**MySQL Workflow Theory**

There are steps that are recommended before the data import.

Parameters for MySQL database:

user="LCRoysterproject"

password="HLLV6Pske0vTzhIZfSya"

dbname="LCRoysterproject"

host="ict-prod-hosting05.mysql.osg.ufl.edu"

port= 3359

1. Enter the latest water quality service information into the service\_log.xlsx file located in:

T:\Oyster Project\oyster\_project2\project\_task\_working\t7\_data\_management\wq

* Find the scanned data sheets here: T:\Oyster Project\oyster\_project2\project\_task\_working\t7\_data\_management\wq\data\wq\_datasheet
* Enter in the information from the scanned data sheets into the service log including, date, times, observation count, and most importantly the sensor serial numbers. Do this for all sensors serviced, and note all sensors that were not able to be serviced in this log.

2. Noticing which sensors are in what location is the main goal of entering in the data of the service log. If a sensor is exchanged or taken out from the field, the MySQL databases needs to have those changes **before** the import process.

* Take note of which site the sensor is located, what is the old serial number of the sensor, and what is the new sensor serial number.
* The MySQL database has a “check-out” and “check-in” procedure for updating a site’s sensors.
* All sensor serial numbers need to be accounted for prior to any “check-out” or “check-in” procedure. Enter all new sensor serial numbers the table **lcroyster\_sensor**. Add all applicable information. Include an “S” for Star-Oddi serial numbers in the *serial\_number* column. **Do not remove any previous/old/broken sensor serial numbers.** This will be useful in the future to locate which sensors were in which site, if there is ever an investigation on a particular site.
* The **lcroyster\_sensordeploy** table is the table to edit which sensors are in which site location.
* Make sure to check out the sensor by adding the date and time what the sensor should be “checked-out” and make the *location\_id* to 0. Make sure to save every time a new MySQL line is created and completed. Add a new line with the date and time that the new/replacement sensor should be active. This time can be in the future. Detailed steps are below.

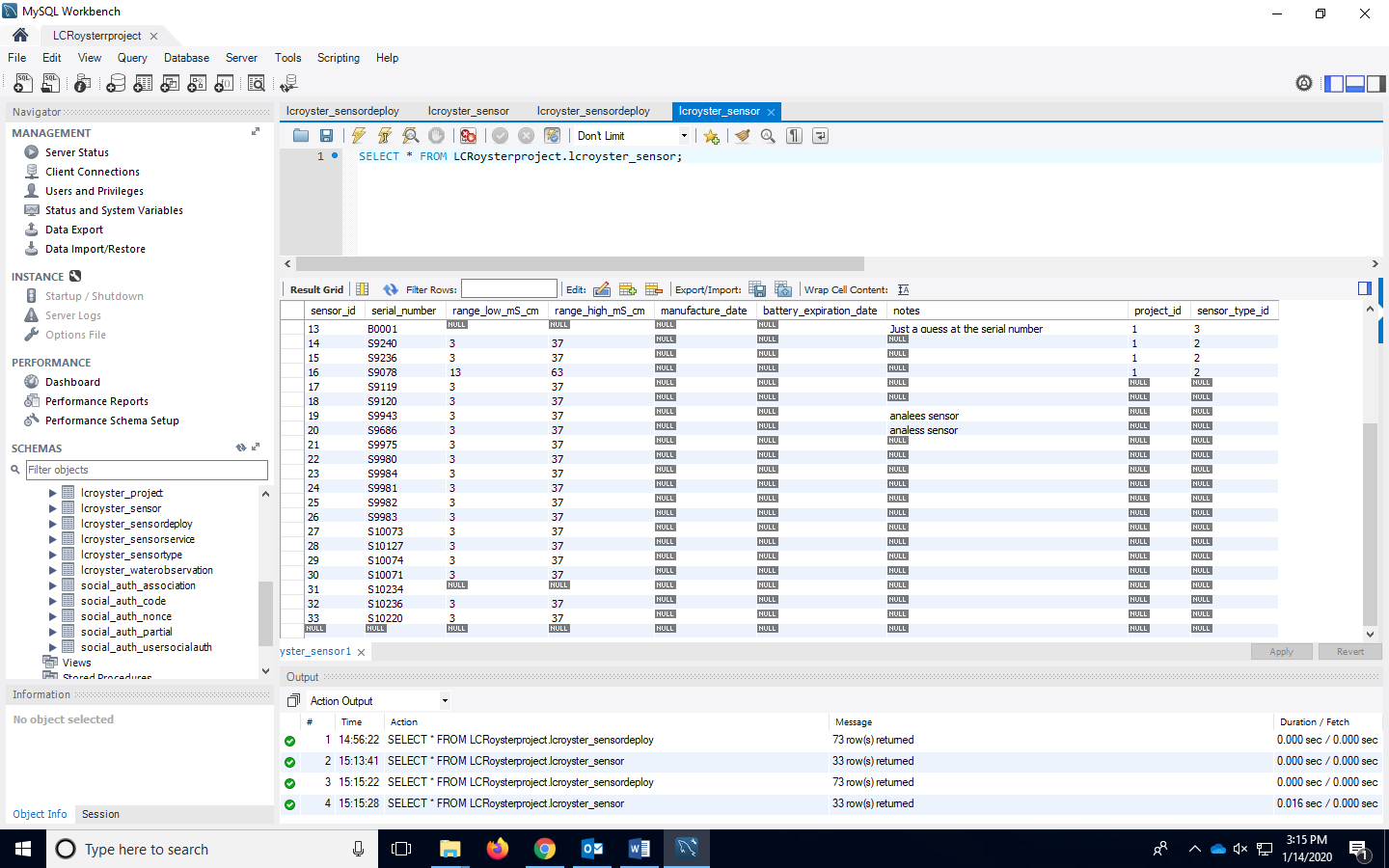


Figure 1- Screen shot of the **lcroyster\_sensordeploy** table.

“Check-out” a sensor procedure:

1. Identify the sensor serial number that has been replicated. Most likely this will be apparent in the data sheet when the user is entering the service trip information to the service\_log.xlsx.

2. Go to the MySQL database.

3. Go to the **lcroyster\_sensordeploy** table.

4. Enter the *sensor\_id*  based on the **sensor\_deploy** table *sensor\_id* number.

5. Enter the date of when the sensor has been removed in *deploy\_datetime*. Enter it in the format of “YYYY-MM-DD HH:MM:SS.000000”. Remember that the time is in UTC.

6. Enter *notes* on why the sensor is being removed with any additional information as needed.

7. If you are removing a sensor, enter the *location\_id as* “0”. Zero signifies that the sensor is removed and not “active” in the field.

8. Enter the *sensor\_id*  based on the **sensor\_deploy** table number.

9. Ensure all of the fields are enter and press on the Apply button. If MySQL doesn’t

“Check-in” a sensor procedure:

10. If a sensor has been replaced for the site, and additional entry in MySQL is necessary. This is considered the “check-in” procedure.

11. Enter a new *sensor\_deploy\_id*, normally just a chronological number.

12. Enter the date of when the sensor has been replaced in *deploy\_datetime*. Enter it in the format of “YYYY-MM-DD HH:MM:SS.000000”. Remember that the time is in UTC.

13. Enter *notes* on why the sensor is being replaced with any additional information as needed.

14. When replacing a sensor enter the *location\_id as* the site location number, located in the **lcroyster\_sensordeploy** table. Most sites location ID numbers will correspond to their physical site name, however it is imperative to check the **lcroyster\_sensordeploy** table to verify the *location\_id* of the site.

15. Enter the *sensor\_id* based on the **sensor\_deploy** table *sensor\_id* number.

16. Ensure all of the fields are enter and press on the Apply button. If MySQL doesn’t

Additional comments:

- All sites that have a sensor replacement will have two entries in MySQL, the “check-out” and the “check-in”, **in that order**.

- All active sites need to have an “active” sensor in the **lcroyster\_sensordeploy** table.

- All sensors need to be accounted for in the **lcroyster\_sensor** table.

- All site locations need to be accounted for in the **lcroyster\_location** table.

**SENSOR LOCATION UPDATES NEED TO BE COMPLETED PRIOR TO PYTHON IMPORT!**

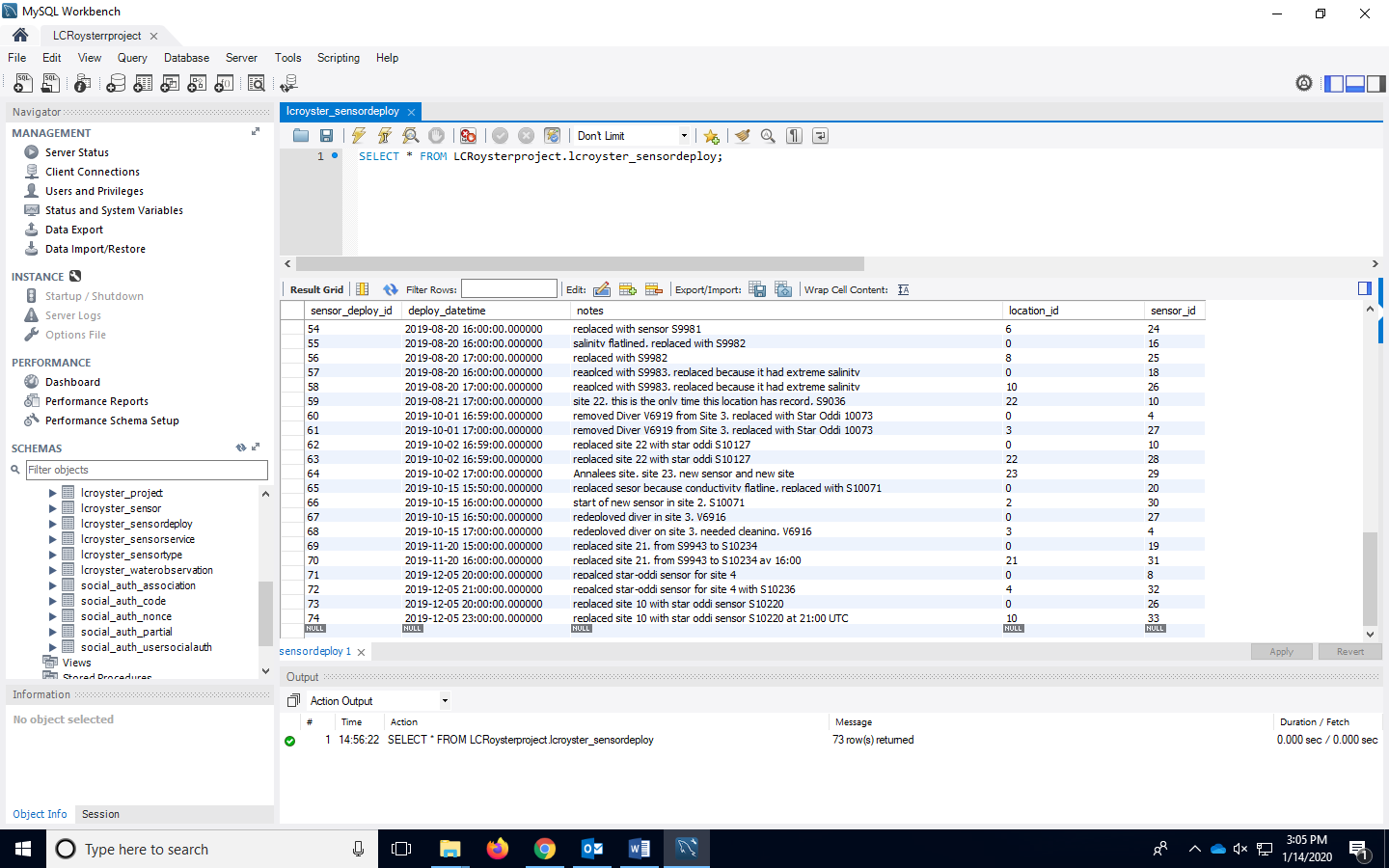


Figure 2- Screen shot of the **lcroyster\_sensordeploy** table.

**Continuous Data Import Steps:**

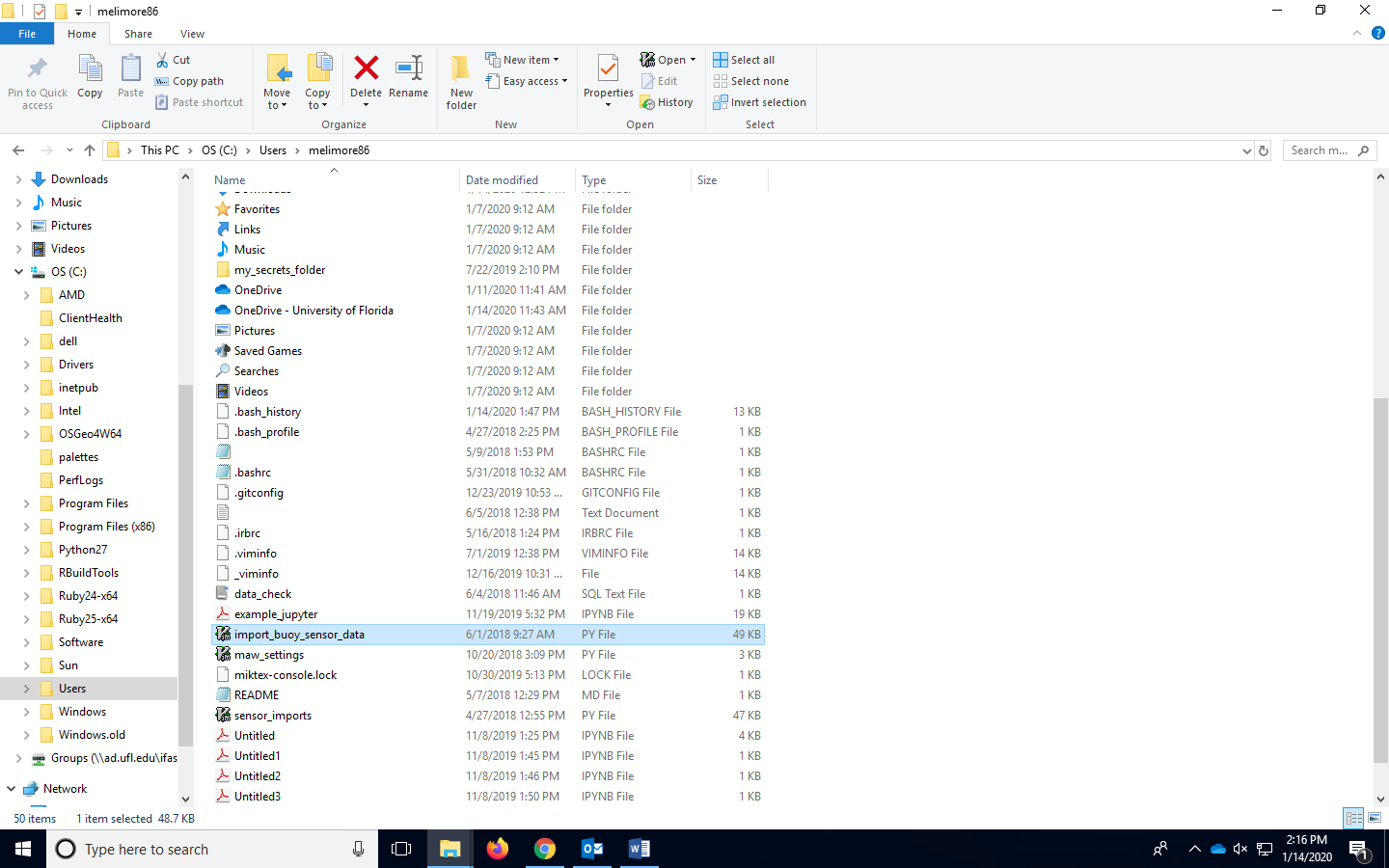
Location of data files:

T:\Oyster Project\oyster\_project2\project\_task\_working\t7\_data\_management\wq

1. Verify all files are complete and correct in the **new\_data** folder.

* You can verify that all of the files are complete, by clicking on each file, and checking the data contents inside. The contents should have variable observations.
* You can also verify that the names of the data files are correctly named.
  + 20200103\_wq10\_star <- this should be the format of the name of the file
  + Be aware the .star and .dat files will import differently, so the last prefix will need to be the name of type of sensor file
  + \_diver are files from the Diver sensor (.mon)
  + \_star are files from the Star- Oddi Sensor (.dat)

2. Navigate to the folder where your *import\_buoy\_sensor\_data.py* and my\_secrets\_folder are located.



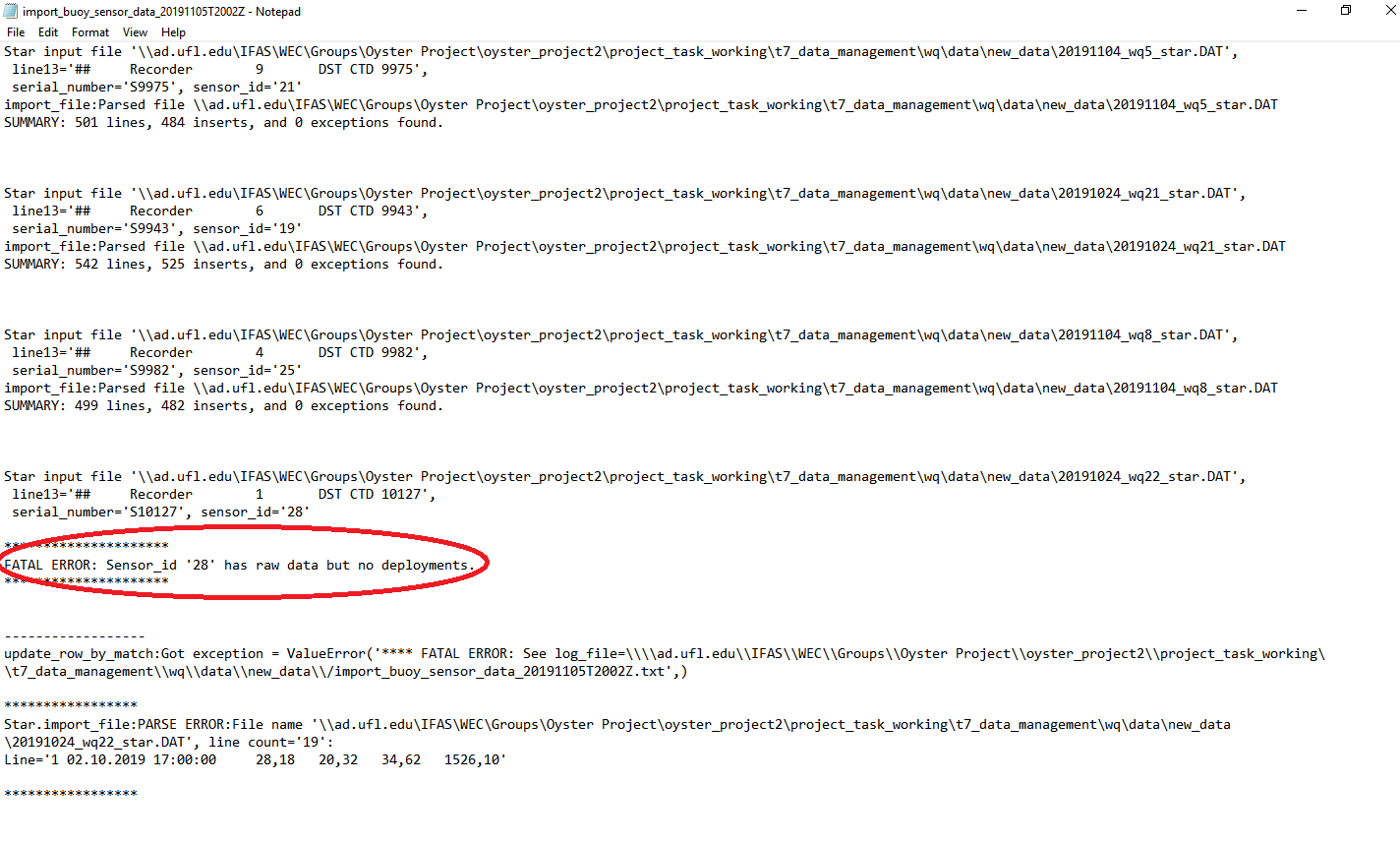
3. Right click to your Git Bash terminal. The code for the import process is

*python import\_buoy\_sensor\_data.py*

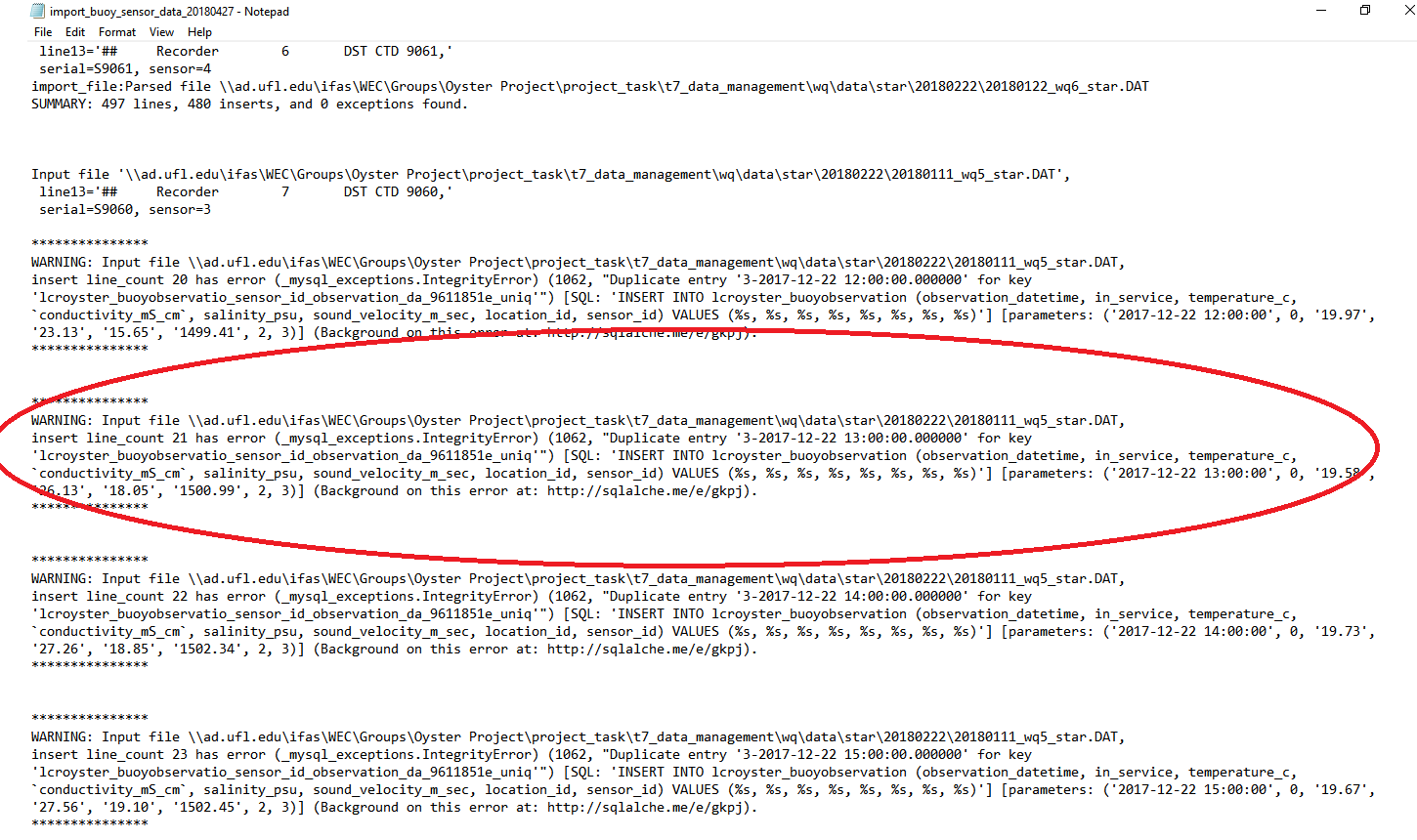
An import process should start and each file will end in a result. An import report will also appear in the **new\_data** folder, where

4. Move the newly imported files into the **imported\_data** folder.

5. Double check the python import file that will appear after the import completion, in the **new\_data** folder.

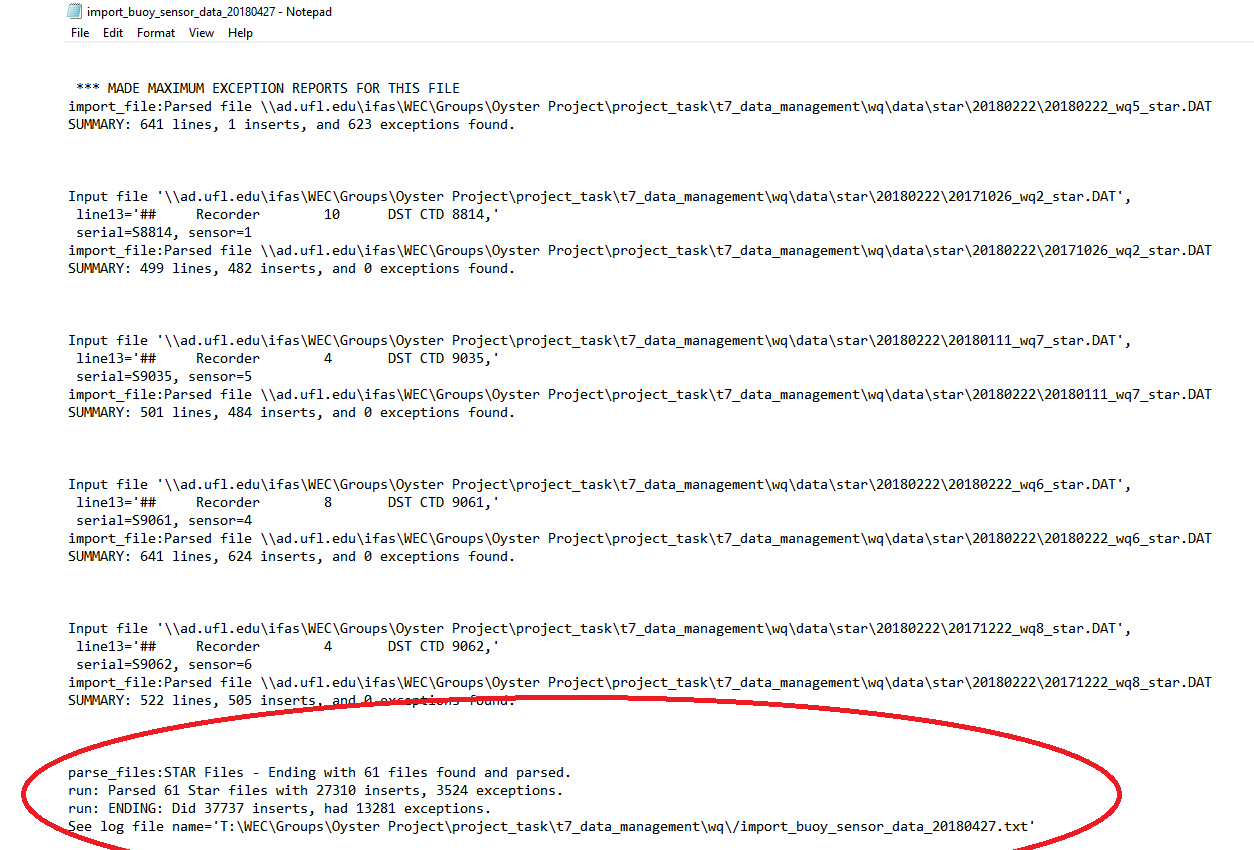
Look for warnings or errors. Some examples are below:

Screen shot- This screen shot displays that a sensor ID was not properly allocated to a site. Each sensor will have its own sensor \_id that is numerical. Double check the MySQL tables: **lcroyster\_sensnor** and **lcroyster\_sensordeploy**.



Screen shot- The WARNING in this import log might arise if the data file has been incorrectly name, if the file has also been imported, if the file has no observations, or if the sensor for the file is not added into the MySQL **lcroyster\_sensor** table.

Check the import log file for additional information about the import.



Screen shot- Double check with your service log to make sure all of the observations are imported. This information can be found at the end of the import log.

**Discrete date data entry**

There are two types of discrete data, Lakewatch, and YSI measurements. Lakewatch measurements usually are processed and updated about every 3 months. YSI, on the other hand, are collected on every water quality service trip. YSI measurements need to be manually entered into the MySQL database.

1. The table to enter the discrete measurements is the MySQL **lcroyster\_waterobservation** table. This table will have far fewer observations than the **lcroyster\_buoyobservation** table.

2. Enter in the information according to the fields specified. With every few cells that are completed, click the Apply button (button right). If you don’t frequently save with the Apply button, you might incorrectly type in the wrong fields and MySQL will not allow you to save. In the sensor\_id column:

5= YSI

4= Lakewatch

The **lcroyster\_sensortype** table displays all of the sensor types including YSI and Lakewatch.

The time of the YSI and Lakewatch to be entered in the column **observation\_datetime** is the time in the water quality service data sheet. Double check that all of the dates and times are entered in the following format.

YYYY-MM-DD HH:MM:SS.000000

Note: There is no completion report when all of the observations are entered. There is also no way for a user to revert back to a previous MySQL.

To revert back to a previous’ s day MySQL, contact the UF IT help desk:

Help Desk support is available in person (check their hours here) and 24/7 via phone (352-392-HELP/4357) and email (helpdesk@ufl.edu), <http://helpdesk.ufl.edu/>.

Most commonly used tables:

* **lcroyster\_buoyobservation** – continuous sensor observations (import using python)
* **lcroyster\_location**- the information for the physical locations of where sensors could be found
* **lcroyster\_sensor** – information pertaining to each sensor
* **lcroyster\_sensordeploy** – an account of when and where the sensors have been removed or replaced (needs to be review prior to python import)
* **lcroyster\_sensorservice** – similar information as the service\_log.xlsx
* **lcroyster\_sensortype**- unique identifier for each sensor type
* **lcroyster\_waterobservation** – discrete observations (manually entered)

Each table is specifically linked to other tables through foreign keys (columns). This document will discuss which foreign keys are link different tables.

**Definitions of tables (starting in the order in MySQL)**

Table: **lcroyster\_buoyobservation**

Function: This table include all continuous observations from Star-Oddi and Diver sensors. The function of this table is to store these observations. The python import process will fill in the required fields. Little to no manual editing should be done in this table. This table will include all observations, even flat lined or questionable observations.

Column definitions:

*buoy\_observation\_id*- This field is automatically filled from the python import process. Each observation will have its own *buoy\_observation\_id*. This number is generated chronologically.

*observation\_datetime*- All Star-Oddi and Diver sensors are in UTC. These fields will be automatically be imported in the format YYYY-MM-DD HH:MM:SS.000000.

*in\_service*- All sensor observations imported will be *in\_service,* unless otherwise specified in the **lcroyster\_sensordeploy** table, such as if the sensor is “checked-out” during the date/time specified in that table.

*pressure\_cm*- Pressure is a variable measured only by Diver sensors, currently in site locations 1 and 3. Star-Oddi sensors will have his field missing from their hourly observations.

*temperature\_cm*- All sensors record temperature measurements in Celsius.

*conductvitiy\_mS\_cm* - All sensors record temperature measurements in mS/cm.

*salinity\_psu­*- Only Star-Oddi sensors observe salinity. Diver sensors will have this field missing in their hourly observations.

*sound\_velocity\_m\_sec* - Star-Oddi sensors measure these observations. Diver sensors will have this field missing in their hourly observations.

*location\_id –* Based on the **lcroyster\_sensordeploy** table, this field will be generated based on which *sensor\_id*’s are “checked-in” to a *location\_id*. The column *location\_id* references other tables, and because of the continuity of this column, a sensor is able to be tracked in all of the *location\_id*’s it has inhabited.

This column is linked to several tables, including:

* **lcryoster\_location**
* **lcroyster\_sensordeploy**
* **lcroyster\_sensortype**
* **lcroyster\_waterobservation**
* **lcroyster\_sensorservice**

*sensor\_id*- Numerical value created in the **lcroyster\_sensor** table. This is a specific value for a specific sensor. This column is linked to other tables:

* **lcroyster\_sensor**
* **lcroyster\_sensordeploy**
* **lcroyster\_sensorservice**

*salinity\_psu\_calculated-* This field is calculated based on the R package “marelac” equation below.

standard=42.914

salinity <- convert\_RtoS(conductivity /standard,

t= temperature, p= 0)

p=0 is used because we are not deploying the sensors in deep water

This is the salinity that is normally used for analysis, not the column *salinity\_psu* column because Diver sensors will not have this field filled, since those sensors do not measure salinity.

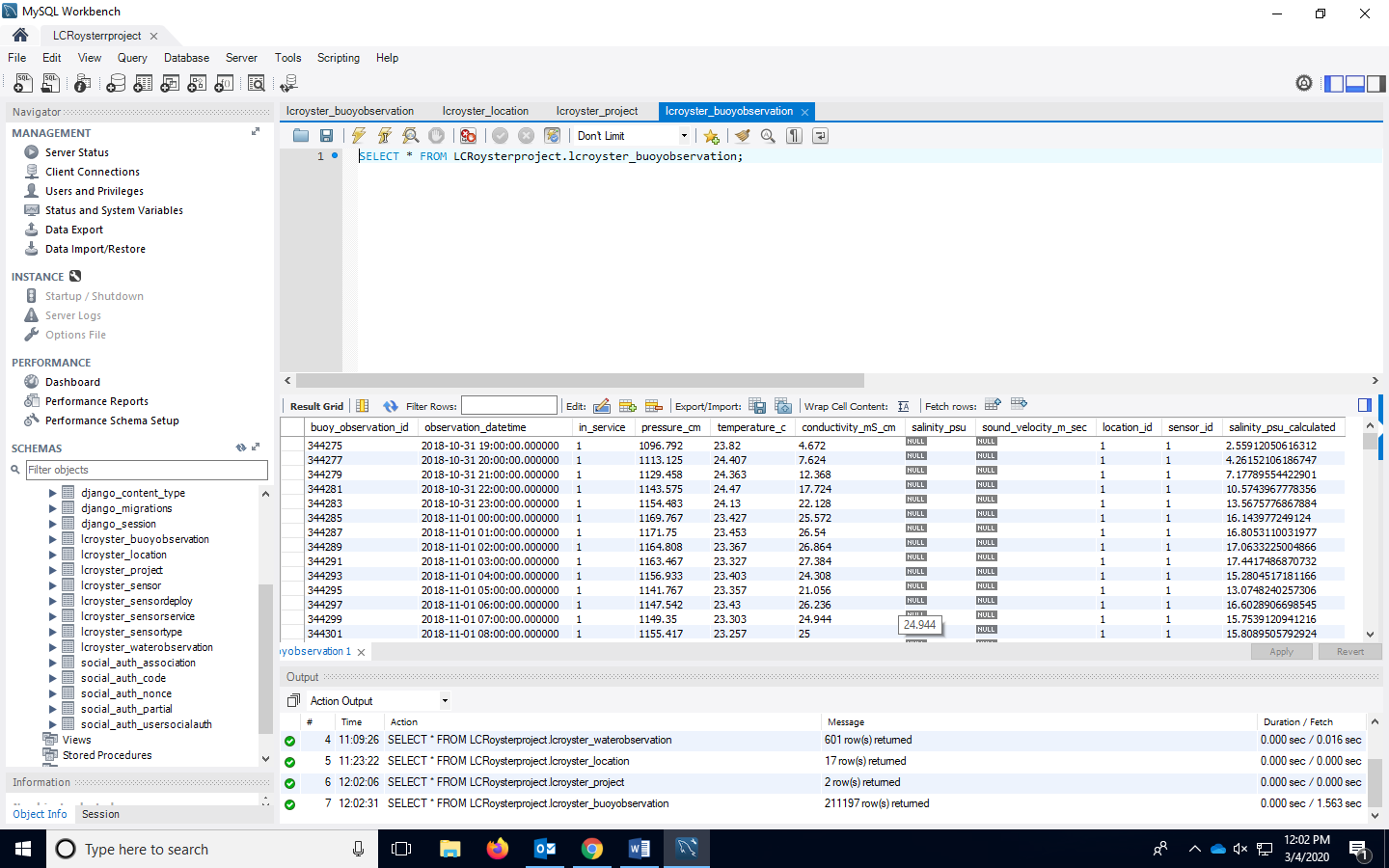


Figure- Screen shot of **lcroyster\_buoyobservation** table.

Table: **lcroyster\_location**

Function: To record all information on the physical location of a site. **Prior to import process, the location of a site will need to be recorded in this table.** All the fields in this table will need to be entered, this table is not auto-generated by any import process.

Column definitions:

*location\_id-* This field will be manually entered. For readability, it is advised that the *location\_id* be the same number as the physical site location name. Sometimes, this will not be the case, depending on what the site location names are called. This column will influence other tables, including:

* **lcryoster\_location**
* **lcroyster\_buoyobservation**
* **lcroyster\_sensortype**
* **lcroyster\_waterobservation**
* **lcroyster\_sensorservice**

*tile\_id­­*- Originally, it was theorized to have all site locations attached to a tiling system in a map. However, this effort is still in progress, and there are no *tile\_id*’s associated with site locations at this time.

*latitude-* Latitude of the site location in decimal degrees UTMs.

*longitude*- Longitude of the site location in decimal degrees UTMs.

*name-* Common name of site location.

*alias1-* Enter an alias if one is needed for the site location.

*alias2-* Enter an alias if one is needed for the site location.

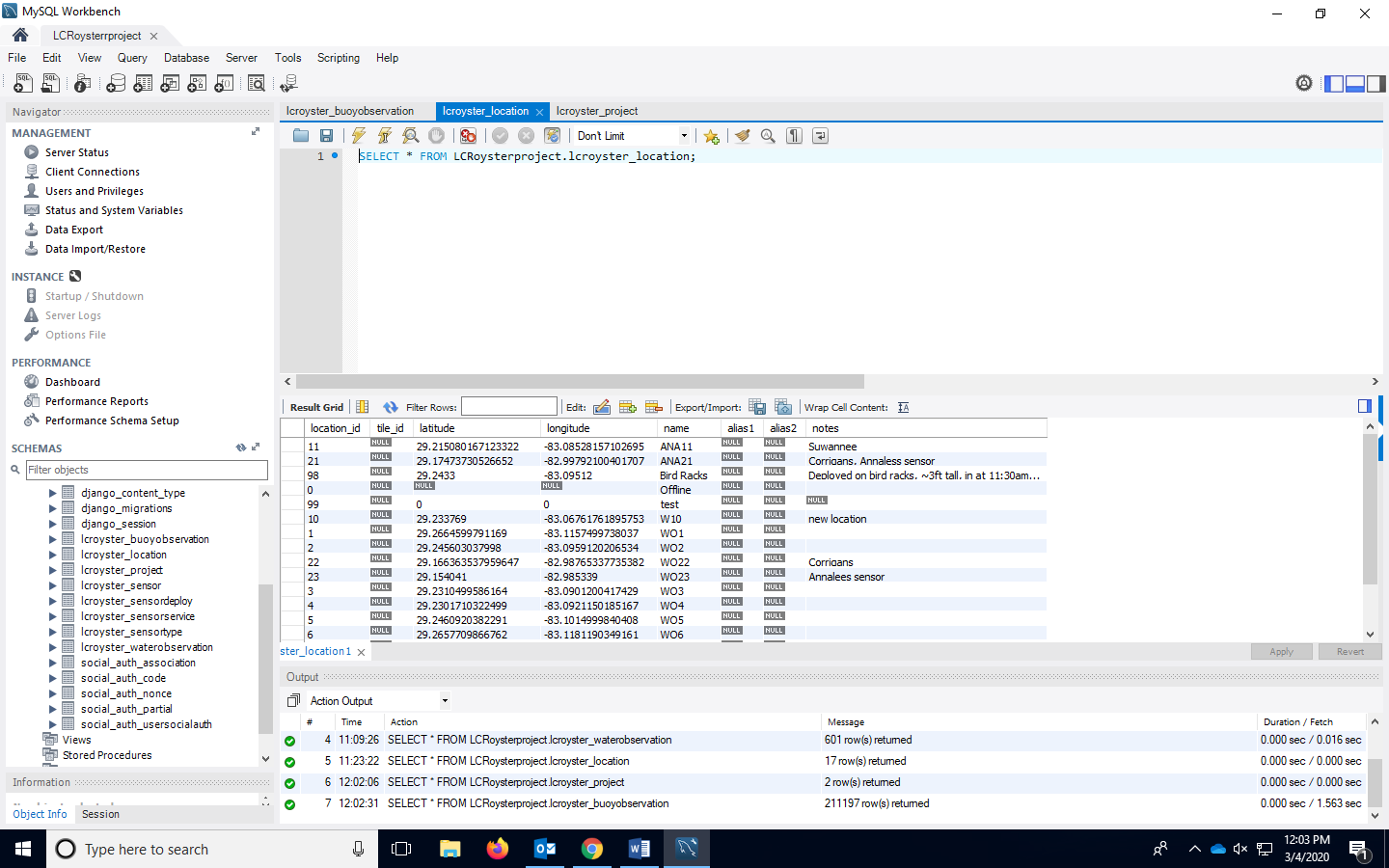
*notes­*- Generally, any notes that pertain to the creation or modification of a site should be added here.

Figure- Screen shot of **lcroyster\_location** table.

Table: **lcroyster\_project**

Function: This table is to describe different projects that are contributing to the database. Most observations are pertaining to the Lone Cabbage Reef Restoration project. This table is manually entered and not automatically generated.

Column definitions:

*project\_id –* Numerical value. This field is created in this table. This field is needed for another linked table:

* **lcroyster\_sensor**
* **lcroyster\_sensorservice**

*project\_website\_code*- Code created by the project manager. Normally just a short acronym.

*name­*- Name of the project.

*uf\_award\_id*- If applicable, enter an award ID.

*sponsor\_names –* If applicable, enter the names of the sponsors funding the grant.

*sponsors\_award\_id –* If applicable, enter the sponsor award ID.

*contact\_investigator*- Enter in the name of the main contact investigator of the project.

*principal\_investigators­*- The names of all PIs should be entered in this field.

*co\_principal\_investigators*- If applicable enter the names of the co PIs.

*collaborators*- If applicable, enter the names of collaborators. This can be agencies, universities, or individuals.

*award\_start\_date* – Field available to enter the start date of the grant using the format YYYY-MM-DD HH:MM:SS.000000.

*award\_end\_date* - Field available to enter the end date of the grant using the format YYYY-MM-DD HH:MM:SS.000000.

*responsible\_unit*-

*department\_id* – If applicable, enter the department ID responsible for the grant.

*proposal\_id ­*­- If applicable, enter the proposal ID responsible for the grant.

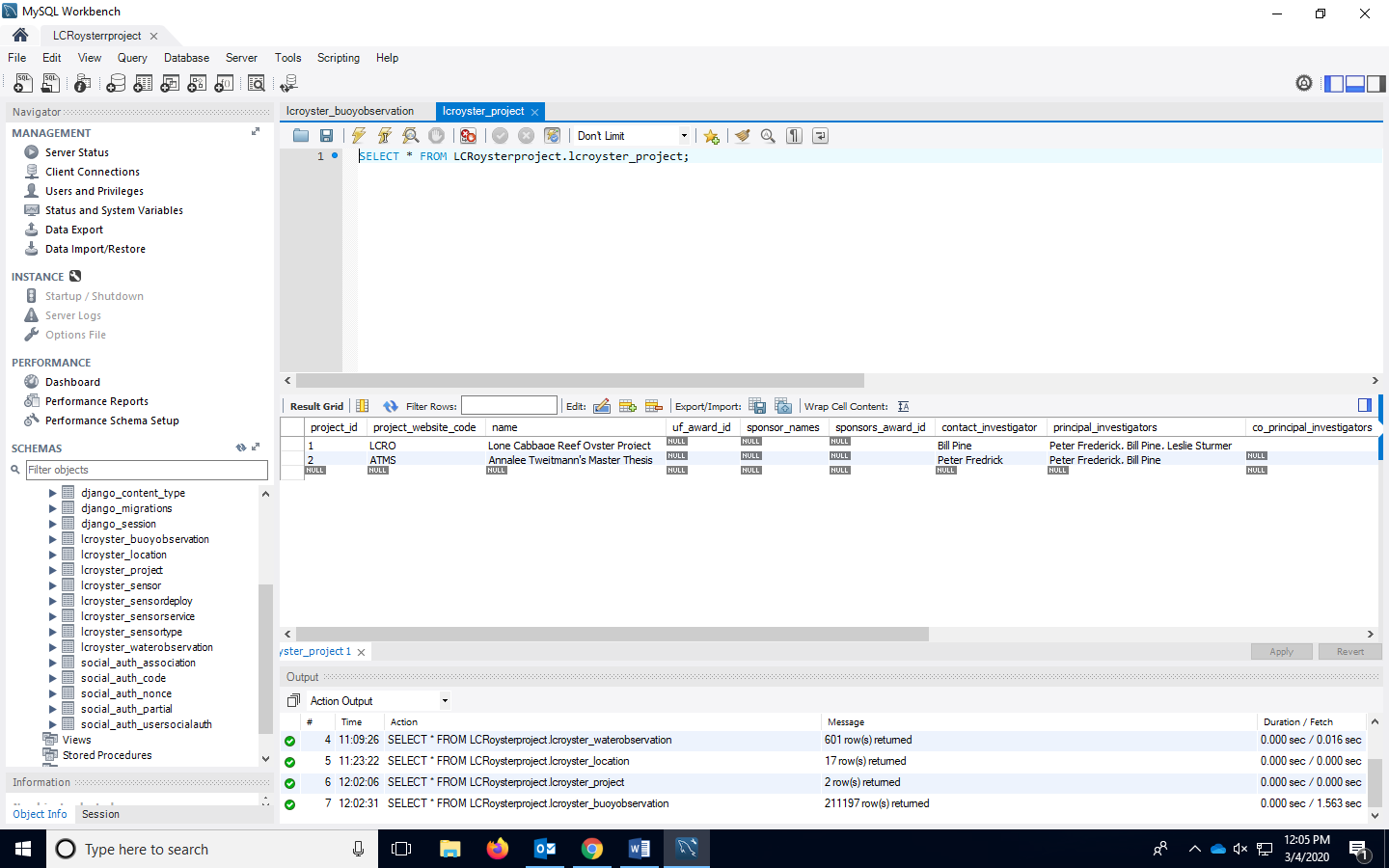
*notes ­– Enter notes applicable to the project if there is not a field that covers the information needed for the project.*

Figure- Screen shot of **lcroyster\_project** table.

Table: **lcroyster\_sensor**

Function: A table to record all sensors (active, deactivated, broken, etc) that have ever been used in data collection, where its data is stored in the MySQL databased. This table is manually entered and is not auto generated. **All sensors must be listed in this table before the python import process begins.** When a new sensor is added, a new entry is needed in this table. Make sure to add all applicable new sensors to this table before the python import process.

Column definitions:

*sensor\_id –* This column is a numerical value, and is normally chronological, but can be any numerical value. The *sensor\_id* column related to other tables:

* **lcroyster\_buoyobservation**
* **lcroyster\_sensordeploy**
* **lcroyster\_sensorservice**

Because the *sensor\_id* is consistent among all tables. Sensors are identified through this ID through the tables in the database.

*serial\_number ­–* This column is to enter the serial number of the sensor being added. All Star-Oddi sensors will have an “S” in front of their serial number. This number related to the Star-Oddi data files (for import) and needs to be exact.

*range\_low\_mS\_cm*- Field to enter the low range of Star-Oddi sensors. This field might not be necessary for Diver sensors.

*range\_high\_mS\_cm* -Field to enter the high range of Star-Oddi sensors. This field might not be necessary for Diver sensors.

*manufacture\_date ­–* If applicable, this field is to enter the manufacturer creation date. This information might not always be available.

*battery\_expiration\_date-* If applicable, this field is to enter the manufacturer battery experiation date. This information might not always be available.

*notes-* Any notes that could be applicable to adding the sensor, which is not covered in the columns.

*project\_id*- This column will indicate the project in which the sensor being added, belongs to. This field is created in **lcroyster\_project** table, but used to identify the project tied to each sensor.

*sensor\_type\_id* – This ID is created in the **lcroyster\_sensortype** table. Enter the corresponding sensor type numerical value based on the **lcroyster\_sensortype** table. This column is linked to other tables:

* **lcroyster\_sensor**
* **lcroyster\_sensordeploy**
* **lcroyster\_sensorservice**

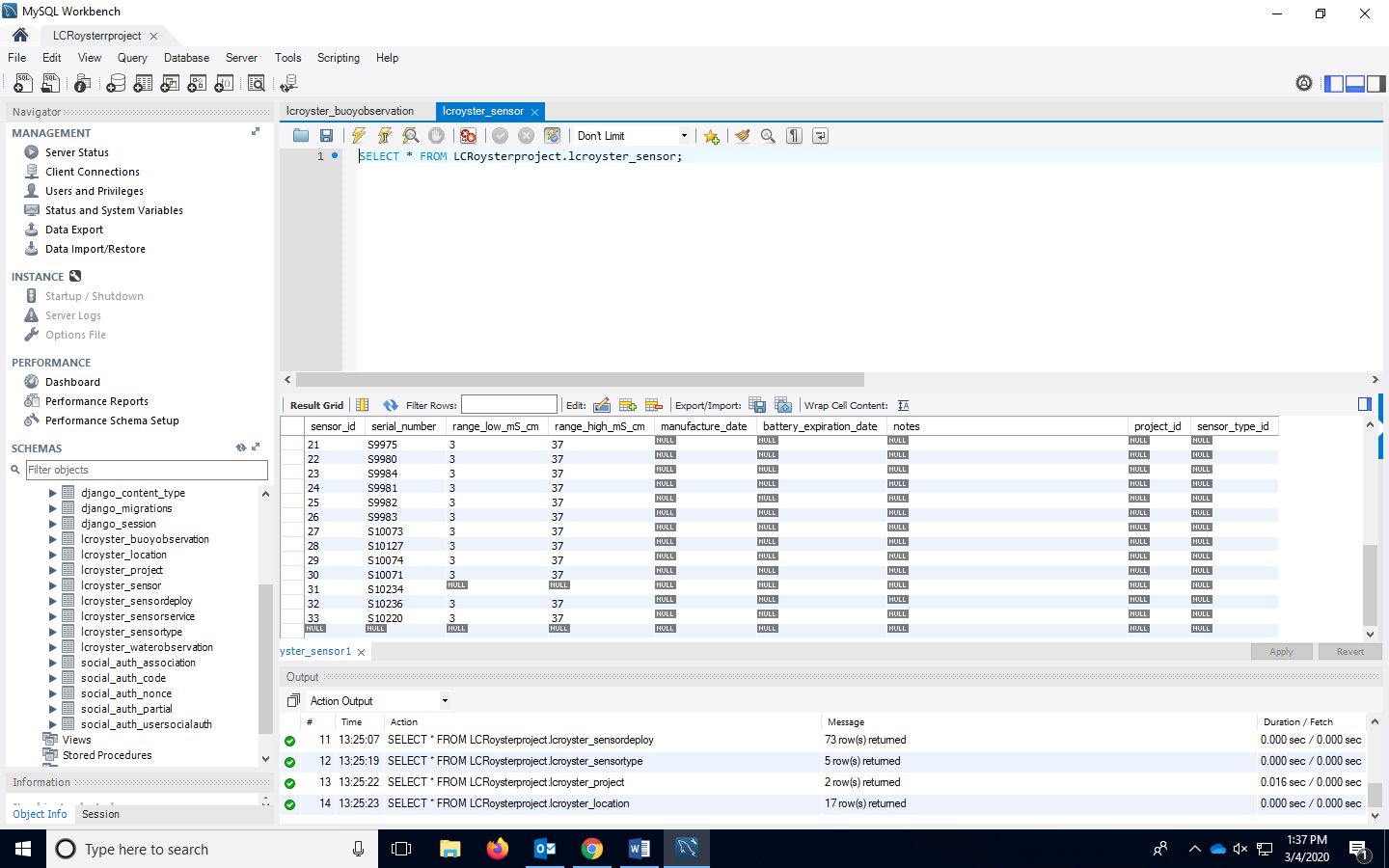


Figure- Screen shot of **lcroyster\_sensor** table.

Table: **lcroyster\_sensordeploy**

Function: As per the “check-out” and “check-in” procedure, this table records all instances where a sensor has been replaced or removed from a site location.

Column definitions:

*sensor\_deploy\_id­-* Chronological numerical value.

*deploy\_datetime*- Date and time of sensor removed and/or replaced in the format YYYY-MM-DD HH:MM:SS.000000. Review the “check-out” and “check-in” procedure.

*notes*- Add any additional notes on why the sensor has been removed or replaced.

*location\_id -* Based on the **lcroyster\_sensordeploy** table, this field will be generated based on which *sensor\_id*’s are “checked-in” to a *location\_id*. The column *location\_id* references other tables, and because of the continuity of this column, a sensor is able to be tracked in all of the *location\_id*’s it has inhabited. If a sensor is being removed place “0” (zero) in the *location\_id* field.

This column is linked to several tables, including:

* **lcryoster\_location**
* **lcroyster\_sensortype**
* **lcroyster\_waterobservation**
* **lcroyster\_sensorservice**

*sensor\_id -* Numerical value created in the **lcroyster\_sensor** table. This is a specific value for a specific sensor. Enter the numerical value that represents the specific sensor.

This column is linked to other tables:

* **lcroyster\_buoyobservation**
* **lcroyster\_sensor**
* **lcroyster\_sensorservice**

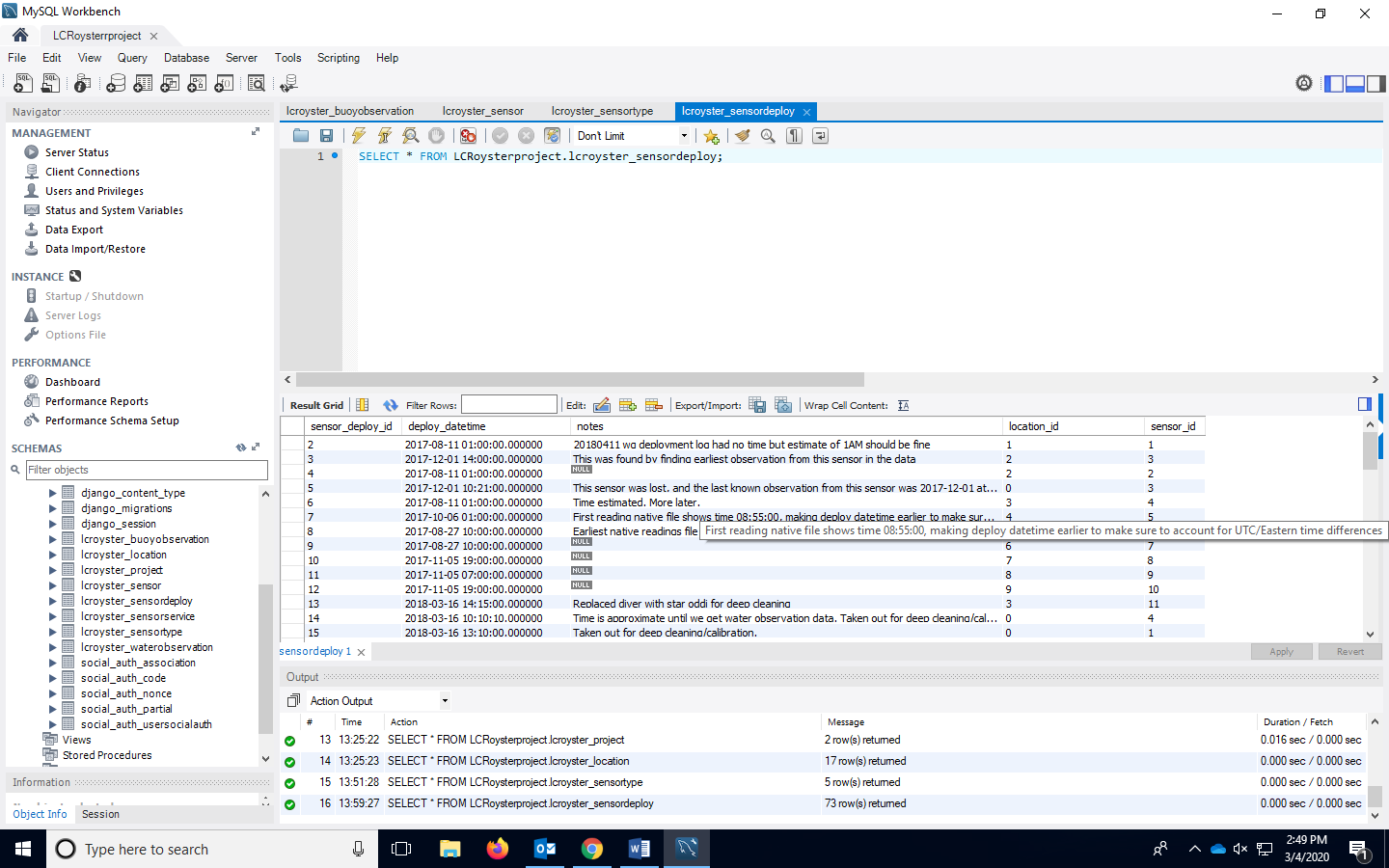
Figure- Screen shot of **lcroyster\_sensordeploy** table.

Table: **lcroyster\_sensorservice**

Function: The function of this table is to be a back-up of the service\_log.xlsx. This table could be analyzed, but it is currently used simply to record water quality service trips.

Column definitions:

*sensor\_service\_id*- Chronological numerical value.

*location\_id –* Site location that was serviced. Based on the **lcroyster\_sensordeploy** table, this field will be generated based on which *sensor\_id*’s are “checked-in” to a *location\_id*. This column is linked to several tables, including:

* **lcryoster\_location**
* **lcroyster\_sensortype**
* **lcroyster\_waterobservation**
* **lcroyster\_sensor**

*service\_datetime*- Date and time, in UTC, when the sensor was physically serviced. This needs to be in the format YYYY-MM-DD HH:MM:SS.000000.

*download\_datetime* Date and time, in UTC, when the sensor data were downloaded. This needs to be in the format YYYY-MM-DD HH:MM:SS.000000.

*active*- Refers to is a sensor was redeployed. The number “1” refers to redeployed and active, and “0” (zero) refers to a sensor not being redeployed and in active.

*measurements\_downloaded*- The number of measurements downloaded in the service trip from the particular sensor. This is a numerical value.

*heavily\_fouled*- Refers to if the sensor being serviced seemed to be heavily fouled by barnacles or other sea creatures. The number “1” refers to the sensor being heavily fouled and the number “0” (zero) refers to a sensor not being shown to be heavily fouled.

*battery\_life\_remaining\_percent­-­ ­­*Each sensor’s remaining battery life is recorded on each service trip. Enter the

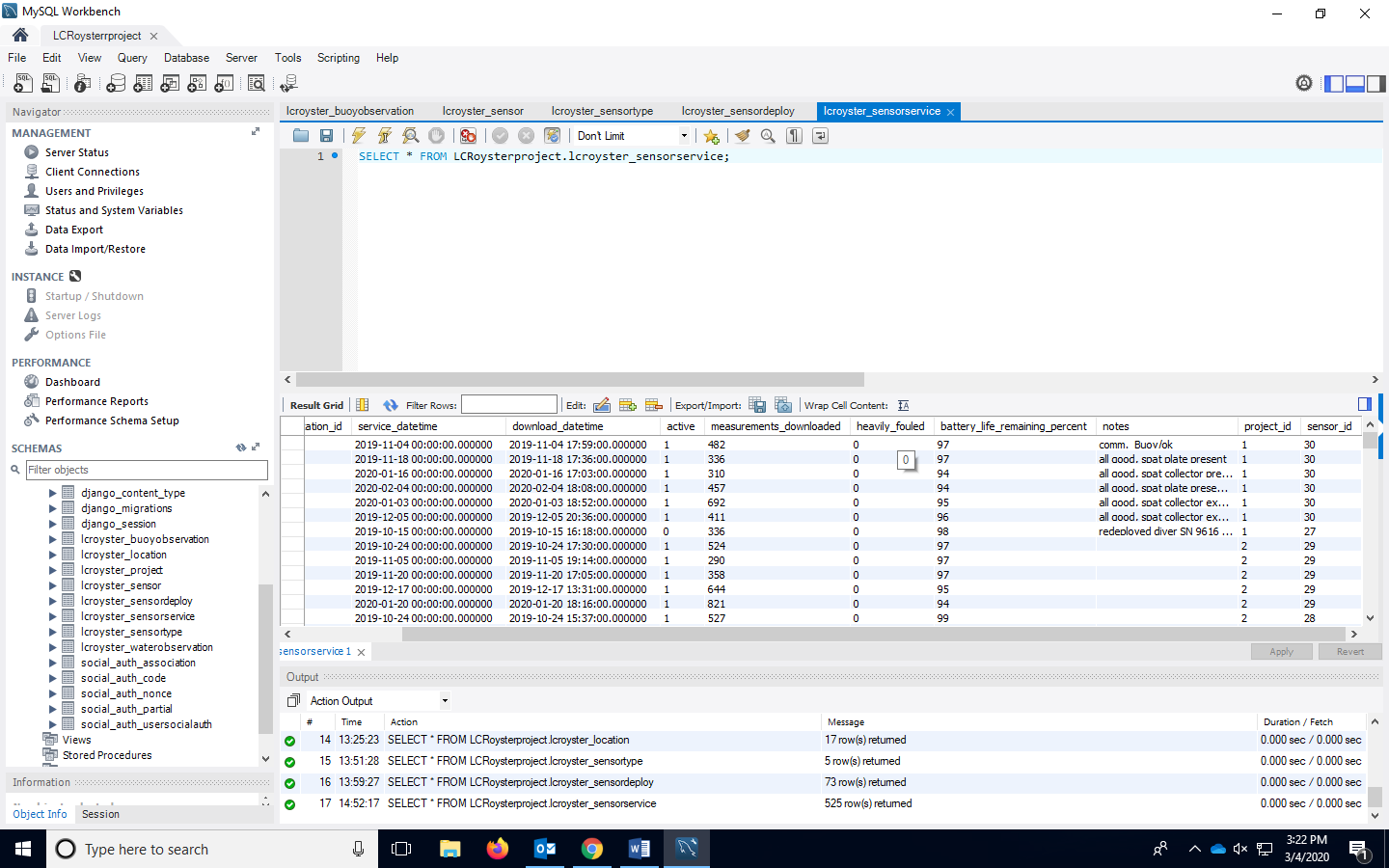
*notes*- Notes on the service trip, which are not covered by any of the columns in the table.

*project\_id-*Numerical value. This field is created in this table. This field is needed for another linked table:

* **lcroyster\_sensor**
* **lcroyster\_sensorservice**

*sensor\_id-* Numerical value created in the **lcroyster\_sensor** table. This is a specific value for a specific sensor. This column is linked to other tables:

* **lcroyster\_sensor**
* **lcroyster\_sensordeploy**
* **lcroyster\_sensorservice**



Resources:

<https://www.youtube.com/watch?v=9ylj9NR0Lcg>

<https://www.mysqltutorial.org/>

<https://www.guru99.com/mysql-tutorial.html>