Journal of
Fisheries and Aquatic Science

ISSN 1816-4927

Academic Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 9 (4): 205-212, 2014
ISSN 1816-4927 / DOI: 10.3923/jfas.2014.205.212

Efficiency of Different Traps for Silver Catfish Fishery and its Aquaculture Implications in the Face of Climate Change

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ABSTRACT

Climate change has the potential to severely impact coastal and inland environments and ecosystems and by extension fisheries and aquaculture. Coastal regions of the world are already experiencing flooding due to rise in sea level. In recent times, salinization of coastal areas due to flooding from storm surges and high tidal influence has been observed. Aquaculture is a fast growing agri-business venture in Nigeria presently and many coastal communities derive their livelihood from it. The culture of fresh water fish species that are very sensitive to high salinity may be threatened leading to mortality of stocked fish and loss of livelihood for coastal population. Consequently, there is urgent need for development and domestication of the silver catfish *Chrysichthys nigrodigitatus* that can tolerate higher salinity more than mudcatfish (*Clarias gariepinus*). This will help mitigate the impact of salinization of coastal areas arising from sea water flooding on culture of fresh water fish species.

Key words: Climate change, silver catfish, *Chrysichthys nigrodigitatus*

INTRODUCTION

Climate change has the potential to severely impact coastal and inland environments and ecosystems. All rural communities need to be aware of the potential impacts of climate change and take measures to adapt, so that they can become resilient to these changes. Only by identifying the risks associated with climate change, can communities initiate a plan that prepares them to adapt and thus manage the social, economic and environmental impacts of climate change on their communities (WorldFish Center, 2012).

Fisheries and aquaculture are vulnerable to climate change (Timmers, 2012). The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2007) highlighted the vulnerability of Africa, as a whole, to climate change and variability. Fisheries and aquaculture production are exposed to various facets of climate change resulting in complex impact pathways (Timmers, 2012). According to Vermeulen *et al.* (2012) the impacts of global climate change on food systems are expected to be widespread, complex, geographically and temporally variable and profoundly influenced by socioeconomic conditions.

Winograd (2005) defined adaptation as a system's ability to adapt to changes in the climate, to reduce the potential damage, to capitalize on opportunities and to cope with the consequences. In the context of aquaculture, a promising intervention and adaptation would be the development and culture intensification of culturable euryhaline fish species that can thrive in the increasing saline conditions of coastal communities, a fall-out of climate change. Intrusion of sea-water into fresh water sources and ecosystems has been observed in some coastal communities in Nigeria (Awosika, 1995; Okali and Eleri, 2004; Uyigue and Agho, 2007).

In Nigeria, the aquaculture industry is dominated by the culture of *Clarias gariepinus* and *Heterobranchus* sp. which are purely fresh water species. However, for coastal communities where there have been cases of salt intrusion as a result of climate induced changes, the culture of these fresh water catfishes may be threatened. Ogunsheye and Sogbesan (2005) studied the effect of different salinity levels ranging from 0.2-4.2 ppt on the growth and survival of *Clarias gariepinus* fry. From the study, the survival and weight gain decreased with increase in salinity. Also, 100% mortality was recorded for hybrid catfish fingerlings that were exposed to higher salt concentrations of 10 and 12 ppt by Gbulubo *et al.* (2011). It is indicating that if alternative culturable fish is not provided, farms in these regions may close up and farmed fish may become scarce in these parts of the country.

Chrysichthys nigrodigitatus is a euryhaline catfish that thrives in both fresh and brackish waters mainly in West Africa (Anyanwu, 1991; Risch and Vreven, 2007). According to Coche (1982), it is found in salinity levels ranging from 0-26 ppt. In Nigeria, *C. nigrodigitatus* is a highly valued food-fish and is among the dominant fishes of commercial catches as well as culturable fish species from the wild (Ezenwa *et al.*, 1986, 1990). A monoculture study of the catfish, *C. nigrodigitatus* was carried out in the late 70's in brackish water ponds off the shores of Lagos lagoon and under varying salinity fluctuations (Coche, 1982). It was recommended that since the Nigerian coast was characterized by extensive stretches of swamps and shallow areas not utilized for any other profitable form of agriculture that the silver catfish could be grown in these brackish waters and therefore, create a unique catfish industry for the coastal waters of Nigeria.

The purpose of this study is to present the outcome of a pilot study undertaken to investigate the likelihood of developing the culture of the Silver catfish by harnessing the strategies of its behavioural tendencies in its natural environment as an effective climate-smart practice. In particular, it seeks to draw attention to appropriate gears that may be utilized for an efficient trapping of broodstock of the silver catfish, *C. nigrodigitatus* at no risk or damage to the fish.

Fig. 1: Preparing a trap before installation

Fig. 2: Finished traps

Fig. 3: Installing a drum trap at the mangrove fringes (Esuk Nwaniba)

MATERIALS AND METHOD

Passive fishing gears: Four types of traps were installed at the mangrove fringes of Ifiayong River located at Ifiayong Usuk in Nwaniba village in Uruan Local Government Area of Akwa Ibom state. The traps comprised twenty-five pieces each of drum trap, netted conical trap, pvc pipes and bamboo traps whose processes of preparation, installation and retrieval are depicted in Fig. 1-5. Seven days later another boat trip was made to check the traps and retrieve them from the different points along the river edges in the company of a fisherman and his son.

Fig. 4: Retrieving pvc pipe

Fig. 5: Bamboo from the coastal edge of Ifiayong river

Morphometric analysis: Body length and weight measurements of broodstock caught in the drum and netted conical traps were taken. The total length was taken from the tip of the snout to the end of the caudal fin while the body weight was taken with a Camry scale. Specimens were ventrally dissected and their gonadal states investigated.

RESULTS AND DISCUSSION

The passive gear that gave the best results in terms of sizes and sexual maturity of *C. nigrodigitatus* caught was the drum trap. The largest gravid male and female silver catfish that were trapped in one of the drums had total lengths of 55 and 39 cm, respectively. The survey trip embarked upon with the fishermen in order to retrieve the fishing gears, the retrieval and the dissection of a specimen of *C. nigrodigitatus* are shown in Fig. 6-9, respectively. The outcome of the morphometric studies carried out on nine silver catfish broodstock are shown below in Table 1.

Collection of *C. nigrodigitatus* by attracting sexually mature couples into passive fishing gears is a first step towards its propagation. Traps as stated by Emmanuel (2008) are simple and passive

Fig. 6: Boat trip with fisherman and son

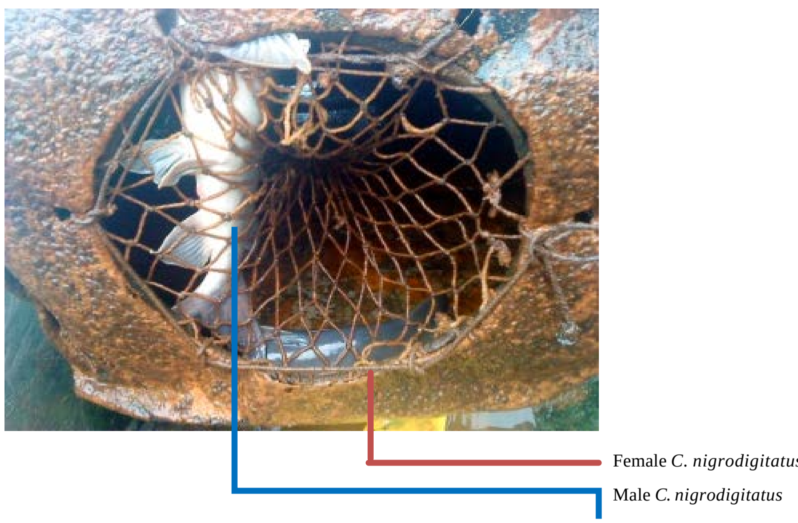

Fig. 7: Sexually mature couple of *C. nigrodigitatus* in drum trap

Table 1: Morphometrics of *C. nigrodigitatus* broodstock

Trap	Wt (g)	SL (cm)	FL (cm)	TL (cm)	Sex	Remarks
Drum	1200	49.5	54.4	60.5	Female	Presence of immature oocytes
Drum	2400	55.5	60.4	66.0	Male	Enlarged head
Drum	2000	56.5	61.0	67.8	Female	Presence of immature oocytes
Drum	700	32.0	35.0	42.0	Female	Presence of immature oocytes
Drum	1400	44.0	48.4	55.0	Male	Enlarged head and elongated papilla
Drum	600	32.6	37.1	39.0	Female	Presence of eggs
Netted cone	300	20.4	24.5	30.2	Male	Immature
Netted cone	550	30.3	34.7	40.1	Male	Immature
Netted cone	325	22.6	27.9	33.8	Female	Presence of eggs

Wt: Weight, SL: Standard length, FL: Fork length, TL: Total length

Fig. 8: Retrieval of male *C. nigrodigitatus* from drum trap

Fig. 9: Dissection of *C. nigrodigitatus*

fishing gears that allow fish to enter and then make it hard for them to escape. This method was preferred as it does not hurt the fish. The fish that were trapped in the different passive gears employed were devoid of wounds. The use of hooks to catch them had been observed in the past to give rise to opportunistic infections resulting in death usually. It was observed that the sizes of *C. nigrodigitatus* caught were to a large extent dependent on the types of gear utilized. For instance, the tubular gears probably due to their small diameters naturally attracted smaller sized catfish. As the interest was in devising a better mode of collecting gravid couples, the drum trap was adjudged the best.

In addition, the drum trap was highly selective of gravid silver catfish. A similar observation was made by Emmanuel and Olojede (2010) with the wire basket trap which was highly selective for the crab, *Callinectes amnicola*. The effectiveness of the trap made it a good small-scale fishing gear.

CONCLUSION

The aquaculture industry in Nigeria is of economic importance nationally, therefore, adaptation plans for climate change in the coastal communities need to be taken into account by broadening the scope of culture species to include fishes that can thrive in a brackish environment, such as *C. nigrodigitatus*. Appropriate gear such as the drum trap for the collection of gravid broodstock for propagation and subsequent culture is a necessary intervention.

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