Growth, Mortality and Recruitment of *Decapterus kurroides* in Davao Gulf, Philippines*

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Abstract

The ringnet fishery off Davao, southern Philippines, is briefly described. The major species (36%) in the catch is *Decapterus kurroides* (Pisces, Carangidae), whose growth parameters and mortality rates (natural and fishing) are estimated, based on length-frequency data collected in 1985-1986 and the Compleat ELEFAN software package.

Introduction

Roundscads (*Decapterus* spp., Family Carangidae) are major contributors to the catches of small pelagic fishes in the Philippines (Calvelo and Dalzell 1987; Dalzell and Ganaden 1987; Dalzell et al. 1990). *Decapterus kurroides* is the major species caught by ringnet in Davao Gulf (Fig. 1), southern Philippines, contributing 36% of total catch. The gear is operated throughout the year, and the highest catches are recorded from March to September.

This paper discusses the population dynamics of *Decapterus kurroides* in Davao Gulf, as required for managing this resource.

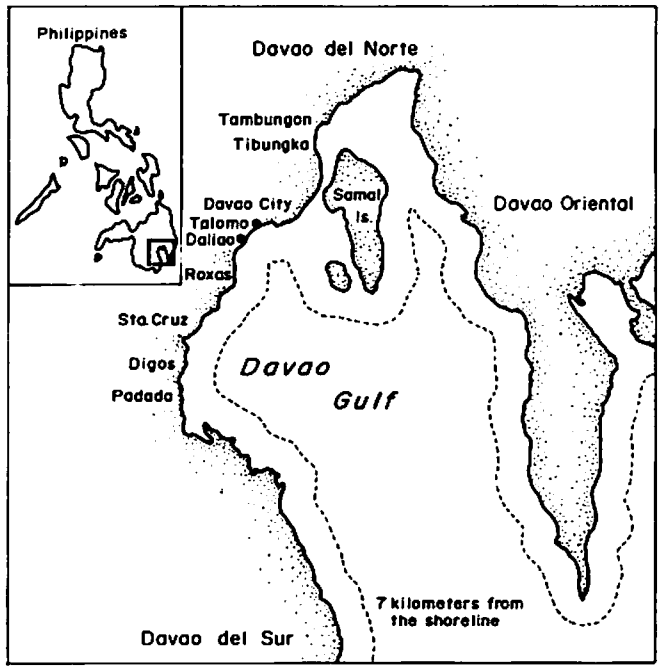

Fig. 1. Map of Davao Gulf showing the locations of the two fish landing centers sampled for this study.

Materials and Methods

The data analyzed here were collected during the implementation of the Regional Assessment Program by the Bureau of Fisheries and Aquatic Resources (BFAR) and the Philippine Council for Agricultural Resources Research and Development (PCARRD) in 1984-1985 (see also Ali 1986).

Fish landing surveys on ringnetters were carried out in two major landing centers in Davao City, Daliao and Talomo (Fig. 1). Ringnetters land their catch in Daliao usually after two-day trips, whereas those in Talomo usually perform one-day trips. The former operates at depths of 500 to over 1,000 fathoms, the latter between 100 and 200 fathoms.

Sampling was carried out every three days; the number of ringnetters, and their catches (kg) and species composition were recorded, and samples of major species were measured (Table 1).

The Compleat ELEFAN software package of Gayanilo et al. (1989) was then used to analyze the length-frequency data at hand.

Results

Tables 2 and 3 present the length-frequency (L/F; cm, total length) data of *Decapterus kurroides* collected at Daliao and Talomo fish landing centers, respectively. As might be seen, the L/F data of Table 3 are based on rather few fishes and they were pooled with those of Table 2 for all analyses.

The method of Wetherall (1986) for estimation of L_∞ and Z/K, yielded, when applied to the pooled length-frequency data, preliminary estimates of L_∞ = 24.6 cm and Z/K = 2.626 (Fig. 2).

*Written during a study stage at ICLARM (16-27 September 1991) funded by the US Agency for International Development through the Philippine Council for Aquatic and Marine Research and Development (PCAMRD).

Table 1. Monthly landed catch of ringnetters (kg), 1985 to 1986 at Daliao and Talomo fish landing centers.

Month	1985		1986	
	Daliao	Talomo	Daliao	Talomo
J	42,273	8,432	98,288	7,542
F	51,552	29,578	26,832	6,240
M	119,480	24,448	140,770	40,161
A	107,490	5,970	71,403	17,949
M	82,942	29,911	80,940	23,974
J	63,008	8,599	178,369	27,739
J	83,461	6,383	131,785	13,480
A	85,216	6,700	114,235	30,839
S	51,240	12,204	159,444	28,819
O	67,558	7,450	84,208	7,742
N	89,603	11,085	58,905	4,980
D	44,360	9,500	77,388	8,420

Table 2. Length-frequency of *Decapterus kurroides* sampled at Talomo fish landing center, Davao Gulf, in 1985-1986 (N = 3,815).

LT(cm)	1985 J	F	M	A	M	J	J	A	S	O	N	D	1986 J	F	M	A	M	J	J	A	S	O	N	D
5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.5	-	-	2	-	1	1	2	5	-	1	2	1	-	1	-	-	-	-	-	-	-	-	-	-
9.5	-	2	9	3	11	3	11	14	-	-	5	3	-	10	1	-	1	-	-	-	2	1	-	1
10.5	-	14	8	16	13	13	22	13	-	-	12	9	-	36	4	4	2	-	1	-	9	2	-	11
11.5	1	29	28	18	20	20	30	18	-	2	10	15	10	52	15	13	7	-	2	-	18	13	-	28
12.5	6	40	32	21	17	26	8	38	-	3	22	44	12	42	17	24	17	-	8	-	18	19	-	28
13.5	4	73	34	31	35	31	8	43	-	8	24	38	6	26	71	31	38	-	18	-	12	22	-	16
14.5	2	70	30	23	26	32	13	34	-	11	18	34	19	5	67	15	48	-	18	-	11	40	1	14
15.5	4	56	33	19	15	16	19	18	-	7	9	11	25	3	74	32	15	-	24	-	17	23	13	5
16.5	6	20	35	11	1	7	8	22	-	3	15	10	23	2	57	19	20	-	61	-	22	19	22	6
17.5	1	2	25	2	5	8	10	9	-	6	5	5	34	4	13	48	4	-	76	-	22	16	19	7
18.5	-	1	18	4	2	2	3	3	-	5	10	2	17	10	4	43	5	-	27	-	40	12	23	7
19.5	-	-	4	3	2	3	5	1	-	4	13	4	3	2	2	13	5	-	15	-	52	8	15	3
20.5	-	-	1	-	-	1	5	1	-	-	5	1	2	-	-	2	4	-	3	-	25	3	9	3
21.5	-	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	10	-	2	-	4	-	9	1
22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-
23.5	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Total	24	307	260	151	148	163	145	219	-	51	150	177	152	193	325	244	177	-	256	-	253	179	111	130

Table 3. Length-frequency of *Decapterus kurroides* sampled at Daliao fish landing center, Davao Gulf, in 1985-1986 (N = 1,375).

LT(cm)	1985 J	F	M	A	M	J	J	A	S	O	N	D	1986 J	F	M	A	M	J	J	A	S	O	N	D
8.5	-	-	-	-	-	-	-	7	-	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
9.5	-	-	-	-	5	-	1	12	-	15	-	-	-	1	-	-	-	-	-	-	-	2	-	-
10.5	1	-	-	1	9	6	-	6	-	29	-	-	-	2	-	-	-	-	-	-	-	6	-	-
11.5	1	-	2	1	4	3	1	2	-	43	-	2	1	4	-	-	1	-	-	-	-	3	-	-
12.5	3	-	9	8	1	4	-	-	-	29	-	7	4	4	7	-	6	-	-	-	-	6	-	-
13.5	5	-	17	18	10	8	3	-	-	21	-	6	10	2	17	-	7	-	3	-	-	6	1	-
14.5	4	-	18	14	15	13	3	-	-	27	-	7	11	3	38	6	8	-	3	-	-	3	1	-
15.5	7	-	19	13	18	13	9	-	-	13	-	4	14	4	92	12	8	-	14	-	3	5	2	-
16.5	18	-	25	5	19	8	2	-	-	15	-	9	13	-	35	14	2	-	33	-	3	3	9	-
17.5	21	-	21	5	5	10	-	-	-	3	-	9	17	2	37	9	3	-	20	-	7	2	7	-
18.5	8	-	12	3	3	5	-	-	-	2	-	4	12	-	7	13	2	-	13	-	4	5	1	-
19.5	9	-	4	2	2	2	1	-	-	2	-	3	3	4	2	5	1	-	3	-	-	4	-	-
20.5	2	-	2	-	1	-	-	-	-	-	-	-	1	4	1	3	-	-	-	-	-	-	1	-
21.5	-	-	1	-	-	2	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
22.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
23.5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
24.5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Total	79	-	130	70	92	74	20	27	-	202	-	51	86	32	236	64	38	-	89	-	17	46	22	-

The ELEFAN I program was then used to refine the L_∞ estimate and to obtain an estimate of K using the same pooled L/F data for 1985-1986. The best estimates thus obtained were L_∞ = 25 cm and K = 0.8 year^{-1}. Fig. 3 shows the growth curve so defined, superimposed on the restructured L/F data.

Fig. 4 shows the corresponding catch curve for *D. kurroides*. Total mortality (Z) was estimated at 4.31 year^{-1} from the descending right arm of that curve. The natural mortality (for T = 28°C) was M = 1.62 year^{-1}, and thus, F = 2.68 and E = (F/Z) = 0.62.

The probabilities of capture estimated from the analysis of the left, ascending part of the catch curve for *D. kurroides* in Davao Gulf are shown in Fig. 5. The resultant curve was fitted using a linearized form of the logistic curve; the corresponding regression yielded values of a = -10.54, b = 0.668 and r = 0.977, with L_{50} = 15 cm.

The recruitment pattern of *D. kurroides* in Davao Gulf is shown in Fig. 6. This suggests two recruitment events per year, one shorter and less important than the other.

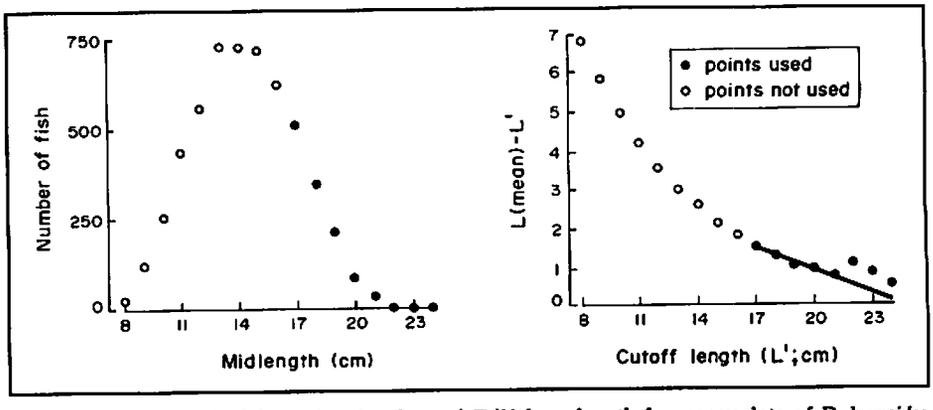

Fig. 2. Wetherall method for estimating L_∞ and Z/K from length-frequency data of *D. kurroides* in Davao Gulf, 1985-1986; the regression equation is Y = 4.78-0.194X, (r = -0.972), i.e., TL_∞ = 24.6 cm and Z/K = 4.15.

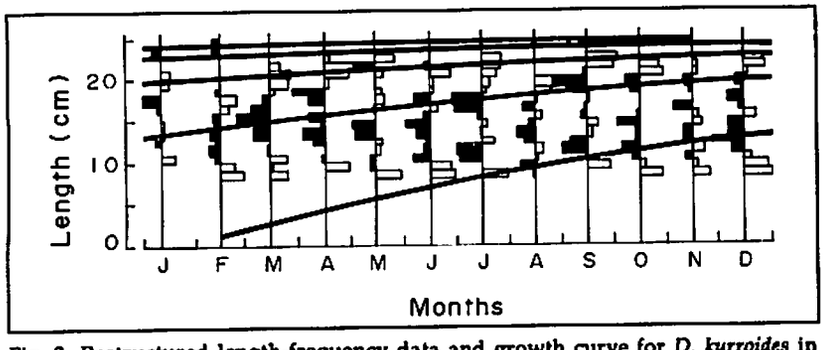

Fig. 3. Restructured length-frequency data and growth curve for *D. kurroides* in Davao Gulf, 1985-1986 (L_∞ = 25 cm, K = 0.8 year^{-1}).

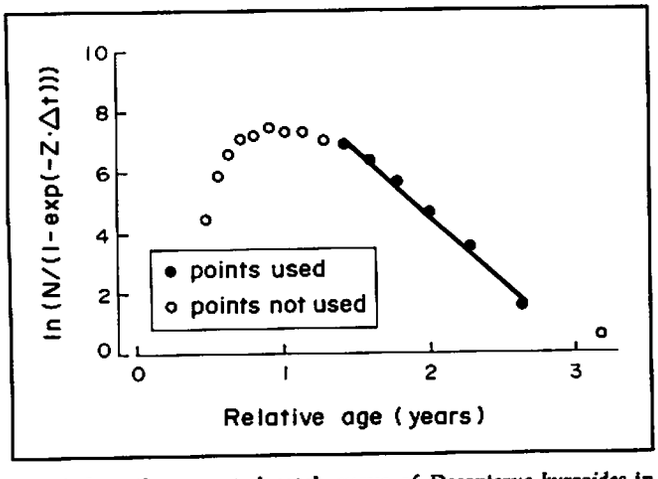

Fig. 4. Length-converted catch curve of *Decapterus kurroides* in Davao Gulf, 1985-1986 (Z = 4.31 year^{-1}).

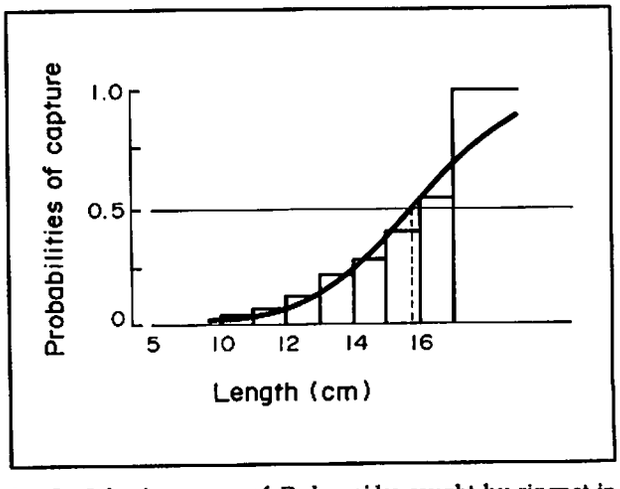

Fig. 5. Selection curve of *D. kurroides* caught by ringnet in Davao Gulf, 1985-1986.

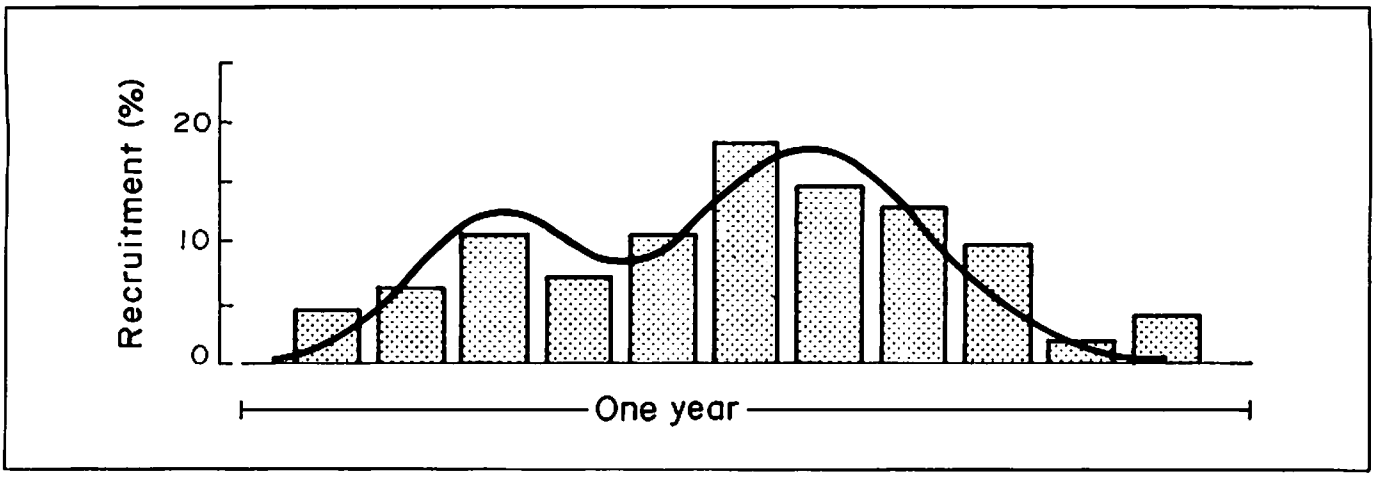

Fig. 6. Recruitment pattern of *D. kurroides*, in Davao Gulf, as obtained from ELEFAN II, and analyzed using the method of Bhattacharya (1967).

Discussion

It is difficult to evaluate the results presented here, as no previous studies of this type appear to have been performed for *D. kurroides*.

A close congener, *Decapterus russelli* has been well studied, however. Comparisons using ϕ' (= $\log_{10}K$ + $2\log L_\infty$), the growth performance index of Pauly and Munro (1984) suggests that *D. kurroides* (ϕ' = 2.39) either grows more slowly than *D. russelli* (ϕ' = 2.54-2.77; Sousa 1988; Widodo 1988; Ingles and Pauly 1984), or that our value of K = 0.8 year^{-1} is an underestimate. The latter is likely, given the absence of small fish in the L/F data of Tables 1 and 2.

With regard to the estimates of mortality, we note that the values estimated here are roughly similar to those reported by Ingles and Pauly (1984) and Corpuz et al. (1985) for *Decapterus* spp. in the Philippines, and Widodo (1988) for *D. russelli* in the Java Sea.

As for the bimodal recruitment pattern in Fig. 6, we note that it differs from the unimodal patterns reported by Ingles and Pauly (1984) for *D. russelli* in the Philippines. However Sousa (1988) reported a bimodal recruitment pattern for *D. russelli* in Mozambique, which seems to be the rule for small pelagic fishes in the tropics and subtropics.

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