

Assessment of *Lutjanus vivanus* and *Lutjanus buccanella* in the North Caribbean Coast of Costa Rica

Evaluation de Lutjanus vivanus et Lutjanus buccanella au nord de la côte atlantique du Costa Rica

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Abstract

This paper presents results of stock assessment on two snapper species, *Lutjanus vivanus* and *L. buccanella*, in the north Caribbean coast of Costa Rica. Growth parameters, mortality rates, length-weight relationships, recruitment patterns and exploitation rates for the two species are given. Results indicate that the two species are subject to relatively low exploitation levels with $E = 0.25$ for *L. vivanus* and $E = 0.39$ for *L. buccanella*.

Résumé

*Cette communication présente des résultats d'évaluation de populations concernant deux espèces de vivaneau, Lutjanus vivanus et L. buccanella au nord de la côte atlantique du Costa Rica. Sont donnés les paramètres de croissance, les taux de mortalité, les valeurs poids par rapport à longueur, les modèles de recrutement et les taux d'exploitation pour les deux espèces. Les résultats révèlent des niveaux d'exploitation relativement faibles pour les deux espèces ($E = 0,25$ pour *L. vivanus* et $E = 0,39$ pour *L. buccanella*.)*

Introduction

The silk snapper (*Lutjanus vivanus*) and the blackfin snapper (*L. buccanella*) are among the most important lutjanids caught in the Caribbean Sea of Costa Rica. Both snappers occur in the western Atlantic as far north as North Carolina and as far south as Trinidad and northern Brazil (Allen 1985). These two species are common near the edge of the continental shelf at depths between 90 and 140 m; they are also found in deeper waters (below 200 m), usually ascending to shallower water at night (Allen 1985). These species are fished commercially by hook and line in Costa Rica.

There are several reports on the biology, ecology, and fisheries of these two species (Pozo and Espinoza 1982; Thompson and Munro 1983; Allen 1985; Leis 1987). This study presents an

assessment of the population parameters and exploitation rate of these two snapper species using length-based methods.

Materials and Methods

Monthly length-frequency data were collected from September 1992 to November 1994 (totaling 20 monthly samples) in three rocky areas located between Barra del Colorado and Parismina river outlet (Fig. 1). Monthly sample size varied from 24 to 226 individuals and the total number of snappers caught was 1 867 *L. vivanus* and 2 165 *L. buccanella*. All the snappers were measured to the nearest millimeter.

The ELEFAN I program as incorporated in FiSAT (Gayaniilo et al. 1996) was used to estimate asymptotic length (L_{∞}) and the growth constant (K), together with the seasonal oscillation

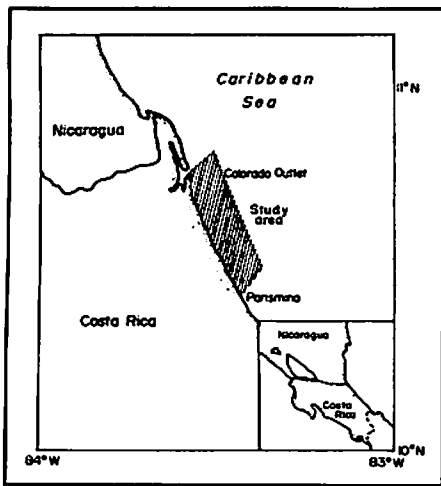


Fig. 1. Map of northern Caribbean coast of Costa Rica showing the location of the study area.

level (C) and minimum growth period or winter point (WP). The length-frequency distribution analysis (LFDA) package (Holden and Bravington 1992) was then used to verify the results.

Total mortality (Z) was estimated using ELEFAN IV with the data corrected for gear selectivity. Natural mortality (M) was estimated using the equation of Ralston (1987) for snappers and groupers. Length at first capture ($LC_{50\%}$) was calculated using differential retention probability obtained with hook and lines.

Parameters of the length-weight relationship were estimated via least squares regression on log-transformed data with bias correction. A total of 200 fish of each species ranging from 180 to 540 mm were used for the analysis.

Results and Discussion

A summary of the growth parameter estimates for the two species is given in Table 1. Fig. 2 gives the growth curve superimposed on the restructured length-frequency data using these parameters. The growth parameters obtained for the two species are very similar, and indicate relatively long life span, slow growth rate and weak growth seasonality (C). The period of minimum growth (WP) was in March for *L. buccanella* and August for *L. vivanus*. The parameter estimates, particularly the growth performance index ϕ and ϕ' (Pauly and Munro 1984), compare reasonably well with available estimates for other *Lutjanus* species/stocks given in Table 2.

The length-weight relationship derived for the two species is as follows: *L. buccanella*: W (g) =

Table 1. Summary of estimates of growth parameters for *Lutjanus vivanus* and *L. buccanella*, Costa Rica.

Parameter	<i>L. vivanus</i>	<i>L. buccanella</i>
L_{∞} (cm)	62.0	62.0
K (year ⁻¹)	0.32	0.35
C	0.53	0.56
WP	0.74	0.82
t_0 (year)	-0.04	-0.04
ϕ	0.85	0.89
ϕ'	3.09	3.13

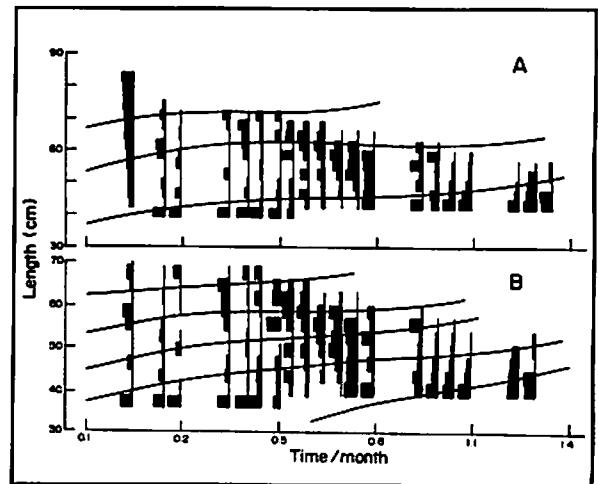


Fig. 2. Growth curve superimposed over restructured length-frequency data of (A) *Lutjanus buccanella* and (B) *L. vivanus* caught off the northern Caribbean coast of Costa Rica.

$0.0000142 L^{2.89}$ ($N = 200$, $r^2 = 0.864$), and *L. vivanus*: W (g) = $0.00009 L^{2.91}$ ($N = 200$, $r^2 = 0.904$). The parameters derived for *L. vivanus* are quite similar to those obtained for the same species in Cuban waters reported by Arteaga and Espinoza (1985).

Recruitment is a continuous process throughout the year, but occurs in two pulses of unequal strength. For *L. vivanus*, the recruitment peaks occur around May (30% of recruits) and October-November (70%). For *L. buccanella*, the recruitment peaks occur around July (34%) and November (65%).

Table 3 gives a summary of the estimates of mortality rates, together with the calculated lengths at first capture and exploitation rates. No significant differences were found in total mortality (Z) between *L. vivanus* and *L. buccanella*. Estimates of Z for the two species are substantially lower than the values reported by García

Table 2. Summary of growth parameters for other *Lutjanus* species/stocks as estimated by various authors.

Method	Species	L_{∞} (cm)	K (year ⁻¹)	ϕ	ϕ'	Reference
Length-Based Methods	<i>L. purpureus</i>	96.7	0.19		0.76	Fonteles-Filho (1970)
	<i>L. vivanus</i>	53.0	0.35	2.99		Reshetnikov and Claro (1974)
	<i>L. vivanus</i>	76.0	0.14	3.30		García (1979)
	<i>L. synagris</i>	60.3	0.20		0.63	Manickchand-Dass (1987)
	<i>L. coccineus</i>	102.0	0.17		0.73	Morgan (1987)
	<i>L. synagris</i>	51.6	0.23		0.65	Acosta and Appeldoorn (1992)
Hard Parts Analysis	<i>L. vittus</i>	57.8	0.39		0.91	Davies and West (1992)
	<i>L. marabanicus</i>	93.7	0.13		0.59	McPherson and Squire (1992)
	<i>L. sebae</i>	100.0	0.25		0.90	McPherson and Squire (1992)
	<i>L. kasmira</i>	94.0	0.29		0.94	Morales-Nin and Ralston (1990)

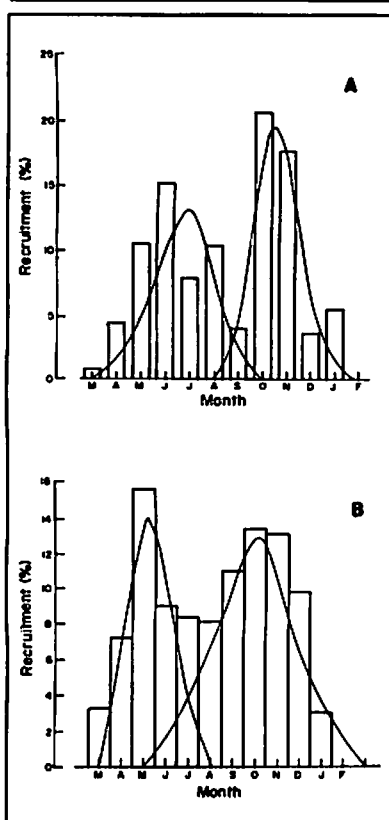


Fig. 3. Recruitment patterns obtained for (A) *Lutjanus buccanella* and (B) *L. vivanus* off the northern Caribbean coast of Costa Rica.

Table 3. Mortality parameters (Z, M, and F), length at first capture ($L_{C_{50\%}}$) and exploitation rate (E) for *Lutjanus vivanus* and *L. buccanella*, Costa Rica.

Parameter	<i>L. vivanus</i>	<i>L. buccanella</i>
Z (year ⁻¹)	1.26	1.19
M (year ⁻¹)	0.86	0.73
F (year ⁻¹)	0.30	0.46
$L_{C_{50\%}}$ (cm)	25.5	20.9
E	0.25	0.39

(1979), Pozo and Espinoza (1982) and Morgan (1987) for snappers from Cuba. This together with the F and E estimates suggests that the two species are relatively underexploited.

Length at first capture for *L. vivanus* was 25.5 cm (corresponding to 1.9 years of age) and 20.9 cm for *L. buccanella* (2.3 years). The length distribution and parameter estimates suggest that both species should have maximum lifespans of at least 7 years, results which are consistent with other studies (Nelson and Manooch 1982; Manooch

and Matheson 1983; Manickchand-Dass 1987; Manooch 1987; Rutherford et al. 1989).

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Growth of Spiny Lobster (*Panulirus penicillatus*) Caught off San Vicente, Cagayan, Philippines

Croissance de la langouste fourchette (Panulirus penicillatus) pêchée aux abords de San Vicente, Cagayan, Philippines

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Abstract

Estimates of growth parameters for male and female *Panulirus penicillatus* caught in coral reef areas off San Vicente, Cagayan, Philippines are presented. Length-weight relationship parameters are also given. The results indicate that the slope (b) is significantly below 3.0 and does not differ significantly between males and females.

Résumé

Cet article présente les données de croissance ainsi que les rapports poids pour longueur des mâles et des femelles *Panulirus penicillatus* pêchés dans les récifs coralliens aux abords de San Vicente, Cagayan aux Philippines. Les résultats indiquent que la pente (b) est significativement inférieure à 3,0 et ne diffère pas significativement entre mâles et femelles.