Evaluation of Sero for Coastal Fishing in Sulawesi, Indonesia

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Abstract: The purposes of this paper was to (a) determine the best fishing zones for the local fishermen to estimate their highest potential load of fish populations, (b) identify the environmental factors that affect fish abundance and catch by using soro (stake), (c) compare the total catch and select the proper mesh size for coastal marine ecosystems and (d) assess the economic value of fish caught by using soro. A stratified sampling technique was used in data collection from several marine environmental conditions. Stratification was based on the distribution of the soro gears in the Bone Bay District Pitumpanua where seros were located 394 m from either side of the river mouth. The most influential marine environmental parameters in the soro catch were water depth, salinity and type of water substrate. The most dominant (50%) fish species caught from the three units of soro trials were pepetek (Leiognathus splendens), biji nangka (Upeneus sulphureus) and kapas-kapas (Gerres filamentosus) while the 50% balance fish species trapped were kerong-kerong (Therapon theraps), salamandar (Siganus canaliculatus) and lencam (Lethrinus lentjam). It is recommended for future studies that the size of the net should be bigger and appropriate for the fishes.

Keywords: Fishing equipment · Environment · Sero · Fisheries · Marine

INTRODUCTION

A total of 90% fish production around the world mostly originates from the sea and shallow coastal areas [1]. In Indonesia, the overall mean fish catch production was 63.5% with the maximum catch of 79.5% from the commercial fish production [2]. The commercial fish production is mostly generated from small-scale fisheries which are operated in the Indonesian coastal areas using the traditional soro gear. This particular gear is operated by fishermen in the waters of the west coast of the gulf of Bone in South Sulawesi, Indonesia. The advantage of this particular soro or stake fishing gear is that of its unique small mesh size which environment user is friendly for the beach and coastal fishing. Unfortunately, there was a claim that this soro fishing gear almost catch every small fish such as ikan biji nangka (Upeneus sulphureus), lencam (Lethrinus lentjam), salamandar (Siganus canaliculatus), kerong-kerong (Therapon theraps), kapas-kapas (Gerres filamentosus) and pepetek (Leiognathus splendens) which were not ready to be consumed [3]. Thus, there should be a solution to tackle this issue by providing some guidelines to the local fishermen on how best to use soro for a sustainable coastal fishing. One of the most appropriate solutions is the use of a selective fishing gear by changing its mesh size and has more seros along the beach area to conserve the fish population in the coastal areas of Sulawesi.

There are few possible solutions to handle the soro issues in sustainable fishing along the coastal areas. One of the possible solutions is to change the size of the seros, change the soro itself or even change the location...
of fishing grounds [4]. The present study applied an established catch reconstruction approach [5] to estimate the total fish catch for the period 1950–2005. This was done to derive a historic baseline and evaluate the overall magnitude of underreporting Mozambique and the United Republic of Tanzania, by applying an established catch reconstruction approach utilising all available quantitative and qualitative data, combined with an assumption based estimations and interpolations [6].

Therefore, the objectives of this study are as follows: (a) to estimate the potential fish catch populations, (b) to determine the environmental factors influencing fish abundance, (c) to compare the total fish catch from the selective sero mesh size and the different types of ecosystems and (d) to determine the economic value of fish caught by using sero (stake). It is expected that this study can assist the fishing communities by providing accurate and sufficient information on potential fishing zone map. This in turn will generate more number of catches and fishermen’s income based on environmental parameters affecting the abundance of fish.

MATERIALS AND METHODS

A stratified random sampling method was used to collect data on the different marine environment and fish populations. Stratification was based on the distance and location of seros from the river mouth, namely (a) in the river estuary, (b) 1,000 m on the left side of the river, (c) 1,000 m on the right side of the river, (d) 2,000 m on the left side of the river and (e) 2,000 m on the right side of the river mouth. The sero fishing gear used by fishermen in coastal waters Pitumpanua Wajo District consists of holdings, surface gill nets, longlines basic, drift gill nets, hook and line extended, charts and other gears. They were most widely operated in coastal areas and consist of 67 units in 2006. Sero gear is shaped like a triangle, extending from the shore into the sea. Sero gear is made from basic materials with a black mesh size of 0.5 cm. Sero-operated in the study site consists of five components, namely penaju, wings, belly, body and crib which all have the same sizes. The penaju has an average length of 90-100 m, 20-25 m wide, wing entrance of 2 m and 3.5 to 4 m body, 0.7 m wide entrance, abdomen of 3 to 3.5 m with an entrance width of 0.5 m. The rectangular crib has an average dimensions of 4 m x 5 m x 4.5 m with a width of 0.2 m entrance.

Water sampling at three sampling points of 50, 100 and 150 m from the shoreline was done during the low tides. The number of catches was based on randomly selected pre-determined points from the river mouth. The number of sero units selected as samples were determined in proportion to the number of units that were operates at each location. The fish samples collected from the selected seros were measured for their length, weight, size and levels of gonad maturation. The number of fish was proportionately sampled based on the composition of the catch. In addition to the measurements in the field, data collection for multiple environmental parameters and measurements were performed in the fish laboratory located at the Fishery Laboratory of the University of Muhammadiyah Parepare. Secondary data were taken from the tidal harbor nearby.

RESULTS AND DISCUSSION

Comparison of Fishing and Environment Variables: The hybrid instruments has proved central to the study of the static model but almost never explored in the dynamic context [7]. Verfishing has also been widely reported due to the increase in the volume of fishing hauls to feed a quickly growing number of consumers. This has led to the damage of marine ecosystems and several fishing industries whose catch has been greatly diminished. The extinction of many species has also been reported by Food and Agriculture Organization (FAO) estimate where over 70% of the world’s fish species are either fully exploited or depleted [8]. Based on the UN FAO projected world’s wild fish harvest, the fish population had fallen to 90 million tons in 2012, down 2 % from 2011 harvest. The first two designs are those most commonly used to assess catch and release mortality in recreational fisheries. The third design is commonly used to assess mortality associated with fishing tournaments in which hundreds or thousands of fish may be captured [9]. The fish were captured, released and observed, with or without control fish, but only a sample of the captured fish was observed for mortality [10]. The quality of many recreational fisheries depends on high survival rates of fishes that were captured and released by anglers. Catch and release of fishes may be voluntary or required by regulation [11].

Environmental Conditions of Study Sites: Table 1 showed the various measurements of some selected environmental variables at five transects (25 stations) in the coastal waters of Pitumpanua District. This includes surface temperature, salinity, pH, brightness, dissolved oxygen, current speed and depth. Based on the results of the calculation shown in Table 1, the condition of coastal waters were relatively similar to each other in the Pitumpanua district.
Table 1: Range and average Multiple Parameter Measurement Results in the Aquatic Environment Pitumpanua Coast District

<table>
<thead>
<tr>
<th>No</th>
<th>Variables Measured (units)</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Depth (m)</td>
<td>0.50 - 24.00</td>
<td>9.16</td>
</tr>
<tr>
<td>2</td>
<td>Temperature (°C)</td>
<td>26.00 - 31.80</td>
<td>28.54</td>
</tr>
<tr>
<td>3</td>
<td>Salinity (ppm)</td>
<td>19.30 - 32.10</td>
<td>25.17</td>
</tr>
<tr>
<td>4</td>
<td>pH (pH scale)</td>
<td>6.00 - 7.60</td>
<td>5.79</td>
</tr>
<tr>
<td>5</td>
<td>DO (ppm)</td>
<td>4.30 - 7.60</td>
<td>5.79</td>
</tr>
<tr>
<td>6</td>
<td>Flow velocity (cm/s)</td>
<td>0.20 - 0.70</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Water chlorophyll and atmospheric parameters were determined by analysing the seasonal WiFS ocean water satellite data. A False Color Composite (FCC) analysis of satellite data with respect to the year of high and low fish catches was performed using the principal component analysis (PCA) technique. The ocean and atmospheric data were then linked up to the climate index and composite hydrographic depth-longitude on landing and were subjected to statistical analysis [12]. The analysis showed that the increase in fish catch was related to a spell of warm weather, salty and dry shelf waters due to changes in climatic factors.

Based on the identification of fish species caught in 10 separate locations, 33 genera of fish were identified (Table 2). The dominant species were biji nangka (Upeneus sulphureus), kapas-kapas (Gerres filamentosus), lencam (Lethrinus spp), pepetek (Leiognathus splendens), kerong-kerong (Therapon theraps) and salamandar (Siganus canaliculatus).
Table 3: Total fish catch from selected seros for the months of November-June, 2010

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>Qty</th>
<th>Wt (kg)</th>
<th>Qty</th>
<th>Wt (kg)</th>
<th>Qty</th>
<th>Wt (kg)</th>
<th>Qty</th>
<th>Wt (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biji nangka</td>
<td>2.194</td>
<td>27.04</td>
<td>1.698</td>
<td>25.60</td>
<td>2.157</td>
<td>33.72</td>
<td>6.049</td>
<td>86.37</td>
</tr>
<tr>
<td>Kapas-kapas</td>
<td>1.250</td>
<td>14.41</td>
<td>1.311</td>
<td>16.59</td>
<td>1.808</td>
<td>15.27</td>
<td>3.469</td>
<td>46.27</td>
</tr>
<tr>
<td>Kerong-kerong</td>
<td>2.197</td>
<td>35.03</td>
<td>1.459</td>
<td>25.57</td>
<td>1.469</td>
<td>30.42</td>
<td>5.125</td>
<td>91.02</td>
</tr>
<tr>
<td>Lencam</td>
<td>1.481</td>
<td>50.71</td>
<td>1.325</td>
<td>51.43</td>
<td>1.382</td>
<td>48.01</td>
<td>4.188</td>
<td>150.15</td>
</tr>
<tr>
<td>Salamandar</td>
<td>1.491</td>
<td>23.65</td>
<td>1.603</td>
<td>28.80</td>
<td>1.360</td>
<td>23.48</td>
<td>4.454</td>
<td>75.93</td>
</tr>
<tr>
<td>Pepetek</td>
<td>3.686</td>
<td>44.75</td>
<td>3.306</td>
<td>37.65</td>
<td>3.800</td>
<td>44.45</td>
<td>10.792</td>
<td>126.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12.299</td>
<td>195.58</td>
<td>10.702</td>
<td>185.65</td>
<td>11.076</td>
<td>195.35</td>
<td>34.077</td>
<td>576.58</td>
</tr>
</tbody>
</table>

The percentage composition of the catch during the study was pepetek (25.4%), biji nangka (14.2%), kerong-kerong (12.0%), salamandar (10.5%), lencam (9.8%) and kapas-kapas (8.2%). The composition of the catch were almost 70-80% using the seros.

A total of 34 six dominant fish species weighing 576.6 kg were caught in three sero units within a five month period. The individual fish counts and their weights were as follows: 6,049 biji nangka (Upeneus sulphureus) at 86.4 kg, 3,469 kapas-kapas (Gerres filamentosus) at 46.3 kg, 5,125 kerong-kerong (Therapon theraps) at 91.1 kg, 4,188 lencam at 150.2 kg, 4,454 salamandar (Siganus canaliculatus) at 75.9 kg and 10,792 pepetek (Leiognathus splendens) weighing 126.9 kg (Table 3). The average catch data showed that pepetek, biji nangka and kapas-kapas contributed 50% of the catch while the balance comprised of kerong-kerong, salamanda and lencam. Other species caught includes baronan (Siganus spp.), balanak (Valamugil spp.), tembang (Sardinella spp.), laying (decaperus russelli), teri (Stolephorus spp.), daun bambu (carangidae), bandeng (milkfish/chanos chanos), julung-julung (Hermichamphus spp.), pari (Trygon spp.), alu-alu (Sphyraena spp.), layur (Trichurus spp.), nila (oreochromis niloticus) and cenro (Tylosorus spp.), kepiting bakau (Scylla spp.), cumi-cumi (Loligo spp.), udang putih (Metapenaeus spp.), lobster, udang windu (Penaeus spp.), buntal (Tetraodon spp.), kuda laut (Hippocampus spp.) and lepuh ayam (Dendrochirus spp.).

**CONCLUSION**

Sero fishing gear technique in the Bone Bay of Pitumpuanua district still need to be further developed. The most ideal location for the sero is 1,000 feet from either side of the river mouth. This is to avoid the influence of the river mouth that contributes to the decline of fish catch. The spatial distribution of the fish catch using seros showed a gradual increase starting from the coastlines to offshores. This indicates that the influence of freshwater input from the river is quite strong. The marine environmental factors influencing the catch are water depth, salinity and types of substrate. The most abundant (50%) fish caught in three units of the seros were pepetek, biji naga, kapas-kapas and less than 50% were as follows: 6,049 biji nangka (Upeneus sulphureus) of the fish catch are kerong-kerong, salamandar, and lencam. Future research should emphasis on the varying size of the net (3-5 cm) which is appropriate for certain required species of fish besides the serious attention by the local government authorities to support the traditional fishermen in Pitumpuanua District in the setting of the right sero technique of sustainable fishing in coastal waters.

**REFERENCES**


