

Original article

Response to mass selection for correlation on growth traits in climbing perch, *Anabas testudineus* (Bloch, 1792)

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Introduction

Climbing Perch, *Anabas testudineus* is a local economically important fish and popular for consumption in Thailand and Southeast Asia. Normally, Climbing Perch has a small body with quite large head so Chumphon Aquaculture Genetics Research and Development Center, Department of Fisheries has genetically improved this fish to enhance growth performances since 2003 under genetic improvement program. The effects of selection responses on mass selection were used to compare the relationship between growth performances and their desired characteristics, small heads and large body, on pre-selection and post-selection populations. The effectiveness of mass selection was evaluated to select the correlations between the growth characteristics in Climbing Perch. Selection program can improve growth performances, survival rate, increase production and efficiency of aquatic animal culture. Divergent selection is quite effective for measuring the selective responses and heritability estimation where limited number of animals has been measured since the expected variance in responses and heritability is minimized [1] and it has been applied to increase the selection response for body weight in several aquatic animals [2,3].

As a mass selection has been successfully used in aquatic animal breeding program, in this study, a mass selection program was applied to evaluate selection progress of growth traits in four generations of pre-selected and post-selected Climbing Perch.

Materials and methods

Genetic resources

Pre-selection population, six populations of Climbing Perch in Thailand were used. Four natural reservoirs from Uttaradit, Ratchaburi, Sakonand Nakhon, Nakhon Si Thammarat and two hatcheries (private farm and Chumphon Aquaculture Research and Testing Center)

were tested for growth, yield and survival rates [6].

Selection system and mating system

Climbing Perch was selected by four generations mass selection. Each of generation, the 30 pairs of longest and weightiest Climbing Perch were spawned at the 1:1 ratio of males and females randomly. The two generations of Climbing Perch from the hatchery of Chumphon Aquaculture Research and Testing Center was used as basic population [4]. After that, third generation had been started breeding process then fourth generation Climbing Perch with mass selection showed more body length and body weight than control ($P < 0.01$) [5].

Performance testing

Post-selection population, growth test of the fourth generation was compared between selected and control populations.

Data in this study as follow

The pre-selection population (from the best growing groups from 6 sources in Thailand, 25 females and 25 males) and post-selection population (the fourth generations 100 females and 100 males) were used for a relationship analysis. The relationship among eight growth traits. The relationship of eight growth traits including Weight (W), Total length (TL), Head length (HL), Body length (BL), Head width (HW), Head depth (HD), Body width (BW) and Body depth (BD) were analyzed by SAS version 9.1.3 [7].

Results

1. The correlation between mixed sexes, female and male of eight growth traits showed 0.35 to 0.99 for pre-selected and 0.30 to 0.99 for post-selected populations (Table 1, 2 and 3).
2. The correlation of HL and BL in mixed sexes, female and male of pre-selection were 0.62, 0.89 and 0.45 and

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post-selection were 0.55, 0.46 and 0.62. The results of mass selection in fourth generations distinguished tendency of the head to be smaller compared to the body as has been expected (Table 1, 2 and 3).

Table 1. Correlation on growth traits in Climbing Perch of mixed sexes between pre-selected (1st generation, upper line) and post-selected (4th generation, lower line) populations

Trait	W	TL	HL	HW	HD	BL	BW	BD
W	1	0.90	0.82	0.84	0.52	0.84	0.92	0.76
		0.69	0.87	0.84	0.58	0.59	0.87	0.81
TL	0.93	1	0.76	0.77	0.66	0.99	0.89	0.65
			0.68	0.63	0.46	0.99	0.59	0.58
HL	0.82	0.76	1	0.71	0.59	0.62	0.75	0.61
				0.82	0.65	0.55	0.79	0.76
HW	0.84	0.77	0.71	1	0.45	0.71	0.80	0.68
		0.84	0.63	0.82		0.53	0.54	0.81
HD	0.52	0.45	0.59	0.45	1	0.37	0.45	0.40
		0.58	0.46	0.65	0.53		0.38	0.52
BL	0.84	0.98	0.62	0.71	0.37	1	0.77	0.57
		0.59	0.99	0.55	0.54	0.38		0.50
BW	0.92	0.82	0.75	0.80	0.45	0.77	1	0.69
		0.87	0.59	0.79	0.81	0.52	0.50	
BD	0.76	0.62	0.61	0.68	0.40	0.57	0.69	1
		0.81	0.58	0.76	0.78	0.48	0.49	0.76

Table 2. Correlation on growth traits in Climbing Perch of female between pre-selected (1st generation, upper line) and post-selected (4th generation, lower line) populations

Trait	W	TL	HL	HW	HD	BL	BW	BD
W	1	0.97	0.90	0.72	0.80	0.96	0.96	0.73
		0.53	0.85	0.77	0.50	0.44	0.78	0.75
TL	0.97	1	0.92	0.71	0.81	1.00	0.98	0.72
			0.57	0.48	0.36	0.99	0.39	0.44
HL	0.90	0.92	1	0.70	0.71	0.89	0.89	0.64
		0.85	0.57	0.81	0.58	0.46	0.70	0.73
HW	0.72	0.71	0.70	1	0.53	0.70	0.69	0.45
		0.77	0.48	0.81		0.44	0.39	0.71
HD	0.80	0.81	0.71	0.53	1	0.82	0.85	0.56
		0.50	0.36	0.58	0.44		0.30	0.39
BL	0.96	1.00	0.89	0.70	0.82	1	0.98	0.72
		0.44	0.99	0.46	0.39	0.30		0.32
BW	0.96	0.98	0.89	0.69	0.85	0.98	1	0.71
		0.78	0.39	0.70	0.71	0.39	0.32	
BD	0.73	0.72	0.64	0.45	0.56	0.72	0.71	1
		0.75	0.44	0.73	0.72	0.37	0.36	0.62

Table 3. Correlation on growth traits in Climbing Perch of male between pre-selected (1st generation, upper line) and post-selected (4th generation, lower line) populations

Trait	W	TL	HL	HW	HD	BL	BW	BD
W	1	0.89	0.59	0.87	0.52	0.87	0.92	0.84
		0.90	0.82	0.84	0.52	0.84	0.92	0.76
TL	0.89	1	0.59	0.84	0.51	0.99	0.80	0.59
			0.76	0.77	0.45	0.98	0.82	0.62
HL	0.59	0.59	1	0.52	0.35	0.45	0.53	0.45
		0.82	0.76	0.71	0.59	0.62	0.75	0.61
HW	0.87	0.84	0.52	1	0.57	0.82	0.83	0.74
		0.84	0.77	0.71		0.45	0.71	0.80
HD	0.52	0.51	0.35	0.57	1	0.49	0.59	0.60
		0.52	0.45	0.59	0.45		0.37	0.45
BL	0.87	0.99	0.45	0.82	0.49	1	0.78	0.56
		0.84	0.98	0.62	0.71	0.37		0.77
BW	0.92	0.80	0.53	0.83	0.59	0.78	1	0.81
		0.92	0.82	0.75	0.80	0.45	0.77	
BD	0.84	0.59	0.45	0.74	0.60	0.56	0.81	1
		0.76	0.62	0.61	0.68	0.40	0.57	0.69

W=weight; TL=total length; HL=head length; HW=head width;

HD=head depth; BL=body length; BW=body width; BD= body depth.

3. The correlation of BW and BL in mixed sexes, female and male of pre-selection were 0.77, 0.98 and 0.78 and post-selection were 0.50, 0.32 and 0.77. The

fourth generation of selection, the trend of selection was reduced. Possibly, BW respond to selection better than BL that cause of the correlation between BW and BL were reduced (Table 1, 2 and 3).

4. The correlation of the BD and BL in mixed sexes, female and male of pre-selection were 0.57, 0.72 and 0.56 and post-selection were 0.49, 0.36 and 0.57. The fourth generation of selection, the trend of selection was reduced like BW and BL (Table 1, 2 and 3).

Discussion

The results of this study indicated that the advancements of growth traits correlations selection in Climbing Perch were HL and BL. The reduced correlation between HL and BL was showed the successful of selection. Whereas, the correlation among BW and BL and BD and BL were decreased, the BW and BD had highly response than BL traits. The different response for selection might be cause of reduced correlation. Therefore, the selection program for next generation indicated that BL should be weighted in the selection index. In addition, BL may effect to other characteristics with negative correlation with BW and BD. This result showed the important of BL that to be more studied in the future.

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