Sustainable Oyster Shellstock Training Handbook

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June 25, 2013

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Introduction

The Sustainable Oyster Shellstock Model has been created to estimate sustainable harvests of oysters from the Louisiana Public Oyster Seed Grounds. A sustainable harvest is herein defined as one in which no net annual reef shell loss occurs. That is, the loss of shell from removing live oysters and cultch by harvesting in combination with natural shell loss must equal shell gains from shell growth.

The purpose of this handbook is to provide a training manual and reference guide to personnel from the Louisiana Department of Wildlife and Fisheries (LDWF) for sustainable management of the State Public Oyster Seed Grounds. Modifications to the standard laboratory processing of samples are presented, data entry is explained and a tutorial in model usage is provided. The field and laboratory techniques described herein support the data requirements of the Sustainable Oyster Shellstock (SOS) model.

Field Sampling

The present LDWF protocol for sampling oysters, in which divers remove all oysters from 1 m^2 quadrats, provides a quantitative estimate of oyster density; alternatively, patenting tonging from a vessel can be used. Patent tongs are large (up to 1 m^2 sample size) hydraulically-controlled mechanical devices used for harvest (e.g., Chesapeake Bay) and quantitative sampling. They are deployed in an open position from a boom or davit, lowered or dropped onto the bottom, closed, retrieved and opened on to the deck. Either diver sampling or patent-tong sampling are sufficiently quantitative to support the SOS model.

Laboratory Processing

A slight modification of the standard LDWF laboratory protocol for laboratory analysis is required to support the SOS model. The protocol described below focuses on addenda to standard practices. An addendum field sheet is supplied to record the data (Appendix 1).

Samples must contain all surficial shell (shell related to the surface), including: 1) live oysters 2) shell from dead oysters and 3) artificial cultch (e.g., limestone). Surficial shell is that which can be scraped by divers from within the 1 m^2 quadrat, and also includes all shell above the mud line in samples collected with patent tongs. The ability to observe the mud line when patent tong samples arrive on the surface is an added advantage of this type of sampling.

Cull the live oysters. It is not necessary to cull spat (≤ 25 mm); they contribute little to the shell budget. Weigh the live oysters. Divide the cultch up into the various types (e.g., dead oyster shell, clamshell, limestone, mussels). Separate each black cultch from brown cultch. Weigh (g) and record the weight of each type of cultch (e.g., black oyster shell, brown oyster shell, black

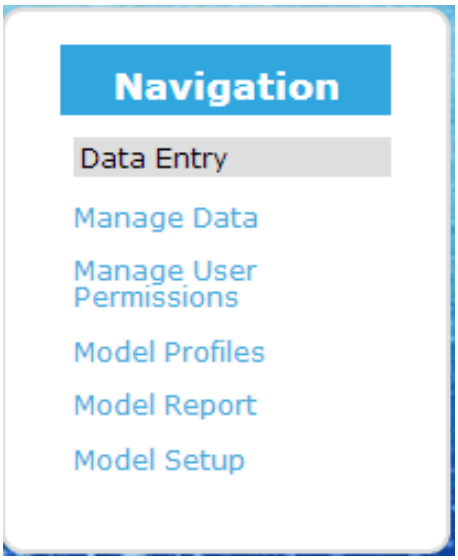
clamshell, brown clamshell, black limestone, brown limestone etc.). You may encounter clusters of live mussels and mussel shell. Muscle shells should be weighed (black and brown) and recorded as Cultch Data (see page 9), whereas live mussels are weighted and recorded as Species Data (see page 9).

Weighing the cultch gives us a value for initial cultch. This is *essential* to run the model. The SOS model allows a harvest in which, after fishing, the final cultch density equals the initial cultch density.

Contact

For details about sampling protocol and laboratory processing please contact Dr. Thomas Soniat at tsoniat@uno.edu.

Forms Overview



There are three types of forms associated with the SOS Model; those available to public users, those available to "trusted users" and those available to managers and administrators. Forms 1-6 are listed in the table below with authorization and description of use for each. These forms can be accessed by clicking the Modeling Tools tab at www.oystersentinel.org.

#	Name	Authorization	Description
1	Data Entry	Trusted	Enter various data for surveys and replicates
2	Manage Data	Manager	Manage data lists such as collectors, cultch and species types, reef conditions, and other data
3	Manage User Permissions	Manager	Allows managers to give permissions to authenticated users to access regions
4	Model Profiles	Public	Create and configure model behavior profiles for growth, mortality, fishing and cultch
5	Model Setup	Public	Setup the model for simulation
6	Model Report	Public	View simulations which have been run

Data Entry

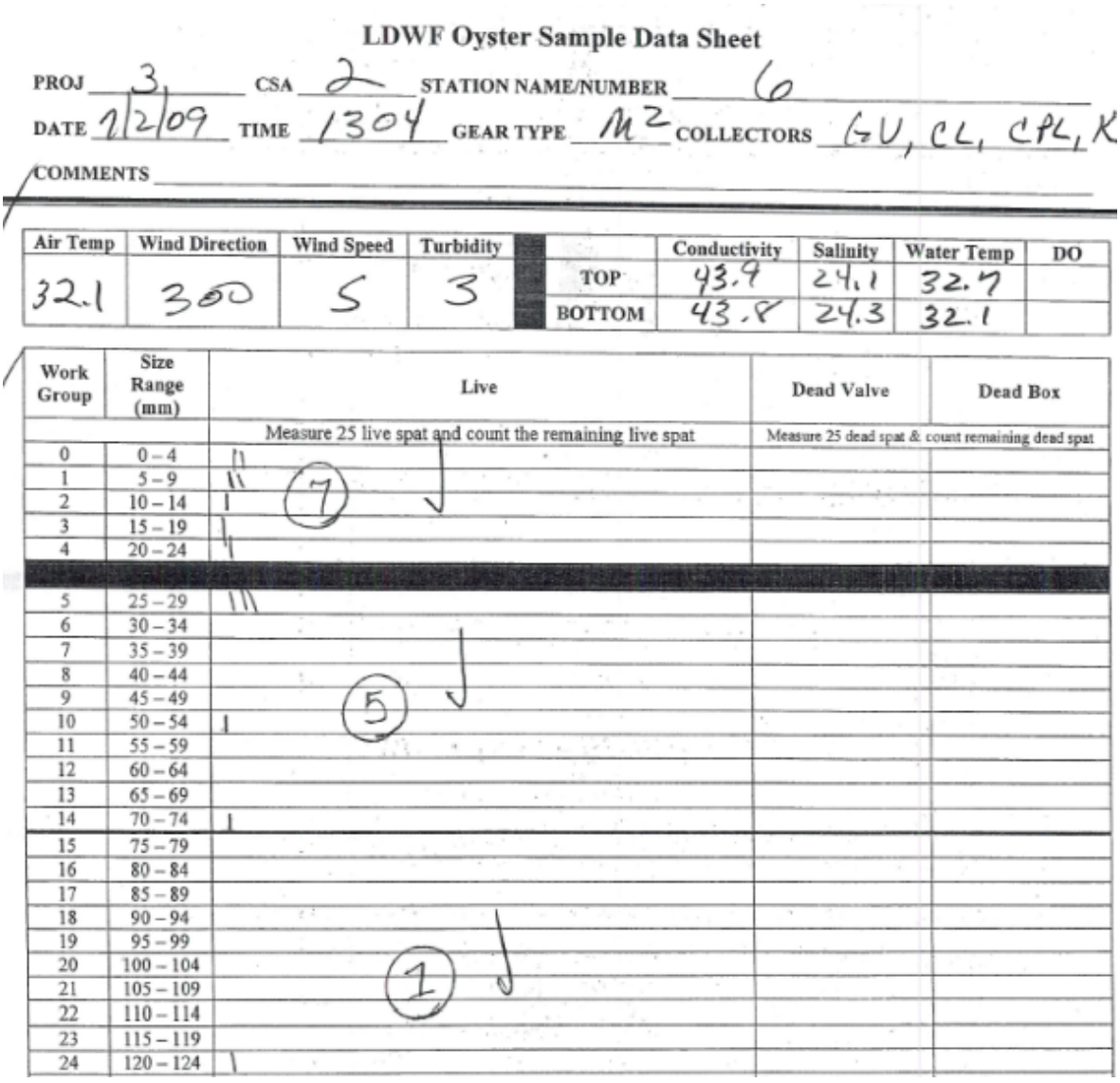
Data from the field sampling and laboratory analysis (measurements) are entered into a multi-page electronic form that mimics the standard LDWF paper form (Data Entry Form). Once these data are entered and saved, they are available to the SOS model to use in a simulation run. Access to data entry is categorized as per the privilege of the user. Once the user signs up on the web site (www.oystersentinel.org), the user may be assigned privileges to one or more Louisiana Department of Wildlife and Fisheries Coastal Study Areas (CSAs). The user can only alter the data of sample stations in those CSAs that he/she has access to. There are other forms that allow for managers and administrators to oversee the access to different CSAs. To ensure proper entry of data, the following steps must be followed:

- Sometimes, a substation termed “a shell plant” is established within the area of a current station. If a shell plant substation has been is created by the LDWF and sampled, and it may also be added in a current year data sheet. Therefore, acreage values of the original station will need to be updated and modified. Thus, for a shell plant with acreage A that is created in an already existing station X with acreage B, the acreage value of the station X would be B – A.

- All user activity will be logged. Therefore, if a user adds, deletes or edits any data associated with a station, the name of user and the time when the alteration was made will be logged. This can be reviewed by administrators as needed.

Detailed Explanation of Forms

For the purpose of speeding data entry, the multi-page electronic Data Entry Form consolidates the LDWF Oyster Samples Data Sheet and other data entry forms into one central location. From here, a user is able to input the environmental conditions, the collectors, the oyster numbers, cultch and species, reef conditions and perform verification of the data entered. The electronic Data Entry Form comes equipped with a status window at the top that provides various information about the replicate, and has a progress bar to confirm that everything has been done.



LDWF Oyster Sample Data Sheet

PROJ 3 CSA 2 STATION NAME/NUMBER 6

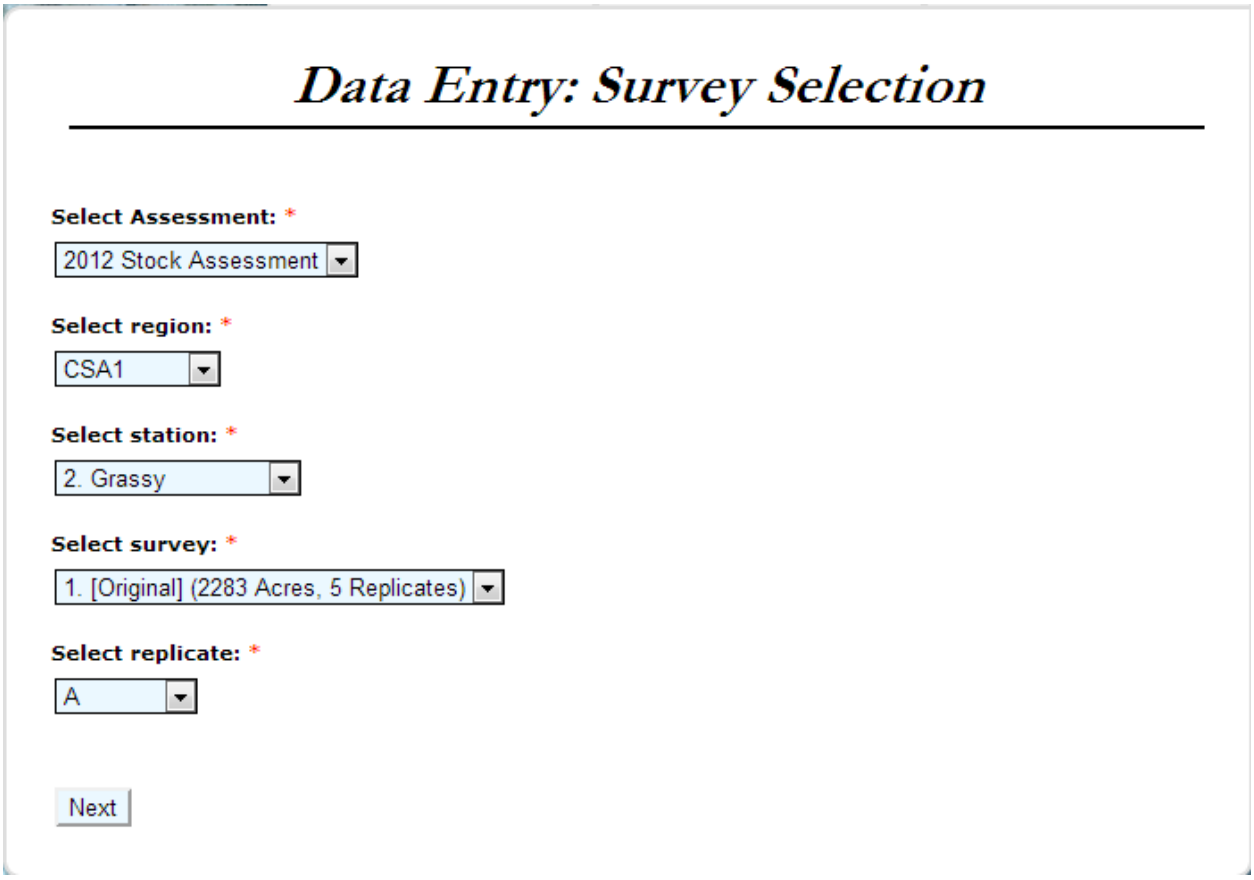
DATE 1/2/09 TIME 1304 GEAR TYPE M2 COLLECTORS GV, CL, CPL, K

COMMENTS

Air Temp	Wind Direction	Wind Speed	Turbidity		Conductivity	Salinity	Water Temp	DO
32.1	300	5	3	TOP	43.9	24.1	32.7	
				BOTTOM	43.8	24.3	32.1	

Work Group	Size Range (mm)	Live	Dead Valve	Dead Box
		Measure 25 live spat and count the remaining live spat	Measure 25 dead spat & count remaining dead spat	
0	0 – 4	||		
1	5 – 9	|| (7) ✓		
2	10 – 14	|		
3	15 – 19	|		
4	20 – 24	|		
5	25 – 29	|||		
6	30 – 34			
7	35 – 39			
8	40 – 44			
9	45 – 49	(5) ✓		
10	50 – 54	|		
11	55 – 59			
12	60 – 64			
13	65 – 69			
14	70 – 74	|		
15	75 – 79			
16	80 – 84			
17	85 – 89			
18	90 – 94			
19	95 – 99			
20	100 – 104	(1) ✓		
21	105 – 109			
22	110 – 114			
23	115 – 119			
24	120 – 124	|		

Old LDWF form

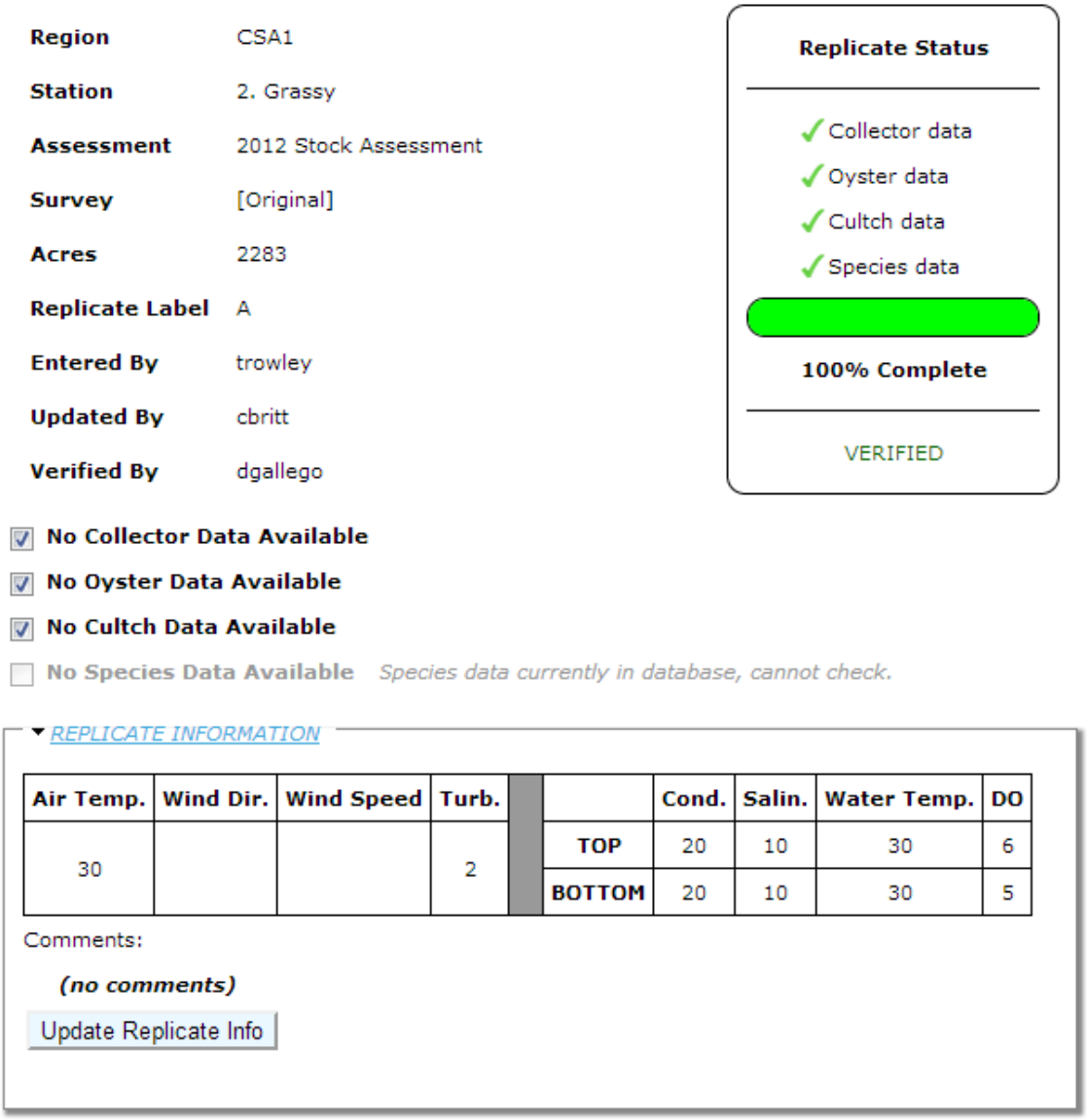


Survey Selection Form: Select assessment, region, station, survey and replicate

The first page of the Data Entry Form allows the user to select an assessment (Year + title) which will usually be a stock assessment. Also selected on this page are the region/CSA, station, survey, and replicate the user may wish to edit. There may be more than one survey conducted in a given year. Each survey consists of one or more 1 m^2 quadrat samplings (replicates). Through this form, the user is also able to add new surveys and replicates to existing stations by selecting "new" from their respective dropdowns. New assessments, regions and stations can only be added by a manager using the Manage Data Form.

When new surveys are created, the user will be able to capture the acreage for that survey, thereby, allowing the same station to be re-used even when the acres are not the same as last year. A suggested acreage will be provided which matches the previous year's value, when applicable. If two surveys exist for the same year and station, then a label must be applied called a suffix to distinguish them. When replicates are created, the gear type is captured, with a default of 1 m^2.

Data Entry: Replicate Summary



Region CSA1
Station 2. Grassy
Assessment 2012 Stock Assessment
Survey [Original]
Acres 2283
Replicate Label A
Entered By trowley
Updated By cbritt
Verified By dgallego

Replicate Status

✓ Collector data
✓ Oyster data
✓ Cultch data
✓ Species data

100% Complete

VERIFIED

☑ **No Collector Data Available**
☑ **No Oyster Data Available**
☑ **No Cultch Data Available**
☐ **No Species Data Available** *Species data currently in database, cannot check.*

REPLICATE INFORMATION

Air Temp.	Wind Dir.	Wind Speed	Turb.		Cond.	Salin.	Water Temp.	DO
30			2	TOP	20	10	30	6
				BOTTOM	20	10	30	5

Comments:

(no comments)

Update Replicate Info

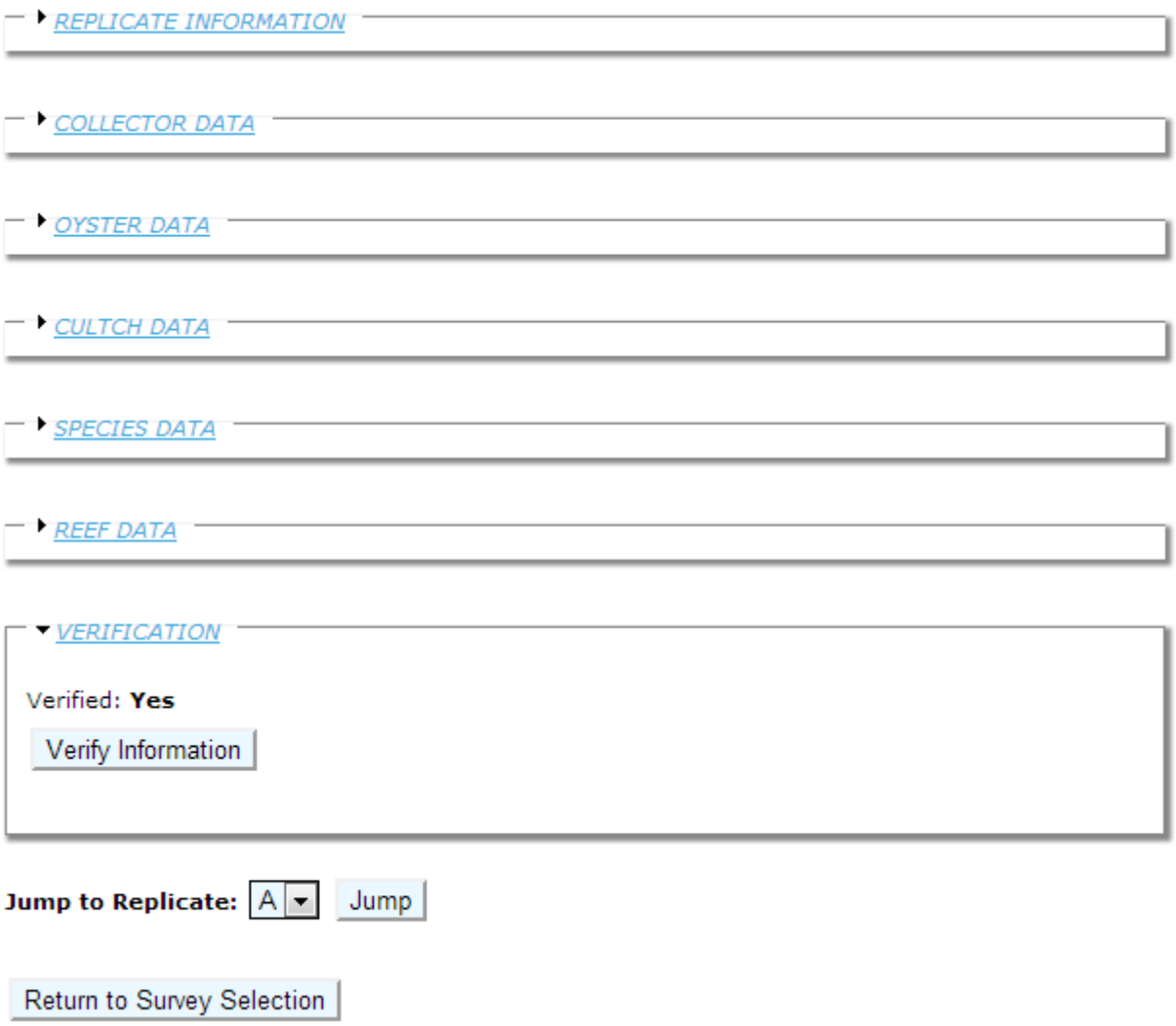
Replicate Summary Form: View overall status of replicate and its information

The top of page two of the Data Entry Form is shown above, and is reached after selecting a specific replicate. On the top left, there is a list of various information for the replicate, including who entered it, who last updated it, and who verified it. On the top right, a status bar is displayed to better facilitate completion of the forms.

If no data exists for a particular category such as collectors, the relevant box can be checked (left mid-screen). Below those, the replicate information is available, including environmental conditions and any comments. Click “Update Replicate Info” to edit any of that information.

Replicate Summary Form: View and update data groups

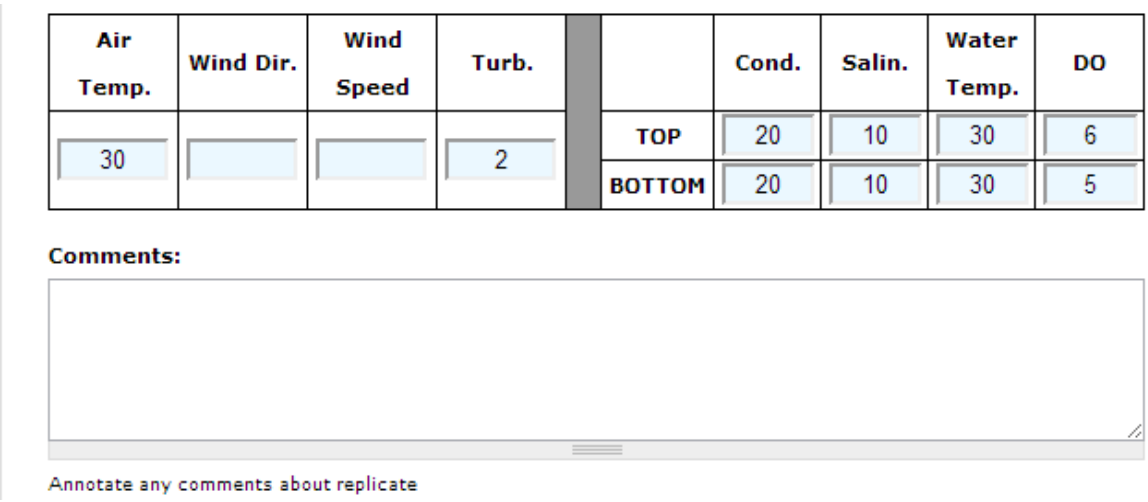
Presented above is the center section of page two of the Replicate Summary Form for Data Entry. Here, datasets that contain any data for collectors (sampling personnel), oyster samples, cultch, species and reef are listed. For any of those groups, clicking its respective "Update" button will allow the user to add or edit the entries.



Replicate Summary Form: Verify information

Below the dataset tabs, which are closed in the figure above, the verification status and verification tab is shown at the bottom of the Replicate Summary Form for Data Entry. In the particular example above, verification has been performed. Alternatively, it could say "No" or "Yes (Modified since last verification)", which is a hint that verification should be performed again. Regular users will not be able to verify a replicate of a survey if they were the last one to update it.

At the bottom of the form, the user may select another replicate of the same survey to jump to, or they can click "Return to Survey Selection" to return to the first page of data entry to select a different survey to work on.



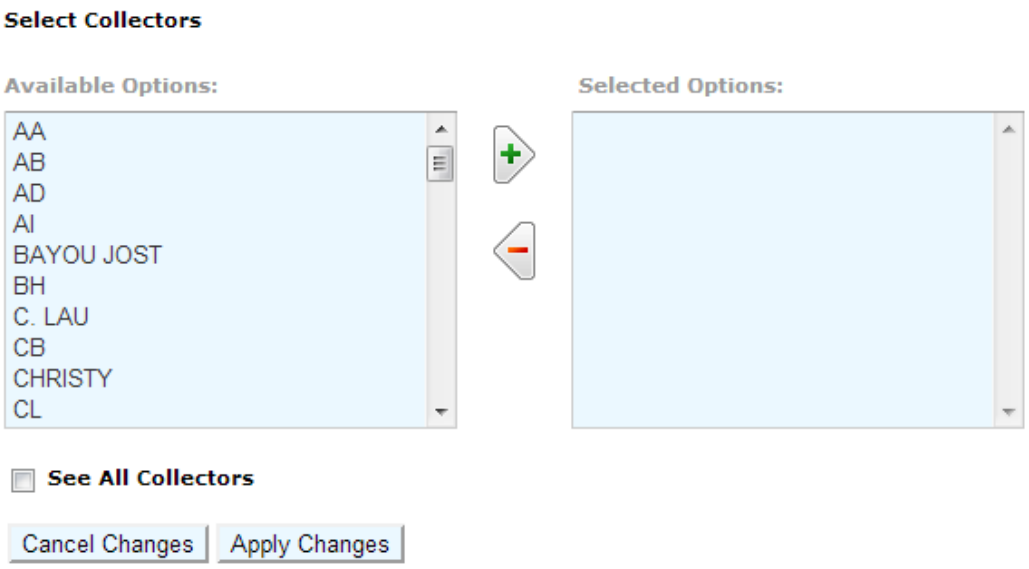
Air Temp.	Wind Dir.	Wind Speed	Turb.		Cond.	Salin.	Water Temp.	DO
30			2	TOP	20	10	30	6
				BOTTOM	20	10	30	5

Comments:

Annotate any comments about replicate

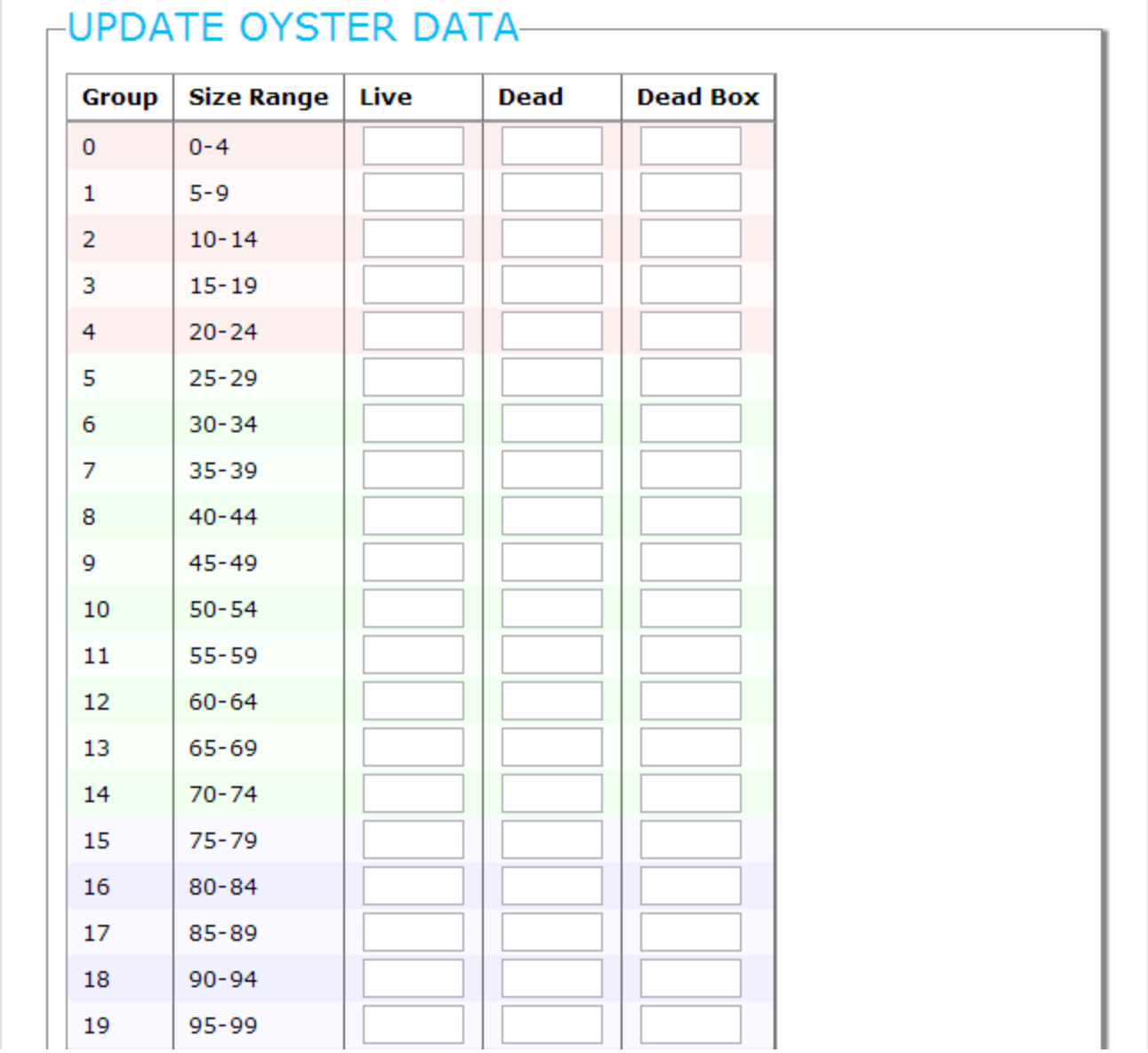
Replicates subform: Update replicate conditions, comments

The subform above can be accessed by clicking the "Update Replicate Info" button (see bottom of figure on P. 8). Here, environmental conditions can be edited and comments can be added, optionally.



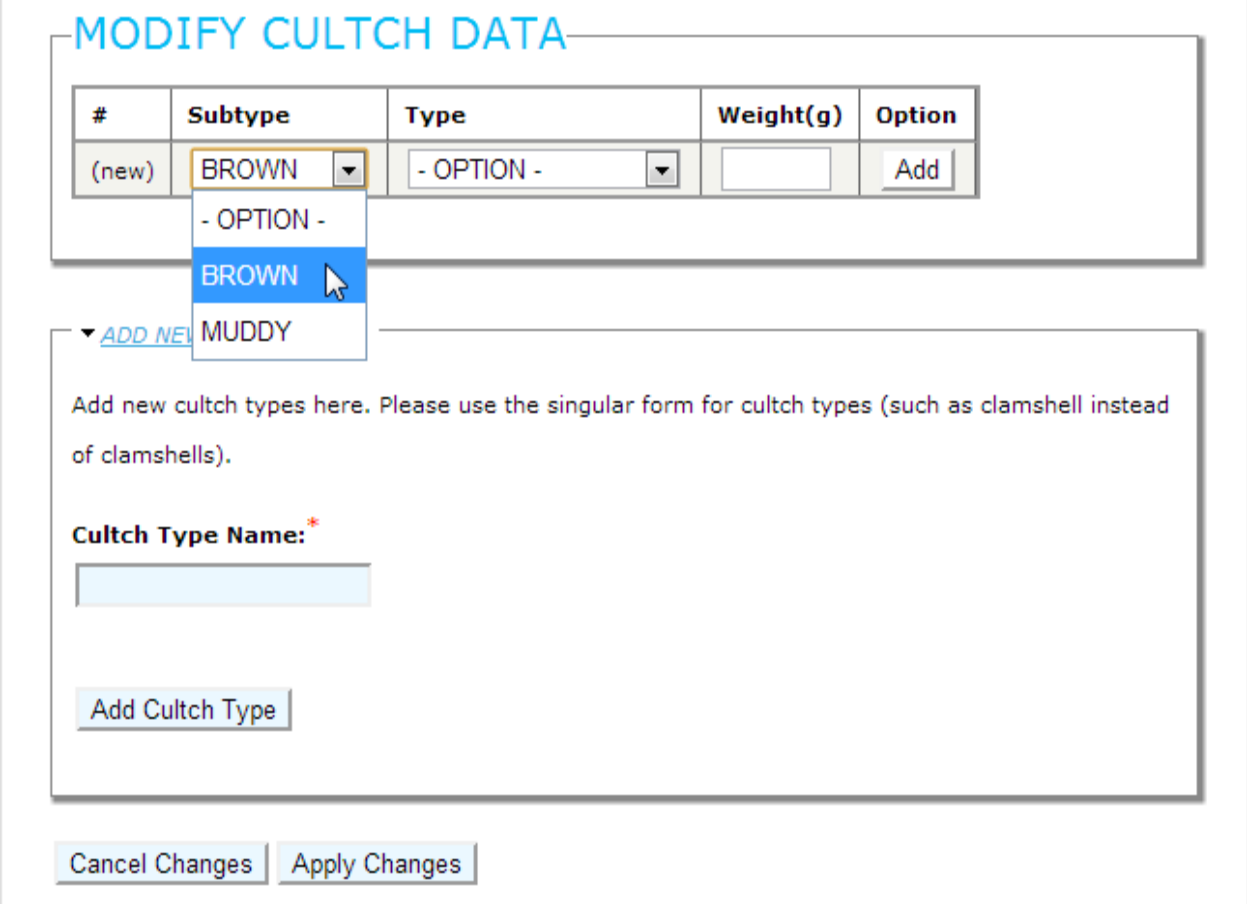
Replicates subform: Update the list of collectors

This subform is accessed by clicking "Update Collector Data". Double click the name or initials of collector (sampling personnel) to move it to the "Selected Options". By default, this only shows collectors already associated with the region of the replicate. To see all collectors, check the appropriate box at the bottom of the figure above. Additional collectors may be added after that point through this form, if needed, however caution is advised to avoid duplicates.



Replicates subform: Update oyster data

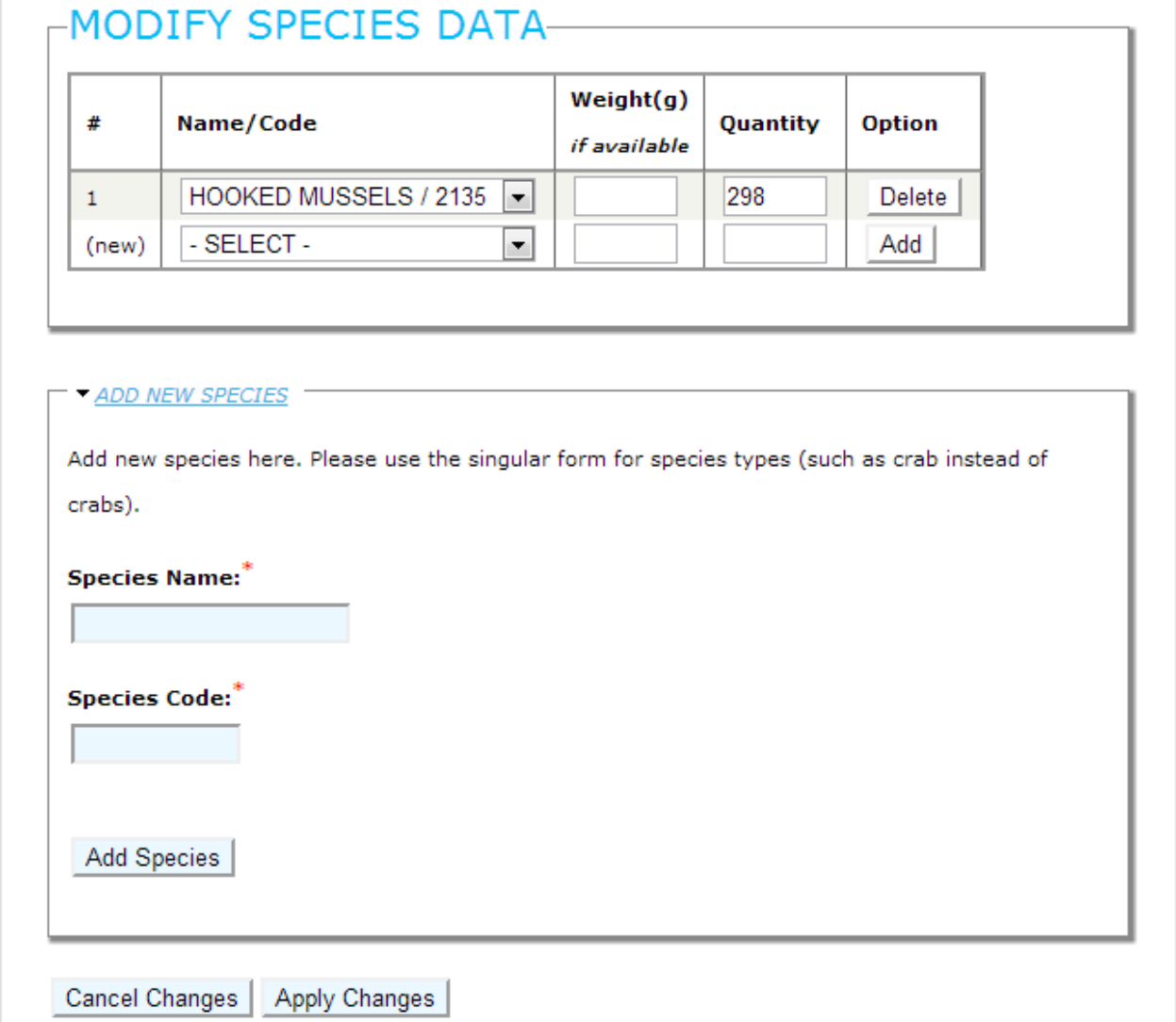
The subform above is reached by clicking “Update Oyster Data”. Here, a user can add the number of live, dead and dead box oysters found for various size groups. Sections of spat, seed and sack sizes are color coded here to help distinguish between the different groups. To remove an entry, just delete the numbers out or change them to zeroes. It is not necessary to fill in all blanks with zeroes, as blanks and zeroes are treated the same way.



Replicates subform: Input cultch data

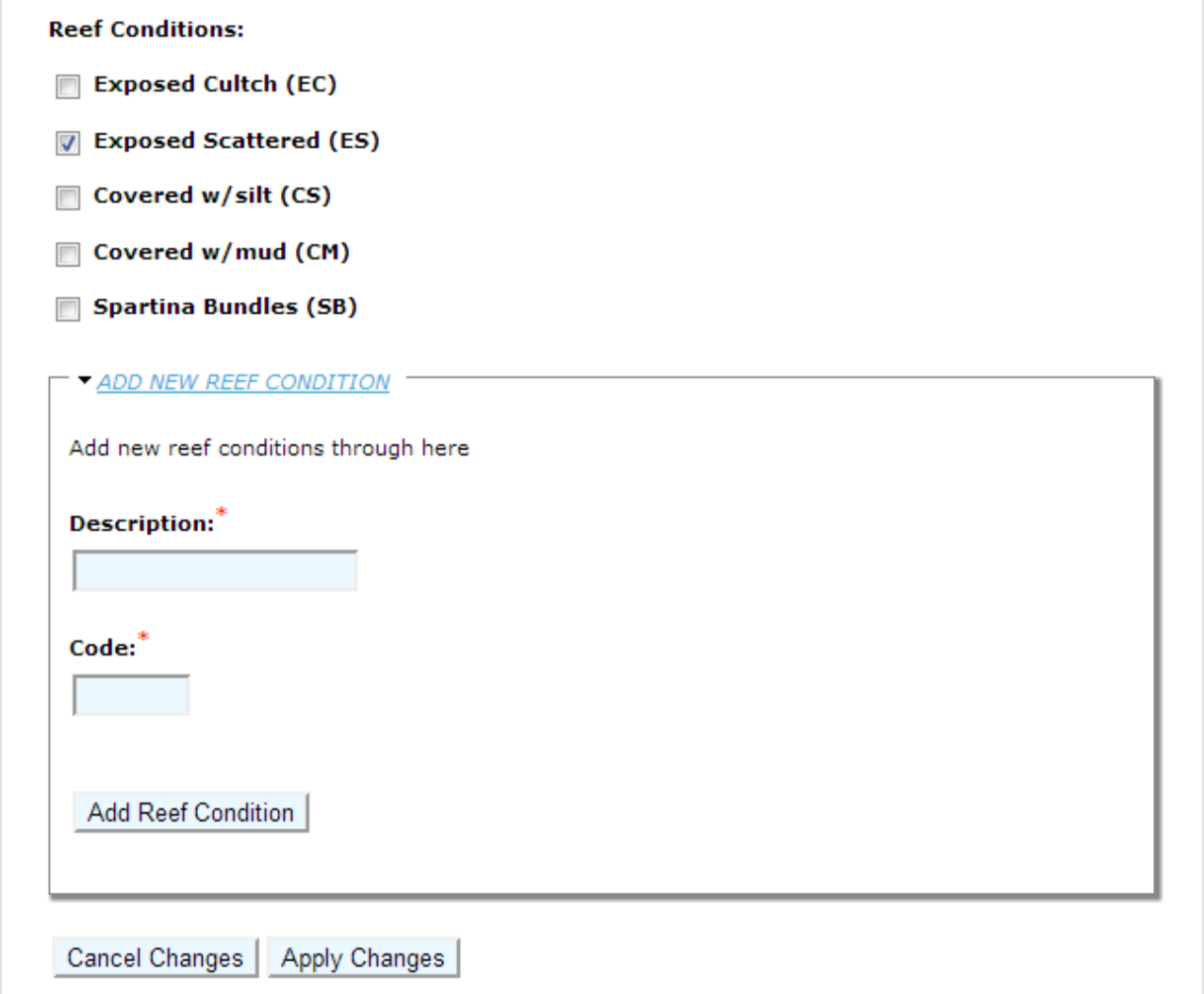
On the "Modify Cultch Data" subform, users are able to list the weight of a cultch subtype (brown, muddy) and cultch type (such as oyster shell). The weight is captured in grams. Click "Add" to associate that cultch to the replicate, at which point another line will appear for further data entry. "Add" will change to "Delete" for previous entries, this should be used to delete out unwanted lines.

When needed, new cultch types can be added through this subform. Cultch entries should be entered in the singular form. Please take care to avoid duplicates.



Replicates Subform: Input species data

In the Modify Species Data subform, the user is able to select from a list of species and input their weight (if available) and quantity. Users should fill in the fields and click "Add" to include that entry with the replicate being worked on. To remove previous entries, click "Delete" next to that line. When needed, new species can be added to the list by naming them and assigning them a LDWF code (usually four digits). Please input species in the singular form, and take care to avoid duplicate entries.



Replicates subform: Reef conditions

Click “Update Reef Data” to display the reef conditions subform. Here, the user can select from a list of checkboxes for various reef conditions. If the reef condition is not listed, users may add new conditions as needed. Please take care to avoid unnecessary duplication.

Management Forms

Two forms fall under the management category and are only accessible by those who are granted the manager role by an administrator. The two forms are:

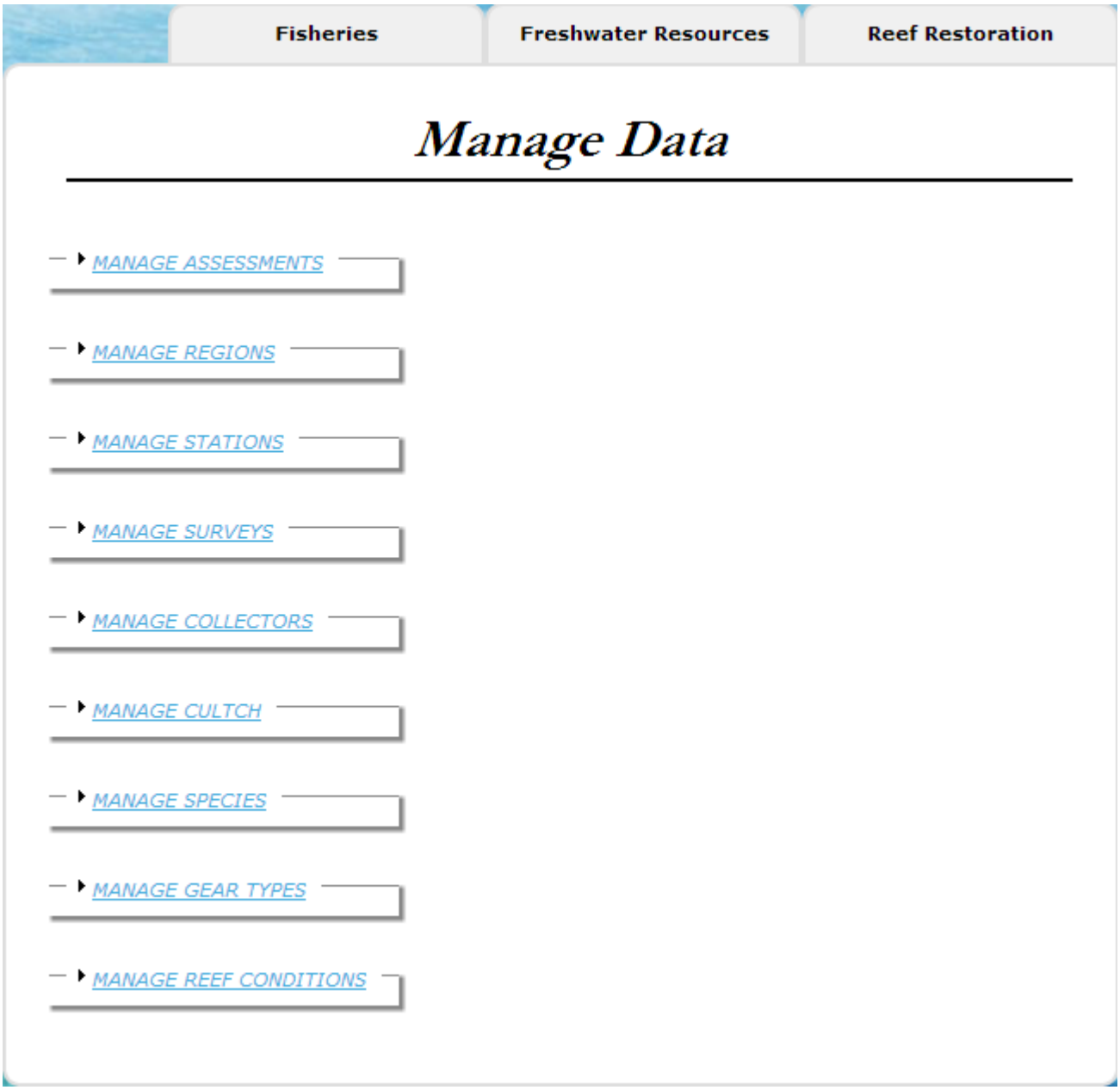
- Manage Data
- Manage User Permissions

Manage Data Form

The manage data form is intended to facilitate editing, adding to and deleting from various lists of data. These include:

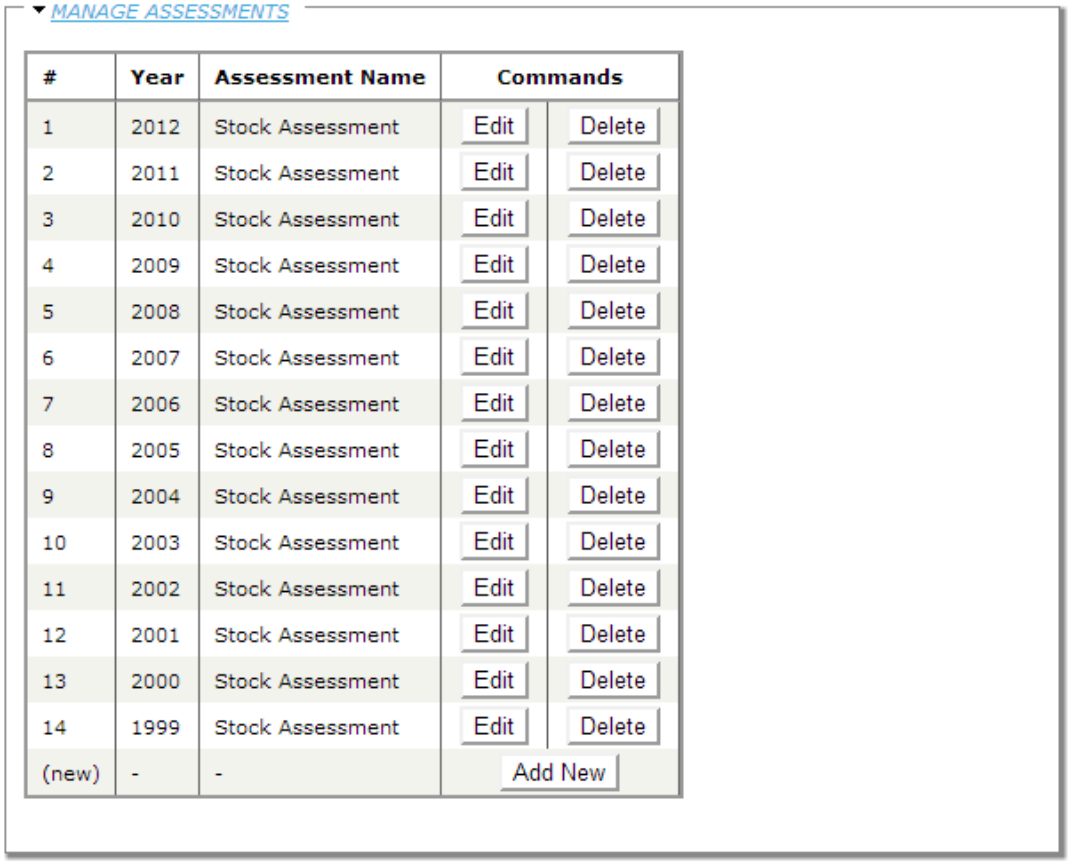
1. Assessments
2. Regions
3. Stations
4. Surveys* (cannot add here)
5. Collectors*
6. Cultch*
7. Species*
8. Gear Types
9. Reef Conditions*

*Users are able to add these on their own



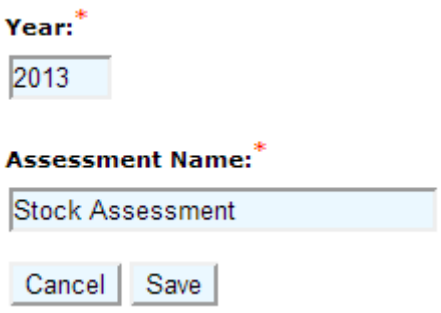
Manage Data Form: Add/edit/delete from various data sets

Typically, managers will need to use the manage data form to intervene if, for example, a new assessment must be added for the current year, a station has been split into its main entry and a shell station, or if a mistake was made when adding a particular cultch type, or any other similar situation. There are nine datasets associated with this form as viewed in the above figure.



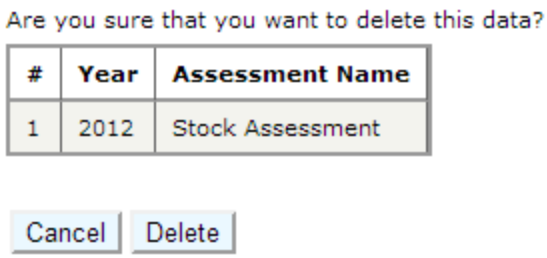
Manage Data Form: A list of all assessments

For each dataset, the presentation is mostly the same. When expanded, each will list all of the entries available, and on each row the user may click "Edit" or "Delete". In the last row managers may add new entries to the list, such as a new assessment in this case.



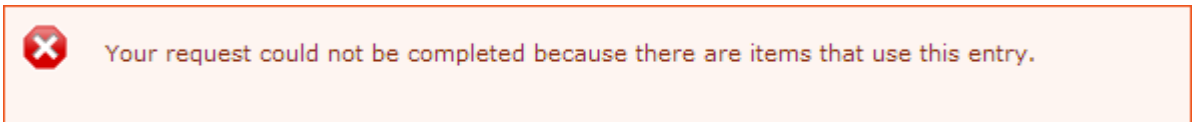
Manage Data Subform: Add/Edit entry screen

Clicking add or edit on a row of the dataset will open up another screen (subform) where the manager may edit various fields for that data item. Adding new entries will use the same subform.



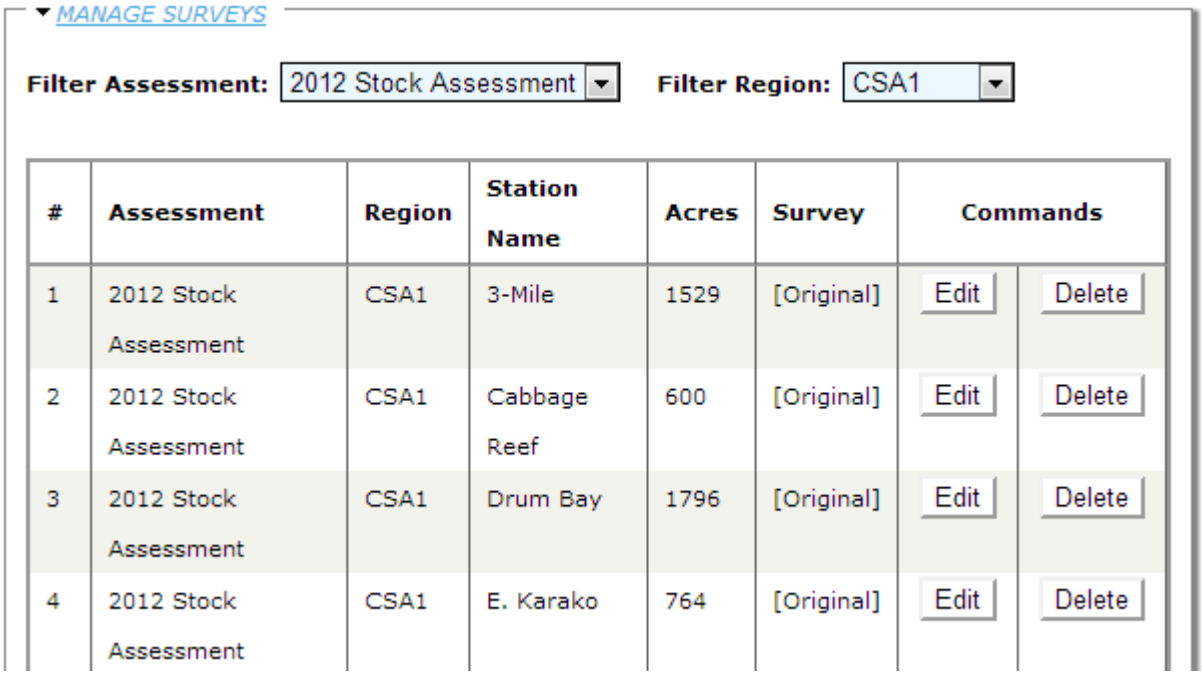
Manage Data Subform: Delete Confirmation screen

If a manager clicks “Delete” on a row from the manage data form, then a confirmation screen will appear (shown above), and once confirmed the item will be eradicated from the database. Clicking “Cancel” will cancel out without any changes occurring.



Manage Data Form: Example of failed deletion attempt

Most deletions will fail if there is any associated data with the particular entry. The message above will be displayed. For example, assume a user adds a cultch type “shrimp”, associates it with a replicate, and then later decides that it should not be there. If a manager attempts to delete it, they will be unsuccessful since this entry is being “used”. A user must go into the replicate, remove the reference to shrimp, and then the manager will be able to delete out the unneeded cultch type.

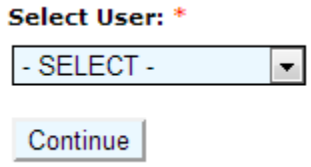


Manage Data Form: Manage Surveys--Filters

Stations and surveys are lengthy lists, and have filters associated with them to narrow down the results. Use these filters to specify the assessment (Year + Name) and/or region. The filters are already selected by default, and must be changed to access different data segments.

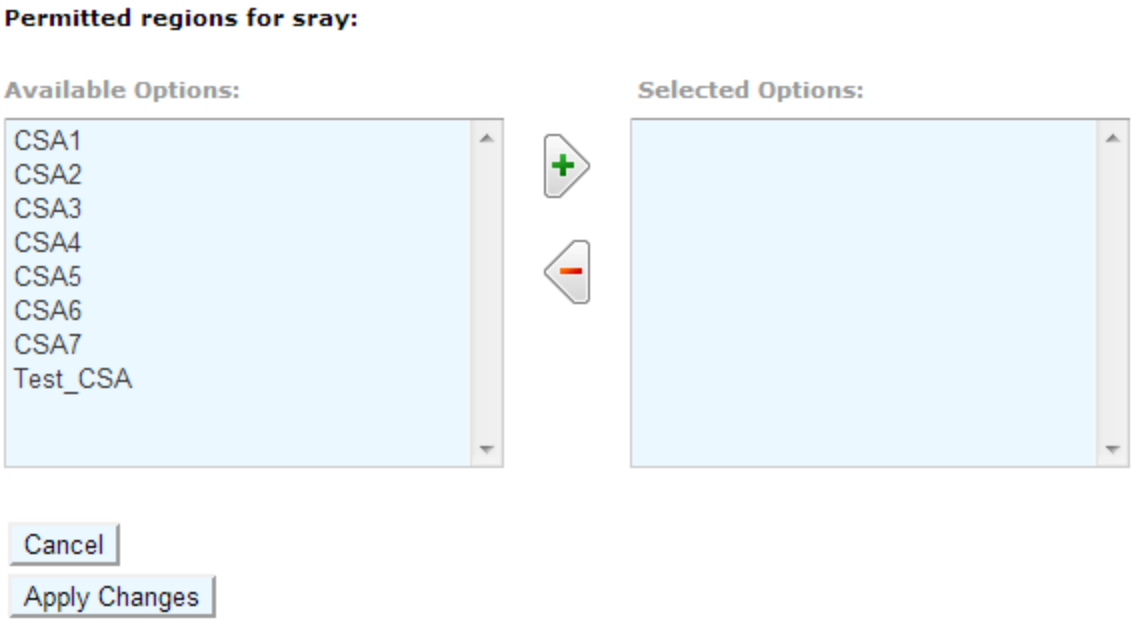
Manage User Permissions Form

The "Manage User Permissions Form" is used for permitting authenticated users (those who have fully registered) to gain access to CSAs/Regions through the data entry forms. Once a user has been given at least one region they may access, they are elevated to "trusted user" status and will automatically be given access to the data entry forms.



Manage User Permissions: Select a user from the dropdown list

First, a manager selects a user to modify his/her permissions. Note that managers and administrators will not appear on the list, and already have access to every region without requiring explicit permissions. Also, a user must be fully registered before they will appear on this list.



Manage User Permissions: List of regions for a given user

Once a user is selected, this screen will be displayed. In order to give users access to a region(s), double click on the region(s) or select each and click the button with the green plus icon. Items on the left are unselected, items on the right are selected.

Contact

For details about data input or management forms, please contact: D. Josh Gallegos at dgallego@uno.edu.

Model Use and Application

The numerical model for the sustainable management of oysters in Louisiana is presented in this section. As explained previously, the model uses no-net-shell-loss as a criterion for resource sustainability. Annual stock assessments of oyster density and size are input into the model, which estimates the number of sacks of seed and market-sized oysters that are harvestable with no net loss of reef cultch. This section of the manual briefly describes a standard application of the oyster model. Data input from the previous section are used to run different scenarios or simulations of the model.

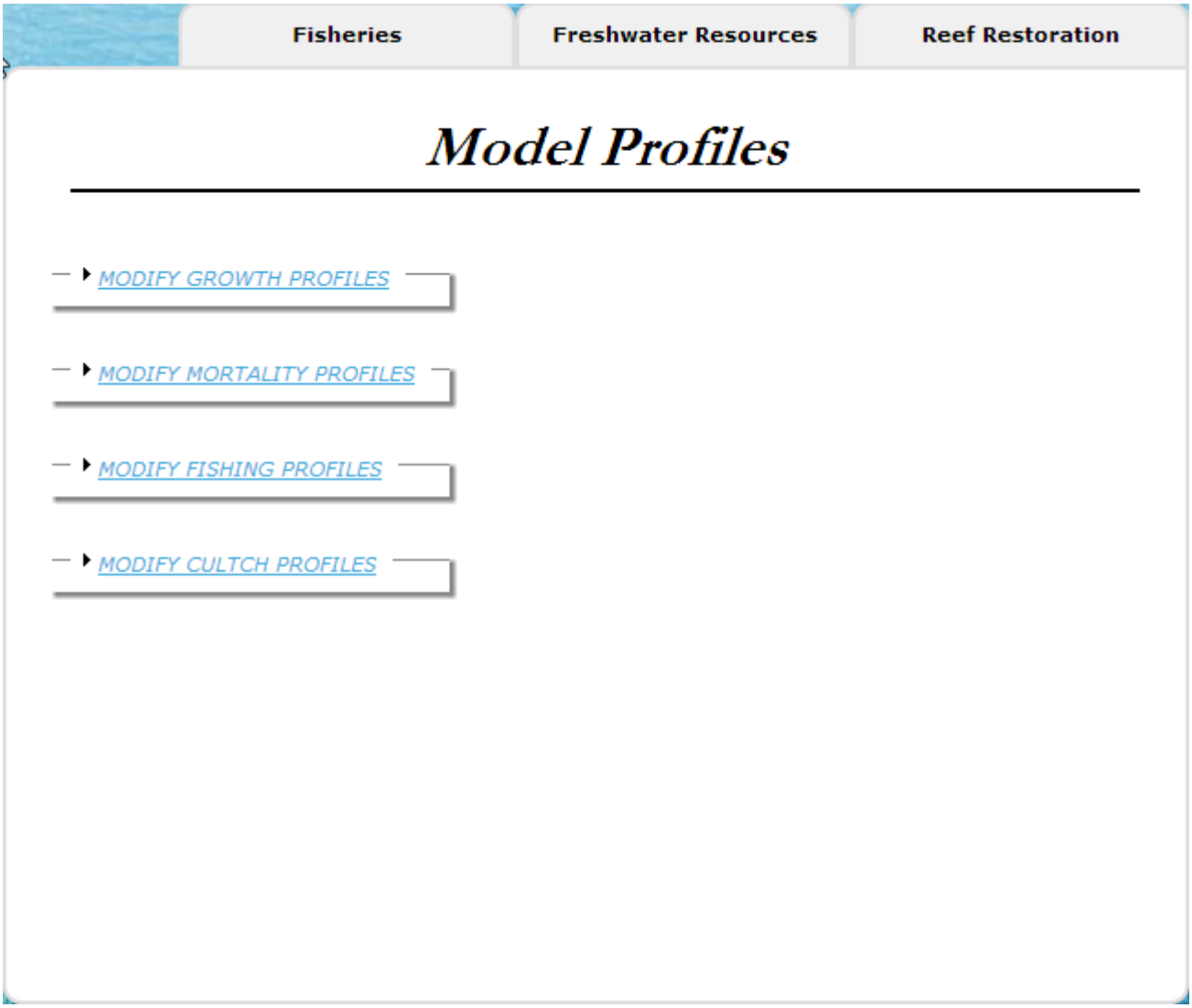
The model is broken down into three forms:

- Model Profiles
- Model Setup
- Model Report

All of the model forms are publicly accessible, but require that the user register in order to view them. If the user is authenticated (registered and confirmed their account), but not trusted (have access for at least one region for data entry) or of higher authorization, they will be unable to publish their results – thereby, preventing other users from seeing what they are doing.

Model Profiles

The “Model Profiles Form” is responsible for many of the specific configurations for the growth, mortality, fishing and cultch. Here, the user may put in the specific values that can be applied to many different surveys instead of configuring each one individually.



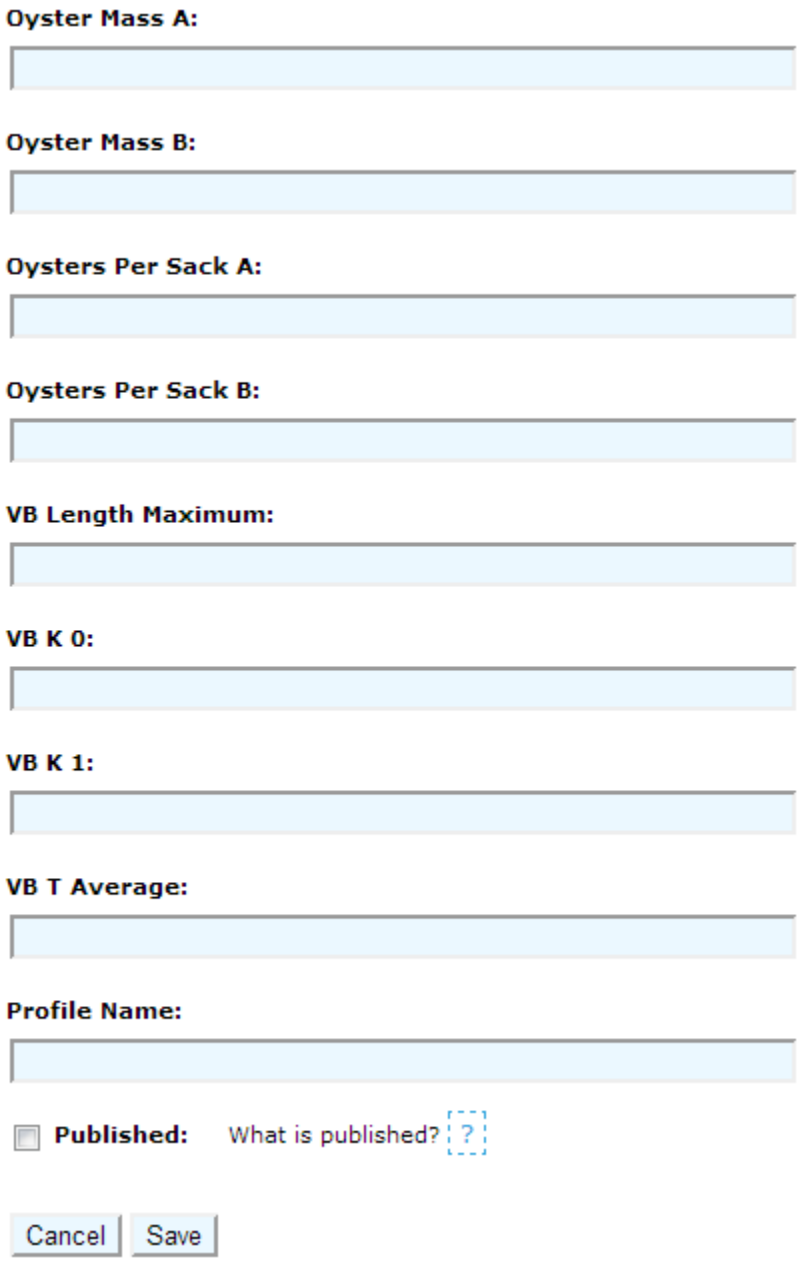
Model Profiles Form: Initial view of the model profiles

Here, the four profile datasets are collapsed as to not overwhelm the screen. To expand each one and view them, click on the name in blue.

Model Profiles Form: A view of the Modify Growth Profiles screen

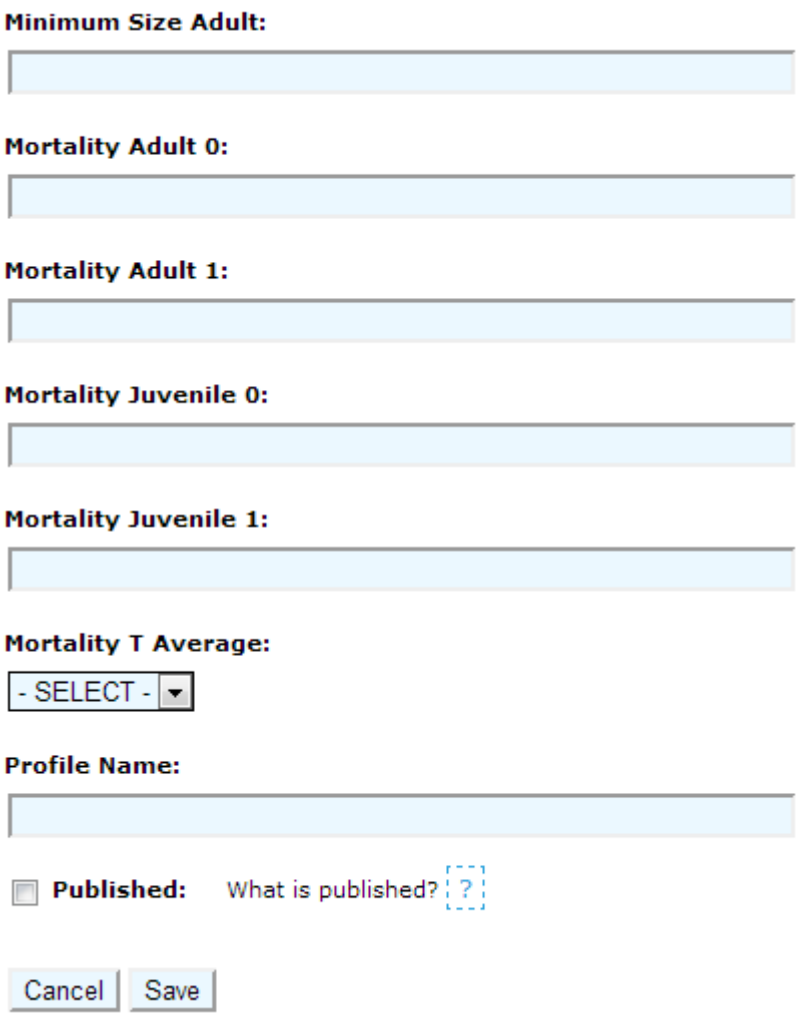
Here, "Modify Growth Profiles" has been expanded. Two lists are available: On the top is a list of profiles defined by the user who is logged in, and on the bottom is a list of other published profiles by other users which can be utilized by the model simulation.

On the top list, for any given entry, the user may click "Edit" or "Delete" to modify that given line. To add new customized profiles, the user may click "Add New". When this is done the screen below appears.



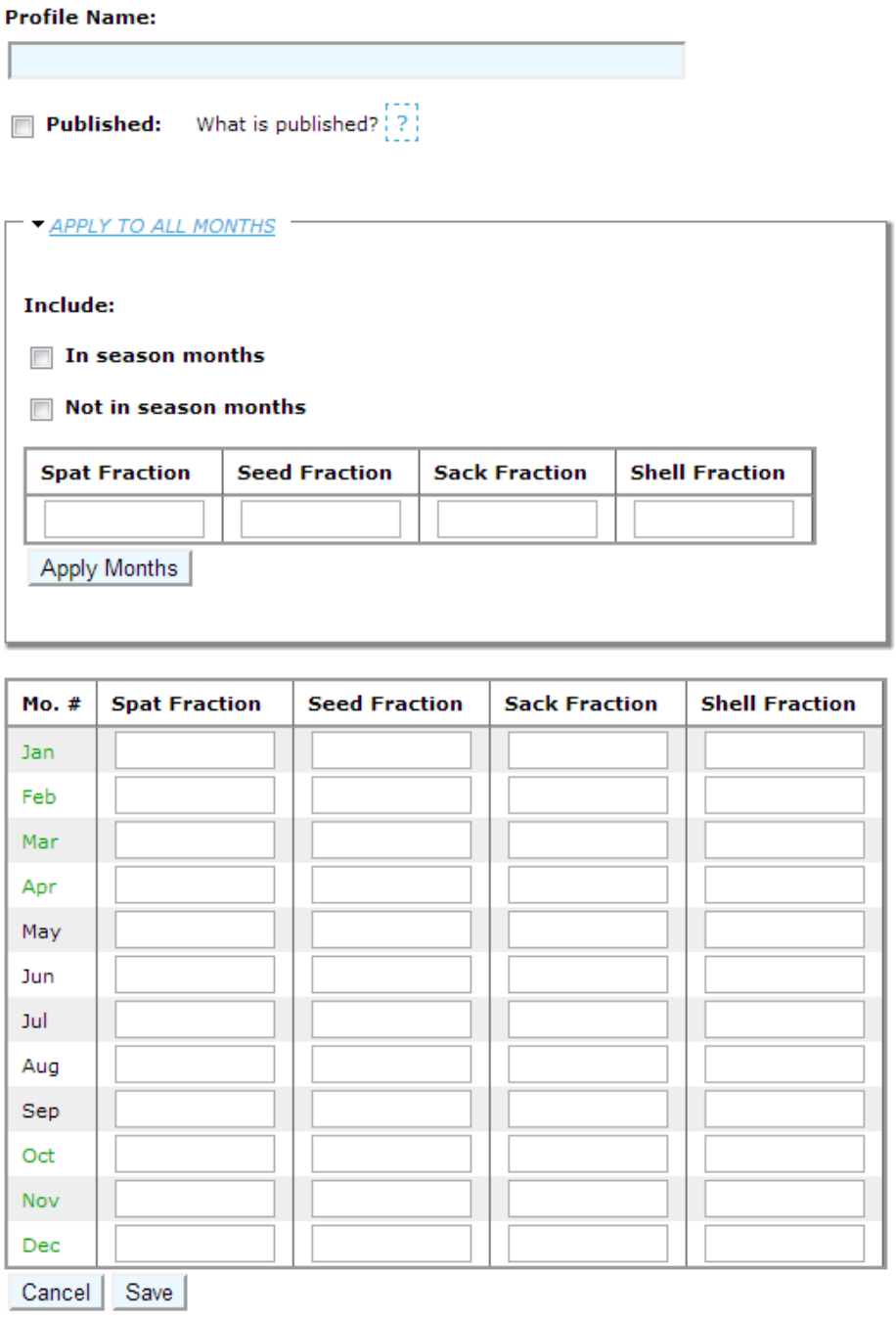
Model Profiles Subform: Adding a new growth profile

The subform above allows the user to add or edit a growth profile. Each field represents a value that the model will use in its calculations. Each profile should be given a meaningful name using the "Profile Name" field. If the user is trusted, they may choose to "publish" their profile, thereby, allowing other users to see it when they're selecting their profiles for the model simulation. If it is not published, then only the user who created it will be able to access it.



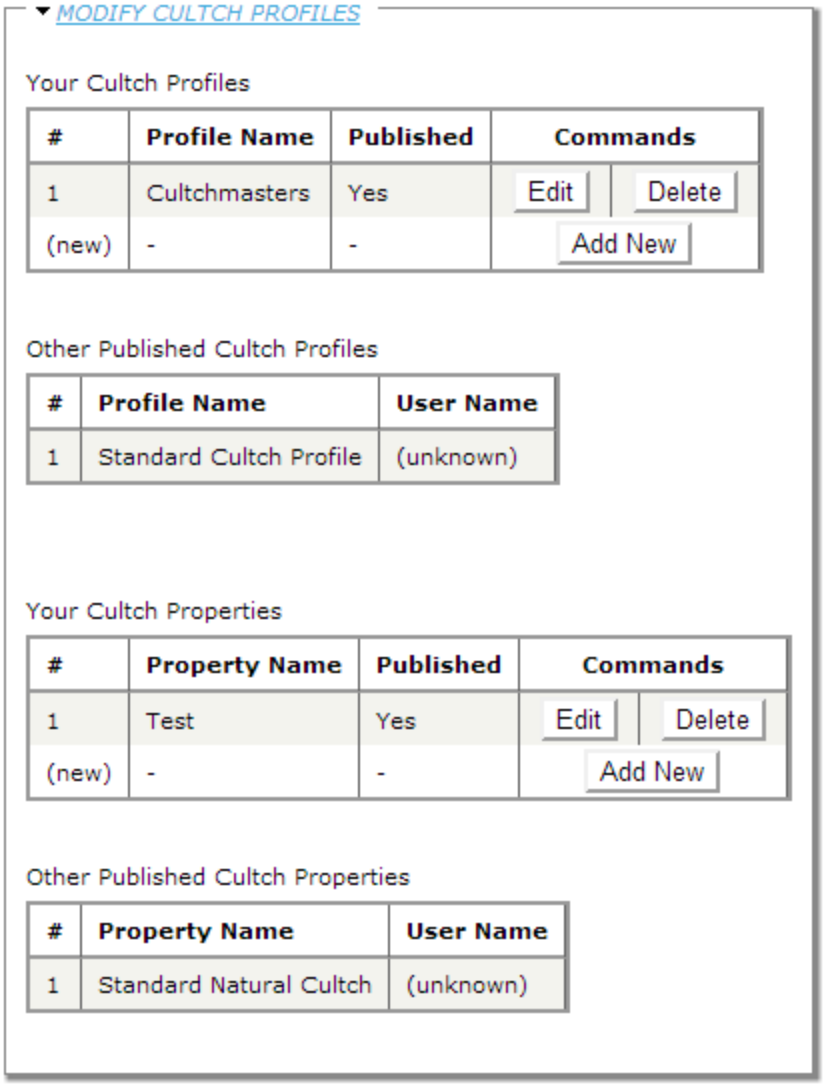
Model Profiles Subform: Adding a new mortality profile

Using the "Modify Mortality Profile" subform, the user may edit or create a new mortality profile.



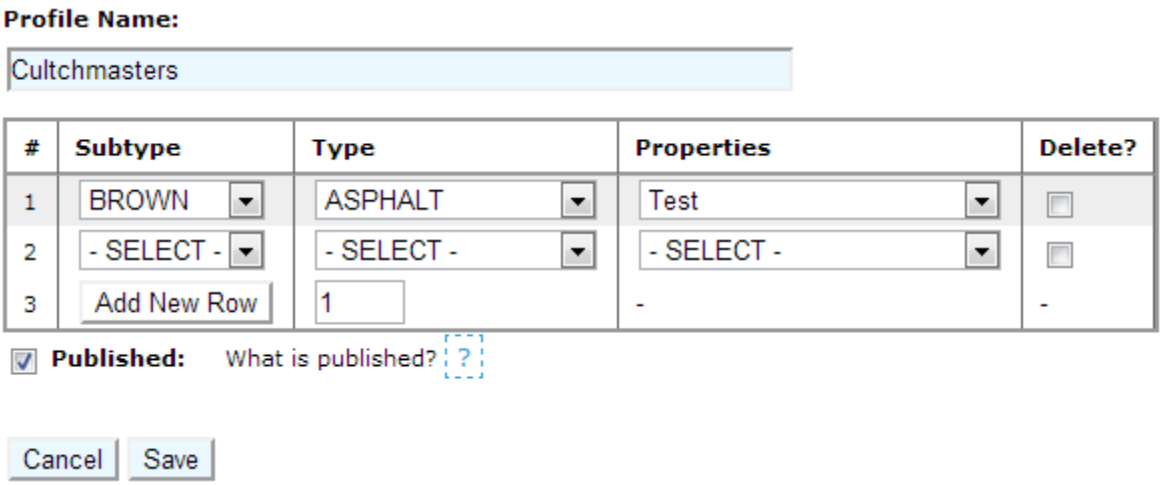
Model Profiles Subform: Adding a new fishing profile

Clicking on the "Modify Fishing Profile" displays the subform above, allowing the user edit or create a new fishing profile. The months colored in green are indicated to be in-season months. At the top, the user may use the "Apply to All Months" utility to fill in the same values for every month. To do so, click either in season and/or not in season, fill in a value, and click "Apply Months". The user may further alter the values after that.



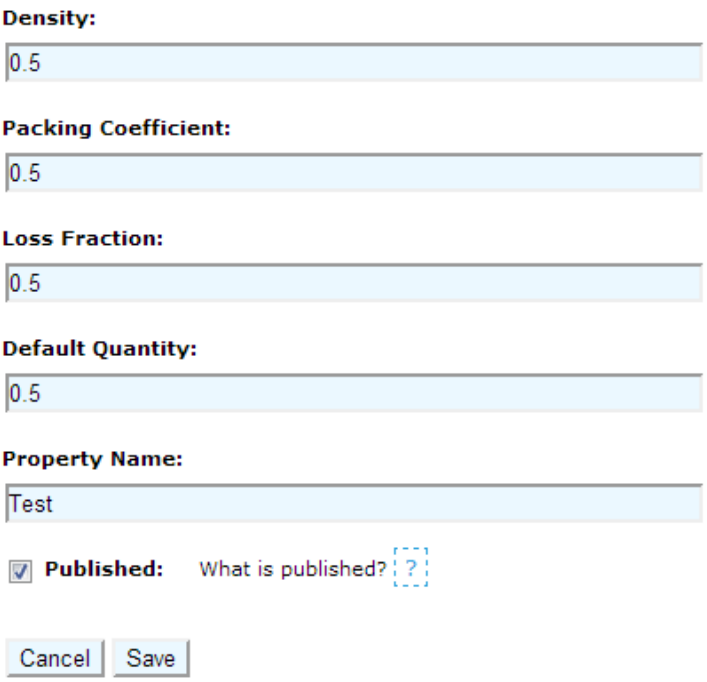
Modify Profiles Form: Cultch profiles

Expanding "Modify Cultch Profiles" displays the screen shown above. Cultch profiles are different in that they have two components of data associated with them. Each cultch profile allows the user to select particular properties to apply to a cultch type. Since the properties are highly repetitive, they can be defined and re-used with the second list, Cultch Properties.



Model Profiles Subform: Edit cultch profile screen

Clicking edit on a row from "your cultch profiles" displays the subform above. This allows cultch profiles to be added or edited. Above, the first line defines the property for the cultch type "Brown Asphalt". The properties will be defined as shown in the next figure. To add new rows, click "Add New Row". The number to the right of the button allows a user to add many rows at once. Each cultch type that the model simulation should consider can be listed here.

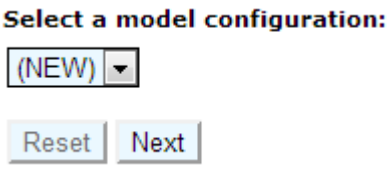


Model Profiles Subform: Edit cultch property screen

This subform allows the user to add/edit cultch properties, defining a set of cultch characteristics.

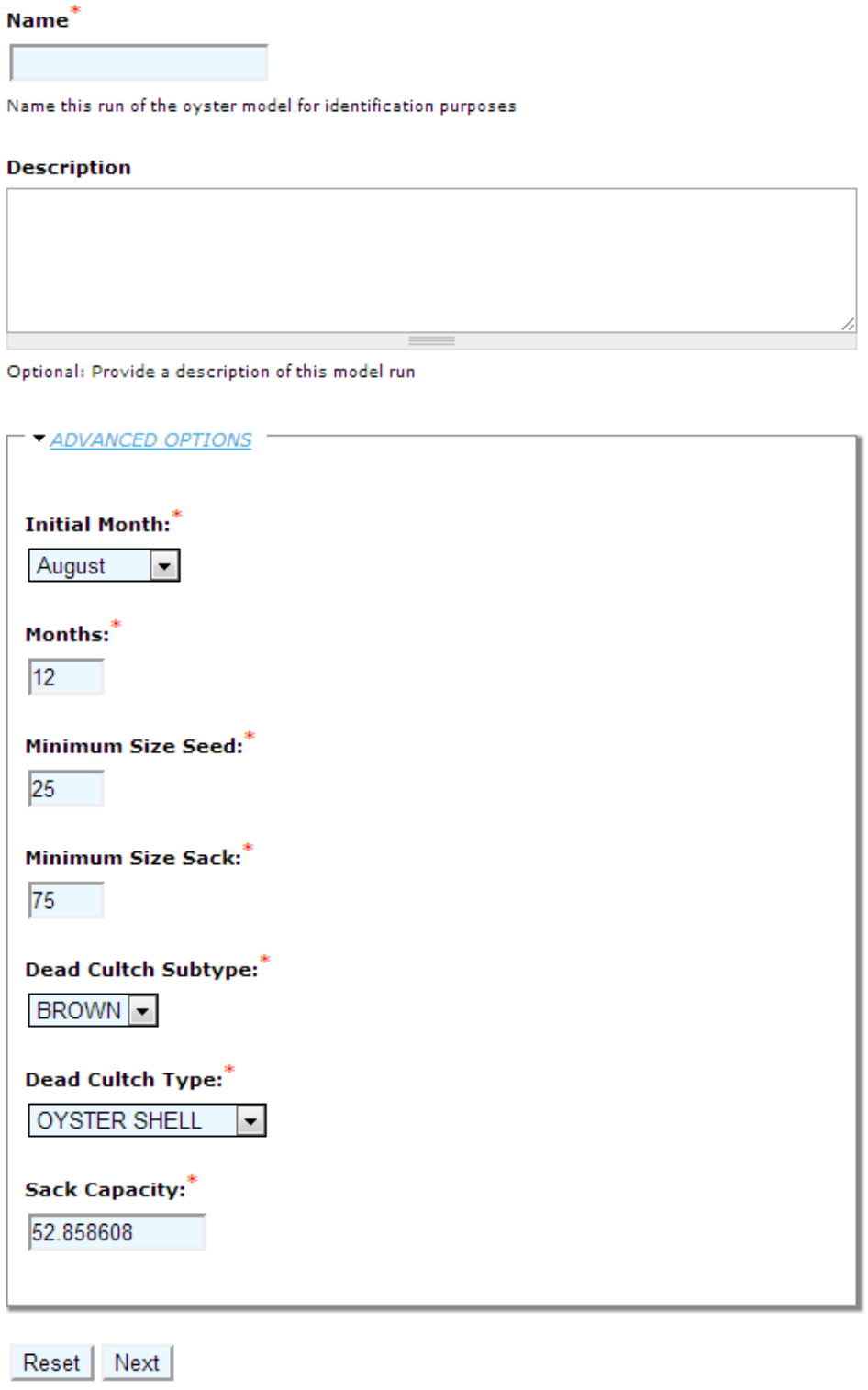
Model Setup

Model setup is a series of steps which can be saved and define a particular model run, combining the different profile types, survey selections and other configurations for the simulation.



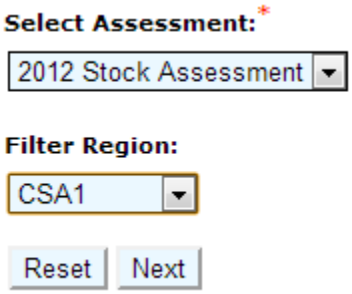
Model Setup First Screen: Select a configuration

Here, a user may re-use a previous configuration allowing them to retain all or most of a previous simulation's settings, or define a new one (default). Click Next.



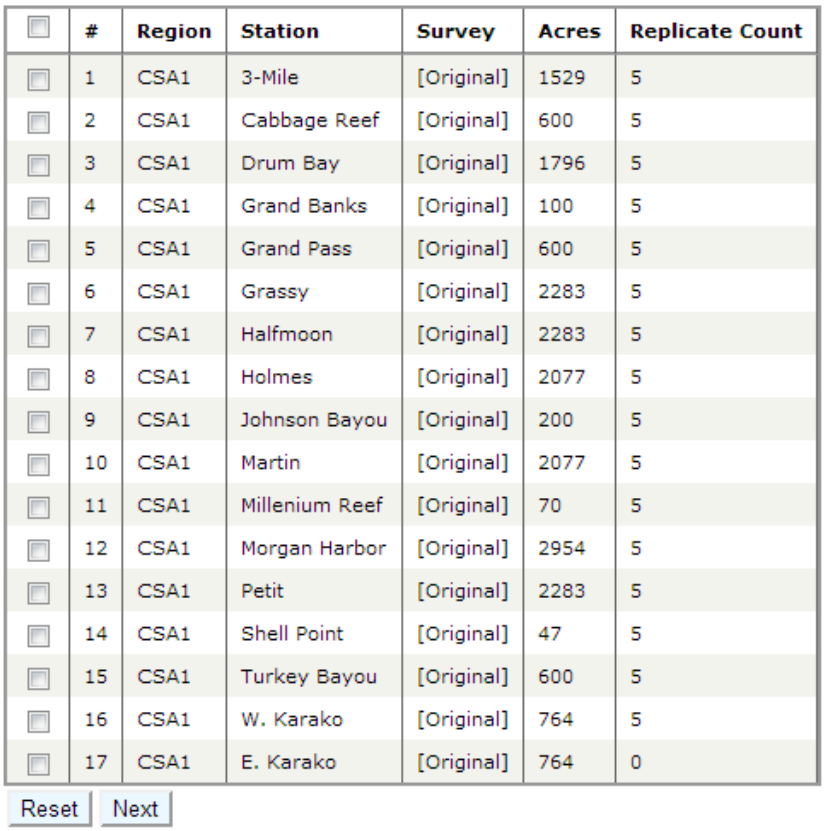
Model Setup Second Screen: Configuring the simulation

Here, the user may provide a name and description. Additionally, advanced configurations are available but default values are always provided, and typically should be left as is. Click Next.



Model Setup Third Screen: Filtering by assessment and region

Next, the user will filter which surveys they are interested in. It is required that the user select an assessment (Year + Title), however filtering by region is optional. If no filter is applied to region, then the user could run the simulation across different regions if needed. Click Next.

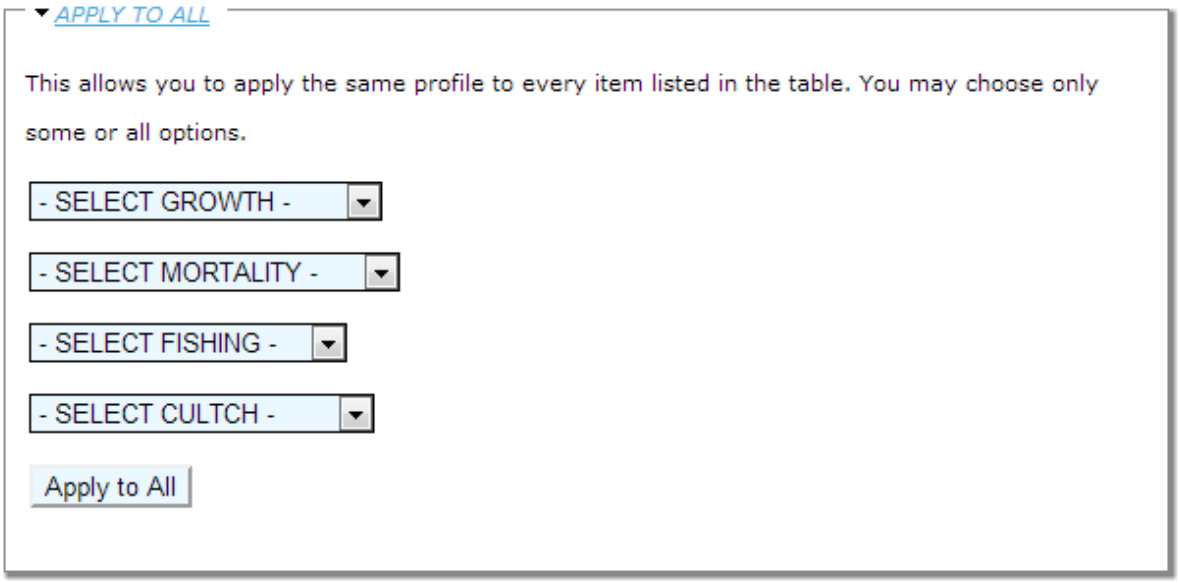


	#	Region	Station	Survey	Acres	Replicate Count
☐	1	CSA1	3-Mile	[Original]	1529	5
☐	2	CSA1	Cabbage Reef	[Original]	600	5
☐	3	CSA1	Drum Bay	[Original]	1796	5
☐	4	CSA1	Grand Banks	[Original]	100	5
☐	5	CSA1	Grand Pass	[Original]	600	5
☐	6	CSA1	Grassy	[Original]	2283	5
☐	7	CSA1	Halfmoon	[Original]	2283	5
☐	8	CSA1	Holmes	[Original]	2077	5
☐	9	CSA1	Johnson Bayou	[Original]	200	5
☐	10	CSA1	Martin	[Original]	2077	5
☐	11	CSA1	Millenium Reef	[Original]	70	5
☐	12	CSA1	Morgan Harbor	[Original]	2954	5
☐	13	CSA1	Petit	[Original]	2283	5
☐	14	CSA1	Shell Point	[Original]	47	5
☐	15	CSA1	Turkey Bayou	[Original]	600	5
☐	16	CSA1	W. Karako	[Original]	764	5
☐	17	CSA1	E. Karako	[Original]	764	0

Reset Next

Model Setup Fourth Screen: Survey selection

All surveys that matched the criteria will be displayed. Check the box on the left of the row to select it, or click the checkbox at the very top to select everything at once. Click Next.



#	Survey	Profile Selection	
1	CSA1 3-Mile [Original]	- SELECT GROWTH - - SELECT MORTALITY - - SELECT FISHING - - SELECT CULTCH -	**Mult:** 1 **Use Data**
2	CSA1 Cabbage Reef [Original]	- SELECT GROWTH - - SELECT MORTALITY - - SELECT FISHING - - SELECT CULTCH -	**Mult:** 1 **Use Data**
3	CSA1 Drum Bay [Original]	- SELECT GROWTH - - SELECT MORTALITY - - SELECT FISHING - - SELECT CULTCH -	**Mult:** 1 **Use Data**

Model Setup Fifth Screen: Configuring surveys

The user can now configure each survey with a model profile, either using published options or profiles that the user created themselves in the "Model Profiles" form. The "Mult" option defines a fishing multiplier, and can be used to easily adjust down the fishing fraction without changing the property. Use Data means that the simulation will use cultch data for that survey, when available.

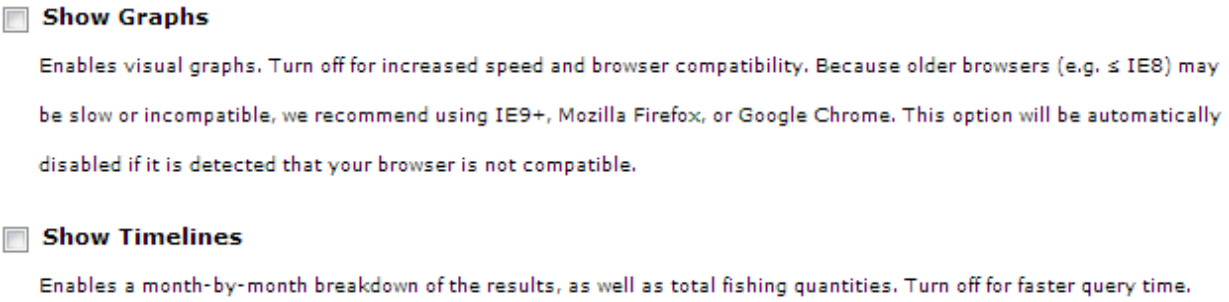
At the top of the screen, "Apply All" allows the user to choose some of the profiles and apply it to all surveys. Click "Run Model" to run the simulation and proceed to the Model Report.

Model Report

Model report shows the results of a particular model simulation, as run through in the model setup form.

Model Report Form: Message and display after a successful simulation run

After clicking "Run Model", this screen will appear with the green message if the model run was successful. Any other previous runs will be listed here as well. Click "View" on run you wish to view to see the results of the simulation.

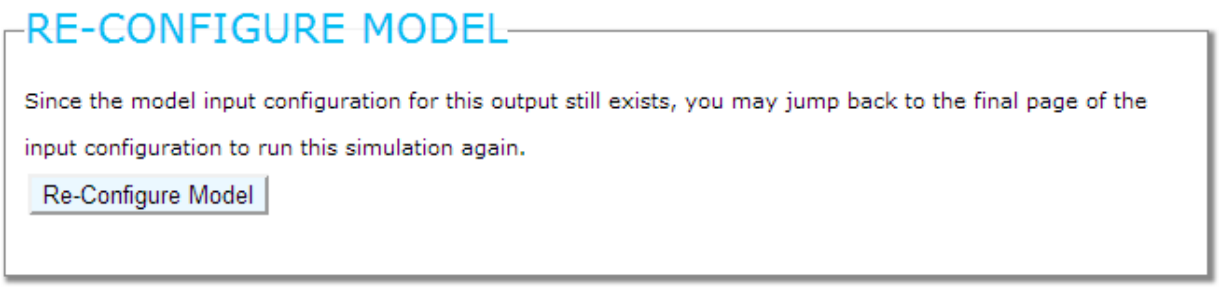


Beneath the table of previous runs are two checkboxes for enabling additional features. Selecting "Show Graphs" will show graphical images of the results. This may be enabled for performance or browser-compatibility reasons. The "Show Timelines" option toggles the computation/display of per-month data. This is usually not important until a suitable simulation is made and the results are ready to be analyzed in depth.

Surveys Simulated						
☐	**Code**	**No.**	**Name**	**CSA**	**Acres**	**m²**
☑		1	Lake Felicity	CSA4	40	161,874
☑		2	Lake Chien 2004	CSA4	15	60,703
☑		3	Lake Chien 2009	CSA4	22	89,031
			ALL SURVEYS		77	311,608
			INCLUDED SURVEYS		77	311,608

Model Report Form: Surveys simulated

The Surveys Simulated table displays a list of the surveys that were used in the simulation. Next to each is a checkbox. The results displayed in the main results section (below) will only factor in the surveys that are checked. To update the selection after modifying the checkboxes, click the "Update Survey Inclusions" button.



Model Report Form: Re-Configure Model

Since it is often necessary to fine-tune the model by experimenting with different fishing multipliers, clicking the "Re-Configure Model" button will allow the user to jump back to the last page of the Model Setup form to re-run the model. This will not over-write the current results. This option is only available if the associated model configuration still exists.

Input Parameters	
Parameter	**Value**
Persist	No
Output Label	Standard Model (New 4)
Input Name	Standard Model
Input Description	A standard model with best-known values.
Run Date	2013-06-20 12:41:01.287
Months	12
Initial Month	August
Min. Size Seed	25 mm
Min. Size Sack	75 mm
Sack Capacity	52.8586 L
Dead Shell Type	BROWN OYSTER SHELL

Persist Results

Model Report Form: Input Parameters

This summary table displays the main input parameters specified when the simulation was run. Beneath is an option to “Persist Results” if the “Persist” value is shown as “No” in the table. Simulations that are not persisted may be deleted regularly as part of regular site maintenance. To avoid this, check “Persist Results” to safeguard the results. If the results are already persisted, the option “Don’t Persist Results” will be shown instead.

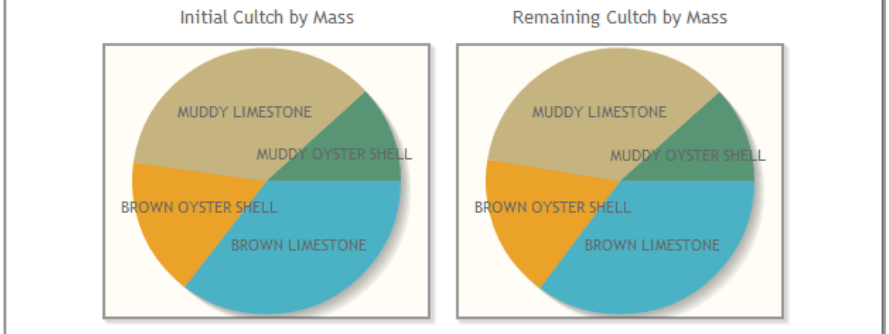
Results Summary (per m²)			
Meta	**Initial Value**	**Final Value**	**Percent Change**
Total Cultch	13,369 g	11,273 g	▼15.7%
Dead Cultch	2,255 g	1,967 g	▼12.7%
Oyster Count	4.10	1.51	▼63.2%
Oyster Mass	41.28 g	173.68 g	▲320.7%
Avg. Oyster Size	102.00 mm	132.82 mm	▲30.2%

Model Report Form: Results Summary

The Results Summary table displays the at-a-glance results returned by the model. It displays the per-square-meter cultch and oyster initial and final values, as well as the percent change. This and the remainder of the results in this section only consider the checked, included stations from the Surveys Simulated table above.

The next two sections are available for both oyster and cultch (hereby called “resources”), broken down by count (for oysters only), mass, and sacks.

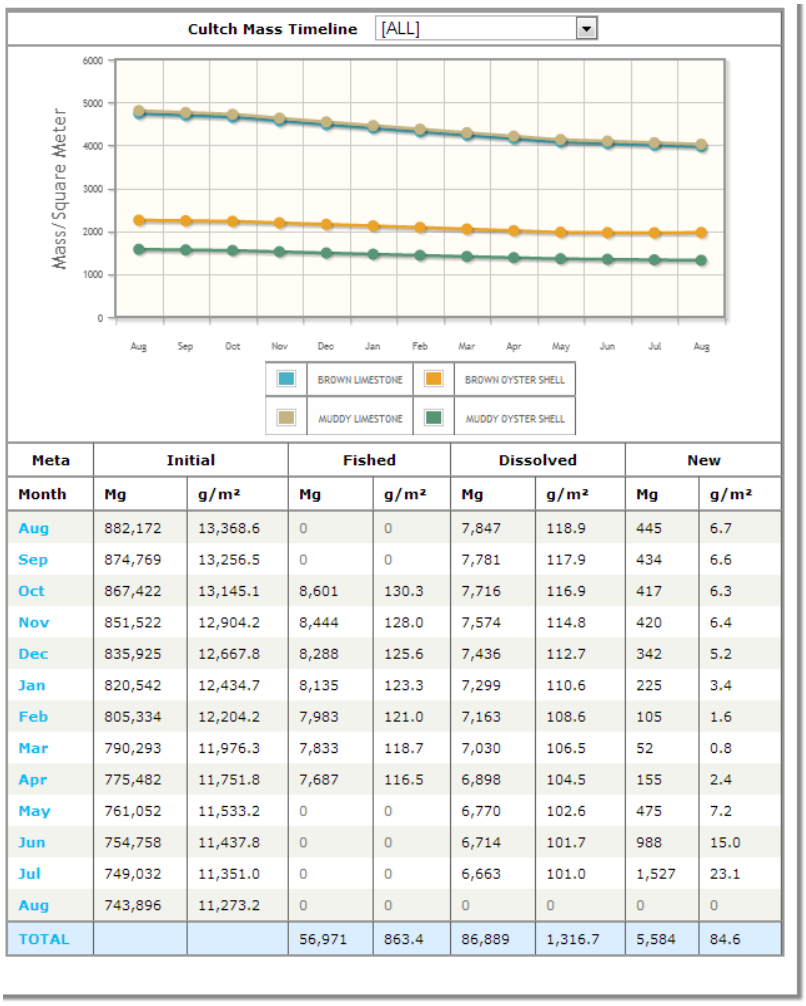
Cultch Mass Summary



Meta	Initial		Remaining		Change
Type	**Mg**	**g/m²**	**Mg**	**g/m²**	**% Change**
BROWN LIMESTONE	312,400	4,734.2	261,573	3,963.9	▼16.27%
BROWN OYSTER SHELL	148,778	2,254.6	129,823	1,967.4	▼12.74%
MUDDY LIMESTONE	317,001	4,803.9	265,425	4,022.3	▼16.27%
MUDDY OYSTER SHELL	103,994	1,575.9	87,074	1,319.5	▼16.27%
ALL	882,172	13,368.6	743,896	11,273.2	▼15.67%

Model Report Form: Summary views

This section displays pie graphs (if enabled) of the quantity breakdown for the current resource, along with a table of each resource’s initial extrapolated value, density, and changes.



Meta	Initial		Fished		Dissolved		New	
Month	Mg	g/m²	Mg	g/m²	Mg	g/m²	Mg	g/m²
Aug	882,172	13,368.6	0	0	7,847	118.9	445	6.7
Sep	874,769	13,256.5	0	0	7,781	117.9	434	6.6
Oct	867,422	13,145.1	8,601	130.3	7,716	116.9	417	6.3
Nov	851,522	12,904.2	8,444	128.0	7,574	114.8	420	6.4
Dec	835,925	12,667.8	8,288	125.6	7,436	112.7	342	5.2
Jan	820,542	12,434.7	8,135	123.3	7,299	110.6	225	3.4
Feb	805,334	12,204.2	7,983	121.0	7,163	108.6	105	1.6
Mar	790,293	11,976.3	7,833	118.7	7,030	106.5	52	0.8
Apr	775,482	11,751.8	7,687	116.5	6,898	104.5	155	2.4
May	761,052	11,533.2	0	0	6,770	102.6	475	7.2
Jun	754,758	11,437.8	0	0	6,714	101.7	988	15.0
Jul	749,032	11,351.0	0	0	6,663	101.0	1,527	23.1
Aug	743,896	11,273.2	0	0	0	0	0	0
TOTAL			56,971	863.4	86,889	1,316.7	5,584	84.6

Model Report Form: Timeline views

If enabled, this section will display a monthly breakdown of each resource, along with line graphs (if enabled) of each resource's relative quantity. Clicking on the legend beneath the graph will enable/disable its appearance in the chart.

Contact

For questions concerning technical details of the model, please contact Nathan Cooper at ncooper@my.uno.edu.

References

1. Louisiana Department of Wildlife and Fisheries (LDWF). 2010. Oyster Stock Assessment Report of the Public Oyster Areas in Louisiana. Seed Grounds and Seed Reservations. Oyster Data Report Series. No. 16, July.

2. Soniat, T. M., J. M. Klinck, E. N. Powell, N. Cooper, M. Abdelguerfi, E. E. Hofmann, J. Dahal, S. Tu, J. Finigan, B. S. Eberline, J. F. La Peyre, M. K. La Peyre & F. Quaddoura. 2012. A shell-neutral modeling approach yields sustainable oyster harvest estimates: a retrospective analysis of the Louisiana state primary seed grounds. *J. Shellfish Res.* 31:1103-1112.

3. Soniat, T. M. 2012. Synopsis of the First Annual Louisiana Oyster Stock Assessment Workshop. University of New Orleans. 10 pp.

Appendix 1

LDWF Oyster Sample Data Sheet Addendum

CSA _____ Station Name _____Station Number _____ Replicate _____

DATE _____ _____COMMENTS _____

Muddy Oyster Shell: _____ grams

Brown Oyster Shell: _____ grams

Live oysters: _____ grams

Other cultch

Muddy Limestone _____ grams

Brown Limestone _____ grams

Muddy Clamshell _____ grams

Brown Clamshell _____ grams

Muddy Concrete _____ grams

Brown Concrete _____ grams

Muddy _____ _____ grams

Brown _____ _____ grams