学 位 論 文 の 要 旨

論文題目　Biological studies on the wild populations of yellowfin black seabream, *Acanthopagrus latus* in Japan
(日本産天然キチヌの生物学的研究)

広島大学大学院生物圏科学研究科
生物質源科学　専攻
学生番号　D 113199
氏　　名　Ahmad Syazni Bin Kamarudin

Population biology and life history are important for optimizing the species management. In Japan, *Acanthopagrus latus*, known as one of the important Sparidae fish along with red seabream, *Pagrus major* and Japanese black porgy, *Acanthopagrus schlegelii*. Stock enhancement programmes of *P. major* and *A. schlegelii* were being heavily conducted in Japan, in contrast to *A. latus*. Hiroshima Bay had been chosen as the study site to understand the biology and life history of *A. latus*. This is due to the fact that more than 20 million *A. schlegelii* have been released since the early 1980s in Hiroshima Bay that might affects the survival of *A. latus*. Unfortunately, the fundamental study on the biology of *A. latus* inhabiting Hiroshima Bay was remained unclear.

The relationship between age and growth of *A. latus* showed that these fishes are well-adapted and suitable for their survival with the ecosystem in Hiroshima Bay. *A. latus*, which was spawned in October and November suggested that its physiology and metabolism in term of reproduction was different compared to other Sparidae fish. *A. latus* is known as a protandrous hermaphrodite where it is matured as male before transforming into female in the later stage of life. During spawning season, the feeding intensity of *A. latus* has dropped dramatically, suggesting the effect of spawning on foraging process. The index of relative importance, IRI % obtained in the present study demonstrated that the diet composition of *A. latus* was mainly composed of polychaetes, bivalves and decapods. Ontogenetic shift of prey preference were detected in *A. latus* while growing where it transformed into more generalist feeder. Besides, considering seasonal changes, the feeding niche showed that *A. latus* was a selective feeder in winter, summer and autumn, before it became a generalist feeder in the spring.

The preferences for a distinct prey category can contribute to the reducing of feeding overlap amongst the species. Therefore, stable isotope analysis can be used at least in part as a tool to differentiate them according to their food preference. For instance, *A. latus* that is categorized as carnivorous showed different stable isotope signatures compared to other Sparidae fish due to its distinct prey preferences. The stable isotope signature can also be used to determine the food webs of *A. latus*. In present study, finding suggested that fishes in Hiroshima Bay posses complex food webs of inshore area due to the variation of stable isotope signatures.

A total of ten microsatellite loci had been successfully isolated from the genomic library of *A. latus* and amplified reproducible peaks. These microsatellite loci were revealed to become a useful tool for determining the genetic variability and structure of *A. latus* in

western Japan. There was high genetic variability among the seven populations of *A. latus* in western Japan discovered by using microsatellite. Global F_{ST} based on microsatellite and mtDNA sequence among these seven populations showed no genetic structure, due to high homogeneity among populations.

MtDNA sequences of Japanese population were then compared by Chinese population to understand their genetic relationship. There were seven haplotypes recorded to be shared with the Chinese population, where one haplotype from the Chinese population was found in 14.3% of individuals in western Japan. Given by high nucleotide and haplotype diversities, we suggested that *A. latus* including Chinese population have been impacted by secondary contact of the previously differentiated lineage or due to long evolutionary in a stable population. Historical expansion during the past glaciations that changed the sea level and surface temperatures have resulted in mixing population of *A. latus* with Chinese population.

Currently, several Asian countries have suffered serious problems in fisheries stock where many species have been reported to be overfish or affected by the unstable environmental conditions. For instance, the number of *A. latus* has been reported to be decreased in China and Taiwan for the past few decades, owing to overfishing. Therefore, conservation of various marine fishes had been introduced to several Asian countries. The fishes such as groupers, flatfishes and seabreams are among the important fish family that have been conserved and restock either by stock enhancement programme or by aquaculture. The evaluation on the effects of conservation programme on the ecosystems, particularly on close related fishes were rarely done.

In conclusion, it can be explained that growth and life cycle of *A. latus* in Hiroshima Bay was not affected by the stock enhancement programme of *A. schlegelii*. From this study, we can conclude that the *A. latus* can survives and tolerates low water temperature and this showed the capability of *A. latus* to spawn in this area. Western Japan has been suggested to be the most northern distribution area of the *A. latus* in Asia. Besides, based on sex distribution to the length frequency, we can introduce minimum legal length of 295 mm to keep sustaining the fisheries of this species in Hiroshima Bay. This legal approach will encourage the authority and anglers to manage a sustainable stock of *A. latus* in Hiroshima Bay. Moreover, the distinct prey categories of *A. latus* from other Sparids such as *P. major* and *A. schlegelii* can become the decent indicators for the survival and viability of the fish for a long period in Hiroshima Bay. Furthermore, based on genetic structure results, a single management unit should be implemented prior to stock enhancement programme of *A. latus* in the future.