Evaluation of Carbon Stocks of Some Freshwater Fishes of Manipur

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Abstract: ***The organic carbon stocks of fresh Colisa sota (Hamilton), Anabas testudineus (Bloch), Channa punctatus (Bloch), Osteobrama belangeri (Valencienes), Amblypharyngodon mola (Hamilton), Esomus danricus (Hamilton) and Puntius sophore (Hamilton) were determined. The varied organic carbon content was recorded in the studied fish species. From the study revealed that organic carbon content was highest in the O. belangeri (56.20±0.04%) and was the lowest (39.46±0.04%) in the A. testudineus. The fish species of the study area is a good reservoir of organic carbon so has a good capacity to sequester organic carbon from the water and atmosphere. Conservation of fish species may help to sequester more organic carbon so that economic benefit for the country and environmental benefit in the international arena are possible from the study area.***

Keywords: Carbon stocks**,** freshwater fish, global warming, ash content

1. Introduction

The carbon being a basic constituent of all organic compounds and a major element involved in the fixation of water, in the fixation of energy by photosynthesis, is so closely tied to energy flow that the two are inseparable. The source of all the fixed carbon both in living organisms and fossil deposits is carbon dioxide CO_2, found in the atmosphere and dissolved in the waters of the corporate into the production of the carbohydrate, glucose, that subsequently may be converted to other organic compounds such as polysaccharides(sucrose, starch, cellulose etc) proteins and lipids. Carbohydrates, which include sugars and starches and also cellulose are compose of three elements, carbon, hydrogen and oxygen, the last two occurring in the proportion to form water. Fats contain the same elements as carbohydrates but in different proportions. The carbon stock is the quantity of carbon contained in a “pool” meaning a reservoir or system which has the capacity to accumulate or release carbon [1]. Global warming is the most vital problems of the new millennium. Carbon emission is supposedly the strongest causal factor for global warming [2].

In Manipur there are some reports on the nutritive value of fresh and processed fishes [3]-[5]. However, there is no report so far on organic carbon stocks of freshwater fishes of Manipur. Thus, the aim of the study was carried out to determine the organic carbon stocks of some freshwater fishes viz., *Colisa sota* (Hamilton), *Anabas testudineus* (Bloch), *Channa punctatus* (Bloch), *Osteobrama belangeri* (Valencienes), *Amblypharyngodon mola* (Hamilton), *Esomus danricus* (Hamilton) and *Puntius sophore* (Hamilton) of Manipur.

2. Materials and Methods

2.1 Sample collection

Fresh fishes were collected from Loktak Lake, ponds and different rivers of Manipur. The fresh fishes are brought to the Life Sciences Department, Manipur University, during January 2011 to December 2011. The fish were washed with running tape water and blotted with blotting paper.

2.2 Sample preparation

The fish were washed with running taped water and blotted with blotting paper. The standard length and weight was measured using a single pan digital balance. The fish was descaled with sharp knife dorso-lateral portion muscle was collected and bones are not removed from the fish. All analyses were triplicates by sampling from the sample.

2.3 Evaluation of Organic Carbon stocks in fishes

The ash content was determined by the methods of AOAC [7]. After taking the fresh weight, the samples were dried in an air dry oven until it is free from moisture. The moisture free samples were powdered and 1g powdered each samples were taken in a pre-weighted crucible. The crucibles were placed in the muffle furnace (Tempo. Ins. & Equipments pvt Ltd) and ignition was made at 550^0C for about two hours until it is white ash. The crucibles were cooled slowly keeping them inside the furnace. After cooling, the crucibles with ash were weighted and percentage of organic carbon was calculated by following the methods of Allen et al., [8].
Ash%= $(W_3-W_1)/(W_2-W_1)$ X 100, C% = (100− % Ash) X .58 where, C is the organic carbon; W_1 the weight of crucibles, W_2 the weight of oven-dried grind samples + crucibles and W_3 the weight of ash + crucibles.
Percentage of organic carbon was estimated for each sample by the same procedure.

2.4 Statistical analysis

The values are expressed as mean±standard deviation (SD). The data were evaluated by using the SPSS (Version 12.0).

Table 1: Ash content and organic carbon stocks of some freshwater fishes

Name of the fish	*Ash content (%)*	*Carbon content (%)*
Colisa sota	23.40±0.03	44.42±0.01
Anabas testudineus	31.95±0.02	39.46±0.04
Channa punctatus	30.23±0.02	40.46±0.02
Osteobrama belangeri	3.10±0.02	56.20±0.04
Amblypharyngodon mola	5.56±0.04	54.77±0.04
Esomus danricus	4.32±0.04	55.49±0.02
Puntius sophore	18.86±0.01	47.06±0.03

Data was expressed as mean ± SD of triplicate sample

3. Result and Discussion

The ash content and organic carbon stocks of the three freshwater fishes were shown (Table 1, Fig.1). The organic carbon stocks were highest in the *O. belangeri* (56.20±0.04%) and lowest in the *Anabas testudineus* (39.46±0.04%). In *Puntius sophore*, *E. danricus*, *C. punctatus* and *A. mola* the organic carbon content were 47.06±0.03%, 55.49%, 40.46±0.02 and 54.77±0.04% respectively. The ash content was maximum in the *Anabas testudineus* (31.95±0.02%) and 30.23±0.02% in *C. punctatus* and minimum in the *O. belangeri* (3.1±0.02%). In the *C. sota* the ash and carbon content was 23.40±0.03% and 44.42±0.01% respectively. The ash content of fish are reported to vary significantly with gradual increase in the weight and length of the fish and also due to seasonal changes aside from the available nutrients in varied habitats [9].The higher ash content in the fish might be due to its higher bony consistency and high scaly nature. Such fish offer minerals in their edible forms more abundantly than large-sized fish do [10]. In plants, organic carbon is stored in the foliage, stems and root systems and, most important, the woody tissue in the main stems of trees. Another study conducted by Alamgir (2005) showed that shrubs strata contains 35% to 50% organic carbon of their biomass both above and below ground biomass in the geoposition lying within Chittagong (South) Forest Division. Litter decomposition is also a function of the C:N ratio of biomass, and higher nitrogen levels may lead to more degradable plant material [12]. Global carbon is held in a variety of different stocks. Natural stocks include oceans, fossil fuel deposits, the terrestrial system and the atmosphere. In the terrestrial system carbon is sequestered in rocks and sediments, in swamps, wetlands and forest, and in the soils of forests, grasslands and agriculture [13].

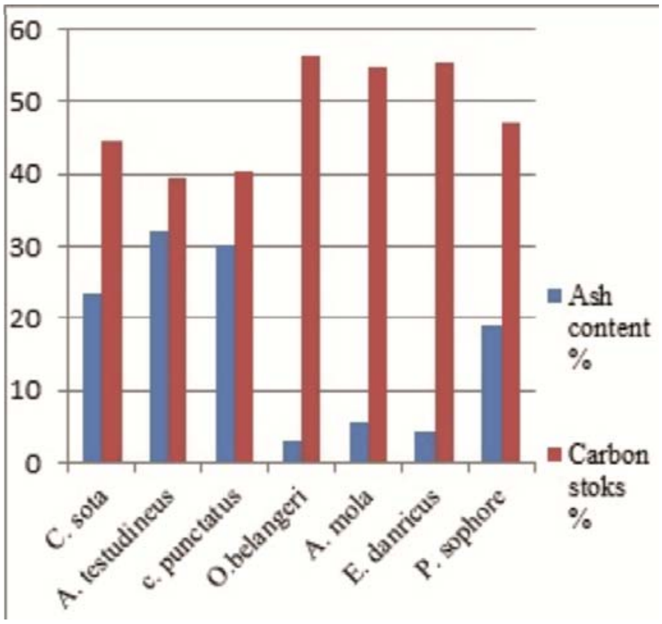

Figure 1: Ash content and organic carbon stocks of some freshwater fishes

One of the key aspects that provide dynamism to our ecosystem is primary productivity, the beginning of food chain, energy flow and mineral cycling. The process is being initiated with the intake of carbon dioxide from the environment as it often becomes a limiting factor in the euphotic zone of freshwaters. Its concentration decreases rapidly with the increase in photosynthesis. This triggers a chain reaction in the carbon dioxide system whereby inorganic carbon is derived from carbonates and bicarbonates to maintain primary productivity during the day hours. At night, as respiration becomes the dominant metabolic activity carbon dioxide evolves and recharges the carbon dioxide system [14]. Fish is the best source of polyunsaturated fatty acids (PUFA) Carbon18:3n3, specifically n-3 fatty acids, especially Eicosapentaenoic acid (EPA) Carbon20: 5n3 and (DHA) Docosahexanoic acid Carbon22:6n3. In most fish species, the following fatty acids were identified: mystiric acid (C14:0, 0.72–8.09%), pentadecanoic acid (15:0, 0.05–2.35%), palmitic acid (C16:0, 15.97–31.04%), palmitoleic acid (C16:1, 1.48–19.61%), heptadecanoic acid (C17:0, 0.31–1.84%), cis-10-heptadecenoic acid (C17:1, 0.17–2.01%), stearic acid (C18:0, 2.79–11.20%), oleic acid (C18:1*n*9, 2.44–28.97%), linoleic acid (C18:2*n*-6, 0.06–3.48%), arachidonic acid (C20:4*n*-6, 0.12–10.72%), cis-5,8,11,14,17-eicosapentaenoic acid (C20:5*n*-3, 1.94–10%) and *cis*-4,7,10,13,16,19-docosahexaenoic acid (C22:6*n*-3, 3.31–31.03%). The proportions of *n*-3 PUFA ranged from 12.66% for annular seabream to 36.54% for European hake, whereas the proportions of PUFA *n*-6 were between 1.24% for oceanic puffer and 12.76% for flathead mullet [15]. The studied fish is a good reservoir of organic carbon so has a good capacity to sequester organic carbon from water, soil and atmosphere.

4. Conclusion

From the above research findings it was concluded that the fishes within the study area can store a significant amount of organic carbon if adequate protection is provided and fish conservation in the wetland areas. In this way we can help to reduce the global atmospheric organic carbon and global warming as well as can protect the country from severe environmental hazards. Therefore, conservation of fishes is essential to maintain ecological, nutritional and socio-economic equilibrium.

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Authors' Profile

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