

Title	Estuarine mangrove fish communities in southwestern Thailand : trophic ecology and movement patterns(Abstract_要旨)
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(続紙 1)

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論文題目	Estuarine mangrove fish communities in southwestern Thailand – trophic ecology and movement patterns-		
(論文内容の要旨)			
<p>The thesis consists of five chapters including three experimental parts about a fish community in Southwestern Thailand.</p> <p>The first chapter is an introduction describing the methodology and the objectives of the thesis. There were three different methodologies in the thesis, i.e. stable isotope analysis, gut content analysis and ultrasonic telemetry. These methodologies adopted to examine the role of different primary producers in trophically supporting fish communities, to clarify if resource use is different among individuals of the same mangrove fish populations, and to examine the movements of a common and commercially important carnivorous mangrove fish.</p> <p>In the second chapter, the gut content analysis and stable isotope analysis were performed to assess fish feeding behavior and trophic reliance on different primary producers in the Sikao Creek mangrove estuary in southwest Thailand. The fish gut contents and the carbon and nitrogen stable isotope composition of available primary producers were analyzed. Cluster analysis led to the identification of 5 trophic groups and the IsoSource model indicated the importance of primary food sources in trophically supporting different fish species. Most analyzed fish species had carbon isotopic signatures that were more depleted than those reported in previous studies, and the IsoSource model indicated that mangrove leaves were an important primary food source. These results may be due to the characteristics of the study site, which is not well connected to other productive coastal habitats that provide alternative primary food sources. Thus the food chains in trophically isolated mangrove estuaries of southwest Thailand are indicated more dependent on mangrove tree production. The relationship of individuality in fish feeding habits and variability of $\delta^{13}\text{C}$ values were also assessed. The presence of a negative correlation implied that several mangrove fish species have significant intraspecies variability in feeding habits, possibly due to high intraspecific competition.</p> <p>The third chapter was based on a fact that there is different light availability in different mangrove habitat settings. It has been theoretically suggested that deeper in a mangrove forest with less light availability the relative importance of mangrove production in supporting fish communities could be increased. On the other hand communities in more open areas could be increasingly algae dependent. To test this</p>			

hypothesis the same set of methods as above was used in studying food webs of two mangrove sub habitats in Sikao Creek. Station 1 was located close to the open ocean and had large, open areas of mudflats leading to higher light availability. Station 2 was located in a small creek deep in the mangrove forest leading to low light availability. The results showed that the fish community in station 1 despite having similar feeding habits had significantly higher carbon isotopic values than that in station 2. Thus differences in light availability can lead to differently structured food webs within the same mangrove systems depending on their location. The results indicated that a choice of sampling location can be crucial when studying food webs of estuarine mangrove habitats as judging about a trophic structure of a given habitat based on one sampling spot can be erroneous.

The fourth chapter dealt with migration patterns of a carnivorous fish species. Migration patterns of mangrove jack *Lutjanus argentimaculatus* were studied in a mangrove estuary in Trang province, Thailand, using ultrasonic telemetry. Ultrasonic coded transmitters were surgically implanted in 18 fish and 16 of them were subsequently monitored by 9 fixed receivers installed along Sikao Creek estuary. All of the individuals showed a tide related movement pattern, suggesting foraging in the small mangrove channels and/or mangrove forest during high tides. 50% of the fish left the study area for the open coast area within a short time following release, indicating that a part of juvenile *L. argentimaculatus* may move in between estuarine habitats instead of being site attached. It was found that *L. argentimaculatus* showed higher movement activity during night high tides possibly explained by an increased availability of the sough after food items. The author also theoretically discussed the possibility to combine information from telemetry research with that acquired from stable isotope and gut content analysis. The conclusion is that the methods can be combined successfully and that the unanswered questions created by one study can be answered using the other and vice versa.

Finally, the findings of the thesis will be further our understanding of the functioning of mangrove systems. This study helps to show that “mangrove habitat” is not a uniform term and that each system`s geographical location and even a location within a given system can be different in its ecological functioning

(論文審査の結果の要旨)

1) マングローブクリークに生息する魚類は熱帯・亜熱帯域における水産資源として高度に利用されているが、その保護・管理は十分になされていない。本論文が研究対象としたタイ国南部のマングローブクリークは、東南アジアをはじめとした世界の熱帯・亜熱帯域に広がるマングローブ生態系における魚類資源の保護・管理を行うに当たりモデルとなる海域である。本論文では当該域に生息する生物の安定同位体分析、魚類の胃内容物解析ならびに超音波バイオテレメトリーを用いたゴマフエダイ (*Lutjanus argentimaculatus*) の行動追跡を行い、マングローブクリークにおける一次生産と魚類の栄養との関連について魚類資源の保護・管理に資する結論を得ている。

2) 本論文第二章では、胃内容物解析と安定同位体分析によって当該マングローブクリークに生息する魚類の餌の栄養段階を解析することで、これらの魚類を5つのグループに分けられることを示した。そして、IsoSourceモデルによってマングローブの樹木の葉がクリーク内の魚類の餌として重要な位置を占めていることが明らかとなった。この結果は、従来の樹木の葉は餌としては重要ではないとする定説とは異なっているが、これは当該クリークが餌の豊富な外洋域と直接繋がっていないことによるものと考えられた。

3) 本論文第三章では、マングローブの上流域と下流域における餌生物の栄養段階を比較することで、光環境が悪い上流域では光環境が良い下流域よりもマングローブからの葉が餌として重要であるとの仮説を確認した。この結果から、同じマングローブクリークにおいてもサンプリングを行う場所によって、マングローブ生態系における食物網の評価に大きな違いが生じる可能性を指摘している。

4) 本論文第四章では、超音波バイオテレメトリーによってゴマフエダイの行動追跡を行った。その結果、マングローブクリークで放流したゴマフエダイは、潮汐に伴って餌を求めて移動すること、ゴマフエダイは高潮時にはクリークの周辺やマングローブの奥で餌を求め、低潮時にはクリークの本流域に移動することなどが明らかとなった。

5) 本論文では、安定同位体分析、胃内容物分析ならびに超音波バイオテレメトリーを組み合わせることで、マングローブクリークに生息する魚類とそれを栄養的に支えているマングローブ生態系との関連を明らかにしている。本手法は、他の熱帯・亜熱帯域におけるマングローブ域の魚類資源の保護・管理のためにも有効であり、魚類資源の保護・管理のための有用な知見を得ている。

よって、本論文は博士(情報学)の学位論文として価値あるものと認める。また平成24年8月15日に実施した論文内容とそれに関連した諮問の結果合格と認めた。