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WOMEN SHELLFISHERS AND FOOD SECURITY PROJECT

**PARTICIPATORY ASSESSMENT OF SHELLFISHERIES IN THE
ESTUARINE AND MANGROVE ECOSYSTEMS OF
SENEGAL**



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Cover photo: Mangrove ecosystem

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ACRONYMS

| | |
|--------|--|
| CCM | Centre for Coastal Management |
| CLPA | Local artisanal fisheries council |
| COGER | Resource Management Committee |
| CRC | Coastal Resources Center |
| ECOWAS | Economic Community of West African States |
| EIG | Economic Interest Group |
| UCC | University of Cape Coast |
| UEMOA | West African Economic and Monetary Union |
| URI | University of Rhode Island |
| USAID | United States Agency for International Development |

Executive Summary

| Basic Contextual Information | |
|---|--|
| Country | Senegal |
| Total land area | 196,722 km ² |
| Population | 16.705 million (2020) |
| Percentage population living in/near the coast | 60% |
| Gross Domestic Product (GDP) | 24.13 billion |
| Human Development Index Rank | 0.505 (164 out of 189) (2017) |
| Length of coastline | 531km |
| Fish consumption (as a percent of animal protein) | 43% |
| Anemia prevalence | 49.9% among women of reproductive age (15 - 49) (2016) |
| Estimated mangrove cover | 124,784 ha (2016) |
| Estimated estuarine and mangrove ecosystem-based shellfish harvesters | 5,270 |
| Estimated women shellfish harvesters (percent) | 4,216 (80%) |
| Estimated direct household shellfish beneficiaries | 59,288 |
| Estimated percentage of shellfish harvesters at all nodes of the value chain (vertical integration) | 50% + |
| No. of coastal systems with mangrove-based shellfishing | 8 (Sine Saloum, Casamance River, Senegal River Estuary, Somone Lagoon, Joal-Fadiouth Lagoon, Mbodiene Lagoon, Dakar Coast, Alahein River Estuary) |
| Shellfish management regulations | <ul style="list-style-type: none"> - Local artisanal fisheries council (CLPA) - Marine protected areas - Traditional system of conservation |
| Mangrove management regulations | <ul style="list-style-type: none"> - +17 Marine protected areas (Cormier-Salem, 2014; http://www.rampao.org/-Senegal-.html?lang=en) and two new MPAs proposed in 2020. - Traditional system of conservation |
| Coastal ecosystems with shellfisheries identified as Ramsar sites | Saloum Delta National Park (73,000 ha) |

Source: Chuku et al. 2020, Global Mangrove Watch, Ramsar Sites Information Service (RSIS).

The USAID Women Shellfishers and Food Security Project aims to document opportunities to replicate and expand shellfish livelihoods based in mangrove ecosystems, which can provide income and a cheap source of protein and micronutrients to coastal dwellers across West African coastal countries and drive sustainable management of coastal ecosystems. This country assessment is aimed

at gathering data on the scale and scope of shellfisheries and shellfish-based livelihoods associated with mangrove and estuarine ecosystems in Senegal.

Located in the western most part of the African continent with a wide opening to the Atlantic Ocean, Senegal has a coastline of nearly 700 km, sometimes marked by estuaries (Saloum Delta, Casamance, Senegal, Alahein), which favors the development of rich mangrove ecosystems and therefore a varied exploitation of shellfish resources.

Molluscs are harvested and farmed in mangrove ecosystems primarily by women principally in eight water bodies/mangrove ecosystems in Senegal (the Sine Saloum Estuary, the Casamance River Estuary, the Senegal River Estuary, the Somone Lagoon, the Joal-Fadiouth Lagoon, the Mbodiene Lagoon, the Dakar Coast, and the Alahein River Estuary). Resource users with shell fisheries livelihoods surveyed for this assessment were mainly females (80%) and harvesters were 90% female, ranging in age from 15-65 years. Shellfishing households are large, averaging 11-15 members with more women than men.

The classification of shellfish in terms of harvesting shows the arches (bloody cockles) are the primary species harvested, oysters are second, and murex and cymbium third. After processing and drying, the products are sold to local or foreign traders from other markets in Senegal. Part of the harvest is also packed in labelled bags and marketed in the shops of the processing units. Although very difficult to estimate accurately and comprehensively, based on this survey, the monthly income of the catch of arches/bloody cockles is estimated at between 15,000 FCFA (US \$26.00) and 20,000 FCFA (US \$35.00) per person. For oysters, the monthly income per person varies between 20,000 FCFA (US \$35.00) and 40,000 FCFA (US \$71.00). Apart from the processing sites for fisheries and forestry resources, the populations lack materials and space for drying shellfish to ensure that they are hygienically preserved and consumed.

In Senegal, officially, there are no national regulations/laws specific to the shellfish fishery, but important efforts are made for the conservation of shellfish resources and the mangrove ecosystem in general. Senegal has more than 17 Marine Protected Areas, most of which include some shellfishing areas, and the 73,000 hectare Saloum Delta National Park, which is designated as a Ramsar site. The implementation of traditional systems to ensure sustainable conservation of the resources is practically applied in all the exploitation areas. These traditional conservation systems are mainly reinforced by the good community organization of the women who are the main actors in this sector through economic interest groups (EIGs) and federations or local unions of EIGs. Despite these initiatives, shellfisheries are open access and survey respondents note that the scarcity of resources has led the estuarine communities to look for shellfish in areas that are further away from the old traditional exploitation areas.

The climate crisis in the fishing areas is linked to salinization, rising sea levels, and reduced rainfall. All these factors result in the decline of shellfish resources. Extensive mangrove reforestation programs initiated by the NGO Oceanium Dakar and other environmental actors with the support of estuarine and island communities have been revitalizing the mangrove ecosystem in some areas for several

years. According to the communities, they do not receive a sustainable payment from the global carbon market to restore and maintain their mangroves at their level.

Recommendations made by survey respondents to improve the conditions and environment of the shellfisheries sector in Senegal are as follows:

- Define a first catch size for molluscs.
- Regulate shellfish collection methods by ensuring selectivity.
- Improve recovery methods to reduce pressure on the resource.
- Promote oyster farming.
- Restore degraded mangrove ecosystems.
- Build markets to facilitate the marketing of products.
- Help finance market gardening and forest product development projects as a diversification/alternative to shellfishing activities.
- Modernize the shellfisheries sector.
- Help finance new boats.
- Increase the number of structures for processing fish products.
- Build protective dikes to combat salinization of the land and maritime erosion.
- Provide equipment and suits to improve fishing conditions.

Additional recommendations for promoting sustainable and recognized management of shellfisheries food resources at and beyond the country level in West Africa include:

- Strengthen consultation mechanisms between groups of women processors at the local, national, and sub-regional levels for the sharing of experience and good practices.
- Advocate with sub-regional and regional institutions such as ECOWAS, the African Union and UEMOA for a better consideration of the shellfish sector in economic and social development programs.
- Reinforce the logistical means of the actors involved in shellfish harvesting, actors who are sometimes confronted with real problems of safety and insecurity that can cause accidents.
- Establish or designate a West African office to monitor and evaluate the various projects in the shellfish sector. Such a unit could accompany decision-makers and technical and financial partners in future interventions and capitalize on efforts made.
- Encourage scientific research in the sector.

1. Introduction

Located in the western most part of the African continent with a wide opening to the Atlantic Ocean, Senegal has a coastline of nearly 700 km, sometimes marked by estuaries (Saloum Delta, Casamance, Senegal, Alahein) (see Appendix 1), which favors the development of rich mangrove ecosystems and therefore a varied exploitation of shellfish resources.

The country is particularly rich in fish species with its 700 km of coastline subject to upwellings and its 23,000 km² wide continental shelf (Iossa et al., 2008).

In Senegal, shellfish harvesting, and farming, plays an important role in the fisheries sector. In general, shellfish harvesting, and farming, helps thousands of women to meet their children's schooling needs, their health, and contributes to the family's daily expenses.

Important efforts are also made for the conservation of shellfish resources and the mangrove ecosystem in general. The implementation of traditional systems to ensure sustainable conservation of the resources is practically applied in all the exploitation areas. These traditional conservation systems are mainly reinforced by the good community organization of the women who are the main actors in this sector. These are economic interest groups (EIGs), associations for the sustainable exploitation of resources, and federations or local unions of EIGs, to facilitate conservation and the sharing of good practices in the management of fisheries resources (Gaye, 2012).

The current study assesses the scale and scope of shellfisheries and shellfish-based livelihoods connected with mangrove systems and coastal water bodies in Senegal through a participatory approach. The main objectives were the identification of key stakeholders and assessment of the scale and scope of existing shellfisheries and shellfish-based livelihoods in mangrove systems or its related water bodies. This study complements a [Literature Review](#) covering shellfisheries in each of the 11 coastal West Africa countries from Senegal to Nigeria. The specific objectives were to:

- a. Identify types of mangrove/estuarine ecosystem-based shellfisheries, by species and location.
- b. Estimate catch per day/month/season, fishing calendar, seasonality of shellfisheries and harvesting methods, processing, and trading of shellfishes.
- c. Estimate revenue generated from mangrove/estuarine ecosystem-based shellfisheries.
- d. Determine the challenges and health-related conditions associated with the consumption of shellfishes.
- e. Assess mangrove exploitation, its uses, gender attributes in its harvest, condition, and protection status.
- f. Determine the governance/management regimes as applied to shellfisheries and mangrove systems.
- g. Determine the effect of climate risks on the livelihoods and food security of women who depend on coastal mangrove and estuarine systems.

2. Methodology

Three working groups were set up to carry out the field assessment for this study. This approach was necessary because the major shellfish industry sites in Senegal are far apart. These three groups made it possible to gather comprehensive and varied information from the stakeholders. There are two communities in the Saloum Delta (Niodior and Toubacouta) and others further south in the Ziguinchor region. It is important to specify that the choice was made to engage with the federations of economic interest groups, which can include up to 10 villages. The existence of these federations greatly facilitated the acquisition of statistics and an overview of the challenges facing shellfish harvesting and farming in Senegal. The Covid-19 pandemic and the limited possibilities for travel did not favor contact with more actors, especially women working in the sector on an individual basis.

The Director of the University Institute of Fisheries and Aquaculture (Cheikh Anta Diop University in Dakar), Prof. Alassane Sarr, also made important contributions to the analysis of the scientific information necessary for the implementation of this assessment in Senegal.

The field research methodology consisted of group and individual oral interviews with women shellfish harvesters and farmers. These recorded interviews were based on the questionnaire provided by the University of Cape Coast. The survey instrument is available in the regional summary report (Chuku et al, 2021). Interviews were conducted in shellfish harvesting workshops, fish processing sites and homes. In addition to the oral interviews, participant observations were conducted and allowed for observation of part of the shellfish production chain. These data were analyzed in relation to the available scientific literature. This includes existing work on the exploitation of molluscs in the coastal zone and in the country in general. In addition, the legislative texts administering the mangrove fisheries zones were analyzed.

Following interviews in the field, a sharing workshop was organized in Toubacouta on April 3, 2021, bringing together more than 20 actors, in particular women processors united within the Federation of Economic Interest Groups (FEIG), governmental actors (Bamboung Marine Protected Area, Saloum Delta Interpretation Centre), and academics working in the sector in the field of research and training.

The workshop provided an opportunity to gather more information from stakeholders, to share good practices and to benchmark the survey data. Essentially, the questions focused on general information about the respondent, his or her socio-professional category, and personal use of molluscs, followed by a second section on the exploitation of molluscs: name of the water body, types of species exploited and their habitat, as well as a description of the chain of operations (from harvesting to consumption/marketing). The mangrove ecosystem was given a prominent place to get an overview of its conservation status. Finally, the governance system was addressed to understand the management of these shellfish resources at different levels.

2.1. Summarized background data

2.1.1. Background data of resource users

Ten resource user respondents were interviewed. Resource user respondents were mainly females (80%) and harvesters were 90% female, ranging in age from 15-65 years. The data on resource users surveyed is presented in Section 3 below.

2.1.2. Background data of non-resource users

The survey included government officials in charge of resource management, as well as researchers from the Cheikh Anta Diop University in Dakar as shown in the table below.

Table 1: Sex distribution of government officials and academics.

| Stakeholder Category | Total | Male | Female |
|----------------------|-------|------|--------|
| Government | 5 | 4 | 1 |
| Academic | 3 | 2 | 1 |
| Total | 8 | 6 | 2 |
| Percent | | 75 | 25 |

3. Status of Shellfisheries

3.1. Shellfish Exploitation

Molluscs are harvested in mangrove ecosystems primarily by women. The molluscs are also transported by the women if a trolley cannot be found to carry the bags or basins. The populations use mangrove wood to process the shellfish (cooking). After processing and drying, the products are sold to local or foreign traders from other markets in Senegal. Part of the harvest is also packed in labelled bags and marketed in the shops of the processing units. The table below identifies the shellfish species exploited from the water bodies (estuary/lagoon) or mangrove ecosystems in Senegal.

Table 2: Shellfish species by water body/mangrove ecosystem in Senegal.

| Water body/mangrove ecosystem 1: Sine-Saloum Estuary | | | |
|--|---------------------|-----------------------------|---------------------------|
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | Pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | Yohos | Oyster | <i>Crassostrea tulipa</i> |
| 3 | Touffa | Black melongene/Welk | <i>Pugilina morio</i> |
| 4 | Sangaradia | Rocher/Rock or horned murex | <i>Murex cornutus</i> |
| 5 | Sangaradia | Rocher/Rock murex | <i>Murex duplex</i> |
| 6 | Yet | Volute | <i>Cymbium spp</i> |
| 8 | Yohos | Pearl oyster | <i>Pinctada sp</i> |
| 9 | - | Razor clam | <i>Tagelus andansonii</i> |

| Water body/mangrove ecosystem 2: Casamance Estuary | | | |
|--|---------------------|-----------------------------|------------------------------|
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | Yohos | Mangrove oyster | <i>Crassostrea tulipa</i> |
| 3 | Touffa | Black melongene/Welk | <i>Pugilina morio</i> |
| 4 | sangaradia | Rocher/Rock or horned murex | <i>Murex cornotus</i> |
| 5 | Sangaradia | Rocher/Rock murex | <i>Murex duplex</i> |
| | yet | Volute | <i>Cymbium spp</i> |
| | - | Razor clam | <i>Tagelus andansonii</i> |
| | - | Periwinkle | <i>Tympanotonus fuscatus</i> |
| Water body/mangrove ecosystem 3: Senegal River Estuary | | | |
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | yohos | Mangrove oyster | <i>Crassostrea tulipa</i> |
| Water body/mangrove ecosystem 4: Joal-Fadiouth Lagoon | | | |
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | Pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | Yohos | Mangrove oyster | <i>Crassostrea tulipa</i> |
| 3 | Touffa | Black melongene/Welk | <i>Pugilina morio</i> |
| 4 | Sangaradia | Rocher/Rock or horned murex | <i>Murex cornotus</i> |
| 5 | Sangaradia | Rocher/Rock murex | <i>Murex duplex</i> |
| | Yet | Volute | <i>Cymbium spp</i> |
| | - | Razor clam | <i>Tagelus adansonii</i> |
| Water body/mangrove ecosystem 5: Somone Lagoon | | | |
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | Pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | Yohos | Mangrove oyster | <i>Crassostrea tulipa</i> |
| Water body/mangrove ecosystem 6: Mbodiene Lagoon | | | |
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | Pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | Yohos | Mangrove oyster | <i>Crassostrea tulipa</i> |
| Water body/mangrove ecosystem 7: Dakar Coast | | | |
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | Moule | Mussel | <i>Perna perna</i> |
| Water body/mangrove ecosystem 8: Alahein River Estuary | | | |
| | Common name (local) | Common name (English) | Scientific Name |
| 1 | Pagne | Arches/Bloody cockle | <i>Senilia senilis</i> |
| 2 | Yohos | Mangrove oyster | <i>Crassostrea tulipa</i> |

3.1.1. Estimated number of shellfishers

Information on the number of shellfish harvesters in Senegal is largely not available. In this participatory assessment, the resource users indicated the number of shellfishers in their communities and/or harvesting areas. Conservative estimates are made with the assumption that each respondent represents exclusively one harvesting area/community to moderately compensate for the shellfish harvesting sites not visited, while averaging obvious duplications for communities with large numbers. The estimates provided in this report represent a combination of information gleaned from available literature sources deemed reasonable from the perspective of ground experience in the women-led shellfisheries sector as well as estimates from the participatory assessment conducted.

An estimated 5,270 persons, the majority of which are females, are engaged in shellfisheries livelihoods in Senegal. An estimated 59,288 persons are direct household shellfisheries beneficiaries based on a conservative estimate of an average of 11 people per household.

In general, all the people interviewed who are active in the value chain state that the size and structure of the families in shellfishing households is very large. Families are often organized around a common courtyard. The composition of the number of people in each household varies from one courtyard to another. However, according to the survey results, each courtyard may average as many as fifteen people. The men are on average more than 7 and therefore less numerous than the women, who are often more than ten 10 people.

3.1.2. Insights on gender in shellfish exploitation

Based on the resource users surveyed, 80% of resource users at any node in the value chain were women and 90% of harvesters/processors were women. Men's roles in harvesting are relatively limited to fishing murex as by-catch in their offshore fishing activities.

Table 3: Sex distribution of resource users.

| | Stakeholder Category | (Male/Female) |
|-----|---|---------------|
| 1. | User (harvester/processor – trader- consumer) | F |
| 2. | User (harvester/processor – trader- consumer) | F |
| 3. | User (harvester/processor – trader- consumer) | F |
| 4. | User (harvester/processor – trader- consumer) | F |
| 5. | User (harvester/processor – trader- consumer) | F |
| 6. | User (trader- consumer) | F |
| 7. | User (harvester - consumer) | M |
| 8. | User (harvester/processor - consumer) | F |
| 9. | User ((harvester/processor - consumer) | F |
| 10. | User (trader - consumer) | M |

The above list refers to those interviewed as individuals for the survey. A larger number were engaged through participation in group discussions with the organizations of economic interest groups in the villages or shellfish harvesting areas. Most respondents were women working throughout the value chain. This is because mollusc fishing in the Saloum Delta and in other ecosystems throughout the country is largely the preserve of women. Their age varies from 15 to 65 years. The table below summarizes all resource users participating.

Table 4: Age and sex distribution of resource users by category.

| Stakeholder | Number | Sex | Age |
|---------------------|--------|-----|---------|
| Harvester/Processor | 655 | F/M | 15 – 65 |
| Trader | 50 | F/M | 25 – 75 |
| Consumer | 655 | F/M | 3 – 95 |

3.1.3. The shellfish value chain

The use of the various shellfish species and the methods of processing are summarized in tables 5 and 6. In all the villages, the processing of products follows the same process, either through a traditional method or through modern processing units, [such as one in Soucouta](#). This is a process of:

- wet preserving of shellfish (harvesting or collection of fresh whole shells).
- purification cooking (on hearth without addition of water).
- removal of flesh.
- flesh washing with fresh water.
- Draining.
- steam cooking.
- conservation (filling in jars (addition of vinegar + 2 spoonfuls of salt)).
- or direct consumption.

Shellfish products are sold by village traders and by traders who come from markets outside the locality. The village traders, known as 'Banabana', buy the goods which they then sell in the large markets. Sometimes molluscs such as oysters are sold outside the local community markets and at fairs, while the fresh meat is also sold in the hotels and restaurants of the place. The shells are used as hard building materials, decorative objects, and house embellishments. In the past, small shells were used to make belts, necklaces, and beads.

Table 5: The processing methods for consumption.

| Shellfish species | Use (consumption/sale) | Method of processing |
|---------------------------|------------------------|---|
| <i>Senilia senilis</i> | Consumption and sale | Boiling, Sun-drying, pickled in vinegar |
| <i>Crassostrea tulipa</i> | Consumption and sale | Boiling, Sun-drying, pickled in vinegar |
| <i>Pugilina morio</i> | Consumption and sale | Sun-drying |
| <i>Murex cornotus</i> | Consumption and sale | Sun-drying |
| <i>Murex duplex</i> | Consumption and sale | Sun-drying |
| <i>Cymbium spp</i> | Consumption and sale | Fermentation; Sun drying |

Table 6: The other uses of shellfish shells.

| Shellfish species | Use |
|------------------------|----------------|
| <i>Senilia senilis</i> | House building |
| <i>Pugilina morio</i> | Decoration |
| <i>Cymbium spp</i> | Decoration |

Harvesters, consumers, traders, and researchers and officials of public institutions all claim that they are consumers of oysters. According to the information gathered in the field, shellfish are used for supplementary food needs. Consumption is very common, and responses suggest that consumption is a daily occurrence. The eating habits of the general population in coastal areas also appears to include consumption of shellfish products.

The main health problems linked to the consumption of shellfish are pathogenic germs and chemicals (heavy metals) and biotoxins.

Women participate in all stages of the shellfish value chain as indicated in Tables 3 and 4 above. At least 50% of women harvesters who were survey respondents are also processors, and traders. This indicates that the value chain is somewhat vertically integrated with women harvesters at every node. This implies that value chain improvements at any node can directly benefit women harvesters and creates an opportunity to incentivize behavior change for sustainable resource management.

Shellfisheries are, according to the testimonies of the communities, faced with several problems. The marketing of shellfish products poses enormous difficulties. Finished products are transported to the weekly markets in the interior of the country (Dakar, Kaolack, Foundiougne, Sokone etc.) and sold, sometimes at very low prices. Working conditions are generally very difficult, especially for those who do the processing at the level of makeshift workshops. Apart from the processing sites for fisheries and forestry resources, the populations lack materials and space for drying shellfish to ensure that they are hygienically preserved and consumed. In addition, the scarcity of resources has led the estuarine communities to look for shellfish in areas that are further away from the old traditional exploitation areas. Finally, the populations claim that they have no health coverage.

The challenges for shellfish exploitation and consumption can be summarized as follows:

- Sustainable resource management.
- Product processing and preservation techniques.
- Sanitary quality of products.

3.1.4. Species harvested

The classification of shellfish in terms of harvesting shows the arches (bloody cockle) are the primary species harvested, oysters are second, and murex and cymbium third. However, it was difficult in this study to obtain precise information on the volume and value of catches because the sector is relatively informal.

1. *Senilia senilis*.
2. *Crassostrea tulipa*.
3. *Murex spp*, *Cymbium spp*.

Arches/Bloody cockles are found in the sandy substrate. The natural habitat of oysters in Senegal is the roots of mangroves. For the cymbium and lobster, their natural habitat is the sandy substrate. The below table summarizes the habitat by shellfish species

Table 7: Shellfish species habitats in Senegal.

| Species name | Habitat(s) |
|------------------------------|--|
| <i>Senilia senilis</i> | sandy substratum; sandy-mud substratum |
| <i>Crassostrea tulipa</i> | mangrove roots |
| <i>Pugilina morio</i> | sandy substratum; mud substratum; sandy-mud substratum; mangrove roots |
| <i>Murex comotus</i> | sandy substratum; mud substratum; sandy-mud substratum |
| <i>Murex duplex</i> | sandy substratum; mud substratum; sandy-mud substratum |
| <i>Cymbium spp</i> | sandy substratum; mud substratum; sandy-mud substratum |
| <i>Tagelus adansonii</i> | sandy substratum; mud substratum; sandy-mud substratum |
| <i>Tympanotonus fuscatus</i> | mud substratum; sandy-mud substratum |

The species exploited in the Saloum Delta include oysters (*Crassostrea tulipa*) in addition to four other species of gastropod molluscs, including *Senilia senilis* (bloody cockle), *Pugilina morio* (black melongene/welk), *Murex comotus* (rocher), *Murex duplex* (rocher) and *Cymbium sp* (volute). These species have a single shell, usually spirally wound with a large opening at the base, which may or may not be closed by an operculum. They can make large movements by crawling on the bottom with their feet.



Cymbium sp (Volute)



Pugilina morio (Mélongène noire)



Murex cornutus (Rocher)



Murex duplex (Rocher)



Crassostrea gasar (Huître)

Figure 1: Shellfish species. Source : "Guide de suivi bioécologique, Projet femmes et coquillages" (November, 2009).

The presence of pearl oysters (*Pinctada spp.*) in West Africa is also documented for the first time with presence in The Gambia and Senegal.

3.1.5. Harvesting methods

Various methods are used to harvest the molluscs. Arches/Bloody cockles are extracted by pulling them out, for example with a spoon. Other instruments used are dugout boats, life jackets, bags, basins, gloves, baskets etc. The pickers are usually women. The oysters are extracted from the shell with cutters, knives, and other sharp objects. The shucking activity is also carried out by women. The harvesting of Murex is generally done exclusively by women in all the mangrove ecosystems in Senegal by hand picking and using iron spears. During daily fishing activities done by men, murex is also caught randomly in their fishing nets. Shellfish harvesting methods by species are summarized in the table below.

Table 8: Shellfish harvesting method by species.

| Shellfish species | Method of harvesting |
|------------------------------|--|
| <i>Senilia senilis</i> | Hands gathering |
| <i>Crassostrea tulipa</i> | Hands gathering |
| <i>Pugilina morio</i> | Hands gathering |
| <i>Murex cornotus</i> | Hands gathering; Gillnets; iron spears |
| <i>Murex duplex</i> | Hands gathering; Gillnets; iron spears |
| <i>Cymbium spp</i> | Hands gathering; Gillnets; iron spears |
| <i>Tagelus adansonii</i> | Hands gathering |
| <i>Tympanotonus fuscatus</i> | Hands gathering |

3.1.6. Harvest volumes and value

Precise information on the volume and value of catches was difficult to obtain in this study because the sector is relatively informal. However, the following volumes were estimated:

- Arches/bloody cockles: approximately 65 kg per harvester per month.
- Oysters: 25 to 50 kg per harvester per month.
- Murex: 25 kg per person per month.
- Cymbium: 20 kg per harvester per month.

The volume of catches by year is very difficult to estimate.

Communities earn income from the marketing of shellfish. Shellfish prices vary according to the species from 2000 FCFA (US \$3.00) per kilogram to 5000 FCFA (US \$8.00). According to information gathered in the field, the monthly income of the catch of arches/bloody cockles is estimated at between 15,000 FCFA (US \$26.00) and 20,000 FCFA (US \$35.00) per person. For oysters, the monthly income per person varies between 20,000 FCFA (US \$35.00) and 40,000 FCFA (US \$71.00). As for catch estimates, monthly and annual values are difficult to estimate. The information on monthly income gathered in this survey indicates that some portion of the catch is consumed or not sold due to post-harvest losses and other factors.

Marketing is done through local markets, weekly markets, and large trading centers in urban areas and even hotels in the capital, Dakar. In the Saloum Delta, women's associations participate in rare initiatives of international partners in international fairs for the promotion of fish products exploited in the region.

3.2. Mangrove Ecosystem

There are mangroves near or within the water bodies where molluscs are harvested. These mangroves are exploited by the community as firewood, for cooking, for fencing for horses and goat pens. The exploitation of mangroves is dominated by women for shellfishing and by men for wood. The state of health of the mangrove vegetation is poor.

The mangrove ecosystem is facing overexploitation due to increasing population. In areas such as the Saloum Delta, the increase in tourist numbers is affecting this mangrove ecosystem, where garbage pollution is noted. This is mainly due to the use of motorized pirogues in certain areas that were previously free of human pollution. The cutting of wood in the mangroves also affects this ecosystem. Rising sea levels are affecting estuaries, causing high salinity levels and coastal erosion. To face these threats, the populations initiate annual campaigns of mangrove reforestation, as well as the implementation of oyster harvesting techniques adapted to the conservation of the mangrove (for example the use of garland or filao wood (*Casuarina equisetifolia*) rather than mangrove wood for oyster culture racks (see photos below).



Figure 2: Soucoute processing unit (Saloum Delta) drying racks (left) and oyster culture racks (right). Source: Moussa WELE, March 2021.

3.3. Governance/Management Regime

Officially, there are no national regulations/laws specific to the shellfish fishery in Senegal. In the Sine-Saloum estuary, the governance regime for shellfish fisheries is the responsibility of the fisheries service. Mamadou Mbacké Diop, a fisheries officer in Niodior, believes that the management of shellfish used to be a matter for the local population. Thus, the authorities in charge of fisheries, after a long reflection on the management of shellfish fisheries, have set up an inclusive approach of co-management of shellfish resources between the Local Artisanal Fisheries Council (CLPA), the sub-prefect, the presidents of the Resource Management Committee (COGER), the village populations, and the village chief.

A biological rest is observed for shellfish fishing activities in this part of Senegal. The populations of the villages of Niodior and Dionewar practice fallow periods, seeding, and rotation in the mudflats for *S. Senilis* and Oysters.

According to the local customs of the communities living in the Saloum estuary, Fridays are declared as days of rest. The harvesting calendar for the arches/bloody cockles runs from the beginning of October to the end of June. A biological rest of three months is then observed from July to the end of September. This period also covers the other mollusc species except oysters. Oysters have a

biological rest period of 6 months. Conventionally, this biological rest extends from July to January. During the oyster resting period, shellfish activities are devoted to the arches/bloody cockle.

In some villages such as Niodior, Dionewar, and Falia the governance decision making regime on shellfish fisheries is the work of the Resource Management Committees (COGER) and the Local Artisanal Fishing Committee (CLPA). The establishment of a community marine protected area by the State of Senegal since 2004 has also ensured the sustainable management of these resources. As mentioned above, there is also the creation of a federation of women's groups, which works to ensure concerted management and the sharing of good practices encouraged also by the services of the ministries of fisheries and environment in the context of the Marine Protected Area and CLPA. Training and capacity building sessions on the responsible exploitation of resources are organized periodically in the processing sites with the support of the State and technical and financial partners. In addition to this concerted management, the existence of traditional methods with sites whose access is regulated by the community leaders also favors sustainable exploitation.

The protection status of the estuarine and mangrove ecosystems used for shellfisheries in Senegal is summarized in the following table.

Table 9: Protection status of estuarine and mangrove ecosystems.

| Water body | Protection status (Specific conventions/treaties etc.) |
|-------------------------|---|
| Saloum Delta | <ul style="list-style-type: none"> - UNESCO World heritage site (2011) - National parc - Biosphere reserve (1981) - The Saloum Delta National Park is listed as a Wetland of International Importance under the Ramsar Convention. - Traditional methods of protection |
| Senegal river estuary | <ul style="list-style-type: none"> - Biosphere reserve - Marine protected area - National parc |
| Casamance river estuary | <ul style="list-style-type: none"> - Several Marine protected areas - Traditional methods of protection |
| Dakar Coast | <ul style="list-style-type: none"> - Marine protected area since 2021 - Traditional methods of protection |

3.4. Climate Risk Mitigation

The climate crisis in the fishing areas is linked to salinization, rising sea levels, and reduced rainfall. All these factors result in the decline of shellfish resources. Extensive mangrove reforestation programs initiated by the NGO Oceanium Dakar and other environmental actors with the support of estuarine and island communities have been revitalizing the mangrove ecosystem in some areas for several years. According to the communities, they do not receive a sustainable payment from the global carbon market to restore and maintain their mangroves at their level.

4. Conclusion and Recommendations

The shellfisheries activity in Senegal is a heritage of several centuries of exploitation, which is attested to by the presence of protohistoric shellfish mounds (Thiaw, 2010). This activity helps the estuarine populations to meet their needs for food, schooling for children, health, and other social needs. The situation of shellfish fishing areas is currently impacted by climate change, which increases the salinization of the land and the rarefaction of molluscs. It should also be noted that the governance systems of mangrove shellfisheries put in place, have made it possible to better protect and conserve fishery resources.

During the surveys of the population and other stakeholders in the shellfish sector in Senegal, suggestions were made by survey respondents to improve the conditions and environment of the shellfisheries sector in Senegal as follows:

- Define a first catch size for molluscs.
- Regulate shellfish collection methods by ensuring selectivity.
- Improve recovery methods to reduce pressure on the resource.
- Promote oyster farming.
- Restore degraded mangrove ecosystems.
- Build markets to facilitate the marketing of products.
- Help finance market gardening and forest product development projects as a diversification/alternative to shellfishing activities.
- Modernize the shellfisheries sector.
- Help finance new boats.
- Increase the number of structures for processing fish products.
- Build protective dikes to combat salinization of the land and maritime erosion.
- Provide equipment and suits to improve fishing conditions.

Recommendations for promoting sustainable and recognized management of these food resources at and beyond the country level in West Africa include:

- Strengthen consultation mechanisms between groups of women processors at the local, national, and sub-regional levels for the sharing of experience and good practices.
- Advocate with sub-regional and regional institutions such as ECOWAS, the African Union and UEMOA for a better consideration of the shellfish sector in economic and social development programs.
- Reinforce the logistical means of the actors involved in shellfish harvesting, actors who are sometimes confronted with real problems of safety and insecurity that can cause accidents.
- Establish or designate a West African office to monitor and evaluate the various projects in the shellfish sector. Such a unit could accompany decision-makers and technical and financial partners in future interventions and capitalize on efforts made.
- Encourage scientific research in the sector.

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APPENDICES

APPENDIX 1: Shellfisheries Site Mapping in Senegal



Figure 3: Water bodies, mangrove/ecosystems with shellfisheries in Senegal. From north to south, the Senegal River Estuary, the Dakar Coast, the Somone Lagoon, the Joal-Fadiouth Lagoon, the Mbodiene Lagoon, Sine Saloum Estuary, the Alaheine River Estuary, and the Casamance River Estuary. Copyright M. Wélé by google earth 2021.

APPENDIX 2: Background Data

Table 10: Sex distribution of Government Officials.

| Name | Stakeholder Category | Male/Female |
|------|----------------------|-------------|
| 1 | Government | M |
| 2 | Government | F |
| 3 | Government | M |
| 4 | Government | M |
| 5 | Government | M |

Table 11: Sex distribution of Academics.

| Name | Stakeholder Category | Male/Female |
|------|----------------------|-------------|
| 1 | Academic | M |
| 2 | Academic | F |
| 3 | Academic | M |

Table 12: Sex distribution of Resource Users.

| Name | Stakeholder Category | Male/Female |
|------|-------------------------------------|-------------|
| 1 | User (harvester – trader- consumer) | F |
| 2 | User (harvester – trader- consumer) | F |
| 3 | User (harvester – trader- consumer) | F |
| 4 | User (harvester – trader- consumer) | F |
| 5 | User (harvester – trader- consumer) | F |
| 6 | User (trader- consumer) | F |
| 7 | User (harvester - consumer) | M |
| 8 | User (harvester - consumer) | F |
| 9 | User ((harvester - consumer) | F |
| 10 | User (trader - consumer) | M |