estimates of Q/B-predictor parameters. Aspect ratios from Opitz (1996) are assumed values.

Family	Species	AR[a]	T(°C)[b]	W_∞ (g)	h	d	HD	Q/B[c]	Q/B[d]	Q/B[e]	Source
Carcharhinidae	*Carcharhinus acronotus*	7.0	28.0	90000.0	0.0	0.0	0.0	6.4	10.2		Opitz (1996), Table 3.8
	Carcharhinus falciformis	7.0	28.0	350000.0	0.0	0.0	0.0	4.9	7.7		Opitz (1996), Table 3.8
	Carcharhinus leucas	7.0	28.0	350000.0	0.0	0.0	0.0	4.9	7.7		Opitz (1996), Table 3.8
	Carcharhinus limbatus	7.0	28.0	116000.0	0.0	0.0	0.0	6.1	9.7		Opitz (1996), Table 3.8
	Carcharhinus longimanus	7.0	28.0	350000.0	0.0	0.0	0.0	4.9	7.7		Opitz (1996), Table 3.8
	Carcharhinus perezi	7.0	28.0	100000.0	0.0	0.0	0.0	6.3	10.0		Opitz (1996), Table 3.8
	Galeocerdo cuvier	7.0	28.0	672000.0	0.0	0.0	0.0	4.3	6.8		Opitz (1996), Table 3.8
	Negaprion brevirostris	7.0	28.0	110000.0	0.0	0.0	0.0	6.2	9.8		Opitz (1996), Table 3.8
	Rhizoprionodon porosus	7.0	28.0	5020.0	0.0	0.0	0.0	11.5	18.4		Opitz (1996), Table 3.8
Dasyatidae	*Dasyatis americana*	7.0	28.0	122000.0	0.0	0.0	0.0	6.0	9.6		Opitz (1996), Table 3.8
	Dasyatis americana		26.3	12236.0			0.0			6.3	This study
	Dasyatis guttata		25.6	13953.0			0.0			6.0	This study
Ginglymostomatidae	*Ginglymostoma cirratum*	7.0	28.0	500000.0	0.0	0.0	0.0	4.5	7.2		Opitz (1996), Table 3.8
Muraenidae	*Enchelycore nigricans*	0.7	28.0	900.0	0.0	0.0	0.0	5.0	7.8		Opitz (1996), Table 3.8
	Echidna catenata	0.7	28.0	600.0	0.0	0.0	0.0	5.4	8.5		Opitz (1996), Table 3.8
	Gymnothorax funebris	0.7	28.0	12000.0	0.0	0.0	0.0	2.9	4.6		Opitz (1996), Table 3.8
	Gymnothorax milliaris	0.7	28.0	201.0	0.0	0.0	0.0	6.7	10.6		Opitz (1996), Table 3.8
	Gymnothorax vicinus	0.7	28.0	3000.0	0.0	0.0	0.0	3.9	6.1		Opitz (1996), Table 3.8
	Lycodontis moringa	0.7	28.0	950.0	0.0	0.0	0.0	4.9	7.8		Opitz (1996), Table 3.8
Myliobatidae	*Aetobatus narinari*	7.0	28.0	230000.0	0.0	0.0	0.0	5.3	8.4		Opitz (1996), Table 3.8
Ophictidae	*Myrichthys breviceps*	0.7	28.0	640.0	0.0	0.0	0.0	5.3	8.4		Opitz (1996), Table 3.8
	Myrichthys ocellatus	0.7	28.0	640.0	0.0	0.0	0.0	5.3	8.4		Opitz (1996), Table 3.8
	Ophichthus ophis	0.7	28.0	2091.0	0.0	0.0	0.0	4.2	6.6		Opitz (1996), Table 3.8
Rhinobatidae	*Rhinobatos percellens*		27.6	825.0			0.0			10.4	This study
Trichiuridae	*Trichiurus lepturus*		26.1	1188.0			0.0			9.2	This study
Sphyrnidae	*Sphyrna lewini*	7.0	28.0	400853.0	0.0	0.0	0.0	4.7	7.5		Opitz (1996), Table 3.8
	Sphyrna tiburo	7.0	28.0	18000.0	0.0	0.0	0.0	8.9	14.2		Opitz (1996), Table 3.8
Torpedinidae	*Narcine brasiliensis*		26.8	1590.0			0.0			9.0	This study
Triakidae	*Mustelus canis*	7.0	28.0	15000.0	0.0	0.0	0.0	9.2	14.7		Opitz (1996), Table 3.8

Note:
[a] Aspect ratio
[b] Mean habitat temperature
[c] Using Palomares & Pauly 1989 equation
[d] Using Palomares & Pauly 1998 equation
[e] Using Pauly et al. 1990 equation

*Table 3. Ranking of Caribbean fish families according to mean Q/B-predictor parameters and mean Q/B values. Q/B1989=based on Palomares and Pauly (1989); Q/B1998= based on Palomares and Pauly (1998); * = based on Pauly et al. (1990). For symbols see text.*

Family	Aspect ratio	Family	W_∞ (g)	Family	HD	Family	Q/B 1989	Family	Q/B 1998
Scombridae	5.6	Ginglymostomatidae	500000.0	Engraulidae	1.0	Engraulidae	73.3	Engraulidae	85.8
Albulidae	4.7	Carcharhinidae	238113.3	Kyphosidae	1.0	Blenniidae	38.3	Blenniidae	50.8
Elopidae	4.1	Myliobatidae	230000.0	Mugilidae	1.0	Acanthuridae	29.7	Gobiidae	39.4
Carangidae	3.9	Sphyrnidae	209426.5	Scaridae	1.0	Mugilidae	29.5	Acanthuridae	33.5
Hemiramphidae	3.0	Coryphaenidae	147000.0	Acanthuridae	0.9	Gobiidae	28.0	Mugilidae	32.6
Emmelichthyidae	2.9	Megalopidae	80532.0	Blenniidae	0.8	Hemiramphidae	24.3	Scaridae	27.7
Ephippidae	2.9	Dasyatidae	49396.3	Hemiramphidae	0.4	Kyphosidae	23.6	Hemiramphidae	27.7
Megalopidae	2.9	Rachycentridae	33400.0	Monacanthidae	0.4	Scaridae	22.2	Kyphosidae	26.2
Kyphosidae	2.9	Scombridae	23387.7	Gobiidae	0.4	Apogonidae	19.3	Apogonidae	23.8
Coryphaenidae	2.9	Serranidae	22228.7	Pomacentridae	0.4	Atherinidae	18.9	Atherinidae	22.9
Sparidae	2.7	Sphyraenidae	15069.9	Pomacanthidae	0.3	Pomacentridae	18.5	Pomacentridae	22.1
Gerreidae	2.7	Triakidae	15000.0	Balistidae	0.3	Cirrhitidae	16.9	Cirrhitidae	21.1
Haemulidae	2.5	Diodontidae	8042.9	Sparidae	0.2	Pomacanthidae	14.8	Callionymidae	20.5
Holocentridae	2.4	Kyphosidae	7630.5	Ostraciidae	0.2	Myctophidae	14.8	Myctophidae	19.7
Clupeidae	2.4	Lutjanidae	7241.2	Ogcocephalidae	0.1	Callionymidae	14.7	Grammidae	18.7
Pempheridae	2.3	Carangidae	6435.7	Ephippidae	0.1	Pempheridae	14.2	Pomacanthidae	17.6
Chaetodontidae	2.2	Ephippidae	5103.6	Tetraodontidae	0.1	Grammidae	14.2	Pempheridae	16.6
Belonidae	2.2	Scaridae	4146.7	Clupeidae	0.0	Chaetodontidae	14.2	Chaetodontidae	16.6
Synodontidae	2.2	Fistulariidae	3931.4	Achiridae	0.0	Sparidae	13.9	Albulidae	16.6
Balistidae	2.1	Pomacanthidae	3210.7	Albulidae	0.0	Gerreidae	13.6	Elopidae	16.0
Mullidae	2.0	Muraenidae	2941.8	Antennariidae	0.0	Albulidae	13.2	Monacanthidae	16.0
Acanthuridae	2.0	Balistidae	2100.8	Apogonidae	0.0	Emmelichthyidae	13.1	Sparidae	15.6
Sphyraenidae	2.0	Ostraciidae	2004.8	Ariidae	0.0	Clupeidae	13.1	Gerreidae	15.4
Ariidae	2.0	Scorpaenidae	1759.3	Atherinidae	0.0	Elopidae	13.1	Emmelichthyidae	15.2
Mugilidae	2.0	Torpedinidae	1590.0	Aulostomidae	0.0	Holocentridae	12.5	Clupeidae	15.0
Pomacanthidae	1.9	Bothidae	1590.0	Batrachoididae	0.0	Balistidae	12.2	Opistognathidae	14.8
Priacanthidae	1.8	Mugilidae	1583.5	Belonidae	0.0	Monacanthidae	12.1	Triakidae	14.7
Pomacentridae	1.8	Echeneidae	1550.7	Bothidae	0.0	Tetraodontidae	11.9	Tetraodontidae	14.6
Polynemidae	1.8	Sparidae	1433.5	Callionymidae	0.0	Achiridae	11.6	Holocentridae	14.4
Atherinidae	1.8	Monacanthidae	1374.6	Carangidae	0.0	Belonidae	11.6	Achiridae	14.2
Engraulidae	1.8	Labridae	1280.0	Carcharhinidae	0.0	Synodontidae	11.2	Balistidae	14.0
Lutjanidae	1.7	Trichiuridae	1188.0	Chaetodontidae	0.0	Mullidae	10.5	Antennariidae	14.0
Aulostomidae	1.7	Ophictidae	1123.7	Cirrhitidae	0.0	Rhinobathidae	10.4*	Belonidae	13.7
Tetraodontidae	1.7	Priacanthidae	1040.1	Clinidae	0.0	Carangidae	10.3	Scombridae	13.0
Apogonidae	1.6	Dactylopteridae	982.3	Coryphaenidae	0.0	Polynemidae	10.0	Paralichthyidae	13.0
Dactylopteridae	1.6	Haemulidae	955.4	Dactylopteridae	0.0	Opistognathidae	10.0	Batrachoididae	12.9
Rachycentridae	1.6	Albulidae	854.7	Dasyatidae	0.0	Antennariidae	10.0	Clinidae	12.9
Cirrhitidae	1.5	Rhinobatidae	825.0	Diodontidae	0.0	Haemulidae	10.0	Synodontidae	12.5
Achiridae	1.5	Malacanthidae	807.2	Echeneidae	0.0	Clinidae	9.9	Carangidae	12.3
Malacanthidae	1.5	Aulostomidae	777.0	Elopidae	0.0	Ariidae	9.6	Mullidae	12.0
Fistulariidae	1.4	Acanthuridae	697.3	Emmelichthyidae	0.0	Paralichthyidae	9.6	Labridae	11.6
Ostraciidae	1.4	Elopidae	687.1	Fistulariidae	0.0	Trichiuridae	9.2*	Polynemidae	11.6
Serranidae	1.4	Grammistidae	685.0	Gerreidae	0.0	Triakidae	9.2	Haemulidae	11.5
Labridae	1.4	Tetraodontidae	571.6	Ginglymostomatidae	0.0	Labridae	9.1	Sphyrnidae	10.9
Grammistidae	1.4	Synodontidae	460.7	Grammidae	0.0	Scombridae	9.0	Ostraciidae	10.8
Bothidae	1.3	Ariidae	456.1	Grammistidae	0.0	Torpedinidae	9.0*	Ariidae	10.8
Clinidae	1.3	Hemiramphidae	456.0	Haemulidae	0.0	Ephippidae	8.9	Sciaenidae	10.4
Diodontidae	1.3	Belonidae	440.0	Holocentridae	0.0	Ostraciidae	8.8	Rhinobatidae	10.4*
Scaridae	1.3	Ogcocephalidae	348.8	Labridae	0.0	Dactylopteridae	8.6	Ephippidae	10.1
Sciaenidae	1.2	Sciaenidae	342.8	Lutjanidae	0.0	Sciaenidae	8.2	Dactylopteridae	10.1
Grammidae	1.2	Mullidae	328.9	Malacanthidae	0.0	Priacanthidae	8.1	Carcharhinidae	9.8
Echeneidae	1.2	Holocentridae	321.4	Megalopidae	0.0	Aulostomidae	8.1	Aulostomidae	9.8
Monacanthidae	1.2	Gerridae	307.7	Mullidae	0.0	Batrachoididae	8.0	Bothidae	9.7
Blenniidae	1.1	Pomacentridae	285.2	Muraenidae	0.0	Malacanthidae	7.7	Ogcocephalidae	9.7
Triglidae	1.1	Emmelichthyidae	282.0	Myctophidae	0.0	Sphyraenidae	7.7	Priacanthidae	9.6
Antennariidae	1.0	Triglidae	279.1	Myliobatidae	0.0	Bothidae	7.6	Dasyatidae	9.6
Scorpaenidae	1.0	Polynemidae	273.3	Ophichthidae	0.0	Serranidae	7.6	Malacanthidae	9.6
Paralichthyidae	1.0	Clupeidae	264.6	Opistognathidae	0.0	Grammistidae	7.4	Serranidae	9.5
Myctophidae	1.0	Clinidae	137.0	Paralichthyidae	0.0	Triglidae	7.3	Grammistidae	9.4
Gobiidae	1.0	Chaetodontidae	112.9	Pempheridae	0.0	Sphyrnidae	6.8	Triglidae	9.3
Opistognathidae	0.9	Pempheridae	100.0	Polynemidae	0.0	Lutjanidae	6.7	Trichiuridae	9.2*
Callionymidae	0.6	Opistognathidae	87.5	Priacanthidae	0.0	Megalopidae	6.7	Torpedinidae	9.0*
Ogcocephalidae	0.5	Achiridae	87.2	Rachycentridae	0.0	Fistulariidae	6.6	Sphyraenidae	8.9
Batrachoididae	0.5	Paralichthyidae	84.3	Rhinobatidae	0.0	Echeneidae	6.3	Myliobatidae	8.4
		Antennariidae	70.0	Sciaenidae	0.0	Carcharhinidae	6.2	Fistulariidae	8.3
		Batrachoididae	23.8	Scombridae	0.0	Dasyatidae	6.1*	Scorpaenidae	8.1
		Grammidae	22.5	Scorpaenidae	0.0	Dasyatidae	6.0	Lutjanidae	8.1
		Blenniidae	21.3	Serranidae	0.0	Scorpaenidae	5.9	Echeneidae	7.9
		Apogonidae	20.2	Sphyraenidae	0.0	Ogcocephalidae	5.8	Ophichthidae	7.8
		Cirrhitidae	15.0	Sphyrnidae	0.0	Diodontidae	5.4	Megalopidae	7.6
		Atherinidae	13.5	Synodontidae	0.0	Myliobatidae	5.3	Muraenidae	7.6
		Engraulidae	8.0	Torpedinidae	0.0	Ophichthidae	4.9	Ginglymostomatidae	7.2
		Myctophidae	5.7	Triakidae	0.0	Muraenidae	4.8	Diodontidae	6.7
		Gobiidae	5.6	Trichiuridae	0.0	Ginglymostomatidae	4.5	Dasyatidae	6.1*
		Callionymidae	1.0	Triglidae	0.0	Coryphaenidae	3.7	Rachycentridae	4.4
						Rachycentridae	3.6	Coryphaenidae	3.9