ReefRanger

User Guide (Series 1: Save the Yellow Tangs)

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Cover: Wade Cooper (NCORE) surveying a reef with a CobraTac.

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Introduction

Coral reefs are vital to the culture and economics of many places in the world, including Hawaii. The average person reaping benefits from reefs has only a vague concept of their importance, and a partial understanding of the complexity of the threats to these ecosystems. The *Reef Ranger* is an educational game designed specifically for teens (ages 13 and above) to give them a better understanding of the complexities involved in managing the coastal resources. This version (*Save the Yellow Tangs*) is focused on monitoring and managing the fish called yellow tangs.

The general objective is to select management options to ensure that the economically important fish industry of Hawaii is sustained and protected from human interventions.

What is a Yellow Tang

The yellow tang also formally called, *Zebrasoma flavescens* (Bennett, 1827) in the scientific community, is the most common aquarium fish in Hawaii. A close relative of the purple tang, they have a yellow body with a white scalpel-like spine on the tail used for defensive (or offensive) weapon. Yellow tangs do well in reef aquaria as they exhibit high tolerance and resiliency to changes in the environment. However, they also exhibit low tolerance and animosity to other fishes of their size and family (Acanthuridae) in an enclosed environment. Yellow tangs are largely herbivores (feeding on filamentous and frondose macroalgae on the reef bottom) and have been observed in an enclosed (tank) environment to occasionally feed on non-aquatic plants like lettuce as an alternative. In waters around Hawaii, their main predators include, among others, groupers, all species of jacks and pompanos, moray eels, and other carnivores that normally hunt for prey in reefs.

They are found in the Pacific and Indian oceans. Reports of yellow tangs in Florida have raised concerns that they have been introduced into the Atlantic (Myers, 1991). They inhabit both

lagoonal and seaward areas of coral reefs. They were also observed to a depth of 46m and they can grow up to 6" in length and live for over 30 years. Very small and young fish settle into deeper reef sites (8 to 25m) with high coral cover. They spend their first few years living and foraging in very specific habitats within these sites until they reach ~140mm (females) or ~165mm (males), after which, they join large roving schools that forage up on shallower (2 to 8m) reef flat areas.

Installing the *Reef Ranger* Software

The *Reef Ranger* game software is distributed in 5 CDs and they may be requested from the authors.

Minimum System Requirement

The following is the minimum system requirements for the software:

- Processor: 600 megahertz (MHz) Pentium processor or better (recommended: 800 MHz);
- Operating System: Microsoft Windows XP Home Edition (SP2); XP Professional (SP2); Microsoft Windows 2000 (SP4); Microsoft Windows Media Center Edition 2002 (SP2);
- Minimum Software: .NET Framework 1.1 Redistributable; Windows Installer 3.0; Microsoft Internet Explorer 6.0 with SP1; Macromedia Flash 7 (or newer version);
- RAM: 128 megabytes (MB; recommended: 256 MB);
- Hard Disk Space: 1.5 gigabytes (GB);
- CD Drive required only for installation;
- Display: 800 x 600 256 colors minimum (Recommended: 1024 x 768 high color - 16 bit); and
- Other Devices: Mouse and Keyboard are required

Installing the Game for the First Time

To install the software, insert *Disk 1* onto your CD drive. The disk contains a file that is set to automatically open the *index.htm* file using the default system web browser. This file provides step-by-step instructions on how to install the software. If the file is not opened automatically, locate this file and load it onto your browser

manually and follow the instructions. To install the software manually, run the SETUP.EXE that can be found in the root directory on each of the disks. It is important to start the manual installation with *Disk 1*.

Post-Installation Notes

In majority of cases, the other supporting software drivers (.NET Framework 1.1 and Macromedia Flash object) required by *Reef Ranger* are already present. The SETUP.EXE will also attempt to install these utilities. If these automatic setup procedures fail, complete the installation by downloading these utilities from:

(1) Microsoft download page (*http://www.microsoft.com/ downloads/*). Download and install the .NET Framework 1.1 Redistributable package.
(2) Adobe download page (http://www.adobe.com/). Download and install the Flash Payer.

Email the authors (ncore@rsmas.miami.edu) for comments or problems encountered in installing the package.

As the need arises, new updates to correct and/or improve program performance are posted on the *Reef Ranger* website (*http://crem.rsmas.miami.edu/reefranger*). Follow the instructions on the website on how to update the software. The website also includes, among others, links to new developments, messages from the authors, and links to important documents.

NOTE: No personal information will be transmitted over the net during the installation. This software is guaranteed not to contain *Spywares*, *Adwares* and is tested for the presence of any virus.

The disk images are available for download from the *Reef Ranger* website. If the Internet connection is slow or unreliable, a CD version may be requested from HCRI.

Getting Started

To start the *Reef Ranger* game, double-click the *Reef Ranger* icon that was installed in the desktop or access the program from the Start Menu. The startup screen (see Figure 2) will contain the default settings. This includes the position of the display screen, the last player (Figure 2a) and corresponding rank (Figure 2b) and points needed until next promotion (Figure 2c).

If this is the first time you have played this game, you will need to first generate your code and register as a new Ranger. To do this, click on the **File** menu and select "**New Player**" (**File → New Player**).
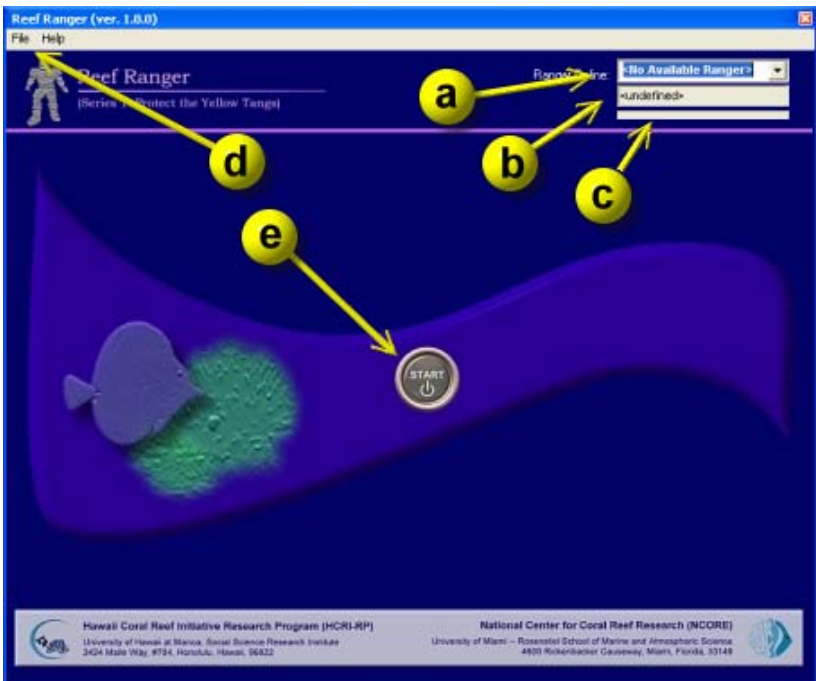

Figure 2. *Reef Ranger* startup screen: (a) the Ranger code, (b) the Ranger's rank, (c) points needed before being promoted to the next level, (d) File and Help menu, and (e) Start button.

Player's Code Generation

All players must agree with the "User Agreement" (partially shown in Figure 3). Read the agreement carefully and if there are statements in the agreement that you cannot agree with, click **I Do Not Agree** and the process of code generation is discontinued.

To generate the code required to play the game, users will have to enter their "screen name" (Figure 4A).No other information about the player will be prompted.

Figure 3. User registration screens: User Agreement.

Once completed, press the **Generate My Code Now** button (Figure 4B) to generate the player's *Reef Ranger* code (Figure 4C). Remember or write this code somewhere so you do not forget

your code. As a default, the rank of a new player is initialized to *Junior Reef Ranger*.

Click the **Submit** button to complete the registration procedure and the display will return to the startup display (Figure 2). Click the **Start** button (Figure 2e) to start the game.

WARNING! Once you have started the game, the only way to stop it is to quit from the **File Menu** → **Quit** option. This will save the current settings and the player may continue at a later time.

Figure 4. Player registration form: (A) screen name, (B) button to generate the code, and (C) Ranger's code and initial rank.
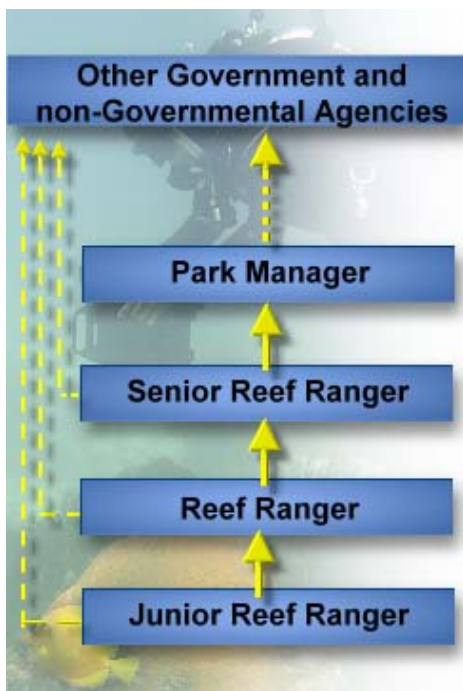
The Ranks, Functions and Scores

Figure 5. Ranks and hierarchy.

A *Reef Ranger* can progress from the initial rank of **Junior Reef Ranger** to the highest rank: **Park Manager**. It should be noted here that it is important to remember the hierarchy (Figure 5).

A *Junior Reef Ranger* reports to a *Reef Ranger*, a *Reef Ranger* reports to a *Senior Reef Ranger* and *Senior Reef Rangers* report to a *Park Manager*. While they all have access to other government and non-governmental agencies, it is only the *Park Manager* who has full access to resources outside the park.

The initial rank that will be given to all new players is *Junior Reef Ranger*. For this rank, all "reporting actions" are directed to the *Reef Ranger*. The points (or score) are initialized to 0 at the start of a new rank. Scores will be added for every decision made (or not made). If a player reaches 100 points, the player is promoted to the next rank until the player gets to the top rank, *Park Manager*.

As the player moves up the ranks, the player will be given shorter times to make decisions about the case presented. *Junior Reef Rangers* have about ten seconds to respond to the posted scenario while a *Park Manager* only has 2 seconds to respond to a scenario. If no selection has been made within the time period, the default "**No action taken or required**" will be assumed to be the desired response.

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Game is over if: (i) all of the yellow tangs die for whatever reason, in which case, the Ranger will be demoted to a lower rank, or (ii) the player, as a *Park Manager*, managed to sustain the population of the yellow tangs and he is retired and elevated to the Reef Ranger Hall of Fame.

The Main User Interface

The main user interface has 9 key components (Figure 6): (A) view ports, (B) activity indicator, (C) view port for the underwater scene, (D) area map, (E) help lines, (F) activity panel, (G) possible choices of player's response, (H) compilation of reactions to the actions taken by the player, (I) indicator on the population of the yellow tangs, (J) time remaining to respond to the case.

The population indicator shows two colors. Green is the remaining population of yellow tangs left in the area. Red is the relative space still available for new yellow tang recruits. The game is over if green disappears from the box, implying that all the yellow tangs are gone from the ecosystem. A numeric label of the remaining biomass and the score of the player is flashed on the screen whenever any of these two values changes.

View Ports

Reef Ranger has four cameras (Figure 7) with intelligent sensors to look for any changes made and to warn *Reef Rangers* about any activity. These cameras are positioned to view and monitor the: **upland**, **lowland**, **coastal** and **offshore waters** (Figure 6A). Click on any of the view ports (Figure 6) to open a larger view of the 3D area.

Figure 6C is a virtual view port of the reef within the coastal area. The scene in this view port changes depending on the scenario in play.

Area Map

The Area Map is a special utility to view the locations of the upland, lowland, coastal and offshore zones in an hypothetical site.   Upland is defined as the hilly and mountainous areas;

lowland is the zone where the valleys and plains are located; coastal zone is the area near the shore that includes the beaches and coastal waters; and offshore is the open water where most commercial fishing is conducted.

Figure 6. The main user interface of the *Reef Ranger* game software and the seven key components of the interface (see text for details).

Help Lines

Players have access to three help lines to assist the player in making decisions and play the game effectively. Please see the section "**Getting Help**" below for details.
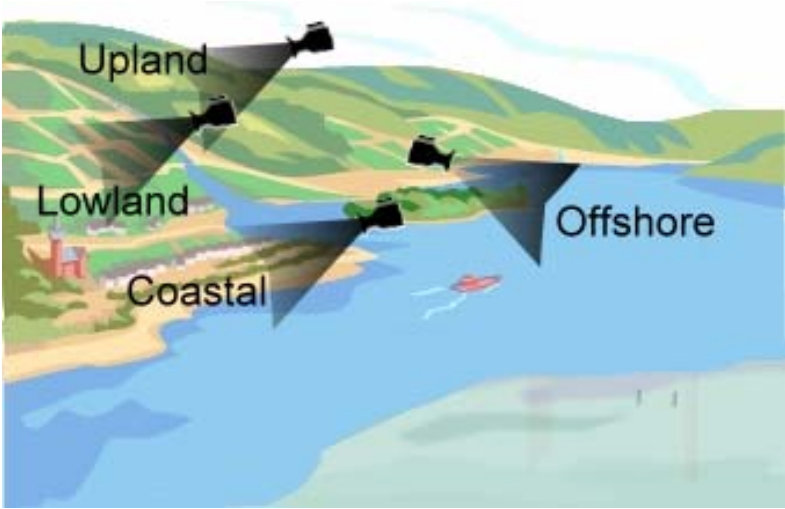
Figure 7. Camera positions available to the *Reef Ranger*.

Activity Indicators

Under each of the view ports is a sensor that can detect ongoing or planned activities. If the sensor is flashing red, a change is about to happen in the area. A slow flashing green indicates that there is no new ongoing activity.

The Player's Workspace

The workspace (Figure 6G) is where players interact with the game and make decisions. The option "**No action taken or required**." is the default answer. If the player does not change the answer within a certain time period, the default answer will be taken as the player's response. Please note that the time limit gets shorter as the player moves up in rank.

Please be warned that the option "**No action take or required**.", may also be the right choice to make.

The panel (H) in Figure 6 compiles all the choices made (or not made) and what management action was taken in response to the player's choice.

Understanding the Network

To be a successful player, it is important to understand, not only how the Ranger organization is designed (see above; Figure 5) but how the various entities in the environment affects the other elements. Figure 7 is the network used in this game software.

Figure 8. Schematic cause and effect diagram of some processes involved in the coral-algal balance on a coral reef. Solid lines represent strong effects; dashed lines represent weak effects. Arrows indicate a positive impact or gain, circles represent a negative impact or loss. Disease affects all biotic components. Dark ellipses are abiotic or anthropogenic factors. (from McManus and Polsenberg, 2004).

This diagram will help you, as a player, understand the impacts. The following is an example on how to read the diagram:

"*In a strong rain **Storm**, this will cause **Runoff** from agricultural farms and will increase **Siltation and Resuspension**. **Runoff** , thus, adds to the negative effect of **Siltation and Resuspension** to **Corals**. However, **Runoff** has a strong positive impact on **Nutrients** that in turn, improves the growth of **Macroalgae** that the yellow tangs, which are **Herbivores**, use for food. If we move back to the level of **Nutrients**, it also has a strong positive effect on another type of algae that yellow tangs do not use for food. Further examination reveals that that **Encrusting Algae** and the group classified as **Macroalgae** negatively affect each other and if….*"

The example given above is incomplete. If you try to follow each connection, the effect of a storm will have a direct or indirect effect on all of the entities. This is the very essence of *Reef Ranger*: for every disturbance made to the system through human interventions/activities or natural phenomena, there will be accompanying effects on the coral reef ecosystem, and we need to consider as much of these as possible to effectively manage coral reefs. There are many books and other types of publications describing the science behind ecosystem modeling that is beyond the scope of this document and should be referred to if you are interested.

Getting Help

The player has access to three help lines:

1. The *User Guide* provides a number of help tips on how to play the game effectively;

2. The *Reef Scientist* is an online scientist that can provide scientific advice on the scenario in play; and

3. The *Kapuna* (or village elder) is an online elder that can provide advice based on experience (if applicable).

The help lines will not say what is the best decision to make but can be used to guide the player towards the best possible answer.

Efforts were made to ensure that the software is free from defects. In cases where program defects (errors) are observed, please contact the authors (ncore@rsmas.miami.edu) immediately to resolve the problem.

References

McManus, J.W. and Polsenberg, J.F. 2004. Coral-Algal Phase-Shifts on Coral Reefs: Ecological and Environmental Aspects. Progress in Oceanography 60: 263-279.

Myers, R.F. 1991. Micronesian reef fishes. 2nd Ed. Coral graphics, Barrigada, Guam, 298p.

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The *Reef Ranger (Series 1: Save the Yellow Tangs)* is an educational game software that immerses the player in the complex world of coral reef management. The effects on coral reefs of human activities in the mountains all the way to the open ocean are simulated. The game illustrates how one entity in the ecosystem can have a large effect on the health of another, and how not only inaction but also inadequate management actions can lead to ineffectiveness and ultimately degradation of resources like the yellow tang.

The intelligence of the program is derived largely from constructed scenarios stored in the game software. The *Reef Ranger Authoring Tool* is a software that will give users the capability to edit, add and submit new scenarios to *Reef Ranger* to configure the game software to local conditions or even to a local language.