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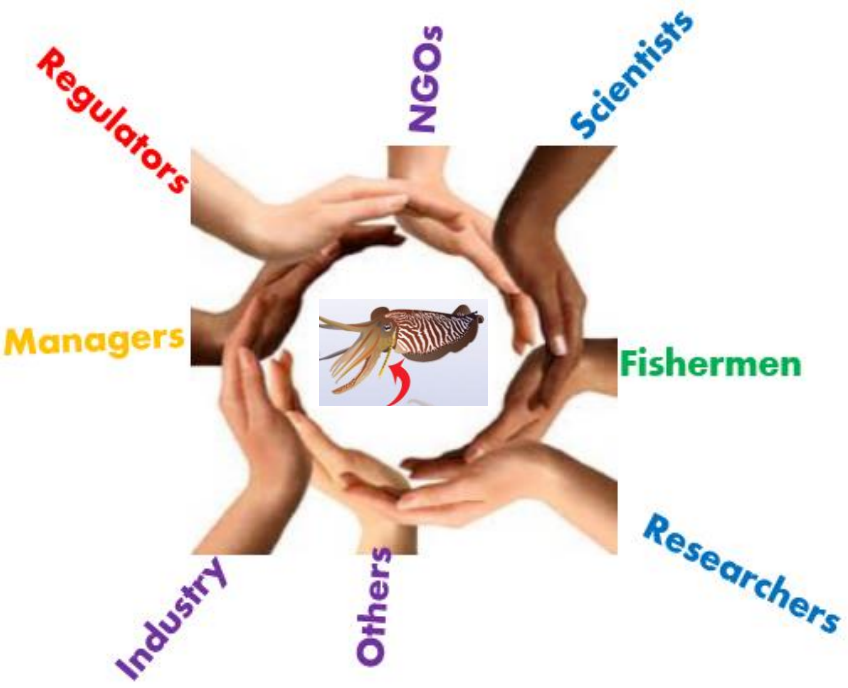
SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

GITA-UCC-SFMP-HM-FC Collaborative Research for Improved Cuttlefish Management Progress Report



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UNIVERSITY OF CAPE COAST
VERITAS NOBIS LUMEN

G.I.T.A

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ACRONYMS

FC	Ghana Fisheries Commission
GIS	Geographic Information System
GHS	Ghana Cedis
GIFA	Ghana Inshore Fishermen Association
GITA	Ghana Industrial Trawlers Association
HM	Hen Mpoano
LEK	Local Ecological Knowledge
SFMP	USAID/ Ghana Sustainable Fisheries Management Project
UCC	University of Cape Coast
USAID	U.S. Agency for International Development

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

BACKGROUND

In 2015 the Ghana Industrial Trawlers' Association (GITA), with support from the USAID-Sustainable Fisheries Management Project (SFMP), embarked on a study tour to the United States to learn best practices that account for the success of fisheries management in the US, and how some of these could be adopted in the pursuit of sustainable fisheries management in Ghana. One of the key lessons learned from the tour was the collaborative engagement

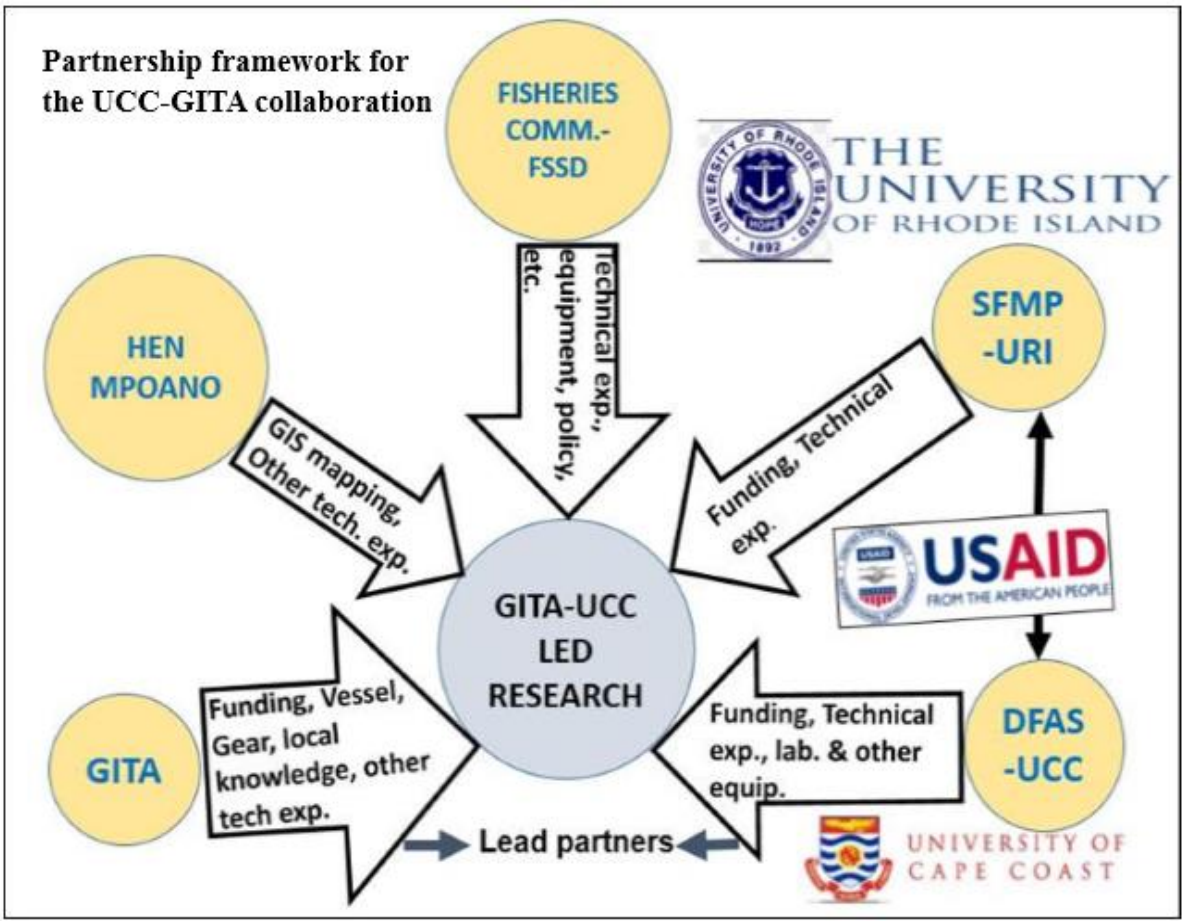

Figure 1. Partnership Framework for the UCC-GITA collaboration

between industry (fishermen) and science/research to drive sustainable exploitation of stocks. To pilot the feasibility of such science-industry driven research in Ghana, GITA proposed to collaborate with Department of Fisheries and Aquatic Sciences-University of Cape Coast (DFAS-UCC) to undertake a study on the breeding and migratory patterns of cuttlefish in Ghana's waters, to inform how the stocks could be sustainably exploited without endangering breeding and recruitment processes of the cuttlefish population. Ultimately, this research feeds into the Government of Ghana's objective of improving information on fisheries biology and stock assessment to support stocks rebuilding and harvest strategies in the "Fisheries Management Plan for Ghana, 2015 – 2019".

The study involves other collaborators including The Fisheries Commission (FC) and Hen Mpoano (HM) a local NGO. It has been partially funded by GITA and by the USAID-SFMP and USAID-UCC fisheries projects as shown in the partnership framework.

The collaborative research focuses on investigating the migration or movement and breeding activities of cuttlefish in the inshore waters of the Central Region of Ghana through the following activities:

Identifying viable cuttlefish areas for the research through focus group discussions. To help focus on areas with a viable cuttlefish fishery for the research, a team from Hen Mpoano conducted a survey on vibrant cuttlefish communities along the coast of Central Region of Ghana using focus groups. The survey identified Mumford, Cape Coast and Elmina as the viable areas for the research. Upon these findings, the study commenced in the said locations.

Figure 2. An initial LEK exercise by Hen Mpoano team to assess the viable cuttlefish areas for the research

MIGRATION

Tagging: A tag recapture study was conducted to evaluate movements of cuttlefish in the inshore waters off Elmina. The team from University of Rhode Island (Barbara Somers and Mitch Hatzipetro) together with the University of Cape Coast (Isaac Okyere, Pearl Sakyi-Djan, Richard Takyi and Isaac Ekow Bossman) commenced the research in February 2017 with the help of resources of GITA, SFMP and the UCC/USAID Fisheries Project. Three tagging trips have been undertaken with a semi-industrial trawl vessel, and about 80 cuttlefish from bottom trawl sampling have been successfully tagged and released (see trawl area in map below). Of the 80 tagged, only two recaptures have been reported by fishermen at Elmina, who have received the appropriate reward of Ten (10) Ghana Cedis phone credit and Cuttlefish Research T-shirt.

URI and UCC teams embarking on a tagging trip at Elmina

UCC team measuring a cuttlefish

Tagging cuttlefish by a team mate

A sample tag

Figure 3. Tagging trip photos

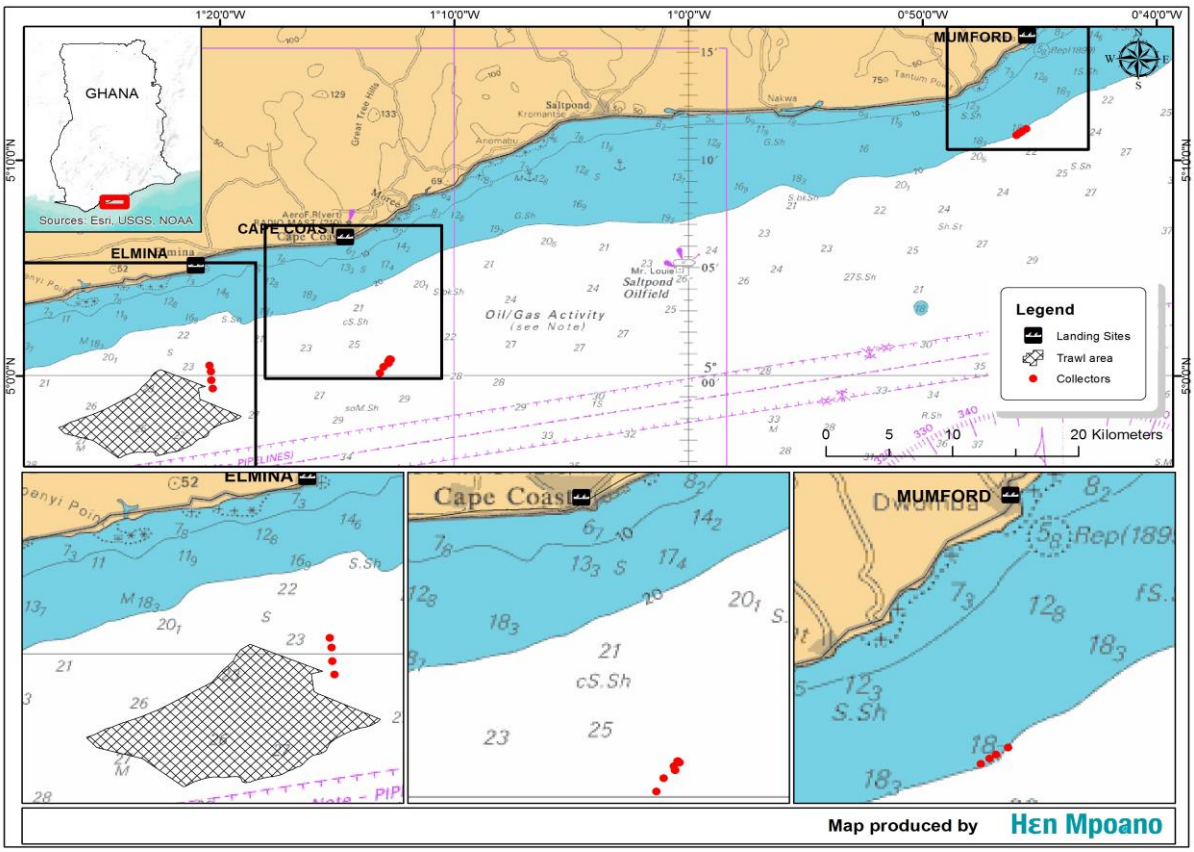

Figure 4. Area of tagging

Challenges with tagging and recapture, and the way forward

The main challenge has been low catches for tagging (averagely 30 cuttlefish per day) and this is hoped to be improved by early departure (dawn instead of morning) in order to increase the number of tows (5 or more tows per day instead the current 3 per day). Future trawls duration should be reduced from 2-3 hours per trawl to about at 20 - 30 minutes to also enhance the survival rate of the organism after being tagged, especially the smaller animals. There are two pending trips to be utilized which have been paid for by GITA, but due to bad weather conditions these trips are yet to be undertaken. One trip was freely offered by Mr. Kojo Mensah Sortoh of the Ghana Inshore Fishermen Association (GIFA) whose vessel is been used (rented by GITA) for the tagging expeditions.

Figure 5. Fishermen receiving rewards after returning tags

BREEDING

For the purpose of verification of breeding activities and spawning areas, artificial egg collectors and underwater camera were sited at vantage areas to help observe presence or evidence of cuttlefish spawning and identify these areas. Using GIS, these locations were mapped to show the spawning areas of the species in the inshore waters. The spawning research activities also included investigating water temperature and oxygen levels around collectors to determine favourable water conditions for cuttlefish spawning and egg hatching to aid in experimental hatching of eggs in the laboratory under similar conditions.

Building and deployment of collectors

Collectors were built to serve as an aggregating device to attract cuttlefish to spawn since the species mostly require certain surfaces to attach their spawns. They were designed with inputs and help of fishermen and have been deployed in three coastal communities in the Central Region namely Mumford, Cape Coast and Elmina waters. These locations were selected based on the preliminary survey by Hen-Mpoano in December 2016 prior to the commencement of the research. In all, twelve collectors have been deployed; four at each site (see location of collectors in the map above)..

Barbara illustrating the attachment of flag to a collector marker

Building of collectors by Mitch & Pearl

Figure 6. Building and deploying collectors

Figure 8. UCC team building collectors

Figure 7. Fishermen redesigning collectors

With hired canoes, sea trips were made to deploy the collectors and are monitored weekly.

Deploying a collector at a location at Elmina

A team mate on board canoe to deploy collectors at Elmina

Figure 9. Deploying collectors

A collector at Mumford

A collector at Cape Coast

Figure 10. Collectors

Verification of breeding using underwater videos

The use of underwater camera was adopted in this research to aid in viewing the nature of the bottom of the ocean, the presence of cuttlefish and the presence of eggs on the deployed collectors. Several trips have been embarked to deploy the camera, and interesting videos have been recorded capturing the presence of cuttlefish on the spawning grounds and presence of eggs on the collectors. Videos showing these visuals have been uploaded on YouTube (https://youtu.be/ZWoKtb5xa0c). Cuttlefish were spotted on the spawning grounds, but they were not seen guarding or fanning their eggs around the collectors.

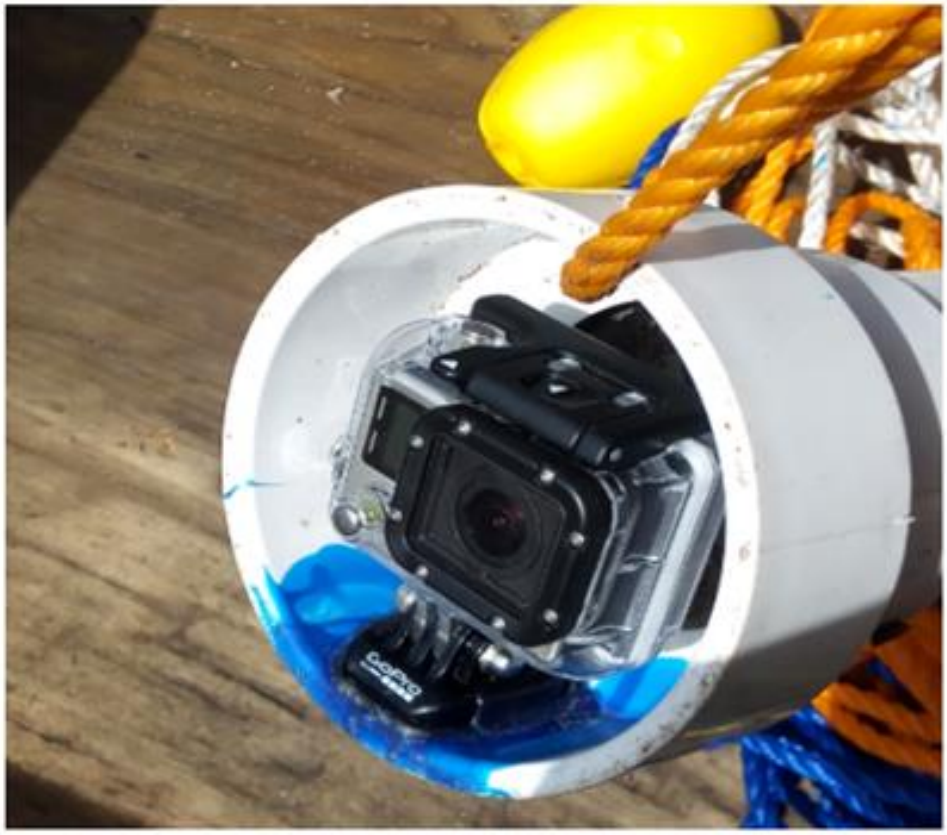

Figure 11. The GoPro Hero 4 underwater camera

Figure 12. Deploying an underwater camera

Figure 13. Cuttlefish spotted cruising on the breeding grounds

Figure 14. Cuttlefish eggs

The initial challenge was the mode of camera control and modification to cause the camera to be stabilized amidst the current at the bottom of the sea. Modifications were made to make camera more stable for easy observation. Multiple cameras or remote-controlled cameras which could record from several angles would be more efficient. A recommendation for the project would be to purchase two additional cameras.

Environmental conditions around collectors

Data on temperature and dissolve oxygen are being monitored around collectors using a water quality checker so as to determine the suitable environmental condition for cuttlefish egg development. These conditions are meant to be simulated in the laboratory for the egg hatching exercise. So far temperature in the laboratory has been similar to that in the laboratory but dissolved oxygen has been much lower in the lab than in the field (See Table 1). Nevertheless, the eggs hatched under the laboratory conditions.

Figure 15. Water sampler in use by Isaac

Figure 16. Water sample being tested by Richard

Table 1. Environmental conditions around the collectors at the three locations, and round the eggs for hatching experiment in the laboratory

Site	Nature of bottom sediment	Depth (m) Range	Temperature (°C) *Mean (±SD)*	Dissolved Oxygen (mg/L) *Mean (±SD)*
Mumford	Sandy	25 -26	28.2 (±0.8)	6 .5 (±0.5)
Cape Coast	Sandy	25-28	26.5 (±0.5)	6.0(±1.0)
Elmina	Sandy	24-26	27.0 (±1.0)	6.2 (±0.5)
Laboratory	Sandy	-	28.0 (±0.2)	3.3 (±0.1)

Hatching of eggs in the laboratory

Cuttlefish eggs were collected the collectors, separated into two batches and transported to the laboratory under different conditions. One batch was transported submerged in seawater while the other batch was transported without sea water but covered with wet or dump fishing nets to prevent dehydration. This was done to ascertain whether these two modes of transport will have any effects on the success of hatching. Temperature and dissolved oxygen of the water in the laboratory aquaria as well as changes in egg size (height and diameter) were measured daily, while physical outlook of the eggs was noted to follow changes in ontogenic development of the eggs from the time they are laid to hatching. After a week under observation in the aquaria, the eggs began to hatch. Both batches hatched successfully.

Laboratory hatching of cuttlefish in progress

Figure 17. Laboratory hatching of cuttlefish in progress

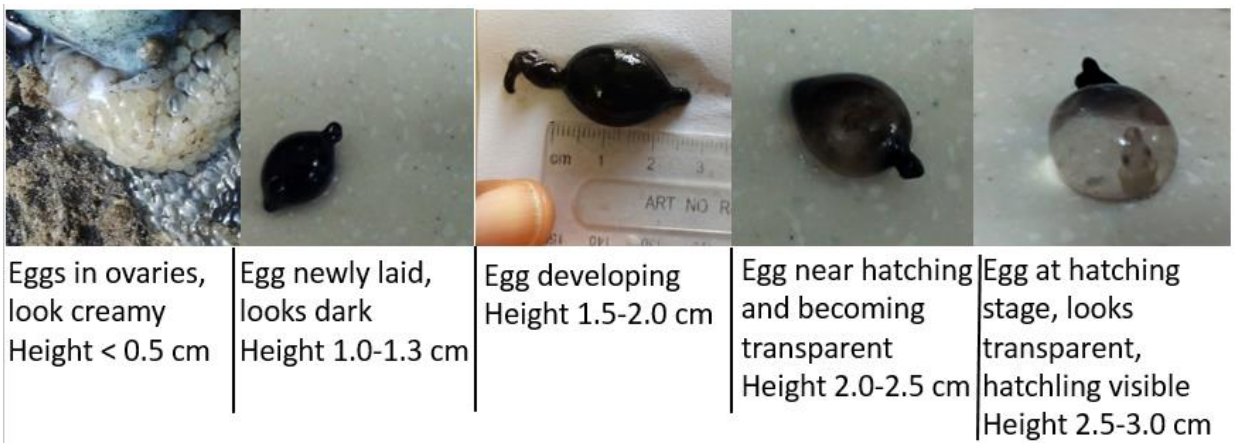

Figure 18. Physical description of ontogenic development of cuttlefish eggs from the ovaries to hatching

Over sixty (60 hatchlings were recorded within the first two days. Unfortunately, mortalities occurred from the third day as the brine shrimp *Artemia selina* eggs did not hatch. The hatching experiment has therefore been halted.

Figure 19. Cuttlefish hatchlings in experimental aquarium tank in the laboratory, UCC

Tagging outreach campaign and community engagement

Community engagement and outreach campaigns have been embarked on in order to educate and sensitize the fisher folks and the fishing communities on the aims and objectives of the collaborative research, and most importantly for the fisherfolk to see themselves as part of the research by reporting and returning all tags found on cuttlefish.

Sensitization at Elmina Central Region

Sensitization at Cape Coast

Figure 20. Sensitization at Elmina, Cape Coast and Mumford

The three communities have been severally visited for the education and sensitization programme from February to May, 2017. Through these engagements, the community members have come to terms with the need to feel part of the collaborative research and have supported. Other sensitization activities include daily announcements on community radios in the three communities, and radio talk show at Asafo FM located within the vicinity of the cuttlefish fishers at Elmina for continuous awareness. The Fisherfolk phoned in the programme to express their support. Nana Kwesi Duncan I, a Chief Fisherman at Elmina who has custodian of a number of the cuttlefish fishers has been very instrumental in assisting with the community engagement and radio talk show at Elmina. Management of the cuttlefish export factory at Elmina, C. G. Elmina LTD, have also been engaged in a discussion to join the collaboration which they have shown positive response.

Figure 21. Cuttlefish team on a radio talk show at Asafo FM, Elmina

SUCCESSES, CHALLENGES, LESSONS LEARNED AND THE WAY FORWARD

Successes

There have been a considerable number of success stories in this pilot collaborative research despite a few challenges. Historically, this is the first time fishermen in Ghana (GITA) have committed financial resources (significant amount of money) into research. A boat owner of another fleet (GIFA), Mr. Kojo Mensah Sortoh, from Elmina has offered a free tagging trip worth about GHS 4,000 (≈ USD 1,000) which is yet to be utilized. Fishermen have been very supportive in the construction of collectors, providing ideas about the utilization of low cost local materials and contributing to robust designing of collectors to withstand the ocean currents. In Cape Coast, the fisherfolk in an effort to ensure the security of deployed collectors on their fishing grounds, confronted a fisherman who landed a collector and instructed him to return the collector to its location at sea before calling the research team. Nana Kwesi Duncan, a Chief fisherman of Elmina, has contributed immensely in being vocal on the radio talk show, championing awareness of this research and mobilizing Elmina fishermen for awareness creation. The collaboration has expanded from GITA to inshore fishers and the canoe fishers, and gradually expanding to include the cuttlefish export factory at Elmina. The collaborative research has created a working relationship between DFAS-UCC research scientists and the fisherfolk.

On the technical side, the collaborative research has been able to identify and begin to map the breeding grounds of cuttlefish within the inshore waters in the Central Region of Ghana. The team has also been able to successfully hatch cuttlefish in the laboratory.

Challenges

There are some challenges that still need to be addressed to further harness the success of the collaborative research. Key among them is the issue of mistrust between fishers of different fleets resulting in the unwillingness of fishers at Elmina to return tags after recapturing a tagged cuttlefish and disclosing the location of recapture for the fear that any disclosed information could be used to their disadvantage in the future. Others also feel the reward for returning a tag (i.e. the project T-shirt and GHS 10 phone credit) is too small incentive to merit reporting a tag. This may contribute to poor reporting although there are many other reasons for the low recapture rate such as mortality from the trawling and tagging and movement out of the area. It is hoped that these issues will be addressed through further extensive engagements.

Concerning the research, there has been low numbers of cuttlefish tagged from the trawls (roughly 30 per day; total of 80 tagged from the three trips). This has been largely attributed to the inability of the team to depart for the sea at dawn to trawl. This we hope to improve by departing at dawn in our subsequent trips. Some delays in GITA mobilizing funds to pay for tagging trips on time also couldn't enable the team embark on sufficient number of trips to tag adequate number of cuttlefish during the peak of the season. Lastly, the brine shrimps did not hatch to feed the cuttlefish hatchlings leading to mortalities which halted the laboratory work.

Lessons learned

The preliminary lessons learned are that collaborative research is possible in Ghana and fishermen are highly resourceful in contributing to research. Collaborative research is a powerful tool for changing attitudes leading to behaviour change. Fishermen can also be very supportive in collaborative research, but much more support and collaboration will be

realized keenly when there is trust among fishers of the different fleet, and between fishers and research scientists as well as other collaborators. In collaborative research, the local ecological knowledge (LEK) of fishermen could be a very useful tool at all stages of the research, especially in the field, sampling and understanding the dynamics of fishery systems and environments as they have long experienced these through their lifetime.

The Way Forward

- GITA needs to engage the inshore and canoe fishers in fisher to fisher (F2F) discussions to build trust and make them feel part of the research and data ownership in order to open up on reporting and returning recaptured tags.
- It has been understood that the canoe fishers who exploit cuttlefish at Elmina are resourced with GPS and nets for building collectors by middlemen who purchase the catch and sell to the factory. The team is therefore making efforts to reach these middlemen and engage them in discussions to partner the collaboration.
- There are still a few field and mapping works to embark on to mop up the research as the season gets over.
- Departure for future tagging trips will be embarked at dawn to help secure high number of cuttlefish fish to tag.
- Reliable brine shrimp and mysids eggs will the secured and the team will build its capacity in hatching brine shrimps and mysids, and try the cuttlefish hatching again.This should be developed as an active part of the project involving the fishermen to help return the animals to the sea and educational activities.