Distribution and Threats to the Conservation of Clariidae in Yankari Game reserve and its influence on green technology aquaculture in Nigeria

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INTRODUCTION

Man relies essentially on resources of nature for survival. His food, water, drugs, clothing, shelter and the energy he uses are derived from nature. As a natural resource, fish is a good source of animal protein. In Africa fish is an important source of animal protein, constituting 23% of human daily animal protein intake as reported by (Konstapel and Noort 1995 and FAO, 1991). It is an important food for over 400 million Africans, contributing essential proteins, minerals and micronutrients to their diets. Paradoxically, despite the high dependence on fish as a source of animal protein, fish consumption in sub-Saharan Africa is the world's lowest. The continent is projected to need an additional 1.6 million tons of fish a year by 2015 just to maintain current consumption (The World Fish Center, 2009). The rapid increases in fish supply required over the next decades will only be possible, therefore, if these fisheries are sustained and improved, while simultaneously developing aquaculture (fish farming). FAO (2005) estimates that fish provides 22% of the protein intake in sub-Saharan Africa. According to Ayeni (1993), since man has no other planet to run to for now, his smooth and hitch-free existence and survival will depend on his ability to maintain a balanced ecosystem and sustainable resources base to the benefit of both present and future generations.

Clarias gariepinus is considered to be omnivorous displaying both scavenging and predatory behaviour (Bruton 1995). It has an extremely varied diet consuming fruits and seeds, all types of aquatic invertebrates and vertebrates, small mammals and even plankton (Bruton 1979a, Skelton 2001). Clarias spp. is the most widely used and accepted aquaculture fish species in Nigeria and parts of Africa. According to FAO (2002), fisheries products represented a major source of export revenue for developing countries, amounting to over US $ 20 billion per annum in late 1990s. Furthermore, Nigeria is one of the largest importers of fish in the developing world importing about 560,000 tonnes of fish estimated at about $400 million annually.

This paper was designed to assess the distribution and threats to the conservation of a major fish seed species in a protected area and the influence of the conservation of this species on the green technology in relation to aquaculture in Nigeria.

MATERIAL AND METHODS

The study area:

Yankari Game Reserve is a large wildlife park located in the south-central part of Bauchi State, in northeastern Nigeria. It is located on Latitude 9° 45’ 16” and Longitude 10° 30’ 37” and covers an area of about 2,244 km² (870 mi²) and is home to several natural warm water springs, as well as a wide variety of flora and fauna (Wikipedia 2011). Its location in the heartland of the West African savanna makes it a unique way for
tourists and holidaymakers to watch wildlife in its natural habitat. The main major water body that traverses the game reserve is the Gaji river whose tributaries and main channels provides an important source of cash income to the villagers around through fishing activities. Being part of a protected area, the river complex serves as home to variety of aquatic fauna, including fish, thereby conserving the genetic resources of the aquatic fauna found in the protected part/portion. Available records show that the reserve also hosts more than 350 species of indigenous birds, 26 species of fish, 7 species of amphibians and 17 species of African reptiles and many mammals.

**Fish Sampling:**
An intensive survey of the Gaji river complex was carried out through reconnaissance visits to identify locations that are easily accessible and have potentials of retaining water for long periods. This enabled the establishment of suitable sampling sites from which samples were collected throughout the period of field work. The hydrologic features of the study area and sampling sites established were closely studied. A total of twenty sampling locations were established on the Gaji river. The river, being not perennial, has some parts of it drying up in some parts of the year.

Fish was sampled monthly for a period of nine months. The sampling covered the period when major pools that have water at different times along the river throughout the year were covered. The period also coincided with the time when all possible drainages in the river complex have been drained into large pools and ponds along the various channels of the river complex. Fish samples collected were preserved in 10% formalin and later identified. Information on the species conservation and associated problems were also obtained through interviews and observation.

**Results:**
A total of 20 sampling sites were established following the reconnaissance survey to cover the major tributaries of the river. The results obtained indicated that only one species was found in the Family Clariidae which is *Clarias gariepinus*. The distribution of the species showed its presence in all the sampling sites (Table 1).

| Fish species          | Sampling site | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
| Clarias gariepinus    |               | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |


The abundance of *Clarias gariepinus* in the study area indicated that Ruwan Gada had the highest abundance of 16.12% of the total catch followed by Ruwan Bangiya with 14.07%. Ruwan Maciyar Maje had the lowest percentage abundance of less than 1% with 7 specimens (Table 2). There is significant difference (P<0.05) in the distribution of the species in the sampling points.

The identified major threats to the conservation of the species in the study area include over-exploitation, presence of competing species, habitat alteration, migration and other human activities. The greatest threat to the conservation of the species is overexploitation followed by habitat alteration. Migration and competition have almost same level of magnitude (Table 3).

<table>
<thead>
<tr>
<th>Sampling Location</th>
<th>Number of fish obtained</th>
<th>Percentage of total catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruwan Dinya</td>
<td>70</td>
<td>7.94</td>
</tr>
<tr>
<td>Ruwan Bugudu</td>
<td>75</td>
<td>8.51</td>
</tr>
<tr>
<td>Ruwan Bangiya</td>
<td>124</td>
<td>14.07</td>
</tr>
<tr>
<td>Ruwan Sarki</td>
<td>54</td>
<td>6.13</td>
</tr>
<tr>
<td>Ruwan Gada</td>
<td>142</td>
<td>16.12</td>
</tr>
<tr>
<td>Ruwan Boda</td>
<td>57</td>
<td>6.47</td>
</tr>
<tr>
<td>Ruwan Gajin Gwaza</td>
<td>47</td>
<td>5.33</td>
</tr>
<tr>
<td>Ruwan Ganga</td>
<td>53</td>
<td>6.01</td>
</tr>
<tr>
<td>Ruwan Kakkida</td>
<td>48</td>
<td>5.45</td>
</tr>
<tr>
<td>Ruwan Gajin Makeri</td>
<td>26</td>
<td>2.95</td>
</tr>
<tr>
<td>Ruwan Bakin Ruwa</td>
<td>21</td>
<td>2.38</td>
</tr>
<tr>
<td>Ruwan Maciyar Maje</td>
<td>7</td>
<td>0.79</td>
</tr>
<tr>
<td>Ruwan Maidabaki</td>
<td>19</td>
<td>2.16</td>
</tr>
</tbody>
</table>
Table 3: Scale of threat factors to conservation of *Clarias gariepinus* in Yankari Game reserve, Nigeria

<table>
<thead>
<tr>
<th>Threat</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over exploitation</td>
<td>+++</td>
</tr>
<tr>
<td>Habitat alteration</td>
<td>++</td>
</tr>
<tr>
<td>Migration</td>
<td>+</td>
</tr>
<tr>
<td>Human activities on watershed</td>
<td>+</td>
</tr>
<tr>
<td>Competition</td>
<td></td>
</tr>
</tbody>
</table>

**Key:** + = Low   ++ = Medium   +++ = High

Human activities in water shed are also an important threat that affects the distribution of *Clarias gariepinus* in the study area.

**Discussion:**

Various methods have been developed for the objective assessment of the conservation status of plant and animal species (Nature Conservancy Council, 1990). The major classification system used internationally for assessing the status of threat to each fish species is that adopted and developed by the International Union for the Conservation of Nature and Natural Resources (IUCN, 1990). The criteria used to classify the conservation status of fish species are outlined by Maitland and Lyle (1990). Normally, to be considered for conservation, the taxa concerned must be indigenous to the geographic area concerned. They are likely to be more important if they are quite distinct taxonomically and not just members of a close species group (Skelton, 1990).

*Clarias gariepinus* is sought to be spreading around the world primarily due to aquaculture (Cambray 2005). In Nigeria it is widely distributed partly due to its wide spread feeding habit. The wide distribution of the species in the study area is a confirmation of its African origin. Despite the distribution however, a number of factors pose a serious threat to its abundance and availability to fully support Aquaculture development in order to improve protein supply. Being a widely accepted species, overexploitation is a major threat to the continued availability of the species in the required sizes and quantity. This is partly in line with the findings of Mustapha (2009) who showed human activities on the watershed of the reservoir and overexploitation appeared to be the greatest threat factors causing the decline of *Barbus occidentalis*. A combination of threats leads to a decline in the population of fish. According to Mustapha (2009) various interacting factors such as reduced availability or competition for food, overexploitation of the species, impact of human activities on the reservoir watershed, low rate of breeding of the species, migration of the species, loss of vegetation and habitat alterations, presence of introduced species among others were some of the factors responsible for the declining population of *Barbus occidentalis* in Oyun Reservoir, Offa, Nigeria. *Clarias gariepinus*, is a successful aquatic invader as it has a eurytopic physiology, is highly fecund, grows quickly and has an omnivorous diet. It can be widely spread through the green technology aquaculture through provision of food. Feed provision accounts for the majority of material and energetic inputs and emissions associated with net-pen salmon farming and understanding and reducing the environmental impacts of feed production is therefore central to improving the biophysical sustainability of salmon farming as a whole (Pelletier and Tyedmers, 2007). This is applicable in the case of *Clarias gariepinus* in the study area.

It can be concluded that the widespread propagation of *Clarias gariepinus* in Nigeria as an aquaculture species can be hampered by the non institutionalization of measures that will ensure its conservation especially in protected areas.

**Recommendations:**

In view of the foregoing, the following recommendations are proposed as strategies to help in the conservation of *Clarias gariepinus* and other species in the study area and beyond:

1. Creation of education and public awareness on the importance of conservation
2. Enactment of laws and enforcement of regulation on biodiversity conservation
3. Closed season and habitat restoration practices
4. Patrol and surveillance in protected areas
REFERENCES


