



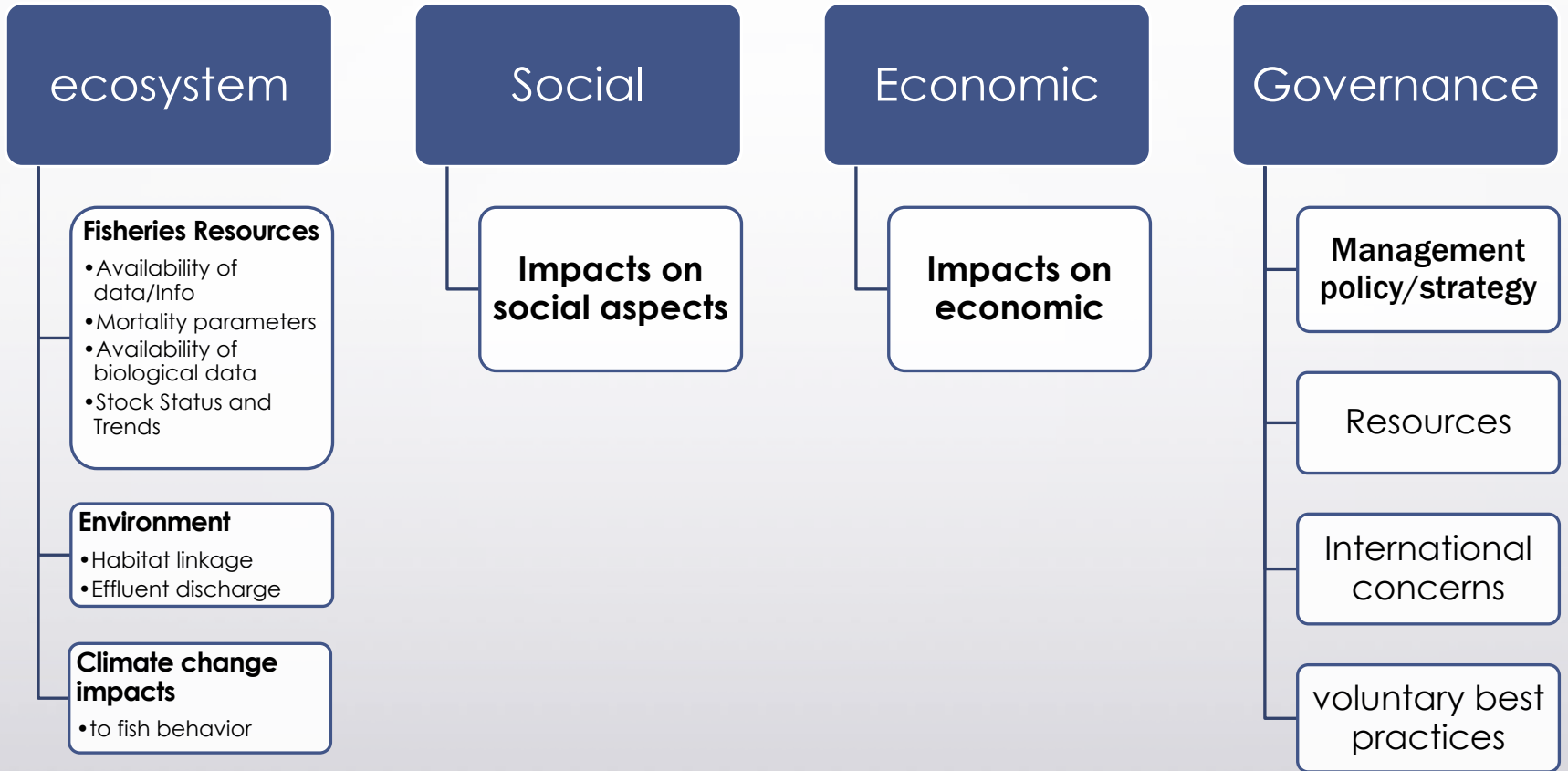
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# Development of the Indicators for Management of Fisheries *Refugia*:

STANDARDIZED METHODS FOR COLLECTION AND ANALYSIS OF DATA AND INFORMATION, FOR THE USE IN ASSESSING THE IMPACTS OF FISHERIES REFUGIA AND IN THE DESIGNING OF APPROPRIATE INDICATORS FOR LONG TERM MANAGEMENT OF THE REGIONAL SYSTEM OF FISHERIES REFUGIA

Presented by :

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**Standardized Methods for Collection and Analysis of Data and Information, for the use in Assessing the Impacts of Fisheries Refugia and in the Designing of Appropriate Indicators for Long Term Management of the Regional System of Fisheries Refugia**

Issues/Knowledge Gaps	Requirements	Data Collection Methods	Analysis methods	
<b>1) Ecosystem Component</b>				
<b>1.1. Fisheries Resources</b>				
a. Availability of fishery data and information	<ul style="list-style-type: none"> <li>○ Fishing operation, fishing area and the fishery status</li> <li>○ Group and species composition of catches from each fishing gear deployed to catch target species</li> <li>○ Catch and effort of each fishing gears deployed to catch target species</li> <li>○ Catch/effort trend</li> </ul>	<ul style="list-style-type: none"> <li>○ Statistic data collection</li> </ul>		
b. Mortality parameters of target species:	<ul style="list-style-type: none"> <li>○ Z - Total mortality coefficient, or instantaneous rate of total mortality or total mortality rate (per time unit),</li> <li>○ M - natural mortality coefficient, or instantaneous rate of natural mortality or natural mortality rate (per time unit).</li> <li>○ F - fishing mortality coefficient or instantaneous rate of fishing mortality (per time unit).</li> </ul>	<ul style="list-style-type: none"> <li>○ <math>Z = M + F</math> (including the Z estimation from catch/effort data)</li> </ul>	<ul style="list-style-type: none"> <li>○ Catch curve analysis is used to estimate L50% (length at which 50% of the fish is retained by the gear 50% escape) and convert it to age, t50% (age at which 50% of the fish is retained in the gear).</li> </ul>	
	<ul style="list-style-type: none"> <li>○ Determination of Exploitation rate</li> </ul>	<ul style="list-style-type: none"> <li>○ <math>E (E = F/Z)</math> using mortality parameters.</li> </ul>		
	<ul style="list-style-type: none"> <li>○ Determination of yield per recruit (Y/R) pattern.</li> </ul>			

Issues/Knowledge Gaps	Requirements	Data Collection Methods	Analysis methods	
	<ul style="list-style-type: none"> <li>○ Stock unit/population structure</li> <li>○ F-array</li> </ul>	<ul style="list-style-type: none"> <li>○ morphological and DNA methods</li> <li>○ by length and Cohort Analysis including Thompson and Bell Prediction Model.</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> </ul>	<ul style="list-style-type: none"> <li>○</li> <li>○</li> </ul>
c. Availability of fishery biological data	○ Monthly size composition	○ Samplings at landing site	<ul style="list-style-type: none"> <li>○ Length-weight relationship</li> <li>○ Length at first maturity</li> <li>○ Sex ratios</li> </ul>	○
	○ Growth rate	<ul style="list-style-type: none"> <li>○ Growth parameters</li> <li>1) <math>K</math> - Curvature growth</li> <li>2) <math>L_{\infty}</math> - Asymptotic length</li> <li>3) <math>t_0</math> - Age at length equal to 0</li> <li>○</li> </ul>	○	○
	○ Spawning season	○ Determination from <u>Gonado Somatic Index (GSI)</u> and % of maturity	○	○
	○ Spawning grounds	<ul style="list-style-type: none"> <li>○ Eggs &amp; larval fish samplings</li> <li>1) Bongo net</li> </ul>	○	○
	○	○ Local knowledge reviews	○	○
	○ Nursery & Feeding grounds	<ul style="list-style-type: none"> <li>○ Zooplankton samplings</li> <li>○ Phytoplankton sampling</li> </ul>	○	○
	○	○ Fish samplings for stomach contents study	○	○
d. Stock status and trends	○ Stock Assessment	<ul style="list-style-type: none"> <li>○ Ref. 1.1</li> <li>○ Historical catch data</li> <li>○ Standardized CPUEs data</li> </ul>	<ul style="list-style-type: none"> <li>○ Ref. to Fish Stock Assessment Manual (FAO, 2003)</li> <li>○</li> </ul>	○
	○ Risk Assessment	○	○	○
<b>1.2. Environment</b>	○	○	○	○

Issues/Knowledge Gaps	Requirements	Data Collection Methods	Analysis methods	
<b>1.2. Environment</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Habitat linkages	<input type="checkbox"/> Status of marine habitats e.g. mangrove, corals, seagrass, and wetland. <input type="checkbox"/> Area of critical habitats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Effluent discharge	<input type="checkbox"/> Monitoring the effluent discharge <input type="checkbox"/> Forecasting system  <input type="checkbox"/> Evaluate the impacts	<input type="checkbox"/> Ocean forecasting: <a href="http://221.215.61.118:2018/#/">http://221.215.61.118:2018/#/</a> <input type="checkbox"/> Survey  <input type="checkbox"/> Questionnaires <input type="checkbox"/> Interviews <input type="checkbox"/> Survey	<input type="checkbox"/> Sea surface temperature <input type="checkbox"/> Wind <input type="checkbox"/> Wave <input type="checkbox"/> Salinity <input type="checkbox"/> Current Stream <input type="checkbox"/> Current vector	<input type="checkbox"/>
<b>2) Social Component</b>				
<input type="checkbox"/> Impacts on Social aspects	<input type="checkbox"/> Fishing community characteristics  <input type="checkbox"/> Gender mainstreaming in fisheries  <input type="checkbox"/> Income AND Livelihoods	<input type="checkbox"/> Questionnaires <input type="checkbox"/> Interviews <input type="checkbox"/> Survey  <input type="checkbox"/> Questionnaires <input type="checkbox"/> Interviews <input type="checkbox"/> Survey  <input type="checkbox"/> Questionnaires <input type="checkbox"/> Interviews <input type="checkbox"/> Survey	<input type="checkbox"/>	<input type="checkbox"/>
<b>3) Economic Component</b>				
<input type="checkbox"/> Impacts on Economic	<input type="checkbox"/> Fisheries exports value (compared with total value of exports) <input type="checkbox"/> Investment in fishing fleets and processing facilities <input type="checkbox"/> Taxes and subsidies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Issues/Knowledge Gaps	Requirements	Data Collection Methods	Analysis methods	
	o Employment	o	o	o
	o Income/ Fishery net revenues	o	o	o
	o Fisheries contribution to GDP	o	o	o
<b>4) Institutions/Governance</b>				
	o Fishery Management Policy	o	o	o
	o Regional Cooperation	o	o	o
	o Stakeholder Participation	o	o	o
<b>5) IMPACT OF CLIMATE CHANGE</b>				
	o Affecting of climate change to fish behavior/ fishing	o	o	o
	o	o	o	o