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Composition and Length-Weight Relationships of Fishes in the Three Floodplain Lakes of Agusan Marsh Wildlife Sanctuary

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Abstract

Freshwater fish fauna in the three floodplain lakes in Agusan Marsh, northeast Mindanao, Philippines is mainly composed of cyprinids and clariids (21.43 %) followed by belontiids (14.28 %) and the rest of the fauna (7.14 %). Length-weight relationship parameters and condition factors were estimated for nine species. Estimates of the parame-ter b ranged from 2.814 and 3.649. A brief discussion of the utility of data such as pre-sented in this study is included.

Introduction

Agusan Marsh was declared a priority-protected area in northeast Mindanao, Philippines in 1989. Its peculiar environment was subjected to considerable changes due to periodic annual flooding and receding of

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floodwaters. Resource management studies initiated by the Department of Environment and Natural Resources (DENR) and concerted efforts by non-government organizations through KABILIN and the local government unit (LGU) in the province of Agusan del Sur were conducted to assess the extent of exploitation of resources in Agusan Marsh. This study complements with the objectives of such initiatives by reporting on fish composition and some biological parameters of 9 species of marsh fishes.

Materials and Methods

Monthly fish samples were obtained from October 1998 to November 1999 in the three traditional fishing floodplain lakes of the Monobo tribe, namely Dinagat, Mihaba and Ticgon of the Agusan Marsh Wildlife Sanctuary, located between 8°00'N - 19°00'N and 125°52'E - 126°02'E (Fig. 1). Only three out of the five gears used at the start were utilized all throughout the sampling period for their applicability in marsh conditions: stationary gill nets, 70 x 1.5 m, with stretch mesh sizes of 125 and 25 mm and four 25 m long series of baited hook and line locally called *palangri*, which were deployed in the floodplain lakes; and 100 pieces of individual, baited hook and line locally called *kawil* which were deployed in ankle to knee-deep water in the inundated areas in the lake periphery.

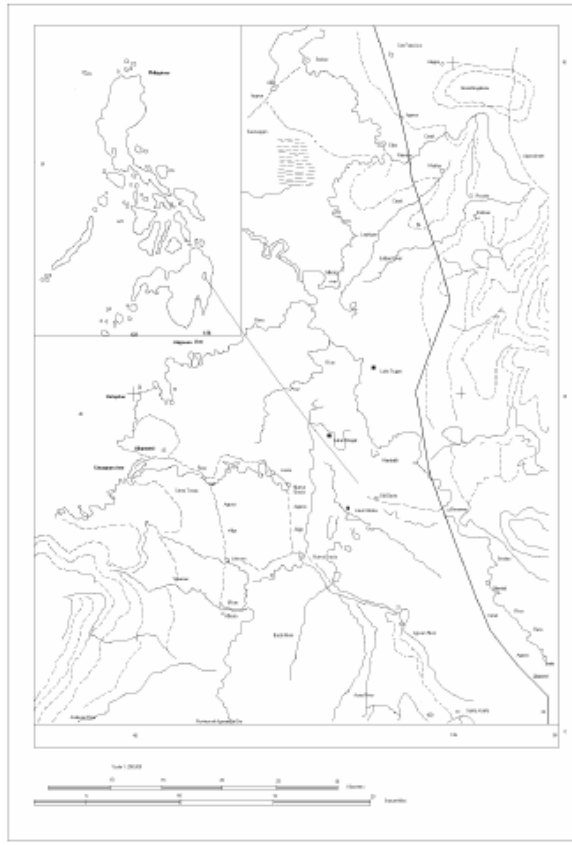


Figure 1. Agusan Marsh protected area in Northeast Mindanao, Philippines showing the stations sampled in this study.

Gears, particularly the gill net and *palangri*, were preferred by fisher folks in the area. Total fish length was measured in cm and wet weight was measured in grams.

The parameters of the relationship linking length (L; total length, cm) and weight (W; live weight, g) expressed as $W = a \cdot L^b$ were estimated using linear regressions fitted to the log-transformed length and weight data. Herein, 'a' is a constant and 'b' is the slope of the regression, with values between 2.5 and 3.5, usually close to 3 (Carlander 1977). The length-weight relationships were also expressed as condition factors of the form $cf = (W \cdot 100)/L^3$ (Le Cren 1951). Note that in this relationship, the multiplicative factor in Carlander's equation, 'a' can be expressed as cf/100 when b=3.

A one-way ANOVA was performed first on condition factor values to determine homogeneity of the samples at the species level. A post-hoc analysis was then used to test for significant differences between the different lake populations of a species (Tukey 1953). Populations with non-significant differences in their cf values were considered to have similar growth patterns and were thus pooled together (Entsua-Mensah et al. 1995; Palomares et al. 1996). Species whose cf values showed significant differences and whose sample size were ≥ 30 were separately analyzed to estimate L/W relationship parameters except for *Trichogaster trichopterus* whose sample size had a very narrow size range.

Discussion

Freshwater fish fauna in Agusan Marsh was mainly composed of cyprinids and clariids comprising 21.43 % (Table 1). Studies in other freshwater ecosystems such as those in North and South Vietnam (Yen 1985; Yen and Trong 1988), in a peat swamp in Malaysia (Mizuno and Furtado 1982), in Thailand (Smith 1945), Lowe-McConnell (1969) noted the dominance of cyprinids and its high endemicity in Southeast Asia (Zakaria-Ismail 1994). Cyprinids were often followed either by siluriids, homalopteriids or catfishes. Herre (1953) presented only five families of true freshwater fishes in the country, having one or two representative for each except for cyprinids. In Agusan Marsh, the said families of true freshwater fishes, namely anabantids, channids, clariids, cyprinids and osphronemids were also present. The current survey, therefore,

Table 1. Species composition of freshwater water fishes caught between November 1998 and October 1999 from the three floodplain lakes in Ticgon, Dinagat and Mihaba in the Agusan Marsh Wildlife Sanctuary

Scientific Names	Local Names	Fish (N)	Length Range (cm)	Percent composition	Occurrence in Lakes [(+) caught; (-) not caught during sampling]		
					Ticgon	*Dinagat*	*Mihaba*
Anabantidae *Anabas testudineus* (Bloch)	puyo	23	14-22	7.14	+	+	+
Belontiidae *Trichogaster pectoralis* (Regan)	gurami	107	10-25	14.28	+	+	+
Trichogaster trichopterus (Pallas)	gurami	226	7-13		+	+	+
Osphronemidae *Osphronemus goramy* (Lacepede)	giant gurami	7	19-25	7.14	+	+	+
Cichlidae *Oreochromis niloticus* (Linnaeus)	tilapia	14	15-25	7.14	+	+	+
Cyprinidae Cyprinus carpio *(Linnaeus)*	karpa	20	10-38	21.43	+	+	+
Puntius binotatus (Valenciennes)	gabut or paitan sibad	12	11-14		+	+	+
Cyprinid spp.		4	29-38		+	-	-
Channidae *Channa striata* (Bloch)	isda, hawan, haluan	293	13-57	7.14	+	+	+

Table 1. Species composition of freshwater water fishes caught between November 1998 and October 1999 from the three floodplain lakes in Ticgon, Dinagat and Mihaba in the Agusan Marsh Wildlife Sanctuary *(continued)*

Scientific Names	*Local Names*	*Fish (N)*	Length Range (cm)	Percent composition	Occurrence in Lakes [(+) caught; (-) not caught during sampling]		
					Ticgon	*Dinagat*	*Mihaba*
Clariidae							
Clarias batrachus (Linnaeus)	taiwan hito, pantat ito, agok-ok	39	17-46	21.43	+	+	+
Clarias macrocephalus (Gunther)		6	26-54		+	+	+
Clarias spp.		1	37		+	-	-
Eleotridae							
Ophiocara porocephala (Valenciennes)	Bunog	1	27	*7.14*	-	+	-
Gobiidae							
Glossogobius giuris (Hamilton)	usail, pid-yanga	11	16-23	*7.14*	-	-	+
TOTAL		***764***		***100.00***			

has new addition to the survey by Davies (1991) in Agusan Marsh and these are: *Ophiocara porocephala* and *Glossogobius giuris*, both brackish water fishes. Another addition to the list may include *Mugil dussumieri* from Lakes Dinagat and Mihaba and one locally called '*ibis*' from Lake Dinagat caught by fisher folks while this study was conducted. Thus, fish composition in Agusan Marsh may be characterized as families being represented by one or two species which are found in similar habitats elsewhere, an occurrence that is common in island communities. Based on food preference, fishes in the floodplain lakes maybe described as generalists and do not have preference for specific diets and habits (Talde et al. 2004) as they feed in the surroundings with annual occurrence of flood water.

Moreover, fish species in Agusan Marsh were of three types, two of which could be broadly divided into two distinct groups based on their responses to conditions in floodwater: 'white fishes' (Cyprinidae and Osphronemidae) and 'black fishes' (Anabantidae, Belontiidae, Channidae, Clariidae) and another group, the brackish water fishes i.e. the euryhaline

freshwater species that tended to inhabit the zone at all times of the year that would include members of the Family Cichlidae (Welcomme 1985).

One-way ANOVA (Table 2) showed significant differences within species values of condition factor (cf) for *Trichogaster pectoralis*, *T. trichopterus*, *Channa striata* and *Clarias batrachus*. The Tukey test (Table 3) showed that *T. pectoralis* and *C. striata* from Lake Ticgon have significantly different cf values from those in Lake Dinagat while those from Lake Mihaba were neither significantly different from those in Lakes Ticgon nor Dinagat. Condition factor values of *T. trichopterus* in Lake Dinagat were significantly different for the samples in Lakes Ticgon and Mihaba but neither was significantly different from each other. *C. batrachus* from Lakes Dinagat and Ticgon were not significantly different from each other but samples from both lakes significantly differ from those in Lake Mihaba.

Table 2. One-way ANOVA of condition factors of fishes sampled in the three floodplain lakes in Agusan Marsh Wildlife Sanctuary, Mindanao, Philippines in October 1998 to November 1999

Species	Source of variation	Sum of squares	df	Mean square	Computed F	Probability
A. testudineus	between groups	0.002794	2	0.00140	169	0.846
	Within groups	1.655	20	0.00827	—	—
	Total	1.683	22	—	—	—
T. pectoralis	between groups	0.460	2	0.230	5.366	0.006
	within groups	4.458	104	0.00429	—	—
	Total	4.918	106	—	—	—
T. trichopterus	between groups	14.92	2	7.461	22.54	0.000
	within groups	73.81	223	0.331	—	—
	Total	88.74	225	—	—	—
O. goramy	between groups	0.001960	2	0.000982	0.597	0.593
	within groups	0.006580	4	0.00164	—	—
	Total	0.008540	6	—	—	—
O. niloticus	between groups	0.663	2	0.00331	0.212	0.812
	within groups	1.719	11	0.156	—	—
	Total	1.785	13	—	—	—
C. carpio	between group	0.00856	2	0.00428	1.130	0.346
	within group	0.643	17	0.00378	—	—
	Total	0.729	19	—	—	—
P. binotatus	between group	0.111	2	0.00557	0.794	0.481
	within group	0.631	9	0.00702	—	—
	Total	0.743	11	—	—	—
C. striata	between group	0.415	2	0.207	4.376	0.013
	within group	13.70	289	0.00474	—	—
	Total	14.12	291	—	—	—
C. batrachus	between group	0.846	2	0.424	11.70	0.00
	within group	1.305	36	0.00362	—	—
	Total	2.152	38	—	—	—

Table 3. Results of a Tukey test on condition factors (cf) of fishes sampled from the floodplain lakes, Ticgon, Dinagat and Mihaba of Agusan Marsh, Mindanao, Philippines in November 1998 to October 1999 (mean differences given for significantly different cf estimates)

Species	Lakes		Mean Difference	Significance 0.05% Level	Standard Error
T. pectoralis	Ticgon	Dinagat	0.131	0.009	0.004
		Mihaba		0.792	0.074
	Dinagat	Ticgon	-1.31	0.009	0.044
		Mihaba		0.058	0.007
	Mihaba	Ticgon		0.792	0.074
		Dinagat		0.058	0.077
T. trichopterus	Ticgon	Dinagat	-4.60	0.001	0.124
		Mihaba		0.687	0.140
	Dinagat	Ticgon	4.60	0.001	0.124
		Mihaba	0.576	0.000	0.093
	Mihaba	Ticgon		0.687	0.140
		Dinagat	-0.576	0.000	0.093
C. striata	Ticgon	Dinagat	0.008954	0.009	0.030
		Mihaba		0.292	0.035
	Dinagat	Ticgon	-0.008954	0.009	0.030
		Mihaba		0.471	0.032
	Mihaba	Ticgon		0.293	0.035
		Dinagat		0.471	0.032
C. batrachus	Ticgon	Dinagat		0.995	0.090
		Mihaba	0.300	0.002	0.079
	Dinagat	Ticgon		0.995	0.090
		Mihaba	0.292	0.001	0.073
	Mihaba	Ticgon	-0.300	.0002	0.079
		Dinagat	-0.292	0.001	0.073

Differences in the condition factors for *C. striata*, *T. trichopterus*, *T. pectoralis* and *C. batrachus* may be associated to an attribute of 'black fishes,' which are capable of short lateral migrations only i.e. from the river to the flooded plains (Welcomme 1979;1985). Such species tend to exploit the nearest and most available inundated plain for food during the flood season and may get trapped in pools or remnants of the shallow lakes with adjacent areas that are mostly encroached by terrestrial vegetation during the dry season when food is scarce. Thus, differences in feeding strategy and possibly inherent differences of the three lake environs may have been expressed as differences in the cf values presented in table 1.

Results of the L/W regression analyses are presented in figures 2 to 4. Inter-population variability in the values of 'a' was highly heterogeneous (C.V. = 418 %) ranging from a_{min} = 0.001 in *C. striata* from Lake Ticgon to a_{max} = 0.094 of the pooled samples. Inter-population variability of 'b' on

the other hand, was low (C.V. = 15.2%) ranging from b_{min} = 2.316 for pooled samples to b_{max} = 3.649 for *C. striata* in Lake Ticgon. King (1996) observed a similar trend in inter-population variability in his study on Nigerian freshwater fishes. The mean exponent, b = 3.091, for the whole fish population in the three Agusan Marsh lakes falls well within the commonly reported values of 'b' i.e. between 2.5 and 3.5 (Carlander 1977).

Fig 2

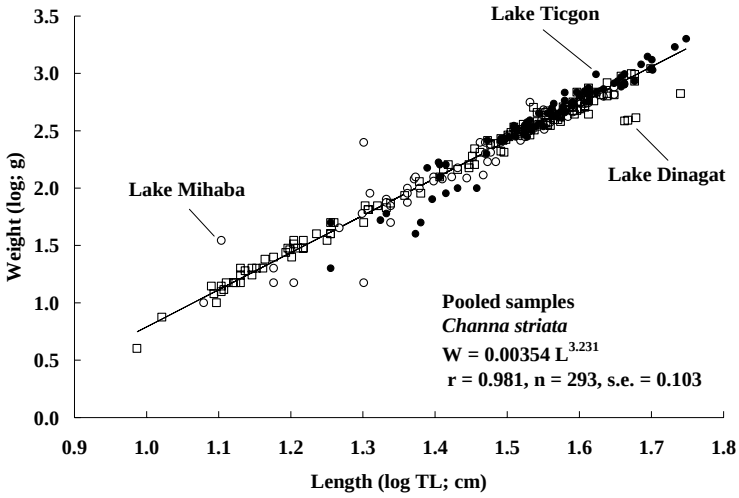
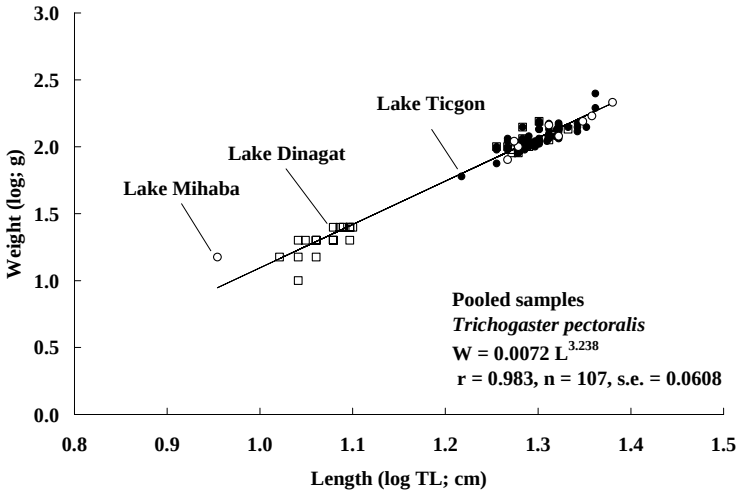


Fig 3



Figures 2 and 3. Regression statistics for *Channa striata* and *Trichogaster pectoralis* pooled samples taken in Nov. 1998 to Oct. 1999 from three floodplain lakes (Ticgon, Dinagat and Mihaba) of the Agusan Marsh, Mindanao, Philippines.

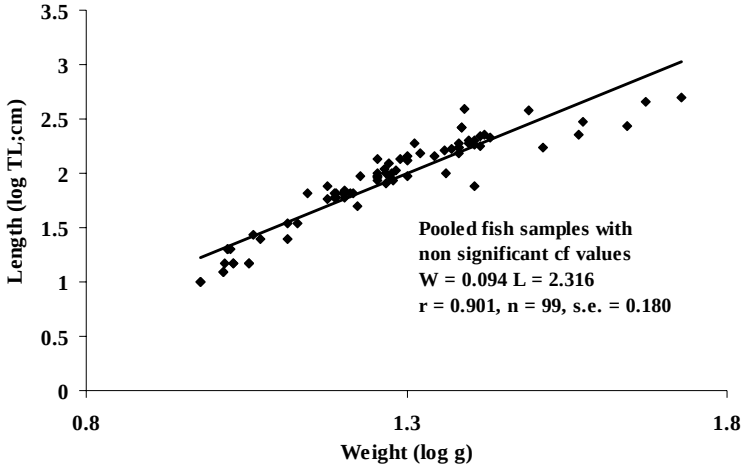


Figure 4. Regression statistics for pooled samples of fishes with non-significant cf values taken in November 1998 to October 1999 from three floodplain lakes (Ticgon, Dinagat and Mihaba) of the Agusan Marsh, Mindanao, Philippines

Conclusion

This study showed that the catch is dominated by the belontiids, *T. trichopterus* that is often used as bait for the more commercially viable *C. striata* which commands the highest price when sold either fresh or sun-dried in addition to *T. pectoralis* which is also commonly sold in dried form. Somehow, the locals' protein requirements are met by its inland freshwater resource. But whether it has sufficiently supplied the requirement or not still remains to be assessed. Thus, by looking into the composition and some biological parameters of Agusan Marsh's freshwater fishes, baseline information for stock assessment to provide advice on the optimum exploitation of living aquatic resources (Sparre and Venema 1992) is created. Availability of empirical data may help policy makers and stakeholders address fishing pressures, namely, rapid population influx of farmer-migrants to the floodplain lakes and government contemplation of converting vast tracts of marshlands into rice fields.

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