UNIVERSITI PUTRA MALAYSIA

SOME ASPECTS OF THE BIOLOGY OF *HAMPALA MACROLEPIDOTA* (VAN HASSELT) WITH REFERENCE TO ITS FOOD, FEEDING, HABITS AND REPRODUCTION FROM ZOO NEGARA LAKE, KUALA LUMPUR, MALAYSIA

AIZAM BIN ZAINAL ABIDIN

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by

AIZAM BIN ZAINAL ABIDIN

A thesis submitted in partial fulfilment of the requirements for the degree of Master of Science (Fisheries) in the Faculty of Fisheries and Marine Science, Universiti Pertanian Malaysia.

July, 1984.

DEDICATION

This work is dedicated to my wife, Rohaya and my children Olane, Elane and Nur Aidya.

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LIST OF ABBREVIATIONS

Atr. Ocy.	-	atretic oocytes
C. & V.	-	Cuvier and Valenciennes
cm.	-	centimetre
conc.	-	concentration
exc.	-	excrescences
Fig.	-	Figure
g.	-	gram
G.S.I.	-	gonadosomatic index
L	-	length
L. or Linn.	-	Linnaeus
mg.	-	milligram
mm.	-	millimetre
N	-	nucleus
Nu	-	nucleolus
R.G.I.	-	Relative Gut Index
SP.	-	spermatozoa
µ	-	micron
µmhos/cm	-	micromhos / centimetre
W	-	weight
YG	-	yolk granule
YV	-	yolk vesicle
ZR	-	zona radiata

An abstract of the thesis presented to the Senate of Universiti Pertanian Malaysia in partial fulfilment of the requirements for the Degree of Master of Science.

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by

Aizam bin Zainal Abidin

July, 1984

Supervisor : Associate Professor Dr. Ang Kok Jee

Faculty : Fisheries and Marine Science

A study on some aspects of the biology of *Hampala macrolepidota* (Van Hasselt) with emphasis on its food, feeding habits and reproduction was carried out at Zoo Negara Lake, Kuala Lumpur, Malaysia.

The length-weight relationships of male and female adult fishes are:-

$$\text{Log } L = 3.114 \text{ Log } W - 11.9034 \text{ and}$$

$$\text{Log } L = 3.461 \text{ Log } W - 13.8770, \text{ respectively.}$$

The length-weight relationship of the combined male and female fishes is:-

$$\text{Log } L = 3.256 \text{ Log } W - 12.692$$

The form of the mouth and its action, dentition, gill rakers, form of the alimentary canal and stomach are described

and the significance of these features are discussed. The gape of the mouth determines the size of prey eaten. Both juvenile and adult fish have similar gill raker structures. The gill rakers do not seem to play an important role in food selection. The relative gut indices of the juvenile and adult fish ranged from 1.20 to 1.02 which is typical of carnivorous species. Food analyses of the gut indicate that the food of adult fish are less varied than the juveniles and they feed primarily on crustaceans and fishes.

The analyses of the maturity stages, gonadosomatic indices and oocyte diameter patterns show that this fish is able to spawn throughout the year. However, physico-chemical and enviromental factors determine the actual spawning time of this species. Spawning activity is associated with decreasing temperatures and daylengths, rising warer levels and increasing turbidities. Spawning is protracted and coincides with the rainy season which extends from November to March the following year.

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia sebagai memenuhi sebahagian dari keperluan untuk ijazah Master Sains.

"SOME ASPECTS OF THE BIOLOGY OF *Hampala macrolepidota* (VAN HASSELT) WITH REFERENCE TO ITS FOOD, FEEDING HABITS AND REPRODUCTION FROM ZOO NEGARA LAKE, KUALA LUMPUR, MALAYSIA"

oleh

Aizam bin Zainal Abidin

Julai, 1984

Penyelia : Profesor Madya Dr. Ang Kok Jee

Fakulti : Perikanan dan Sains Samudera

Kajian mengenai beberapa aspek biologi ikan sebarau, *Hampala macrolepidota* (Van Hasselt) dengan penekanan terhadap makanan, tabiat memakan dan pembiakan telah dijalankan di Tasik Zoo Negara, Kuala Lumpur, Malaysia.

Perhubungan panjang-berat bagi ikan jantan dan betina yang matang adalah:-

Log L = 3.114 Log W - 11.9034 dan

Log L = 3.461 Log W - 13.8770, masing-masing.

Perhubungan panjang-berat bagi kesemua ikan-ikan jantan dan betina adalah:-

Log L = 3.256 Log W - 12.692

Bentuk mulut dan pergerakannya, pergigian, sisir insang, bentuk salur makanan dan perut serta keertian ciri-ciri tersebut telah dibincangkan. Bukaan mulut boleh menentukan saiz mangsa

yang dimakan. Kedua-dua ikan juwana dan yang matang mempunyai struktur sisir insang yang serupa. Sisir insang ini tidak memainkan peranan penting dalam pemilehan makanan. Relatif indeks gut bagi ikan juwana dan yang matang berbeza dari 1.20 hingga 1.02. Ini biasanya terdapat pada spesis-spesis karnivor. Analisis makanan daripada gut menunjukkan makanan bagi ikan matang adalah kurang berbeza jika dibandingkan dengan ikan juwana dan makanan primer kedua-duanya adalah krustacea dan ikan-ikan.

Analisis peringkat kematangan, indeks gonado-somatik dan pola garis pusat oosit menunjukkan ikan ini berupaya untuk bertelur sepanjang tahun. Walau bagaimanapun, faktor-faktor fisiko-kimia dan sekitaran menentukan masa peneluran yang sebenar bagi spesis ini. Aktiviti peneluran berkaitan dengan penurunan suhu, panjang siang hari, paras kenaikan air dan penambahan turbiditi. Jangkamasa peneluran berlanjutan dan serentak dengan musim hujan iaitu dari bulan November hingga Mac tahun berikutnya.

CHAPTER 1

INTRODUCTION

REVIEW OF LITERATURE

Biological studies of Malaysian freshwater fishes are scanty. Most of the earlier works were mainly taxonomic in nature. Alfred (1966) gives a comprehensive reference list of publications dealing with the taxonomy of freshwater fishes of Malaysia. Mohsin and Ambak (1983) in their recent work on the freshwater fishes of Malaysia reported that over 200 articles were published dealing mainly with the listing of freshwater fishes. Some of the important works are those of Cantor (1849), Maxwell (1921), Herre and Myers (1937), Fowler (1938), Herre (1940), Brittan (1954), Tweedie (1952[a], 1952[b], 1953[a], 1953[b]), Alfred (1958, 1961, 1964) and Inger and Chin (1962). A considerable amount of literature is available on the biology and culture of introduced species (Bertwistle, 1931; Soong, 1937; Le Mare, 1948, 1949, 1952, 1953; Anon[a], 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968; Hickling, 1959, 1960[a], 1960[b], 1963; Slack, 1962; Prowse, 1963; Chen, 1966; Chen *et. al.* 1969; Ahmad Tajuddin *et. al.* 1983). However, there is a paucity of information on the biology of the indigenous species (Soong, 1948, 1949, 1950; Johnson, 1967; Tan, 1968; Ang, 1971, 1975; Yap, 1978; Teoh, 1978; Mohsin, 1977, 1980; Mohsin and Law, 1978; Tan, 1980; Yap and Furtado, 1981; Hails and Abdullah, 1982; Aizam *et. al.* 1983; Aizam and Ang, 1984).

Indigenous fishes form an important aspect of riverine fisheries and they play an important part in the supply of protein for the people. As early as in the 50's, Gopinath (1950) stressed this point in his survey on the extent of freshwater fish culture in the Malay States. Among the local species, *Hampala macrolepidota* (Van Hasselt), *Osteochilus melanopleura* (Bleeker), *Tor tambroides* (Bleeker), *Pangasius pangasius* (Hamilton), *Osphronemus gouramy* - Lacepede, *Mystus nemurus* (C. & V.), *Osteochilus hasselti* (C. & V.), *Cyclocheilichthys apogon* (C. & V.), *Puntius daruphani* - Smith, *Puntius schwanenfeldii* (Bleeker), *Leptobarbus hoeveni* (Bleeker), *Oxyleotris marmorata* (Bleeker), *Clarias batrachus*, *Trichogaster pectoralis* (Regan) and *Puntius bulu* (Bleeker), to name a few of the major species that are popular among the people.

These species which were available in abundance a decade ago have lately been decreasing in catch Anon[b] (1972-1981). One cause of the decrease might be due to the changes in the environment owing to siltation of most rivers in Malaysia (Bishop, 1973). The result of increase turbidity in rivers where forests have been cleared to make way for development have been well documented (Van Oosten, 1945; Erichsen-Jones, 1969). Studies have also shown that pollutants (both organic and inorganic) have deterimental effects on fish species in our rivers (Mohsin and Law, 1980). Use of explosives and poisons such as tuba root can also lead to the destruction of fish species. Mohsin and Azmi (1983) listed 118 species of fish which are very rare or are already extinct and 59 fish species which are endangered. There are many reasons for these fish species to become extinct or endangered. Alfred (1965) cited by Mohsin and Azmi (1983) stated that the most serious factors were pollution and silting from mining and land clearing.

The sources of pollution in Malaysian waters are domestic and industrial effluents, agricultural wastes, pesticides and poisons. Another source of pollution which cause a large oxygen deficit in the aquatic environment are effluents from palm oil mills which cause massive fish mortality. Apart from these factors, the effects of the introduced species in our rivers and lakes could also be a factor in reducing the number of local species. Johnson and Soong (1963) suggested that the introduction of exotic species affect the population size and distributional areas of native species. Munro (1980) suggested that the depletion of local species might also be due to competition for space, backed by predation of eggs, fry and adults.

It has been noted that man-induced changes to the freshwater enviornment is increasing at an alarming rate in Malaysia. In his studies on a small Malaysian river, Bishop (1973) noted that changes in the physico-chemical characteristics of the water as a result of construction of roads in the vicinity had critically changed the native biota inhibiting such environment. Ball (1961) postulated that any form of environmental disturbances may lead to massive follicular atresia of the ovary in fishes. This may result in a reduction of population size and the regulation of stock. These phenomena had been demonstrated by June (1977) who observed atresia and massive resorption of eggs as a result of changes made to water bodies and the subsequent alterations of water levels and spawning grounds. Changes in water levels also resulted in altered temperature regimes. Lake (1970) and Hobson (1974) stated that altered temperature regimes which is outside the range of thermal adaptation of the organisms present in that system usually inhibit the normal sequence of reproduction and survival of fauna in that

system. In this light, it is essential that a proper programme for conservation and management of our riverine species should be made. In order to have a proper programme of this nature, it is necessary that information on the ecology of these species and their environment in which they occur should be available.

For proper management of a fishery, a thorough study of the cycle of maturation of gonads of a fish and its breeding biology is important. Ramanathan and Natarajan (1979) stated that such a study is aimed at understanding and predicting the annual changes that the population undergoes. It was also stated that from these studies a variety of inferences could be drawn, such as the rate of regeneration of stocks and determination of ecological factors which lead to synchronization of breeding activities. In addition, information on such related aspects as fecundity, size and sex ratio is equally important for the successful propagation of a fish species. To date, studies on local freshwater species are confined only to a few and the available information are so diffused and limited that no integrated picture of the biological patterns could be established. Ang (1971) studied the reproductive patterns and growth of some anabantid fishes in Selangor. Yap (1978) studied the life-history and breeding seasons of *Osteochilus hasselti*. The reproductive biology of four cyprinids were described by Tan (1980). Teoh (1978) studied on the reproductive biology of *Puntius gonionotus*. Yap and Furtado (1981) studied on the ecology of *Cyclocheilichthys apogon* in Subang Reservoir. Hails and Abdullah (1982) and Aizam *et. al.* (1983) studied on the reproductive biology of the anabantid, *Trichogaster pectoralis* and the cyprinid, *Osteochilus melanopleura* respectively.

Work on the reproductive biology and seasonal changes in the

ovary and testis of tropical species had been done by a number of researchers in other countries. Most tropical species in India tend to show seasonal breeding cycles. Khan (1942) reported that *Labeo rohita*, *Mystus seenghala* and *Wallago attu* breed from June to August while Nair (1958) reported that *Hilsa ilisha* breeds in July, August and September. This normally coincides with the annual rainy season. Ghosh and Kar (1952) studied on the Indian Catfish - *Heteropneustes fossilis* while Belsare (1962) worked on the seasonal changes in the ovary of *Ophiocephalus punctatus*. Sathyanesan (1959, 1962) concluded that *Mystus seenghala* spawns in March to July in the river Ganges while Lehri (1967) reported that *Clarias batrachus* breeds from July to early September. Charkarbarthy and Singh (1963) described the fishery and biology of *Cirrhina mrigala*. The reproductive biology of *Mastacembelus armatus* was described by Gupta (1974). It was found that *Mastacembelus armatus* has two breeding seasons of short duration during May, June and July and again in November. Gupta (1975) described the maturation of gonads in carps. Studies on the biology of tropical species of fish have also been carried out by many other workers (Vaas and Hofstede, 1952; Lowe, 1952, 1953; Welcomme, 1967; Hyder, 1970; Van Der Wall, 1974; Scott, 1974; Siddiqui, 1977; Hodgkiss and Man, 1978; De Silva and Chandrasoma, 1979; Rinne and Wanjala, 1983).

Breeding seasons in a number of animals of the tropical regions range from complete aseasonality (Berry and Varughese, 1968; Tan, 1969), to slightly seasonal with a peak breeding season during the rainy period (Ang, 1971; Yap, 1978; Hails & Abdullah, 1982) to highly seasonal with one breeding peak during the first wet period of the year (Langham, 1980). Ang (1971) in the study on the reproductive activity and growth of some anabantids in Selangor

and Yap (1978) in the study on the breeding seasons of the cyprinid, *Osteochilus hasselti* found that breeding is linked with annual rainfall even though matured fishes in the breeding condition can be found at all times of the year.

Among temperate species, the time of fish spawning varies; some species spawn in autumn or winter while others in spring or summer. Matthews (1938) observed peak spawning for *Fundulus heteroclitus* in June and July (summer) in the Delaware River, New Jersey. Gokhale (1957) investigated the breeding patterns of *Gadus merlangus* and *G. esmarkii* in the sea off the coast of England and reported that these two species spawn in March, April and May (spring) with a peak spawning period in April. Henderson (1962) reported that *Salvelinus fontinalis* spawns in late September to early November (autumn) in Ontario, Canada, while Ahsan's (1966) work indicates that *Couesius plumbeus* spawns in June and July (summer) in a lake in British Columbia, Canada. Such variety reflects a non-directedness in the evolution of timing cues used by fish species.

Marshall (1936, 1937) stated that the sexual periodicity of mammals in temperate regions is governed by two main factors, that is the intrinsic and the extrinsic factor. The first is an internal gonadal rhythm which is characteristic of the species, while the second is the external environmental factor which determines the precise time of breeding. These two factors normally act together. The same general conclusion seems to apply to fishes also (Bullough, 1963) and it has been shown that the environmental influence is stronger than that of the internal rhythm. Hence it is pertinent to review some of the literature dealing with environmental factors which influence breeding in animals. Rain is apparently an