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Length-weight Relationships for 11 Fishes Caught by Fish Pots in the Coastal Water off Baekya Island, Korea

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Abstract - Length-weight relationships were estimated for 11 fish species caught in Baekya Island, Korea. Samples were caught in depths of <15 m by fish pots between November 2008 and July 2009. The sampling gear, fish pots, is a widely used as commercial fishing gear in shallow waters of the region. The most abundant families were Hexagrammidae (20.7%), Cottidae (18.5%), Tetraodontidae (14.8%) and Scorpaenidae (13.3%). Estimates for parameter *b* of the length-weight relationship ($W=aL^b$) ranged between 2.454 and 3.361.

Key words : length-weight relationships, Baekya Island, fish pots, correlation coefficient

INTRODUCTION

Length-weight relationships are beneficial for a wide variety of studies, including growth rate estimation, age structure, and other aspects of fish population dynamics. The use of length-weight regressions has been extensively applied to studies on: i) the estimation of biomass from length observations required in yield assessment (Froese 1998; García *et al.* 1998); ii) equations for the conversion of growth in length to growth in weight, for use in stock assessment models; iii) estimating the condition factors of fish; and iv) interregional comparisons of life histories of a certain species (Pauly 1993; Petrakis and Stergiou 1995; Goncalves *et al.* 1997).

In fish studies, fish length is often more rapidly and easily measured than mass. Thus knowing the length-weight relationships make it more convenient to determine mass where only the length is known (Lalèyè 2006).

In Korea waters, length-weight relationships have been reported for sargassum ichthyofauna (Yoon and Choi 2010), but data for most fish are insufficient to date. This study reports the length-weight relationships for 11 fish species taken by fish pots fisheries in the Baekya Island coastal area.

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MATERIALS AND METHODS

1. Study area

The Baekya Island is located in the Jeollanamdo region of southern Korea (Fig. 1). The study area shows a salinity range of 30.56-33.67 psu with a temperature varying from 8.86°C in winter to 23.69°C in summer. The coastal area off Baekya Island supports important commercial fisheries, namely fishes such as *Lateolabrax maculates* and *Scomber japonicus* (Lim 2010).

2. Sampling design and statistical analysis

This study was carried out in the coastal area off Baekya Island (34°36′N; 127°38′E), Korea. Fishes were sampled by fish pots (130 cm diameter × 60 cm height, mesh size 36 mm) between depths of 7-15 m in November, February, May and July 2008 and 2009. To keep them as fresh as possible, fish were identified in the field down to species level and preserved on ice, but not frozen. Samples were immediately transported to the laboratory, where total length (TL) was measured to the nearest centimeter. Fish in an advanced stage of rigor mortis were not considered for analysis. Weight was measured to the nearest gram or to the nearest 0.1 g with a precision balance whenever possible.

For all length-weight relationship calculations, the least squares fitting method was used to estimate *a* and *b* parameters of the function $W=aL^b$, *W* is the weight of the fish in grams *L* is the total length in cm *a* is a coefficient related to body form, and *b* is an exponent indicating isometric growth when equal to 3. The *b* value for each species was tested by *t*-test at the 0.05 significance level to verify if it was significantly different from 3.

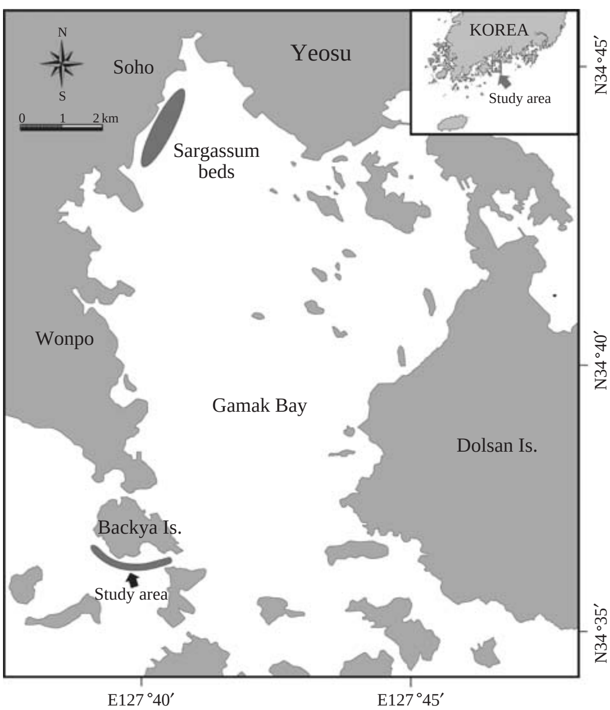

Fig. 1. Map of sampling site around Baekya Island, including sargassum beds in Gamak Bay.

RESULTS AND DISCUSSION

The length-weight relationships of 11 species of fish representing 10 families are presented in this study. The family name, species name, sample size (N), size range (minimum and maximum), length-weight parameters *a* and *b*, coefficient of determination (r^2), and standard error of slope (*b*) are given in Table 1.

Hexagrammidae (20.7%), Cottidae (18.5%), Tetraodontidae (14.8%) and Scorpaenidae (13.3%) were the most abundant families. Most r^2-values were greater than 0.928 with the exception of one species: *Takifugu niphobles* ($r^2=0.695$, 20 individuals).

The exponent *b* often has a value close to three, but varies between two and four (Tesch 1971). A value close to three indicates that the fish grows isometrically and other values indicate allometric growth. The exponent *b* varied between 2.454 for *Pterogobius zonoleucus* and 3.361 for *Lateolabrax japonicus* (Table 1). Samples of *Lateolabrax japonicus*, *Pseudopleuronectes yokohamae*, *Sebastes inermis*, *Scomber japonicus*, and *Takifugu niphobles* were represented by small length ranges, and mostly by juveniles caught in a certain period of the sampling surveys. The relationships estimated in this study should be used with caution, and considered as representative of the study period. Also, the selective characteristics of fish pot do not include all range of length distri-

Table 1. Length-weight relationships for 11 species caught by fish pots in the coastal water off Baekya Island

Family	Species	n	Total length (cm)		Parameters			r^2
			Min	Max	*a*	*b*	SE (*b*)	
Congridae	*Conger myriaster*	8	28.30	40.60	0.00056	3.292	0.35531	0.935
Cottidae	*Pseudoblennius cottoides*	25	10.38	17.14	0.00746	3.142	0.10234	0.976
Gobiidae	*Pterogobius zonoleucus*	7	6.19	7.34	0.03051	2.454	0.33609	0.914
Hexagrammidae	*Hexagrammos agrammus*	28	5.13	16.32	0.00713	3.216	0.07432	0.986
Moronidae	*Lateolabrax japonicus*	4	8.84	11.54	0.00432	3.361	0.06894	0.999
Pholidae	*Pholis nebulosa*	13	4.69	25.48	0.00378	3.019	0.06608	0.994
Pleuronectidae	*Pseudopleuronectes yokohamae*	8	7.36	14.25	0.01706	2.827	0.14939	0.984
Scorpaenidae	*Sebastes inermis*	14	7.05	10.73	0.03359	2.659	0.21382	0.928
	Sebastes schlegeli	4	13.30	26.73	0.07178	2.471	0.30732	0.970
Scombridae	*Scomber japonicus*	4	2.47	3.79	0.01410	2.751	0.04826	0.999
Tetraodontidae	*Takifugu niphobles*	20	7.86	9.18	0.05408	2.509	0.39176	0.695

n is the sample size; min. and max. are minimum and maximum total lengths in cm; *a* and *b* are the parameters of the length-weight relationship; SE (*b*) is the standard error of the slope b; r^2 is the coefficient determination.

Table 2. Comparison of length-weight relationships parameters for species considered in this study with previously published

Species	Locality	Fishing gear	n	Parameters				Source
				a	*b*	SE (*b*)	r^2	
Hexagrammos agrammus	Gamak Bay	Surrounding net	48	0.00639	3.250	0.09071	0.965	Yoon and Choi (2010)
	Baekya Island	Pots	28	0.00713	3.216	0.07432	0.986	Present study
Lateolabrax japonicus	Gamak Bay	Surrounding net	196	0.00682	3.151	0.04982	0.953	Yoon and Choi (2010)
	Baekya Island	Pots	4	0.00432	3.361	0.06894	0.999	Present study
Pholis nebulosa	Gamak Bay	Surrounding net	241	0.00157	3.354	0.05344	0.952	Yoon and Choi (2010)
	Baekya Island	Pots	13	0.00378	3.019	0.06608	0.994	Present study
Pseudoblennius cottoides	Gamak Bay	Surrounding net	25	0.00477	3.330	0.07140	0.989	Yoon and Choi (2010)
	Baekya Island	Pots	25	0.00746	3.142	0.10234	0.976	Present study
Pterogobius zonoleucus	Gamak Bay	Surrounding net	486	0.02364	2.546	0.10414	0.755	Yoon and Choi (2010)
	Baekya Island	Pots	7	0.03051	2.454	0.33609	0.914	Present study
Sebastes inermis	Gamak Bay	Surrounding net	7	0.05326	2.502	0.32750	0.921	Yoon and Choi (2010)
	Baekya Island	Pots	14	0.03359	2.659	0.21382	0.928	Present study
Scomber japonicus	Gamak Bay	Surrounding net	14	0.01104	2.811	0.19152	0.947	Yoon and Choi (2010)
	Baekya Island	Pots	4	0.01410	2.751	0.04826	0.999	Present study
Takifugu niphobles	Gamak Bay	Surrounding net	275	0.05545	2.491	0.13947	0.635	Yoon and Choi (2010)
	Baekya Island	Pots	20	0.05408	2.509	0.39176	0.695	Present study

n is the sample size; *a* and *b* are the parameters of the length-weight relationship; SE (*b*) is the standard error of the slope b; r^2 is the coefficient determination.

butions. Table 2 gives the length-weight relationships for 8 species estimated in this study and those previously obtained for sargassum beds of Gamak Bay. For four of these species there were no significantly different *b*-values ($P > 0.05$), with the differences ranging between 0.018 and 0.092; 4 of 8 species had significantly different *b*-values ($P < 0.05$), with the differences ranging from 0.157 to 0.335. According to Petrakis and Stergiou (1995), for more precise weight estimation the use of length-weight relationships should be strictly limited to the ranges applied in the estimation, of the linear regression parameters. A combination of one or more of the following factors can be attributed to differences in *b*-values: (i) differences in the number of specimens examined; (ii) area/season effects; (iii) habitat; (iv) the degree of stomach fullness; (v) gonad maturity; (vi) sex; (vii) health and general fish condition; (viii) preservation techniques; and (ix) differences in the observed length ranges of specimens caught (Tesch 1971; Wootton 1998). However, these factors were not considered in the present study. The fish sample data from this study could be used as mean annual values for each species, and are not representative of any particular season, because the fish samples were obtained during different seasons throughout the sampling period. These data are close to the median values of *a* and *b* (Froese 2006).

The purpose of the length-weight relationships given here was to contribute to the knowledge of the length-weight relationships of some marine fish species from Korean waters.

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