

# Characterization of the Sole Fishery in The Gambia



## Gambia-Senegal Sustainable Fisheries Program (Ba Nafaa)

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Cover Photo: Pictures of the sole fishery in The Gambia by Christopher Parkins

Photo Credit: Coastal Resources Center/URI Fisheries Center

## **Acknowledgements**

There is little doubt that involving stakeholders as partners in developing management plans will assist in the progress towards improved management of the fishery resources. Local fishermen contributed greatly to this study on gillnet performance and subsequent research. We wish to thank the fishermen of the Gambia who participated in this project to gather information. This information dramatically improved the data poor scenario and allowed very specific questions to be formulated and investigated.

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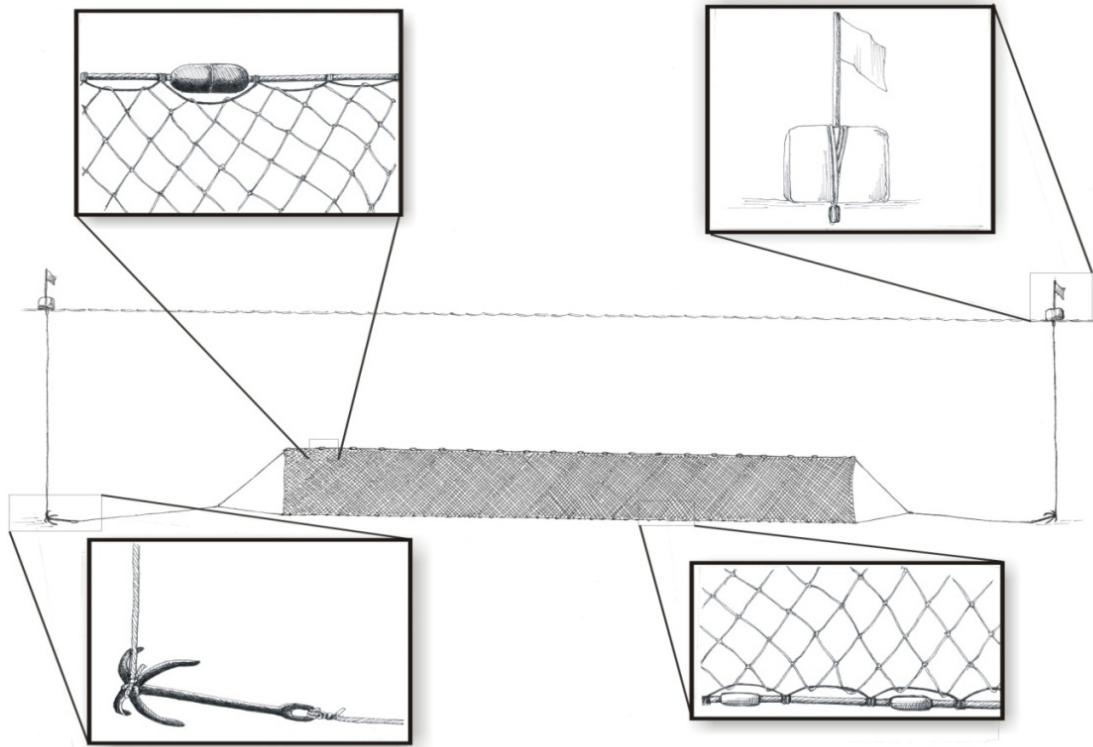
## **Preface**

This report discusses the characteristics of the sole fishery as determined by discussions with fishermen and the NASCOM executive committee using a rapid survey technique in January 2011. The gear outlined (gillnets and longlines) were mentioned as the predominant methods of capture for sole in the Gambian artisanal fishery. This information was prepared to assist in development of the sole management plan.

### **1. What is a gillnet?**

A gillnet is a wall of webbing of a certain mesh size that interrupts movement of fish and captures them through the gilling or wedging of the body. Gillnets are fished as a vertical wall of webbing designed in such a way that they are selective for a certain shape, size and or species of fish. A gillnet consists of marker buoys to indicate the beginning and end of a set, anchors to keep the net fixed (if a bottom set net), a floatline to keep the panel of webbing upright and a leadline to keep the panel of webbing taught and fixed. Gillnets can be placed in different configurations including bottom set gillnets which are nets anchored on or near the bottom (see figure 1) to catch bottom dwelling species; there are anchored mid water gillnets as well as free drifting gillnets that target pelagic species.

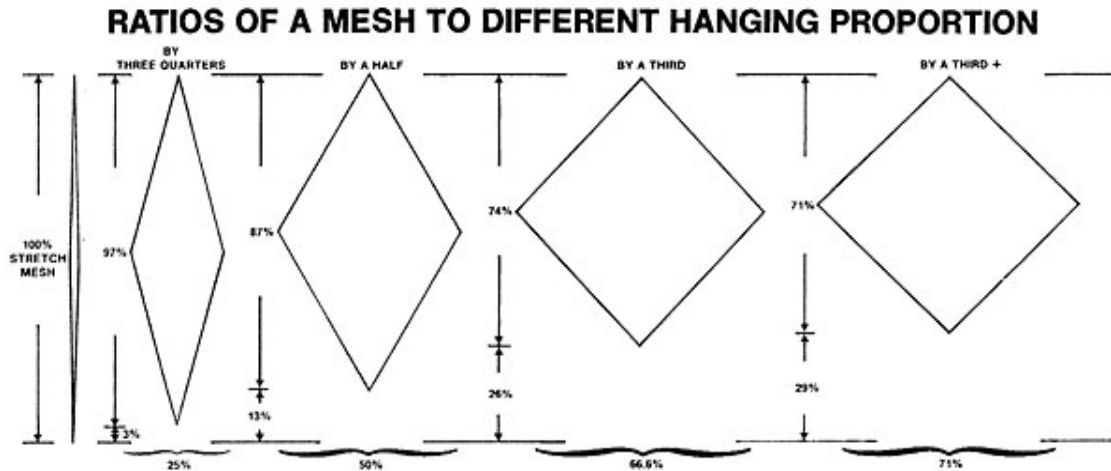
A gillnet can be constructed of different twine types including: natural fibers, monofilament and multi-fiber synthetic twines. The twine diameter and color used is determined by the fishes ability to see and react to the gillnet (ex. In clear tropical water a clear monofilament net would be most effective). Twine diameter is also affected by current, as twine diameter increases as does surface area and drag. Mesh size is determined by the body shape and size of the target species. Stiffness of the twine determines the ability of the net to be forgiving to certain fish species.



**Figure 1:** Artists representation of a bottom set gillnet showing the anchors, marker buoys, floatline and leadline (Courtesy of *Juan Chuy Sociedad de Historia Natural Niparajá 2007*)

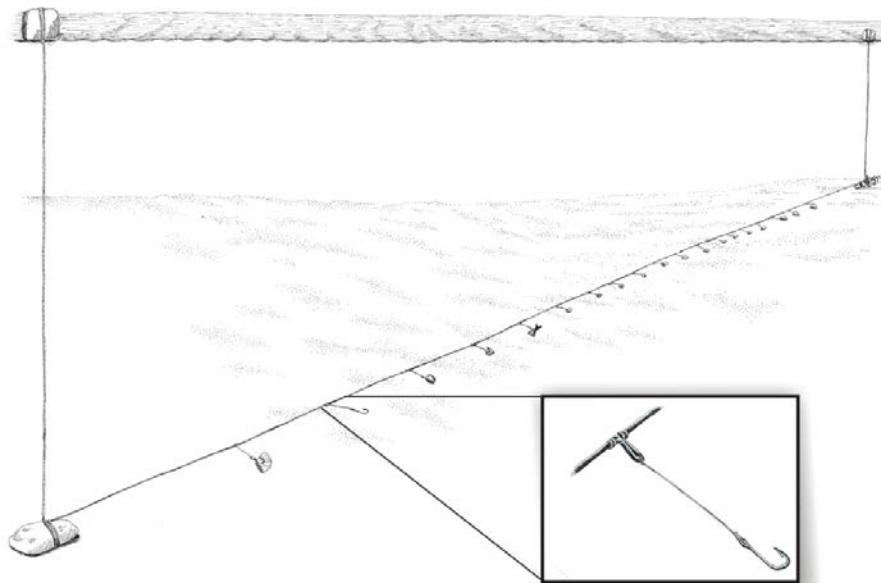
An important factor in determining how selective a gillnet will be is the hanging ratio (see Figure 2). Hanging ratio refers to how the webbing is hung to the leadline and floatline. It compares the length of the stretched webbing hung to the length of leadline or floatline and how slackly or tightly the webbing is hung to any rigid or flexible frame.

Hanging ratio determines the ability of the gillnet to catch and discard certain species. A ratio closer to 1.0 (100%) is ideal for laterally compressed fish, a ratio of 0.5 is ideal for many roundfish species, and a ratio closer to zero is ideal for flatfish species. All the factors mentioned above must be considered along with local regulations when designing a gillnet to be used in a commercial fishery.



**Figure 2:** Example of different hanging ratios

**2. What is a longline?**



**Figure 3:** Example of a longline trawl (Courtesy of Juan Chuy Sociedad de Historia Natural Niparájá 2007)

A longline is a passive gear by which multiple baited hooks are fished along a mainline in order to capture fish (Figure 3). A longline set begins and ends with a marker buoy that goes to an anchor which is attached to the mainline. The single set of gear is

referred to as a trawl. The hooks are attached to the mainline with lines of varying lengths called gangions. The hooks are evenly spaced along the mainline in an effort to maximize efficiency while decreasing fouling of the gear.

Hook size is determined by the target species and the ability of the hook to enter the mouth of the fish. Hooks come in two different shapes; traditional “J” hooks with a straight shank and circle hooks which have a circular shape that allows the hook to set itself in the fishes mouth without being swallowed (Figure 4). Circle hooks are commonly used in the longline fishery as they catch better than the traditional “J” hooks. The bait used by the fishermen is personal preference and is usually based upon trial and error to determine the best bait for the target species.



**Figure 4:** Examples of a circle hook and a “J” hook

### **3. The Gambia**

This report summarizes the information gathered on the sole fishery in an effort to develop a management plan for the sole fishery. In The Gambia sole is primarily caught as a bycatch in the bottom set gillnet fishery along with the higher value roundfish species (catfish, ladyfish etc.). Currently harvesting rules consist of a minimum mesh size, bar length no smaller than 4cm, and minimum fish size, a fish no smaller than 25cm. Given interest by the co-management committee to examine new harvest rules, we examined the general characteristics of the gillnet design used for sole.

Bottom set gillnets used in the Gambian fishery consist of: monofilament webbing, marker buoys, anchors (rocks), foam floats, a floatline and a leadline. Though mesh sizes greater than 4cm (bar length) can be used, in the sole fishery, mesh sizes commonly used are: 4cm, 4.2cm, and 4.6cm. Gillnet sets are constructed of 20m sections tied together to form a wall of webbing. In the past the gillnets were only 1m in depth, in an effort to increase catch, fishermen now fish gillnets that are 2m in depth. Each set, on average, consists of 10-20 sections (dependent on wealth of fisherman). The number of sets fished each day is also dependent upon the resources of the

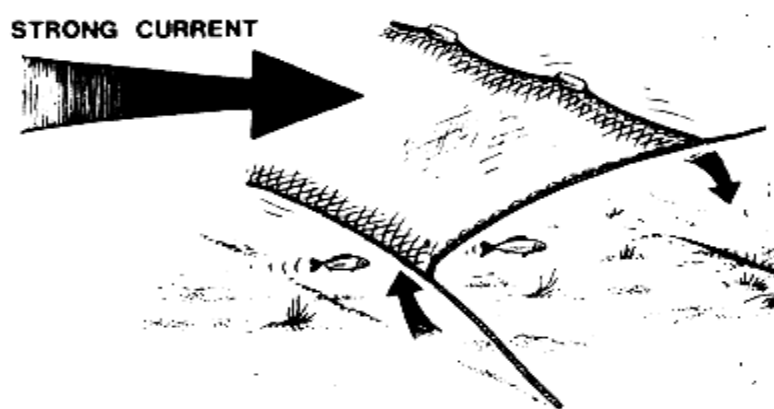


fisherman. The floatline has foam floats (~8cm) spaced at about ~2m apart along the length of the webbing. The leadline has lead weights evenly distributed at ~.5m intervals, as well as rock anchors at the end of each section. The hanging ratio, when observed, was 0.5 an ideal hanging ratio for roundfish species. Many nets were observed without a hanging ratio on the leadline or floatline, limiting their ability to be selective.

The gillnets are commonly fished with multiple sets one after the other. Once set they are left to soak for a 24 hour period and hauled the following morning. All gillnets are hauled by hand and fish are removed by hand. Crabs caught that are not commercially valuable are smashed out of the net using a piece of wood, as they foul up the net and are difficult to pull out. Almost all catch is retained for sale on the beach.

#### 4. Observations

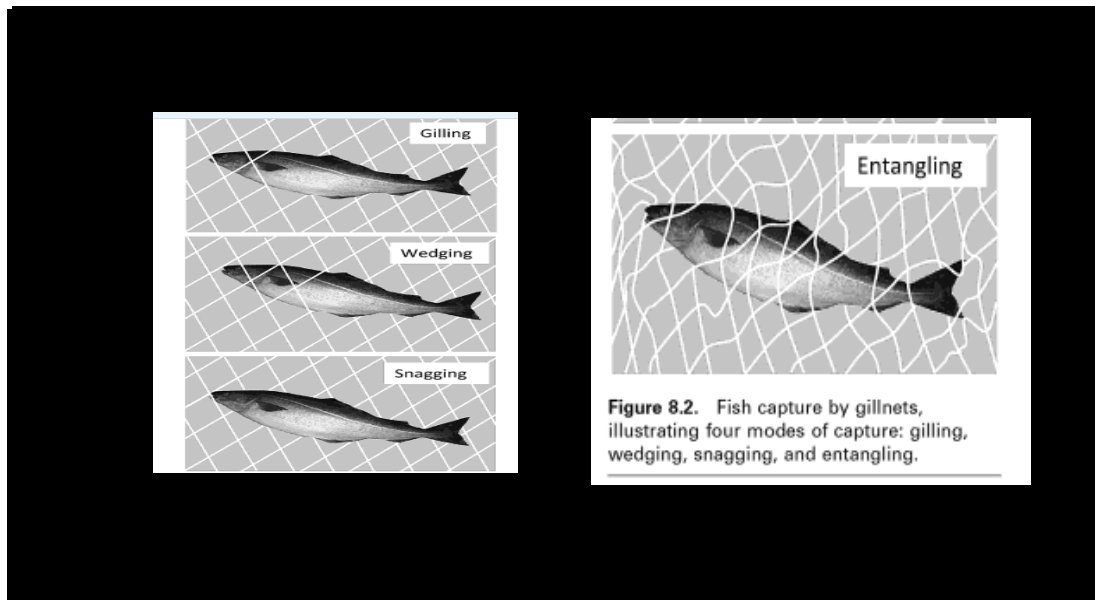
All observations are based upon interviews with two fishermen from the fishing port of Sanyang and observations made during the ongoing bycatch study at 4 landing sites. Information was also collected during a meeting of the executive committee. While watching the fishing operations it became evident that not all of the gillnets had a consistent hanging ratio. This was evident as the webbing was simply laced through the leadline and floatline without ties. The fishermen mentioned that the gear was fished in an upright manner with a small purse formed by the current. Upon observation of the gear being fished it was evident that the gear was partially lying on the bottom. This can be due to a combination of factors including: too little floatation, compression of foam and loss of buoyancy at depth, and current (Figure 5).



**Figure 5:** Gillnet that does not have sufficient buoyancy to keep it upright in a current.

Entanglement, as well as gilling (Figure 6) was occurring in nets (Figure 7), indicating that portions of the net were fishing as a gillnet while the portions were acting as entangling gear. If the net is lying down it is losing its characteristics as a gillnet as the hanging ratio becomes ineffective and the mesh is loose. Due to these observations it

should be noted that these gillnets, as fished, are acting more as an entangling gear (Figure 7).



**Figure 6:** Methods of capture in gillnets



**Figure 7:** Examples of gilling, wedging, and entanglement in the Gambian gillnet fishery

## 5. Longline Fishery

There is a small longline fishery used for demersal species including sole in the Gambia. The gangions and main line are monofilament. The large hook size is probably used for catfish (note: not a circle hook). It does not appear to be a major gear type but more inquiry should be conducted to evaluate the efficiency of this method/gear.



## 6. Problems and Harvest Rules

A meeting was held with the executive committee to discuss how to move forward and solve the problems in the sole fishery. The discussion focused on current harvest rules and how they should be modified in the new management plan for the sole fishery. It was agreed that the current minimum fish size of 25cm and the minimum mesh size of 4cm (bar length) may not be the best harvest rules for the health of the sole fishery.

The executive committee came up with an action plan on how to move forward based upon the information gathered about the sole fishery. The executive committee recommended that meeting be held with the master fishermen. The purpose of the meeting is to get the input of the fishermen on how to design a research project that will compare the current method of fishing gillnets to a new design. They will help decide what modifications should be made to the gear and how the project will be performed. The knowledge of these fishermen will be important in moving forward and designing a gear that will benefit not only the sole fishery but the fishermen themselves.

## 7. Possible Follow-up

- Discuss with the LASCOM/NASCOM fishermen panel
- Determine the cost of continued fishing using this method (cost of replacing gear versus new management)
- Research project: Examine a more selective gear on the cost of fishing and the benefits/losses to the fishermen

## 8. Some Recommendations to Consider

Management Tool	Pros	Cons
Design a new gear that is more selective	<ul style="list-style-type: none"> <li>-Reduce bycatch while retaining more profitable species</li> <li>-Problems associated with gear wear and tear can be eliminated</li> </ul>	<ul style="list-style-type: none"> <li>-Designing can be difficult, long and expensive</li> <li>-Implementation can be difficult, fishermen may be reluctant to use new gear</li> <li>-Difficult to enforce</li> </ul>
Control how much of a species can be landed (daily quota) regardless of how caught	<ul style="list-style-type: none"> <li>-Penalty for landing more than allowed</li> <li>-Encourage fishermen to fish cleaner</li> </ul>	<ul style="list-style-type: none"> <li>-Catch can be sorted at sea, therefore not eliminating bycatch, just what is landed</li> <li>-Difficult to enforce</li> </ul>
Control what species can be landed	<ul style="list-style-type: none"> <li>-Penalty for landing a restricted species</li> <li>-Encourage fishermen to fish cleaner</li> </ul>	<ul style="list-style-type: none"> <li>-Catch can be sorted at sea, therefore not eliminating bycatch, just what is landed</li> <li>-Difficult to enforce</li> </ul>
Minimum sizes on fish species	<ul style="list-style-type: none"> <li>-Fishermen will be encouraged only to use methods that catch larger fish</li> <li>-Improvement of the health of the stock</li> </ul>	<ul style="list-style-type: none"> <li>-Catch can be sorted at sea, therefore not eliminating bycatch</li> <li>-Difficult to enforce</li> </ul>

## **9. Suggested Research Project Design**

### **Gillnet Catch Comparison Research Study**

#### **Preface:**

Based on our discussion with the executive committee, it was suggested that this design for the study be discussed with the master fishermen to get their input. The discussion should include modifications to project and gear design and the involvement of the fishermen in the project

#### **Purpose:**

Design a gillnet that will be hung correctly and have proper floatation to fish as a vertical wall of webbing. Construct a gillnet that meets these specifications and compare it to a brand new net that is designed after what is currently being fished. Perform a catch comparison between both nets fished side by side in order to determine if there is any difference in catch.

#### **Objectives:**

1. Design a gillnet that will maintain proper fishing characteristics when fished in heavy current and at depth
2. Determine if there is significant difference in selectivity between a properly hung gillnet and the gillnet design that is currently being fished

#### **Materials:**

1. Properly hung gillnet with 42 and 46cm alternating sections
2. Gillnet designed after current gillnet being fished
3. Boat
4. Data sheets/pencils
5. 2 data collectors
6. Camera
7. GPS
8. Measuring board

#### **Methods:**

- 1) Design and build gillnets
- 2) Perform research 2 times a week for one month at a site to be determined
- 3) Fish gillnets side by side for a twenty four hour soak time identical to current soak time in the gillnet fishery
- 4) Monitor catch coming aboard and fill in data sheet criteria:

- a) Where in net is fish captured
  - b) What size mesh
  - c) Is the fish gilled, wedged or entangled
  - d) Length
  - e) Species
  - f) Quality of fish
- 5) Enter data into a usable format using excel
  - 6) Perform an analysis to determine if there is a significant difference between the properly hung gillnet and what is currently being fished
  - 7) Decide how to move forward based upon the preliminary results
  - 8) Document deterioration of the nets as used in different manner.