Wann-Nian Tzeng and Chih-Wei Chang
Department of Zoology, College of Science,
National Taiwan University, Taipei 106, Taiwan.
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Stock Status and Management Prospect of the Freshwater Eels *Anguilla* spp. in Taiwan

Abstract

To understand the population status of the anguillid eels in Taiwan, the species composition of eel caught by a bamboo trap in seven rivers of Taiwan was investigated and the catch data of both elver and adult eel in Taiwan Fisheries Yearbooks were analyzed by spectral analysis and cross correlation. *Anguilla japonica* was the most abundant among the four species identified, making up 89.8 % of the total catch, followed by *A. marmorata* (9.6 %), and *A. bicolor pacifica* (0.6 %). *A. celebesensis* were rare. *A. japonica* tended to be distributed downstream while *A. marmorata* upstream. The catch of both elvers and adults showed a cyclic change in the interval of 7 and 11 yrs. There is a close correlation between the catch of elvers and the adults. The reduction of elver catch in the estuary can increase the population of the adult eels in the river.

Key words: Stock status, Freshwater eels, *Anguilla* spp.

There are fifteen species and three subspecies of freshwater eels in the genus *Anguilla* Shaw of the family Anguillidae[1,2]. According to previous studies, there are four eel species, *A. japonica* Temminck & Schlegel, *A. marmorata* Quay & Gaimard, *A. bicolor pacifica* (Schmidt), and *A. celebesensis* Kaup, that could be found in Taiwan[3-5]. *A. japonica* is a temperate species; the other three species are tropical ones. Only *A. japonica* elvers are harvested for eel aquaculture in Taiwan. Due to the increasing demand of elvers for restocking, the elvers in the estuary of Taiwan were overexploited since the eel aquaculture industry was established in 1965.

Several aspects on the resources and ecology of the elver of *A. japonica*, including catch and the timing of estuarine immigration in relation to environmental cues[6,7], fishing exploitation rates[8] daily age and birth date[9], larval migration[10,11], stock identification[12,13], otolith microchemistry and migratory environmental history[14-16], were well investigated. However, little is known concerning the resources and ecology of the adult eel in the freshwater streams of Taiwan[17,18]. For the conservation of eel resources, a baseline study of the ecology of the eel is essential. This study attempts to understand the species composition, species-specific distribution and resources status of adult eels in the rivers of Taiwan.

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Materials and Methods

Adult anguillid eels in the seven rivers of Taiwan were investigated (Fig. 1). In this study, we collected the adult eel by a trap in 1997-1998. The trap was made of bamboo in a dimension of 100 cm in length, 10-15 cm in diameter with earthworm as lure. The trap was set both upstream and

downstream of the river to collect the eel. Species was identified from external morphology[3,4]. Species composition of the eels upstream and downstream of the river was compared to understand if the distribution of *A. japonica* and *A. marmorata* was separated because it has been believed that *A. marmorata* tended to distribute in the higher elevation of the stream.

The catches of elvers in each coastal prefecture of Taiwan recorded in the Taiwan Fisheries Yearbooks were mapped to understand the distribution of the elvers on the coast of Taiwan. Meanwhile, the annual catch of both elver and adult eels recorded in the same yearbook[19] was analyzed with spectral analysis respectively to understand their periodic fluctuation. The relationship between the catch of the elver and adult was analyzed by cross-correlation.

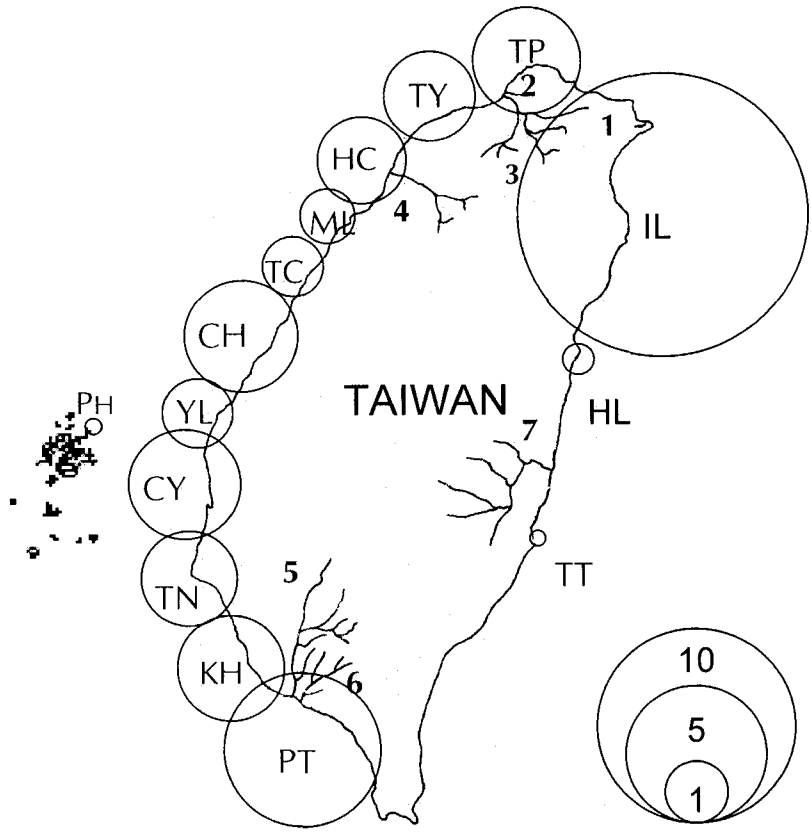

Fig. 1. Mean annual catch of elvers of *A. japonica* in each coastal prefecture of Taiwan,1967-1998. Abbreviation, prefecture name; circle, number in 10^6; bold number, sampling river of adult eels as in Table 1.

Results and Discussion

1. Distribution of elvers on the coast of Taiwan

There were four species of eels identified in the previous study. *A. japonica* was the most numerous species in the catch of elvers, making up 81.4 % of the total elver catch, followed by *A. marmorata* (16.2 %). The other two species were very rare[20-22]. The spatial distribution of mean annual catch indicated that elvers were more abundant on the north and western than eastern coasts of Taiwan

aquaculture with glass eels. Therefore, economic dependency on the Atlantic species already exists and, togther with it, a marine-scientific cooperation is highly promising.

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