ECOSYSTEM-BASED MANAGEMENT TOOLKIT FOR PHILIPPINE COASTAL RESOURCE MANAGEMENT:

COASTPLAN

COASTAL ASSESSMENT TOOL AND PLANNING SOFTWARE TOOL DEMONSTRATION GUIDE

Coastal Assessment Tool and Planning Software (COASTPLAN) Tool Demonstration Guide

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Coastal Assessment Tool and Planning Software (COASTPLAN) Tool Demonstration Guide

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I. INTRODUCTION

The Ecosystem-Based Management (EBM) tools demonstration workshops conducted under the Project "Finding a way out for depleted subsistence fisheries in the Philippines (FindFishSup)" showcases three (3) different complementary EBM tools: Relief Mapping, FISH-BE/FISHDA, and ReefGame.

Relief mapping (Figure 1) aims to show the fishery and coastal resources, uses, environmental threats and stresses from ridge to reef. Various local stakeholders can participate in mapping their marine resources and also sources or causes of coastal environmental stresses. The mapping medium is a three-dimensional (3D) board representing the terrain and waters of their municipality; giving the participants a holistic view of their resources and thus allowing them to discuss issues and conflicting coastal resource management (CRM) policies.

Figure 1. Relief Mapping Activity in Looc, Occidental Mindoro on Feb. 22-23, 2010.

FISH-BE (Figure 2) or the "Fisheries Information for Sustainable Harvest Bio-Economic" Model is a managerial and communication tool used to assess, test, and demonstrate various management scenarios in the fishery (Licuanan *et al.* 2006, 2008). It is mainly used to estimate the broad carrying

Figure 2. FISH-BE demonstration workshop at El Nido, Palawan on April 12-13, 2010.

capacities of fisheries, as well as to estimate the area needed by the municipality for protection in order to sustain harvest rates through time. FISHDA or "Fishing Industries' Support in Handling Decision Applications" Model is the free and stand-alone version of FISH-BE that is distributed and described in a separate booklet which is part of this toolkit.

ReefGame (Figure 3) is a coupled computer and board game tool used to demonstrate the effect of various fishing strategies to the fishery especially the effect of overfishing to coral reefs (Cleland *et al.* 2008). It explores various alternative livelihood options present within and outside the municipality, which in most cases are untapped by the fishers, as a means to reduce fishing pressure. Through games, it is able to translate model results into dynamic discussions between stakeholders addressing specific concerns in the marine environment (e.g., overfishing and pollution).

Figure 3. ReefGame activity in Looc, Occidental Mindoro on Feb. 22-23, 2010.

For further readings on the three tools, please refer to the corresponding booklets in this toolkit.

Relief Mapping and FISH-BE are designed to give the participants a better grasp of the status of their fisheries while the ReefGame stitches the lessons from the two tools and provides a finer scale reaction of fisheries resources to individual and collective fisheries actions.

The three tools have their own strengths and can stand individually but the combination of the functions of these tools provide a more holistic approach to coastal resource management specifically in imparting the ecological and economic messages to stakeholders. We present here, a new participatory management tool inspired by the relief mapping activity, FISH-BE model, and ReefGame called the "Coastal Assessment Tool and Planning" Software (COASTPLAN). This software attempts to package the functionality of the three tools into a single software/model. COASTPLAN was developed with the following functionalities:

1. Synthesize basic fisheries information at the municipal and regional level and provide estimates and scenario testing on fisheries carrying capacities and MPA size;
2. Map various resources and anthropogenic stresses experienced by the community, and consequently allow spatial planning such as choosing the best site to be protected;
3. Demonstrate, through visual representation, the effects of protection and effectiveness of reserves on the conservation of marine habitats and associated communities.

The software is intended to help local government units (LGUs), coastal managers, policy makers, and fisher's organizations in facilitating options for CRM decision-making. It also functions as an educational and information dissemination tool that will assist in demonstrating ecological and economic incentives of good practices and disincentives of various stresses and malpractices such as overfishing and pollution.

The accuracy of the modeling scenarios highly depends on the accuracy of the data inputs. The role of a facilitator is therefore crucial in the overall success of the participatory activity and the effective delivery of correct modeling insights to the community.

II. COASTPLAN PARAMETERS OR DATA NEEDED

a. Area of Municipal Waters (hectares)

> **NOTE!**
>
> Remember to use "hectares" for the area of municipal waters. 1 km^2 = 100 hectares.

This is the total area of municipal waters from the shoreline up to 15 km, except for coasts shared by neighboring towns (e.g., towns under embayed geographical topology) as stipulated in the Philippine Fisheries Code of 1998 (Republic Act 8550). There are various methods to acquire the area of municipal waters. The Municipal Agricultural Office (MAO) - Fisheries Department or the LGUs may have this data. The National Mapping and Resource Information Authority (NAMRIA) may have information on municipal water boundaries and corresponding area. If the data is missing or unreliable, consult a map-based information software such as ArcView® or derive it from other Geographic Information System (GIS) software. Just remember to make sure that appropriate units are used (i.e., in hectares).

b. Percent of Municipal Water being Fished (%)

> **NOTE!**
>
> 100% = The entire municipal waters are accessible to fishers.
>
> 0% = No part of the municipal water is used for fishing.

An estimate of the proportion (in percentage) of the municipal water being used as fishing ground. If all fishers access all parts of their waters, the municipal fishing area is the same as the area of municipal waters. On the other hand, if some areas are restricted from fishing, only parts of the area of municipal waters are effectively treated as the fishing ground so this value should be between 0 to 100%.

c. Number of Municipal Fishers

In the software inputs, the "Number of municipal fishers (current)" pertains to the current number of municipal fishers while the "Number of municipal fishers (hypothetical)" is the value specified by the user to represent the expected number of fishers as a result of management scenarios such as shift of fishers to alternative livelihood or failure to regulate entrants (e.g., migrants and illegal fishers). The users are allowed to adjust this hypothetical value based on their perception. The number of municipal fishers (both registered and unregistered) fishing within the municipality is an important input for estimating total fishing effort. The fishers from other towns fishing within the municipality are also included in the count except for commercial fishers where a separate input box and slider is present. Do not include the fishers who are permanently fishing outside the municipal waters. This data can be obtained from the local government or by doing quick key informant interviews per barangay.

Did you know?

Among the 10 towns* surveyed along the South China Sea (SCS), Bolinao has the highest number of active fishers. They have at least 4000** fishers, both registered and unregistered.

*The 10 towns are: Alaminos City, Batangas City, Bolinao, El Nido, Looc, Lubang, Mabini, Masinloc, Puerto Galera, Subic.
**Data from the FISH-BE demonstration Workshop.

TIP!

Coastal municipalities should have established fish catch monitoring systems to help guide them and regularly determine the status of their fishery resources, identify improvements due to management interventions, and/or prevent sudden collapse of specific fish species.

d. Municipal Catch per fisher per day (kg/fisher/fishing day)

Ideally, municipal governments should have established regular fish catch monitoring to accurately estimate how much fish is being taken from the municipal waters. In the absence of these accurate data, an estimate of the average municipal catch (kg) rate per fisher per day can be obtained from structured interviews of fishers or through focused-group discussions. As with any of the parameters, the user can change this input with values that fishers or the audience think or feel are more accurate just to demonstrate its effects on fishery carrying capacity and MPA size requirements.

Did you know?

Among the 10 towns surveyed along SCS:
The town with the highest average catch per fisher per fishing day is Lubang where fishers are getting 11 kg/fisher/fishing day while the site with the lowest average catch is Verde Island in Batangas City where fishers are only catching about 2 kg/fisher/fishing day.

Data source: EBM survey of 10 towns.
Data analyzed by R. Muallil.

e. Municipal Fishing Days per Month (averaged)

Survey-derived information describing the average number of days that fishers go out to fish within a month. Fishers can easily give figures of number of fishing days per month or per week (just multiply this with number of weeks per month).

f. Percent Demersal Fish in Municipal Catch (%)

Demersal fishes are those who live or spend most of their time at the bottom of the water and they are usually near the shore. Examples of the fishes under this category are the reef-associated fish such as serranids (“lapu-lapu”), acanthurids (“labahita”), lutjanids (“maya-maya”), and nemipterids (“bisugo”). This information may be derived from frequent landing surveys. From fish landing surveys, compute for the proportion (in percentage) of demersal fishes from the total municipal catch. Alternatively, the facilitator can ask the fishers during the FISH-BE exercise "In your daily catches or in one fishing trip, what percent are demersal fishes?" followed by giving examples of demersal fishes. The percent demersal fish in municipal catch also describes the relative dependency of the municipal fishers on the demersal and pelagic stock and the fishing behavior (i.e., if fishing pressure is concentrated on the reef or is more dispersed) of municipal fishers which is important in determining the trajectory of fish stocks (Cabral *et al.* 2010).

TIP!

Use quartiles (i.e., 25%, 50%, 75%, or 100%) in asking fishers about the percentage of demersal fish in their catches (unless there are actual fish catch data).

g. Average Fish Price (PHP/kg)

This should be the average price per kilogram of fish sold to its first buyer. The first buyer may be a community member, wholesaler, broker, or resort owner. Similar to "farm gate price".

h. Average Daily Expenses per Municipal Fisher (PHP)

This pertains to the average daily expenditure a municipal fisher needs to support his/her family. The value of this includes all expenses for food, education, water and electricity bills, and medicine.

Did you know?

The average fish price in Puerto Galera, which is a well-known tourist destination, is PHP 95.60* while in El Nido, another well-known tourist destination, it is PHP 47.66*, the lowest price among the 10 towns. The average fish price in the 10 towns facing South China Sea Region is PHP 71.08*.

* Data source: EBM survey of 10 towns. Data analyzed by R. Muallil.

i. Monthly Household Income from Supplemental Livelihood (PHP)

Pertains to the average monthly income a fishing household gets from activities or supplemental livelihoods other than fishing. Includes income of other household members (i.e., spouse and children) that are not fishers.

How to do it!

The best way to compute for the average monthly income per fishing household from supplemental livelihood is by one-on-one interview/ survey. Note that not all fishers have supplemental livelihood and zero income values should be included in computing for the average. If it is easy for the respondents to give the yearly income from their household supplemental livelihood as some of which are seasonal (i.e., during lean fish-catch season or strong wind season), then do the average computation on a per year basis then just divide by 12 to get the per month value. Remember that this pertains to all income of the household that does not come from fishing! Includes income of other members of the family (i.e., spouse and children)

j. Demersal Fish Biomass (MT/km^2)

The users are asked to estimate the current demersal fish biomass of their municipality in metric tons per square kilometer (MT/km^2) of fishing ground. This estimate can be derived from the fish visual census. If the value is missing, one can use the default value of **1.5 MT/km^2**.

k. Pelagic Fish Biomass (MT/km^2)

Similar to the demersal fish biomass estimate, the users are asked to estimate the pelagic fish biomass of their municipal waters. Pelagic fishes are those fishes that spend most of their time at the surface of the water and they often form schools. They are usually silvery in color. Some of the examples of pelagic fishes are tuna ("tulingan"), Scombridae (e.g., "alumahan"), carangids ("talakitok"), and Loliginidae ("pusit"). A default of **2 MT/km^2** is often used as a last resort if information is not available.

l. Initial Carrying Capacity of Demersal Stock per km^2

In FISH-BE, the default value used for the initial carrying capacity per km^2 of the demersal stock is **10 MT/km^2** (Licuanan *et al*. 2006, 2008). The default value can be used as estimate during the COASTPLAN exercise except under special circumstances where the coral cover and related nursery habitats are absent and obviously will have lower carrying capacity.

m. Initial Carrying Capacity of Pelagic Stock per km^2

The default value of initial carrying capacity per km^2 of pelagic stock used in FISH-BE is **3 MT/km^2** (Licuanan *et al*. 2006, 2008). This value can also be used in the absence of data.

n. Number of Commercial Boats

Pertains to the average number of commercial boats that encroach into the municipal waters.

o. Catch per Commercial Boat per Trip (kg/trip)

The average catch in kilogram of a commercial boat per fishing trip.

p. Number of Trips of Commercial Boat per Year

Average number of trips per commercial boat that fished inside the municipal waters within one year.

III. GUIDE TO COASTPLAN GRAPHICAL USER INTERFACE (GUI)

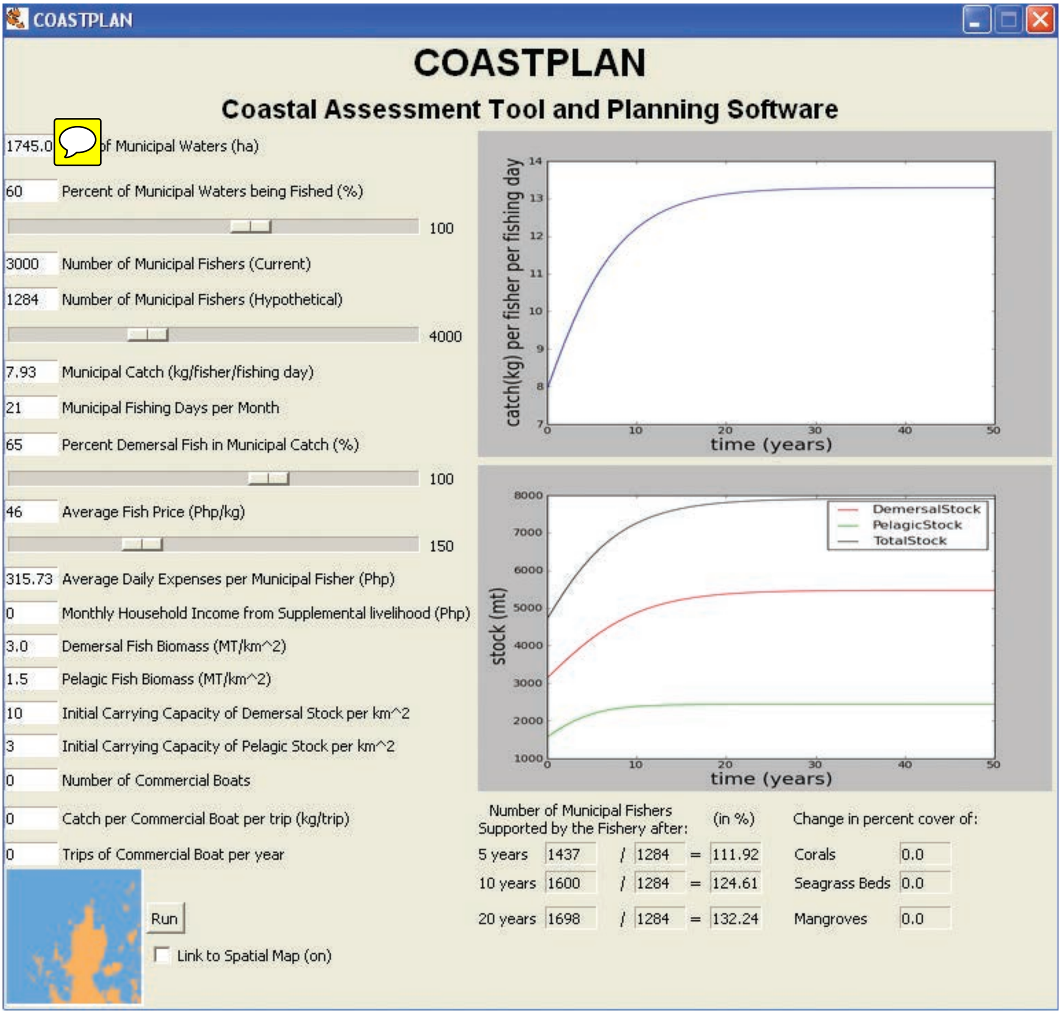

Figure 4. Window 1 of COASTPLAN software.

This section will guide the users on how to use COASTPLAN. To run the COASTPLAN, open the COASTPLAN folder and look for the icon named "COASTPLAN" or "Shortcut to COASTPLAN" with the nemo figure on it. No installation is needed. Double-click the icon and two windows will pop-up. The first contains many sliders and boxes that ask for inputs (data) from the user (Figure 4). The second is the spatial element of the model (Figure 5) where the user is asked to map resources and stresses of their fishery and assess current fishery status such as the level of threats each habitat is experiencing.

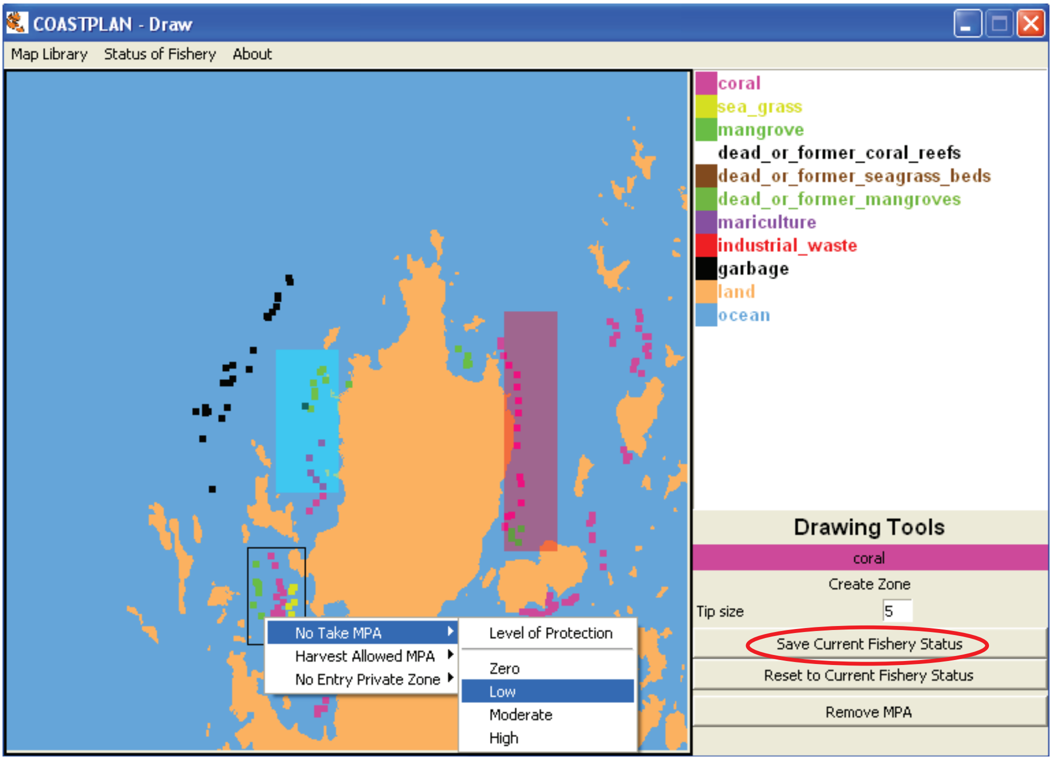

Figure 5. Window 2 of COASTPLAN software.

Data inputs asked in the first window (Figure 4) is straightforward and described in the section above (see II. COASTPLAN Parameters). The second window, "COASTPLAN Draw", (Figure 5), requires a more detailed description. The following are the steps and inputs needed in the second window:

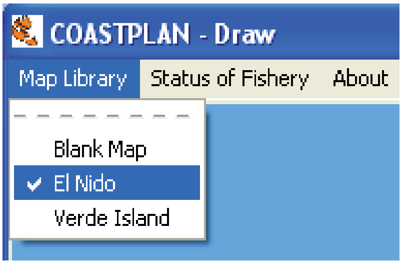

Figure 6. COASTPLAN: Map Library Button.

1. Choose the map of your town.

At the left side of the top panel, look for the menu bar with label "Map Library" (Figure 6). Choose a map from the list. If the map of your town is not there, you can create your own map by using the drawing tools. Click "Map Library" and choose "Blank Map". Then, click "Click to change resource/stress type" and choose "land" to draw land into the blank map. The advantage of having a drawing tool is that you can create the map of your own town at any scale (i.e., local or regional). Alternatively, you can create your own map by using the Paint program (Start → All Programs → Accessories → Paint) installed in Microsoft Windows Operating System. Just draw your map using a black color in white background. If you experience some problems, you may contact reniel.cabral@gmail.com for assistance

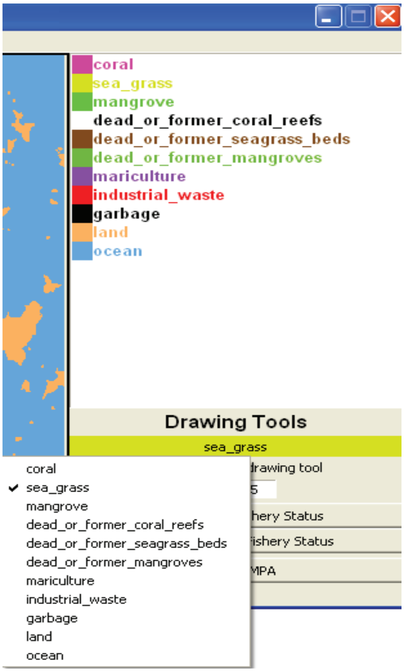

Figure 7. COASTPLAN: Coastal resources and stresses mapping option.

in uploading and creating the map of your municipality.

2. Map habitats and stresses

At the right side of the second window, you will see the drawing tools. Before engaging yourself in the mapping (drawing) of habitats, you need to click "Click to change resource/stress type" and choose the habitat or stress you want to draw in the map (Figure 7). Also, click "Click to change drawing tool" and choose either Box or Circle for the tip shape (Figure 8). The default tip size is 5 (5x5 pixels) and can be changed by entering the desired size (see red circle in Figure 8). Low value of tip size is intended for finer details.

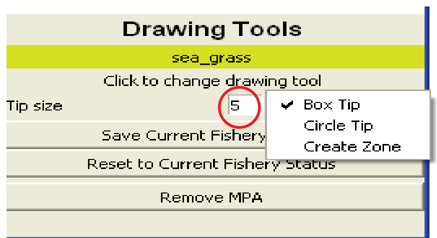

Figure 8. COASTPLAN: Coastal resources, stresses, and zones drawing tool. Box Tip = Box pen tip for resource and stress mapping, Circle Tip = Circle pen tip for resource and stress mapping, Create Zone = creating coastal zoning (e.g., Marine Protected Areas, "No-take" zones, etc.)

If your municipal/coastal waters has "No-take" Marine Protected Areas (NMPAs), Harvest-allowed MPAs, and/or No Entry Private Zone Areas, you just need to click "Click to change drawing tool" and choose "Create Zone". Move the pointer on the map, left-click it with your mouse and drag it to make a square. The area enclosed by the square or rectangle pertains to the zone you want to represent. Point inside the square you have just created and right-click it with your mouse and choose the type of zone. Upon clicking the type of zone, a sub-panel will

> **NOTE!**
>
> This is a user defined option so the perception of the workshop participants (if this is done during a workshop) would be valuable in determining the level of protection.

appear where you will be asked to evaluate categorically the current protection level of such zone (see Figure 9). "Zero" for not effective or not protected and "High" if effectively protected/implemented.

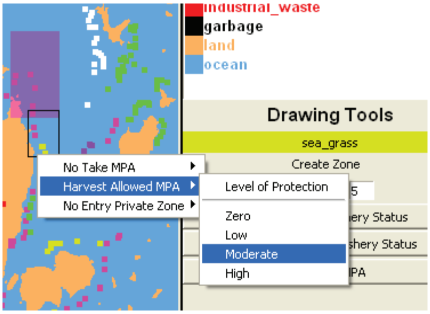

Figure 9. Creating zones with variable protection level

3. Assess the current status of your fishery

Next to the "Map Library" menu bar is the "Status of Fishery" menu bar (Figure 10). When you click the "Status of Fishery" button, you will see "Threats to Coral Reefs", "Threats to Seagrass beds", and "Threats to Mangroves". The user is asked to evaluate categorically the current threats experienced by these habitats. Options are Zero, Low, Moderate, and High. "Zero" means the habitat has no threats while "High" means that the habitat is highly threatened. For example, if blast fishing is rampant, this is a high threat to coral reefs. Example of high threats to mangroves and seagrasses are reclamation of mangroves areas and dredging of seagrass beds respectively. "Low" and "Moderate" stress can be based on user perception.

After completing the assessment and accounting of your current fishery status, you need to click "Save Current Fishery Status"

NOTE!

1. The first time you draw a habitat or stress, you need to click "Click to change resource/stress type" and choose the habitat/stress you want to draw and click "Click to change drawing tool" and choose either Box or Circle for tip shape. If you do not do these steps, you can still draw with the default features: "corals – box – 5 x 5 pointer size."
2. In this part, you are mapping the current fishery status. Your proposed fishery with planning and management options will come later.

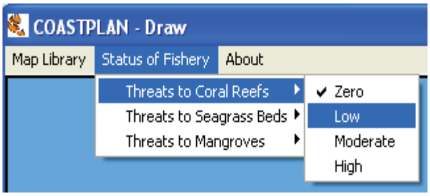

Figure 10. COASTPLAN: Status of fishery button

(see red oval in Figure 5). The purpose of saving the current fishery status is so that you can retrieve the original/current status of the fishery in case you want to test other types of spatial planning strategy for your fishery.

4. Other important buttons (refer to Figures 5 & 8)

"Reset to current fishery status" – Allows user to reset or go back to their current fishery status (this is the "saved current fishery status" referred to in the previous paragraph) when their proposed fishery (embedded with spatial planning) turns out to be ineffective or you just want to try other types of planning or management option.

"Remove MPA" – Button that removes all MPAs plotted or created in the map.

5. Modeling using the COASTPLAN software

Now that you have represented your fishery into a miniature map, you are now ready to do your proposed management plan. You can change the values in the first window where the parameters there are not interpreted spatially (e.g., fish price, number of fishers, number of commercial fishers, etc.) and at the same time, you can assign areas to be protected in the second window by doing the same procedure as above on how to represent zones in the map. Further, you may simulate scenarios of varying levels of protection for each proposed zone.

You may also choose whether to link the dynamics of the first window containing graphs to the second window which contains the spatial map by checking the "Link to spatial map (on)" located below the first window (Figures 4 & 11). If you do not link the first window with the second, the program will still run but the results will not be dependent on the trajectory of habitats through time. When everything

has been set (i.e., data inputs and maps filled up) click "Run", found on the left bottom of window 1 (red circle in Figure 11). Results will be shown on the right side of window 1 (i.e., graphs and values; see next section for interpretation of results)

If the proposed management plan does not turn out to produce good outcomes, just press "Reset to current fishery status" in order to go back to the current status of your fishery and do the planning again.

NOTE!

As a guide, the following management scenarios can be tested using COASTPLAN:

- Decrease the number of fishers through opening alternative livelihood options
- Simulate the effect of continuous increase in the number of fishers in the fishery
- Change values of Fish Price and Income from Supplemental Livelihood to determine the effect of fish price and supplemental livelihood in the number of fishers that can be supported by the fishery
- Effect of intrusion of commercial boats on the municipal catch and stock biomass
- Effect of variable fishing effort to the pelagic and demersal stock
- Demonstrate the effect of variable protection levels provided to key habitats through marine protected areas
- Demonstrate the effect of threats to the fate or changes in habitats
- Map resources and anthropogenic stresses from ridge to reef
- Test different spatially explicit management scenarios

IV. WHERE TO FIND THE RESULTS AND HOW TO INTERPRET IT?

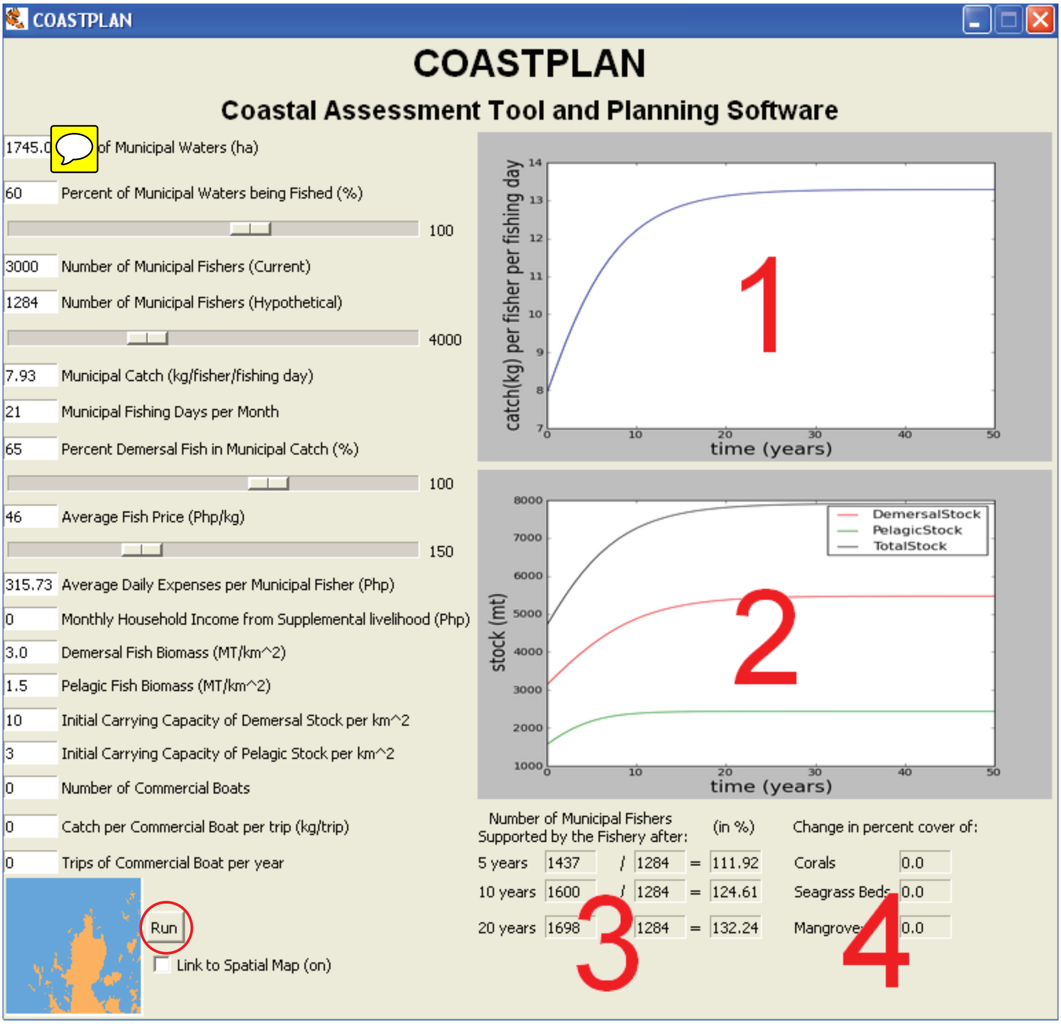

Figure 11. Location of coastal assessment results in COASTPLAN

1 This graph shows the trajectory of catch per fisher per fishing day through time (in number of years) starting at the current catch rate at time "zero". If the trajectory is increasing as what is shown in Fig. 11, it means that the fishery is improving through time. If the graph shows a declining trend, catch is decreasing through time.

2 This graph shows the trend of fish stocks (Pelagic, Demersal, and the sum of the Pelagic and Demersal stocks equal to "Total stock") in metric tons through time starting at the current stock at time "zero". If the trajectory is increasing as what is shown in Fig. 11, it means that the fishery is improving through time. If the trajectory shows a declining trend, stock is depleting indicating a non-sustainable fishery. If there is a plateau it means that the stocks will stabilize after certain number of years.

3 Shows the number of municipal fishers that can be supported by the fishery after 5, 10, and 20 years. If this value is 100%, it means that the fishery can support all active fishers. If the value is greater than 100%, it means that the system can accommodate more fishers or the current fishers will earn more than enough for their basic needs. If the value is lower than 100%, the fishing pressure is greater than what the fishery can handle. Values closer to zero implies that the fishery is depleted, unsustainable, or overfished.

4 Shows the change in percent cover of corals, seagrasses, and mangrove habitats after 50 years. Negative values mean reduction of habitat cover while positive values mean improvement in the habitat cover. A value of "0" means that the habitat cover does not change after 50 years while a value of "-100" means that all habitats disappeared after 50 years.

V. Final remarks

COASTPLAN is a simple model which is easy to comprehend. It is a knowledge-based product derived from the cumulative lessons learned from the series of FindFishSup EBM tools demonstration workshops. After reading the chapter on COASTPLAN, you should start exploring the software and test it in your own town. The model is written in Python which is a free programming language. This book comes with a free open access COASTPLAN model found in the accompanying CD.

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