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Growth of the Checkered Puffer *Sphoeroides testudineus*: Postscript to Papers by Targett and Pauly & Ingles*

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Abstract

J. Ingles and D. Pauly presented at the Fourth International Coral Reef Symposium a seasonally oscillating growth curve for the puffer *Sphoeroides testudineus* (Tetraodontidae), based on length-frequency data collected in 1974 in Florida by T.E. Targett, but forgot to include the corresponding growth parameters in the ensuing publication. These are given here (TL_∞=30, K = 0.51 year^{-1}, C = 0.7, and WP = 0.05), along with some related biological information on the species.

Introduction

Pauly and Ingles (1981), in a paper devoted to the growth and mortality of coral reef and other tropical fishes illustrated seasonally oscillating growth curves (then a relative novelty) through an analysis of length-frequency data on the checkered puffer *Sphoeroides testudineus* (Linné, 1758) from Biscayne Bay, Florida (Targett 1979).

I noted only recently that we forgot to include the relevant growth parameters in the paper in question, thus somehow defeating the purpose of that part of our paper. This is corrected in this note, in which the opportunity is taken also to present some related information on *S. testudineus* (Fig. 1).

Materials and Methods

The length-frequency data of Targett (1979) were analyzed using the Compleat ELEFAN software of Gayanilo et al. (1988).

No attempt was made to estimate mortality from the size-frequency data at hand because adult fish were reported by Targett (1979) to leave the seagrass bed, where sampling occurred, to spawn in deeper waters. This was also the reason why L_∞ was fixed at 25 cm SL, corresponding to 30 cm TL, i.e., to the maximum reported size (Table 1).

All other information on *S. testudineus* presented below was extracted from the literature (Table 2).

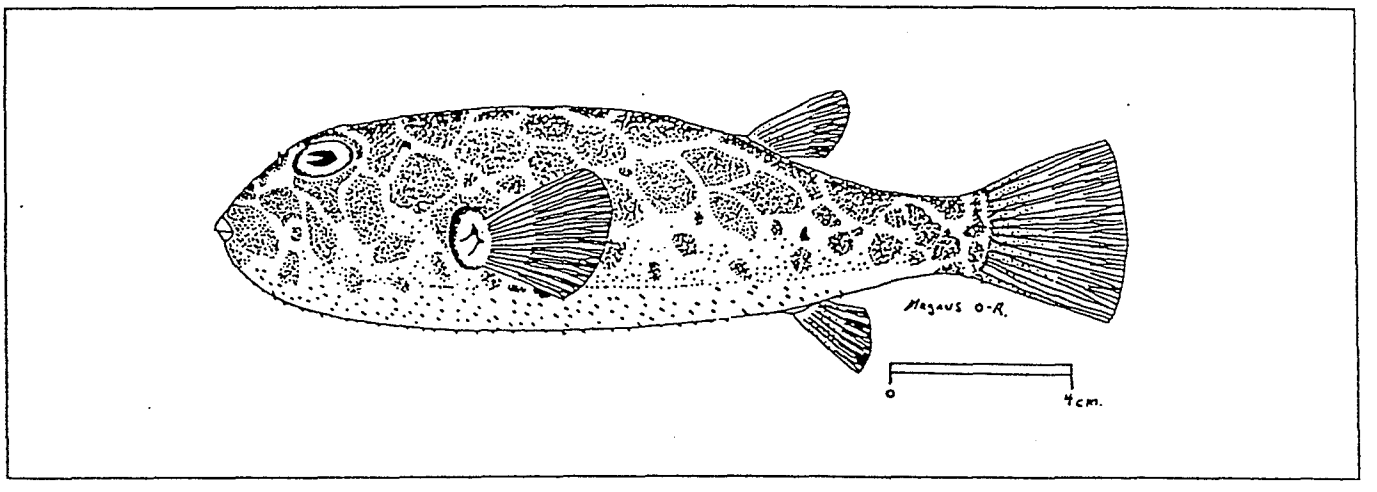

Fig. 1. The checkered pufferfish *Sphoeroides testudineus* (Linnaeus, 1758), Tetraodontidae (adapted from Beebe and Tee-Van 1928 and Guitart 1978). Note that this fish can change its shape by pumping itself up with water or air, hence several of its names.

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Table 1. Growth parameters and performance index (ϕ')[a] of four species of tetraodontids.

Species		L_∞ (TL, cm)	K (year^{-1})	ϕ'	Remark/Source
Contusus[b] *richei*	♀	18.9	0.326	2.07	This study[c], based on Table 1 in Habib (1977)
	♂	12.5	0.362	1.77	
Lagocephalus sceleratus		18.0	1.50	2.69	Chan and Liew (1986), using ELEFAN I
Sphoeroides maculatus	♀	28.2	0.607	2.68	Laroche and Davis (1973)
	♂	24.5	0.620	2.57	
Sphoeroides testudineus		30.0	0.51	2.66	This study, based on Targett (1978)

[a]$\phi' = \log_{10}K + 2\log L_\infty$ (Pauly and Munro 1984).
[b]The genus name *Uranostoma*, used by Habib (1977) is taxonomically not "available" and should be replaced by the one used here.
[c]von Bertalanffy equation fitted to length-at-age data, (weighted by n) using the ETAL I program of Gaschütz et al. (1980).

Table 2. Morphological relationships and other features of checkered puffer *Sphoeroides testudineus*.

Item	Source
TL = 1.20 SL	Shipp (1974)
$W = 0.0821(TL)^{2.87}$ (cm, g)	This study[a]
$W = 0.000023\ (TL)^{2.991}$ (dry season; cm, g)	Colmenero et al. (1982)
$W = 0.000047\ (LS)^{2.839}$ (rainy season; cm, g)	Colmenero et al. (1982)
Fecundity[b] $= 0.0001(SL)^{2.74}$ (cm), and Relative fecundity = 1.146 eggs/g body weight	Targett (1979)
Maximum size = 30 cm (prob. TL)	Shipp (1978)
Mean size at first maturity > 13 cm(TL)	Colmenero et al. (1982)
Spawning season = late spring to early fall (in Biscayne Bay, Florida)	Targett (1979)
Food: mainly benthic crustaceans, bivalves and gastropods	Targett (1978), Colmenero et al. (1982)
Highly toxic	Bréta (1939), Yudkin (1944), Halstead (1978)
Forms large aggregates (but not schooling)	Halstead (1978), Shipp (1978)
Enters river mouths	Colmenero et al. (1982)
Caught by traps, seines and dynamite	Beebe and Tee-Van (1928)
Used to poison cats and dogs	Shipp (1978)

[a]SL in mm, Win g (as also used below); recomputed from data in Fig. 1 of Targett (1979) (which includes an erroneous equation) and two length/weight data pairs in Beebe and Tee-Van (1928).
[b]Number of yolked eggs in nine ♀♀ ranging from 127 to 178 mm SL.

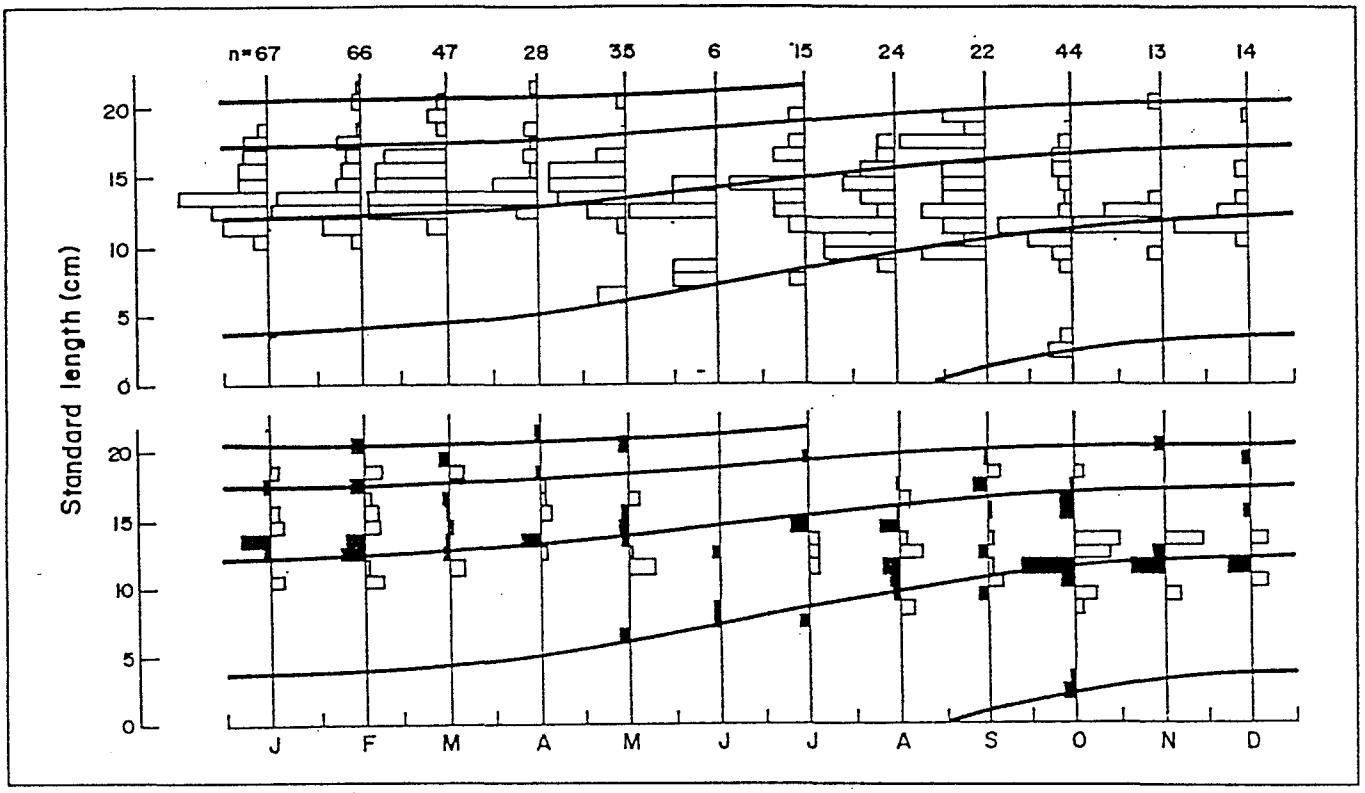

Fig. 2. Seasonally oscillating growth curve of checkered puffer *Sphoeroides testudineus* caught off Biscayne Bay, Florida. Above: curve superimposed on the length-frequency data (Targett 1979); note "doubling up" of the dataset and sample sizes (n = 67, 66, ...). Below: "restructured" length-frequency data, as computed and used internally by ELEFAN I. Dark histograms represent frequencies that are part of "peaks", open histograms represent "troughs" separating peaks (modified from Pauly and Ingles 1981).

Results and Discussion

The checkered puffer or turtle-headed globefish (Fig. 1) has a broad distribution, ranging from the western coast of Florida in the north, throughout the Caribbean and beyond Sao Paulo, Brazil, in the south (Shipp 1978; Santos 1982). Some of its common names are: "compère corotuche", "foufou sans piquant" in French; "pez globo", "tambor", "xpu", "tamboril corrotucho" or "tamboril rayado" in Spanish; and "baiacu-mirim" in Portuguese (Shipp 1978; Colmenero et al. 1982; Guitart 1978; Santos 1982).

The growth of *S. testudineus* in Biscayne Bay, Florida, is described by the parameters SL_∞ = 25 cm (TL = 30 cm), K = 0.51 year^{-1}, C = 0.7, and WP = 0.05 of the seasonally oscillating version of the von Bertalanffy growth equation (Pauly and Gaschütz 1979; Somers 1988) (Fig. 2).

As might be seen, the growth reduction in winter is substantial: C = 0.7 corresponds to a 70% reduction of the growth rate that would have occurred had it not been for the seasonal oscillations (Pauly and Gaschütz 1979). On the other hand, the summer-winter differences of (mean monthly) SST in Biscayne Bay reach 7-8°C (Rivas 1968) and are thus sufficient to generate the observed value of C (Fig. 3).

Another neat feature of the growth curve in Fig. 2 is its origin, which falls in late summer, i.e., in the peak spawning season, thus suggesting that $t_0 \approx 0$.

Published information on the growth of tetraodontids appears to be scarce, and Table 1 summarizes what I could assemble on this subject.

Note the closeness of the estimate of ϕ' obtained here for *S. testudineus* ($\phi' = 2.66$) to the mean of the three ϕ' values ($\phi' = 2.65$) for *S. maculatus* and *L. sceleratus*, a species earlier included in the genus *Sphoeroides* (Halstead 1978). This contrasts strongly with the ϕ' values for *C. richei*, otherwise similar to the other two species in Table 2.

Note also the strong difference in growth parameters and growth performance between female and male tetraodontids, with the females growing "better", inspite of their stronger production of gametes. This paradoxon is discussed in Pauly (1989).

Table 2 presents various information on *S. testudineus*, which is very abundant in lagoons and inshore waters of the Southern Gulf of Mexico (Yañez-Arancibia et al.

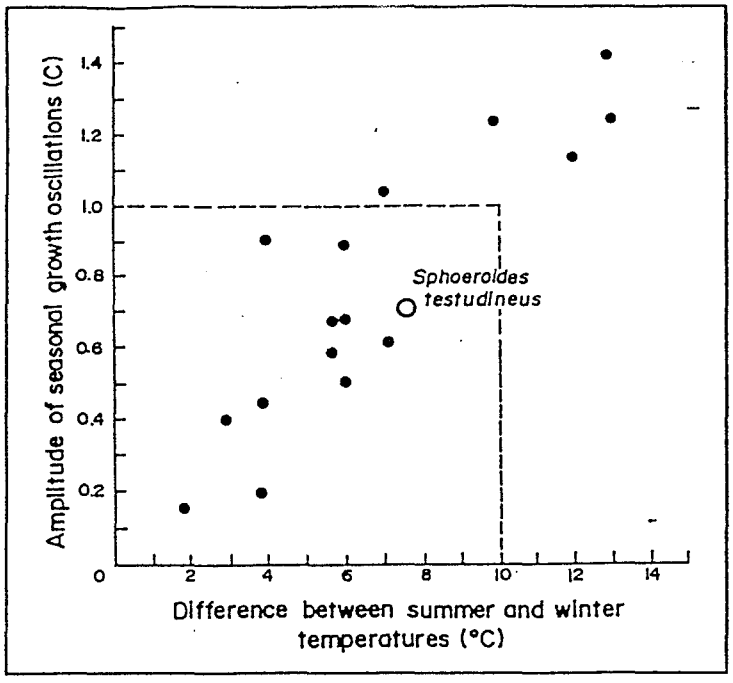

Fig. 3. Relations between the amplitude (C) of seasonal growth oscillations in fish, penaeid shrimp, and squid and the summer-winter temperature difference of their habitat. Values of C = >1 imply a period of no growth, not discussed here and which occurs only in tropical freshwater and high latitude habitats (modified from Longhurst and Pauly 1987).

1982; Colmenero et al. 1982; Guillen et al. 1985) and the Caribbean Sea (Shipp 1978). This only emphasizes the general uselessness of this species and its equally toxic relatives[a], reputed, moreover, to make a certain part of man's anatomy a "frequent target of their attacks" (Halstead 1978).

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[a]Editor's note: the author insisted on these harsh words, although he is aware that tetraodontids are a delicacy in Japan. He points out that eating "fugu" has caused to date hundreds, perhaps thousands, of deaths (Halstead 1978); besides, he says, tetraodontoxin is used to "zombify" people (whatever that means).

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