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Importance of hatchery enrichment in laboratory rearing and conservation of critically endangered fish Nandus nandus

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ABSTRACT

Attempts to counteract hatchery-related behavioural deficiencies have utilized intensive training programmes shortly before the hatchery fishes are released to nature. Induced breeding of, Nandus nandus (Hum-Buch) was conducted by synthetic hormone in the intensity level of ovaprim 0.5 mL kg^{-1} of body weight respectively.Application of hatchery enrichment technique used in Anabas testudineus was adopted before release into nature. So more viability in nature found due to the development of flexible behaviour rather than normal hatchery condition .Hence conservation of Nandus nandus from LnRt category and sustain its fauna.

Key words: *Anabas testudineus*, *Nandus nandus*, LnRt category, enriched hatchery, behavioural ecology, pre release training protocol.

INTRODUCTION

Maintenance and preservation of biodiversity along with other biotic resources is a pre requisite for the well-being of even human beings [1]. Fish and fish products are one of the major food items that support hundreds of people all over the world. Over exploitation of fish resources, coupled with habitat destruction result in shrinkage of fish population [2]. The only viable alternative is to conserve and propagate native species, which are at the verge of extinction. Induced breeding and re-introduction of hatchery reared larvae and fingerlings into their natural habitat are the usual techniques employed for the rehabilitation of threatened and endangered species. However, captive reared individuals frequently suffer mortality shortly after release [3]. Annually billions of young fishes are released from hatcheries into the natural water bodies, yet the majority of these fish perish, incapable to cope up with the new environment [4]. Environmental effects on hatchery rearing may result in the development of behaviour patterns that are not akin to the behaviour of the conspecifics living in the wild [5].The environment during early life stages has been suggested to have a strong influence on subsequent behaviour, which may not be easily modified during later life [6].

Understanding the behavioural ecology of an organism is essential in current scenario where many animals being decimated or forced to get extinct due to unbridled human intervention. Behavioural ecology helps to find the change in the population structure as well as to predict the future predispositions of species concerned. Knowledge from the field of foraging ecology, reproductive ecology as well as the understanding of cognitive abilities of fishes are essential for developing strategies to control the process of extinction. Animals use different behavioural strategies to maximize their fitness in natural environments. Learning and memory is critical, allowing organism to respond to environmental changes flexibly and rapidly. To forage efficiently animals need accurate information about the quality of foraging patches. Spatial learning allows animals to locate territories successfully and to return to abundant food sources [7] . As in the case of several other vertebrates, fishes are also said to have the ability to develop map of the ecosystem. The homing ability of an intertidal fish, the shanny Lipophrys pholis can encode information about its familiar surroundings into a spatial map and use this information to home[8].

Nandus nandus (Hum-Buch) is having high potentional in exporting and fetching an average price of 0.75 US $.Based on IUCN categorization [9] this fish was analysed to find out status of threat. Nandus nandus (Hum-Buch) is enlisted under the low-Risk near threatened (LnRt) category[10] .Considering LnRT status of this fish and its food and ornamental value its highly desirable to conserve and native species which is still in greater demand by consumers and ornamental fish market. So a study on its sexual dimorphism is indeed as a preliminary step to generate more information on their biology, breeding patterns and to promote the induced breeding operation.

Adult females are normally fuller-bodies and larger than comparably-aged males. Our observations suggest that females also possess a more conical, pointed and upward bend mouth than males. During breeding season a prominent black bloch is noticed in caudal peduncle of female .During breeding season milt oozes from the males when belly is squeezed and females with bulged belly full of ripe ova. Mature fish were induced to breed by commercially available ova prim and the life-history, from the first cleavage to post-larva, was studied. After 6 hour of injection, fish started spawning activities. Depending on the season time variation observed. Male actively moved around the female started vent kissing. Male bent its body with female and tried bring genital pore together. Play continuous for hours together finally female ejects brown coloured egg and male ejected milt on the released egg. Fertilization occurs with splashing movement. Fishes become calm and quite after spawning and show high rate of opercular movement.

Induced breeding study helped to take good breeders as parents so healthy young ones after induced breeding. Main aim of our study was to conserve Nandus nandus (Hum-Buch) by introducing induced breed post larvae in to nature. N.nandus can be successfully induced breed in captivity during month June to September at a successful dose of 0.5ml per body weight. Almost 80% of egg hatched out and larval first feeding of artemia starts at 56- 72hour of hatching (Figure.1).

Naturalistic rearing environments promote adaptive behaviour that might otherwise not develop in typical hatchery environments. Experiments of Oncorhynchus mykiss[11] shown that effects of structure and structural stability occur at the level of both average behaviour and behavioural variation, and suggest that these effects should be considered when fishes are reared in hatcheries for later release into the wild. It was found that *Anabas testudineus* when exposed to spatial heterogeneity during early rearing were bolder; they were also faster at seeking food than fish reared without spatial cue (Sheenaja and Thomas *pres.obervation*). It implies that environmental enrichment can improve learning abilities, as complexities in the environment provide greater sensory feedback to the brain than unstructured enclosures, resulting in increased neurogenesis [12]. Hence, spatial learning protocols could realistically be applied on a large scale to enhance the viability of hatchery fish prior to their release into the wild. Thus for *Anabas testudineus*, reared in enriched hatchery tank (Figure 2) appears to increase exploratory behaviour and improve post-release success.

Growing in regular laboratory condition and releasing to the nature brings less viability in nature. Hence it's recommended to improve learning capacity and increased viability in nature by providing structured environment while rearing in laboratory. We also suggest a practical pre-release training protocol that may be applied at the hatchery level in Nandus nandus (Hum-Buch) to enhance survival ability hatchery reared fish in nature. Such a kind of pre-release hatchery training protocol, if applied in the restocking attempts of threatened fishes (as per IUCN red data book) can augment the success of conservation programs.

FIG 1. Hatched larvae of Nandus nandus

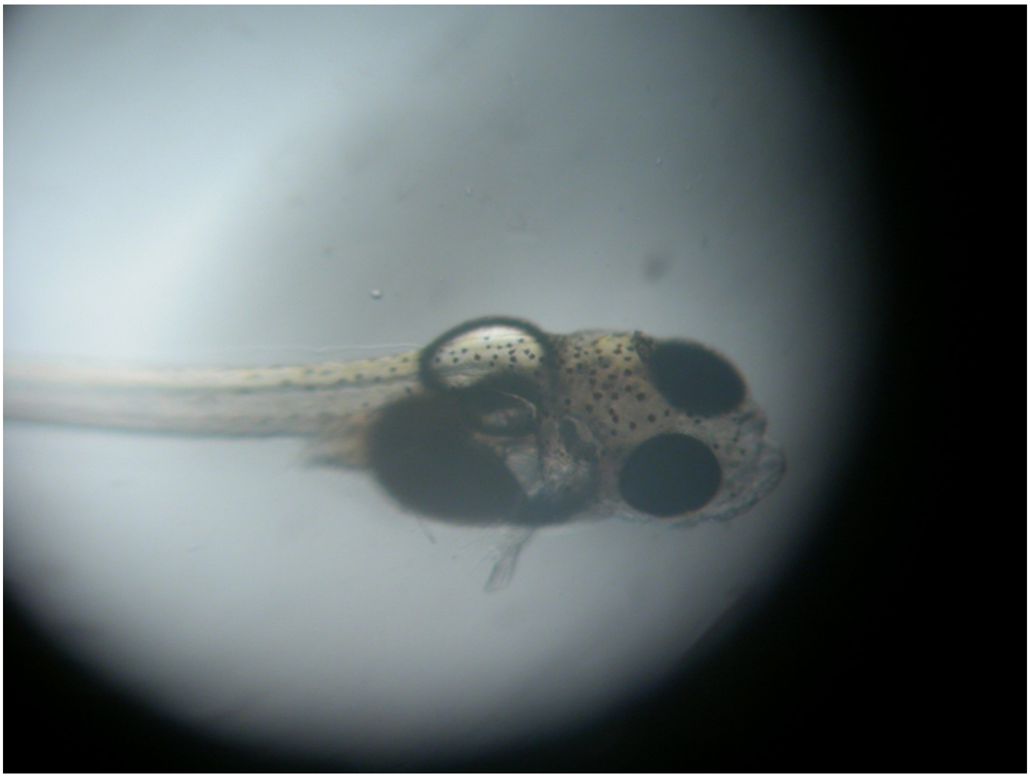

FIG 2. ***Anabas testudineus*** **rearing in enriched hatchery tank**

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