

Title of dissertation			
Classical polyandry in the reversed sex-role substrate breeding cichlid <i>Julidochromis marlieri</i>			
RONPAKU Fellow			
Name	Deo Mushagalusa CIRHUZA		
Position	Assistant Researcher	ID No.	R11613
Department	Department of Biology		
Institution	Center of Research on Hydrobiology	Nationality	Congo
Japanese Advisor			
Name	Masanori KOHDA		
Position	professor	Institution	Osaka City University

During the period from April 2016 to March 2019, he performed the project of his PhD, the theme of reproductive ecology of Lake Tanganyika cichlid. During the first year, he studied on the defensive strategy of predatory fish against the predator, and the last two years he studied classical polyandry of a cichlid fish. These studies were conducted at the shallow shore of the lake: the first study at Mpulungu in Zambia, and the second study at Pemba point in Congo, both with the aid of SCUBA diving.

Anti-predator strategies are known from behavioural type and physical or chemical type. In the first study, he studied scale eating predator (*Perissodus microlepis*) and the prey fishes. The anti-predatory behaviour of the prey fish against the scale eaters has been documented (Hori 1997; Kohda et al. 1997). Dr. Mushagalusa studied on the physical strategy against the scale eaters. He did underwater experiment about the attacking pattern to five prey fish species, *Lepidiolamprologus elongates*, *L. attenuates*, *Lamprologus callipterus*, *L. fasciatus* and *Altolamprologus compressiceps*. The scale width and thickness, which were measured at laboratory using special measure, increased in this order. The predator attacked the two fishes of thin scales frequently, and not so frequently in *L. caliptellus* and *L. fasciatus*, and rarely attacked the thick scale fish *A. compressiceps*. The power of scale attaching on its body were most strong in *A. compressiceps*, and he suggests the hard and thin scale of *A. compressiceps*, the most hard scale in cichlid fishes, will be the morphological defense against the scale eater.

In this study, fish behavioural observation and field experiment underwater, fish sampling, measurement of various items of fish samples, all he conducted. And the first manuscript also he wrote. This study was submitted to the journal of Japan Zoological Society, Zoological Science, in January 2018, and has been accepted in September 2018.

The theme of the second study is classical polyandry of cichlid fish. In classical polyandry, females are larger than males, and have large territory in which several males stayed and breed each with territorial females. This mating system is documented from birds but not from mammals and fish. However, Yamagishi and Kohda (1996) suggest the polyandrous mating system in the cichlid *Julidochromis marlieri* in Lake Tanganyika, the point at Pemba. After this paper the field studies could not be conducted because of the political problem of this country. But recently, the condition becomes good, and he tried to study the mating system of this fish again during the last two years. If he will confirm the classical polyandry in this fish, it is the first document from fish, and its contribution to behavioural ecology should be so great, and if he evidence the evolutionary significance of this mating, that is, the fitness of participant individuals the impact of the outcome will be outstanding.

After choosing the study site, we made 20 m x 22 m study area with 2m x 2m meshes. He identified all

breeding individuals in the area (about 150 fish) by the individually specific color pattern on their heads. The territories of each fish, parental care time and behaviour, foraging, number of young in nests were recorded for 5 months. After the field observation, most of the observed fish were captured and reserved. These samples were measured in size and weight, gonad weight, and the DNA were analyzed for examination of relatedness between mating partner and between parent fish and young.

From the all results, he document this interesting mating system from the Lake Tanganyika cichlid *Julidochromis marlieri*, that care for brood at nest, exhibiting size dimorphism of females larger than males. From field observations and DNA analysis, he found followings: 1) larger females had large territories and some enclosed several nests at which small males were attending, 2) DNA analysis showed these females spawned eggs at multiple nests in their territories, and were sired by the males at nests, 3) female defense of the new clutch of young, suggesting the clutch would be her own young, 4) males guarded the offspring more frequently in total than the females, and 5) females that had more nests foraged more and spawned more number of clutches. Together all, the results suggest, the some females distributed clutches among the nests in heir territories, and thus their mating system can be regarded as classical polyandry associated with sex-role reversal. His doctor thesis provides the first evidence of classical polyandry in fish, and he compared the mating system to those documented from birds.

He presents his thesis on 28 December 2018 in front of many audiences of Department of biology Osaka City University (OCU), including all of 10 professors. At the committee with the professors, the contents, presentation style and speech was highly evaluated, and received the certification of Dr. of Science from OCU successfully.

Photos



Dr. Mushagalusa talking with me on his study in meeting room using PC and white board behind.



Dr. Mushagalusa writing Dr. thesis on his desk.