

Length-weight relationships of two Serranids and a Lutjanid caught off Nevis, West Indies

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ABSTRACT

Measurements of total length (TL) and total weight (Wt) of the coney, *Epinephelus fulvus* (n = 418), and the red hind, *Epinephelus guttatus* (n = 512); and, measurements of fork length (FL) and total weight for the queen snapper, *Etelis oculatus* (n = 173), were collected in Nevis from March to May, 1995. The data were used to calculate length/weight relationships (in millimetres and grammes) for the three species. These relationships are presented: for *E. fulvus* weight (Wt) is equal to $3.394 \times 10^{-5} \times TL^{3.274}$; for *E. guttatus* it is equal to $1.218 \times 10^{-6} \times TL^{3.397}$; and for *E. oculatus*, to $4.754 \times 10^{-5} \times FL^{2.801}$. These results, on comparison to those obtained from previous studies, may be interpreted as suggesting that the stocks fished in Barbados, St. Lucia, and Nevis could be from the same biological population. While these results may be considered just preliminary, they are among the first significant scientific results to be produced from data obtained by the island's fisheries data collection system.

Keywords: coney, red hind, queen snapper, morphometric, length/weight, data collection, Nevis

INTRODUCTION

Nevis is part of the twin island Federation of St. Christopher (St. Kitts) and Nevis, situated in the northern part of the Eastern Caribbean chain of islands, known as the "Leeward Islands". Shallow and deep demersals are taken with Antillean Z-traps and vertical longlines (called "palangs" in the southernmost, or "Windward", islands, and "rigs" in Anguilla) respectively. The catches range from miscellaneous reef fish, taken in the shallow areas, to snappers and groupers more commonly taken in deeper areas (Barrett *et al.*, 1988). Fishermen haul their traps 2-3 times a week, and may haul 24-45 traps each trip.

While there are some eight landing sites in Nevis (*ibid.*) samples were obtained at the Charlestown Fisheries Complex. The fish measured during this study were caught on the flat or deep slope of Nevis' "south bank" which is in fact the southern part of the island shelf. The coney, *Epinephelus fulvus*, and the red hind, *Epinephelus guttatus* were caught in water of depths between 10 - 40 fathoms (18.2 - 73.2 metres). Traps had mesh sizes ranging from $1\frac{1}{4}$ - $1\frac{1}{2}$

inches, and were baited with fresh cowhide or the digestive system of conchs. The fishermen whose catches were sampled soaked their traps for 3 - 4 days, and placed the fish on ice immediately after removing them from the traps. The queen snapper, *Etelis oculatus*, were caught by vertical longlines set in water of depths 100 - 200 fathoms (182.9 - 365.8 metres).

Pitcher and Hart (1982) have implied that a given set of morphometric characteristics may be indicative of a given stock of the species, while Ricker (1975) has noted that the functional regression value b in the length/weight relationship may vary between different populations of the same species. This relationship may also vary between the same population in different years (*ibid.*), and may thus be used as a measure of fish condition (Pitcher and Hart, 1982); thus conceivably, as an indicator of ecological changes taking place within the population.

Additionally, the length/weight relationship has applications both for stock assessment, and in the "market-place". Knowledge of the constants of the length/weight relationship can be an important prerequisite for length-based Virtual Population Analysis, for example, as found in the VPA II routine of the Compleat ELEFAN (Gayanilo, *et al.*, 1988) to facilitate the estimation of the steady-state biomass for each length class. Often, market sampling of economically important fish may measure either length or weight; when necessary, an estimate of the other characteristic is determined by use of the length/weight relationship.

METHODS

Measurements of total length (TL) and total weight (Wt) of the coney ($n = 418$), and the red hind ($n = 512$); and, measurements of fork length (FL) and total weight of the queen snapper ($n = 173$), were collected in Nevis from March to May, 1995 at the Charlestown Fisheries Complex. The data were used to calculate length/weight relationships for the three species by fitting a regression line to the equation:

$$\ln Wt = \ln a + b \ln L$$

which is equivalent to the equation:

$$Wt = aL^b$$

where Wt is total weight in grammes, and L is length (total length for *Epinephelus* spp. and fork length for *E. oculatus*) in millimetres, and a and b are constants. The regression constants, standard error of the constants, and coefficient of determination (R^2) were calculated using the least squares data regression function of LOTUS 123[®] ver. 3.1+.

RESULTS

Results of the regression analyses are shown in Table 1.

Figures 1 and 2 show the plot of $\ln TL$ vs $\ln Wt$, and TL vs Wt ,

respectively, for the coney. Figures 3 and 4 show the plot of $\ln TL$ vs $\ln Wt$, and TL vs Wt , respectively, for the red hind. Figures 5 and 6 show the plot of $\ln FL$ vs $\ln Wt$, and FL vs Wt , respectively, for the queen snapper.

The length/weight relationships can be summarised as follows:

E. fulvus

$$Wt = 3.394 \times 10^{-5} \times TL^{3.274}$$

E. guttatus

$$Wt = 1.218 \times 10^{-6} \times TL^{3.397}$$

E. oculatus

$$Wt = 4.754 \times 10^{-5} \times FL^{2.801}$$

CONCLUSIONS

The exponent of the total length/weight relationship derived for the red hind in this study is significantly different from that ($b = 3.112$) obtained for fish of the same species ($n = 20$) studied in southern Florida (Bohnsack and Harper, 1988). The exponents derived here for both coney and the red hind are significantly different from those obtained for fish of the same species ($b = 2.574$ and $b = 2.960$ respectively) from Jamaica (Thompson and Munro, 1983). The exponent of the fork length/weight relationship derived herein for the queen snapper is significantly different from those obtained in St. Thomas/St. John ($n = 21$; $b = 2.550$), and St. Croix ($n = 48$; $b = 2.578$; *ibid.*). The differences seen here may be functions of the differences in the ranges of values over which the regressions were calculated.

The exponent of the fork length/weight relationship obtained in this study is not significantly different from that obtained for the same species landed in Vieux Fort, St. Lucia, during 1987 ($n = 62$; $b = 2.722$; Murray and Moore, 1992). Similarly, neither the Y-intercept (-9.999) of the $\ln FL$ versus $\ln Wt$ regression ($R^2 = 0.965$), nor the slope ($b = 2.788$) calculated with data ($n = 38$) for queen snapper measured at Bridgetown, Barbados during 1991 (Prescod, 1991) are significantly different from those obtained in this study.

If we accept the suggestion that a given set of morphometric characteristics may be indicative of a given stock of the species, then our results (preliminary as they are) may be interpreted as suggesting that the stocks fished in Barbados, St. Lucia, and Nevis could be from the same biological population. Further investigative work may be warranted to determine the likelihood of this being the case.

These results are among the first significant scientific results to be produced from data obtained by the Nevis' fisheries data collection system. These three species are among those which are of some significance to the economies of Eastern Caribbean States, and we hope that the relationships presented here will be useful, if only as a means of comparison with fish from other stocks in the Wider Caribbean.

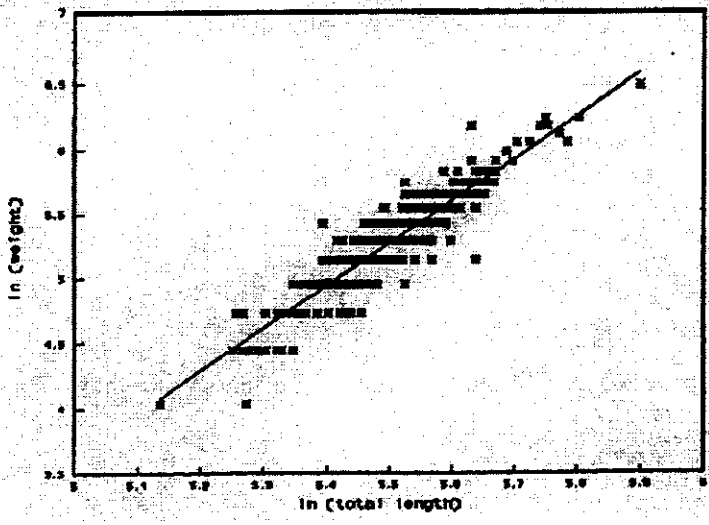


Figure 1. Graph of ln (total length) vs ln (weight) for *Epinephelus fulvus* caught in Nevis, March - May, 1995 (n = 418)

Table 1. Results of regression analyses for in length versus ln weight for the coney, red hind, and queen snapper caught on the south bank of Nevis between March and May, 1995.

	Y-intercept	SE of y estimate	R ²	# of observations	deg. of freedom	slope	SE of slope
coney	-12.735	0.142	0.822	418	416	3.274	0.075
red hind	-13.618	0.205	0.890	512	510	3.397	0.053
queen snapper	-9.954	0.120	0.965	173	171	2.801	0.041

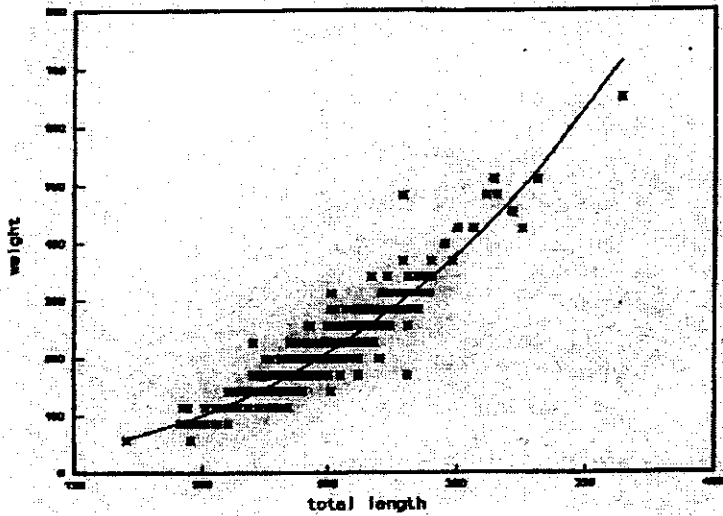


Figure 2. Graph of total length vs weight for *Epinephelus fulvus* caught in Nevis, March - May, 1995 (n = 418)

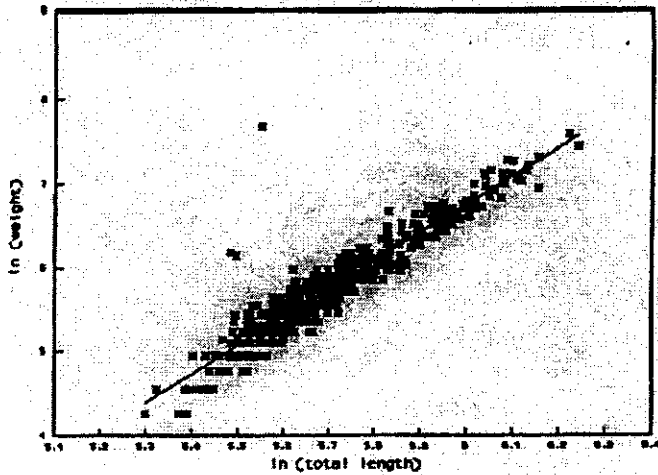


Figure 3. Graph of $\ln(\text{total length})$ vs $\ln(\text{weight})$ for *Epinephelus guttatus* caught in Nevis, March - May, 1995 (n = 512)

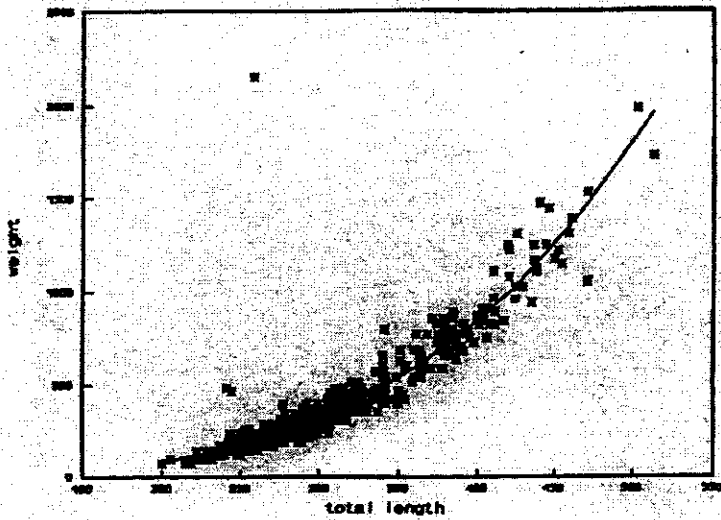


Figure 4. Graph of total length vs weight for *Epinephelus guttatus* caught in Nevis, March - May, 1995 (n = 512)

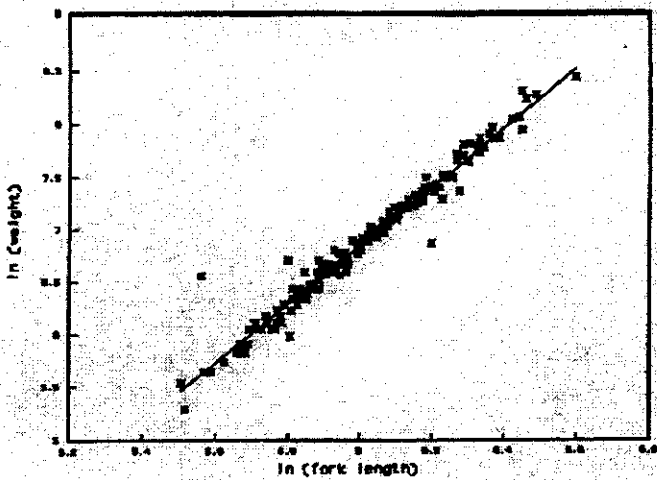


Figure 5. Graph of \ln (total length) vs \ln (weight) for *Etelis oculatus* caught in Nevis, March - May, 1995 (n = 173)

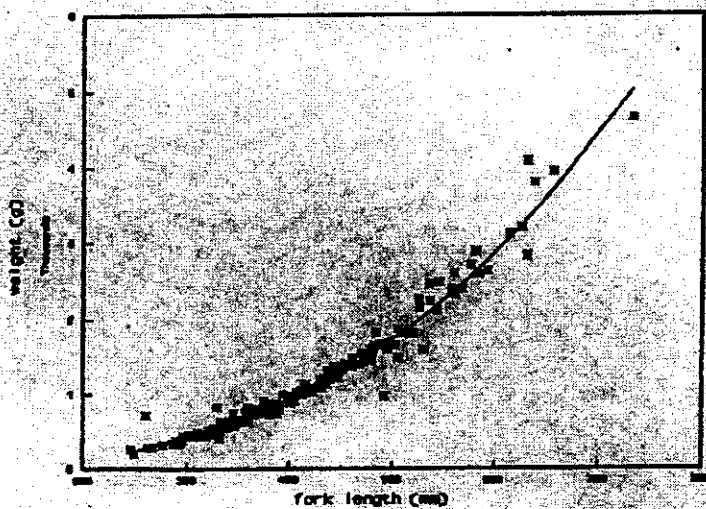


Figure 6. Graph of total length vs weight for *Etelis oculatus* caught in Nevis, March - May, 1995 (n = 173)

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LITERATURE CITED

- Barrett, A., S. Heyliger, R. Wilkins, S. Henry, and R. Mahon, 1988. A fishery data collection system for St. Kitts and Nevis. pp. 129 - 139 in R. Mahon and A.A. Rosenberg (eds.), 1988. Fishery data collection systems for eastern Caribbean Islands. *OECS Fishery Report no. 2*: 185p.
- Bohnsack, J.A. and D.E. Harper, 1988. Length-weight relationships of selected marine reef fishes from the southeastern United States and the Caribbean. *NOAA Technical Memorandum NMFS-SEFC-215*:31p.
- Gayanilo, F.C., Jr., M. Soriano and D. Pauly, 1988. A draft guide to the Compleat ELEFAN. *ICLARM Software 2*. 65p. International Center for Living Aquatic Resources Management, Manila, Philippines.
- Murray, P.A. and E.A. Moore, 1992. Some morphometric relationships in *Etelis oculatus* Valenciennes (queen snapper), landed in St. Lucia, W.I. *Proc. Gulf Caribb. Fish. Instit.* 41:416-421.
- Pitcher, T.J. and P.J.B. Hart, 1982. *Fisheries Ecology*. AVI Publishing Co., Westport, Connecticut:414p.
- Prescod, S.D., 1991. The snapper fishery of Barbados: present status and a preliminary assessment of the potential for expansion. Submitted in partial fulfilment for the requirements for the Advanced Diploma in Resource Management and Environmental Studies. Centre for Resource Management and Environmental Studies, University of the West Indies, Cave Hill Campus, Barbados. *CERMES ES 500 Project Report 29*:65p.
- Ricker, W.E., 1975. Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Board Can.* 191:382p
- Thompson, R. and J.L. Munro, 1983. The biology, ecology and bionomics of the hinds and groupers, *Serranidae*. pp 59 - 81 in J.L. Munro (ed.), 1983. Caribbean coral reef fishery resources. *ICLARM Studies and Reviews 7*. 276p. International Center for Living Aquatic Resources Management, Manila, Philippines.

